T-41 J. GRIMWOOD

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

info. on reverse page 316

APOLLO 13

TECHNICAL AIR-TO-GROUND VOICE TRANSCRIPTION

Prepared by
Test Division
Apollo Spacecraft Program Office

MANNED SPACECRAFT CENTER
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INTRODUCTION

This is the transcription of the technical air-to-ground (TAG) voice communications of the Apollo 13 mission. The primary communications net (GOSS net 1) will be in continuous operation for the duration of the mission. An alternate communications net (GOSS net 2) may be activated when separate, simultaneous communications links with both spacecraft are desired.

The transcript is divided into three columns — time, speaker, and text. The time column consists of four two-digit pairs for days, hours, minutes, and seconds (e.g., 04 22 45 12). The speaker column indicates the source of a transmission; the text column contains the verbatim transcript of the communications.

The primary communications net (GOSS net 1) comprises the bulk of the transcript. However, when GOSS net 2 is activated, the communications on that net will be integrated with the GOSS net 1 communications. A heavy dark line alongside the time column will indicate GOSS net 2 communications.

A series of three dots (...) is used to designate those portions of the text that could not be transcribed because of garbling. A series of three asterisks (***) is used to designate those portions of the text that could not be transcribed because of clipping caused by the VOX mode. One dash (-) is used to indicate a speaker's pause or a self-interruption and subsequent completion of a thought. Two dashes (- -) are used to indicate an interruption by another speaker or the point at which a recording was abruptly terminated.

Speakers in the transcript may be identified as follows.

Spacecraft:

CDR	Commander	James A. (Jim) Lovell, Jr.
CMP	Command module pilot	John L. Swigert, Jr.
LMP	Lunar module pilot	Fred W. Haise, Jr.
SC	Unidentified crewmember	
MS	Multiple speakers	

Mission Control Centers:

CC	Capsule communicator (CAP COMM)
LCC	Launch Control Center
F	Flight director
S	Surgeon

Remote sites:

AB	Airboss (Recovery aircraft)
CT	Communications technician (COMM TECH)
IWO	USS Iwo Jima
P-1, P-2, etc.	Photographic helicopters
R-1, R-2, etc.	Recovery helicopters

When the CDR and LMP are in the undocked lunar module or on the lunar surface, their speaker designations will be suffixed by either LM or EVA to indicate their status (e.g., CDR-EVA or LMP-LM). Voice calls during this mission were assigned in accordance with the following station operating procedures: "For all phases when only the CSM is manned, the AS-508 call sign will be Apollo 13. When both vehicles are manned, the call sign will be Odyssey for the CSM and Aquarius for the LM. The call signs for the CDR and LMP during lunar surface operations will be the individual crew's first names."

Transcription of these tapes was managed by David M. Goldenbaum, Test Division, Apollo Spacecraft Program Office, to whom questions regarding this document should be referred.

ACRONYM LIST

Because specialized readers of the Apollo 13 transcription, such as the principal investigators, may not be thoroughly familiar with the acronyms used during the mission, the decision was made to define those acronyms that probably will be encountered. For obvious reasons, no effort was made to include every acronym that conceivably could be used; only those acronyms that are considered likely to be used are included here.

AEA	Abort electronics assembly
AGS	Abort guidance system
ALSCC	Apollo lunar surface closeup camera
ALSD	Apollo lunar surface drill
ALSEP	Apollo lunar surface experiments package
AOS	Acquisition of signal
AOT	Alinement optical telescope
APS	Auxiliary propulsion system (S-IVB)/Ascent propulsion system (LM)
ARS	Atmosphere revitalization system
BEF	Blunt end forward
CCGE	Cold cathode gage experiment
CCIG	Cold cathode ion gage
CDH	Constant delta altitude (height)
CM	Command module
CMC	Command module computer
COAS	Crew optical alinement sight
CP	Control point
CPLEE	Charged particle lunar environment experiment
CSC	Contingency sample collection
CSI	Coelliptic sequence initiation
CSM	Command and service module
CWEA	Caution and warning electronics assembly
DAC	Data acquisition camera
DAP	Digital autopilot
DEDA	Data entry and display assembly

DET	Digital event timer
DOI	Descent orbit insertion
DPS	Descent propulsion system
DSE	Data storage equipment
DSEA	Data storage equipment assembly
DSKY	Display and keyboard
DTO	Detailed test objective
ECS	Environmental control system
EI	Entry interface
EMS	Entry monitor system
EMU	Extravehicular mobility unit
EPS	Electrical power system
ETB	Equipment transfer bag
EVA	Extravehicular activity
EVT	Extravehicular transfer
FDAI	Flight director attitude indicator
GDC	Gyro display coupler
GET	Ground elapsed time
GETI	Ground elapsed time of ignition
HFE	Heat flow experiment
HGA	High gain antenna
HTC	Handtool carrier
IMU	Inertial measurement unit
IP	Initial point
ISA	Interim stowage assembly
IU	Instrument unit
IVT	Intravehicular transfer
LAD	Lunar atmosphere detector
LCG	Liquid cooled garment
LEB	Lower equipment bay

LEC	Lunar equipment conveyor
LGC	Lunar module guidance computer
LM	Lunar module
LOI	Lunar orbit insertion
LOPC	Lunar orbit plane change
LOS	Loss of signal/line of sight
LPD	Landing point designator
LTC	Lunar topographic camera
MCC	Mission Control Center/midcourse correction
MESA	Modular equipment stowage assembly
MSFN	Manned Space Flight Network
MTVC	Manual thrust vector control
OPS	Oxygen purge system
ORDEAL	Orbital rate display earth and lunar
PDI	Powered descent initiation
PGA	Pressure garment assembly
PGNCS	Primary guidance, navigation, and control system (CM)
PGNS	Primary guidance and navigation system (LM)
PIPA	Pulsed integrating pendulous accelerometer
PLSS	Portable life support system
PRD	Personal radiation dosimeter
PSE	Passive seismic experiment
PTC	Passive thermal control
RCS	Reaction control system
RCU	Remote control unit
REFSMMAT	Reference to stable member matrix
RLS	Radius of landing site
RTG	Radioisotope thermoelectric generator
SCE	Signal conditioning equipment
SCS	Stabilization control system
SECS	Sequential events control system

SEF	Sharp end forward
SIDE	Suprathermal ion detector experiment
SLA	SM/LM adapter
SM	Service module
SNAP	Systems for nuclear auxiliary power
SPS	Service propulsion system
SRC	Sample return container
SWC	Solar wind composition
SWE	Solar wind experiment
TEC	Transearth coast
TEI	Transearth injection
T_{ig}	Time of ignition
TLC	Translunar coast
TLI	Translunar injection
TPF	Terminal phase final
TPI	Terminal phase initiation
TSB	Temporary stowage bag
TVC	Thrust vector control
UHT	Universal handtool

MILA (REV 1)

Day	Hour	Min	Sec		
00	00	00	02	CDR	The clock is running.
00	00	00	03	CMP	Okay. Pll, Jim.
00	00	00	05	CDR	Yaw program.
00	00	00	12	CMP	Clear the tower.
00	00	00	14	CDR	Yaw complete. Roll program.
00	00	00	16	CC	Houston, Roger. Roll.
00	00	00	30	CC	13, Houston. GO at 30 seconds.
00	00	00	34	CDR	Roll complete, and we are pitching.
00	00	00	36	CC	Roger that. Stand by for mode I Bravo.
00	00	00	42	CC	MARK.
00	00	00	43	CC	I Bravo.
00	00	00	44	CMP	I Bravo.
00	00	00	45	CDR	RCS COMMAND.
00	00	01	03	CC	13, Houston. GO at 1. We show the cabin relieving.
00	00	01	07	CDR	13; Roger.
00	00	01	55	CC	13, Houston. Stand by for mode I Charlie.
00	00	01	58	CC	MARK.
00	00	01	59	CC	You're I Charlie.
00	00	02	00	CDR	MARK.
00	00	02	01	CDR	I Charlie.
00	00	02	02	CC	And, 13, you are GO for staging.
00	00	02	04	CDR	GO for staging. Roger. We're EDS MANUAL.

00 00 02 08	CC	Copy that.
00 00 02 16	CDR	Inboard.
00 00 02 27	CC	We confirm inboard out, 13. You're looking good.
00 00 02 29	CDR	Roger.
00 00 02 48	CDR	S-II ignition.
00 00 02 51	CC	Roger.
00 00 03 00	CC	13, Houston. Trajectory is good; thrust is good.
00 00 03 04	CDR	Roger.
00 00 03 15	CDR	Skirt SEP ... tower JETT.
00 00 03 21	CC	We confirm skirt SEP. Roger. Tower JETT; mode II, Jim. Looking good.
00 00 03 24	CDR	Mode II.
00 00 03 33	CDR	Guidance initiate.
00 00 03 43	CC	13, Houston. Guidance is good, and the CMC is GO.
00 00 03 47	CMP	Okay. Thank you.
00 00 03 48	CDR	13; Roger.
00 00 04 16	CC	13, Houston. You are GO at 4 minutes. The little red lines are right on the little white lines down here.
00 00 04 22	CDR	Sounds good.
00 00 04 55	CC	13, Houston. Coming up 5 minutes. You're looking perfect. Over.
00 00 04 59	CDR	13; Roger.
00 00 05 32	CDR	Inboard.
00 00 05 36	CC	Roger. We confirm inboard out.
00 00 05 44	CC	13, Houston. Stand by for S-IVB to COI capability.

00 00 05 48	CDR	S-IVB to COI. Roger.
00 00 05 49	CC	Roger. You've got it now, Jim.
00 00 05 52	CDR	We've got S-IVB to COI.
00 00 06 03	CC	You're GO at 6 minutes, 13.
00 00 06 06	CMP	GO at 6.
00 00 06 10	CDR	And, Houston, what's the story on engine 5?
00 00 06 14	CC	Jim, Houston. We don't have the story on why the inboard out was early, but the other engines are GO and you are GO.
00 00 06 21	CDR	Roger.
00 00 06 41	CC	13, Houston. Still looking good. Your gimbals are good; trim is good.
00 00 06 45	CDR	Roger.
00 00 06 53	CC	13, Houston. Level sense arm time 8 plus 38 nominal; S-II cut-off time 9 plus 48. Over.
00 00 07 02	CDR	Roger. Nominal on the level sense arm, 9:48 on the S-II cut-off.
00 00 07 08	CC	That's affirmative, and stand by for S-IVB to orbit.
00 00 07 11	CC	MARK.
00 00 07 12	CC	You have S-IVB to orbit, Jim.
00 00 07 14	CDR	Roger. We have S-IVB to orbit.
00 00 08 02	CC	13, Houston. Looking good at 8 minutes.
00 00 08 05	CC	13; Roger.
00 00 08 45	CC	Apollo 13, Houston. Mark level sense arm.
00 00 08 48	CDR	Mark level sense arm. Roger.
00 00 08 58	CC	Apollo 13, Houston. At 9 minutes, you are GO; the CMC is GO.

00 00 09 02	CMP	Okay, Joe.
00 00 09 04	CDR	13; Roger.
00 00 09 19	CC	13, Houston. You are GO for staging.
00 00 09 22	CDR	13; Roger. GO for staging.
00 00 09 45	CC	Apollo 13, Houston. Stand by for mode IV capability.
00 00 09 48	CC	MARK.
00 00 09 49	CC	You have mode IV, Jim.
00 00 09 50	CDR	Mode IV. Roger. Staging.
00 00 09 57	CC	Roger. Staging.
00 00 10 00	CDR	And S-IV ignition, Houston.
00 00 10 04	CC	Roger that, Jim. Thrust looks good.
00 00 10 07	CDR	Roger.
00 00 10 17	CC	13, Houston. You're looking good. Trajectory, guidance, CMC are all GO.
00 00 10 23	CDR	Thank you, Joe.
00 00 11 09	CC	13, Houston. At 11 minutes, you're GO. Predicted cut-off on the S-IVB is 12 plus 34. Over.
00 00 11 35	CC	Apollo 13, Houston. You're GO at 11-1/2, and predicted cut-off time is 12 plus 34. Over.
00 00 11 42	CDR	Understand; 12 plus 34 predicted cut-off time.
00 00 11 45	CC	That's affirm.
00 00 12 31	CDR	SECO.
00 00 12 32	CC	Copy SECO, Jim. We're looking at the DSKY.
00 00 12 36	CDR	Roger.
00 00 13 02	CC	Apollo 13, Houston. You have a GO orbit all sources, and the booster is safe. Over.
00 00 13 07	CDR	GO orbit and the booster is safe. Thank you, Joe.

00 00 13 10	CC	Don't mention it.
00 00 13 30	CC	13, Houston. We copy your NOUN 44.
00 00 13 34	CMP	Okay, Joe.
00 00 14 57	CC	Apollo 13, Houston. Your preliminary orbit down here is 102.5 times 100.3, and everything is looking good.
00 00 15 06	CDR	Roger, Houston. And it looks good to be up here again.
00 00 15 10	CC	I'll bet.
00 00 15 34	CC	13, Houston. I have your Z torquing angles. You ready?
00 00 15 42	CDR	Jack is ready to copy, Joe.
00 00 15 44	CC	Okay. It's plus 0.26. Over.
00 00 15 52	CMP	Okay, Joe. Plus 0.26.
00 00 15 55	CC	That's Roger.

CANARY (REV 1)

00 00 21 39	CC	Apollo 13, Houston.
00 00 21 42	CDR	Go ahead, Houston.
00 00 21 44	CC	Okay. Couple minutes to LOS, Jim. Everything is looking real good. Your AOS time at Carnarvon will be 52:36, and we don't have too much of a handle on why the inboard cut off early except that it apparently was an engine problem and not a switch-select function. But we are certain that you'll be able to make TLI based on what we are looking at now.
00 00 22 11	CDR	Roger. There's nothing like an interesting launch.
00 00 22 14	CC	That's right.
00 00 23 14	CC	Apollo 13, Houston. Canary LOS in 30 seconds. Request COMMAND RESET, please.

00 00 23 21	CDR	Roger. COMMAND RESET coming on.
00 00 23 24	CC	Thank you.
00 00 23 40	CC	Apollo 13, Houston. Request LOW BIT RATE, please. Over.
00 00 23 44	CDR	LOW BIT RATE.

CARNARVON (REV 1)

00 00 52 16	CMP	Houston, how do you read 13?
00 00 52 20	CC	13, Houston. Loud and clear.
00 00 52 23	CMP	Okay, Joe. Everything's going good. We're proceeding on the time line in good fashion. I've got a P52 done. I can give you the torquing angles.
00 00 52 33	CC	I'm ready for them, Jack.
00 00 52 35	CMP	Okay. Use NOUN 26; stars 26 and 33. The star angle difference was all balls. NOUN 93: minus 067, minus all balls, plus 0.162. The time of torquing was 45 minutes 35 seconds.
00 00 52 59	CC	Well, that sounds marginally acceptable.
00 00 53 04	CMP	For a new CMP, it ain't too bad.
00 00 53 05	CC	Yes. Okay, 13. We've got nothing for you at the moment. Everything's looking good. We're looking at your data now.
00 00 58 10	CC	Apollo 13, Houston. LOS Carnarvon in about 30 seconds. Honeysuckle on the hour, and verify your S-band is up for Honeysuckle. Over.
00 00 58 21	LMP	That's verified.
00 00 58 23	CC	Roger.
00 00 58 24	CDR	And, Houston, we're beginning to see a beautiful sunrise here.
00 00 58 29	CC	Roger that, Jim.

HONEYSUCKLE (REV 1)

00 01 00 51	CC	13, Houston through Honeysuckle.
00 01 01 10	CC	Apollo 13, Houston through Honeysuckle.
00 01 01 15	CDR	Roger, Houston; 13 here. Reading you loud and clear.
00 01 01 19	CC	Okay. S-band sounds good, Jim.
00 01 03 21	LMP	Houston, 13.
00 01 03 24	CC	Go ahead, 13.
00 01 03 26	LMP	Would it be okay if I crank up the FM ... ...?
00 01 03 37	CC	You're coming in weak. I didn't quite copy it.
00 01 03 42	LMP	Would it be okay, Joe, if we crank up the FM after we leave Honeysuckle here?
00 01 03 47	CC	Oh. Stand by on that one.
00 01 04 43	CC	13, Houston.
00 01 04 46	CDR	Go ahead, Houston.
00 01 04 48	CC	What TV was that? Okay, 13 - -
00 01 04 55	LMP	Okay, Joe. I just wanted to put on the TV switch at Honeysuckle to tune her up there.
00 01 05 01	CC	Roger. I'm being prompted, and you've got a GO for that. You can turn it on, go to TV, and we'll see you that way over the States.
00 01 05 10	LMP	Okay.
00 01 05 36	CC	Okay. 13, Houston. LOS Honeysuckle in about 30 seconds, and we'll see you over the States at 1 plus 28 plus 43.
00 01 05 57	CC	13, Houston. Did you copy your AOS time?

GUAYMAS (REV 1)

00 01 28 40	CC	Apollo 13, Houston through Guaymas. Over.
00 01 29 31	CC	Apollo 13, Houston through Guaymas. Over.
00 01 29 55	CC	Apollo 13, Houston.

END OF TAPE

00 01 30 28	CC	Apollo 13, Houston. Over.
00 01 30 48	CC	Apollo 13, Houston. Over.
00 01 31 07	CC	Apollo 13, Houston. Over.
00 01 31 09	CMP	Go ahead.
00 01 31 10	CC	Hello there. We thought you were still up there.
00 01 31 13	CMP	And we're just coming up on Baja, and I've got the TV on. Do you want it?
00 01 31 18	CC	I don't think we require it just yet, Jack, but we'll command it when we're ready. I believe they are dumping the tape now. The booster looks good. The spacecraft looks good on the few minutes' data we've had.
00 01 31 31	CDR	That sounds good.
00 01 31 35	CMP	Jim finally let me look out.
00 01 31 41	CC	(Laughter) How do you like it?
00 01 31 52	CMP	Chained me to the LEB down there stowing things and unstowing things, and I finally got a chance to look out and see the world.
00 01 32 16	CC	Apollo 13, Houston. I have the TLI plus 90, and lift-off plus 8 pads whenever you're ready.
00 01 32 35	CDR	Okay. Go ahead with the TLI pad, Joe.
00 01 32 41	CC	Okay. This is the TLI plus 90 pad. SPS/G&N, 63825, minus 1.54, plus 1.32, 004:06:45.53, minus 0491.7, plus 0000.1, plus 6634.0, 180, 228, 001; HA is N/A; HP is plus 0017.9; 6652.2, 7:37, 6626.5, 26, 155.4, 15.7. Boresight star is Zeta Sagittarii; up, 08.0; right, 2.1; minus 22.81, minus 025.00, 1140.7, 34087, 013:32:14. Set stars Arcturus, Denebola; roll 044; pitch 012, yaw 025; no ullage. Over.
00 01 34 41	CDR	Joe, we had a dropout of signal there about midway or about a fifth of the start of your pad, and Fred didn't get it. We'd like you to start over again. Could you please?

00 01 34 52	CC	Sure thing. You want the whole thing?
00 01 34 54	CDR	Yes, I think you'd better.
00 01 34 56	CC	Okay. TLI plus 90: SPS/G&N, 63825, minus 1.54, plus 1.32, 004:06:45.53, minus 0491.7, plus 0000.1, plus 6634.0, 180, 228, 001; N/A; plus 0017.9, 6652.2, 7:37, 6626.5, 26, 155.4, 15.7; Zeta Sagittarius; up, 08.0; right 2.1; minus 22.81, minus 025.00, 1140.7, 34087, 013:32:14. Set starts: Arcturus, Denebola; roll 044, pitch 012, yaw 025; no ullage. Over.

MILA (REV 2)

00 01 36 47	LMP	Okay, Joe. That's 63825, minus 1.54, plus 1.32, 004:06:45.53 - -
00 01 37 02	CC	Fred, Houston. Stand by 1.
00 01 37 04	LMP	- - minus 0491.7, plus 0000.1, plus 6634.0.
00 01 37 12	CC	Fred, Houston. Over.
00 01 37 13	LMP	Go ahead.
00 01 37 15	CC	That's correct. We would like you to go the S-BAND AUX TV switch to TV, please.
00 01 37 22	LMP	Okay. It's set to TV.
00 01 37 23	CC	Okay. We're not getting a signal.
00 01 37 25	CDR	Okay. I'll go to TRANSMIT, Joe.
00 01 37 26	CC	Okay. You can continue reading back.
00 01 37 31	LMP	Okay. Roll 180, pitch 228, yaw 001; N/A; plus 0017.9, 6652.2, 7:37, 6626.5 and I missed sextant shaft - trunnion - trunnion, 15.7, Zeta Sagittarius, up, 08.0; roll 2.1; minus 22.81, minus 00 - correction, minus 025.00, 1140.7, 34087, 013:32:14. Set stars: Arcturus and Denebola; roll aline 044, pitch 012, yaw 025; no ullage.
00 01 38 31	CC	Roger, Fred. Readback correct. The sextant star is 26, and the shaft is 15.54. Over.

00 01 38 42	LMP	Okay. Sextant star 26 and 15.54.
00 01 38 46	CC	Roger. And we have a picture now; however, it's moving around quite a bit, if you could hold the camera a little steadier. And I have your - -
00 01 38 54	LMP	- - Okay, Joe. There's nothing but clouds outside, and when we get some land down there coming up, I'll switch back to the window. I thought I'd just show you Jim here, to make sure he's still here.
00 01 39 08	CC	Okay; real fine. We had a good picture of Jim there for a minute. I have the lift-off plus 8 pad, Fred. If you're ready.
00 01 39 17	LMP	Go ahead, Joe.
00 01 39 18	CC	Okay. GETI, 008:00; DELTA-V_T, 7835; longitude, minus 165; GET 400 K, 022:36. Over.
00 01 39 41	LMP	Okay. 008:00, 7835, minus 165, 022:36.
00 01 39 49	CC	Okay, then. And I have a TLI pad for you.
00 01 39 54	LMP	Okay. I'm ready.
00 01 39 55	CC	TLI: 2:26:05, 179, 108, 000, 5:47, 10416.9, 35587, 358, 139, 320, 302, 319, 040. Ejection time, 4 plus 01 plus 00. Over.
00 01 40 44	LMP	Okay. TLI: 2 plus 26 plus 05, 179, 108, 000, 5 plus 47, 10416.9, 35587, 358, 139, 320, 302, 319, 040, and ejection time, 4 plus 01 plus 00.
00 01 41 18	CC	Roger, Fred. Readback correct, and we're getting a nice color TV picture now. If you have any commentary to go with it.
00 01 41 31	CMP	Okay, Joe. I'll tell you, I'm just trying to figure out where we are here.
00 01 41 40	CC	That's your job, not mine.
00 01 41 43	CMP	You know, I've just been up out of the LEB for a short time here, and I'm trying to find out which country we're over.
00 01 41 52	CDR	I have to keep telling Jack that the blue stuff down there is water.

00 01 41 56	CC	I'll give you a hint. You're in the western hemisphere.
00 01 42 10	CMP	Okay, Joe. It appears like that we've crossed out into the Gulf of Mexico here, and I've got a peninsula or an island that's down there. I don't know whether you can see it.
00 01 42 34	CC	Roger, Jack. We see that. Of course, there's a lot of cloudcover and you see it more clearly than we do, but it does look like the Earth, not the Moon.
00 01 42 58	CC	Apollo 13, Houston. We've had LOS MILA now. Thank you very much.
00 01 43 48	CC	Apollo 13, Houston. Request POO and ACCEPT for a state vector. Over.
00 01 43 53	CDR	Roger, Houston. We're in POO and ACCEPT.
00 01 43 56	CC	Okay.
00 01 48 08	CC	Apollo 13, Houston.
00 01 48 10	CDR	Go ahead, Houston.
00 01 48 11	CC	Okay. The computer is yours, Jim.
00 01 48 14	CDR	Thank you, - -
00 01 48 16	CC	And you are GO for TLI. Huntsville reports that you have a 6-second propellant pad which is 3 seconds more than a 3-sigma case; so you're good on consumables. The IU is so good that we're not going to update it. The only change we have for you is in the TLI checklist. At 57 minutes where you slew the FDAI to 18 degrees, we recommend 20 degrees there, and we recommend that you look for 8 degrees instead of 6 degrees at ignition. The S-IVB is riding on the top of its deadband.
00 01 48 56	CDR	- - Understand; and just out of curiosity, was that engine out to use up more S-IVB fuel?
00 01 49 03	CC	The engine out did cause you to use more S-IVB fuel - about a 10-second-longer burn; but you're still GO.

00 01 49 12	CDR	Okay. Thank you.
00 01 49 21	CC	And, 13, Houston. We're ready to support pyro arm and docking probe extension whenever you're ready.
00 01 49 36	CDR	Okay, Houston. Docking probe has been extended and all indications are nominal. We're down to PYRO ARM now and we're getting ready.
00 01 49 47	CC	Okay, Jim.
00 01 49 58	CDR	Okay, Houston. My circuit breaker's armed - or closed; SEQUENTIAL LOGIC, two, on and up and we're ...
00 01 50 06	CC	Okay, 13. You are GO for pyro arm.

CANARY (REV 2)

00 01 50 40	CDR	And, Houston, 13. Were you reading us?
00 01 50 43	CC	Roger, 13. Go ahead.
00 01 50 47	CDR	Roger. We have our SEQUENTIAL ARM circuit breakers in and our SEQUENTIAL LOGIC, two, on and up and we are just standing by for your confirmation for a GO.
00 01 50 56	CC	Sorry, 13. You didn't copy. You are GO for pyro arm. Over.
00 01 51 00	CDR	Okay; fine. Thank you.
00 01 53 21	CC	Apollo 13, Houston.
00 01 53 24	CDR	Go ahead, Houston.
00 01 53 26	CC	About 2-1/2 minutes to LOS, Jim, and your AOS at Carnarvon will be 2 plus 25 plus 50. Over.
00 01 53 41	CDR	Roger. AOS at Carnarvon 2 plus 25 plus 50.
00 01 53 45	CC	That's affirm.
00 01 53 57	CC	Apollo 13, Houston. LOS in about 1 minute. At LOS we would like COMMAND RESET and then NORMAL.
00 01 55 06	CDR	Roger.

CARNARVON (REV 2)

00 02 25 38	CC	Apollo 13, Houston through Carnarvon.
00 02 25 41	CMP	Okay, Joe. Read you loud and clear. We are sitting here monitoring time base 6. ... count-down; we're 20 seconds away.
00 02 25 49	CC	Okay. We're just starting to get data, and everything still looks good to us.
00 02 25 53	CMP	Hey, Joe. At 2 hours and 12 minutes, the O_2 FLOW HIGH light came on, and it's been pegged high ever since, so it's been on about 14 minutes now.
00 02 26 04	CC	Roger, 13. We're looking at it.
00 02 26 09	CDR	Time base 6.
00 02 26 12	CC	Copy. Time base 6.
00 02 26 52	CC	Okay. Apollo 13, Houston. You have a GO for all systems, and the O_2 FLOW HIGH check is nominal with the WASTE TANK VENT open at this time, and it's no sweat.
00 02 27 05	CMP	Okay. Just wanted you all to check it for me.
00 02 27 08	CC	Okay. We did.
00 02 27 11	CMP	Thank you.
00 02 31 22	CC	Apollo 13, Houston. We will be losing data from Carnarvon in about 1 minute. We'll probably have voice through ARIA. Everything is honkey-dory, and we will be listening for you to tell us how the burn goes.
00 02 31 34	CDR	Okay, this is 13. We are standing by, too.

ARIA (REV 2)

00 02 33 14	CC	Apollo 13, Houston through ARIA. Just a COMM check. Over.
00 02 33 20	CDR	Reading you clear ...

00 02 33 26	CC	Okay, Jim. It's not the best, but we are reading you.
00 02 33 30	CDR	Roger.
00 02 35 51	CDR	Ignition, Houston.
00 02 35 53	CC	Copy that, Jim. Good deal.
00 02 37 52	CDR	Everything's okay so far.
00 02 37 56	CC	Houston; Roger.
00 02 38 27	CDR	... at 38.
00 02 40 26	CDR	We're getting a little vibration during this burn.
00 02 40 28	CC	Houston; Roger.
00 02 41 40	CDR	It's off. Engine off.
00 02 41 42	CC	Houston. Copy. Engine off.

NOTE

After the Hawaii pass following TLI, there is continuous acquisition among Goldstone (GDS), Madrid (MAD), and Honeysuckle (HSK).

00 02 42 27	CC	13, Houston. We'll have you through Hawaii in 3 minutes.
00 02 42 31	CDR	Roger. Through Hawaii in 3 minutes.
00 02 45 30	CC	Apollo 13, Houston through Hawaii. Over.
00 02 45 34	CDR	13 through Hawaii. How do you read?
00 02 45 38	CC	13, Houston. You're weak but clear; it will probably get better in a second. We're standing by for the burn report.
00 02 45 44	CDR	Roger.
00 02 46 01	CC	13, Houston. The booster reports that everything looks good with the S-IV.
00 02 46 08	CDR	Sounds good, Houston. The ride was very nominal. We a little vibration, though, during most of the run.

00 02 46 15	CC	Okay. We copied your call on that, Jim.
00 02 46 19	LMP	Okay, Joe. The DSKY read 35560, plus 04445, plus 01769, and DELTA-V_C was minus 3.0.
00 02 46 37	CC	Roger. You can't ask for much better than that. How about the burn time? Did you notice?
00 02 46 42	CDR	Okay. On my trusty watch, I had about 3-3/4 seconds long.
00 02 46 49	CC	Okay. Copy that.
00 02 48 34	CC	Apollo 13, Houston.
00 02 48 38	CDR	Roger, Houston; 13 here.
00 02 48 39	CC	Okay. We have the S-IVB maneuver to SEP attitude commencing at 2 plus 56 plus 37. Duration of the maneuver: 4 minutes. SEP time, 3 plus 06 plus 37. Over.
00 02 49 15	LMP	Okay. If I heard those right, Joe, the S-IVB maneuver was 2 plus 56 plus 57. SEP time is 3 plus 06 plus 27.
00 02 49 25	CC	Correction on the second; 2 plus 56 plus 37, and 3 plus 06 plus 37.
00 02 49 43	LMP	Okay. 2 plus 56 plus 37, with the maneuver time and the SEP time, 3 plus 06 plus 27?
00 02 49 53	CC	That's plus 37, too. Exactly 10 minutes later, Fred.
00 02 50 05	LMP	Okay; 37.
00 02 57 52	CC	Apollo 13, Houston.
00 02 57 54	CDR	Go ahead.
00 02 57 57	CC	We see the booster doing all the right things, and FIDO says your trajectory looks good, and it looks like we'll stick with a pretty close to nominal midcourse, too. We'll have some numbers for you later
00 02 58 02	CDR	Okay. And we concur. The S-IVB is maneuvering at this time.

00 02 58 13	CC	Roger.
00 02 58 32	CC	And, Apollo 13, Houston. We'd like OMNI Alfa. Over.
00 02 59 54	CC	13, Houston. Now request OMNI Charlie.
00 02 59 56	CDR	Roger. OMNI Charlie.
00 03 00 06	CC	And, 13, we'll be doing a handover, now.
00 03 00 09	CDR	Okay.
00 03 01 33	CC	Apollo 13, Houston. You are GO for T&D.
00 03 01 37	CDR	Okay, Joe. Thank you.
00 03 01 44	CC	And, 13, Houston. Check your NOUN 17 for extraction pitch attitude. It should be 319 degrees. Over.
00 03 01 52	CDR	Okay. We'll look at it.

END OF TAPE

00 03 05 20	CMP	Okay, Houston; 13. Do we have a GO for pyro arm?
00 03 05 31	CC	13, Houston. Affirmative. You're GO for pyro arm, and recommend you secure the cabin pressurization.
00 03 05 39	CMP	We did. We closed the waste management vent valve, there. Or waste stowage valves - -
00 03 05 48	CC	Okay. We're reading 6 psi on the cabin, Jack.
00 03 05 55	CMP	Roger, Joe. Thank you very much.
00 03 07 38	CMP	Yes, that's quite a bang, Joe. We've separated, and we've pitched around about 60 degrees now.
00 03 07 44	CC	Roger, Jack. We see you pitching.
00 03 07 47	CMP	Okay. We got the SLA panels - one of them is out front now.
00 03 07 52	CC	Ah, so.
00 03 08 38	CMP	Got the S-IVB. I guess we're about 80 feet.
00 03 08 42	CC	Good deal.
00 03 09 01	LMP	Okay. I'm going to come on with the TV now, Joe.
00 03 09 03	CC	Okay, Fred. We're waiting for it.
00 03 09 52	CC	13, Houston. We've got a groovy TV picture.
00 03 09 58	CMP	Sounds good.
00 03 11 25	LMP	Is the focus good enough, Joe, that you can see all the glittering debris?
00 03 11 33	CC	We've seen some debris, Fred. The booster itself is a little bit bright. What's your f-stop?
00 03 11 40	LMP	Okay. I'm at 22.
00 03 11 41	CC	Why don't you go up a click and let us have a look at that.
00 03 11 50	LMP	Okay. You're at 44 now.
00 03 11 55	CC	Okay. Let's stay there for now and I assume you're in peak.

00 03 11 58	LMP	Affirmed.
00 03 12 17	CC	13, Houston. Recommend RATE 2 on the BMAGs.
00 03 12 23	LMP	Thank you.
00 03 13 23	CC	It's getting bigger.
00 03 13 42	CDR	As you might know, Joe, I've got the center seat, again and I can't see a thing.
00 03 13 47	CC	Too bad.
00 03 13 49	CDR	I gave him the TV monitor.
00 03 15 04	LMP	Okay, I'm going to be moving the TV directly. I'm going to pull it out of this bracket, Jim.
00 03 15 10	CC	13, Houston. Did you call?
00 03 15 12	LMP	Roger. I'm going to be moving the TV to get a better shot here - moving it out of this bracket.
00 03 15 18	CC	Okay, Fred. It's just beginning to cut off at the bottom, but it's still a very good picture.
00 03 16 30	CC	That's a good picture, Fred.
00 03 16 36	LMP	Yes, we are just about there. About 10 more feet now.
00 03 16 41	CC	Roger.
00 03 16 43	LMP	Everything looks pretty good down in the S-IVB, too. The shroud still looks intact down there.
00 03 16 50	CC	Good deal. There is really quite a bit of detail on this picture.
00 03 17 07	CMP	Okay. We've got two - two barber poles.
00 03 17 11	CC	Houston; Roger.
00 03 18 10	LMP	Okay. You should be able to see down into the portion of the IU right now, Joe.
00 03 18 21	CC	Fred, Houston. We'd like to try going to AVERAGE on the TV for a minute or so.
00 03 18 29	LMP	Okay. You've got AVERAGE, and a little yellow dust cap just floated by in front of us.

00 03 18 36	CC	Yes. We see it at the top of the screen.
00 03 18 41	CC	Fred, after a few minutes of this, at your convenience, we could use some interior shots if you get the time and if the lighting is good.
00 03 18 51	LMP	Okay.
00 03 18 52	CC	And, 13, Houston. The S-IVB vent times are nominal as in the flight plan within a few seconds.
00 03 19 18	CDR	We're hard docked, Houston.
00 03 19 21	CC	Roger. Understand. Good deal. Fred, one more thing on the TV. If you could come to f:22 again - -
00 03 19 32	LMP	Okay. You've got f:22 again.
00 03 20 22	CDR	And, Houston, Fred will handle the camera as we go through the postdocking checklist.
00 03 20 26	CC	Okay, Jim. Real good.
00 03 21 38	LMP	Okay, Joe. I am pointing it over toward Jack, and it's pretty bright with the Earth out that window. Is that sort of washing out the picture here?
00 03 21 49	CC	No, Fred, it's not. We've got a bright spot where the window is. The rest of you are semi-silhouetted. It's a pretty impressive picture.
00 03 22 36	CC	Apollo 13, Houston.
00 03 22 38	CDR	Go ahead, Joe.
00 03 22 40	CC	For Fred. The IOS [?] has caught you with the fuel cell reactant values in latch again.
00 03 22 52	LMP	Touché.
00 03 22 54	CC	And we have word that the propellant usage for T&D was nominal.
00 03 23 01	CMP	Okay, what is nominal, please?
00 03 23 02	CC	Well, I didn't ask that yet, Jack; stand by one.
00 03 23 07	CMP	Okay (laughter).

00 03 24 20	CC	Fred, this is Houston. Over.
00 03 24 22	LMP	Go ahead.
00 03 24 24	CC	Okay. With the direct sunlight from the window, out of the TV camera field as it is now, we'd like you to open it up an f-stop or so and, if convenient, try to keep that bright spot out of the window.
00 03 24 40	LMP	Okay.
00 03 26 14	CC	13, Houston. I guess we could stand one more twick down on the f-stop.
00 03 26 24	CMP	Okay, Joe. He's going to do it.
00 03 26 26	CC	That is, we want you to open it up. Looks like a very interesting book you're reading.
00 03 26 33	CMP	I have two of them.
00 03 30 11	CC	Hey, that's pretty, Fred.
00 03 30 17	LMP	Okay. I hope you got more detail than I have on the monitor here.
00 03 30 21	CC	No. We probably don't, but it's kind of a neat picture anyway.
00 03 30 39	CMP	Houston, we are now going to finish repressurizing the tunnel.
00 03 30 46	CC	Houston; Roger.
00 03 31 47	LMP	... probably hear, Joe, we're just finishing pumping up Aquarius here.
00 03 31 54	CC	Okay. About all we see on this picture, Fred, are the bright spots with the lights around the tunnel area. The hatch itself is pretty dark.
00 03 31 57	CC	13, Houston. By the way, we'd like to know how the high gain antenna lockup worked. Our signal strength is a little bit lower than we thought it would be.
00 03 33 06	CMP	It looked just the way I expected it to, Joe. I had her sitting there in REACQ with the numbers cranked in and soon as we got pretty much through the rotation, I just threw it down to HIGH GAIN and it appeared to lock right up.

00 03 33 24	CC	Okay. Good deal. See that flashlight beam wandering around in there.
00 03 33 45	LMP	Houston, 13.
00 03 35 47	CC	13, Houston. Go ahead.
00 03 35 50	LMP	We'd kind of like to hold off on the - start the venting again until we get the things - pumped back up inside here. Wonder if you might give us a call to remind us when to initiate that.
00 03 36 06	CC	Okay, 13; will do.
00 03 36 26	LMP	And we'll try to shift her up to look up into the tunnel here.
00 03 36 31	CC	Okay. Real good.
00 03 36 54	CC	Okay, 13; Houston. I think we could use an f-stop lower. What f-stop are you in now?
00 03 37 03	LMP	I'm about as low as you can go, Joe. I'm sitting on 4.4.
00 03 37 06	CC	Okay.
00 03 37 18	LMP	What you're looking at, Joe, is the commander has removed the hatch and is proceeding to stow it.
00 03 38 06	CC	Okay, 13. That's a pretty good picture there.
00 03 38 14	LMP	The CDR is verifying the docking latches now.
00 03 38 17	CC	Roger.
00 03 38 25	CMP	Hey, Joe. Jim reports that there's a slight, you know, burn smell up in the tunnel area, as been reported on previous flights.
00 03 38 34	CC	Okay. We copy that.
00 03 39 06	CMP	Okay. The commander reports all docking latches latched.
00 03 39 11	CC	Houston; Roger.
00 03 42 08	CC	13, Houston. For your information, the S-IVB vent is proceeding on schedule.

00 03 42 15	CMP	Okay, Joe.
00 03 42 20	LMP	Yes, Joe. That's - That's concurring with all the thousands of particles that I see going by outside here.
00 03 42 30	CC	Yes. I guess I didn't need to tell you.
00 03 44 16	CC	13, it looks like Jim is connecting the umbilical at this time. Is that right?
00 03 44 21	LMP	Yes, that's affirm - affirm, Joe. Do you have any detail up in there at all? On the monitor it looks like I can - I can make out the drogue - the drogue a little bit, but not much else.
00 03 44 34	CC	We can see the probe pretty well, and we can see his hands quite well there.
00 03 45 59	CMP	Okay. We're powering the LM now, Joe.
00 03 46 03	CC	Okay, Roger that.
00 03 46 19	CC	And the voltage looks good there, 13.
00 03 46 23	CMP	Roger.
00 03 47 04	LMP	Okay. We're going to take an outside view now, out the left side, Joe.
00 03 47 07	CC	Okay, Fred. Real good.
00 03 48 03	LMP	Okay. You making out the picture there, Joe?
00 03 48 07	CC	Yes. Is that the world?
00 03 48 19	CC	Okay, Fred. That's pretty nice looking picture. We'd like to know what settings you used to get that.
00 03 48 28	LMP	Okay. I think Jim is holding it now and - it - Okay, it should be in about f:22, infinity, and I think the 50-millimeter. And Jim says he thinks he hit Baja in the picture now.
00 03 48 50	CC	Okay. I think we can stand to go to f:44 on that. The clouds are pretty bright.
00 03 48 56	LMP	Okay. We are going to have to press on here, Joe, so we are back inside.

00 03 49 00	CC	Okay. Thanks a lot.
00 03 54 04	LMP	Okay. How's that picture looking back outside now, Joe? Getting ready for LM extraction.
00 03 54 13	CC	Okay. That looks pretty good, Fred.
00 03 54 14	CDR	Houston, this is 13. Do we have a GO for pyro arm?
00 03 54 20	CC	13, Houston. Affirmative. You're GO for pyro arm.
00 03 54 50	CMP	Hey, Joe, when we went back up and rechecked the tunnel there, we found two latches that weren't cocked and we reset them.
00 03 55 02	CC	I'll roger that, Jack.
00 03 56 56	CMP	Joe, I've got a beautiful view of the Earth out window 1.
00 03 57 03	CC	Roger, Jack.
00 03 57 04	LMP	By the way, the windows came through in real good shape. Window 5 looks real clean, so I am kind of hopeful that Hycon stuff will be pretty good.
00 03 57 14	CC	Good deal.
00 03 57 22	LMP	I meant window 3, Joe.
00 03 57 58	CC	Okay, 13; Houston. You're GO for LM SEP whenever you're ready.
00 03 58 06	CDR	Roger.
00 03 58 18	CC	Okay, 13; Houston. Correction on that. You're GO for LM SEP at the nominal time and - or later. We don't want it early.
00 03 58 27	CDR	Okay, Joe. We'll do it at 04:01:00.
00 03 58 29	CC	Roger.
00 04 00 54	CMP	Okay. We're about ready to pull the LM out, Joe.
00 04 00 59	CC	Okay, 13.
00 04 01 03	CMP	Here she comes.

00 04 01 15	CMP	Okay. Looks like we're clear, Joe.
00 04 01 19	CC	Okay. Looks good. It's weird because we get the TV about 10 seconds after you call it.
00 04 02 45	CC	Apollo 13, Houston.
00 04 02 52	CDR	Go ahead.
00 04 02 53	CC	Okay. We'll be waiting for you to tell us that you feel you're safely clear of the booster, and give us the GO to command the booster in its yaw maneuver.
00 04 04 39	CC	13, Houston. Did you copy my last about giving us a GO for the yaw?
00 04 04 46	LMP	Yes, we're maneuvering, Joe, and we hadn't picked her back up again yet.
00 04 04 55	CC	Okay. Do you want to wait till you acquire it before we yaw it?
00 04 05 03	CDR	How much time do you have, Houston? Can you wait, or do you want to do it right now?
00 04 05 09	CC	We can wait if you want us to, Jim.
00 04 05 11	CDR	Why don't you wait just a little bit.
00 04 05 13	CC	Okay.
00 04 06 02	CMP	Joe, did they ever get an idea of what that - the TD and E fuel was?
00 04 06 09	CC	Jack, they're not willing to pin it down to a specific number right now because they say the tanks will warm up later on and the apparent consumption will go down. But it was nominal.
00 04 06 20	CMP	Okay.
00 04 08 26	CMP	Okay, Houston. We have the S-IVB in sight. You are GO to maneuver the S-IVB.
00 04 08 31	CC	Houston, Roger that.
00 04 09 04	CMP	Try to give you a - Houston, we're going to try to give you a shot of the S-IVB with the TV out window number 3.

00 04 09 11	CC	Okay. Real good, Jack. Our S-band signal strength has been fluctuating. Does it seem to be going all right up there in the AUTO TRACK mode?
00 04 09 24	LMP	Yes. Right now; yes, it's dropped off to about the 70-percent point, Joe, and it was before up about 85.
00 04 09 34	CC	Okay.
00 04 09 54	CDR	And, Houston, do you have a TV picture?
00 04 09 57	CC	Not at the moment, Jim. We had a garbled one there for a few seconds, and we don't have one at this moment.
00 04 10 05	CDR	Okay. I can see the S-IVB now out the hatch window and it's - -
00 04 10 11	CC	Okay, Jim. Suddenly we have a very good picture.
00 04 10 13	CDR	Okay.
00 04 10 50	CDR	And, Houston, I can see the gold shroud around the IU, and it looks that it's all intact.
00 04 10 56	CC	Roger, Jim. We copy that. Incidentally, the APS evasive maneuver will be about 4 minutes late. It'll be at about 04 plus 18.
00 04 11 09	CDR	Roger.
00 04 11 37	CC	13, Houston. Wonder if you could zoom in on that S-IVB for us a little bit?
00 04 11 42	CDR	Okay.
00 04 12 19	CC	Yes, yes. More like that. That's nice. It's off our screen to the right, now.
00 04 13 08	CC	Oh, that's very nice, very nice.
00 04 13 55	CMP	Okay, Joe. Is EECOMM monitoring the O_2 FLOW HIGH light again? We haven't yet started the venting yet.
00 04 14 04	CC	Okay. Stand by. I'll check.
00 04 14 35	CC	13, Houston.

00 04 14 38	CMP	Go ahead.
00 04 14 39	CC	Jack, your cabin REGs are still making up, but you're GO to open the waste management vent again at this time, and we'll delta the time to close it by the appropriate amount for you.
00 04 14 52	CMP	Okay. Real fine. Well, we'll wait till the S-IVB does its maneuver here.
00 04 14 58	CC	Okay.
00 04 16 53	LMP	Okay, Joe. We just had a momentary dropoff in signal strength again there.
00 04 16 59	CC	Roger, Fred. We had an LOS for a minute and we lost our TV picture. It looks like - yes, we just got it back. It looks great again.
00 04 17 15	CC	13, Houston. You might stop the f-stop down one more notch, if you got any left.
00 04 17 41	CC	And, 13, Houston. We'll be commanding the evasive maneuver in about 17 seconds.
00 04 18 41	CMP	Okay, Joe. We can see it start to move. However, it doesn't seem to be a lot of debris or vapor coming out of it.
00 04 18 48	CC	Roger that, Jack. Booster says that's great. He says the booster's doing its thing normally. Concur. We don't see much on the television at all.
00 04 19 16	CC	And, Apollo 13, Houston. We'd like to change the S-band and antenna configuration. Like you to go OMNI Delta. Like you to go MANUAL mode on the high gain with pitch of minus 60 and yaw of 90. Over.
00 04 19 37	LMP	Okay. You want us to OMNI Delta and MANUAL on the high gain to minus 60 and plus 90. Is that correct?
00 04 19 44	CC	That's affirmative.
00 04 20 06	CMP	Okay, Houston. How much longer would you like the television?
00 04 20 10	CC	Stand by on that. We'll get a word.

00 04 20 21	CC	Okay, 13; this is Houston. You can turn the TV off anytime you're ready. We've enjoyed the show.
00 04 20 40	CC	13, Houston. Before you secure the TV, we'd like to know whether that was in maximum zoom, just for information.
00 04 20 48	LMP	That's affirm. Jim had it in MAX zoom.
00 04 20 51	CC	Okay. Good deal. That was a real good picture.
00 04 21 24	CC	And, 13, Houston. The APS evasive maneuver appeared to be nominal. The LOX dump time is now 4 plus 39 plus 20, about 3 minutes late.
00 04 21 37	CDR	Roger.
00 04 24 24	CMP	Okay, Joe. We are right now opening the WASTE STOWAGE VENT.
00 04 24 29	CC	Okay, Jack. We copy.
00 04 25 00	CMP	Okay, Houston. We are charging battery B.
00 04 25 05	CC	Roger, 13. We see it. Looks good.
00 04 30 47	CC	Apollo 13, Houston. Request OMNI Alfa now. Over.
00 04 39 01	CC	Apollo 13, Houston.
00 04 39 04	LMP	Go ahead, Joe.
00 04 39 07	CC	Roger. They are having trouble verifying that the high gain is doing its thing. Like to verify that the pitch is minus 10, the Y is plus 350, you're in WIDE BEAM WIDTH and AUTO.
00 04 39 29	LMP	Okay. Minus 10 pitch, plus 350 yaw, and WIDE BEAM WIDTH and going into AUTO. You want HIGH GAIN, John?
00 04 39 41	CC	That's affirm.
00 04 39 44	LMP	Okay. Here, it's coming at you.

END OF TAPE

00 04 50 43	LMP	All right, Houston; 13.
00 04 50 45	CC	13, Houston. Go ahead.
00 04 50 49	LMP	Is the S-IVB doing something different now?
00 04 50 56	CC	Well, I don't know. It should be - let's see, it should have started the LOX dump at least quite a while ago. I guess that's complete. Why do you ask, Fred?
00 04 51 10	LMP	I'm looking out window 5 at what I think is the S-IVB, and I'm seeing what looks to be double plumes, going in two very narrow bands maybe about 3 degrees that are streaming out from it. And then there is a less dense band that covers maybe a 40-degree swath through the sky that continues out, also, in two directions.
00 04 51 45	CMP	Hey, Joe, what it looks like, kind of, is if you pull up behind a guy that's pulling a contrail, and you get in his contrail, like he's going away from you - there's a long contrail -
00 04 51 55	CC	Okay; stand by. Let me see what Frank's got to say about that.
00 04 51 59	LMP	Except we're between - Looks like we're between two contrails, one guy above and one below.
00 04 52 07	CC	Roger.
00 04 52 14	LMP	It's a very pretty sight.
00 04 52 33	CC	Okay, 13; Houston. The booster says that the propulsive dump is concluded; he now has the nonpropulsive vents open and what you see is a normal phenomenon and it should go on for another 5 minutes or so.
00 04 52 52	LMP	Okay.
00 04 52 54	CC	And, while I've got you, 13, at your convenience, we'd like to have the results of the EMS bias tests that you did pre-TLI and pre-SEP.
00 04 53 08	CMP	Stand by.
00 04 53 10	CC	Okay.

00 04 54 05	CMP	Okay, Joe. The TLI - the DELTA-V no bias test prior to TLI, we had a 0.8, and post-TLI, it was 1.0.
00 04 54 24	CC	Okay, Jack. Copy that. Thank you very much. Incidentally, as your tracking gets better and better, the size of MCC-2 is getting lower and lower and figures to be somewhere between 20 and 30 feet per second now.
00 04 54 40	CMP	Sounds good.
00 04 54 41	CC	Yes, sure does.
00 04 54 54	CC	Apollo 13, Houston.
00 04 54 56	CMP	Go ahead, Joe.
00 04 54 57	CC	Okay. We have a PTC REFSMMAT ready, if you're ready to go POO and ACCEPT, we'll stick it in there.
00 04 55 05	CMP	Okay. Stand by.
00 04 55 08	CC	Okay.
00 04 55 45	CMP	Okay. I'm POO and ACCEPT, Joe.
00 04 55 48	CC	Okay. Roger that.
00 04 59 02	CC	Apollo 13, Houston. We'll have a handover in half a minute or so. You may get a momentary loss of strength.
00 04 59 09	CMP	Okay, Joe.
00 05 00 28	CC	Apollo 13, Houston. The computer is yours. Over.
00 05 00 31	CMP	Okay. Going to BLOCK.
00 05 00 32	CC	Roger.
00 05 30 13	LMP	Okay, Houston. Do you copy 13's torquing angles on the P52?
00 05 30 18	CC	13, Houston. Leave them up just a second, and we'll get them down.
00 05 30 29	CC	13, Houston. Okay. We got them.

00 05 30 46	CDR	Okay. The time of torquing was 5 hours 30 minutes and 40 seconds.
00 05 30 51	CC	Roger. We copy.
00 05 39 47	CDR	Hello, Houston; Apollo 13.
00 05 39 49	CC	13, Houston. Go ahead.
00 05 39 51	CDR	Okay. I just got all hooked up to get in my COMM system here, and I just wanted to check out. I've got my suit stowed, a few other odds and ends done, and I'm back in business again.
00 05 40 01	CC	Okay. Good deal. We're kind of hanging loose down here. I've got a lift-off plus 15 pad. There's no hurry to read it up, so let us know when you're ready.
00 05 40 09	CDR	Okay.
00 05 41 44	CDR	Okay, Houston. Go ahead with the pad.
00 05 41 48	CC	Okay, Jim. Lift-off plus 15 pad: GETI 015:00, DELTA-VT 5622, longitude minus 165, and GET 400K 047:04. Over.
00 05 42 19	CDR	Okay, Houston. Lift-off plus 15: GETI 015:00, 5622, minus 165, 047:04. Is that correct?
00 05 42 36	CC	That's right, Jim.
00 05 54 45	CC	Apollo 13, Houston.
00 05 54 48	CMP	Go ahead, Jim.
00 05 54 50	CC	Roger. We'd like to have the ATTITUDE SET switch back to GDC, if you're finished with your aline. It gives G&C down here a telemetry problem.
00 05 55 01	CMP	Yes; okay.
00 05 55 02	CC	Thank you.
00 05 55 10	CMP	I'm just going to give them one more aline here.
00 05 55 12	CC	Okay. No rush.

END OF TAPE

00 06 15 40	CC	Apollo 13, Houston.
00 06 15 41	CDR	Go ahead, Houston.
00 06 15 43	CC	Roger. Would you please verify or tell us what S-band antenna configuration you're in, please?
00 06 15 51	CDR	Okay. Stand by.
00 06 16 07	CDR	We're in HIGH GAIN.
00 06 16 10	CC	Roger. Stand by a minute, Jim. Our signal strength is getting a little low. We may have a recommendation.
00 06 16 21	CC	13, Houston. Are you in MANUAL or AUTO in HIGH GAIN?
00 06 16 26	CDR	Stand by. We're in AUTO TRACK, Joe, and HIGH GAIN.
00 06 16 37	CC	Roger.
00 06 44 30	CMP	Houston, you copy 13?
00 06 44 39	CMP	Hello, Houston; Apollo 13. Over.
00 06 44 48	CC	13, Houston. Go ahead.
00 06 44 51	CMP	Hey, were you copying my P23 results?
00 06 44 56	CC	That's affirmative, Jack. We followed you through the whole thing. You're ahead of schedule.
00 06 45 03	CMP	Okay.
00 06 45 04	CDR	And, Joe, we confirmed there is no midcourse-1. Over.
00 06 45 11	CC	That is affirmative as far as I know. Let's get a final check on it, Jim.
00 06 45 16	CDR	Okay. Because we're standing by. We want to do a fuel cell purge and a waste water dump.
00 06 45 24	CC	Okay, Jim. We confirm there will be no midcourse-1.
00 06 45 30	CDR	Okay. It sounds good.

00 06 45 42	CC	And, 13, Houston. You can go ahead with the purge and dump at your discretion.
00 06 45 47	CDR	Roger, Houston. What we're going to do is, we're going to get rid of Fred's suit here. Fred's suit has been right in the commander's slot here for the last half hour. So we're going to try and get it stowed.
00 06 46 00	CC	Okay.
00 06 46 03	CDR	You did a pretty good job.
00 06 49 12	CC	Apollo 13, Houston. We'll have a handover in about 1 minute.
00 06 49 17	CDR	Hello, Houston. Apollo 13.
00 06 49 20	CC	Roger, Jim. We'll have a handover from Hawaii to Goldstone in about 30 seconds.
00 06 49 26	CDR	Say again, Houston.
00 06 49 29	CC	We'll be handing over from Hawaii to Goldstone in a few seconds. You may get a temporary loss of COMM.
00 06 49 37	CDR	Okay, Houston. We've got a whole bunch of noise, too.
00 06 59 23	CMP	Okay. Houston, 13.
00 06 59 26	CC	13, Houston. Go ahead.
00 06 59 28	CMP	Hey, Joe. Do you want to dump waste water down to 25 percent. Is that right?
00 06 59 33	CC	That's affirm.
00 06 59 34	CMP	Okay, in work.
00 06 59 35	CC	Okay.
00 07 00 18	CMP	Do you know we're also purging fuel cells O_2 now.
00 07 00 21	CC	Okay, Jack.
00 07 09 31	CMP	Okay, Houston. The fuel cell purge and waste water dump are complete.
00 07 09 38	CC	Roger, Apollo 13. And this is your relief CAP COMM shift on now.

00 07 09 49	CDR	Well, good evening, Vance.
00 07 09 53	CMP	Boy, you sure made it back fast.
00 07 09 55	CC	Yes. You guys had a beautiful launch, there. Really nice.
00 07 10 07	CMP	Could you follow it all the way up, Vance?
00 07 10 11	CC	No, I didn't see staging. It was too hazy for that, but we could see it for a few miles anyway.
00 07 10 24	CMP	I'll tell you, it's sure an interesting ride.
00 07 10 28	CC	Right.
00 07 17 00	CDR	Houston, Apollo 13.
00 07 17 02	CC	Roger. Go ahead, Jim.
00 07 17 05	CDR	Roger. We're at that stage now where we're going to take some Earth weather photography. If you're standing by, I have the camera aimed at the Earth right now, and I'll give you a mark when I take this first picture.
00 07 17 19	CC	Roger. We copy, Jim. We'll be standing by for the mark.
00 07 17 41	CDR	Okay, Houston. 3, 2, 1 -
00 07 17 45	CDR	MARK.
00 07 17 48	CC	Roger, copy.
00 07 18 17	CC	And Apollo 13, Houston. Over.
00 07 18 21	CDR	Go ahead.
00 07 18 23	CC	For the PTC, recommend that you disable quads A and B. Over.
00 07 18 30	CDR	Okay. Disable quads A and B, will do; and soon as Jack gets finished thrashing around, we'll be going to that PTC mode.
00 07 18 37	CC	Okay.
00 07 31 29	CDR	Okay, Houston. We're starting PTC. We're disabling quads A and B now.
00 07 31 34	CC	Roger, Apollo 13. Houston copies.

00 07 33 08	CC	Apollo 13, Houston. Over.
00 07 33 11	CDR	Go ahead.
00 07 33 12	CC	Jim, we'd like to verify that the high gain is secured, that the S-BAND antenna is on OMNI, and OMNI B should be the right antenna. Over.
00 07 33 27	CDR	Okay. You want the high gain secured and you want the OMNI on OMNI Charlie, huh? Or Baker?
00 07 33 35	CC	That's affirm. And this'll be maintained in the PTC.
00 07 33 39	CDR	Okay.
00 07 33 50	CC	And the high gain angles for stowage - or for stowing - are pitch minus 52, yaw 270.
00 07 39 21	CDR	Houston, Apollo 13.
00 07 39 24	CC	Roger. Go ahead.
00 07 39 26	CDR	Stand by for another Earth weather picture. I'll give you a mark.
00 07 39 29	CC	Okay. Standing by, Jim.
00 07 39 46	CDR	3, 2, 1 -
00 07 39 49	CDR	MARK.
00 07 39 51	CC	Houston copies.
00 07 40 22	CC	Apollo 13, Houston.
00 07 40 24	CDR	Go ahead, Houston.
00 07 40 27	CC	Houston here. Your rates look very stable. It looks like your rates are damped out completely here. As far as we can see, it would be alright to start the PTC.
00 07 40 39	CDR	Okay. We'll give it a try.

END OF TAPE

00 07 54 29	LMP	Hello, Houston. This is 13. How do you read?
00 07 54 34	CC	Hello, 13; Houston. Loud and clear. 13, Houston is reading loud and clear. How do you read?
00 07 54 48	LMP	Okay. And do you have any estimate, Vance, on how long we'll be charging battery B?
00 07 55 01	CC	Stand by 1, Fred.
00 07 55 21	CC	Apollo 13, Houston.
00 07 55 24	CDR	Go ahead.
00 07 55 26	CC	We'll be charging for 4-1/2 to 5 hours yet, Jim.
00 07 55 32	CDR	Roger.
00 08 02 33	CC	Apollo 13, Houston.
00 08 02 36	LMP	Go ahead.
00 08 02 39	CC	Fred, recommend that, when your window comes around facing the Earth again, that you catch another one of those pictures, and at the same time, you should probably start PTC again. We might have sent a confusing bit of info up to you. The "disable two quads" only applies to an early step in the procedure. We didn't mean that for the latter part of the procedure where we have the statement "enable all jets." Over.
00 08 03 15	LMP	Okay.
00 08 07 33	CMP	Houston, Apollo 13.
00 08 07 43	CC	Apollo 13, Houston. Go ahead.
00 08 07 46	CMP	Vance, Fred said that you had some more information about PTC and a different way of establishing it or something, huh?
00 08 07 55	CC	Roger. Referring to the procedure on G/8-2, if you have that open, I'll tell you what we had to give you.
00 08 08 11	CMP	Okay. Stand by and I'll get it out.
00 08 08 13	CC	Okay.

00 08 08 35	CMP	Okay. Go ahead, Van.
00 08 08 38	CC	Okay. On checklist G/8-2 under step 5, there's a statement, "disable all jets on two adjacent quads," and that's what we were referring to when we called up saying "disable quads A and B." So that's all fine; however, going down now to step 7 where it says "enable all jets," we hoped that you didn't think we meant leave A and B disabled there. In that case, it's as written. All jets should be enabled. Over.
00 08 09 20	CMP	Okay. Our checklist has "all jets" scratched out, and it says "enable couples on all axes." So what we'll do is - we'll reestablish this thing and come down to that step 7, and we'll enable all jets. That means enable quads A and B. Is that right?
00 08 09 42	CC	That's affirm. You'll have A, B, C, and D enabled for step 7.
00 08 09 47	CMP	Okay, real fine. I'll start on it now.
00 08 09 51	CC	Okay. Understand you're going to reestablish it.
00 08 10 46	LMP	And Vance, on that picture, I was all set to shoot it just a little before you called, and the Earth hasn't showed up in the window yet. I don't know if we got too far off the bellyband or what.
00 08 11 02	CC	Roger. Copy, Fred.
00 08 11 46	CC	Apollo 13, Houston.
00 08 11 50	LMP	Go ahead, Vance.
00 08 11 52	CC	Roger. On the photo, you'll probably have to reestablish the attitude for PTC and then whenever it comes into the window again, why we'll just be standing by for the photo.
00 08 12 06	LMP	Okay.
00 08 19 49	CC	Apollo 13, Houston.
00 08 19 51	CMP	Go ahead, ...
00 08 19 57	CC	Roger. You're coming in a little weak. Have a recommended roll rate for this PTC, if you could copy.

00 08 20 08	CMP	Alright. Go ahead.
00 08 20 10	CC	Okay. Recommend that you put in R_1 the following: 03750, and that should give you exactly a rate of 0.3 degrees per second. Over.
00 08 20 27	CMP	Okay. Enter 03750. Is plus or minus our choice?
00 08 20 38	CC	Roger. The same direction you rolled the last time, which I believe is plus.
00 08 20 47	CMP	Okay.
00 08 25 06	CMP	Hey, Vance, would you monitor our rates and kind of give an idea of when you think they're stable enough to start PTC.
00 08 25 14	CC	Roger, Jack. We'll take a look and let you know as soon as they look stable enough.
00 08 25 19	CMP	Okay. I've got quads A and B disabled here.
00 08 25 24	CC	Roger.
00 08 25 32	CMP	Have they come up with an idea of how much fuel I used on the docking and also the P23 session at 5 hours or 6 hours.
00 08 25 47	CC	I think we can give you something. Stand by a minute.
00 08 26 59	CC	Apollo 13, Houston.
00 08 27 02	CMP	Go ahead.
00 08 27 04	CC	Okay. It's looking good so far as RCS consumables are concerned, Jack. You're standing about 20 pounds above the curve right now. Looking at the TD&E, you expended 65 pounds or - Stand by - 55 pounds, correction on that.
00 08 27 27	CMP	How much?
00 08 27 28	CC	And 14 pounds on P23s. You used a little more out of quad A than out of the others.
00 08 27 37	CMP	Okay. Thanks, Vance.
00 08 27 38	CC	Roger.

00 08 27 42	CMP	Hey, could you say again the TD&E fuel? We've got a different - we all heard different things.
00 08 27 49	CC	I said 65 and then corrected that to 55 pounds.
00 08 27 55	CMP	Okay.
00 08 31 36	CC	Apollo 13, Houston.
00 08 31 39	CDR	Go ahead, Houston.
00 08 31 41	CC	Okay, Jim. Your rates look good. It's okay to start the roll again, if you'd like.
00 08 31 50	CDR	...
00 08 41 46	LMP	Hello, Houston; Apollo 13.
00 08 41 49	CC	Apollo 13, go ahead.
00 08 41 53	LMP	Okay. Ready for a little count here, Vance, and I'll shoot another picture. We found the Earth again.
00 08 41 59	CC	Okay. We'll be standing by, Fred.
00 08 42 05	LMP	A 3, 2, 1 -
00 08 42 09	LMP	MARK.
00 08 42 11	CC	Roger. Copy.
00 09 02 47	LMP	Hey, Houston, 13.
00 09 02 50	CC	Roger. Go ahead.
00 09 02 52	LMP	Okay. Stand by for a mark on another picture.
00 09 02 55	CC	Okay. Standing by, Fred.
00 09 03 09	LMP	3, 2, 1 -
00 09 03 12	LMP	MARK.
00 09 03 17	CC	Okay, we got it.

END OF TAPE

00 09 23 58	CC	Apollo 13, Houston.
00 09 24 08	CDR	Go ahead, Houston.
00 09 24 11	CC	Jim, Houston here. Two items: first of all, your PTC is looking very good and it should carry you through the night; second point, have a procedure to give you, if you're ready to copy. We'd like to set three bits in the computer, and I'll explain why.
00 09 24 43	LMP	Go ahead, Vance, we're ready to copy.
00 09 24 46	CC	Okay. The procedure is as follows: VERB 25, NOUN 07, ENTER; 1331, ENTER; 7, ENTER; and ENTER. Explanation as follows. During the P23s, there was one time when VERB 37 was entered into the computer at about 16 seconds after the OPTICS ZERO switch was flicked to ZERO. This is a very uncommon anomaly in that, if you do this during a 0.4-second interval at around 16 seconds after you zero the optics, some OPT-mode bits are reset; and this would mean that, if you had a OCDU fail, it wouldn't be indicated; so all this procedure is doing is setting these three bits back again where they should be.
00 09 26 01	LMP	Okay, Vance, and I guess I'll try to be slower on that VERB 37.
00 09 26 07	CC	Yes. Actually slower or faster, either one, I guess. Well, yes, slower. It's a very unusual thing to have that happen.
00 09 26 19	LMP	Okay. And, Houston, stand by for a mark on another picture.
00 09 26 24	CC	Roger. Standing by.
00 09 26 33	LMP	3, 2, 1 -
00 09 26 36	LMP	MARK it.
00 09 26 39	CC	Roger. We copy, Fred.
00 09 26 54	LMP	Okay, Vance; we've completed that procedure, and let me know if everything was okay.

00 09 26 59	CC	Okay, thank you. We'll let you know if anything isn't okay. I'm sure it's good now.
00 09 27 15	LMP	Tell G&C and GUIDO thanks a lot for keeping good track of me, there.
00 09 27 21	CC	Roger. They're right on the ball.
00 09 27 36	CC	And, 13, Houston. If you would like, we can let you know about every 2 minutes before the Earth should be coming into your window. We think we've got it pegged down pretty well now, and you won't have to look for it so much. You want that?
00 09 27 54	LMP	Yes. That would be fine, Vance.
00 09 27 56	CC	Okay.
00 09 28 06	CC	And, 13, Houston. GUIDO says the bits are reset - rather, are set.
00 09 28 13	LMP	Okay, thanks much.
00 09 45 58	CC	Apollo 13, Houston.
00 09 46 01	CDR	Go ahead, Houston.
00 09 46 04	CC	It's time for Fred to start looking for the Earth, should be coming by in about a couple of minutes.
00 09 46 10	CDR	Okay. He's got his head out there right now.
00 09 46 14	LMP	Yes. You've got that pretty well pegged, man. There it be.
00 09 46 21	CC	Doesn't that give you confidence?
00 09 46 26	LMP	Yes. I guess so. In a minute, you're going to hear my kitchen timer ding, and that also says the Earth is there.
00 09 46 39	CC	Okay.
00 09 46 57	LMP	Okay. Stand ... countdown.
00 09 47 09	CDR	3, 2, 1 -
00 09 47 12	CDR	MARK.

00 09 47 15	CC	Roger. We copy.
00 09 49 51	CC	Apollo 13, Houston. Over.
00 09 49 54	CDR	Go ahead, Houston.
00 09 49 56	CC	Roger. We're enjoying Fred's music there.
00 09 50 04	CDR	Yes, ... up here.
00 09 50 09	LMP	Yes, I kind of like it too, Vance.
00 09 50 15	CC	Yes, we didn't hear much of it, though.
00 10 03 38	CMP	Houston, Apollo 13.
00 10 03 41	CC	13, Houston. Go ahead.
00 10 03 44	CMP	Okay, Vance, we did another EMS null bias test and the - it went from 100.0 to 101.8 in 100 seconds.
00 10 03 59	CC	Roger. We copy.
00 10 06 09	CC	13, Houston.
00 10 06 12	CMP	Go ahead, Vance.
00 10 06 13	CC	Jack, like to verify, was that 100 to 100.8 or 101.8?
00 10 06 20	CMP	101.8.
00 10 06 23	CC	Roger.
00 10 06 26	CMP	It was plus 100 to plus 101.8.
00 10 06 31	CC	Roger.
00 10 07 57	CC	Apollo 13, Houston.
00 10 08 01	CMP	Go ahead.
00 10 08 02	CC	The Earth's coming up in the window again in 1 to 2 minutes.
00 10 08 08	CMP	He's got it. You're right again.
00 10 08 24	CMP	Okay, stand by for a mark here.

00 10 08 26	CC	Roger.
00 10 08 38	CMP	Okay, ready? 3, 2, 1 -
00 10 08 40	CMP	MARK.
00 10 08 42	CC	Roger, copy your mark.
00 10 09 06	CC	Apollo 13, Houston. We have a CSM state vector to send you. Request POO and ACCEPT at your convenience.
00 10 09 28	CMP	Okay, Vance. There's POO and ACCEPT.
00 10 09 32	CC	Okay, it's coming up.
00 10 11 30	CC	13, the computer is yours again.
00 10 11 33	CMP	Okay, going back to BLOCK.
00 10 11 35	CC	Roger.
00 10 29 31	LMP	Looks like picture-taking time again.
00 10 29 50	CC	Apollo 13, Houston.
00 10 29 53	LMP	Go ahead, Van.
00 10 29 56	CC	Okay, Earth should be coming into view.
00 10 30 01	LMP	Okay. I got it.
00 10 30 56	CMP	Okay. Stand by, Vance. 3, 2, 1 -
00 10 31 01	CMP	MARK.
00 10 31 03	CC	Roger. We got it.
00 10 31 14	CC	Earth starting to look pretty small now?
00 10 31 23	CMP	Well, looking at here, Vance, it's hard to be convinced it's even the Earth. All we see is water and clouds.
00 10 31 36	CC	Well, I guess that's what we want. We want pictures of weather, right, clouds.
00 10 31 43	CMP	Yes, about half of it's covered with clouds.

00 10 39 25	CMP	Houston, Apollo 13.
00 10 39 28	CC	This is Houston. Go ahead.
00 10 39 30	CMP	Okay, Van. Ready to copy in the torquing angles of the P52 option 3?
00 10 39 45	CC	That's affirm - that's affirm, but stand by.
00 10 39 51	CMP	Okay.
00 10 39 56	CC	Okay. We've got them. Go ahead with the torquing, Jack.
00 10 40 01	CMP	Okay. That was stars 20 and 27 and star-angle difference is five balls, and the time at torquing would be 10 hours 40 minutes 15 seconds.
00 10 40 15	CC	1 hour 40 minutes and 15 seconds; 20 and 27, stars; and five balls. Roger.
00 10 51 33	CC	Apollo 13, Houston.
00 10 51 37	CMP	Go ahead, Vance.
00 10 51 40	CC	Time to look out your window for us again.
00 10 51 46	CMP	Lo and behold.
00 10 52 58	CMP	Okay. It's 3, 2, 1 -
00 10 53 01	CMP	MARK.
00 10 53 03	CC	Roger. Copy.

END OF TAPE

00 10 59 08	CC	Apollo 13, Houston.
00 10 59 12	CDR	Go ahead, Houston.
00 10 59 13	CC	Jim, we're coming up on a handover between sites. You might lose COMM momentarily.
00 10 59 20	CDR	Okay. Understand handover, we might lose the COMM.
00 10 59 23	CC	Roger.
00 11 13 52	CC	Apollo 13, Houston.
00 11 13 55	CMP	Go ahead.
00 11 13 56	CC	You should have the Earth coming into view here shortly.
00 11 14 02	CMP	Okay.
00 11 14 12	LMP	We got a new CAP COMM now.
00 11 14 29	CC	No, I changed my voice.
00 11 14 58	LMP	3, 2, 1 -
00 11 15 01	LMP	MARK.
00 11 15 03	CC	Roger. Copy.
00 11 15 08	CDR	Negative, Houston. Say again.
00 11 15 12	CC	We got your mark, Jim.
00 11 15 16	CDR	Okay.
00 11 16 53	LMP	Hey, you still there, Van?
00 11 16 56	CC	Roger. Go ahead.
00 11 16 59	LMP	I guess the world really does turn. I can see some of my landmasses now. It must be Australia down near the bottom and I guess we haven't really figured out what's over the - to the left. It must be some part of Asia. China, probably.
00 11 17 19	CC	Hey, maybe the fact that you verified that the Earth really turns, we can call this Haise's theory, huh?

00 11 17 32	LMP	Very good, Vance. Very good.
00 11 17 36	CDR	...
00 11 17 39	CC	No, seriously. Very interestingly, we can see on the map now that you're between Guam and Hawaii and a little bit north, and you're almost out 60 000 miles.
00 11 17 58	CMP	Yes. I just did a P21 and we had 55 900.
00 11 18 08	CC	Okay. That's pretty good.
00 11 18 12	CMP	I'll let you look at it again here.
00 11 18 24	CC	Incidentally, we're looking at a replay of your TD&E stuff here and the TV looks pretty good. First chance some of us had had to see it.
00 11 18 47	CMP	Okay, Vance. In R_1, there's our altitude in tens of miles, 55 290.
00 11 19 01	CC	Okay.
00 11 20 14	CC	Apollo 13, Houston.
00 11 20 18	CDR	Go ahead, Houston.
00 11 20 19	CC	Okay. Looking at our computations back here, we show you about 55 450 and going out rapidly now.
00 11 20 33	CDR	Well, Hal might be a little bit off.
00 11 20 36	CC	Okay.
00 11 20 37	CMP	We have a sign underneath our LEB DSKY that "my name is Hal."
00 11 20 45	CC	I can't imagine how that got there. Just remember, you have to be nice to Hal.
00 11 20 55	CMP	We will.
00 11 21 04	CMP	I think this PTC's going to work out good. I been watching it here for the last hour here.
00 11 21 13	CC	Good. It's looking good here.
00 11 21 26		(Music - Aquarius)
00 11 21 44	CC	Good Lord!

00 11 23 57	CDR	Houston, 13.
00 11 24 02	CC	13, Houston. You're very weak. Please repeat.
00 11 24 07	CDR	Vance, to my calculations, we have taken about 10 Earth window photography pictures. I see nothing coming up here except to close the waste stowage vent here in a little while. I was thinking about getting squared away to bed down for the evening pretty soon.
00 11 24 35	CC	Okay. That sounds good, Jim. FAO here would like to request just one more picture before you bed down, if you don't mind.
00 11 24 47	CDR	Okay. We'll come through with one more picture.
00 11 24 50	CC	Okay.
00 11 30 33	CC	Apollo 13, Houston.
00 11 30 38	CDR	Go ahead, Houston.
00 11 30 40	CC	A couple of items, Jim. The first is, the time for closing the waste stowage vent is 12:24. If you turn in before that time, why it's okay as far as we're concerned down here to close it before that time just before you go to bed. The second point, we have some results on the P23s, and, if Jack's interested, we could give him the corrected altitudes we're getting, and so forth.
00 11 31 18	CMP	Yes. I sure am, Vance.
00 11 31 26	CC	Okay. This is preliminary results, but it will give you some indication. Corrected altitude is turning out to be 17 plus or minus 4 kilometers, and the fact that it's plus or minus 4 kilometers indicates that you're being very consistent in judging the altitude. The effective altitude is turning out to be 10 plus or minus 12 kilometers. Comments are that, as I said before, you're being consistent on the horizon selection. The sub-stellar point error is averaging 15 arc-minutes and if you could hold the rates to a minimum, you might shoot for 5 arc-minutes. That's the only comment there. Over.
00 11 32 31	CMP	Okay. We'll try doing it better next time.
00 11 32 35	CC	But, they're real satisfactory.

00 11 32 43	CMP	Okay. Thanks, Vance.
00 11 32 46	CC	Roger.
00 11 35 30	CC	Apollo 13, Houston.
00 11 35 33	CMP	Go ahead.
00 11 35 34	CC	Okay, Jack, this is the last time for the Earth coming into view in about 1 or 2 minutes.
00 11 35 43	CMP	Okay. I got my photographer looking out there.
00 11 35 47	CC	Okay.
00 11 35 59	CC	13, Houston. I just corrected. Actually, the Earth will come into view more times. It's just that we're ... to the photography. Over.
00 11 36 12	CMP	Okay.
00 11 37 17	LMP	3, 2, 1 -
00 11 37 20	LMP	MARK.
00 11 37 23	CC	Roger. We copy, and could you give us the frame number on that last picture, please?
00 11 37 31	LMP	Okay. We've been writing them all down, Vance, as we went, but that one turned out to be 29.
00 11 37 38	CC	Roger. Twenty-nine, Fred.
00 11 37 46	LMP	Okay, Jack says I can't read the camera very well. It should be 28 based on our start frame.
00 11 37 54	CC	Correction to 28.
00 11 38 09	CC	13, Houston. Understand, though, the number showing that you read on the camera was 28. Is that affirm?
00 11 38 21	LMP	Yes. The readability of that thing is like, you know, half a frame one way or the other; so, 28, I think, is a good number.
00 11 38 27	CC	Okay.
00 11 41 57		(Music - Halls of Montezuma)
00 11 42 12	CC	Roger. Houston copies.

00 11 42 23	LMP	I'll have to not wear it out before Jack gets there.
00 11 42 30	CC	Sounds like that music's a pretty nice thing to have on a long voyage.
00 11 42 39	LMP	Yes, you're right.
00 11 59 28	CC	Apollo 13, Houston.
00 11 59 32	LMP	Go ahead.
00 11 59 34	CC	Fred, did you get any MASTER ALARMS up there about 5 or 10 minutes ago? Folks thought they saw some here and they were curious about it.
00 11 59 46	LMP	Yes. We got another O_2 FLOW HIGH on - I guess it was about 5 minutes ago.
00 11 59 57	CC	Okay.
00 11 59 58	CMP	Vance, what the people down there might have been seeing is our testing.
00 12 00 06	CC	Roger. Testing the CAUTION and WARNING?
00 12 00 13	CMP	Yes. We were rigging the siren device over the MASTER ALARM, and we were running a test on it.
00 12 00 20	CC	Okay. Good enough. And anytime you're ready to copy, I've got a pad P37 block data.
00 12 00 32	CMP	Stand by.
00 12 01 21	CMP	Okay. Go ahead, Vance.
00 12 01 24	CC	Okay. P37 block data, starting with GETI. 025:00, 5119, minus 165, 071:08; 035:00, 7733, minus 165, 070:36; 045:00, 6208, minus 165, 094:52; 060:00, 5993, minus 165, 118:53. Over.
00 12 03 14	CMP	Okay. Stand by 1 minute.
00 12 03 27	CMP	Okay. 025:00, 5119, minus 165, 071:08; 035:00, 7733, minus 165, 070:36; 045:00, 6208, minus 165, 094:52; 060:00, 5993, minus 165, 118:53.
00 12 04 08	CC	Roger. That's all correct.
00 12 04 14	CMP	Okay.

00 12 08 15	CDR	Houston, 13.
00 12 08 17	CC	Roger. Go ahead.
00 12 08 20	CDR	We're starting our presleep checklist and no medication.
00 12 08 24	CC	Okay. The Doc says very good.
00 12 08 38	CDR	And, Houston, is there any onboard readouts that you don't have from us.
00 12 08 50	CC	Stand by 1. We need the LM/CM DELTA-P for one thing, and I'll check back in a minute with the others.
00 12 09 00	CDR	Okay. And we still have the vent valve open. We'll close it one of the last things and looking at LM/CM DELTA-P right now and I see 0.5 in psi indicated.
00 12 09 14	CC	Roger. Five-tenths.
00 12 09 37	CC	13, Houston.
00 12 09 41	LMP	Go ahead.
00 12 09 42	CC	Only other readouts we need are those on page 3-13 of the flight plan. BAT C, pyro BAT A, pyro BAT B, RCS A, B, C, and D readings, and DC INDICATOR select main A or B.
00 12 10 07	LMP	Okay. Stand by.
00 12 10 49	LMP	And, Vance, we're still charging BAT B. Did you want to dispense with that in a few minutes?
00 12 11 06	CC	Stand by on that, Fred.
00 12 11 13	CMP	Okay, Vance, I've got your readouts on page 3-13 of the flight plan.
00 12 11 17	CC	Okay. Ready to copy.
00 12 11 20	CMP	Okay, BAT C is 37, pyro BAT A is 37, pyro BAT B is 37, RCS A 94 percent, B 95 percent, C 93 percent, D 96 percent.
00 12 11 41	CC	Roger. Copy that.
00 12 12 23	CC	Apollo 13, Houston.

00 12 12 28	LMP	Go ahead.
00 12 12 30	CC	Okay. In answer to the battery-charging questions, I calculate it should be fully charged at 12:35. Play that one, though, the same as the waste vent. If you want to do it earlier because you're turning in, why that's fine with us.
00 12 12 52	LMP	Okay, we'll continue on with a few other things we got to get done, and just before turning in, we'll check with you, and you can remind us then.
00 12 13 02	CC	Okay.
00 12 17 17	CMP	Houston, Apollo 13. Give me a call when you're ready for E-memory dump.
00 12 17 26	CC	This is Houston, 13. You are weak. Please repeat.
00 12 17 30	CMP	Okay, Vance, give me a call when you're ready for our E-memory dump.
00 12 17 47	CC	Okay, 13. We're not quite ready yet. We'll give you a call when we're ready.
00 12 19 14	CC	Roger. Go ahead.
00 12 19 21	CMP	Okay, Vance. I understand you're ready.
00 12 19 26	CC	Negative, GUIDO isn't quite ready yet.
00 12 19 32	CMP	Okay. I thought I heard you call us.
00 12 19 37	CC	But we're ready now, Jack, so GUIDO says he's ready to take it.
00 12 19 46	CMP	On the way down.
00 12 19 48	CC	Roger.

END OF TAPE

00 12 34 33	CDR	Houston, Apollo 13.
00 12 34 38	CC	13, Houston. Go.
00 12 34 41	CDR	Okay, Vance. Requesting clearance now to turn the vent valve back to CLOSE again, and also the battery charge off.
00 12 34 53	CC	Roger. That's fine with us, Jim. Proceed.
00 12 34 56	CDR	Okay, we'll do that.
00 12 41 05	CC	Apollo 13, Houston.
00 12 41 07	CDR	Go ahead, Vance.
00 12 41 13	CC	We think the spacecraft's looking in good shape. Nobody has any comment down here before you hit the hay.
00 12 41 24	CDR	Okay. How do they think we stand on the way of consumables so far?
00 12 41 39	CC	You're looking in good shape in all respects - consumables-wise.
00 12 41 47	CDR	Okay. Real fine.
00 12 47 37	CC	13, Houston.
00 12 47 41	CMP	Okay, go ahead, Vance.
00 12 47 43	CC	Just the last comment, Jack. Would you clear Hal, please, so he doesn't burn his lights out there tonight?
00 12 47 51	CMP	No, I - I was just - I'll do that for you.
00 12 47 54	CC	Okeydoke.
00 12 48 04	CC	And we'll see you in the morning, huh?
00 12 48 07	CMP	Okay. It'll be just a minute or 2 yet. We have to finish up a couple more chores.
00 12 48 18	CDR	What do you mean? It is morning.
00 12 48 22	CC	Hey, that's right.

00 12 48 42	CC	It's been a long day, huh?
00 12 48 45	CDR	Yes, it sure was.

END OF TAPE

REST PERIOD - NO COMMUNICATIONS

00 23 11 14	CDR	Hello, Houston. Houston, Apollo 13. Over.
00 23 11 17	CC	Good morning, 13. This is Houston. How are you?
00 23 11 22	CDR	Read you loud and clear. We had a fairly good night's sleep.
00 23 11 32	CC	Okay. Real fine. At your leisure, you can give us radiation reports, I guess. We are getting a consumables update together for you, and a few other little details whenever you are ready to talk. About the only major thing on the spacecraft is that it's been getting farther away.
00 23 11 51	CDR	Okay. Well, that's to be expected, I guess.
00 23 11 54	CC	Yes.
00 23 15 38	LMP	And we're starting to charge battery A, Houston.
00 23 15 44	CC	Roger on battery A, Fred. EECOMM says battery B looks real good.
00 23 15 51	LMP	Okay.
00 23 16 46	CDR	Houston, 13.
00 23 16 48	CC	Go ahead.
00 23 16 51	CDR	Okay. For information, Fred was on COMM last night; and he was over in the left-hand seat, and if you want our radiation readings, we just goofed. We left them all in the suits which are now nicely tucked away. We are going to get out Jack's suit in an hour or so anyway, and we'll get his dosimeter out if you wanted to get the reading on that one.
00 23 17 13	CC	Okay. That will be satisfactory.
00 23 17 17	CDR	Okay.
00 23 17 18	CC	And in exchange for that, the surgeon would like to have a rough number of hours each of you slept and a qualitative verb to describe whether it was good, fair, or poor.

00 23 17 30	CDR	Okay. Stand by.
00 23 17 46	CDR	Okay, Houston. We had an average of around 5 or ...
00 23 18 06	CC	Jim, Houston. Your COMM got pretty garbled there just as you started to talk.
00 23 18 38	CDR	Okay. Houston, Apollo 13.
00 23 18 40	CC	Okay, 13. You're loud and clear again.
00 23 18 45	CDR	We averaged about 5-1/2 hours' sleep apiece, and we are estimating that the sleep was good.
00 23 18 53	CC	Okay. Copy that. Let's see what else we have for you, Jim. Midcourse-2 looks like about 23 feet per second, approximately retrograde and on time. And it's holding real firm now. For your information, and you don't need to copy this down, because it's still pretty soft, but we have an S-IVB impact of about 8.57 south and about 33.9 west, which is a little west and a little south of the flight plan value. We have it at a GET of about 77 plus 51 which is just before AOS, and the LOI pads are a little bit late, and as I say, it's still pretty soft, and we'll be updating you with firm numbers.
00 23 19 57	CDR	That's fine, Joe. Just as long as it doesn't hit Cone Crater.
00 23 20 02	CC	Okay. And I'll have a consumables update for you in a little while, and I have a small flight plan update for you sometime a little later on when you're ready to copy. There's no big deals in it.
00 23 20 19	CDR	Roger.
00 23 20 23	CC	And, 13, Houston. We'd like to verify that you cycled the O_2 cryo fans. We saw the H_2, but we didn't see the O_2 get stirred up.
00 23 20 35	CMP	Yes, Joe. We did, and it kind of looked like we might have had a little stratification because right after we put them on, we had a CRYO PRESS light.

00 23 20 45	CC	Okay. EECOMM told me that might happen, and he was right.

END OF TAPE

00 23 21 54	CMP	Okay, Joe. We're ready to copy a flight plan update and your consumables.
00 23 22 00	CC	Okay, Jack. The flight plan update has a couple of items in it, and the first one we'd like to do is to update the T_{ephem} values in the G&C checklist on page G/9-2. These are fairly small changes, but in case you need them, we'd like you to have the exact numbers. Over.
00 23 22 25	CMP	Okay. Just a minute. I'll get it out.
00 23 22 56	CMP	Joe, was that the G&C checklist, page 9-2?
00 23 23 00	CC	That's affirmative. G&C, page G/9-2.
00 23 23 08	CMP	Okay. Go ahead.
00 23 23 09	CC	Okay. On that page in line 04, column B, change the number from 03366 to 05253. Over.
00 23 23 30	CMP	- - 53.
00 23 23 31	CC	Okay. And in line 05, column B, change from 11000 to 33661. Over.
00 23 23 47	CMP	33661.
00 23 23 50	CC	Okay. That's right. The only other thing I've got for you, Jack, is three additional questions for the booster systems debriefing, which is to take place at about 25 hours, and we thought we'd pass these questions up to you early so you can consider them. Over.
00 23 24 12	CDR	Okay. We're ready to copy.
00 23 24 15	CC	Okay. The first extra is, and let me get the original question because this question says, "More specifically on item 2," and item 2 says, "Were there any significant changes in the noise vibration level during the single stage of powered flight?" Specifically, describe your observations during the early S-II center engine cut-off, and approximately 90 seconds prior to TLI cut-off, you reported a high vibration in the S-IVB. We'd like you to describe the buildup of this vibration and its behavior through cut-off. Over.

00 23 25 02	CDR	Okay. Essentially, what you'd like us to talk about is vibration sequence during the early S-II cut-off of the center engine and also describe the vibrations that we encountered during the S-IVB TLI burn. Is that correct?
00 23 25 17	CC	That's it. Okay. The second extra question is for you, Jim, and it says, "Comparing this flight with your ride on Apollo 8, were there any significant differences in the powered flight environment?"
00 23 25 35	CDR	Okay. We'll describe a comparison with 8 and 13 as far as powered flight goes.
00 23 25 41	CC	Roger. And the last additional question is what did the ORDEAL ball look like during TLI? As you know, we passed you an update to that setting, and we'd like to know whether it was riding right on zero or what during the burn. Over.
00 23 26 00	CDR	Okay. Will do. We'll describe the ORDEAL ball.
00 23 26 03	CC	Okay. That's it, and that's the whole flight plan update. I have a consumables update now if you want to listen to that.
00 23 26 12	CMP	Okay, Joe. We're ready to copy.
00 23 26 14	CC	Okay. At 23 hours the total RCS is 1121, quad A is 274, quad Bravo is 286, quad Charlie is 274, quad Delta is 287, and the cryos are as follows: H_2 tank 1, 83 percent; H_2 tank 2, 86 percent; O_2 tank 1, 87 percent; O_2 tank 2, 87 percent. Over.
00 23 27 07	CMP	Okay, Joe. We got all those, and how do we compare them with where we should be in the time line?
00 23 27 15	CC	As I understand it, Jack, you're running slightly ahead of nominal in both those areas.
00 23 27 24	CMP	Okay; real fine.
00 23 27 25	CC	No problem.
00 23 28 07	CC	And, 13, Houston. That's all the business I got right now. I have a little news and plan of the day for you, if you feel like listening to that a little later on.

00 23 28 30	CDR	Just hold off a little bit there, Joe, if you don't mind. ...
00 23 28 36	CC	Stand by one, Jim. You're coming in garbled again.
00 23 29 58	CMP	Houston, 13.
00 23 30 00	CC	Okay, 13; Houston. Loud and clear again. Go ahead.
00 23 30 05	CMP	Okay. Joe. On the news, Jim would like to hold off a little bit on that, and I want to make a request to FAO, if he will at sometime during the day, when we get a flight plan update with those activities we agreed to make optional during lunar orbit and the few activities we were going to delete, I think that I forgot and left that card back during the press of suiting, I left it in the suit room.
00 23 30 33	CC	Okay. Wilco.
00 23 30 35	CC	Okay, Jack. I understand FAO's working on that and we'll have something for you later on.
00 23 30 42	CMP	Okay. We're not in any hurry.
00 23 30 45	CC	Roger.
00 23 47 00	CMP	Okay, Houston; 13.
00 23 47 11	CC	Okay. Jack. We copy the angles. You can go ahead and torque them.
00 23 47 24	CMP	Okay. Joe. The time of torquing will be 23 hours 47 minutes 30 seconds.
00 23 47 30	CC	We copy.
00 23 54 45	CDR	Houston, 13.
00 23 54 48	CC	13, Houston. Go ahead.
00 23 54 51	CDR	For information, Joe, we're all configured back again now to our regular seating positions, if you're monitoring us.
00 23 54 59	CC	Okay. Thank you, Jim.
01 00 16 02	CDR	Hello there, Houston; 13.

01 00 16 08	CC	13, Houston. Go ahead.
01 00 16 12	CDR	Gosh, we had forgotten, but we'd like to hear what the news is.
01 00 16 15	CC	Okay. There's not a whole lot to it. Well, let's see, we'll start with the - Let's start with sports, what the heck. The Astros survived 8 to 7, the Braves got five or six runs in the - five runs in the ninth inning, but they just made it; and in the other important game of the day, the Cubs were rained out. I have all the rest of the scores, you can tell me if you want any of them. They had earthquakes in Manila and other areas of the island of Luzon. There were three tremors and they kept the buildings shaking for about a half an hour or so, and it was about a 5 on the Richter scale. Okay, let's see. The Beatles have announced they will no longer perform as a group. The quartet is reported to have made in excess of a half billion dollars during their short musical career. However, rumors that they will use this money to start their own space program are false.
01 00 17 24	CDR	Maybe we could borrow some.
01 00 17 26	CC	(Laughter) Okay. Okay; West German Chancellor Willy Brandt, who witnessed your launch from the Cape yesterday, and President Nixon will complete their round of talks today. Brandt reportedly came to the U.S. to seek assurance from the President to go ahead with talks with the eastern European nations, especially East Germany, Poland, and Russia. Many air traffic controllers are still out, but reports indicate that they are slowly returning to work, and you'll be happy to know the controllers here in the MOCR are still on the job.
01 00 18 04	CDR	...
01 00 18 05	CC	Go ahead.
01 00 18 09	CDR	I said thank goodness for that.
01 00 18 10	CC	Okay. Some truck lines are being struck in the Midwest, and the school teachers have walked off the job in Minneapolis. Today's favorite pasttime across the - Uh oh; have you guys completed your income tax?

01 00 18 28	CDR	How do I apply for an extension?
01 00 18 31	CC	(Laughter)
01 00 18 32	CMP	Yes, Joe. I got to - hey, listen - It ain't too funny; things kind of happened real fast down there, and I do need an extension.
01 00 18 43	CC	(Laughter)
01 00 18 44	CMP	I didn't get mine filed. And this is serious; would you - -
01 00 18 47	CC	You're breaking up the room down here.
01 00 18 49	CMP	- - because I may be spending time in a - -
01 00 18 51	CC	We'll see - -
01 00 18 52	CMP	I may be spending time in a - I may be spending time in another quarantine besides the one that they are planning for me.
01 00 18 59	CC	We'll see what we can do, Jack. We'll get with Recovery and see if we can get the agent out there in the Pacific when you come back. By golly, let's see. In professional basketball, the Nicks beat the Milwaukee Bucks 110 to 102, and Billy Casper is leading the Masters after 54 holes with a 208, and spring football practice is in full swing. And that's about all the news we got; the updated plan of the day for you guys, the uniform will be service dress inflight coverall garments with swords and medals, and tonight's movie shown in the lower equipment bay will be John Wayne, Lou Costello, and Shirley Temple in the "The Flight of Apollo 13." Over.
01 00 19 50	CDR	Outstanding.
01 00 20 06	CDR	Houston, this is 13. Is it true that Jack's income tax return was going to be used to buy the ascent fuel for the LM?
01 00 20 18	CC	Well, considering that he's a bachelor and hasn't got that deduction to take, yes.
01 00 20 29	CMP	Hey, Joe. I'm glad you brought that up, because I was really serious about that.
01 00 20 36	CC	Okay, Jack. We'll - We'll take care of it. Tom Stafford says he'll get an extension for you.

01 00 20 43	CMP	Okay.
01 00 20 50	CC	And Jim McDivitt says, "yes, now that you mention it, he forgot to fill the ascent stage."
01 00 21 00	CDR	(Laughter) Suspicions confirmed.
01 00 21 04	CC	Should give you very good performance on descent.
01 00 21 11	LMP	We should have a lot more hover time, huh?
01 00 21 13	CC	That's right.
01 00 21 23	CC	Okay, crew. About the only other thing I've got for you right now is an update to your P37 pad for lift-off plus 35. This is a change to the pad we gave you yesterday. The reason for the update is for weather avoidance in the mid-Pacific landing area at 70 hours, which is the return time for this pad, and in case the question arises in your mind, we don't expect any problem there for the end of the mission. The weather area is 20 degrees south of your end-of-mission landing point, and it appears to be moving to the south.
01 00 22 01	CDR	Okay, Joe. I'm ready to copy the pad.
01 00 22 03	CC	Okay. GET of ignition is 035:00, DELTA-V_T 7883, Longitude minus 155, and the GET 400K 069:54. Over.
01 00 22 28	CDR	GETI is 035:00, 7883, minus 155, 069:54.
01 00 22 39	CC	Okay.
01 00 23 17	CDR	And, Houston, Jack's going to try donning his suit now for practice, himself, and when he gets it out, we'll give you a dosimeter reading.
01 00 23 26	CC	Okay. Real good.
01 00 41 49	CDR	Houston, Apollo 13.
01 00 41 51	CC	13, Houston. Go.
01 00 41 55	CDR	Okay. We've retrieved Jack's dosimeter, and it's reading 02022.
01 00 42 07	CC	Okay. We copy 02022 on the dosimeter, Jim.
01 00 42 14	CDR	That's affirm.

01 00 42 31	CC	13, Houston. At your convenience, we'd like the LM/CM DELTA-P reading.
01 00 42 37	CDR	That reading is 0.65 psi.
01 00 42 42	CC	Copy 0.65. Thank you.

END OF TAPE

01 01 10 56	CC	Apollo 13, Houston.
01 01 10 58	CDR	Houston, Apol ... Roger. We're thinking together. And we're here waiting for your call.
01 01 11 07	CC	Okay, you were a little broken up there, Jim, but I think it's getting better. We are ready for the launch-vehicle-systems debriefing whenever you are.
01 01 11 31	CDR	Okay, Houston; Apollo 13. You were cut out again; say again, please.
01 01 11 35	CC	Roger, Jim. We are ready for the launch-vehicle-systems debriefing whenever you are. Over.
01 01 11 43	CDR	Okay. Stand by 1.
01 01 12 00	CDR	Okay, Houston; 13. In answer to question 1, the changes in noise level occurred mainly between the first stage and the other stages - the other stages were about the same in noise level, very quiet, with the first stage, of course, making quite a bit of noise in the beginning but - which built up during the high Q, and then ... went quiet just after high Q.
01 01 12 31	CC	Okay, copy that, Jim.
01 01 12 37	CDR	I might mention that the noise level during the first stage was not sufficient to be uncomfortable at all.
01 01 12 46	CC	Roger. And I assume COMM was okay.
01 01 12 50	CDR	That's affirm. COMM was very good all during - throughout the entire flight. Much better than I expected.
01 01 12 57	CC	Okay.
01 01 13 04	CDR	Now, in answer to question 2, there was, of course, a vibration transient in the second stage that - due to the number 5 engine going out - which occurred shortly before the engine went out, and slightly after that then the S-II stage was very smooth.

01 01 13 33	CC	Okay, Jim. I guess the significant point there is that you didn't notice the vibration before you saw the engine light.
01 01 13 39	CDR	That's right. We - we noticed the vibration but it wasn't such that we thought something catastrophic was going to happen; it just started vibration and then the EN light came on, and then the vibration went away and the stage itself was smooth.
01 01 13 59	CC	Okay, copy that.
01 01 14 03	CMP	Yes, and that - it was all pretty - pretty short in span - just a second or so before and like a second afterwards, Joe.
01 01 14 14	CC	Oh. Roger.
01 01 14 18	CDR	And on the S-IVB, the vibration of the vehicle itself wasn't what ... second ... powered flight - a very-high-frequency vibration.
01 01 14 33	CC	That was - was that during - just during TLI, or did you notice that at insertion?
01 01 14 45	CDR	Well, it was a high-frequency viola - vibration but more noticeable during the TLI burn than it was during the ... flight.
01 01 14 59	CC	Okay, I - understand.
01 01 15 13	CMP	I guess the S-IVB vibration during TLI was there all the time although it seemed to - to grow to us as the burn progressed, although that may have been just due to the boost weight decrease.
01 01 15 30	CC	Okay, you called this about 3-1/2 minutes, but I guess the thing was slowly building up throughout the whole burn. Right?
01 01 15 37	CMP	That's right.
01 01 15 40	CC	Okay, was it uncomfortable or did it cause your vision to degrade or anything like that?
01 01 15 46	CDR	No, it - it was not uncomfortable at all but I was recalling the ride on 8, and the S-IVB was more - much more smooth than even it was on 13.

01 01 15 59	CC	Copy that.
01 01 16 24	CDR	Okay, now, in answer to number 3, we did not experience any unexpected transients except that all of us noticed the PU shift. We thought it was more pronounced than we had expected it to be.
01 01 16 39	CC	Okay. Understand.
01 01 16 42	CMP	Joe, on that. I guess most of every time that PU shift occurred we all - almost all of us glanced at the engine light. We could feel definite acceleration change.
01 01 16 53	CC	Roger. Understand, Jack.
01 01 16 58	CDR	And, during the high-Q portion of the flight, the Alfa meter, to my knowledge, nearly went above 25 percent.
01 01 17 06	CC	Okay.
01 01 17 14	CDR	In answer to number 4, we got a pretty good look at the thermal shroud and the IU after taking the LM away, and from our viewpoint, the shroud was completely intact. I saw no loose particles or parts of it floating at all.
01 01 17 30	CC	Okay, Jim. Understand.
01 01 17 40	CDR	And, I guess we answered number 5. I don't think at any time did we have any communication problem during powered flight.
01 01 17 45	CC	Roger.
01 01 17 59	CDR	In answer to number 6, the answer is essentially no. We saw no venting or suspected leak on the LM or the CSM ...
01 01 18 14	CC	Okay, Jim. I guess you described to us the non-propulsive venting on the S-IVB after the APS maneuver and we copied that at the time.
01 01 18 30	CDR	Okay. Fred saw the S-IVB venting.
01 01 18 33	LMP	Yes, we had already talked about that, Joe. And that was also visible when it - of course, when it did its evasive maneuver when we were looking at it right close up.

01 01 18 44	CC	Roger.
01 01 19 12	CDR	Okay, Joe. The last time we saw the S-IVB positively was when Fred saw it venting at about - at about 5 hours. We think we might have picked it up later on. We saw a particle or something out there that was tumbling which might have been the booster or one of the SLA panels.
01 01 19 34	CC	And when was that, Jim?
01 01 19 41	CDR	We're - we're debating. It was somewhere between - say 7:30 and 9 hours.
01 01 19 47	CC	Okay.
01 01 19 50	LMP	But, Joe, assuming the S-IVB is still stable. The object I was looking at was definitely tumbling.
01 01 20 01	CC	Okay, Fred. As I recall, it was stable then, although it's tumbling now.
01 01 20 08	LMP	Okay. It probably was the SLA panel I picked up.
01 01 20 14	CC	Right. Incidentally, I guess the guys in building 6 - -
01 01 20 17	CDR	Oh and I think we -
01 01 20 18	CC	Go ahead, Jim.
01 01 20 19	CDR	I - I think we answer to number 9. We - at around 5:32, I think, was when we think the number 5 light came on in the S-II, and a definite vibration which was more than just a high-frequency vibration we got with the normal S-IV burn, and then the light came on. I called ECO thinking from the training that it was 7:42 and looked up at the time and realized it was early. And then, soon after the light came on, the vibration stopped and the engine or the booster smoothed down. It was very smooth from there on.
01 01 20 59	CC	Okay. This may be a stupid question, but do you have any idea what the frequency of it was?
01 01 21 08	CDR	Only to say that it was much higher - I couldn't really guess now. It was rather a rapid longitudinal vibration.

01 01 21 23	CC	Okay, Jim. Stand by now for a minute, we're going to switch OMNI.
01 01 22 48	CDR	Houston, 13, ...
01 01 22 51	CC	13, Houston. I read you. We still have quite a bit of noise on the loop.
01 01 22 59	CDR	I'll stand by. Roger.
01 01 23 04	CC	Okay, Jim. It should be pretty good now. We copied you answering question number 9.
01 01 23 16	CDR	Do you want any more comments on the S-IVB vibrations?
01 01 23 20	CC	I don't think so. When you get all done, I'll - I'll make a quick check to see if the booster people have any - any additional questions. You skipped number 8, Jim; could you go back to that for a second?
01 01 23 34	CDR	Okay, stand by.
01 01 23 54	CDR	Our only comment there, Joe, was that the burn on TLI, to our knowledge, was about 3-3/4 second longer than had been predicted and that was the only thing that we really noticed; otherwise, looked like PI [?] was nominal at cut-off.
01 01 24 11	CC	Okay, understand.
01 01 24 23	CDR	Okay, on comparing the flight of 13 to Apollo 8, lift-off was about the same amount of vibration as I noticed on 8, but at the beginning of the flight, there was less of the sideways motion than we experienced on Apollo 8. The S-IC separation felt more violent on 13 than it did on 8, maybe that's because I was in a different seat, I don't know. But there was about three sharp transients of the cut-off and a couple of big bangs where we were thrown backwards longitudinally on our straps before the S-II went off. And the S-II was, of course, just as smooth on 13 as 8 except for the number 5 engine. And we did not experience the vibration that we experienced on 8 towards the end of the S-II burn. And the S-IVB was - had more vibration than we had on 8.
01 01 25 31	CC	Okay, Jim, got all that.

01 01 25 39	CDR	The up - the update on the ORDEAL ball was a good one. At the burn, we were about - just about 8 degrees. We had to pitch down. The yaw was right on all the way through the entire burn, and just towards the end of the burn, the ball started going black in pitch a little bit.
01 01 26 03	CC	Okay, sounds good, we'll give Mike Wash a gold star on that one. Okay, Jim, stand by 1 while I see if we have any extra questions.
01 01 26 44	CC	Jim, while we're waiting to see if they have any more questions, I'd like to read you the booster people's preliminary analysis on the - the S-II cut-off. Over.
01 01 26 58	CDR	That would be very interesting. Go ahead.
01 01 27 00	CC	Okay, preliminary analysis of the data indicates that the center S-II engine vibrated at a somewhat higher amplitude than we've seen on previous flights, and it started at about 160 seconds into the S-II burn. As a result of these vibrations, the engine chamber pressure decreased to the level where the two low-level thrust sensors, the thrust-okay sensors, initiated center engine cut-off. Early evaluation of data indicates that no damage occurred to the engine, and the cause of the increased vibration amplitude is still under investigation. Over.
01 01 27 43	CDR	I thought it was the center engine.
01 01 27 48	CC	Yes, right.
01 01 27 58	CDR	Joe, do you have any word on what marks we had for TLI?
01 01 28 04	CC	At the time of TLI, as I recall, you had 6 seconds longer than the nominal burn which was 3 seconds longer than the 3-sigma low burn, and you were also GO for a second-opportunity TLI if we had required one.
01 01 28 24	CDR	Okay, we were just wondering because it appeared to us that we had a longer TLI burn than had been predicted.
01 01 28 30	CC	Yes, you did. We confirmed that - that - that cut-off time just about as you saw it, and I don't have an explanation for it, but it was within the 3-sigma margin.

01 01 29 47	CC	13, Houston.
01 01 29 49	CDR	Go ahead.
01 01 29 51	CC	Roger, we have no further questions. All the answers were clear and satisfactory, and we thank you very much. You can press on with the rest of your busy day.
01 01 30 02	CDR	Right-o.
01 02 29 08	LMP	And, Houston; 13.
01 02 29 13	CC	13, Houston. Go ahead.
01 02 29 18	LMP	Okay, Joe. Out window 5, I just picked up the tumbling object again so, for sure, it must have been a SLA panel. I don't think we could still be in the proximity of the S-IV at this time.
01 02 29 33	CC	I don't think so, Fred. It's several hundred miles aft of you. 700 miles is - is the number, I'm told. And since the SLA panel didn't make the midcourse correction, that might be it.

END OF TAPE

01 02 29 51	LMP	Yes, it's, I can't really tell for sure even through the monocular that it is, but it looks the same relative position to the stars. And the best I can tell about the same intensity and still about the same distance from us.
01 02 30 08	CC	Can you see it tumbling. Does it have a shape, or is it a point?
01 02 30 19	LMP	No. I can tell it's tumbling; I guess the flat side not only is facing me, it's not only much brighter, it also grows larger.
01 02 30 34	CC	Okay. Very interesting. We'll see if we can figure out where that's relative to you. They keep updating the S-IV impact on us a little bit. The last guess we had was that it will impact about the same longitude we gave you but close to zero latitude and a little bit later. You still won't be able to see it. And they're saying it might make a - -
01 02 31 02	LMP	Roger.
01 02 31 03	CC	- - they're saying it might make a 100 to 120 foot crater, too.
01 02 31 13	LMP	It'll still be past the terminator for us for awhile.
01 02 31 19	CC	Right. It will be at about the REV 20 terminator, so it will be late in your lunar orbit activities before you will be able to photograph it, and FAO is looking at whether we can work that in or not.
01 02 31 36	LMP	Okay.
01 02 43 26	CMP	Houston, 13.
01 02 43 29	CC	13, Houston.
01 02 43 33	CMP	Hey, Joe? Is FAO ready to - do you - or are you ready to give me those items that we made optional and deleted in the solo book?
01 02 43 44	CC	Jack, we are not quite ready with that yet, but we will be before too long. Can you wait awhile?

01 02 43 53	CMP	Sure can. Got lots of time.
01 02 43 54	CC	Okay.
01 03 59 41	CDR	Hello, Houston; Apollo 13.
01 03 59 49	CC	13, Houston. Go ahead.
01 03 59 54	CDR	Just a passing comment, Joe. We're having lunch right now, and I just made myself a hotdog sandwich with catsup. Very tasty and almost unheard of in the old days.
01 04 00 07	CC	That's correct, 13. As I recall the flight plan, you're supposed to put mustard on the hot dogs and not catsup, but I guess we'll overlook that.
01 04 00 18	CMP	We blew it.
01 04 00 20	CC	Right. How's everything going?
01 04 00 28	CDR	It's going pretty good. We have about four different methods of spreading catsup, right now.
01 04 00 34	CC	Okay. Jack, we'll have your update to you before too long.
01 04 00 41	CMP	Okay. Fine, Joe. We did a pit check on the Hycon camera and everything works okay.
01 04 00 49	CC	Okay. Beautiful. We don't have anything else for you at the moment.

END OF TAPE

01 04 46 44	LMP	Houston, 13.
01 04 46 49	CC	13, Houston. Go ahead.
01 04 46 56	LMP	Okay. We'd like to get the FM up now to look at some inside pictures there.
01 04 47 04	CC	Okay. Stand by and I'll get a GO on this.
01 04 47 57	CC	13, Houston.
01 04 48 01	LMP	Go ahead.
01 04 48 02	CC	That's acceptable, Fred, and meanwhile, when you guys are ready to copy, we've got an MCC-2 pad for you.
01 04 48 13	LMP	Okay. Stand by 1.
01 04 48 15	CC	Roger that. And also if you can go to POO and ACCEPT conveniently, we'd like to uplink.
01 04 48 31	LMP	Okay. You've got it.
01 04 48 33	CC	Okay.
01 04 49 06	LMP	Okay, Joe. You can go ahead with the P30 pad.
01 04 49 11	CC	Okay. Here we go. MCC-2, SPS/G&N: 63634; plus 0.96, minus 0.23; 030:40:49.00; minus 0021.7, minus 0001.7, minus 0008.0; 080, 164, 326; N/A, N/A; 0023.2, 0:03.5 - We'll give you half a second on the burn time because it's so short - 0018.5; 44, 135.9, 28.1; and the rest is N/A. Comments: set stars 31 and 23; roll aline 288, pitch 205, yaw 034; no ullage, LM weight 33499, and over.
01 04 51 02	LMP	Okay. MCC-2, SPS/G&N: 63634; plus 0.96, minus 0.23, 030:40:49.00; minus 0021.7, minus 0001.7, minus 0008.0; 080, 164, 326; N/A, N/A; 0023.2, burn time 0:03.5, 0018.5; 44, 135.9, 28.1; and the rest N/A. Set stars 31, 23; roll aline 288, pitch 205, yaw 034; no ullage, LM weight 33499.
01 04 52 11	CC	Roger. Readback correct. I have two more short comments on them, but I want to wait just a second and make sure I understand them before I pass them to you.

01 04 52 25	LMP	Okay.
01 04 52 45	CC	Okay, Fred; Houston.
01 04 52 50	LMP	Go ahead.
01 04 52 51	CC	The two additional comments were just that, first of all, they biased DELTA-V_C by minus 0.34 feet per second based on your EMS null bias checks. That's just for information. And the second one also for information is that your targeted pericynthion is 60 miles after this correction.
01 04 53 25	LMP	Okay, understand. For Jack's information the EMS DELTA-V bias is 3.4, and our targeted pericynthion after this maneuver is 60 miles.
01 04 53 41	CC	That's correct on the pericynthion. The EMS bias is 0.34, very small.
01 04 53 48	LMP	Okay. 0.34 on the EMS DELTA-V bias.
01 04 53 53	CC	Roger. And - -
01 04 53 56	CMP	Hey, Joe, we'll give - -
01 04 53 58	CC	Go ahead, Jack - -
01 04 53 59	CMP	We'll give you - we'll give you the read - we'll give you the results of another null bias test for comparative purposes right before the - oh, at the proper time.
01 04 54 08	CC	Okay. Real fine; and the computer is yours.
01 04 54 12	CMP	Okay. Thank you. Going BLOCK.
01 05 00 04	CMP	Okay, Houston; 13. Are you copying the torquing angles on the P52?
01 05 00 08	CC	Okay, Jack. Give us a second.
01 05 00 26	CC	And, 13, Houston. We have them. You can torque them.
01 05 00 30	CMP	Okay, Joe. Time of torquing 29 hours 0 minute 30 seconds.
01 05 00 36	CC	Roger that.

01 05 29 35	CC	Apollo 13, Houston.
01 05 29 39	CMP	Go ahead, Joe.
01 05 29 40	CC	Hey, you've got a new CAPCOM on now with the Black Crew, and we have about three items to give you, Jack.
01 05 29 50	CMP	Okay. Stand by 1. Are these updates or what?
01 05 29 56	CC	I'm going to give you some high gain antenna angles for TV and the rest is just information, general words.
01 05 30 08	CDR	Go ahead ...
01 05 30 10	CC	Okay. Burn attitude for TV, your pitch and yaw angles are as follows: PITCH minus 1 - minus 69, YAW 180, HIGH GAIN.
01 05 30 26	CMP	Okay.
01 05 30 27	CC	Okay. Second point is that you're GO for MCC-2. Everything's looking good here.
01 05 30 34	CMP	Okay. Real fine.
01 05 30 36	CC	And the last item's for Jack. Jack, the preliminary indications are that you can get a 60-day extension on your - filing your income tax if you're out of the country.
01 05 30 54	CMP	That's good news. I guess I qualify.
01 05 31 00	CC	Yes, we were just looking at the map, and you're south of Florida so you're not in the country now. But we wondered how about your car tags. Have you taken care of those?
01 05 31 20	CMP	Yes, I did, as a matter of fact. I think I did!
01 05 31 28	LMP	Known as, "plan ahead."
01 05 31 30	CC	Okay. Good.
01 05 31 52	CC	And, Apollo 13, Houston. Recommend OMNI Alfa until you get to the burn attitude.
01 05 32 00	CMP	Okay. OMNI Alfa.

END OF TAPE

01 05 40 32	CMP	Okay, Houston; Apollo 13.
01 05 40 34	CC	13, go ahead.
01 05 40 38	CMP	Okay, Vance. The EMS DELTA-V pass passive, the results of the no-bias pass in 100 seconds, have been from 100 to 101.5.
01 05 40 52	CC	Roger. Copy plus 100 to plus 101.5, and that agrees fairly closely with the last one, as I recall.
01 05 41 00	CMP	Okay. Fine.
01 05 45 46	CMP	Okay, Houston. We're at P40 burn attitude. Jim is on the sextant star check, and we do have a star in the sextant.
01 05 45 56	CC	Roger, Jack. Copy. Very good.
01 05 46 02	CMP	But we could't tell you whether it's 44 or not.
01 05 46 08	CC	Whoops.
01 05 46 44	CMP	Okay, Houston; 13. We're a little bit ahead of ourselves. Do we have a GO to do the fuel cell purge and the waste water dump?
01 05 46 57	CC	Jack, that's affirm. You have a GO for those.
01 05 47 01	CMP	Okay. We're on our way.
01 05 50 14	CC	Apollo 13, Houston.
01 05 50 18	CDR	Go ahead.
01 05 50 21	CC	Jim, battery A is charged now. Whenever you want to unhook it will be fine with us.
01 05 50 28	CDR	Okay.
01 06 12 04	CMP	Houston, 13. Are you still planning to have TV at the scheduled time?
01 06 12 16	CC	Okay, 13; Houston. That's affirm. At the flight-plan-scheduled time.
01 06 12 21	CMP	Okay. All right. We've got a beautiful sight we want to show you.

01 06 12 36	CC	Right.
01 06 12 47	CC	13, Houston. You can go ahead with the TV now. We're standing by.
01 06 13 03	CMP	Okay. Here it comes.
01 06 13 04	CC	Okay.
01 06 13 53	CC	Okay. Jack. It's coming in, and it's right in the center of our screen.
01 06 14 00	CMP	Okay, Vance.
01 06 14 04	LMP	Can you - Think you could guess what that might be, Vance? Better than Charlie?
01 06 14 14	CC	I don't want to start flipping coins at this point.
01 06 14 21	CMP	Okay, Vance. We're pointed just a little ways off from looking directly at the Moon. Jim is holding the camera through window 3. The Sun is coming at about 40 degrees off our left side, and what we are going to show you in just a minute is about 30 seconds of waste water dump and just show you just what it looks like. It's really fantastic.
01 06 14 49	CC	Okay. We'd like to see that.
01 06 15 29	CC	Okay. We saw some droplets speeding out for a little while, Jack. Now we don't see anything.
01 06 15 40	CDR	Actually, Vance, what you're looking at is solid water droplets coming out just about all the time. It lights up the whole sky around the Moon. It's just far too fine for you to see. Now I think they're coming out a little thicker.
01 06 15 53	CC	Okay. Yes, we see those.
01 06 16 01	CDR	Jack's complaining about seeing stars.
01 06 16 16	CC	FIDO says he can understand why that would perturbate a trajectory now.
01 06 16 26	CDR	It's amazing watching these little frozen droplets maneuver. They seem to go in all directions, but finally after they get out a certain ways, settle down and they all seem to be traveling in the same direction.

01 06 16 42	CC	Right. That's coming in real well.
01 06 16 51	CDR	The objects in the foreground are parts of the LM that you're looking at.
01 06 17 11	CDR	The camera is now going to ...
01 06 17 18	CC	We can just barely see those parts of the LM. They must be in a shadow.
01 06 17 34	CDR	Okay. Now you are looking at a thruster quad at the lower part of your screen.
01 06 17 41	LMP	I've got the f-stop all the way open now, Vance; that's quad - quad 1 you're looking at with the LM should - The Moon should be in view just over the top of the quad.
01 06 17 58	CC	Right. We see the nozzle of the quad, but it's dark and it's not easy to see.
01 06 18 28	CC	13, Houston. INCO suggests you try AVERAGE if you're in PEAK to see if that gives us a better picture.
01 06 18 41	LMP	Okay. We're in AVERAGE now.
01 06 19 02	CC	I think that helps out. We can see it better.
01 06 19 23	CC	Okay. Now, 13, request you either move it away from the bright area or else move it back to PEAK. Over.
01 06 20 08	LMP	Okay, Vance. I cranked the focus down a little bit. Is the quad coming in any better now?
01 06 20 17	CC	It's coming in about the same, Fred, and you're a little weak now on the COMM.
01 06 20 32	CC	We could see when you went back to PEAK.
01 06 20 38	LMP	And I'm now ... all the way out.
01 06 20 50	CC	Okay. We could see you zoom in on the Moon, and it's near the center of our screen, just a little to the left. Very clear.
01 06 21 09	LMP	Yes. I show it just about at 38.
01 06 21 16	CC	We can't tell if it's gray or light brown, though.
01 06 21 33	LMP	Do you have your grid down there, Vance?

01 06 21 43	CC	That's negative, Fred.
01 06 21 48	LMP	Okay.
01 06 22 31	LMP	I don't know if you can make out the features there, Vance, on the Moon, but it looks like the terminators are at central plains area somewhere around Descartes, maybe.
01 06 22 45	CC	Okay. We're - We see it just as a bright portion of the lunar disk, and it looks a lot like you see it from Earth. Very bright. We are unable to see any features at all.
01 06 23 09	LMP	It's pretty much the same with the eyeballs in here, and it looks a little bigger now. But the only way I could see it very good at all was with the monocular, a little while ago.
01 06 23 31	CC	Okay, Fred. Very good. We'd be interested to seeing the cabin when you get ready for that, too.
01 06 23 39	LMP	Okay. I'll set up now.
01 06 23 59	CDR	And, Vance, we're counting down to midcourse-2, we're up to, in our checklist, to minus 6 minutes to go.
01 06 24 08	CC	Roger. Minus 6 minutes. Understand you're about ready to turn on the gimbal motors and all that sort of thing. Okay. We see the computer now in the upper middle part of the - the panel. I think we see somebody's checklist in the center couch. It must be Jim holding the checklist.
01 06 24 39	LMP	Right. And what Jim's holding now, he's got a pen in his hand we've rigged on a string, as sort of a simple-minded accelerometer. This burn's pretty short and I'm not sure even that's going to show very much. But we'll see if it'll stretch out at the end of its string.
01 06 25 02	CC	Yes. We see the pencil at the top of the picture floating around. And Jack's coming into view now.
01 06 25 10	LMP	And I've gone back - Okay, I've gone back to AVERAGE now and ... pitch up.
01 06 25 18	CC	Roger.
01 06 28 08	LMP	Now in a few minutes, Vance, I guess we'll see how about the only system we haven't used yet works. Everything else sure has worked mighty fine.

01 06 28 20	CC	Right. The spacecraft's really working nicely. Okay. We're picking up panel 2 now. Still a little bit of the checklist.
01 06 28 57	LMP	Wondering if you can pick up the caution array there?
01 06 29 00	CC	Right. We just saw your - your testing of the caution and warning system at the left-hand side of the panel on our TV. See the lights all flash on. You're doing it again.
01 06 29 54	CC	You mission timer's showing up as a - a brilliant green in the upper left-hand part of the picture.
01 06 30 12	LMP	Roger. I got the camera kind of canted on you here, Vance.
01 06 30 19	CMP	Vance, Jim's going to go to VOX now.
01 06 30 22	CDR	Vance, how do you - -
01 06 30 23	CC	Roger. Read you loud and clear, Jim.
01 06 30 28	CDR	Okay. We'll - what we'll do - We'll be on VOX for the remainder of the burn and preburn countdown.
01 06 30 38	SC	...
01 06 30 40	CDR	... And what we're waiting for is 54 minutes on our counter or 20 which would be minus - -
01 06 30 58	CC	Jim, we hear clipping on your VOX. Could you adjust it so that you're coming in continuously all the time?
01 06 31 08	CDR	Okay. Stand by 1.
01 06 31 17	CDR	1, 2, 3, 4, 5. How's that, Vance?
01 06 31 21	CC	Okay. That's better.
01 06 32 04	CMP	Vance, how do you read the CMP on VOX?
01 06 32 07	CC	Jack, read you loud and clear.
01 06 32 10	CMP	Okay. Fine.
01 06 32 21	CDR	We show minus 8-1/2 minutes.
01 06 32 25	CC	Roger. Houston copies.

01 06 32 44	SC	Close - -
01 06 33 00	LMP	Is that too close, Vance, or can you make out the SPS engine panel now?
01 06 33 06	CC	We can see your fuel and oxidizer gages and hydrogen/oxygen gages at the top of the picture and the PUGS, but it isn't coming in in focus too well. It's a little dim.
01 06 33 20	LMP	Yes. I think the problem is I'm about 2 feet and it doesn't go down but to 4.
01 06 33 32	CC	Right. We understand that's the panel right in front of your face.
01 06 33 43	CDR	Okay. Vance, stand by for the main ...
01 06 33 49	LMP	Okay. We're minus 7 minutes.
01 06 33 53	CC	Roger.
01 06 34 25	CC	Fred, the focus is good enough that we can see the position of your four ball valves at the top of the picture for the big SPS engine.
01 06 34 37	CDR	What would you like to watch, Vance?
01 06 34 43	CMP	Hopefully, you'll see the - or we'll see the two on the left here, set A, go on here directly - -
01 06 34 51	LMP	Minus 6 minutes.
01 06 34 52	CDR	MAIN BUS TIES, two, ON, Fred. Okay. SPS HELIUM VALVE, two, AUTO and checked AUTO barber pole. TVC SERVO POWER is 1, AC1/MAIN A; 2, AC2/MAIN B.
01 06 35 04	CMP	AC1/MAIN A, AC2/MAIN B.
01 06 35 06	LMP	MAIN BUS TIES, ON.
01 06 35 07	CDR	Okay. ROTATIONAL POWER NORMAL no. 2, AC.
01 06 35 11	CMP	Number 2, AC.
01 06 35 12	CDR	DIRECT, two, OFF.
01 06 35 13	CMP	DIRECT, two, OFF.
01 06 35 15	CDR	BMAGs, three, ATT 1/RATE 2.
01 06 35 20	CMP	ATT 1/RATE 2.

01 06 35 21	CDR	SPACECRAFT CONTROL, SCS.
01 06 35 23	CMP	SCS.
01 06 35 24	CDR	And arm your hand controller.
01 06 35 27	CMP	RHC armed.
01 06 35 29	CDR	Okay. Let's do a primary TVC check.
01 06 35 34	CMP	Fred, are you ready to start primary?
01 06 35 36	LMP	Okay. Go ahead on primaries.
01 06 35 38	CMP	Okay. PITCH 1, START.
01 06 35 40	LMP	Good.
01 06 35 41	CMP	YAW 1, START.
01 06 35 42	LMP	That one's good.
01 06 35 45	CMP	Thumbwheel control. 0.96 plus 0.96 minus 0.23.
01 06 35 51	CDR	That's affirm. Check MTVC.
01 06 35 54	CMP	MTVC checked. Okay.
01 06 35 56	CDR	Okay.
01 06 35 57	CMP	THC - -
01 06 35 58	LMP	... C - -
01 06 35 59	CMP	- - TRIM returns to NEUTRAL.
01 06 36 03	CDR	Clockwise on the translation controller.
01 06 36 05	CMP	Mine? No MTVC.
01 06 36 06	CDR	No MTVC. Okay.
01 06 36 07	CMP	Starting ...
01 06 36 08	LMP	Okay.
01 06 36 09	CMP	Okay.
01 06 36 10	LMP	Go ahead.
01 06 36 11	CMP	PITCH 2, START.

01 06 36 12	LMP	Good.
01 06 36 13	CMP	YAW 2, START.
01 06 36 14	LMP	Okay. Both good.
01 06 36 15	CMP	Good. Good trim control. Minus 0.96, plus 0.96, minus 0.23.
01 06 36 22	LMP	Good.
01 06 36 23	CMP	MTVC. TRANSLATION CONTROL, NEUTRAL. MAX trim up to zero.
01 06 36 30	CDR	Good. No MTVC.
01 06 36 31	CMP	No MTVC.
01 06 36 33	CDR	Okay.
01 06 36 34	CMP	BMAGs MODE, RATE 2.
01 06 36 36	CDR	ROTATIONAL HAND CONTROL POWER, two, NORMAL, AC/DC.
01 06 36 38	CMP	AC/DC.
01 06 36 39	CDR	RATE 2, MAIN A/MAIN B.
01 06 36 41	CMP	B.
01 06 36 42	CDR	Okay. BMAGs, you got three, RATE 2? Okay, we'll proceed for final trim.
01 06 36 54	CMP	MAG's where we are.
01 06 36 55	CDR	Okay. BMAG MODEs, three, ATT 1/RATE 2.
01 06 36 58	CMP	ATT 1/RATE 2.
01 06 36 59	CDR	... ENTER. Okay. We'll do the GIMBAL TEST OPTION.
01 06 37 04	CMP	Okay. PROCEED.
01 06 37 05	CDR	Proceeding.
01 06 37 06	CMP	Plus 2, minus 2, 0, plus 2, 2, 0.
01 06 37 17	CDR	Yes. We can hear and feel the engine gimbal as we do the test.
01 06 37 22	CC	Roger. Good - -

01 06 37 24	CDR	FDAI SCALE - -
01 06 37 25	CMP	- - ... relay cut in and TRIM is set.
01 06 37 28	CDR	FDAI SCALE, 5/5?
01 06 37 30	CMP	5/5.
01 06 37 34	CDR	RATE, HIGH and update the DET.
01 06 37 36	CMP	Time?
01 06 37 37	CDR	Let's check it.
01 06 37 38	CMP	Okay. We're coming up on 3 minutes. I'll give you a Mark.
01 06 37 41	CDR	Fair enough.
01 06 37 50	CMP	MARK.
01 06 37 51	CMP	Three minutes. DET is good.
01 06 37 53	CDR	Okay. We're set.
01 06 37 58	CDR	At 58, we want DELTA-V THRUST A to NORMAL.
01 06 38 05	CC	Jim, Houston. You're looking good down here. GO for the burn.
01 06 38 10	CDR	Right, Vance.
01 06 38 50	CMP	Okay. Two minutes. DELTA-V thrust - -
01 06 38 52	CDR	DELTA-V THRUST A to NORMAL.
01 06 38 53	CMP	NORMAL.
01 06 38 55	CDR	TRANSLATION HAND CONTROLLER armed. Arm your ROTATIONAL HAND CONTROLLER. I've already got mine armed. Okay, Fred. TAPE RECORDER, HIGH BIT RATE, RECORD, FORWARD, COMMAND RESET. Standing by for 59.
01 06 39 09	LMP	It's running.
01 06 39 51	LMP	Minus 1 minute.
01 06 39 52	CMP	Okay. ...
01 06 40 17	CMP	AVERAGE G.

01 06 40 19	CDR	EMS mode to NORMAL.
01 06 40 21	CMP	MODE NORMAL.
01 06 40 22	CDR	Standing by for ENTER ENABLE.
01 06 40 46	LMP/CMP	ENTER ENABLE.
01 06 40 51	LMP	Two balls.
01 06 40 56	CMP	Okay. Shutdown.
01 06 40 57	CDR	...
01 06 40 58	CMP	Okay. Let's get the residuals. Okay, Houston, there are the residuals.
01 06 41 10	CDR	Okay; gimbal motors.
01 06 41 12	CC	Okay. Copy residuals.
01 06 41 13	CMP	... secondaries.
01 06 41 15	LMP	Okay. Go.
01 06 41 16	CMP	Okay. YAW 2.
01 06 41 18	LMP	Good.
01 06 41 19	CMP	PITCH 2.
01 06 41 20	LMP	That's good.
01 06 41 23	CMP	Primary.
01 06 41 24	LMP	On LOW BIT RATE. Start. Go with the primaries.
01 06 41 30	CMP	Okay. YAW 1.
01 06 41 31	LMP	That's good.
01 06 41 32	CMP	PITCH 1.
01 06 41 33	LMP	Okay.
01 06 41 34	CMP	TVC SERVO POWER, OFF.
01 06 41 35	LMP	- - is OFF. Okay. Record the DELTA-V_C. You got that?
01 06 41 38	CMP	Okay. You got the - You got the DELTA-V_C in minus 3.7.

01 06 41 41	CMP	Okay. FUNCTION, OFF. MODE, STANDBY.
01 06 41 43	CDR	Proceeding now.
01 06 41 44	CMP	OFF. MODE, STANDBY - -
01 06 41 45	LMP	TRANSLATION HAND CONTROL POWER, OFF.
01 06 41 47	CMP	Okay. POWER OFF.
01 06 41 48	LMP	ROT POWER DIRECT, two, OFF.
01 06 41 49	CMP	Two OFF.
01 06 41 50	LMP	RATE 2.
01 06 41 52	CMP	BMAGs, RATE 2.
01 06 41 53	LMP	I'm already in low bit rate.
01 06 41 54	CMP	Okay.
01 06 41 56	LMP	Yes, we were on those ... so that we had less than 0.2.
01 06 42 02	CC	Okay. Houston copied your residuals, very low.
01 06 42 13	LMP	Okay. Fuel is 1.0; oxidizer 0.25; the OX unbalance is reading on the decrease, which doesn't mean very much, and I guess that wasn't too much for a push there, Vance. I didn't see the accelerometer do a whole lot and it was a little surprising how slowly the injector valves opened, at least on the indicators.
01 06 42 44	CC	Roger. That was a very short burn. Request you give us a sweep across the panel when you get a chance, Fred. Let us see Jack and Jim again. Over.
01 06 42 56	LMP	Okay.
01 06 42 57	CMP	Okay, Vance, I was going to show you on - wonder if the folks might - down there might be interested in how we find out how far we're away from the Moon. Going to do that right now in program 21 here.
01 06 43 09	CC	Okay.
01 06 43 11	CMP	I'm asking the computer how far away we are. And the computer is telling me we're 121 490 miles out.

01 06 43 21	CC	Okay. That agrees fairly closely with our map on the wall.
01 06 43 30	CMP	I'm glad. That means you're tracking us too.
01 06 43 38	CDR	And if you didn't see our residuals, it was 0.1 X, 0.2 on Y, and 0.1 Z, and DELTA-V_C was minus 3.8.
01 06 44 01	CC	Jack, Houston. We show you down here 121 thousand miles 520 out. So I guess we all agree.
01 06 44 12	CMP	Okay. Real good, Vance. What I'm going to do is give you a shot of Fred.
01 06 44 23	LMP	If we can get all the wiring out of the way.
01 06 44 27	CMP	The big problem here is, when you move the TV around, this wire follows you like a snake here.
01 06 44 35	CC	Yes, we have Fred now. Looks like he has a lariat there, getting ready to rope the checklist.
01 06 44 47	LMP	That's only half of it. We have most of it hidden away. It's been pretty interesting doing all the camera work here to get a little extra training running the TV here, hopefully for when we get on the ground at Fra Mauro. The monitor does make it pretty easy though.
01 06 45 12	CC	Right. That's a real advantage in the cockpit. You're just a little bit dark. It looks like it might help to have the f-stop run down about one increment. See how it comes out - -
01 06 45 26	LMP	Can't do it, we're wide open.
01 06 45 27	CC	Are you?
01 06 45 29	CDR	I think we're wide open - -
01 06 45 30	CMP	Yes. We're wide open, Vance.
01 06 45 42	CMP	Okay. Does that help any, Vance?
01 06 45 45	CC	Okay. It's reasonablly good. We can make out Fred fairly well. Looks like he's in a shadow. Hey, that helps. You just turned up the lights, huh?
01 06 45 55	CMP	Yes. We went fixed on the - -

01 06 45 59	CC	Okay. You're on candid camera.
01 06 46 05	CDR	We did notice one thing, Vance. You know that new fad with long hair? It won't work too well up here in space.
01 06 46 15	CC	What was that one again?
01 06 46 18	CDR	I say, you know the new - the new fad with long hair?
01 06 46 21	CC	Right.
01 06 46 22	CDR	It doesn't work too well up in space, you can't comb your hair up here.
01 06 46 27	CC	Well, I guess you have to give up something.
01 06 46 36	CC	Well, at least it - it helps to try. We can see you trying to comb your hair there, Jim. It looks like your - your beards haven't come along to the point where you've had to use the razor though.
01 06 46 51	CDR	Well, we've been debating that. We thought we'd take care of our beards tomorrow and make that one of our daily routines.
01 06 47 06	LMP	I take it that was a subtle hint, Vance.
01 06 47 11	CC	No, no. We're not commenting on your appearance, Fred. I mean nothing derogatory, understand.
01 06 47 20	CDR	And, Vance, thought we'd get a picture of Jack just so that all the girls know that he's still here.
01 06 47 30	CMP	(Laughter)
01 06 47 31	CDR	...
01 06 47 34	CC	Yes, we - we appreciate that. There he is. Big Jack.
01 06 47 57	CC	Jack, you're in the shadow right now; we have a little bit of interference from your window, which is very bright, so we can't - I think you're smiling, but it's a little hard to tell.
01 06 47 11	CDR	...

01 06 47 12	CC	Hey, there we go. Incidentally, we've been getting all kinds of bits of information to pass up to you. We've had baseball scores coming in, basketball. Somebody said there's 220 days, shopping days left until Christmas.
01 06 47 46	CMP	Yes. Who won the Masters, Vance?
01 06 47 56	CC	It was a tie in the Masters and stand by. It was a tie between Littler and Casper after 72 holes, and there is going to be a playoff Monday, we understand.
01 06 49 16	CMP	Oh. Sounds good.
01 06 49 35	CC	One thing the world might be interested in knowing is what you do after the burn in the way of configuring switches back. We - We heard you go through the checklist. But, I guess right now, basically, you probably have all the switches back in position and you're in the mode to continue on with - Okay. What does the flight plans say? You're going to be doing cislunar navigation. So, Jack you're going to be down in the LEB. Is that correct?
01 06 50 12	CMP	That's right, Vance. Be going down there shortly.
01 06 50 30	CC	Okay. The TV now is all but black. Looks like it must be pointing into a shadow.
01 06 50 39	CMP	What he's doing, he's trying to give you one more shot of the Moon, and right now I'm setting to maneuver pad and the optics calibration attitude.
01 06 50 47	CC	Roger.
01 06 50 55	LMP	And what I wanted to point out, I don't know if it's apparent, but ... to show the advantage of doing all the dumps just before the burn, we're looking again at the same scene over quad 1 at the Moon. And now you don't see all the sparkly frozen particles outside there any more. We've sort of run off and left them.
01 06 51 22	CC	Roger. We - We don't see anything out there anymore in the way of particles leaving the spacecraft. We'd suggest, maybe you zoom the Moon in a little bit again so we can see the shape of it better.

01 06 51 59	CC	Okay. That brings the Moon in. We can see the terminator at the top of the melon-shaped disk.
01 06 52 11	LMP	Okay. Now you can see a few of the spark - sparkling particles going across the screen. Those are being emitted from the thrusters. Jack's maneuvering the spacecraft now.
01 06 52 34	CC	Okay. We can see those very poorly. Well, actually, they are coming in better now. It looks like little specks going from the upper left part of the screen across to the right, and understand those are from the thrusters.
01 06 52 52	LMP	That's affirm.
01 06 54 12	CC	Okay, 13; Houston. Just as an item of interest, advise your speed with respect to the Earth is now 4667 feet per second.
01 06 54 29	CMP	Okay. Thanks, Vance.
01 06 55 01	CC	Okay, Apollo 13; Houston. The Moon has been in and out of the - the - our screen here. Right now it's off at the bottom side, but we can still see the particles coming off of the spacecraft.
01 06 55 20	CMP	Okay. I am going to have to pull it out the window now, Vance. The Sun's coming up on the right side.
01 06 55 26	CC	Roger. Understand. You - -
01 06 55 27	CDR	Do you want to see any shots down in the LEB, Vance?
01 06 55 31	CC	Say again.
01 06 55 35	CDR	Do you want to see any of the photographs or do you want the TV down in the LEB?
01 06 55 40	CC	That's right, Jim. It would be good to see what you are doing down in the LEB or the far corner of the spacecraft where the optics are. Might be interesting to describe what you will do in the next few minutes in the way of sighting.
01 06 55 59	LMP	Okay, Vance. First we are going to give you a shot of the sleep station.

01 06 56 22	CC	Okay. The camera's bounced around a little, but we can see the green computer come in every once in a while.
01 06 56 59	CDR	While Jack is getting the sleep station rolled up, I thought I would show you one interesting corner. We've got a temporary stowage bag here and that's where all our wastepaper and all that goes while we're - after every meal. It's in the right-hand corner down by our dump system.
01 06 57 16	CC	Roger. Understand. We're looking at the wastebasket.
01 06 57 26	CDR	And the age-old question that is always asked us is how do we get rid of liquid waste and that line that you see, I think you can see it now, it goes right outside where we open up the overboard drain dump, and all of our waste products, liquid waste products, go out through that line and get dumped overboard.
01 06 57 45	CC	Roger. Understand, and we can see somebody's foot, as well.
01 06 57 51	CDR	Okay. Fred is now going down there, and he is going to try to get underneath the sleep station on his side where we have a sleep restraint. And the whole object of that is to ... to position the body between the - between the bottom of the spacecraft and - so it doesn't float up between that and the bottom of the couch.
01 06 58 14	CC	Roger. The sleep restraint of the hammock is coming into view underneath the couch. It's the white object.
01 06 58 27	CDR	You perhaps can see the zipper of the hammock right now. It's the black lines in that white object.
01 06 58 34	CC	Right. We can see it.
01 06 58 39	CDR	These hammocks, by the way, are very comfortable. When we first heard about them in the design of Apollo, we thought they weren't necessary, but they turned out to be very nice devices to sleep in.
01 06 59 15	CDR	I'm trying now to get down there with Fred to show you how it works. I keep floating up, though, but maybe we can get a little shot here.

01 06 59 42	CC	Okay. We have somebody upside down in the photograph now. Realizing, of course, in - in space there is no really rightside up or upside down. It still looks that way to us.
01 07 00 10	CDR	Okay. That's - That's Fred now. I'm trying to put him rightside up, for you folks back there in the sleep station. Fred, would you move your hands there so the folks back home can see you?
01 07 00 23	CC	Okay. That's coming in real clear, Jim. We see Fred in the sleep restaint - restraint.
01 07 00 36	CDR	As a matter of fact, Vance, I find my - I find Fred down there all the time.
01 07 00 44	CC	Yes. I can see he appreciates that. Looks fairly comfortable.
01 07 01 08	CC	Looks like there is a lot of room down there, considering all the boxes on the floor and underneath the couch.
01 07 01 16	CDR	It's surprising. There still is quite a bit of room down there even with the Hycon camera box down. And now, I'm going to bring the camera back up.
01 07 01 55	CDR	Okay, Vance. If there is no more that you would like to see right now, we'll terminate our little TV for you today.
01 07 02 01	CC	Okay. Thank you very much, Jim. Appreciated seeing inside the spacecraft and getting a look at the Moon that you're rapidly approaching.
01 07 02 13	CDR	Roger. This is Odyssey saying goodby.
01 07 05 36	CC	Apollo 13, Houston.
01 07 05 41	LMP	Go ahead, Houston.
01 07 05 44	CC	Okay. At your convenience we have an item to give you which will have to be copied. It's information on how to photograph Comet Bennett at time 32 hours GET. Over.
01 07 06 02	LMP	Okay. Stand by 1 minute.
01 07 06 03	CC	Okay.
01 07 07 02	LMP	Okay, Vance. Go ahead.

01 07 07 06	CC	Okay. Time 32 hours 00 minutes GET. Instructions at completion of P23, maneuver to following attitude: roll 101.0, pitch 090.0, yaw 000.0. High gain antenna angles will be: pitch minus 23, yaw 93. Use normal PTC procedures to dampen rates. After vehicle's stable, and before spinup, take photographs of Comet Bennett. Use the DAC on the sextant with magazine G. That is, very high-speed black-and-white film, right? That's the dim-light film. Take three photos, one each at 5-, 20-, and 60-seconds' time exposure. Use AUTO optics. NOUN 88 values are R_1 plus 34717, R_2 minus 08028; R_3 plus 35075. Take three photos one each at 5-, 20-, and 60-second time exposure using manual optics. Shaft will be 000.8 degrees, trunnion 12.5 degrees. Comment: Strip off about 50 frames; that is, 2 seconds of - at 24 feet per second before the first frame and after the last frame of the photos. That is, 2 second - 2 seconds at 24 frames per second - before the first frame and after the last frame of photos.
01 07 07 13	LMP	Is that it, Vance?
01 07 11 15	CC	And that's all.
01 07 11 19	LMP	Okay. The time is - The event will be at 32:00; and we're to maneuver to the following attitude; roll 101.0, pitch 090.0, yaw all zips. High gain angles will be pitch minus 23, yaw 93. And we're to use normal PTC procedures to damp the rates. And after damping the rates and before spinup, we're to put the DAC on the sextant with the magazine G, very high-speed black and white film. Then, we're to take three photos, one each at 5-, 20-, and 60-seconds' time exposure using audio - AUTO optics. Our NOUN 88 values R_1 plus 34717, R_2 minus 08028, R_3 plus 35075. Thence, three more photos, one each at 5-, 20-, 60-seconds' time exposure using manual optics. Shaft 0.8 degrees, trunnion 12.5 degrees. And we're to take 2 - second bursts at 24 frames per second, before and after these pictures.
01 07 12 49	CC	Your readback is correct, Fred.

END OF TAPE

01 07 20 14	CC	Apollo 13, Houston.
01 07 20 18	CDR	Go ahead, Houston.
01 07 20 21	CC	Jim, for PTC tonight, request that you disable quads C and D. That's the opposite of last night. Over.
01 07 20 36	CDR	Okay. For PTC tonight, disable quads C and D.
01 07 20 40	CC	Roger. And advise in approximately an hour, we'll have some read-ups whenever you're ready to take them regarding solo book changes.
01 07 20 53	CDR	Okay. We'll be standing by for it.
01 07 20 56	CC	Roger.
01 07 30 52	LMP	Houston, 13.
01 07 30 54	CC	Go ahead, 13.
01 07 31 00	LMP	Have you all got a chance to look at the data on the SPS yet?
01 07 31 06	CC	Stand by 1, Fred.
01 07 31 40	CC	Apollo 13, Houston.
01 07 31 44	LMP	Go ahead.
01 07 31 47	CC	Fred, it looks good, but they haven't had a chance to evaluate everything. They'll probably be finished with looking at strip charts in about 15 minutes, and after that we'll try to get back with you.
01 07 32 01	LMP	Okay. Thank you.
01 07 32 03	CC	Roger.
01 07 36 44	CC	Apollo 13, Houston.
01 07 36 48	CMP	Go ahead.
01 07 36 50	CC	On the P33, just like to verify that you changed the NOUN 88 values for this last star. It looks like they haven't been changed. Over.

01 07 37 06	CMP	Okay, Vance.
01 07 37 10	CDR	That's better. Let's read you what we - what we have. We have what they had in the flight plan, and if it's been changed from the flight plan, we don't have it.
01 07 37 29	CC	Stand by 1.
01 07 38 09	CDR	We think you're right, Vance. It looks like they used the same set of NOUN 88 for both stars by mistake.
01 07 38 16	CC	Okay, very good.
01 07 44 04	CMP	Okay, Vance. That ought to complete the P23s, right?
01 07 44 07	CC	Okay. Very good, Jack.
01 07 44 37	CC	Apollo 13, Houston.
01 07 44 42	CMP	Go ahead, Houston.
01 07 44 44	CC	We have some results on your - your first star, if you'd like to hear them. The rest of the stars we'll - we'll have to give you in a couple of hours. Over.
01 07 44 58	CMP	Go ahead.
01 07 44 59	CC	Okay, the first star: the corrected altitude, 15 kilometers plus or minus 4; effective altitude, 12 kilometers plus or minus 7. As far as the substellar point, the value is arc-minutes - 2 arc-minutes, and that's very good. And, like I said, we'll get back with you in a couple of hours for the rest.
01 07 56 31	CC	Apollo 13, Houston.
01 07 56 36	CMP	Go ahead.
01 07 56 37	CDR	Go ahead.
01 07 56 38	CC	Okay. We have several items, here. First, is a reminder on the PTC that R_1 should be 375 - 0.375 degrees as last night, to get 0.3-degree rotation rate. The second one - -
01 07 57 00	CMP	Okay. Copy that.

01 07 57 02	CC	Okay. The second one, at 32 hours looking at Bennett's Comet - we want the pictures taken when the spacecraft is as stable as it's going to be before starting PTC. The stability requirement is very high. We weren't sure if you understood that from what we passed up. In addition, the photographs might not show as much as the eye can see of the comet, so if you see anything interesting about the structure of the comet, why, sketching it is in order and is encouraged. Over.
01 07 57 50	CMP	Okay, Vance. What we'll do is, when we get to attitude, we'll disable the quads and do like we did last night; we'll let GUIDO and you people down there tell us when you think we are stable enough; then we'll do all this work with the DAC on the sextant, first; and then when we get that done, we'll go back and put the sextant eyepiece back on and see what we can observe visually.
01 07 58 18	CC	Okay. That sounds good. Also, while you are waiting for the vehicle to stabilize, it might be interesting to have the eyepiece on and be looking at it visually. Okay. Next item: your SPS burn had no anomalies whatsoever. It was a very good burn.
01 07 58 52	CMP	Okay. Very good.
01 07 58 55	CC	Next item: request hydrogen tank 1 HEATER OFF for balancing purposes.
01 07 59 22	CC	And Apollo 13, another item: something that we have observed and you might be seeing is a slight TCE fluctuation on fuel cell 3. This fluctuation has been going from about 152 to 160 over a 37-second period. It has been seen on other flights in the past. No one is worried about it, but the usual fluctuation is about 1-1/2 degrees instead of 7 seconds, so I thought you should be aware of it.
01 08 00 07	CMP	Okay, Vance. And one other slight distinction we've noted is the flow of hydrogen versus the oxygen is not exactly matched on fuel cell 3 either.
01 08 00 26	CC	Okay. We copy. And the last item: we'd like to send you an IRIG update, so at your convenience, request POO and ACCEPT.

01 08 00 46	CMP	Okay. We are in POO and ACCEPT, Vance.
01 08 00 49	CC	Okay.
01 08 01 20	CMP	Quad C and D are disabled, Vance.
01 08 01 24	CC	Roger. Disabled. And down here, we see that your hydrogen and oxygen on the fuel cell are exactly matched, so we suspect it's purely a spacecraft read-out problem.
01 08 01 40	CMP	Okay.
01 08 04 26	CMP	Okay, Vance, let us know when you're through with the DSKY so we can load NOUN 88?
01 08 04 40	CC	Roger. We'll let you know, Jack.
01 08 05 22	CC	Apollo 13, Houston. The computer's yours, again.
01 08 10 56	CC	Okay. You're go for the pictures.
01 08 11 01	CMP	Okay, Vance. We tried our AUTO OPTICS and couldn't pick it up there. We're pointing pretty much right into the Sun, and things are pretty well washed out. And I've gone to MANUAL OPTICS and I'm trying to get 0.8, 12.5 on the shaft and trunnion, and I still can't pick it up. So - it's very light in the sextant, so I kind of think maybe we're too near the Sun to see it.
01 08 11 28	CDR	That's right, Vance. The sextant is all - it's - it's all milky and it - any comet that could be seen through there is just going to be missed in the background.
01 08 11 41	CC	Okay, we copy that. We got some discussion. Stand by.
01 08 13 35	CMP	Okay, Vance, it isn't - we're not looking into the Sun - what we are getting is a large reflection from the Sun behind us off the LM; and it is - it is coming on that quad 1 there, and that quad is reflecting back into the sextant.
01 08 13 54	CC	Okay, Jack. Understand. Just a question: if you look through the telescope, can you see the comet at all? Over.
01 08 14 07	CMP	No, I can't, Vance. It's - it's still too light.

01 08 14 35	CC	Stand by.
01 08 17 45	LMP	Say, Vance?
01 08 17 50	CC	Roger. Go ahead.
01 08 17 55	LMP	Are the flowers blooming yet?
01 08 18 00	CC	Gee, I sure haven't seen any.
01 08 18 04	LMP	Okay.
01 08 18 05	CC	Hey, we've - we've got quite a discussion down here on your trying to observe the comet, and this reflection is not unexpected. And give us another minute, and we'll be back with you on something on that.
01 08 18 26	CDR	Okay. I doubt very seriously though, if we take any photographs with high-speed black and white with the light coming into the sextant that you're going to get anything out of it.
01 08 18 42	CC	Okay. Unanimous opinion is that you're right, and we'll scratch all of this Bennett Comet stuff on the way out, with the hope that conditions will be more favorable after TEI. Over.
01 08 19 04	CDR	Sounds good. Without the LM, we may have a better chance.
01 08 19 10	CC	Roger.
01 08 19 29	CC	And Apollo 13, you're GO for PTC. Your rates are very low according to what we can read.
01 08 19 38	CDR	Roger, Vance.
01 08 22 24	LMP	Okay. Are you going to give a call on OMNI B, Vance?
01 08 22 42	LMP	Do you read, Vance?
01 08 22 43	CC	Roger. Go ahead. Request OMNI B, Fred, and secure the high-gain antenna.
01 08 22 53	LMP	Okay. You got it.
01 08 22 55	CC	Okay.
01 08 43 21	CC	Apollo 13, Houston.

01 08 43 25	CDR	Go ahead, Houston.
01 08 43 27	CC	Just something to think about. In about 30 minutes, we can generate the pads that we have yet to send up before the sleep period, so we could support an earlier sleep period if you so desired. And - but, it will take us 30 minutes to get that stuff. The other thing is any time you're ready to copy, I can read up the solo book changes. Over - And, also, two pages in the flight plan.
01 08 44 01	CDR	Okay, Vance. We're about ready to copy the solo book changes and the flight plan changes, and whenever your pads are ready, we'll take those. And as far as moving up the sleep period, that's fine, but we'll - if we don't go to sleep right away, we'll use it to get out some of our lunar maps and study them.
01 08 44 21	CC	Okay. And we'll get busy getting those pads for you as soon as possible then, and I'll stand by on the copying bit.
01 08 47 28	CDR	Okay, Vance, I'm ready to copy the solo book changes there.

END OF TAPE

01 08 47 37	CC	Okay. First, turn to page 12. On the right-hand side of the page, starting from the middle of the page down, everything under "Cycle 5 frames, Replace dark side or dark slide" should be deleted until you get to the very bottom of the page where you have "Acquisition MSFN OMNI D" and that should remain in. Also, leave in "Remove window shades," which is about the third line down from where you start.
01 08 48 37	CMP	Okay. Okay. Then from "Cycle 5 frames, Replace dark slide," from there on down, delete.
01 08 48 50	CC	That's everything from there on down, with the exception of "Remove window shades" and at the bottom "Acquisition MSFN OMNI D."
01 08 49 10	CMP	Okay. Copy.
01 08 49 12	CC	And that includes in the margin to the left, the "DAP load" that's at the very start there and the "0.0507" and "plus 0500," farther down.
01 08 49 31	CMP	Okay. Got it.
01 08 49 34	CC	Okay. Going to page 13.
01 08 49 39	CMP	Okay.
01 08 49 42	CC	Okay, in the left margin, just below 105 hours GET, cross out the "0507" and the "plus 0500," and below that, add in "DAP load" as follows: "10111 and 11111."
01 08 50 11	CMP	Okay. Got it.
01 08 50 13	CC	Okay. Now, next, at about 105:05, there's a "VERB 48." That should be moved up to 105, and below that, the "VERB 49 maneuver" should be moved up, too.
01 08 50 42	CMP	Okay. That "VERB 48" should be moved up to 105:05 and also the "VERB 49."
01 08 50 50	CC	That should be moved up to 105:00. I'm sorry. Both.

01 08 50 56	CMP	Okay.
01 08 50 57	CC	And what that does is give you more time to maneuver.
01 08 51 07	CC	Okay. Next.
01 08 51 09	CMP	All right.
01 08 51 10	CC	Page 14, right-hand side, near the bottom under "Orbital Science," scratch out "Verify DSE ON," and also delete "Visual target 3 on track 180 plus 19," and cross out the penned-in "D5."
01 08 51 43	CMP	Okay. Got it.
01 08 51 46	CC	Next, page 15, left-hand column, or left-hand side, rather, near the bottom, where it says "Configure cameras and tape" and goes down through "Replace dark slide." Just make the comment there, "Solar corona is optional." Over.
01 08 52 16	CMP	Okay. Got it.
01 08 52 19	CC	Okay, next page, 16. This is a continuation of the same solar-corona thing. On the right-hand side of the page, starting just above 107:40 with "VERB 49, maneuver to solar-corona attitude," from there on down to 107:55 just beneath "Replace dark slide," all of this is in an optional category. So you just might line off - -
01 08 53 03	CMP	All right. Got it.
01 08 53 04	CC	- - that and put "Optional, solar corona." Okay, next, page 17 - -
01 08 53 12	CMP	Okay.
01 08 53 13	CC	- - starting at 108:00 on the left-hand side, line out "Stop ORB rate at ORB science attitude." At - Line out in the left-hand column the DAP load of "10101" and "11111." Going down to 108:10, add in the following: "Stop ORB rate at track attitude," and, in parentheses, "0, 353, 0." In the left-hand - -
01 08 54 14	CMP	Okay.

01 08 54 15	CC	Okay, in the left-hand column under 108:10, put in a DAP load in parentheses of "10101" and, under that, "11111."
01 08 54 33	CMP	Okay.
01 08 54 35	CC	Beneath that, scratch out "Spacecraft control dash CMC AUTO verify." Scratch out the "VERB 79" and all in parentheses after that, like the "Minus 00507," et cetera. And beneath that, scratch out "PRO to start pitch rate." In parentheses, "0, 230 slash 018, 0."
01 08 55 10	CMP	Okay.
01 08 55 12	CC	Okay. Looking to the right, the LM attitude or rather the CSM attitude will be incorrect, so you can cross that off. And beneath the picture of the moon, cross out the - in parentheses, "108.19" and the "0, 230/018, 0."
01 08 55 39	CMP	All right.
01 08 55 41	CC	On the right-hand half of the page, cross out the "Orbital science block," and under that "Visual target 1 south of track TR." And under that, the penned-in "D2/3/4."
01 08 56 08	CMP	All right. Got it.
01 08 56 09	CC	And beneath that, cross out "VERB 49, maneuver to track attitude" by the "'C' 0, 353, 0" and the "HU,SCF."
01 08 56 28	CMP	All right.
01 08 56 30	CC	Okay. The information beneath that starting with "Configure camera earthshine photos" down through "Replace dark slides" is optional. So just put in "Earthshine optional" as a comment there, and in the camera settings, in the block that has "f:2.8 125, infinity," cross out the "125" and put in "one-eighth," 1 slash 8, in other words.
01 08 57 18	CMP	Okay, that last part was, cross out the "125" and put in "1/8." Is that right?
01 08 57 25	CC	That's affirm. Okay. Next page. No change. Go to page 19.

01 08 57 45	CMP	Okay.
01 08 57 49	CC	Okay. On the right-hand side, from the "VERB 49, maneuver to earthshine attitude," down through everything up to "MSFN uplink," this is optional. This is "Earthshine optional."
01 08 58 19	CMP	All right. Got it.
01 08 58 21	CC	And once again, a camera-setting correction up near the top of that section that we called optional, where you have "bracket MIR f:0.9, 125," cross out the "125" and put in "1 slash 60." In other words, one-sixtieth. Over.
01 08 58 46	CMP	Okay. Cross out the "125" and put in "1 slash 60."
01 08 58 52	CC	That's correct. And further down at 109:50, where you have "Visual target 17," et cetera, cross out that line and cross out the penned-in "D17."
01 08 59 18	CMP	Okay.
01 08 59 27	CC	Now, move to page 25.
01 08 59 53	CMP	Okay, go ahead, Vance.
01 08 59 54	CC	Okay. At about 114:10, everything under "Altitude set equals 60 miles" should have the comment "Solar corona, optional," and on that first line of that optional where it says "VERB 49, maneuver to solar corona and limb brightening attitude," cross out "And limb brightening attitude."
01 09 00 33	CMP	Okay.
01 09 00 35	CC	Going further down to 114:16, cross out the "14 DAC 18 VHBW limb brightening" line and the line under that which is "BRKT, MIR," et cetera.
01 09 00 59	CMP	All right.
01 09 01 01	CC	In the block where it says "Solar corona and limb brightening photos," cross out "And limb brightening photos" and just put "Solar corona, optional."
01 09 01 23	CMP	Okay. Got it.

01 09 01 25	CC	Going a few lines below that where you see "DAC ON for 4 seconds at about 50 frame rate cover lens," cross that out.
01 09 01 50	CMP	Hey, Vance, we lost you there, or did you ...?
01 09 01 58	CC	Yes, I think we lost lock. We'll stand by a minute.
01 09 02 03	CMP	Okay, I got you back.
01 09 02 07	CC	Okay. Going on down, cross out "114:29:16, DAC ON, SR dash 40 seconds."
01 09 02 26	CMP	Okay.
01 09 02 27	CC	And at the very bottom line on that half of the page should be crossed out which is "114:29:56, DAC OFF, SR."
01 09 02 42	CMP	Okay.
01 09 02 43	CC	On the right-hand side of page 25, where you have the title "Solar corona and limb brightening photography," cross out "limb brightening photography."
01 09 02 57	CMP	Okay.
01 09 02 58	CC	And in the figure, where you have the "DAC LOS" line, which is parallel to the X-axis on the horizon, cross out "DAC LOS" parallel to X-axis on horizon.
01 09 03 24	CMP	All right.
01 09 03 26	CC	And cross out the bottom block on that half of the page which is "DAC magazine percent required 12 magazines, g," et cetera.
01 09 03 42	CMP	All right.
01 09 03 45	CC	Next page, 26.
01 09 03 57	CMP	Go ahead.
01 09 03 58	CC	Okay. Cross out the top line on the right-hand side of that page, which is "DAC on for 4 seconds, 50 frame rate cover lens." And cross out the block to the right of that and down, which has "Magazine percent."

01 09 04 35	CMP	All right. Got it.
01 09 04 40	CC	Okay. Next, page 28.
01 09 05 08	CC	Ready to go?
01 09 05 10	CMP	Go ahead.
01 09 05 11	CC	Okay. On the left-hand side of page 28, at the very bottom, cross out "Photo target 5 north, frame f:5.6, 215, infinity," et cetera. All of that line over to the vertical strip. And cross out the penned-in "E4" below that.
01 09 06 02	CMP	Okay, go ahead.
01 09 06 04	CC	Okay, and the next page, 29, right-hand side near the top, cross out "Photo target 13, north at 5.6, 250," et cetera, all of that line. And cross out beneath that the penned-in "E5 slash 6."
01 09 06 27	CMP	All right.
01 09 06 29	CC	Going to page 30, next, left-hand side.
01 09 06 45	CMP	Go ahead.
01 09 06 47	CC	At the top at 127:01, cross out "Visual target 9 on track, 180 degrees, plus 0.47," and cross out the penned-in "E11" beneath that.
01 09 07 08	CMP	Okay.
01 09 07 10	CC	Going down to 127:11, cross out "Verify DSE ON." Beneath that a ways, cross out "127:14:20, start visual observations of Fra Mauro."
01 09 07 34	CMP	All right.
01 09 07 36	CC	Beneath that, cross out "Continue visual observations," and cross out "Stop observations." And beneath that, cross out "Photo target 56 on track f:8, 250, infinity, 5," et cetera, to the end of that line. Cross out the "5.6" beneath that and the penned-in "E15."
01 09 08 12	CMP	Okay.
01 09 08 14	CC	Over in the margin, to the left of all that, make a comment: "Delete visual only."

01 09 08 38	CMP	Where was that, Vance? I didn't get that last one.
01 09 08 42	CC	Okay. That's still on page 30, on the left-hand side. In the time - in the margin at the left where you have times, just pen in beneath the "127:10" the following: "Delete visual only." That's only a comment.
01 09 09 04	CMP	Okay. All right.
01 09 09 12	CC	Okay. Going to page 34.
01 09 09 27	CMP	Okay.
01 09 09 31	CC	About - on the left-hand side about almost halfway down beneath the "VERB 49, maneuver to TOPO target 54A," make the comment "Target 54A is optional."
01 09 09 54	CMP	All right. Got it.
01 09 09 56	CC	And, next, page 35, on the right-hand side. Everything from "Spacecraft control, CMC, AUTO, verify" on down should be given the comment "Zodiacal light photos optional."
01 09 10 32	CMP	All right.
01 09 10 35	CC	And, well, where you have the block in the middle of the page that says - the small block that says "Zodiacal light photos," just put "Optional" in that title, too.
01 09 10 48	CMP	Okay.
01 09 10 50	CC	And, next, page 36, on the left-hand side.
01 09 11 00	CMP	Okay, go ahead.
01 09 11 03	CC	Okay. First a comment. In the middle of the page is where the zodiacal light stuff ends, just under VERB 48. And then, if you'll go down to the bottom of the page, cross out the line "Photo target 12 on track," et cetera, and cross out the "E5" that is below that line.
01 09 11 30	CDR	Okay, Vance, can I break in a minute?
01 09 11 33	CC	Sure.

01 09 11 39	CDR	We have the CRYO PRESSURE light on now. The H_2 has hit its lower bound, so do you want us to go back to AUTO on the H_2 HEATER 1?
01 09 11 51	CC	Stand by.
01 09 12 14	CC	13, Houston.
01 09 12 18	CDR	All right, go ahead.
01 09 12 20	CC	They request that you leave that switch in the AUTO position until you go to bed tonight. Stand by. I mean in the ON position. I'll repeat that again. In the OFF position until you go to bed tonight for reasons that you have a 3-percent imbalance, and they'd like to get that more even. So, just before turning in, we'll change the switch to AUTO.
01 09 12 54	CDR	Okay.
01 09 13 10	CMP	Okay, Vance, continue.
01 09 13 11	CC	Okay - -
01 09 13 12	CMP	Before we get away, would you ask FAO - something I didn't get briefed on - what the penned-in E5 and those letters and numbers mean?
01 09 13 31	CC	Okay. Just 1 minute.
01 09 13 54	CC	Okay, we'll have comments on that for you in just a second.
01 09 14 00	CMP	Okay.
01 09 15 00	CC	Apollo 13, Houston.
01 09 15 01	CMP	Okay, Vance, I'm ready to continue. I'm ready. Go ahead.
01 09 15 06	CC	Okay, new subject. Like to break in to say that request you re-initialize the PTT - PTC. For some reason, it's gone up to 18 degrees in pitch and yaw both. We don't quite understand this. All we can think of is - start it again. Over.
01 09 15 27	CMP	Okay. We'll go back.

01 09 15 33	CC	Okay. We are at the - the end of the changes in the solo book, and I have two pages of changes in the flight plan. Those are pages 3-122 and 3-125. While you're looking that up, we'll put Ken on to answer your question.
01 09 16 01	CMP	Okay. I'll start back - let me start back re-initializing PTC here.
01 09 16 07	CC	Okay.
01 09 16 59	CDR	Okay, Vance, I'm on 3-122 of the flight plan.
01 09 17 03	CC	Okay. Okay, about - at time 156:50 on the right - well, on the right-hand half of the page, there's a line which states "Visual target 16, south, 180 plus 1:11, Gassendi, f:15." Request you cross out that line.
01 09 17 38	CDR	Okay, we'll cross them out.
01 09 17 42	CC	That's all on 3-122. Next change is 3-125.
01 09 18 07	CDR	Okay, I'm looking at 125.
01 09 18 10	CC	Okay, starting from the top of the page, cross out the first five lines, which are "Set up camera for contamination and photography, Betelgeuse, CM4/EL/80," et cetera, "MAG T," et cetera, "Install window shades."
01 09 18 35	CDR	I've got them crossed.
01 09 18 37	CC	Okay, then jump down to just about 159:28. Cross out "Maneuver to contamination field photography attitude," and all other lines below that through "Enable thrusters A3, C4, B3," et cetera.
01 09 19 06	CDR	Okay, so we start with "Maneuver to contamination field photography," and we cross out everything down to and including "Enable thrusters A3, C4, B3, and D4."
01 09 19 16	CC	That's correct. And those are all of the flight changes - flight plan changes we have. And Ken is coming on now and later sometime when we get PTC squared away, and it's convenient, I suppose you should read all these things back to make sure that we're squared away on them.

01 09 19 41	CMP	Okay. Go ahead, TK.
01 09 19 48	CC	Yes, sir. Understand you have a question.
01 09 19 53	CMP	Yes. I guess I didn't understand what the letter and the number was behind some of these photo targets.
01 09 20 02	CC	Okay - -
01 09 20 03	CMP	Does that refer to the pages?
01 09 20 05	CC	Yes, sir. That's the map. Each fold is lettered in the lower - or upper right-hand corner if you work your way from east to west and the charts are labeled D, E, and F and the solo stuff will all be the D and E, and they change with the plane change 1. That's the time they change the two maps.
01 09 20 30	CMP	Okay. I got it. Thank you.
01 09 20 32	CC	Yes, sir. You're doing good work, hey.
01 09 20 37	CMP	Well, I had a good prime crewman that taught me all I know.
01 09 20 43	CC	Don't run out.
01 09 20 50	CMP	Hey, when FIDO gets a good hack on our trajectory, will you let us know?
01 09 20 58	CC	How long you willing to wait?
01 09 21 03	CC	He's looking at his calendar, if that means anything.
01 09 21 07	CMP	(Laughter) All right.
01 09 21 31	CMP	Okay. I'm back at the attitude here, and I'll wait for rates to damp, and you let me know when we're stable again.
01 09 21 38	CC	Okay. Will do.
01 09 24 00	CC	13, Houston.
01 09 24 06	CMP	Go ahead, Vance.

01 09 24 08	CC	Roger. Just a reminder you have to disable Charlie and Delta here as you've done in the past. Over.
01 09 24 15	CMP	Okay. I was kind of holding off on this. We're dumping a little waste water now.
01 09 24 23	CC	Okay. FIDO says he knew it all along. He's - he says he's been very concerned that you've been doing a lot of water dumping.
01 09 30 07	CMP	Okay, Vance. We've got quad C and B disabled.
01 09 30 13	CC	Okay. Copy, Jack.
01 09 41 12	CC	Apollo 13, Houston.
01 09 41 16	CMP	Go ahead.
01 09 41 18	CC	It may be awhile before your rates are settled down. We're still observing fairly high rates and deadbanding. Over.
01 09 41 29	CMP	Okay. Thank you.
01 09 44 54		(Music)
01 09 50 36	CC	Apollo 13, Houston.
01 09 50 41	CMP	Go ahead, Vance.
01 09 50 42	CC	Okay. We've got about three items. First one is, all of your P23 batch - two marks have been evaluated and - Hey, congratulations. Looks real good; they're very happy with it. You're down to 4 arc-minutes on the substellar-point aspect of it, and that's the first thing to mention. The second is, unless you see a need, I don't see any need for you to read back the information we gave you on the solo book and so forth. Do you concur?
01 09 51 20	CMP	Roger. I think I got it. I remembered a lot of it, and so I think with what you gave me and what I remember, I'm pretty sure we got it right.
01 09 51 36	CC	Okay, and the third item, I was just about to call that your rates were stabilized to start the PTC, but it looks like they're jiggling around again from a dump, so we'll stand by some more.

01 09 51 55	CMP	Okay.
01 09 52 23	LMP	No secrets around here.
01 09 52 28	CC	Say again. Hey, that's right.
01 09 52 33	LMP	I said there's no secrets around here.
01 09 52 38	CC	Yes. Big Brother is watching.
01 09 52 50	CC	13 - -
01 09 52 51	CMP	I can just see EECOM telling FIDO.
01 09 53 03	CC	Yes. You really have to watch that pair, all right. By the way, we have a maneuver pad for you, a fly-by pad, whenever you're ready to copy.
01 09 53 17	CMP	Okay. Stand by.
01 09 53 55	CMP	Go ahead, Vance.
01 09 53 57	CC	Okay, maneuver pad, purpose: fly-by, SPS/G&N; 63385; plus 0.97, minus 0.23; 072:24:33.08; plus 0212.7, minus 0141.7, minus 0254.8; 148, 316, 050; NA, plus 0022.5; 0360.9, 0:53, 0356.3; 33, 352.7, 15.0; NA, NA, NA. Starting with latitude, minus 23.26, minus 165.00; 1147.7, 36172; 166:54:02. Comments, GDC aline stars are 31, Arcturus; and 23, Denebola. R aline 288, pitch aline 205, yaw aline 034; ullage, none; other, burn is SPS docked. LM weight, 33499. Over.
01 09 57 39	CDR	Our pad as follows: fly-by, SPS/G&N; 63385; plus 0.97, minus 0.23; 072:24:33.08; plus 0212.7, minus 0141.7, minus 0254.8; 148, 316, 050; NA, plus 0022.5; 0360.9, 0:53, 0356.3; 33, 352.7, 15.0; NA, NA, NA; minus 23.26, minus 165.00; 1147.7, 36172; 166:54:02; set stars 31, 23; roll is 288, pitch 205, yaw 034; no ullage; SPS docked; and LM weight, 33499.
01 09 59 20	CC	Roger. That's correct. Want to verify under NOUN 81 that DELTA-V_X is plus 02127. You cut out right there.
01 09 59 35	CDR	Roger. DELTA-V_X is 02127.

01 09 59 40	CC	Roger. And your rates are low. Looks like you can start the PTC.
01 09 59 51	CMP	Okay. In work.
01 09 59 54	CC	Okay. And when the computer is available, request POO and ACCEPT and we'll ship you your state vector.
01 10 00 07	CDR	Wait until I get PTC going first, Vance, then we'll give it to you.
01 10 00 10	CC	Okay.
01 10 02 41	CMP	Okay, Vance. We're POO and ACCEPT. The computer's yours.
01 10 02 48	CC	Roger. Here it comes.
01 10 03 09	CMP	You know, somehow, everytime I do a set of P23s, you guys uplink me a state vector. I don't think I do too well.
01 10 03 24	CC	No - -
01 10 03 25	CMP	I could get a complex.
01 10 03 26	CC	No. You know - you know how the FIDOs are. They like to load in their own data, no matter what.
01 10 03 44	CMP	But our state vectors take into account the waste water dumps.
01 10 03 56	CC	Yes, that's -
01 10 05 28	CC	Apollo 13, Houston. It's your computer again.
01 10 05 33	CMP	Okay. Going to BLOCK.
01 10 05 36	CC	And as a matter of interest, understand that the downrange comparison between the MCC and the computer is within 35000 feet, and that's on the last sighting, which people think is pretty good.
01 10 05 56	CMP	Okay. Maybe that gives us a little more confidence that if we had to do P23s on the way home, we'd make it.
01 10 06 05	CC	No doubt about it.

END OF TAPE

01 10 58 16	CC	Apollo 13, Houston.
01 10 58 21	CDR	Go ahead, Houston.
01 10 58 23	CC	Just info on your PTC, Jim. It's looking very good. Just - excursions in pitch and yaw are very low.
01 10 58 34	CDR	Okay, thank you. And we're going to change another lithium hydroxide canister now.
01 10 58 42	CC	Okay.
01 10 58 54	CMP	And, Vance. Has FIDO come up with any observations on the trajectory?
01 10 59 02	CC	Well, a minute ago, he said that to tell you that he was pacified now after your past comments on his trajectory and so forth, and he hadn't seen any waste water dumps or anything and he's pretty happy.
01 10 59 24	CMP	Okay. I just wondered if we're going to need any more midcourse.
01 10 59 36	CC	He says, seriously, it's looking probably like you won't have any more.
01 10 59 45	CMP	Hey, that's real fine.
01 10 59 49	CC	FIDOs never guarantee anything, however.
01 10 59 55	CMP	Yes. That's right.
01 11 04 50	CMP	Houston, 13. I have the onboard read-out, if you're ready to copy.
01 11 04 57	CC	Roger. Go ahead.
01 11 05 01	CMP	Okay. BAT C 37, PYRO BAT A 37, PYRO BAT B 37, RCS A 97 percent, B 97 percent, C 96 percent, D 97 percent.
01 11 05 27	CC	Roger. We copy that. Thank you.
01 11 26 56	CC	Apollo 13, Houston.
01 11 27 05	CDR	Go ahead, Vance.

01 11 27 07	CC	Jim, just an item for you and Fred to be thinking about in case you haven't been briefed on this, something that's now being talked about a little bit. These conservative people would like to have you read the SHe tank pressure when you go into the LM for the LM familiarization at 58 hours. If there's no midcourse-3, and it looks like there's a good chance that there will not be, why, they might want to move the LM familiarization up from 58 to 55 hours. Over.
01 11 27 50	CDR	Okay. If we don't have a midcourse-3, then we'll probably move LM FAM up to 55 hours, in which case we'll go in there and read SHe tank pressure.
01 11 28 02	CC	Roger. Along with the other FAM stuff, and it's not certain that we want to do this, it's just being talked about, so this is just the information for you.
01 11 28 18	CDR	Okay. This is beginning to sound like the SIM that we ran not too long ago.
01 11 28 29	CC	I don't think it will be a very big deal.
01 11 43 42	CMP	Okay. Houston, 13.
01 11 43 46	CC	This is Houston. Go ahead.
01 11 43 50	CMP	Okay, Vance. Our LM/CM DELTA-P is 0.9.
01 11 43 58	CC	Roger. 0.9.
01 11 44 05	CMP	Roger.

END OF TAPE

01 12 42 10	CC	Apollo 13, Houston.
01 12 42 14	LMP	Go ahead, Vance.
01 12 42 17	CC	Are you guys hacking into your presleep checklist yet?
01 12 42 24	LMP	Oh, we just finished eating and cleaning up a bit afterwards. Jim's going around collecting debris off of all the inlet hoses. And, I guess you might say we're kind of thinking about getting ready to go to sleep.
01 12 42 47	CC	Well, I hope you had a good meal.
01 12 42 52	LMP	It wasn't too bad.
01 12 42 55	SC	(Music)
01 12 43 01	CC	Sounds like you guys are really living it up up there. All that music, food. I didn't say drink.
01 12 43 09	LMP	Yes, it is pretty nice. Not bad at all. You're right; you didn't say it. This PTC we're in is a pretty - pretty nice merry-go-round, Vance. Every 10 minutes alternately I get to look at the Earth and the Moon.
01 12 43 40	CC	You couldn't ask for anything more than that. Just so it isn't so fast you - -
01 12 43 44	LMP	No, it's a lot - a lot better. I remember from 8 when they didn't hardly ever get to look at either one.
01 12 43 57	CC	That's right. They were tumbling about another axis, weren't they.
01 12 44 03	LMP	Yes.
01 12 44 31	LMP	It's pretty cloudy down there tonight. About the only land I can see again is a portion of Australia and Korea and looks like a part of China. Just about clouds covering everything else.
01 12 44 51	CC	Can you still see that clearly with the naked eye, or do you have to look through a glass?

01 12 45 01	LMP	I can see Australia with the naked eye and the China landmass, but I - It took the monocular to pull out the Korean Peninsula.
01 12 45 15	CC	How about the Moon? Is it looking very big yet?
01 12 45 21	LMP	No, not really. Bigger, but we've got a ways to go.
01 12 45 31	CC	I understand that they're estimating your pericynthion - lunar pericynthion is now 62 miles.
01 12 45 46	LMP	Well, that's not bad.
01 12 45 47	CC	That's supposed to be just right.
01 12 45 50	LMP	Yes.
01 12 46 25	CMP	Okay, Houston; 13.
01 12 46 28	CC	Go ahead, Jack.
01 12 46 31	CMP	Okay. We're into the presleep checklist now. As far as the crew status report, as far as medication goes, we've had no medication. And we're all feeling really good. I've given you the onboard readouts. Jim is chlorinating the potable water now. I'm ready for an E-memory dump whenever you're ready.
01 12 47 01	CC	Stand by 1 on the E-memory dump, Jack. I think we'll be ready in about a minute.
01 12 47 08	CMP	Okay.
01 12 47 12	CC	And EECOMM says that as soon as you stir your cryos, request you go back to AUTO on that one tank.
01 12 47 25	CMP	Okay. We'll do that.
01 12 48 14	CC	Hello, 13; Houston. We're ready to take your E-memory dump.
01 12 48 21	CMP	Okay. Coming down.
01 13 07 15	CC	Apollo 13, Houston. Were you trying to call?
01 13 07 20	CDR	Go ahead, Houston.
01 13 07 29	CDR	Houston, 13.

01 13 07 33	CC	Apollo 13, Houston. We thought you were trying to call. Were you?
01 13 07 38	CDR	I don't believe so unless we inadvertently hit the microphone button.
01 13 07 48	LMP	Must have been some other guy trying to call, Jack.
01 13 07 53	CDR	Just trying to get some words in, eh Jack?
01 13 07 58	CC	Roger. We saw the downvoice subperiod come on. We thought maybe you were trying to call. Sorry. I hope we haven't disturbed you and from where I sit, it looks like you're running a rest home up there. Good night.
01 13 08 14	CDR	We're all going to bed now just after we play the last rendition of "With Our Eyes on the Stars."
01 13 08 24	SC	(Music)
01 13 08 29	CC	Okay, Jim. And we'd like you to check your S-BAND NORMAL voice switch, OFF.
01 13 08 37	CDR	S-BAND NORMAL, OFF.
01 13 11 09	CDR	Houston, 13. We'll be off COMM; so if you need us, send a crew alert, please.
01 13 11 44	CC	Okay, Jim. If we need you, we'll send a crew alert, and we'd like to know who's got the duty tonight on the BIOMED. Is that you?
01 13 12 03	CDR	Yes. I'll be on the BIOMED.
01 13 12 09	CC	Okay. We copy, and you're spoiling my good record of two watches without saying anything.
01 13 12 24	CDR	Just want to keep you busy, Jack.
01 13 12 27	CC	You're waking me up.

END OF TAPE

REST PERIOD - NO COMMUNICATIONS

01 22 43 18	CDR	Houston, Houston, Apollo 13. Over.
01 22 43 22	CC	Good morning, 13. You're early.
01 22 43 27	CDR	Ah so. I just thought I'd be waking up. And we are awake and getting the spacecraft shipshape. ...
01 22 43 38	CC	Roger. Spacecraft is in real good shape as far as we're concerned, Jim. We're bored to tears down here. We do have a few little items for you, like a P37 update and a couple of flight plan updates. But there's no rush about them. Over.
01 22 43 56	CDR	Okay. Gig us again in a few minutes. We're breaking out some food, and we'll copy them then.
01 22 44 01	CC	Okay. And the surgeon will be ready for your sleep report whenever you get that together.
01 22 44 08	CDR	Righto. If he's listening, LMP had a solid 9 hours of sleep; I couldn't wake him up this morning. The CMP had 6 hours, and the commander about 5 intermittent.
01 22 44 22	CC	Okay - -
01 22 44 24	CDR	Jack's dosimeter - Jack's dosimeter is reading 02026.
01 22 44 32	CC	Okay. We got it.
01 22 44 36	CDR	It might be interesting that just after we went to sleep last night we had a MASTER ALARM and it really scared us. And we were all over the cockpit like a wet noodle.
01 22 44 45	CC	(Laughter) Sorry it wasn't something more significant. I've also got a procedure for you on that H_2 tank; simple thing after you get done stirring up the cryos.
01 22 44 59	CDR	Okay.
01 22 46 56	SC	(Music - With Their Eyes on the Stars)

01 22 47 10	CC	That was beautiful. What was it?
01 22 47 16	CDR	A little of "With Their Eyes on the Stars" to wake up to.
01 22 47 24	CC	Sounds like all the comforts of home. Have you guys got a flower on your breakfast table?
01 22 47 33	CDR	Yes. Jack!

END OF TAPE

01 23 38 10	CDR	Houston, Apollo 13. Over.
01 23 38 13	CC	13, Houston. Go ahead.
01 23 38 24	CC	13, this is Houston. Go.
01 23 38 28	CDR	Roger, Joe. We're standing by for that P37 block data if you have it for us.
01 23 38 32	CC	Okay. Got it right here, Jim, and it follows. This is the P37 pad for lift-off plus 60. The reason for the update is for weather avoidance in the MPL at 119 hours. It's the same one we passed you yesterday, and it's the same weather, but we still don't expect a problem at the end of the mission. GETI is 060:00, DELTA-V_T 6079, longitude minus 153, GET 400K 118:04. Over.
01 23 39 18	CDR	GETI of 060:00, 6079, minus 153, 118:04.
01 23 39 29	CC	Roger. That's correct. I've got a consumables update for you, Jim, if you're ready for that.
01 23 39 41	CDR	Ready to copy.
01 23 39 43	CC	Okay. As of 47 hours, RCS total 1096, quad Alfa 270, Bravo 278, Charlie 270, Delta 278, and the H_2 - - They gave me the H_2s in percent, 76 percent; and on the O_2 we have 81 percent. However, we show the O_2 tank 2 reading off-scale high now. We're quite sure it's a sensor failure. We'd like you to verify it with your onboard reading.
01 23 40 29	CDR	Okay. Stand by.
01 23 40 47	CDR	Joe, we confirm. Our gage reading is - on the number 2 O_2 tank is reading off-scale high now, but Jack just tells me that it was okay when we first looked at it this morning.
01 23 41 00	CC	We verify that. At 46:45 we had 82 percent and apparently when he stirred the, the cryos, the sensor broke.
01 23 41 17	CDR	Okay.

01 23 41 19	CC	So it's no problem. You're above nominal on all your consumables. On the H_2 tank problem, we have a procedure that we'd like you to carry out which is simply turning the H_2 tank 2 heaters to OFF at this time, and we want to see whether that won't solve the problem of the tank pressure setting off caution and warning. We want to look at it that way for a few hours.
01 23 41 47	CDR	Okay. You want both H_2 tank 2 heaters to OFF. Is that correct?
01 23 41 51	CC	That's negative; just tank 2. We want tank 1 to stay in AUTO.
01 23 41 57	CDR	Okay. Tank 2 heaters off at this time.
01 23 42 00	CC	Okay. Good deal. That's been the high tank and apparently while waiting for that pressure switch to close, to start the heater cycle, the tank 1 pressure has been dropping even a little bit lower and just setting off caution and warning, so we feel if we turn off the tank 2 heater and let tank 1 activate the heater cycle, we won't get into the caution and warning range.
01 23 42 25	CDR	Roger.
01 23 42 26	CC	Okay, Jim. At your convenience we'd like POO and ACCEPT. We're ready for - to uplink your state vector now since we will not do midcourse 3. Over.
01 23 42 38	CDR	Roger. You're in POO and ACCEPT, no midcourse 3, and we're all set for a state vector update and I'm giving you the LM/CM DELTA-P here shortly.
01 23 42 46	CC	Okay. Good deal. And I have flight plan updates for you later, at your convenience.
01 23 43 18	CDR	Houston, Apollo 13. The LM/CM DELTA-P is 1.0 psi.
01 23 43 23	CC	Copy, 1.0, Jim.
01 23 44 37	CDR	Houston, Apollo 13. I'm about ready for any flight plan updates that you have.
01 23 44 40	CC	Okay, 13. To start off with, got a minor procedural change for Jack on his next P52, if he's ready to listen to that.

01 23 44 54	CDR	Okay. Jack's still off COMM. We'll hold off on that a little bit and then we'll pick it up when he gets on COMM.
01 23 45 01	CC	Okay; fine. I've got two updates for you, Jim. One is a procedure for looking for Comet Bennett at about 49:45, and I'll wait till Jack gets up before passing you the details on that. The other update is concerned with going into the LM 3 hours early, and I think Vance mentioned to you last night that this was a possibility, that we'd like to look at the SHe tank pressure early. And since we're not going to do midcourse 3, we'd like LM entry at 55 hours. Is that okay with you?
01 23 45 41	CDR	Okay. Right, that's fine with us. We'll move up LM entry to 55 hours.
01 23 45 48	CC	Okay. I've got some details on the flight plan for you as follows. Of course, since there's no MCC-3 you'll be deleting all the midcourse 3 stuff including the - the P52, which is called out at about 54-1/2, and we'll be slipping that until later, which I'll - which I'll tell - which I'll tell - which I'll tell you in a minute. Okay. Then you - we want to move the battery charge up 3 hours to about 52:30. And we want to move the - moving the LM tunnel vent valve to LM/CM DELTA-P up 3 hours to 52:45, and at that point you can simply go to the 57-hour point in the flight plan and change your number from 57 hours to 54 hours and start through that. In the remarks section at about 57:50 it says, "O_2 fuel cell purge and waste water dump," here. If not performed earlier, we want you to do that at 54 hours and 50 minutes. The TV pass then, will be at 55 hours to 55:30. You'll go right through the LM Activation checklist stuff. I'm losing you; let's wait a minute.
01 23 47 41	CC	13, Houston. How do you read me?
01 23 48 05	CC	13, Houston. You back with us?
01 23 49 14	CC	Apollo 13, Houston. Are you back with us?
01 23 49 19	CDR	We're back with you.
01 23 49 20	CC	Okay. I've gone through the battery charge, the LM vent valve, the fuel cell purge, and then

stop PTC at 55 hours, and your roll attitude there will be 285 degrees, which is per the flight plan. The high gain antenna angles are slightly different, pitch 23 and yaw 267 degrees. The TV pass till 55:30, the standard LM activation except for some special steps we'll give you to take a look at SHe tank pressure, which I don't have yet. Restart PTC at about 56:30 or whenever you're through with the LM activities, and after that, at your convenience, we'd like you to - to do the P52 option 3 that we cancelled at 54-1/2 hours. Over.

01 23 50 27	CDR	Okay. That last comment was that we'll do the P52 after we start PTC at about 56:30.
01 23 50 31	CC	That's right. Any time after that; it's not time critical.
01 23 50 43	CDR	Okay. Let's see if I have some of this, Joe. Around 52:30 we're to do the battery charge on BAT - battery B.
01 23 50 52	CC	That's correct.
01 23 50 54	CDR	And then about 52:40 we're going to do the LM tunnel vent valve, and the LM/CM DELTA-P which has been written up at 55:40.
01 23 51 04	CC	That's correct.
01 23 51 09	CDR	We're deleting midcourse-3 and we've moved up the LM entry to 55 hours. So we'll merely follow all the - We'll follow all the procedures that leads up to LM entry that was originally scheduled for 58.
01 23 51 29	CC	That's correct. You can start at 57 in the flight plan; call it 54 hours and press right on.
01 23 51 48	CDR	Okay. Then whenever we're finished with the LM, which we anticipate around 56:30, we'll commence PTC and sometime after that we'll do a P52.
01 23 51 59	CC	That's affirmative. And did you copy the new high gain angles for 55 hours? The ones we had - -
01 23 52 12	CDR	Okay. We're going to stop the PTC for LM entry at roll 285, and high gain angles are pitch 23 and yaw 267.

01 23 52 23	CC	That's correct, Jim. And, 13, Houston. The computer is yours.
01 23 52 35	CDR	The computer is ours. We're in BLOCK, and exactly when do you want the TV to be cranked up?
01 23 52 41	CC	You can crank it up sometime prior to 55 hours at your convenience just to set it up. We'll be expecting transmission at 55 hours.
01 23 52 55	CDR	Okay.
01 23 53 46	CDR	And, Houston, Apollo 13. One thing I missed about the O_2 fuel cell purge and waste and water dump.
01 23 53 53	CC	Roger. We'd like the the O_2 fuel cell purge and waste water dump at 54:50.
01 23 54 04	CDR	Roger. We'll pick up those items at 54:50.
01 23 54 30	CC	Apollo 13, Houston.
01 23 54 35	CMP	Go ahead, Joe.
01 23 54 36	CC	All right, Jack. One thing we'd like to have done sometime soon is to have you cycle the cryo fans in O_2 tank 2 one more time. We'd like to see if we can get that sensor back.
01 23 54 50	CMP	Okay. O_2 tank 2 fan on now.
01 23 54 55	CC	Roger.
01 23 56 08	CDR	Houston, 13.
01 23 56 09	CC	Go, 13.
01 23 56 14	CDR	We - We have just one question, the LM tunnel vent valve. We're questioning why we're venting until the DELTA-V is greater than 1.7 if we are going to open up the tunnel, then pressurize the LM usually.
01 23 56 27	CC	Right. Stand by on that.
01 23 56 51	CC	13, Houston.
01 23 56 55	CDR	Go ahead.

01 23 56 56	CC	Roger. The word on that, Jim, is that they want to insure the proper O_2 concentration in the LM when you get to the surface, and this is a method of doing that by bleeding out additional nitrogen.
01 23 57 12	CDR	Okay. Thank you.
01 23 57 21	CC	And, 13, Houston. If Jack is up, I'd like to talk to him about the P52, briefly.
01 23 57 29	CDR	Okay. He's here.
01 23 57 31	CMP	Go ahead, Joe.
01 23 57 32	CC	Okay, Jack. What they'd like you to do on this P52 at 49 hours, they've been observing a slight jitter in the optics shaft angle of about 0.2 of a degree plus or minus. Before you come out of the OPTICS ZERO position, at the start of this P52, they'd like you to just observe the shaft readout, and see if the jitter occurs on your direct readout there, and also they'd like you to briefly call up a VERB 16, NOUN 91 so we can look at the shaft and trunnion angles.
01 23 58 11	CMP	Okay. Let's see if I got it right. On the P52 at 49 hours, before coming out of ZERO on the OPTICS, observe the shaft and also call up 16, 91 and let you look at the shaft and trunnion angles to observe a possible jitter. See whether it occurs in the ZERO position as well as out of ZERO.
01 23 58 33	CC	Roger, Jack. That's correct; and if you have time, now, I've got a flight plan update for you on looking for the Comet Bennett.
01 23 58 50	CMP	Okay. Stand by 1, Joe. And the commander's going off the air briefly.
01 23 58 58	CC	Roger that.
02 00 00 02	CMP	Okay, Joe. I'm ready to copy the ... now.
02 00 00 04	CC	Okay, Jack. I'm going to read it to you, and then add some comments and we'll talk about it a little. This should occur sometime after 49:30. After the P52 realine at 49 hours, if time permits we would like the crew to investigate while in PTC if there is a roll angle in

which the comet can be observed for photos. If there is, record the optimum roll angle for possible photography, prior to reinitiating PTC at 56:30 or so, whenever the guys are done in the LM, use P52 planet option, and the following half-unit vectors for tracking Comet Bennett at about 49:46. Are you ready to copy half-unit vectors? Over.

02 00 01 05 CMP Okay. Go ahead, Joe.

02 00 01 07 CC Okay. R_1 plus 0.34202, R_2 minus 0.07374, R_3 plus 0.35719. Read back.

02 00 01 33 CMP Okay. Copy R_1 plus 0.34202, R_2 minus 0.07374, R_3 plus 0.35719.

02 00 01 48 CC Okay. That's correct and the last sentence on the update is that you can expect AOS of the comet at a roll of 45 degrees and LOS at a roll of 155 degrees. Now, the deal here, Jack, according to the plots they showed me is, the comet appears to be about 10 degrees away from the Sun, and due to the geometry of the LM there shadowing the Sun, it would appear that you will be able to see the comet through the sextant without getting Sun shafting between roll angles of about 45 degrees and 75 degrees. It appears that as your roll gets higher than 75 degrees, although the comet is still in the field of view, the Sun is also in the field of view, and you probably will not have any success between 75 and 155 if you haven't got it from 45 to 75. If you do find that you can see the comet somewhere between 45 and 75 or 80 degrees, just note that roll angle and then if it's feasible we'd like you to photograph it after the LM entry part of the checklist. Over.

02 00 03 10 CMP Okay, Joe. Let me give it back to you and see if I've got it here. After the P52, during our PTC you want us to use P52 and observe Bennett's Comet through the sextant; note a roll angle if we can find it visible. It would be visible somewhere between - ideally between 45 and 75 degrees, and we should lose it about 155 roll, and if we do see it, make an observation of whether it is photographable, note the roll angle for photographs to be taken after or prior to initiation of PTC at 56:30.

02 00 03 58	CC	That's exactly right, Jack.
02 00 04 04	CMP	Okay. Real fine.
02 00 06 20	CC	Apollo 13, Houston.
02 00 06 24	CMP	Go ahead, Joe.
02 00 06 25	CC	We're ready to have to O_2 tank 2 fan off, and thank you.
02 00 06 32	CMP	Okay. Doesn't look like we got it back, huh?
02 00 06 35	CC	No, it doesn't, Jack.

END OF TAPE

02 01 01 01	CMP	Houston, Apollo 13.
02 01 01 20	CMP	Houston, Apollo 13.
02 01 01 22	CC	Hey, 13; Houston. Go ahead.
02 01 01 26	CMP	Okay, Joe. I've started into P52 here. I've proceeded on option 3, and on the dis - 1520 - 1525 display, I've called up 1691. I'm going to let you observe and see while the - the shaft angle while the OPTICS are still in ZERO.
02 01 01 47	CC	Okay. Roger that, Jack. We're looking at it, and I'll give you a mark as soon as G&C is happy.
02 01 01 55	CMP	Okay. Real fine.
02 01 02 26	CC	13, Houston. Jack, could you give us a readout on your counter now?
02 01 02 35	CMP	Okay. I'm showing a shaft of 0.2 and a trunnion of 359.92.
02 01 02 48	CC	Roger. Copy that. Is there any jumping around on the shaft?
02 01 02 57	CMP	You mean on the TPAC readout?
02 01 02 59	CC	Yes.
02 01 03 02	CMP	As a matter of fact, it went from 0.2 to 0.21.
02 01 03 08	CC	Okay. Copy that. Stand by 1.
02 01 03 13	CMP	Okay. Now it went down - It went down as low as 0.15.
02 01 03 18	CC	Okay.
02 01 04 09	CC	Jack, Houston. Let us watch that for another minute or so.
02 01 04 15	CMP	Okay. I'm in no hurry. It looked like it burned between 0.14 and 0.8 with an occasional spike up to 0.2.
02 01 04 24	CC	Roger.

02 01 05 30	CC	Apollo 13, Houston.
02 01 06 04	CC	Apollo 13, Houston. You can press on with P52 now. Over.
02 01 06 10	CMP	Okay, Joe.
02 01 08 17	CMP	Hey, Houston, are we clear to torque? Are you reading the torquing angles?
02 01 08 28	CC	13, Houston. Go ahead and torque.
02 01 08 35	CMP	Okay. Time of torquing will be 49 hours 8 minutes 35 seconds.
02 01 08 41	CC	Roger that.
02 01 10 13	CC	Apollo 13, Houston.
02 01 10 17	CDR	Go ahead, Houston.
02 01 10 19	CC	Roger. For Jack, we missed the star angle difference on the P52. Would you read us that?
02 01 10 30	CDR	Roger, Houston. It was all balls.
02 01 10 32	CC	Okay. Thank you.
02 01 42 38	CMP	Hey, Houston; 13.
02 01 42 40	CC	13, Houston. Go ahead.
02 01 42 44	CMP	Okay, Joe. I got into P52 about 49:34. We loaded the planet - or Bennett Comet vectors into the planet option, and P52 tracked it all the way across except that it was always occulted by the LM, and we're in a roll angle of 155 now.
02 01 43 09	CC	Roger. We're copying your roll angles. At what roll angle were you able to start tracking it, Jack?
02 01 43 24	CMP	Okay. At the time we entered it there, we were about 66 degrees roll, so either we started too late, or maybe somehow we got a wrong calculation on the roll angle.
02 01 43 40	CC	Okay. Let me have G&C comment on that. I suspect that the roll angles we gave you were calculated for exactly 90 degrees pitch, and you're probably wobbling enough that they're not exactly correct.

02 01 44 02	CMP	Yes, I think you - You probably got the right idea.
02 01 45 24	CC	13, Houston. Over.
02 01 45 29	CMP	Go ahead.
02 01 45 30	CC	Okay, Jack. Notice you've secured from that, and that was going to be our recommendation, anyway. We're going to have the guys in the back room look at it and see if they can come up with some - with some better numbers based on the cone angle that - that you're traveling through, whether there are any roll angles that - that are available to you. And if there are, and we have time, we might give it another try; if not, we just will forget it.
02 01 46 05	CMP	Okay.
02 01 48 17	CC	Apollo 13, Houston. Over.
02 01 48 22	CMP	Go ahead, Joe.
02 01 48 27	CC	Okay, Jack. I'd like to pass you a switch configuration on the CRYO O_2 TANKS and give you the reason. Right now, we'd like you to go to HEATERS tank 1, OFF; tank 2, AUTO, which is the opposite of the way you've got them now. Over.
02 01 48 48	CMP	Okay. Is this O_2 or H_2?
02 01 48 51	CC	This is O_2, and stand by for a minute and we'll have a - Excuse me. This is H_2, Jack; it's H_2.
02 01 49 22	CMP	... is AUTO, ... 2 OFF.
02 01 49 52	CMP	Okay, Joe. Do we have you back again?
02 01 49 55	CC	Okay, Jack. We're getting you back, and I hope you copied my - my correction of my mistake. I'm talking about the H_2 CRYO TANKS. We'd like the tank 1 HEATER to OFF; tank 2 to AUTO. Over.
02 01 50 09	CMP	Okay. We lost you again. Here's our heater configuration now. H_2 HEATERS 1, OFF; 2, AUTO. Both O_2 HEATERS are in AUTO.

02 01 50 23	CC	Okay. That's the configuration we want you in, and here's what we're thinking about. When we went to tank 1 AUTO, tank 2 OFF; we found that the heater cycle had a tank 1 pressure of about 233 psi, which is well above the caution and warning limit, and if we go to that configuration for sleep, we'll keep from getting CAUTION AND WARNING lights during the sleep cycle. Okay. In order to do that comfortably, we want to spend the rest of the day using more H_2 out of tank number 2, so as to get an unbalance in favor of tank 1, so at the end of the sleep cycle it'll all come out even. And that's why we have you in tank 1 OFF, tank 2 AUTO, now. We expect to get about a 3-percent unbalance over the next 10 hours; and prior to sleep, we'll call you to reverse the configuration again. Now the only disadvantage here is that, during the day, you will probably get a few CAUTION AND WARNINGS, and we just figured it would be better to get them now than while you were sacked out. Over.
02 01 51 35	CDR	I'll buy that 100 percent.
02 01 51 37	CC	Okay. Good deal. One other detail for you, Jack; G&C tells us that the OPTICS jitter is very similar to what we had on Apollo 12. It's no problem, but when you're not using the OPTICS, we recommend that you turn the OPTICS POWER switch to OFF to guard against a possible degradation as the flight progresses. Over.
02 01 52 09	CMP	Okay. Will do.
02 01 52 23	CC	Okay. Apollo 13, Houston. I have one more little update for you, and it's another update to the erasable memory onboard crew charts on page G/9-2. Over.
02 01 52 48	CDR	Houston, 13. We're ready to copy.
02 01 52 51	CC	Okay, Jim. These are gyro compensation terms. They've already been uplinked, and we're just updating your onboard charts now. In column A, number 11, change from 77646 to 00114; number 12, change from 77332 to 77546; number 13, change from 76617 to 77201. Over.

02 01 53 43	CDR	The changes are as follows, and all in column A: number 12, the new change is 77546; number 11, the new change is 00114; and 13, the new change is 77201. Over.
02 01 54 01	CC	Roger. Readback correct.
02 01 54 06	CMP	And, Joe, do you know - Are you going to try and let us spot the Bennett Comet on this next revolution there? Or do you want me to turn the OPTICS power off now?
02 01 54 17	CC	Stand by 1, Jack. Okay, Jack. We don't have confidence in those roll angles yet, so why don't you turn the OPTICS off, and we'll update you later.
02 01 54 32	CMP	Okay. Going off now.
02 01 54 34	CC	Roger.

END OF TAPE

02 02 26 48	CC	Apollo 13, Houston.
02 02 26 53	CMP	Go ahead.
02 02 26 54	CDR	Go ahead, Houston.
02 02 26 55	CC	Roger, Jim. If you've got a couple of minutes now, I'd like to read up to you the change to the LM entry procedure that we'd like you to observe at 55 hours, and the rationale for it. Over.
02 02 27 14	CDR	Okay, Stand by.
02 02 27 17	CC	Roger.
02 02 27 23	CDR	Go ahead, Joe.
02 02 27 25	CC	Okay. Before you start copying, this procedure is - is basically simply to activate the supercritical helium pressure gaging so that you can read it. And the concern here is lest this supercritical helium pressure reach 1800 psi by 103 hours, at which point we'd be within a possibility of rupturing the burst disk when you activate the DPS. Now, based on the pressure at launch, and based on a nominal rise time of about 6-1/2 psi per hour between then and now, the pressure should read about 710 psi. Stand by, 13, until we get better COMM.
02 02 28 43	CDR	Houston, you were cut out. Would you say again about the helium pressure.
02 02 28 49	CC	Roger. Based on the prelaunch pressure in the SHe tank and the nominal rise time of about 6-1/2 psi per hour, the pressure should be about 710 at 55 hours. Are you reading? Over.
02 02 29 16	CC	Jim, Houston. Did you read that last?
02 02 30 43	LMP	Okay, Joe. I'm on OMNI C now. How do you read?
02 02 30 47	CC	13, Houston. You're loud and clear now. INCO tells me he's having a little problem at Goldstone and wants me to stand by for a minute.
02 02 31 02	LMP	Okay. How do you read now, Joe? I'm going from OMNI C to D now.

02 02 31 06	CC	You're still loud and clear on - on D, Fred. Stand by 1.
02 02 31 14	LMP	Okay. I'll put her back to OMNI B if you all want to take command again?
02 02 31 49	LMP	And the last thing we heard, Joe, was that the SUPERCRIT should be reading about 710 psi.
02 02 31 56	CC	Okay. That's the last thing I passed up. And while we're waiting for INCO to decide here, let me continue. The deadband that is considered acceptable is between 660 and 770 psi. In other words, any rise time that'll give you one - a pressure between those two, will keep you below the critical pressure at 103 hours or so. So, we expect it to read in that - in that band and if it does, there will be no problem. If it reads between 770 and 800 psi, we will want you to check the pressure again at about 59 hours, and I'll get the detailed procedures in a minute. If the pressure is equal to or greater than 800 psi, we're going to have to go into some more detailed procedures; we're going to try to - to get PCM data on it, for one thing. We may have to have you sit there and stare at the gage for a while to find out when it clicks up and get an accurate rise time on it, and then in extreme case, we are even thinking about a DPS burn, but we don't really think that will happen. Now, if you are ready to copy, what I have for you is a change or an addition to the LM Activation checklist between pages TLC-1 and TLC-2, which consists of seven steps, and if you can find a blank side to write it down on, I would like to pass it up. Over.
02 02 33 44	LMP	Okay. How do you read on OMNI C, now?
02 02 33 48	CC	Okay. You're loud and clear on OMNI C. Stand by 1 while we get INCO synced up.
02 02 34 00	LMP	Okay. The rest of your update was that it's okay if it is anywhere between 660 and 770 psi. If it's above 770, you are going to ask us to consider going back in at 59 hours and either get PCM going or sit there and give you gage reading changes on the basis of that. And you said something about an extreme measure. We may have to consider some sort of DPS maneuver.

02 02 34 45	CC	That's correct, Fred. We don't have procedures for that yet, and we don't have any real expectation of getting into it. The procedure I'd like to read up to you now is simply the steps required to get the supercritical helium pressure reading at 55 hours. Over.
02 02 35 10	LMP	Okay.
02 02 35 12	CC	Okay. We're calling this TLC-1A, step 6, "Transfer to LM power."
02 02 35 23	LMP	All right. Stand by 1, Joe.
02 02 35 25	CC	Okay.
02 02 35 37	CMP	Okay, Joe. He's ready to copy.
02 02 35 40	CC	Okay. Step 6, "Transfer to LM power (floodlights blank), CAUTION WARNING POWER CAUTION light ON. Report GET to MCC. Panel 11, CIRCUIT BREAKER EPS TRANSLUNAR BUS TIE, CLOSED. Circuit breaker panel 16, EPS TRANSLUNAR BUS TIE, CLOSED. Circuit breaker panel 11, LIGHTING UTILITY, CLOSED. And activate utility lights." Over. And, 13, Houston. Select OMNI Bravo, please.
02 02 37 08	LMP	Okay, Joe. I've created a new page here called TLC-1A, item 6, Transfer to LM power and the usual check that the floodlight's blank and that I've got the CAUTION WARNING POWER light ON; I get a GET from Jack, and I will pass that on down to you. Item 7, CIRCUIT BREAKER EPS TRANSLUNAR BUS TIE, panels 11 and 16, CLOSED. Step 8, circuit breaker lighting and utility on panel 1, CLOSED, and turn on the utility lights. However, the lighting is such that I don't really need those. They are in stowage, right now, I guess, in the ISA, and I'll probably just leave them there.
02 02 37 48	CC	Okay. That's optional. The way we had page TLC-1A written, that was all part of step 6. You haven't even gotten to step 7 yet. Step 7 is as follows.
02 02 38 11	CC	Fred, Houston. Are you with me?
02 02 38 41	CC	Apollo 13, Houston. Are you reading me now?
02 02 40 20	LMP	Okay. Houston, 13. How do you read?

02 02 40 22	CC	13, Houston. Loud and clear. What OMNI you on now?
02 02 40 28	LMP	I'm going to stay OMNI B, if you all want to take command back and you can let INCO jockey them around between B and D. And how many steps we got, so I know whether to write big or small here, Joe?
02 02 40 41	CC	Okay. We got steps 6 through 12, but step 7 is the same size as 6, and 8 through 12 are short. They're only one line each.
02 02 40 53	LMP	Okay.
02 02 40 54	CC	Okay. Step 7 follows: "Circuit breaker panel 11, AC BUS B, HELIUM PQGS PROPELLANT DISPLAY, CLOSED. Circuit breaker 11, AC BUS B, NUMERIC LIGHTING, CLOSED. Circuit breaker 11, AC BUS B, BUS TIE INVERTER 1, CLOSED. Circuit breaker panel 11, EPS INVERTER 1, CLOSED. Circuit breaker panel 16, INSTRUMENTATION SIG SENSOR, CLOSED. INVERTER 1" - -
02 02 41 44	LMP	Hold on a minute, Joe.
02 02 41 45	CC	Okay.
02 02 41 49	LMP	My shorthand is rather poor today.
02 02 42 13	LMP	Okay I'm now up to circuit breaker panel 11, INVERTER 1, CLOSED.
02 02 42 20	CC	Okay. Next was "Circuit breaker panel 16, INSTRUMENTATION SIG SENSOR, CLOSED. Then INVERTER 1, SELECT. Then HELIUM MONITOR to SUPERCRIT PRESS. Report SUPERCRIT PRESS to MCC." Over.
02 02 44 31	LMP	Houston, 13. How do you read?
02 02 44 34	CC	13, Houston. You're coming through. We still have some background noise. Do you want to read back step 7?
02 02 44 53	LMP	Hello, Houston; 13.
02 02 44 55	CC	13, Houston. Go ahead.
02 02 45 00	LMP	Okay, Joe. The last thing I got was HELIUM MONITOR to SUPERCRIT PRESSURE.

02 02 45 07	CC	Okay. The last part of step 7 is, "Report SUPERCRIT PRESSURE to MCC," and read back step 7.
02 02 45 30	LMP	Okay. Step 7. Circuit breaker panel 11, AC BUS B, HELIUM PQGS DISPLAY, CLOSED. Main - Circuit breaker panel 11, AC BUS B, NUMERIC LIGHTING, CLOSED. CD panel 11, AC BUS - Is that AC BUS B? BUS TIE INVERTER 1, CLOSED?
02 02 45 51	CC	That's affirmative.
02 02 45 53	LMP	And CB - CB EPS INVERTER 1, panel 11, CLOSED. CB panel 16, INSTRUMENT SIGNAL SENSOR, CLOSED. INVERTER 1, SELECT. HELIUM MONITOR to SUPERCRIT PRESSURE. Report pressure to MSFN.
02 02 46 09	CC	Okay. That's correct. Now step 8 is, "On MCC request, perform step 9." In other words, you wait for us to decide what to do and that's according to the gouge we've already given you. And step 9, I'll give you now, is "HELIUM MONITOR to OFF, INVERTER to OFF." Over.
02 02 46 45	LMP	Okay. Step 8 says, "Set in an MCC hold." Step 9 says, "On MCC's words, HELIUM MONITOR OFF, INVERTER OFF."
02 02 47 00	CC	Roger. That's correct. Step 10 is, "Configure circuit breaker panels per Activation 3 and 4."
02 02 47 24	LMP	Okay. Configure - step 10, "Configure circuit breakers per Activation pages 3 and 4."
02 02 47 31	CC	Roger. That's correct. Step 11 is, "Deactivate the utility lights if you activated them," and step 12 which is the last one is, "Transfer to CSM power, usual observations, and report time to MCC."
02 02 48 20	LMP	Okay. Step 11, "Deactivate utility lights." 12, "Transfer to CSM power and note the usual observations and report the GET."
02 02 48 31	CC	Okay. That's it. And, of course, Houston will be requesting you to go to step 9 if the pressure is less than 770. If the pressure is between 770 and 800, we will be asking you to do the following, if you're ready to copy.
02 02 48 59	LMP	Stand by. I've got to find some more blank paper.

02 02 49 01	CC	Yes. This is going to be page TLC-3, but it's very short.
02 02 49 25	LMP	Okay. Go ahead with TLC-3.
02 02 49 31	CC	Okay. Stand by 10 seconds, Fred.
02 02 50 20	CC	Fred, Houston.
02 02 50 25	LMP	All right. Go ahead.
02 02 50 26	CC	Roger. We'll hold off on that. It was a short three-step procedure which said, "Repeat activation pages 1, 1A, and 2, "but there was another step in it that nobody understands. So, essentially what we'd recommend in that case would be that you would repeat the procedure that we just passed up for reading the SUPERCRIT pressure. If we need to, we'll clarify it later on. And that's all we've got.
02 02 50 56	LMP	Okay.
02 02 57 38	CDR	Houston, 13.
02 02 57 44	CC	13, Houston. Go ahead.
02 02 57 49	CDR	Okay. One thing, Joe; I just want to doublecheck again. All the stuff that normally was going to start at 57 hours, which the first item was pressurize CSM to 5.7 psia, we're going to move that up to 64 now, so we have our LM entry which was nominally at 58 at 55. Is that correct?
02 02 58 10	CC	That's correct, Jim.
02 02 58 12	CDR	Okay.
02 03 07 02	CC	Apollo 13, Houston.
02 03 07 07	CDR	Go ahead, Houston.
02 03 07 08	CC	Roger, 13. Because of the O_2 tank 2 quantity sensor drop out, EECOM wants to keep a little closer track of the cryo quantities, and he's going to be asking you to stir all the cryo tanks at slightly more frequent intervals than had been planned, and the first time is now, and we will be calling you probably every 5 or 6 hours, except during sleep period and high activity periods. We'd like you to do it now. Over.

02 03 07 44	CDR	Okay. We'll start it ... now.
02 03 07 46	CC	Thank you.
02 03 07 59	CC	And, 13, Houston. For your information, a normal 1-minute or so stir will be fine.

END OF TAPE

02 04 07 42	CC	Apollo 13, Houston.
02 04 07 48	CDR	Go ahead, Houston.
02 04 07 50	CC	Jim, just an advisory; expect a CAUTION AND WARNING on H_2 tank 1 pretty quick. No problems; just warning you about it.
02 04 08 04	CDR	Okay. A zero pressure light on H_2 tank 1 coming on shortly, huh?
02 04 08 08	CC	Right.
02 04 08 11	CDR	Okay. Well, you're pretty close. It just came on.
02 04 08 20	CC	Any other predictions you'd like?
02 04 08 26	CDR	Well, there's - I guess there's all sorts. Could you go to the horse races with me?
02 04 08 32	CC	I'm sorry; you were garbled. Say again?
02 04 08 37	CDR	I said I'd like to invite you to the horse races with me.
02 04 08 41	CC	Right. We'll - We'll send EECOMM.
02 04 16 55	LMP	Well, it's time for a little grits again here, Vance.
02 04 17 01	CC	Understand. Some grits, huh? Chow. Bon apetit.
02 04 45 20	CC	Apollo 13, Houston.
02 04 45 25	CDR	Go ahead, Houston.
02 04 45 27	CC	Roger. Just expect that same CAUTION AND WARNING to come on again. And you want us to keep warning you of that thing?
02 04 45 43	CDR	Go ahead, Houston.
02 04 45 47	CC	Roger, Jim. Just expect a CAUTION AND WARNING to come on the same as it did about an hour ago.
02 04 46 04	CDR	Go ahead, Houston. We've lost ...
02 04 46 08	CC	Roger. How are you reading me now, Jim?

02 04 46 33	CDR	Houston, Apollo 13.
02 04 46 36	CC	13, Houston. How do you read now?
02 04 46 41	CDR	Okay. Read you good now. Seems like we've had a little trouble with the COMM today.
02 04 46 46	CC	Yes. I guess it's partly because you are further out. We just wanted to tell you that you were going to get that CAUTION WARNING that you just got.
02 04 46 58	CDR	Right. We just got.
02 04 47 00	CC	And I won't bother you with those calls anymore, unless you especially want them.
02 04 47 10	CDR	That's okay, Vance. You don't have to call us about that, unless it's something serious.
02 04 47 14	CC	Okay.
02 04 47 32	LMP	We just ate a can of ham salad and that was an experience.
02 04 47 40	CC	Roger. Copy.
02 04 47 49	LMP	It's really kind of like eating on the sly. Chasing it around.
02 04 48 02	CC	Right. Copy.
02 04 48 18	LMP	But good.

END OF TAPE

02 05 19 28	SC	...
02 05 19 31	CDR	Houston, Apollo 13.
02 05 19 40	CC	13, Houston. Go ahead.
02 05 19 45	CDR	Right, we're not doing anything right now, Vance, we're just getting curious, we could start the LM entry procedures, and get everything squared away, and then when the TV comes up at 55 hours, we can just use it for the TV, and we wouldn't be worrying about checking out the SHe tank pressures and everything like that.
02 05 20 07	CC	Okay, let us mull that one a minute here, and I'll get right back with you.
02 05 20 14	CDR	Okay.
02 05 23 35	CDR	Also, Houston, Apollo 13. We'd like to move up the waste water dump and maybe the O_2 fuel cell purge a little bit early, if we could.
02 05 23 51	CC	Okay, stand by.
02 05 26 30	CC	Apollo 13, Houston.
02 05 26 35	CDR	Go ahead, Houston.
02 05 26 37	CC	Jim, you're clear to go on into the LM, and just advise though that the TV time is still fixed at 55 hours, and - so we'll be standing by to support your entry and we'll get back with you on a minute - in a minute on the O_2 fuel cell purge and the waste water dump.
02 05 26 59	CDR	Okay. Sounds good.
02 05 27 02	CC	And also request your LM/CM DELTA-P which was on the flight plan for 53 hours. What did you vent it down to? Over.
02 05 27 16	CDR	We have 1.7 now. We vented it down to that figure.
02 05 27 20	CC	Okay, you vented down to 1.7, and what did it start at?
02 05 27 28	CDR	It was about 1.1, Vance.

02 05 27 31	CC	Roger, copy.
02 05 34 32	LMP	Houston, 13.
02 05 34 35	CC	Go ahead, 13.
02 05 34 40	LMP	What do you read for suit pressure down there?
02 05 34 53	CC	We're reading 4.3, Fred.
02 05 34 59	LMP	Okay.
02 05 38 58	CDR	Houston, 13.
02 05 39 03	CC	Go ahead, Apollo 13.
02 05 39 07	CDR	We'd like another confirmation, when we closed the tunnel vent valve back to LM/CM DELTA-P, we were reading about 1.7 - 1.75, and it slowly went up now to about - oh, I'd say a little less than 2.2. Seems to be holding there - Is there a lag in the gaging system?
02 05 39 33	CC	Okay. We'll - we'll ask that question. Stand by.
02 05 40 58	CC	Apollo 13, Houston.
02 05 42 07	CC	Apollo 13, Houston.
02 05 42 24	CC	Apollo 13, Houston.
02 05 42 30	CDR	Go ahead, Houston.
02 05 42 32	CC	Okay, to answer your question, Jim, that increase in pressure is normal, because it was just tracking an increase in cabin pressure.
02 05 42 46	CDR	Okay. Okay.
02 05 42 57	CDR	We're not thinking today.
02 05 43 20	CC	And, 13, from Houston, it's okay with us if you want to move the O_2 fuel cell purge and the water dump up to this time. Over.
02 05 43 33	CDR	Okay. We'll work it in shortly. Thank you.
02 05 43 36	CC	Right.
02 05 45 11	CC	Apollo 13, Houston.

02 05 45 16	CDR	Go ahead.
02 05 45 17	CC	Jim, recommend you stay in the PTC until we stop it for the TV at 55 hours, in case you were thinking of - -
02 05 45 24	CDR	Go ahead, Houston.
02 05 45 26	CC	Roger. Recommend you continue PTC until 55 hours. Over.
02 05 46 05	CDR	You were calling, Houston?
02 05 46 12	CC	That's affirmed, Jim. How do you read now?
02 05 46 17	CDR	Okay. We read you loud and clear.
02 05 46 19	CC	Okay. The only comment that we just made was that, in case you were thinking of stopping PTC, there's no need to stop it until 55 GET when TV starts.
02 05 46 34	CDR	Right. We'll stop it when we're setting up our TV.
02 05 46 37	CC	Roger.
02 05 54 34	CMP	Okay, Houston, the waste water dump and O_2 fuel cell purge are complete.
02 05 54 41	CC	Houston. Roger.
02 06 05 54	LMP	Okay, Houston, the LM/CM DELTA-P is constant. We're going to go ahead with hatch removal.
02 06 06 04	CC	Houston. Roger.
02 06 06 16	LMP	Is that you, Jack?
02 06 06 20	CC	No, this is Jack's replacement.
02 06 24 15	CMP	Okay, Houston; 13.
02 06 24 18	CC	Houston, go ahead.
02 06 24 25	CC	Go ahead, 13.
02 06 24 46	CMP	Houston, Apollo 13.
02 06 24 49	CC	This is Houston. Go ahead, 13.

02 06 25 18	CMP	Okay, Houston; Apollo 13.
02 06 25 22	CC	Roger. Go ahead, 13.
02 06 25 28	CMP	Okay. The LMP has entered the LM.
02 06 25 31	CC	Roger.
02 06 25 37	CMP	Is that Big John?
02 06 25 39	CC	It sure is. How're you doing?
02 06 25 43	CMP	Fine.
02 06 25 44	CC	Yes, you're doing great, man.
02 06 25 49	CMP	Thank you. I had a good CDR.
02 06 25 54	CC	You're doing it on your own now.
02 06 26 01	LMP	Yes, it feels like I'm back at home, again, John, down in here.
02 06 26 04	CMP	I hope you did a good job, John.
02 06 26 06	CC	Roger.
02 06 26 40	CMP	Okay, Houston, we want to take the FM and bring up TV here for our own use. Then we'll go to TRANSMIT 1 - at 55 hours.
02 06 26 58	CC	Roger, 13.

END OF TAPE

02 06 46 28	CMP	Okay, Houston, we've transferred to LM power; the time was 54 hours 46 minutes 15 seconds.
02 06 46 40	CC	Roger, Jack. Transfer to LM power. Thank you.
02 06 46 47	LMP	And the docking-tunnel index, Jack, was minus 2 degrees.
02 06 46 54	CC	Say again, Fred, you're coming in with a lot of background noise.
02 06 47 00	LMP	Okay. The docking-tunnel index mark was minus 2 degrees.
02 06 47 05	CC	Roger. Minus 2 degrees.
02 06 49 17	LMP	Okay. Jack, how do you read?
02 06 49 29	CC	Fred, Houston is reading you loud and clear.
02 06 49 34	LMP	Okay. I've got up through step 7 now, and I'm not getting much of a light in the helium indicator here. Why don't I review for you how we've proceeded, and you look at the procedure you gave me, and see if we've missed anything.
02 06 49 53	CC	Roger. Go ahead.
02 06 49 57	LMP	Okay. We transferred to LM power and that looked okay. I'm staring at a CAUTION AND WARNING POWER light, and all the red flags; and we got both X LUNAR BUS TIE breakers IN. The UTILITY LIGHTING breaker is IN; then AC BUS B HELIUM PQS DISPLAY; the AC BUS B NUMERIC LIGHTING, and AC BUS B INVERTER 1 is - BUS TIE is CLOSED. Then I closed the INVERTER 1 breaker, and I've selected, on panel 16, and the SIGNAL CONSENSOR [sic] breaker is in; I've selected INVERTER 1 and put the HELIUM MONITOR switch to SUPERCRIT and I have no lights.
02 06 51 06	CC	Okay, Fred, let us take a look at it.
02 06 51 07	LMP	I was wondering, do we need an A - do we need, possibly, in the - one of the ANUN/DOCK/ COMPONENT breakers in?
02 06 51 18	CC	Stand by 1.

02 06 51 33	LMP	Okay, Jack. Hold the phone. I forgot the rheostat was cranked all the way down on the ANUN/NUM and it's showing 720, which looks like a pretty good - pretty good number.
02 06 51 47	CC	Roger. We copy 720. Thank you, Fred - -
02 06 51 49	LMP	Flashed to 7 - Okay, and it just flickered down to 710. It's kind of flickering between 710 and 720.
02 06 52 00	CC	Roger. 710 to 720.
02 06 52 16	CC	Okay, Fred. Those are good numbers, and we're not going to have to crank up the TM. That's the number we were looking for.
02 06 52 26	LMP	Very good. Okay. Do you want me to back out of this in reverse at least as far as getting this part of it powered down?
02 06 52 36	CC	Stand by 1.
02 06 52 56	CC	Fred, this is Houston. Go ahead and back out of this little test and proceed.
02 06 53 04	LMP	Roger.
02 06 59 01	CMP	Okay. We're back on CSM power. The time was 54 hours 58 minutes 50 seconds.
02 06 59 10	CC	Roger, Jack. 54:58:50. Thank you.
02 06 59 26	CMP	Okay, Houston, we'll try to pick you up on the high gain.
02 06 59 32	CC	Roger.
02 07 00 08	CC	And, 13, we're ready on the TV when you are.
02 07 00 19	CDR	This is 13. Say again, Houston.
02 07 00 23	CC	13, we're ready on the TV when you are. Any time.
02 07 00 28	CDR	Okay, sounds good. With you in a minute, we're just cranking up high gain now.
02 07 01 20	CDR	Okay, Houston. How do you read us in the high gain?

02 07 01 23	CC	We're hearing you 5 square, Jim, how me?
02 07 01 28	CDR	Okay. You're coming through okay.
02 07 01 40	CC	As you were on that, Jim. We don't have you on high gain yet. We're still looking at you.
02 07 02 27	CC	13, Houston. In this attitude, we'd suggest pitch 5, yaw 237 on the high gain. Over.
02 07 02 39	CDR	Pitch 5, yaw 237. Roger.
02 07 05 12	CMP	Okay, Jack. Can you - can you read the high gain now?
02 07 05 24	CC	Affirmative, Jack. We've got you on a high gain and it appears to us that we're in wide beam - wide beam width.
02 07 05 32	CMP	Yes. We can't get it to come down to narrow. We tried to switch to AUTO track or REACQ, and it - yaw drives around from 270 to 0. And pitch goes from about 6 degrees around to 90. I'm trying - we're fitting it manual now at the angles that you gave us, and I'll try and get you in medium and narrow beam widths picking it up manually here.
02 07 06 06	CC	Roger, Jack. Meanwhile, we'll look at the situation you describe there.
02 07 06 13	CMP	Okay. And it does it on both sets of servo electronic power.
02 07 07 15	CMP	Jack, what it looks like is that, when we hit 239 degrees at this attitude, it hit some sort of scan limit or something and drops off.
02 07 07 33	CC	Roger, Jack; thank you.
02 07 07 37	CMP	Okay, I'm trying you in wide or medium beam width now.
02 07 07 54	CMP	Can you pick up the TV in this condition here at all?
02 07 08 07	CC	Negative, Jack. We'll have to have the narrow beam width.
02 07 08 14	CMP	Okay. Can you give us, maybe, a slight maneuver?

02 07 09 09	CC	Jack, we'd like you to check two high gain circuit breakers down in panel 25. Check your high gain group 2 and your high gain in the flight bus. Over.
02 07 09 19	CMP	Okay. Okay, Jack, they're both IN.
02 07 09 27	CC	Roger.
02 07 10 43	CC	13, we've got an attitude suggestion for you. We suggest that you go to roll 285 and try pitch 90 and yaw 0. Over.
02 07 10 57	CMP	Okay.
02 07 14 00	CDR	Okay, Houston; Apollo 13. I think we've got high gain locked up now. Do you confirm?
02 07 14 07	CC	We confirm that, Jim, we've got you locked up on the high gain and narrow beam.
02 07 14 13	CDR	Okay, sounds good. We'll get the TV started right away.
02 07 14 16	CC	Roger.
02 07 14 36	CC	13, Houston. We'd like to disable quads C and D; use Alfa and Bravo. Over.
02 07 14 44	CMP	Okay - -
02 07 14 45	CDR	- - Disable quads C and D. Roger.
02 07 14 56	CC	Okay, 13. We've got Fred-o on TV.
02 07 15 04	CDR	Roger, Houston. What we plan to do for you today is start out in the space shipper [sic] Odyssey, and take you on through from Odyssey in through the tunnel into Aquarius. And show you a little bit of the landing vehicle, and your TV operator is now resting on the center couch, looking at Fred Haise, whose head is now just about at the beginning of the tunnel, and his back is against the lower-equipment-bay optical area. And Fred will now transport himself into the tunnel, and into the spaceship Aquarius.

02 07 15 48	LMP	You know one thing I noted, Jack, when I first came across here, that starting upright in the command module and heading down in Aquarius, there's a little bit of an orientation change that, even though I'd been through it once in the water tank, it still pretty unusual. I find myself, now, standing with my head on the floor when I get down inside the LM.
02 07 16 25	CC	That's a great picture, Jim. You got the light just right.
02 07 16 40	LMP	And one of the nice things, Jack, particularly for a novice like myself, is the - the ease of moving around in here. It's, of course, as you know from working in the command module simulator, it's really quite a boon to have zero gravity as an aid. Because you get - pretty confining, really, at one g, to move around very much in there, and it's quite easy in this environment. The LM, as you can see, it looked pretty clean, I found a couple of loose washers about it and the - a little plastic cap off the sequence camera had come loose and I found it lodged over by the ED panel. Okay. Right under Jim, now, he's actually standing on a - what looks to be a can here. And, for the sake of all the people back there, housed inside this can is the - the LM ascent engine where, hopefully, you can see my hand resting on top of right now - the engine that we use to get off of the Moon. Immediately adjacent to the engine cover here, I have my hand on a white box now, which has been shown before. This happens to be Jim's PLSS, or the backpack which'll supply oxygen and water for cooling while on the lunar surface. This device we hope to make use of for - a planned 4 hours and possibly up to as much as 5 hours. Right - right behind the PLSS, a couple of little square packages I now have my hand on here, one here and one right below, are our OPSs, which are, in essence, the emergency oxygen supplies, which are good for some 40 to 45 minutes. These are - when we get ready to mount up and head outside, will be placed up on top of the PLSS.
02 07 19 24	LMP	The second backpack is mounted down on the LM floor, I hope, positioned right between the two of us. I have my hand on it at this time.

02 07 19 41	CC	Roger, Fred. We see it. The picture's coming through real good, and your description is good. We see Jim's got the camera oriented the way we like to look at it. So, keep talking.
02 07 20 05	LMP	Okay. I guess everybody has pretty much envisioned the space program as being all a lot of exotic electronics, and, certainly, a lot of it is. But I thought I'd bring out a couple of items here in conjunction with the PLSS. After the first EVA, you get a very accurate measurement of the amount of water that's left in the PLSSs. We're going to make use of this bag I'm showing now to collect the remaining water out of the PLSS and see just how much we really did have left, and hopefully, on future missions, to be able to extend safely the allowable time on these units even a little further. And, my other hand, I have the mechanism by which we determine just how much water we really have in this bag. And I guess this - an apt description for this device would be a fish scale. And you can see I'm weighing myself right now, and it says I weigh actually less than zero right now. Guess its calibration isn't too good.
02 07 21 22	CC	That'll be the day.
02 07 21 29	LMP	I think even you'd weigh zero here, Jack..
02 07 21 38	CC	Touché.
02 07 22 14	CDR	Houston, this is Jim. Since Fred's been in the lunar module, and since he's the lunar module pilot, this is the first time that he's felt that he's been right-side up.
02 07 22 34	CC	Roger, Jim.
02 07 22 37	CDR	I might tell you that we're looking at right now, that round bag that's just behind Fred holds our vacuum hose; and when we get back inside the LM we'll hook the vacuum off our suits, and it's resting or it's attached to the hatch which will - we will open to go on to the lunar surface, and, of course, to come back in. The hatch which we have come to now is a round hatch, which is our docking hatch between the - between Odyssey and Aquarius.

02 07 23 11	CC	Roger, and we see Fred looking in the vacuum cleaner there now.
02 07 23 22	LMP	Okay, what I have out now, Jack, is LEVVA, which has also been shown before. It's a head garment for wearing out on the surface, and I - I'm bringing Jim's out here to show a couple of MODs. One problem before is that the cast of characters down on the surface haven't been able to be distinguished apart very well. So, not only Jim's suit has some red stripes on it, but as you can see his LEVVA also has a - a red stripe. And now you can see one other MOD here too, Jack, which I hadn't really seen myself before. I guess on 12, Pete and Al had commented about the - commented about having trouble with sunlight in the eyes, so on our LEVVAs they put on a new center section which you can pull down and use sort of like a baseball cap.
02 07 24 56	CDR	Okay, Jack. Who fixed up our LEVVAs?
02 07 25 12	LMP	How's the detail on this one, Jack?
02 07 25 15	CC	Say again, Fred.
02 07 25 19	LMP	Can you see any detail in this picture now, or am I blocking out too much of the sunlight?
02 07 25 26	CC	That's affirmative. We've got a good picture of the LEVVA there, and it's coming through loud and clear.
02 07 25 35	LMP	Okay.
02 07 25 54	CDR	Okay, Jack, while Fred is putting away my helmet, you are looking over into Fred's station now. How's this picture, is it okay before - or do I have to adjust it?
02 07 26 06	CC	We have a hunch that the setting might be in PEAK but we recommend AVERAGE on the ALC if you haven't got it there already.
02 07 26 16	CDR	We're in AVERAGE, Jack.
02 07 26 18	CC	Okay. And we're getting a good picture of the LMP side with the DEDA over there.

02 07 26 29	CMP	Hey, Jack, one question on the command module here. Do I - I have the DAP right now wide deadband. Do you want me to begin setting up nar deadband and nulling the rates to start PTC ag[illegible]
02 07 26 47	CC	Stand by, Jack.
02 07 27 31	LMP	What I'm fishing out now, Jack, is another new piece of hardware that we are taking along this time as a result of some comments made on the Apollo 12 flight.
02 07 27 52	CDR	What Fred is opening up - is a drink bag that we place inside of our neckring that will allow us to drink while we are on the lunar surface. They - Pete and Al - did not have that on Apollo 12 and they, consequently, got very thirsty. But we hope to alleviate that situation by having our own little bag of water which, with very little effort, we can have a sip or two while we are looking around and doing our geology work.
02 07 28 33	LMP	So if you hear any funny noises, it is just probably the drink bag.
02 07 28 50	CDR	Fred, the bag's empty.
02 07 29 16	CDR	Fred is now looking through our optical device. It's an instrument in which to aline our platform, and Fred is now looking into it just to see what kind of an outside picture he might be able to get. We might be able to use a TV camera to look through our optical instrument to the outside of the command module. A few minutes ago while we first came in, we did manage to look to the outside of the side hatch of the command module through our optical instrument. Stand by. We'll try to see what we can do here.
02 07 29 49	CC	Roger, Jim. Break, Jack, we'd like you to stay in the deadband you are now in, and we'll make a change when the TV is over. Another thing we would like you to do is check your pitch and yaw on your high gain meter so we can compare it with what we're seeing down here.
02 07 30 11	CMP	Okay, it's showing about - say 28 degrees and 267.

02 07 30 18	CC	20 and 267.
02 07 30 21	CMP	28 - 28 and 267.
02 07 30 45	LMP	Okay, Jack, have you got that picture now?
02 07 30 49	CC	Fred, about one-quarter of our screen is lighted, and it's impossible to determine what you are looking at right now. Maybe you could give us a little verbal description.
02 07 31 02	LMP	Okay. It's looking through the AOT in position 4, right rear. And we're looking back toward the - over the side hatch at the aft side of the service module.
02 07 31 28	LMP	Okay. Is - is it too dark a picture, Jack? You think the f-stop open may help?
02 07 31 34	CC	No, Fred, it's got to be centered up a little bit. That's primarily what you have to do.
02 07 31 43	CDR	Jack, we can't center it up any more, because the side hatch is only one part of the AOT. The rest of that blackness you see is really space.
02 07 32 11	LMP	Okay. We'll try another one, and it's a little better centered. In fact, the only other one we have that shows the whole picture. We're in the forward D-10 of the AOT now, position 2, and you should be seeing something familiar like a radar antenna.
02 07 32 41	CC	Okay, we see you moving the camera up to the AOT lens, and we got a real good picture now.
02 07 33 03	CDR	And -
02 07 33 23	LMP	Okay, Jack, I'm looking out the right window now, and not too far off in the distance now, you can see the objective, and I'll zoom in on it here a little and see if it brings it in better.
02 07 33 57	LMP	And it's actually beginning to look a little bigger now. You can see quite distinctly some of the features with the naked eye. And so far, I guess I have to even agree with Jim that it's still looking pretty gray with white spots.
02 07 34 39	CC	Okay, Fred. We're getting a good picture of your destination there.

02 07 35 04	CDR	Jack, you've been looking at the - at Fred's workshop now, and you can see the abort guidance computer. And over there on the - tucked away in his armrest, is our activation checklist, which we'll be using very shortly. Up on the top of the window, we have our camera already mounted ready for photographing the descent. And now Fred's engaged in his favorite pastime, I found out on this flight so far.
02 07 35 47	CC	He's not in the food locker, is he?
02 07 35 52	CDR	That's his second favorite pastime. He's rigging his hammock for sleep on the lunar surface now to find out - to see what it's going to be like.
02 07 36 03	CC	Roger. Sleeping and then eating.
02 07 36 29	LMP	It's kind of difficult here, Jack, getting into a hammock in zero g. I'm not sure if I keep floating away from it or it keeps moving away from me.
02 07 36 50	CDR	If you notice a few things floating around, we found just about one or two washers occasionally.
02 07 36 57	LMP	And for the benefit of those that may wonder where Jim sleeps. Be a little difficult to rig his hammock in here right now with the hatch open, but his runs laterally in this direction, fore aft. So he has the upper berth and I get the lower berth.
02 07 37 34	CDR	And now while Fred's taking his hammock down and restowing it, I might give you some idea of what sort of confusion of attitudes since there is no up or down, and I'm situated on top of the ascent engine just at the entrance to the tunnel. I'll reverse the camera 180 degrees and go from Fred, look through the tunnel again back at Odyssey, and we might pick up part of Jack.
02 07 38 25	CC	There he is. We see him.
02 07 38 56	CDR	Okay, Houston. For the benefit of the television viewers, we've just about completed our little inspection of Aquarius, and now we're proceeding through the hatchy-gap into the tunnel and going back toward the Odyssey.
02 07 39 22	CC	Okay, Jim. It's been a great show so far.

02 07 40 20	CDR	And finally, Jack's let me back into the Odyssey as we slide on through the tunnel here.
02 07 41 14	CDR	Houston, 13. Are you still on TV?
02 07 41 17	CC	Yes, we sure are. We've got a good picture of the skipper there.
02 07 41 22	CDR	Okay. What we can show you now, a little added benefit, we've got the drogue on Fred's couch in the command module right now. We stowed it temporarily while we're checking out the - out Aquarius and underneath his couch, we've got the probes stowed. Quite a big cumbersome device, and we'll get a shot of it for you.
02 07 42 13	CDR	You're looking now at our probe, the place on the nose of Odyssey. It's a very heavy thing but I suppose in zero gravity it weighs nothing, and it's much easier to move around. As a matter of fact, both Fred and Jack commented, as many people in the past have, of how much bigger the spacecraft appears in actual flight when you have such ease in moving compared to our simulator which make training rather difficult.
02 07 42 58	CC	Okay. We're seeing a good picture of the probe there, Jim, and looks like the characters shaved before the show this time.
02 07 43 10	CDR	Well, Fred said he had to keep up his TV image.
02 07 43 17	LMP	Yes. That may be my first and last time though, Jack.
02 07 43 21	CDR	It took Fred 1 hour to shave.
02 07 43 37	CDR	We might give you a quick - a quick shot of our entertainment on board the spacecraft, which has been keeping us company for some time.
02 07 43 57		(Music - Willow Weep For Me)
02 07 44 15	CDR	This little tape recorder has been a big benefit - has been a big benefit to us in passing some of our time away on our transit to the Moon, and it's rather odd to see it floating like this in Odyssey while it's playing the theme from "2001." And, of course, the tapes wouldn't be complete without "Aquarius."

02 07 45 08	CC	Okay, Jim. We're seeing the tape recorder now, and just - by the way, how long do you expect to keep the TV on this evening?
02 07 45 18	CDR	Well, when we - Stand by 1.
02 07 45 25	LMP	Yes, I got them with the cabin repress valve again there, Jack.
02 07 45 29	CDR	Every time he does that our hearts - our hearts jump in our mouth. And, Jack, any time you want to terminate TV, we're all set to go.
02 07 46 01	CC	Okay, Jim. It's been a real good TV show. We think we ought to conclude it from here now. What do you think?
02 07 46 11	CDR	Roger. Sounds good. And this is the crew of Apollo 13 wishing everybody there a nice evening, and we're just about ready to close out our inspection of Aquarius and get back for a pleasant evening in Odyssey. Good night.
02 07 46 30	CC	Thank you, 13.
02 07 48 40	CC	Apollo 13, Houston. The next thing we'd like you to do is to - -
02 07 48 45	CMP	Go ahead.
02 07 48 46	CC	- - we'd like you to roll right to 060 and null your rates for photography of the Comet Bennett. To do that, we would like you to enable quads C and D. For the maneuver, use all your quads. And in precisely 1 minute, we'd like you to terminate the battery charge on battery B. One other request, we'd like to have you verify - -
02 07 49 12	CMP	Okay. Will do.
02 07 49 14	CC	One other request, we'd like you to verify your high gain configuration. We'd like to know what track mode, what SERVO, and what beam width.
02 07 49 25	CMP	Okay, Jack, during the TV, we were AUTO TRACK, NARROW BEAM WIDTH, and the PRIMARY ELECTRONICS. And we had a good lockup. Just after we started the maneuver, I was able to lock you up and get real good signal strength, and it just seemed that right there at about 239 degrees in yaw, that the signal strength would just drop off and yaw would go to zero and pitch would go to 90.

02 07 50 05	CC	Roger. We copy, and the TV show was great.
02 07 50 12	CMP	Okay, real fine. Okay, I'm going to maneuver to 060, 090, and 0.
02 07 50 31	CC	And, 13, we'd like you to check C-4 thruster.
02 07 51 33	CMP	Okay, Jack. The battery charge has been terminated on the battery B.
02 07 51 38	CC	Roger. We see it, Jack. And we got a reading of minus 2 degrees on the docking index. We'd like to know it that's 2.0 precise or if it's 2.1 or 1.9.
02 07 51 54	CMP	No. It's a minus 2.0 precisely.
02 07 51 56	CC	Thank you.
02 07 52 58	CC	13, we've got one more item for you, when you get a chance. We'd like you to stir up your cryo tanks. In addition, I have shaft and trunnion - -
02 07 53 06	CMP	Okay.
02 07 53 07	CC	- - for looking at the Comet Bennett, if you need it.
02 07 53 12	CMP	Okay. Stand by.
02 07 55 19	LMP	Okay, Houston - -
02 07 55 20	CDR	I believe we've had a problem here.
02 07 55 28	CC	This is Houston. Say again, please.
02 07 55 35	CDR	Houston, we've had a problem. We've had a MAIN B BUS UNDERVOLT.
02 07 55 42	CC	Roger. MAIN B UNDERVOLT.
02 07 55 58	CC	Okay, stand by, 13. We're looking at it.
02 07 56 10	LMP	Okay. Right now, Houston, the voltage is - is looking good. And we had a pretty large bang associated with the CAUTION AND WARNING there. And as I recall, MAIN B was the one that had had an amp spike on it once before.
02 07 56 40	CC	Roger, Fred.

02 07 56 54	LMP	In the interim here, we're starting to go ahead and button up the tunnel again.
02 07 57 01	CC	Roger.
02 07 57 04	LMP	Yes. That jolt must have rocked the sensor on - see now - O_2 QUANTITY 2. It - was oscillating down around 20 to 60 percent. Now it's full-scale high again.
02 07 57 22	CC	Roger.
02 07 57 30	CDR	And, Houston, we had a RESTART on our computer and we had a PGNCS light and the RESTART RESET.
02 07 57 37	CC	Roger. RESTART and a PGNCS light. RESET on a PGNCS, RESET - -
02 07 57 44	CDR	Okay. And we're looking at our S - SERVICE MODULE RCS HELIUM 1. We have - B is barber poled and D is barber poled, HELIUM 2, D is barber pole, and SECONDARY PROPELLANTS, I have A and C barber pole. BMAG temperatures?
02 07 58 07	LMP	Okay, AC 2 is showing zip. I'm going to try to reconfigure on that, Jack.
02 07 58 13	CC	Roger.
02 07 58 25	LMP	Yes. We got a MAIN BUS A UNDERVOLT now, too, showing.
02 07 58 29	CC	MAIN A UNDERVOLT.
02 07 58 33	LMP	It's reading about 25-1/2, MAIN B is reading zip right now.
02 07 59 33	CDR	And, Houston, Odyssey.
02 07 59 38	CC	Stand by 1, Jim.
02 08 00 35	CC	13, Houston. We'd like you to attempt to reconnect fuel cell 1 to MAIN A and fuel cell 3 to MAIN B. Verify that quad Delta is open.
02 08 00 53	LMP	Okay, Houston. I'm showing - I tried to reset and fuel cell 1 and 3 are both showing gray flags, but they are both showing zip on the flows.
02 08 01 08	CC	We copy.
02 08 03 17	LMP	Okay, Houston. Are you still reading 13?

02 08 03 20	CC	That's affirmative. We're reading you. We're trying to come up with some good ideas here for you.
02 08 03 29	LMP	Okay. Let me give you some reading ... in the interim to help MAIN A voltage, Jack. I've got BUS TIE AC on.
02 08 03 37	CC	Say again, Fred.
02 08 03 42	LMP	In the interim, to help out MAIN A voltage, I've got MAIN BUS TIE BAT AC on. Or would you rather accept the 25 volts we are seeing on MAIN A?
02 08 03 52	CC	Okay. BUS TIE AC on.
02 08 04 09	CC	13, Houston. We need OMNI Charlie, please.
02 08 04 19	LMP	You got it.
02 08 05 32	CC	13, Houston. We'd like you to verify couple of readings for us. We would like the nitrogen pressure on fuel cell 1. We need the oxygen pressure on fuel cell 2.
02 08 05 46	LMP	Okay. Nitrogen on 1 and oxygen on 2. Is that correct?
02 08 05 50	CC	Negative. Oxygen on 3.
02 08 05 54	LMP	Okay.
02 08 06 24	LMP	Okay. The systems test 1-A says zip.
02 08 06 44	LMP	And 2 Baker, which is 3 oxygen, says 0.6.
02 08 06 50	CC	2 Baker says 0.6, and say again the other one.
02 08 06 57	LMP	Fuel cell 1 nitrogen reads zero.
02 08 07 01	CC	Roger. Zero.
02 08 08 47	CC	13, Houston. We'd like you to open circuit fuel cell 1; leave 2 and 3 as is.
02 08 08 55	LMP	Okay. I'll get to work on that.
02 08 08 57	CDR	And, Jack, our O_2 quantity number 2 tank is reading zero. Did you get that?
02 08 09 04	CC	O_2 QUANTITY number 2 is zero.

02 08 09 07	CDR	That's AC, okay. Yes, that's good AC and it looks to me, looking out the hatch, that we are venting something. We are venting something out into the - into space.
02 08 09 22	CC	Roger. We copy your venting.
02 08 09 29	CDR	It's a gas of some sort.
02 08 09 49	LMP	Okay. Fuel cell 1, you just wanted it off the line now, Jack, is that right?
02 08 09 52	CC	We just wanted you to open the circuit on fuel cell 1.
02 08 09 58	LMP	Okay. She's off the line.
02 08 12 47	CC	13, Houston. We see you getting close to gimbal lock there. We'd like you to bring up all quad Cs on MAIN A, quad C-1, C-2, C-3, C-4 on MAIN A, and also bring B-3 and B-4 up on MAIN A.
02 08 13 14	CC	13, Houston. Do you read?
02 08 13 20	LMP	Yes. We got it.
02 08 13 21	CDR	Affirm.
02 08 13 22	CC	Okay. Can you tell us anything about the venting, where it is coming from, what window you see it at.
02 08 13 30	LMP	It's coming out of window 1, right now, Jack, and could you give me the thrusters again?
02 08 13 35	CC	Okay, the thrusters - -
02 08 13 37	LMP	What buses?
02 08 13 38	CC	We'd like - on MAIN A, we'd like Charlie 1, 2, 3, and 4. Also Bravo 3 and 4 on MAIN A.
02 08 13 52	LMP	Okay. Got it.
02 08 14 42	CC	13, we need OMNI Bravo.
02 08 14 46	LMP	OMNI Bravo.

END OF TAPE

02 08 16 08	CC	Okay, 13; this is Houston. We'd like you to go to your G&C checklist, the pink pages, 1-5. Do powerdown until we get a Delta of 10 amps. Over.
02 08 16 21	LMP	All right. Roger.
02 08 17 03	CDR	Okay, Jack, say again that - ... for the powerdown; it's not in the pink pages, the 1-5.
02 08 17 10	CC	Okay. We'd like you to go down that powerdown procedure until you get a Delta of 10 amps. Over.
02 08 17 21	CDR	Roger. ...
02 08 17 50	CC	13, Houston. Did you copy our powerdown request?
02 08 17 57	CMP	Roger, Jack. We're - yes, we're doing it right now.
02 08 17 59	CDR	Where did you say that was located, Jack?
02 08 18 03	CC	That's in your systems checklist, page 1-5.
02 08 18 26	CC	And, 13, you might also check for those pages in your launch checklist. They're emergency pages; pink pages, 1-5, and we'd like you to power down until you get - -
02 08 18 37	CMP	Okay. That was in the launch checklist, Jack.
02 08 18 42	CC	Roger. Power down until you get an amperage of 10 amps less than what you got now. Over.
02 08 18 50	CDR	Okay.
02 08 22 06	LMP	Okay. Jack. Are you happy with the amps we have now?
02 08 22 10	CC	Stand by 1, Fred.
02 08 22 15	CMP	Okay, Jack, and on this page 1-5, we proceeded right down the list, all the way down; we're right now at BMAG number 2 is in WARM UP.
02 08 22 26	CC	Roger. We copy BMAG 2 in WARM UP. We'll follow you through.

02 08 22 31	CMP	Okay, and something is giving us a reach, Jack, both in pitch and roll, so I'm suspecting that maybe it's whatever it is that's venting back there. I've had to use DIRECT in order to stabilize this, and as soon as I do, we're starting to pick up rates again. Can you pick up any jets firing?
02 08 22 54	CC	Stand by. What direction are your rates in, Jack?
02 08 23 06	CMP	It's negative pitch and negative roll.
02 08 23 12	CC	Roger.
02 08 24 42	CC	13, Houston. We need to get some more instrumentation up. We'd like you to put INVERTER 1 on both AC BUSES. Over.
02 08 24 53	LMP	Okay. Okay, you got INVERTER 1 on both AC BUSES now. And Jack, one of the items that we turned off was the - all the fuel cell pumps. Okay, and you might let us know when fuel cell 2 needs its pump back; we ought to take care of that guy.
02 08 25 37	CC	Roger. Okay, Fred, we want FUEL CELL 2 PUMPS to AC1, please.
02 08 25 55	CDR	FUEL CELL 2 to AC1. Roger.
02 08 26 00	LMP	Okay, it's on AC1.
02 08 27 48	CC	OMNI Charlie, please, 13.
02 08 27 52	CDR	OMNI Charlie.
02 08 28 06	CC	Okay, 13. We've got lots and lots of people working on this; we'll give you some dope as soon as we have it, and you'll be the first one to know.
02 08 28 19	CMP	Oh, thank you.
02 08 28 29	LMP	Okay, Jack, and the weird configuration we're sitting in now is we have the hatch installed, we still have the probe and drogue inside the command module, and we're going to stay in this situation until you - kind of give us an okay to reinstall the probe and drogue.

02 08 28 47	CC	Roger. We'll give you an answer.
02 08 28 48	LMP	Or, if necessary, to use the LM consumables.
02 08 28 52	CC	Roger.
02 08 32 11	CC	13, we'd like to have you put thruster Alfa 3 on MAIN A, please.
02 08 32 19	CDR	Alfa 3 on MAIN A.
02 08 32 24	LMP	Okay, Jack, are you monitoring the quad temps in quad A - package temps?
02 08 32 31	CC	Affirmative.
02 08 33 37	CC	13, this is Houston. We'd like to power down just a little bit more, so let's get BMAG 2 OFF; and make sure your lights are down. Over.
02 08 33 49	CDR	Okay. The lights are down, and BMAG 2's going from STANDBY to OFF.
02 08 34 27	CC	13, Houston - -
02 08 34 28	CMP	Okay, Jack, now I've got a rate -
02 08 34 29	CC	- - we'd like you to open circuit fuel cell 3.
02 08 34 36	CMP	Open circuit fuel cell 3.
02 08 34 37	CC	Go ahead, Jack.
02 08 34 46	CMP	Okay, fuel cell 3 is off the line now.
02 08 35 16	CC	And 13, Houston. We'd like you to turn all your Bravo thrusters OFF; and put all your Delta thrusters on MAIN A, please.
02 08 35 26	CDR	All Delta thrusters on MAIN A and all Bravo thrusters OFF. Roger.
02 08 35 55	CC	13, Houston. Turn BATTERY A OFF - -
02 08 35 56	CDR	Okay, Jack, ...
02 08 35 57	SC	...
02 08 36 01	CMP	That's right; we were pulling current all the time.

02 08 36 02	CDR	BATTERY A OFF. Roger.
02 08 36 05	CMP	Now you're ... up.
02 08 36 07	CDR	I'm transmitting. I don't have any current now.
02 08 36 15	CMP	Hey, it's off - it's off. They - they killed the bus completely now.
02 08 37 07	CC	13, Houston. We'd like you to isolate your O_2 surge tank. Over.
02 08 37 19	CMP	Surge tank off now, Jack? Okay, Jack, are you copying - O_2 tank 1 cryo pressure?
02 08 37 30	CC	That's affirmative. And we're trying to get power to that tank. Stand by; we're working on it.
02 08 37 38	CMP	Okay.
02 08 39 05	CMP	Okay. We had a - SERVICE MODULE RCS B light, Jack, due to package temperature.
02 08 39 13	CC	SERVICE MODULE RCS B. We copy. No problem.
02 08 39 21	CMP	Let's read you the lights we got on now; CRYO PRESS, FUEL CELL 1, FUEL CELL 3, MAIN BUS B UNDERVOLT, SUIT COMPRESSOR.
02 08 39 33	CC	Roger, we copy them and we'd like to build up the pressure in O_2 tank 1, so turn the heaters on manually; we'll watch the pressure for you.
02 08 39 44	CMP	Okay, do you want to see - -
02 08 39 45	CC	Go ahead.
02 08 39 46	CMP	- - We're going to get a MAIN BUS A UNDERVOLT, probably.
02 08 39 49	CC	Roger. We realize that; we feel we can stand 5 more amps on it.
02 08 39 56	CMP	Okay.
02 08 40 00	CDR	Okay, heater on tank 1's ON.
02 08 41 52	CC	13, Houston. We'd like you to additionally bring on the fans in O_2 tank 1, and we can stand the additional amperage on that.

02 08 42 03 CDR Okay - bring up the fans on O_2 tank 1.

END OF TAPE

02 08 44 32	CC	13, Houston. We'd like you to check some circuit breakers on panel 226. CRYO O_2 HEATER number 1 MAIN A, and check the three CRYO FAN MOTORS, TANK 1, three phases.
02 08 44 56	LMP	Okay, Jack. 226 is configured just like it should be. I got three REACS breakers and three RAD breakers open. All the rest are closed.
02 08 45 11	CC	Okay, Fred. Thank you.
02 08 45 55	CMP	Jack, looking outside, the number of particles has diminished greatly, almost ceased now, which indicates maybe what was venting has almost stopped.
02 08 46 09	CC	Roger, Jack. Thank you. We copy.
02 08 46 14	CMP	I'm still getting some rates in negative pitch, though.
02 08 46 17	CC	Roger.
02 08 46 28	CC	And, 13, we'd like to verify that both BMAGs are off, please.
02 08 46 35	CMP	Negative. We just have one BMAG. BMAG number 1 is still on.
02 08 46 43	CC	Okay, Jack. Let's take BMAG 1 off.
02 08 46 50	CMP	Okay. BMAG number 1 off now.
02 08 48 06	CC	13, this is Houston. We'd like you to give us a survey of your displays on MDCs 1 and 2. Give us gage readings and talkbacks. Over.
02 08 48 22	CDR	Okay. We'll start with display number 1.
02 08 48 30	CMP	Okay, Jack. On MDC 1, there's nothing abnormal. All the rate indicators are zero. Ball number 2 is frozen, of course; we lost MAIN B. I've got - Ball number 1 appears to be working normally. Right now I'm sitting at roll 0, pitch 180, and yaw about 13 degrees. I'm going to try and hold 0, 180, and 0.

02 08 49 08	CDR	Okay, Houston. The center panel - I'm looking at the RCS indicator A. We have a package temperature of about 180. Our helium pressure is 3900. I'm looking at fuel pressure of about 180 and percentage of about, I'd say 85 percent. B is about the same, except that that package pressure is 190. On quad C, we're looking about the same, except that the package temperature is 100. On quad D, we're looking at package temperature of 160. All other indications are about the same. CM pressure - RCS pressure is looking nominal. Helium pressure's up around 4000. And package temperature is about - a little less than 80 on ring 1 and about the same on ring 2.
02 08 50 02	CDR	And the - talkbacks on the SM RCS, I've got HELIUM 1 now are all gray. HELIUM 2 are all gray. PRIMARY PROPELLANT all gray. SECONDARY PROPELLANT, I've got two barber pole, and A is barber pole, B gray, C barber pole, and D gray. Okay. On the ECS RADIATORS, barber pole is gray. On the - On the ECS, PRIMARY INDICATOR.
02 08 50 57	LMP	Okay, Jack. Starting at the top. Okay. The CRYO TANKS; H_2 1 is reading 230 and the same for 2. Our O_2 CRYO TANK 1 is - looks like it's barely holding its own at 300. And, CRYO TANK 2 is reading zip. Our quantities: H_2 1 is reading 73; 2, 74. On the O_2 side, we're reading O_2 1 at quantity, 76; O_2 2 pegged to full scale high. RAD TEMPs PRIMARY INLET, we're reading about 55; RAD OUT is reading about 30, and the SECONDARY OUTLET is reading - reading 52 degrees. And the EVAP OUT TEMP is 45, STEAM PRESSURE 0.17, and GLYCOL DISCHARGE 48. SUIT COMPRESSOR is reading zip. The ACCUM is reading 30; H_2O WASTE is reading about 34; POTABLE's reading about 98; SECONDARY RAD INLET is reading about 71; and the RAD OUT is about 30; GLYCOL EVAP TEMP is reading 65, STEAM PRESSURE pegged full scale high; DISCHARGE PRESSURE 9 psi.
02 08 53 06	CC	Excuse me, Fred; I'd like to butt in here a minute. We'd like to have THRUSTER C-1 off.
02 08 53 17	CDR	C-1 is off.
02 08 53 18	CC	And proceed - -

02 08 53 19	LMP	Okay - -
02 08 53 20	CC	- - my last copy is SECONDARY RAD IN.
02 08 53 28	LMP	Okay. Your SECONDARY RAD IN, I gave to you 70 - about 72 degrees; the RAD OUT is about 30; the GLYCOL EVAP TEMP is reading about 65; STEAM PRESSURE full scale high, GLYCOL DISCHARGE PRESSURE about 9 psi. The ACCUM - SECONDARY ACCUMULATOR is about 30 - 34 percent. Our temperatures: SUITS showing about 52 degrees; CABIN about 58 degrees; pressures, SUIT reading 4.1, CABIN at 5. PARTIAL PRESSURE CO_2 is up to little over 1, about 1.1. On the SPS side of the house, the temperature is 72 degrees, helium's reading 3500; N_2 A is reading 2300; N_2 B about 2450. And our ullage pressures: FUEL is reading about 165; OXIDIZER 170. Fuel cells: FUEL CELL 1, both CLOSED, they're zip; SKIN TEMP 405 degrees; CONDENSE EXHAUST is lower scale. FUEL CELL 2 - right now we've got an O_2 or an H_2 FLOW reading of 0.13 to 0.14, and the O_2 FLOW is right now pegged full scale high although it has been varying depending on thruster activity which has also given us MAIN BUS A under volts from a steady reading of about 1.1 up to full scale high. The T_{SKIN} is about 445 and the CONDENSOR EXHAUST 17, correction, 180. Let's see if you want it on the DC indicator: FUEL CELL 1 is 0 amps; 2 is reading somewhere between 44 and about - oscillating 44 to 48 again depending on thruster activity.
02 08 56 03	CC	Stand by.
02 08 56 04	LMP	- - is 0 amps. Say again, Jack.
02 08 56 23	CDR	Houston, 13.
02 08 56 55	LMP	Hello, Houston; Apollo 13. How do you read?
02 08 57 07	CC	Okay, 13. This is Houston. It appears to us that we're losing O_2 flow through fuel cell 3. So, we want you to close the REAC valve on fuel cell 3. It looks like fuel cell 1 and 2 are trying to hold up okay. You copy?
02 08 57 26	LMP	Are you saying fuel cell 1 and 2 - 1 and 2 are trying to hold up but we're leaking O_2 out of

fuel cell 3? And you want me to shut the REAC valve on fuel cell 3? Did I hear you right?

02 08 57 40	CC	That's affirmative. Close the REAC valve on fuel cell 3.
02 08 57 48	LMP	Okay. I'll go to the SSR page. Do you want me to go through that whole smash for fuel cell shutdown? Is that correct?
02 08 57 57	CC	Stand by.
02 08 58 24	CC	Okay, 13. We want you to turn the inline heaters off on fuel cell 1. Then we want you to go through the fuel cell shutdown procedure on fuel cell 3. Read back.
02 08 58 40	CMP	Okay. Shut down the inline heater on fuel cell 1. We're proceeding with the shutdown, special subroutine, for fuel cell 3.
02 08 58 51	CC	That's affirmative.
02 08 59 12	CC	13. OMNI Bravo, please.
02 08 59 54	CC	13, Houston. Over.
02 08 59 58	CMP	Go ahead.
02 08 59 59	CC	Okay. You got OMNI Bravo and we'd like to have you verify that the tape recorder is off please.
02 09 00 08	CMP	That's verified. Okay, Jack. I'm sitting here with an 0618 showing and I can't get rid of it. Oh, stand by just a - -
02 09 00 48	CDR	Okay. Fuel cell 3 REACs off, Houston.
02 09 00 52	CC	Roger, Jim. Thank you.
02 09 01 54	CMP	Okay, Jack. Step 2, special subroutine 1 for the fuel cell procedure, has been completed.
02 09 02 01	CC	Roger. Thank you.

END OF TAPE

02 09 04 29	CMP	Okay. Jack. I'd like to bring on jet A-4. I've got null on negative pitch control, and - negative pitch control, and right now neither DIRECT or AUTO coils.
02 09 04 47	CC	Okay. You say no pitch in either DIRECT or AUTO? You want to bring on A-4?
02 09 04 53	CMP	Yes. I've got a positive pitch rate and I can't stop it.
02 09 04 58	CC	Okay.
02 09 05 08	CC	Okay, Jack. Bring A-4 on; stop the pitch rate.
02 09 05 14	CMP	Okay. That got it.
02 09 05 35	CC	And, 13, we need OMNI Charlie, please.
02 09 05 41	LMP	OMNI Charlie.
02 09 05 46	CC	And, Fred, we would like to have you verify fuel cell reactants talkback is barber pole.
02 09 05 54	LMP	That's affirm. I watched it and it went barber pole as I threw the switch.
02 09 06 01	CC	Roger.
02 09 08 01	CMP	Okay. Jack. Let me give you a thruster configuration right now. Able 1, Charlie 1, Able 2 are off. Charlie 2, MAIN A, all the thrusters that I call that are on are on MAIN A. Baker 1 off. Dog 1 on, Baker 2 off, Dog 2 on. Able 3, Charlie 3, Able 4, Charlie 4 on. Baker 3 off, Dog 3 on, Baker 4 off, Dog 4 on.
02 09 09 27	CC	Okay, Jack. That thruster configuration looks okay.
02 09 09 35	CMP	All right. Okay. Do you want some readings from the systems test meter regarding fuel cells?
02 09 09 45	CC	Stand by 1 on that, Jack. Let me ask the EECOM.
02 09 09 46	CMP	We've got some incompatibilities here.
02 09 10 03	CC	Okay, 13. We'd like to have you give us those systems test readings on fuel cell 1 and 3, please.

02 09 10 11	CDR	Okay. 1 and 3 coming up.
02 09 10 14	LMP	Okay. Jack, 1-A is reading, lower scale, 0; 1-B is reading 3.45. Okay. You only want fuel cells 1 and 3. Okay. Ignore that 1-B reading. 1-C is reading 3.4. Now, 1-D is reading 2.4. 2-D is reading 0.25.
02 09 11 09	CC	Roger. Is that 2 Bravo, Fred?
02 09 11 15	LMP	That's 2 Bravo is reading - oh, about 0.25 to 0.3.
02 09 11 39	LMP	Okay. 2-C is reading 4.1.
02 09 12 10	LMP	And 3-A is reading 4.0.
02 09 12 15	CC	Roger. 4.0. Say again what it is, please.
02 09 12 22	LMP	3 Able, 3-A.
02 09 12 48	LMP	3-B is reading 1.8.
02 09 12 58	LMP	And 3-D is reading 1.95.
02 09 14 08	LMP	And, Houston, 13. O_2 tank pressure number 1 is less than 300 now.
02 09 14 14	CC	Roger. We're seeing that. We confirm it.
02 09 15 04	CC	13, Houston. We're going to have to have you go through the shutdown procedure on fuel cell 1. Our O_2 pressure is going down as you note and the temperature confirms it. Did you copy?
02 09 15 24	CMP	Okay. Well, what bus configuration - What main bus do you want powered?
02 09 15 36	CC	Okay, Jack. We want you to leave the bus configuration as it is. Fuel cell 2 on MAIN A, and we need OMNI Bravo.
02 09 15 52	CMP	Okay, Jack. We're proceeding on the shutdown procedure for fuel cell 1.
02 09 16 35	CC	And, 13, Houston. We'd like you to isolate the REPRESS package, please.
02 09 16 42	CMP	Okay.
02 09 16 43	CDR	Isolate the REPRESS package. Roger.

02 09 16 45	LMP	I can confirm REPRESS package is off.
02 09 16 48	CC	Roger. So now you've got the REPRESS package and the surge tank isolated. Is that affirm?
02 09 16 55	LMP	That is Charlie.
02 09 16 59	CMP	Okay. Now, this is - We're ready to close the REACs on fuel cell 1; is that right?
02 09 17 35	CC	Jack, stand by on the fuel - -
02 09 17 36	CMP	On that last - confirmation. Okay.
02 09 17 41	CC	Roger. We're - We're giving you one last - -
02 09 17 42	CMP	We want to just get one last confirmation.
02 09 17 45	CC	Okay, Jack. We're getting that last confirmation. Stand by, please.
02 09 17 51	CMP	Okay.
02 09 18 01	CC	Okay, 13. We verify that we want you to close down - shut down fuel cell 1, close REACs valve.
02 09 18 10	CDR	Roger - -
02 09 18 11	CMP	Okay.
02 09 18 12	CDR	- - fuel cell 1; close the REACs valve.
02 09 18 19	CMP	Fuel - -
02 09 18 20	CDR	REACs valve on fuel cell 1 is closed.
02 09 18 45	CMP	Okay, Jack. I can confirm step 2. The fuel cell shutdown procedure is complete for fuel cell 1.
02 09 18 55	CC	Roger.
02 09 19 58	CC	13, we recommend that you enable BD roll in the DAP. Over.
02 09 20 05	CMP	Okay. Will do - -
02 09 20 06	CDR	BD roll in the DAP.
02 09 20 23	CC	13, Houston. We're working on the big dish now, so turn the HIGH GAIN POWER switch off, please.

02 09 20 32	LMP	Okay.
02 09 20 55	CMP	Okay, Jack. When we got the loud bang, we got also a restart. Did you copy that? Is - does GUIDO want anything, a VERB 74 or anything done with the CMC?
02 09 21 06	CC	Stand by.
02 09 21 54	CC	13, Houston. We're ready with a VERB 74 now, please.
02 09 22 05	CMP	Coming down at you.
02 09 23 54	CMP	Okay, Jack. It looks like O_2 tank 1 pressure is just a hair over 200.
02 09 24 02	CC	We confirm that here and the temperature also confirms it.
02 09 24 09	CMP	Okay. Does it look like it's still going down?
02 09 24 12	CC	It's slowly going to zero, and we're starting to think about the LM lifeboat.
02 09 24 20	CMP	Yes. That's what we're thinking about, too. You want me to do a quick P52? It kind of looks like - We've been talking it over, and it kind of looks like we'd probably aline our plats - LM platform with our platform and then power down the CM, and keep the LM powered up doing a DPS - whatever DPS burns you give us?
02 09 24 54	CC	13, we're not going to concern ourselves at the moment with a DPS burn. It's going to be some time before we'd get to that; but we're working on other procedures to give you, which will allow us to use the LM systems. Over.
02 09 25 12	CMP	Okay. Real fine.
02 09 26 40	CC	Apollo 13, Houston. We'd like to charge battery A now.
02 09 26 46	CDR	Charge battery A. Roger.
02 09 27 13	CC	And, Jack, in regard to your question about the P52 and LM platform, it's - There's no need to worry about that now. We wouldn't be using the LM platform for - until about 79 hours, so let's go as is on the platform for now. Over.

02 09 27 30	CDR	Okay. We understand.
02 09 27 37	CMP	Okay, Jack.
02 09 30 13	CMP	And, Jack, we've turned off the waste dump heater. If you're going to consider dumping any more waste water, we probably ought to do it while the duct is warm there.
02 09 30 30	CC	Roger. Stand by, Jack.
02 09 30 34	CMP	Okay.
02 09 30 38	CC	Okay, Jack. Let's keep the water; no need for a dump right now.
02 09 30 44	CMP	All right.
02 09 32 15	CC	13, Houston. We see the PROP ISOL valve on RCS quad Charlie closed, so we'd like to also disable AUTO RCS feature in quad Charlie.
02 09 32 30	CDR	You want to isolate the AUTO RCS features in quad Charlie?
02 09 32 33	CC	Affirmative.
02 09 32 44	CDR	Okay, Jack. I didn't plan to reset that quad Charlie DROP ISOL valve. Do you want me to do that? Okay. We just tried it and quad Alfa and Charlie barber poles are showing.
02 09 33 01	CC	Stand by, Jim.
02 09 33 03	CMP	Okay, Jack. That's the sec - secondary propellant barber poles on Alfa and Charlie.
02 09 34 47	CC	13, Houston. It won't do any good to try to power the propellant valves on A and C, so we want you to disable the AUTO on RCS Charlie. And we have a procedure for getting power from the LM we'd like you to copy down.
02 09 35 08	CMP	Okay.
02 09 35 09	CDR	Stand by, Jack.
02 09 35 11	CMP	That sounds like good news.
02 09 36 05	LMP	Okay, Jack. About how long is it?

02 09 36 12	CC	It's not a very long procedure, Fred. We figure we've got about 15 minutes' worth of power left in the command module, so we want you to start getting over in the LM and getting some power on that. And, you ready to copy your procedure?
02 09 36 27	LMP	Okay.
02 09 36 29	CC	Okay. In the CSM.
02 09 36 30	LMP	Stand by.
02 09 36 40	LMP	Go ahead.
02 09 36 41	CC	Okay. In the CSM on panel 5, circuit breakers LM POWER 1 and 2, OPEN. Then LM POWER switch, reset and release. In the LM, on panel 11 and panel 16, TRANSLUNAR BUS TIE. Both circuit breakers CLOSE. On panel 16, circuit breaker ASCENT ECA CONTROL, CLOSE. On 16, DESCENT ECA CONTROL, CLOSE. On panel 14, put your BAT 5 NORMAL feed ON. BATs 1, 2, 3, and 4 LOW VOLTAGE taps, ON. BAT 5 NORMAL feed, OFF. ASCENT ECA CONTROL, OPEN. You copy?
02 09 38 08	LMP	Stand by 1.
02 09 38 24	LMP	Okay. In the CSM, on panel 5, we want CB LM POWER 1 and 2, OPEN. Then the LM POWER switch to reset, release. In the LM, panels 11 and 16, X LUNAR BUS TIE breakers closed. On panel 16, the ASCENT ECA CONTROL closed; the DESCENT ECA CONTROL closed. On panel 14, BAT 5 NORMAL feed ON, followed by BATS 1, 2, 3, and 4 LOW VOLTAGE taps ON. Then BAT 5 NORMAL feed OFF. Then ASCENT ECA CONTROL breaker OPEN.
02 09 38 58	CC	That's a good readback, Fred.
02 09 39 14	CC	And, 13, Houston. As a final effort here, we would like you to turn on the fans in tank 2. Over.
02 09 39 23	CDR	Roger. Understand. Turn on the fans in tank 2.
02 09 39 34	CDR	You want the O_2 fans in tank 2, Jack?
02 09 39 38	CC	That's affirmative, Jim.
02 09 39 45	CDR	O_2 tanks - fans in tank 2 are on.

02 09 44 51	CC	Stand by, Jack. We'll get the word on that.
02 09 44 56	CMP	Okay.
02 09 45 06	CC	And, Jim, when you get to the end of that procedure, we'd also like to have you put the DEMAND REGs to CABIN.
02 09 45 15	CDR	DEMAND REGs to CABIN. Roger.
02 09 45 31	CDR	Jack, was that Activation 1, step 3 only, or all of Activation 1?
02 09 45 38	CC	That's go all the way down to step 3, Jim.
02 09 45 44	CDR	Activation 1 to step 3. Roger.
02 09 46 48	CDR	Houston, Apollo 13. Never mind.
02 09 46 54	CC	13, say again, please.
02 09 46 58	CDR	Oh, we were curious about Activation 11 on the VHF.
02 09 47 04	CC	Omit the VHF.
02 09 47 05	CDR	- - ... Jack. It's got - Okay.
02 09 48 17	CC	Jack, this is Houston. We want you to keep the IMU up and keep the lights on so you can see in there, and leave battery off - battery A off and, at the appropriate time, we'll put it on MAIN A. And we're going to keep the IMU up so's we can get a coarse aline in the LM.
02 09 48 38	CMP	All right. Real good. Right now, we're charging battery A. Do you want to discontinue that?
02 09 48 46	CC	Discontinue the charge on battery A, Jack.
02 09 49 22	CMP	Okay, Jack. I discontinued charge on battery A. You give me the call and I'll turn BUS TIE AC on.
02 09 49 32	CC	Roger. And we want you to keep the lights up and the IMU on.
02 09 49 38	CMP	Okay.
02 09 49 48	CC	And, Jack, we'd like you to leave the COMM configuration as is until we get COMM with the LM.

02 09 39 48	CC	Roger.
02 09 41 31	CC	13, Houston. We'd like you to start making your way over to the LM now.
02 09 41 38	CMP	Fred and Jim are in the LM.
02 09 41 42	CC	Okay, Jack. Thank you.
02 09 41 47	LMP	And, Jack, I got LM power on.
02 09 42 50	CMP	Okay. You still with us, Houston?
02 09 43 03	CMP	Okay, Houston. You read 13?
02 09 43 06	CC	Reading you loud and clear, Jack. I've got a procedure for - -
02 09 43 10	CMP	Okay.
02 09 43 11	CC	- - the guys in the LM.
02 09 43 15	LMP	You got another one?
02 09 43 17	CC	I have an activation procedure. I'd like you to copy it down.
02 09 43 25	CDR	How long is it, Jack?
02 09 43 27	CC	It's just four lines. Go to Activation 1, do step 3. Go to Activation 11, omit step 1. Do Activation 12, and then go to Activation 13 and do step 1. Do you copy?
02 09 43 54	CDR	Okay. Is that Activation 1? Do step 3. Is that correct?
02 09 43 59	CC	That's affirmative, Jim.
02 09 44 03	CDR	Activation 11, omit step 1, do the rest. Is that correct?
02 09 44 06	CC	That's affirmative.
02 09 44 12	CDR	Do Activation 1 and Activation 13, step 1.
02 09 44 14	CC	That's all correct.
02 09 44 25	CMP	Okay, Jack. Pressure in tank 1 is approaching 100 psi. What's going to be the symptoms of this fuel cell starting to drop off?

02 09 49 57	CMP	Okay.
02 09 50 08	CC	And, 13, this is Houston. I've got another procedure for the LM. A short one.
02 09 51 15	CDR	Okay. Ready to copy, Jack.
02 09 51 17	CC	Okay. On panel 11, we'd like you to close the LGC DSKY circuit breaker. Then we want you to go to Activation 25; do steps 1, 2, and 3. Then go to Activation 30, and that will give us a docked IMU coarse aline. Over.
02 09 51 41	CDR	Roger. Panel 11, close LGC circuit breaker. Activation 25, do steps 1, 2, 3, and then do complete Activation 30. Is that correct?
02 09 51 50	CC	That's affirmative. On panel 11, LGC DSKY circuit breaker closed.
02 09 53 15	CC	And in the LM, let's go to panel 11 and close the SUIT FAN circuit breaker and get suit fan 1 cranked up.
02 09 53 26	CDR	Okay. Panel 11, close SUIT FAN circuit breaker, and we'll get the suit fan cranked up.
02 09 53 30	CC	That's affirm.
02 09 53 47	CC	And, Jack, in the CSM, go to BYPASS on the radiators and turn your GLYCOL PUMP off.
02 09 53 56	CMP	Okay. Pull the BYPASS; GLYCOL PUMP going off.
02 09 54 04	CC	Roger.
02 09 55 42	CC	And, 13, in the CSM, we want to verify that all the fuel cell pumps are off, and we want to have you turn off the O_2 fans in the tank 2.
02 09 55 56	CMP	Okay. Tank 2 fans going off. Okay. That leaves me with tank 1 fans on the tank 1 heaters on.
02 09 56 08	CC	That's affirm.
02 09 56 10	CMP	Fuel cell 2 pump going off now.
02 09 56 21	CC	Jack, leave them both on in tank 1.
02 09 56 26	CMP	Okay.

02 09 57 55	CC	13, Houston. We've got AOS on the LM here.
02 09 58 01	CMP	Okay.
02 09 59 23	CC	And, 13, this is Houston. In the LM, we'd like to have 12, step 3, which is get the batteries on high taps. Over.
02 09 59 34	LMP	Okay.
02 09 59 41	CDR	How you going there? Activation 12, step 3.
02 10 00 18	LMP	Okay. And, Jack, how do you read from Aquarius?
02 10 00 23	CC	Aquarius, Houston. Say again, please.
02 10 00 28	LMP	Okay. I was just making a COMM check here. I'm on high voltage taps.
02 10 00 32	CC	Roger. We see them, Fred, and I'm reading you loud and clear.
02 10 00 39	LMP	Okay. Didn't think I'd be back this soon.
02 10 00 51	LMP	Okay. What next, James? Coarse aline?
02 10 00 57	CDR	Do it right. Take your time.
02 10 01 32	CC	And, Aquarius, Houston. We'd like you to, on your alinement, can you continue right on through the fine aline Activation 31? Go right on through step 7. Over.
02 10 01 45	LMP	Okay. You want to go on 31 through step number 7, Jack.
02 10 01 50	CC	That's affirmative. And, Odyssey, we've got another configuration for you. All 16 RCS AUTO SELECT OFF. All RCS heaters off. Over.
02 10 02 06	CMP	Okay. I can verify all heaters off. Jack, I've got to keep a fairly minimum deadband until I get through this coarse aline.
02 10 02 15	CC	Roger.
02 10 02 26	LMP	Okay. VERB 41, NOUN 20. Okay. You want plus? Plus or minus? Plus 302.43? Is that right?

02 10 03 12	LMP	Okay. Let me enter it. Okay. What's the next one? Plus 347.78. 347.78. Okay. 081.3. Is that right? ENTER. Okay.
02 10 03 53	CC	Odyssey, Houston - -
02 10 03 54	CDR	...
02 10 03 55	CC	- - your battery A on.
02 10 03 59	CMP	Battery A on now.
02 10 04 01	CC	Go ahead, Aquarius.
02 10 04 03	CDR	Houston. Okay. I want you to doublecheck my arithmetic to make sure we got a good coarse aline. The roll CAL angle was minus 2 degrees. The command module angles were 355.57, 167.78, 351.87.
02 10 04 36	CC	Okay, Jim. We copy the roll CAL at minus 2.0. The command module is 355.57, 167.78, 351.87.
02 10 05 19	LMP	Okay. VERB 41, we've done that. Okay.
02 10 05 27	CC	Aquarius, Houston. Request high bit rate, please.
02 10 05 36	LMP	You want high bit rate?
02 10 05 38	CC	That's affirmative, Fred. Won't cost us anything.
02 10 06 22	CC	Odyssey, Houston. We'd like you to, on your COMM configuration, go to PRIMARY POWER AMP OFF, LOW BIT RATE, and DOWNVOICE BACKUP. Over.
02 10 06 42	CC	And, Aquarius, we need your SUIT GAS DIVERTER to CABIN.
02 10 06 55	CMP	All right. You got it.
02 10 07 02	CMP	Houston. I've gone to PRIMARY POWER AMPLIFIER, OFF, LOW BIT RATE, DOWNVOICE BACKUP.
02 10 07 11	CC	Okay, Jack. Thank you. And, Aquarius, your arithmetic looks good on the coarse aline, there.
02 10 07 20	CMP	Okay. Okay stand by for an ENTER.
02 10 07 26	CMP	Three -

02 10 07 39	CMP	Get the GET; we need the GET. What is it? What's that? 58? 58:07?
02 10 08 15	CMP	58 what?
02 10 09 16	CDR	Houston, Aquarius.
02 10 09 18	CC	Go ahead, Aquarius.
02 10 09 23	CDR	Here are the gimbal angles. Command module, 356.69, 163.42, 346.67. Aquarius is 302.26, 345.92, 011.79. Over.
02 10 09 47	CC	Okay, Jim. I got command module 356.65, 163.42, 346.67. Aquarius, 302.26, 345.92, 011.78.
02 10 10 07	CDR	That's 011.79.
02 10 10 11	CC	Say again, please.
02 10 10 17	CDR	The LM middle gimbal is 011.79.
02 10 10 22	CC	011.79. Got it.
02 10 12 10	CMP	Houston. ... flashing.
02 10 12 19	CC	Odyssey, Houston. We need a command reset on your - on your COMM, and then we'd like you to power down to CMC, power down the IMU, heaters off on the IMU, but leave the battery A on.
02 10 12 43	CMP	Yes.
02 10 12 58	CC	Odyssey, Houston.
02 10 13 08	LMP	Ask him if he's ...
02 10 13 10	CDR	Yes.
02 10 13 11	LMP	Are you ...?
02 10 13 12	CDR	Yes.
02 10 13 13	CDR	Houston, this is Odyssey. Go ahead.
02 10 13 16	CC	Okay, Jim - -
02 10 13 18	CDR	Copy it down.

02 10 13 20	CC	Okay, Jim. I think I'm reading Jack, now. But what we want him to do is to give us a command reset. And then power down the CMC, power down the IMU, turn the IMU heater off, leave battery A on. Over.
02 10 14 19	CMP	That's just about 80 - in fact, 82 hours out of the two primary cartridges. That's two guys. 44 is what LC8 got. That would be 88 hours. We got a secondary. You're right. We're listening.
02 10 14 41	CC	Odyssey, Houston.
02 10 14 43	CMP	They can stand it - Go ahead?
02 10 14 47	CC	Yes, Jack. Did you copy down about the CMC IMU?
02 10 14 52	CMP	Yes, Jack. I read it back twice to you. Command reset, which I've done. I'm about to power down the IMU, power down the CMC, turn the IMU heaters off, leave BAT A on.
02 10 15 07	CC	That's affirm. Thank you.
02 10 15 11	CMP	Okay. I just got a MASTER ALARM and MAIN BUS A UNDERVOLT. And I'm starting to power down, now. - -
02 10 15 21	LMP	We've lost - The only advantage to doing it early; if we can power back - the LM back down. The only advantage doing it early is you can do a big burn now and a midcourse and then power the LM down. Otherwise, we got to keep the LM powered up clear until we get around the Moon. Plus it would be inside on the burn. I just hope the G&N hangs up on - hangs in on this one - I'd sure hate to do that one manual.
02 10 16 05	CDR	Oh boy.
02 10 16 06	CC	Odyssey, Houston. Couple circuit breakers for you. On panel 276, on our INSTRUMENTATION POWER CONTROL, open CB number 3 and number 4.
02 10 16 33	CMP	Okay, Houston. Panel 276, INSTRUMENTATION out and reset - -
02 10 16 39	CMP	- - a lot of light.
02 10 16 40	LMP	- - CB-3 and CB-4 are open.
02 10 16 45	CMP	What?

02 110 16 47	CC	That's affirmative, Odyssey. And also get your SCS electronics package and power off, and your FDAI POWER/GPI off, and your AUTO jet SELECT, all 16 off.
02 10 17 07	CMP	Okay. Well, wait a second. Let me - Let me get the CMC power down.
02 10 17 13	CC	Roger, Jack.
02 10 17 16	LMP	I wonder how much that's going to bring this up, here.
02 10 17 23	CDR	Jack, while he's doing that, copy down what you just said again. I want to write it down.
02 10 17 36	CC	Aquarius, we need to get your sublimator powered up, Activation page 20 and Activation page 21, step 3. Over.
02 10 17 52	CDR	Roger. Activation page 20 and Activation page 21, step 3, sublimator.
02 10 17 58	CC	Roger.
02 10 18 00	CMP	That's Activation, page 20? Okay, Jack. Now I have to power down IMU. I have no control at all. I'm going to turn my 16 jets off. Say again the other things you wanted?
02 10 18 28	CC	Okay, Jack. We'd like you to turn off your O_2 tank 2 heaters and fans. Correction - tank 1. Turn the fans and heaters off.
02 10 18 41	CDR	Okay. And, Jack, can we turn on the FDAI circuit breakers so we could have a ball to see if we go to gimbal lock or not?
02 10 18 49	CC	Stand by.
02 10 18 53	CMP	Houston, he's going to give a 16 NOUN 20, Jack. And, okay, I've got O_2 heaters and fans off in tank 1.
02 10 19 15	CDR	And, Jack, let me know if you get close to gimbal lock, would you?
02 10 19 25	CC	Jim, we don't want you to power down the ball in the LM. We wanted you to power down the ball in the CSM.

02 10 19 39	CMP	Jack, they haven't powered down - -
02 10 19 42	CDR	Jack, we don't have the balls powered up in the LM.
02 10 19 45	CMP	I have the CMC and IMU in the command module is powered down. The heaters are out.
02 10 19 56	LMP	And the EVAP flow valve, that's open now, and I've undone my suit hoses here and opened up the suit flow valves; so, we got air flowing in the LM now.
02 10 20 11	CMP	Okay, Jack. Will you say again the SCS items you wanted me to power down?
02 10 20 45	CMP	Okay, Houston. Do you read Odyssey?
02 10 20 55	CDR	Hello, Houston. How do you read?
02 10 21 01	LMP	His gimbal lock and ours are different, Jim.
02 10 21 09	CC	Apollo 13, Houston. Say again, please. You were cut out.
02 10 21 15	CMP	Okay, Jack. Do you want me to proceed by the SCS powerdown checklist? I did not copy the SCS items you wanted me to power down.
02 10 21 32	CC	Okay, Odyssey. We want to go SCS ELECTRONICS POWER, OFF.
02 10 21 39	CMP	Okay. It's done.
02 10 21 41	CC	FDAI POWER/GPI, OFF. AUTO jet SELECT, 16 - -
02 10 21 47	CMP	That's done.
02 10 21 48	CC	- - OFF. And all your ROTATIONAL CONTROL POWER, OFF.
02 10 21 52	CMP	It's done. ROTATION CONTROL POWER, DIRECT, and AUTO ..., OFF.
02 10 21 59	CDR	Okay, Jack. Tell me there. We need to know when we're getting close to gimbal lock in the LM. We have no balls right now.
02 10 22 06	CC	Okay. We want you to power up your eight-ball. We want you to get your RCS heaters on. Pressurize the RCS and open up the MAIN SOVs. Over.

02 10 22 23	LMP	Okay, Jack. I got two commander FDAI breakers in, AC and DC, and the two GASTA breakers in AC and DC and next you'll want the RCS heaters all on with the - pressurize the RCS and then the MAIN SOVs open. And I think they're already open.
02 10 22 40	CC	Roger. And, Fred-o, get the TCA breakers in last. Please.
02 10 23 00	LMP	Roger, Jim. I'm holding open those until you give me a further word anyway. I'm just going to pressurize right now.
02 10 23 08	CDR	Jack, are you reading LM gimbal angles?
02 10 23 38	CMP	- - ... power off, come down here and ... the audio ...
02 10 24 16	CC	Okay, Aquarius. I have some gyro torquing angles and the Odyssey is powered down, attitude-control-wise, so LM's got attitude control now.
02 10 25 13	CC	Aquarius, Houston.
02 10 25 21	LMP	Go ahead, Jack.
02 10 25 24	CC	Okay. We want you to know that we got some gyro torquing angles for you. And we want you to tell us when you got attitude control in the LM.
02 10 25 38	LMP	Okay. We're still working on the pressurization. I'm getting Jim on the horn here so he can help out, there.
02 10 25 43	CC	Roger.
02 10 26 09	CMP	Wonder why.
02 10 26 14	LMP	We got to get this pressurized.
02 10 26 55	CDR	Houston, Aquarius.
02 10 26 58	CC	Stand by 1, Aquarius, Odyssey. We'd like you to go DIRECT RCS and hold your present attitude out the window until the LM gets RCS powered up. Go ahead, Jim.
02 10 27 12	CDR	Well, that's my question. We're not - Our 16 20 doesn't match our eight-ball here. We went to FDAIs ON, and we don't have our balls completely powered up. There may be a ... and our angles don't look the same and we don't want to go into gimbal lock.

02 10 27 28	CC	Roger. How far are you from RCS power up - RCS pressurization?
02 10 27 45	LMP	Okay, Jack. I'm right up to where it's MASTER ARM, ON; RCS, FIRE; - -
02 10 27 49	MS	...
02 10 27 50	LMP	- - both LOGIC POWERs out ... goes into normal circuit-breaker. ... Do you want A in and then I'll fire them?
02 10 27 59	CC	Okay, 13. You're both talking at once. One at a time, please.
02 10 28 10	CMP	Okay. Who's first?
02 10 28 11	CC	Close LOGIC POWER A and B, Fred, and pressurize RCS.
02 10 28 17	LMP	Okay.
02 10 28 24	CC	Go ahead, Odyssey.
02 10 28 29	CMP	Okay. I'm going to try to do the best I can. I've got a one-attitude reference I'm going to fly according to the lunar terminator.
02 10 28 37	CC	Roger, Jack. Just maintain attitude.
02 10 29 04	CMP	What am I doing? I can't do that, anyway. Let's see, cross feed. Nope. Now, and -
02 10 29 25	CC	Aquarius, Houston. We'll have to get some AC up so you can get a ball reading. Close your BUS TIE INVERTER circuit breakers, all four of them on panel 11. Close your AC BUS VOLT circuit breaker on panel 11. On panel 16, INVERTER 2, CLOSE. Select inverter 2. Over.
02 10 29 50	CDR	That's been completed, Jack.
02 10 29 58	LMP	Okay. The RCS is pressurized now.
02 10 30 39	LMP	Okay, Jack. Do you want us to proceed right on down the line with the RCS check-out and Activation 37 now?
02 10 30 51	CC	Stand by, Fred.
02 10 31 03	LMP	Hell, is he still firing up there?

02 10 31 15	CC	Okay, Fred. Negative on the activation on page 37. Go on to your RCS pressurize and then get your TCA breakers in and go to PGNS attitude hold.
02 10 31 53	CDR	Okay, Jack. How do you read?
02 10 31 56	CC	Okay, Jim. This is Houston. We want you to load the DAP with 30120.
02 10 32 06	CDR	Load the DAP with 30120. Complete.
02 10 32 16	LMP	Okay. We need to change that CSM weight.
02 10 32 25	CC	Okay, Aquarius. Your CSM weight is 63400.
02 10 32 51	CDR	And Jack's alive to take control the LM to stay away from gimbal lock. Over.
02 10 32 58	CC	Affirmative. Take control of the LM. PGNS ATTITUDE HOLD.
02 10 33 06	LMP	We are.
02 10 33 08	CC	And, Odyssey, request you coordinate with Aquarius on attitude control.
02 10 33 16	CMP	Okay.
02 10 33 17	CDR	Roger.
02 10 33 19	CDR	Okay. I don't see where you're firing these things ...
02 10 33 22	SC	Oh?
02 10 33 27	CDR	Are you firing anything?
02 10 33 28	CMP	I don't think so.
02 10 33 54	CDR	Okay. I got DIRECT.
02 10 34 04	CC	And, Aquarius, check you ATCA (PGNS) breaker on panel 11 in.
02 10 34 13	CDR	Say again.
02 10 34 15	CC	Close, on panel 11, circuit breaker ATCA (PGNS).
02 10 34 21	CDR	ATCA (PGNS). Come on. Let's take it easy now.
02 10 34 30	CDR	Okay. We've got ATCA (PGNS) closed.

02 10 34 31	LMP	Yes.
02 10 34 32	CDR	Is that okay?
02 10 34 34	LMP	Yes.
02 10 34 35	CDR	Okay. Now I'm looking.
02 10 34 37	LMP	... okay ...
02 10 34 46	CMP	How about plus?
02 10 34 48	LMP	No. ...
02 10 34 49	CDR	Okay. It's already open.
02 10 34 53	CDR	Okay. Slow down.
02 10 34 58	LMP	Okay, Jack. We got it.
02 10 35 16	CDR	Yes.
02 10 35 21	CC	Okay, Jim. How's the attitude control?
02 10 35 27	CDR	Okay, Jack. We've got attitude control now in the LM. We're going to try to rotate up through the bellyband.
02 10 35 34	CC	Roger.
02 10 35 38	CDR	I like that sound like I got back there.
02 10 35 59	CC	Odyssey, Houston. I've got a procedure for you.
02 10 36 05	CMP	Okay, Jack. I'm ...
02 10 36 09	CDR	I want to go up this way to get away from that - the radios are powered, huh?
02 10 36 16	CMP	Yes.
02 10 36 33	CDR	Check your antenna?
02 10 36 37	CMP	Okay, Jack. Odyssey is ready to copy.
02 10 36 40	CC	Okay, Jack. What we want you to do is close the reactants valve on fuel cell 2. Power down your inverters. Power down your battery relay bus. Battery ties, off, and pull your entry circuit breakers, entry battery circuit breakers A, B, and C.

02 10 37 15	CMP	Check the control, and make sure we don't go to gimbal lock, Fred.
02 10 37 21	CMP	Okay, Jack; understand. Close REAC valve circuit breakers in fuel cell 2. Power down inverters. Power down BAT relay bus. BAT TIES, OFF. Power entry and both running circuit breakers A, B, and C. All off.
02 10 37 41	CC	That's affirmative, Jack. And close the reactant valve on fuel cell 2, there.

END OF TAPE

02 10 37 50	CDR	Okay. I'll do that, and Jack'll do that other.
02 10 38 02	CC	Okay, Jack; on fuel cell 2, open circuit it.
02 10 38 18	CMP	Okay. Fuel cell 2 is open circuited. Do you want me to go through the standard shutdown procedure for the REAC valves and -
02 10 38 37	CC	Odyssey, Houston. All you have to do is close the REACs valve on fuel cell 2.
02 10 38 42	CMP	Okay. CB REACs and vent REAC valves all closed.
02 10 39 24	CMP	Yes.
02 10 39 55	CDR	Yes.
02 10 39 58	LMP	... an hour and a half.
02 10 40 01	CDR	Okay.
02 10 40 06	CDR	Houston, Aquarius.
02 10 40 09	CC	Go ahead, Aquarius.
02 10 40 12	CDR	Okay. Odyssey is completely powered down, according to the procedure that you read to Jack.
02 10 40 22	CC	Roger; we copy. That's where we want to be, Jim.
02 10 40 36	LMP	And, Jack, have you all got good LM data down there now?
02 10 40 47	CC	That's affirmative, Fred. We're getting good LM data.
02 10 40 53	LMP	Okay. In that case, I think I'll pull out some display breakers and just let you all keep an eye on things.
02 10 41 02	CC	Roger.
02 10 41 04	CDR	He's turning his lights off now, too.
02 10 41 06	CC	Stand by 1 on that, Fred.
02 10 41 18	LMP	Okay.
02 10 41 21	CDR	What about these lights up here?

02 10 41 30	LMP	I've got it.
02 10 41 32	CDR	Okay.
02 10 41 34	LMP	Where would you like ...?
02 10 41 37	CDR	...
02 10 41 47	LMP	Oh.
02 10 42 41	CDR	We don't want to lose COMM with him.
02 10 42 45	LMP	I'm watching it.
02 10 43 52	CC	Aquarius, Houston. Stand by on opening your circuit breakers for displays. We're going to let you know what they are, and I have some gyro torquing angles for you.
02 10 44 10	LMP	Okay. What page is that there gyro torquing?
02 10 44 12	CDR	Okay. What page is the, do we write the gyro torquing angles on there, Jack?
02 10 44 17	CC	Stand by.
02 10 44 18	LMP	Okay. We're there now, Jim. Jim's got it. Go ahead with the gyro torquing angles.
02 10 44 24	CC	Okay. We'd like you to proceed with the fine aline and your gyro torquing angles are X plus 003.30, Y plus 024.80, Z minus 015.10. Over.
02 10 44 48	CDR	Okay. I read your gyro torquing angles as plus 003.30, Y is plus 023, I only have four numbers for Y; you'll have to give that one to me again, and Z is minus 015.10. Read Y again, please.
02 10 45 06	CC	Okay, Jim. X and Z are correct and Y is plus 024.80.
02 10 45 19	CDR	Okay. We read Y as plus 024.80. We'll proceed on Activation 40 to fine aline the platform.
02 10 45 28	CC	Roger. Okay, Aquarius, proceed as on page 40 with IMU fine aline.
02 10 47 41	CC	Aquarius, Houston. Can you see any stars out the LM window?

02 10 47 53	LMP	We'll have to wipe them off, Jack. They're coated with water right now.
02 10 47 59	CDR	Can I get a towel?
02 10 48 00	LMP	Yes.
02 10 48 01	CC	Roger. As soon as you get a chance to - on your position - to take a look, we'd like to know if you can see stars for alinement purposes.
02 10 48 16	LMP	Okay. Jim's going to be in trouble in our present attitude out his side. The Sun's there.
02 10 48 25	CDR	Wait 1.
02 10 48 29	LMP	What have you got? How much you got left in battery A? Okay. I wish I knew what the hell they were thinking right not ... - -
02 10 48 51	CDR	They're talking about powering down and doing a P51 here?
02 10 48 57	LMP	No. They were just thinking about P52 - -
02 10 49 00	CC	Aquarius, Houston. Negative on the P51. We want to stay just like we are, but we'd like to be able to correlate what you're doing with some simulator work we're going to crank up. And so if you can give us information as to what stars you can see out the window, we can make that correlation.
02 10 49 22	CDR	Would you say one more time? Give me the top two. The top two.
02 10 49 33	CC	Jim, what we want you to do is go with your current fine aline and disregard the P51. What we're attempting to do is to crank up some LMS simulations to correlate what we can get out your window with what we can get out the LMS window to see if that will help us any. So when you can see some stars, if you can, you think you can recognize them and recognize constellations, please let us know.
02 10 50 02	CDR	Okay. We'll check. Stand by.
02 10 50 16	CDR	Okay. Watch the - -
02 10 50 45	CMP	I'm just glad ...

02 10 51 25	CDR	Okay, stand by.
02 10 51 40	CDR	Okay. Here, unplug this.
02 10 52 13	CC	Aquarius, Houston. We notice that the O_2 pressure in the ASCENT TANK O_2 is a little high, so we want to use some of it. So close DESCENT O_2 and open ASCENT O_2, tank 2. Over.
02 10 52 45	LMP	Okay, Jack. Switch now on ASCENT number 2 O_2 tank, DESCENT O_2 is closed.
02 10 52 53	CC	Roger, Fred.
02 10 53 39	CDR	... that?
02 10 54 01	CDR	Okay, Houston; Aquarius. How do you read?
02 10 54 05	CC	Reading you 5 square, Jim. Go ahead.
02 10 54 09	CDR	Okay. I'm looking out of Fred's window. I see a lot of particles out there, but a lot of that stuff is still drifting away from us, so a lot of it is flashing in the local vicinity, and I don't recognize any constellations right now, in this particular attitude.
02 10 54 34	CC	Okay, Jim. If that status changes, please let us know.
02 10 54 41	CDR	Roger. We're continuing to drift. Okay, get your TTCAs to roll.
02 10 54 54	LMP	TTCA ...
02 10 55 08	CC	And, Aquarius; Houston. I've got some circuit breakers you can open to power down displays. In addition, I have a P30 maneuver pad. Over.
02 10 55 20	CDR	Roger. Stand by, Houston. Get the CS - get the pad book.
02 10 55 28	LMP	Get the LM data - get the LM book.
02 10 55 32	CDR	And, say - We're getting the pad book now, Jack - and say the boost on powered up?

02 10 55 38	CC	Okay. I have some circuit breakers that you can open up in order to power down displays.
02 10 55 45	LMP	Okay. Stand by 1, Jack. I'm going to get my COMM carrier on.
02 10 55 54	CDR	All right, I'll tell you what. Get all the LM stuff. Give me the LM stuff right now. Jack, give me all the LM stuff.
02 10 56 45	LMP	Why?
02 10 57 06	CDR	All right, Jack. Hey, what do you need out of here?
02 10 57 13	CMP	... status.
02 10 57 19	CDR	Here.
02 10 58 12	CDR	Now is there any way they can control this thing with the LM on? Fred-o?
02 10 58 20	LMP	What's that?
02 10 58 21	CMP	Looks like I'm cross-coupling here. I might as well -
02 10 58 23	LMP	Yes, you are. TTCA will give you the best controlling warning.
02 10 58 30	CDR	Yes, and I want to get out of this roll. What if I go to - -
02 10 58 42	LMP	It doesn't matter where the hell you are. ... gimbal lock ... my flashlight or any flashlight.
02 10 59 16	LMP	... down and power down ...
02 10 59 34	CDR	Well, I'm not doing any good here.
02 10 59 38	LMP	Okay, how do you read now, Jack?
02 10 59 44	CMP	OMNI.
02 10 59 46	LMP	Yes, we're on.
02 10 59 51	CDR	Hello, Houston; Aquarius.
02 10 59 54	CMP	Back on? Yes.
02 11 00 04	CC	Aquarius, Houston. You're watching the middle gimbal there, aren't you? Go ahead, Aquarius.

02 11 00 12	LMP	Okay. Go ahead with the breakers first, Jack.
02 11 00 15	CC	Okay. You watching your middle gimbal there?
02 11 00 20	CDR	Tell them we are.
02 11 00 24	CMP	Your attitude is just straight pitch down, Jim. Okay, you're moving away.
02 11 00 48	CC	Okay, Fred, I've got six circuit breakers for you.
02 11 00 54	LMP	Okay. Go ahead.
02 11 00 56	CC	Okay, they're all on panel 11. Row 1 under AC BUS B, open HELIUM PQGS for PROPELLANT DISPLAY.
02 11 01 07	LMP	It's OPEN.
02 11 01 08	CC	On row 2, FLIGHT DISPLAYS, open THRUST, open MISSION TIMER, open RANGE/RANGE RATE, ALTITUDE/ ALTITUDE RATE, and open the AC BUS A RANGE RATE, ALTITUDE/ALTITUDE RATE.
02 11 01 25	LMP	They're OPEN.
02 11 01 26	CDR	Okay. They're all OPEN.
02 11 01 27	CC	Okay. On row 4, PGNS, SIGNAL STRENGTH DISPLAY.
02 11 01 38	CDR	It's OPEN.
02 11 01 39	LMP	It's OPEN?
02 11 01 42	CC	Okay. That concludes the powerdown of displays. And I have a P30 pad for you.
02 11 01 53	LMP	Okay. Go ahead.
02 11 01 57	CC	Okay. The purpose is a pericynthion plus 2 hours DPS abort. NOUN 33: 079:25:26.48; plus 1633.0, minus 0014.5, minus 0751.5; apogee not applicable, perigee is plus 0020.5; 1797.7, 8:35, 268, 264, plus 16410, minus 00145, minus 07338. COAS is NA. And I have two gimbal trim angles for you which will be updated. Right now, however, we want you to go with pitch 5.86, roll 6.75. Over.
02 11 03 37	LMP	What was that for?
02 11 03 40	CDR	Pitch and yaw, maybe, huh?

02 11 03 42	LMP	Okay, what was the last two things you gave me, a pitch and roll angle for what?
02 11 03 47	CC	That's for your DPS trim.
02 11 03 48	CDR	Those were gimbal angles for - pitch and yaw.
02 11 03 54	LMP	Oh, Roger. GDAs.
02 11 03 56	CC	Yes, that's what I mean. Sorry.
02 11 03 58	LMP	Pericynthion plus 2 - Okay, DPS pericynthion plus 2, at 079:25:026.48; plus 1633.0, minus 0014.5, minus 0751.5; HA N slash A, HP plus 0020.5; 1797.7, 8:35, 268, 264, plus 16410, minus 00145, minus 07338 - -
02 11 04 43	CDR	Did we lose the water in the - -
02 11 04 44	LMP	- - N slash A in the COAS, and you gave me GDA angles of pitch 5.86, and you want roll 6.75.
02 11 04 56	CC	Good readback, Fred.
02 11 05 00	CDR	Yes, lose - get all the little bags you can with water.
02 11 05 06	CC	Aquarius, Houston. Say again, please.
02 11 05 13	LMP	Okay. We didn't answer back there, Jack. Check to see if you're on VOX.
02 11 05 19	CDR	No.
02 11 05 22	LMP	Neither am I, okay. Why the hell are we maneuvering at all now? Are we still venting?
02 11 05 34	CDR	Well, we're at ATT HOLD for one thing - I mean, we're at MINIMUM IMPULSE.
02 11 05 38	LMP	No, I mean why can't you null them out, somewhere?
02 11 05 41	CDR	Every time I try to - I can't take that doggone roll out. I got to wait until they get around to the bellyband.
02 11 05 50	LMP	Wait a minute. Do you - you fight roll by using the TTCA left right. That's what you need to play with.
02 11 06 04	CDR	Okay. We'll try that. Let me get around though. Let's roll. Let it roll all the way.

02 11 06 12	LMP	Yes, you can't let it roll all the way.
02 11 06 13	CDR	I know. I know. But I mean -
02 11 06 16	LMP	Okay. Then until it's upside down at least, huh?
02 11 06 18	CDR	Yes.
02 11 06 19	LMP	Okay. Well, should I ask him what the return time on that one is? Or are you interested?
02 11 06 31	CDR	Let's get the first things first.
02 11 06 43	LMP	Oh, you don't want to hear. Let me figure some times out here. That's at 79, and what are we at now? About - do we - do we - do we even know any better computer time, do we?
02 11 06 57	CDR	No.
02 11 07 00	LMP	Hey, Jack. Do you still have a mission timer? You don't? Okay.
02 11 07 07	CDR	I'll tell you what. Let's ask - let's ask Houston to give us a mission timer, computer time. They can up link it to us. Okay, hold it.
02 11 07 18	LMP	Go ahead.
02 11 07 20	CDR	Houston, Aquarius.
02 11 07 21	CC	Go ahead, Aquarius.
02 11 07 25	CDR	You know, we don't have a - I don't think we have a computer clock going, and why don't you up link that stuff to us?
02 11 07 31	CC	Roger.
02 11 07 40	CC	And, Fred-o, I got some fast circuit breakers on panel 16 for you.
02 11 07 49	LMP	Okay. Go ahead.
02 11 07 51	CC	Okay. On row 1 under FLIGHT DISPLAYS, SYSTEMS ENGINEER's CROSSPOINTER, OPEN. Under RCS B - -
02 11 08 00	LMP	It's OPEN.
02 11 08 01	CC	Open the TEMP/PRESS DISPLAY-FLAGS and PQGS/DISPLAYS.

02 11 08 10	LMP	Okay. They're both OPEN.
02 11 08 12	CC	Okay, Fred. On row 3 under COMM, open DISPLAYS and under ECS, open DISPLAYS.
02 11 08 25	LMP	Okay. COMM DISPLAYS, ECS DISPLAYS, both OPEN.
02 11 08 28	CC	Okay. And two more. In row 4 under HEATERS, open DISPLAYS and under EPS, open DISPLAYS.
02 11 08 40	LMP	Okay. HEATERS DISPLAY, EPS DISPLAY OPEN. And I've long since had all the lights off, floods, et cetera.
02 11 08 55	CDR	Where are those bags? Where are those bags for weighing water in the PLSS?
02 11 09 02	LMP	Why?
02 11 09 03	CDR	We're going to fill up command module water. We'll ...
02 11 09 09	LMP	Hell, do you need a QD *** Jim. No way to get ours in there. I don't think.
02 11 09 37	LMP	Hey, Jim.
02 11 09 44	CDR	I wonder if one of our water ... jet is. Okay, let's control - What else can we fill up there?
02 11 10 00	CC	Aquarius, Houston.
02 11 10 02	LMP	We're not - we're not going to - -
02 11 10 03	CC	We're not going to be able to up link your time because of the IU, and we have a frequency problem there. But what I'd like to do is give you a time to set up on your mission timer and give you a mark and then you can put it into the DSKY from there. Over.
02 11 10 25	CDR	Okay. Stand by.
02 11 10 27	LMP	Wait a minute. Why do we need a mission timer right now, anyway? I mean, that bad, they'd tell us.
02 11 10 32	CDR	Well, I'd rather have a timer going so that we - what are we going to put in the DSKY? Should we shut down the mission timer?

02 11 10 37	LMP	Is that what you want to do?
02 11 10 38	CDR	Yes. Hey, OMNI.
02 11 10 43	LMP	Great.
02 11 10 47	CDR	Switch them. Okay. Let's fire on the mission timer.
02 11 10 59	CC	Aquarius, we need FORWARD OMNI.
02 11 11 05	CDR	FORWARD OMNI.
02 11 11 07	LMP	Say again, Jack.
02 11 11 09	CDR	FORWARD OMNI.
02 11 11 11	LMP	I am. Okay, Houston. If that call was an OMNI switch, I'm in FORWARD now.
02 11 11 28	CDR	Okay, Fred-o, how do I get the mission timer up? I got the mission timer cranked in.
02 11 11 34	LMP	You got it on?
02 11 11 35	CDR	I got the mission timer circuit breaker in.
02 11 11 38	LMP	Okay. We're going to probably need NUMERICS LIGHTING. There you go. You got it.
02 11 11 47	CC	Aquarius, Houston. I think we've got a better way of getting your mission time up.
02 11 11 56	CDR	Go ahead with it.
02 11 11 59	CC	Okay. We can do a VERB 55, ENTER, and then put an R_1, minus 00088. In R_2, minus 00059; R_3 minus 03274.
02 11 12 28	LMP	Watch the crapping attitude.
02 11 12 31	CDR	We're okay.
02 11 12 36	CMP	God damn. I wish you'd get to something I know.
02 11 12 41	CDR	Well, as soon as we get over here, we'll stop it with the TTCA.
02 11 12 43	CMP	Okay.
02 11 12 46	CC	And, Aquarius; Houston. We've got you both on VOX.

02 11 12 54	LMP	Like to go what?
02 11 12 56	CDR	You want us on VOX, Jack?
02 11 12 58	CC	We have you on VOX. We're reading you loud and clear and the clock took good.
02 11 13 17	LMP	Okay. Looks like we're on the FDA route there, Jack.
02 11 13 39	LMP	Okay, Jack. How do you read me on NORMAL VOICE now?
02 11 13 42	CC	Reading you 5 square, Fred.
02 11 13 46	LMP	Okay.
02 11 14 12	CC	And, Aquarius, we're ready for a VERB 74 when you can give it to us.
02 11 14 23	LMP	You got it.
02 11 14 25	CC	Okay. And one other thing we noticed. When you pressurized the RCS, we got an increase in pressure in the ascent tanks, and so we want to have you verify that the ascent feeds are closed. In order to do that, on panel 11, close the ASCENT FEED 1 and 2 circuit breakers on - and cycle the Parker valves, and then open the ASCENT FEED circuit breakers on panel 11.
02 11 15 08	CDR	Completed, Houston.
02 11 15 10	CC	Okay, Jim. Thank you.
02 11 17 53	LMP	And, Jack, Aquarius. What kind of return time is this maneuver given?
02 11 18 02	CC	That puts you back in the water at 133 hours.
02 11 18 11	LMP	133, hey.
02 11 18 13	CC	Affirm.
02 11 18 24	CC	And that's an Atlantic landing site.
02 11 18 31	LMP	Atlantic landing?
02 11 18 36	CC	Affirmative. That's the pad that we've given you, but we may change our mind later on. We want you to have this info for now. And that's a minimum - -

02 11 18 47	LMP	Okay.
02 11 18 48	CC	- - minimum time return.
02 11 20 09	CC	Aquarius, Houston. We've got to change the REFSMMAT to the one to which you're alined. So we'd like to have POO and DATA and we'll ship that up to you.
02 11 20 21	CDR	Roger.
02 11 20 30	LMP	Okay, you got it, Jack.
02 11 20 34	CC	Roger. Coming up.
02 11 21 22	CC	Aquarius, could you give us DATA please?
02 11 21 32	CDR	Okay, Jack, you got it.
02 11 21 33	LMP	- - the updata link, the DUA breaker may not be in, Jack.
02 11 21 44	CC	Okay, Fred, and close the DUA breaker.
02 11 21 51	CDR	It's in now, Jack.
02 11 21 54	CC	Okay, Jim, and it's coming up now. Thank you.
02 11 28 03	CC	Aquarius, Houston. We're finished with the uplink. The computer's yours. We'd like to power down the DUA, so pull the DUA circuit breaker please.
02 11 28 14	LMP	Okay. Updata link breaker's coming OPEN.
02 11 36 25	CC	Aquarius, Houston. We'd like to have AFT OMNI, and we're going to lose contact with you for about a minute here while we try to establish tracking. And our latest data shows that your closest approach to the Moon is going to be 60 miles perigee. Over.
02 11 36 44	LMP	Okay. Closest approach, 60 miles, and I'm sitting on AFT OMNI now.
02 11 36 50	CC	Roger. We'll probably be going off the air here in about a minute.
02 11 41 12	CDR	Houston, Aquarius. Over.
02 11 41 14	CC	Go ahead, Aquarius.

02 11 41 19	CDR	Okay. We're thinking about rigging up the urine dump to the side hatch. We're thinking about rigging up the urine dump to the side hatch and save urine heater power. What do you think?
02 11 41 36	CC	Stand by 1.
02 11 41 42	CDR	Better still so we won't freeze up our urine dump.
02 11 41 48	CC	Roger. That sounds like a good plan, Jim. Why don't you go ahead with that one?
02 11 42 59	CC	Okay, Aquarius. And down here we're getting regrouped, trying to work on your control modes and trying to set up something for PTC and taking a look at consumables as opposed to flight plan, and so forth, and as soon as we get all that information, we'll pass it up to you. We also have the 14 backup crew over in the simulators looking at dock burns and also trying to see what kind of alinement procedures they can come up with for looking at stars out the window. So if you ever are able to see any stars out there and think you can do an alinement out the window, why let us know.
02 11 43 40	CDR	Okay. Jack, right now we're not able to. The sunlight's reflecting off the thrusters and whatever debris came away at the time of the mishap is still with us, such that the stars are hard to find, and why - what respect do you want us to do the stars out the window - just to check the LMS run, is that correct?
02 11 44 04	CC	That's affirmative. We'd like to correlate the information we get with your's, so that if we can use it to update the platform, we can. What we're really trying to do, Jim, is see if we can do a COAS aline so we can power down the platform.
02 11 45 23	CDR	That is Aquarius. We're getting an awful lot of static on the uplink now, and we're not reading you at all.
02 11 45 39	CDR	I have good signal strength and I'm on AFT OMNI.
02 11 45 51	CC	How do you read now, Aquarius?
02 11 47 06	CC	Hey, Jim, do you suppose that you could orient the LM so that the service module would be between you and the Sun? I believe you could see - recognize constellations out your front windows then.

02 11 47 47	CC	Aquarius, Houston. Radio check.
02 11 48 15	CDR	Okay, Jack. How do you read now?
02 11 48 17	CC	Okay. Hearing you 5 square now, Jim. And the question we have, is there some way you can orient the spacecraft so that the service module is between the LM and the Sun so you can recognize constellations out the window? And secondly, can you see anything out the AOT?
02 11 49 28	CC	Aquarius, Houston. How do you read?
02 11 53 46	CC	Aquarius, how do you read me now?
02 11 56 56	CC	Aquarius, Houston. How do you read?
02 11 57 08	CC	Aquarius, request FORWARD OMNI, please.
02 11 58 22	CC	Aquarius, Houston. Request FORWARD OMNI. How do you read?
02 11 59 06	LMP	Okay, Houston; Aquarius. How do you read?
02 11 59 09	CC	Hello there, Aquarius. Loud and clear. How do you read me?
02 11 59 14	CDR	There's an awful lot of background - -
02 11 59 16	LMP	We get a lot of background static, Jack. You're down in the mud. You having a ground problem?
02 11 59 23	CC	What we tried to do was to get the IU frequency shifted off a little bit so that we'd have less interference. I think it'll come up - What we want you to do is turn on your descent oxygen and turn off your ascent oxygen. Over. And request FORWARD OMNI.
02 11 59 43	LMP	You're unreadable, Jack. We've got our signal strength meter - right now it keeps wavering up and down, and the best I'm getting is about 2.4 AGC.
02 11 59 53	CC	Roger. Request FORWARD OMNI.
02 11 59 58	LMP	I am on FORWARD OMNI. I've been on FORWARD OMNI.
02 12 00 43	LMP	Okay. How do you read, Jack?
02 12 00 46	CC	I'm hearing you 5 square, Fred. How me?

02 12 01 13	CC	Aquarius, Houston. How do you read?
02 12 01 58	LMP	Okay. We're up to about 2.6 AGC now.
02 12 02 03	CC	Aquarius, Houston. Radio check.
02 12 02 10	LMP	Okay. Every time you transmit, Jack, the AGC starts to drop off and the static level turns up.
02 12 02 18	CC	Okay, Fred. You're loud and clear.
02 12 02 24	LMP	I wish you were.
02 12 02 30	CC	Fred, go to DESCENT O_2.
02 12 02 35	LMP	DESCENT O_2. Roger.
02 12 04 05	CDR	Hello, Houston; Aquarius.
02 12 04 08	CC	Hello there, Aquarius. How do you read me now?
02 12 04 23	CDR	Hello, Houston. Aquarius.
02 12 04 26	CC	Aquarius, Houston. Go.
02 12 04 30	CDR	Okay. That's the first clear word we heard from you, Jack. Do you think it could be my pitch attitude that's breaking up your incoming? I guess you've been hearing us.
02 12 04 42	CC	We have been hearing you, and the problem is on the ground. I hope we have it corrected now.
02 12 04 51	CDR	Okay. That sounds good.
02 12 04 53	CC	We're considering powering down the PGNS but we want to know what capability you have to do a coarse and fine aline. We read your conversation about being unable to see out the window very good. How about out the AOT?
02 12 05 26	LMP	He's looking now.
02 12 05 29	CC	Okay. And the other thing we thought you might try is to put the service module between you and the Sun and then to see if you can see anything out the window in that attitude.
02 12 05 43	CC	The reason that we think that that would work is that it worked on Apollo 10. It made the constellations all recognizable when we put the the service module - in our case a LM, between us and the Sun.

02 12 06 00	CC	AFT OMNI, Fred.
02 12 06 07	LMP	You're down in the mud again, Jack. It appears that some other circuit is feeding through on there with you.
02 12 06 14	CC	Roger. AFT OMNI.
02 12 06 42	CC	Aquarius, AFT OMNI.
02 12 07 29	LMP	Okay. You're down in the mud again, Jack. Lots of background static.
02 12 08 10	CC	AFT OMNI, Aquarius.
02 12 09 00	CC	Aquarius, Houston.
02 12 11 18	LMP	Okay, Houston; Aquarius. How do you read?

END OF TAPE

02 12 18 21	CC	Aquarius, Houston. How do you read?
02 12 22 46	LMP	Hello, Houston; Aquarius. How do you read?
02 12 22 48	CC	Hello, there, Aquarius. Loud and clear. How me, now?
02 12 22 54	CDR	Okay, we're reading you loud and clear, Jack. I hope it stays this time.
02 12 22 58	CC	Okay. We'd like to brief you on what our plan is. We're, at this time, water critical in the LM. So we'd like to use as little as possible. To do this, we're going to plan to make a free-return maneuver of 16 feet per second at 61 hours, which is 37 minutes from now. Then we're going to power down the PGNS, and then we'll - at 79 hours, we'll go ahead and make another abort maneuver to kick what we got. But we'd like to get that PGNS powered down as soon as possible. That would be after the midcourse and - so how do you feel about making a 16-foot-per-second burn in 37 minutes?
02 12 23 49	CDR	Well, we'll give it a try, Jack, if that's all we've got. That's a 16-foot-per-second DPS burn in 37 minutes?
02 12 23 57	CC	Roger. We're working up a pad for it, but we'd want to know what you think about doing it at that time.
02 12 24 08	CDR	Well, we'll do it. Could you give us a little bit more time?
02 12 24 30	CC	Okay, Jim. We'd like to get a suggested time from you. We can figure out a free-return maneuver for any time you want to give us, so if you'll give us the time you'd like to shoot for, we'll figure out a pad.
02 12 24 47	CDR	Okay, that sounds good. I think if we have a little bit more time; we want to do it right. Stand by 1.
02 12 25 04	CDR	Let's shoot for an hour if we can, Jack. How's that.

02 12 25 15	CC	Okay, Jim. How about 61 hours and 30 minutes? That's an hour and 5 from now.
02 12 25 24	CDR	Okay. We'll do it and we want to be sure we talk back and forth now to make sure we get this burn off right.
02 12 25 31	CC	Affirm.
02 12 25 35	LMP	Okay, in the interim, Jack, I looked around again and I saw that we have a radar and a landing-radar heater breaker in. Can I pull those out?
02 12 25 46	CC	Affirmative. Pull them both out.
02 12 25 52	CC	And now we want to ask you a question about alinements, and so forth. We wanted to know if you can see any stars out of the AOT. We also wanted to know if you could use the service module to cast a shadow on the LM windows and then look out the windows to see stars for a P51 COAS alinement.
02 12 26 14	CDR	Okay, in this attitude, Jack, that we're pitching around, I cannot use the AOT to see stars. We - we're just not able to see them at all. Now we may be able to maneuver off in yaw or - and/or roll and see stars. Right now, we haven't been able to. The AOT is useless. The command module structure is just radiating too much light into the - into the telescope.
02 12 26 41	CC	Okay, and how about using the service module to cast a shadow on the commander's window? If you do that, can you see stars for a COAS alinement?
02 12 26 55	CDR	We could give that a try, Jack, although I don't know how successful it will be. We tried to do it - The light shines off our quads which makes it difficult to see stars. We do have the Earth and the Moon, if that can be of assistance.
02 12 27 18	LMP	Another problem - Right now, Jack, I'm looking out the right window and it's pretty dark out that window but there are about a thousand or so false stars out here from - left over from some of the debris. It's hard to discern what's real and not real.

02 12 27 38	CC	Okay. That's good information and during the time that we see you're continuing to pitch, if you ever get in a position where you think the AOT might be of some use, we'd like you to periodically look out of it and see if you can see some stars that would enable us to get a P52.
02 12 27 59	CDR	Okay, will do. And also, let me ask you a question. In this configuration, docked, we have to use the TTCA to control pitch and roll. And, just how much can we use that without really changing our trajectory? We only have 60 miles to play with.
02 12 28 21	CC	Roger, we'll put that to them.
02 12 28 45	LMP	Okay, Jack, are you ready to go to work with me on the 2-hour DPS activation and contingency book, page 1?
02 12 28 54	CC	Roger, we're ready to go.
02 12 29 05	LMP	Okay. Item one, we can - one through five, we can scratch off, as done. Is that correct?
02 12 29 14	CC	Stand by 1, Fred.
02 12 30 18	CC	Okay, Fred, let's go ahead. Step 1, page 1. Everybody's listening.
02 12 30 28	LMP	Okay, I've looked around, and I've essentially done steps 1 through 5 with the exception of floodlights and utility lights and I think we'll just do without those.
02 12 30 40	CC	Roger. Your choice.
02 12 30 47	LMP	Okay, on EPS activation, we're through step - we're through that - bottom of that page. That's all done.
02 12 30 58	CC	We concur, page 2.
02 12 31 13	LMP	Okay, in essence, we've circumvented step 4, and we're not sitting with all 4 aps - descent BATs on high-voltage taps, so I'll scratch off step 4.
02 12 31 28	CC	Roger, and in step 5, we want to leave INVERTER 1 circuit breaker OPEN.

02 12 31 37	LMP	Roger. In step 5, we'll leave INVERTER 1 CB OPEN.
02 12 31 41	CC	Omit step 6.
02 12 31 53	LMP	Okay, for the time being, our mission timer is the computer so, mission timer activation scratch off.
02 12 32 05	CC	Roger.
02 12 32 09	LMP	Okay. We've done the primary glycol loop activation.
02 12 32 15	CC	We verify it.
02 12 32 29	CC	Aquarius, we recommend you leave the caution and warning off on page 3.
02 12 32 37	LMP	Okay. I was going to say that next. Page 3, we'll just scratch item 1. And item 2, I've already got the RCS heaters on. And I don't know if I gave you the time or you got the time on the PRIMARY EVAP FLOW number 1, OPEN.
02 12 33 04	CC	We got the time.
02 12 33 10	LMP	Okay. Let's go to the CB pages now.
02 12 33 29	CC	Fred-o, did you close the engine control breaker in panel 11?
02 12 33 38	LMP	What control is that, Jack?
02 12 33 40	CC	Did you close the S and C engine control breaker on panel 11? As we got step 1 there on page 3.
02 12 33 49	LMP	Okay. Okay, yes, the EPS DESCENT ECA CONTROL breaker is CLOSED on 11.
02 12 34 00	CC	Roger, and how about the - on panel 11, S and C ENGINE CONTROL, CLOSED? AFT OMNI, Fred.
02 12 34 16	LMP	Okay. We're AFT OMNI, and we have the S and C ENGINE CONTROL breaker CLOSED.
02 12 34 24	CC	Roger. Let's go on with the circuit breaker panel checkout.

02 12 34 34	LMP	Okay. I'll just give you - I think it'll be easier to give you what I got in. Okay, in the top row on 11, we have the four AC BUS TIE breakers IN and the AC BUS VOLTS breaker IN, and that's it. Second row, we have the four TCA breakers IN. We have the GASTA under FLIGHT DISPLAYS and COMMANDER's FDAI. And likewise under AC BUS A, we have a GASTA and a COMMANDER FDAI breaker IN. That's it. On row 3, we have a SIGNAL CONDITIONER 1. We have the ATCA (PGNS). We have the ENGINE CONTROL breaker, ATTITUDE DIRECT CONTROL breaker, and the - under LIGHTING, ANUN/DOCK/COMPONENT breaker IN. And one other, ED LOGIC POWER A - ED LOGIC POWER A is also IN.
02 12 35 41	CC	Copy.
02 12 35 45	LMP	Okay, under the fourth - fourth row, we got all the QUAD HEATER breakers IN, SUIT FAN 1. Under ECS, GLYCOL 1 and 2; and under COMM, we have COMMANDER AUDIO IN, and PGNSs LGC/DSKY, IMU STANDBY, IMU OPERATE, and that's it. Okay, in the bottom row, EPS, we have the BAT FEED TIE both IN, and we have the CROSS TIE BALANCE LOADS IN, the X LUNAR BUS TIE, DESCENT ECA CONTROL, DESCENT ECA, and the DC BUS VOLTs breaker.
02 12 36 38	CC	Roger. We copy. - -
02 12 36 39	CMP	That completes it for panel 11. Okay. Stand by. Okay.
02 12 36 54	LMP	As I see it, some of the short ones are - we need the DECA GIMBAL in sooner or later.
02 12 37 00	CC	That's affirmed. Close the DECA GIMBAL.
02 12 37 01	LMP	And probably - Okay, DECA GIMBAL, and sooner or later, we're going to need DECA POWER, I guess, also.
02 12 37 15	CC	All right, DECA POWER will come up later in the procedure, Fred-o.
02 12 37 21	LMP	Okay.
02 12 38 41	CC	Aquarius, Houston. On your circuit breaker checklist, on panel 11 and 16, we want you to configure the panels as outlined in the checklist.

02 12 38 57	LMP	Okay. You want us to configure as per checklist. Okay. We'll do that.
02 12 39 03	CC	That's right. Close the black ones and open the white ones.
02 12 39 12	LMP	Yes. I think we can manage that.
02 12 39 19	CDR	With the activation power up, we're starting right now.
02 12 40 12	CDR	Houston, we might as well leave our RCS TCAs IN, right?
02 12 40 23	CC	Affirmative, Jim. Leave your RCS TCAs in - -
02 12 40 26	LMP	Check that - -
02 12 40 27	CC	- - on panel 11.
02 12 40 30	LMP	- - Yes. I used my Pentel pen and made those white ones black ones.
02 12 40 35	CC	Roger. Same on 16, Fred.
02 12 40 40	LMP	Roger.
02 12 40 46	CDR	And you might look there, Houston, to see what circuit breakers aren't required, like the tape recorder.
02 12 40 52	CC	We're looking.
02 12 41 41	CC	Okay, Jim. On panel 11 over there, you can also leave open the RENDEZVOUS HEATER breaker and the LANDING RADAR HEATER breaker, in addition to the tape recorder.
02 12 41 55	CDR	They're out.
02 12 42 04	LMP	I'm leaving a few in, Jack, too, like the SUIT FAN 1 is still IN, RCS SYSTEM is still IN, the TCAs. ATTITUDE DIRECT CONTROL is IN.
02 12 42 18	CC	Roger.
02 12 42 33	CDR	How about if I leave the VHF A and B OFF?
02 12 42 41	CC	Switch to FORWARD OMNI.

02 12 42 53	CC	Okay. We can leave the VHF powered down, too.
02 12 43 01	CDR	And, do you want the SECONDARY S-BAND?
02 12 43 04	CC	Negative on SECONDARY S-BAND. Leave them open.
02 12 43 13	CDR	UP DATA LINK is IN. Do you want that in or out?
02 12 43 21	CC	Leave the UP DATA LINK open. We'll call for it when we want you to put it in.
02 12 44 36	LMP	Okay, Jack, on panel 11 on the top row, do you really want the PROPULSION PQGS and ASCENT HELIUM REGs in?
02 12 44 54	LMP	And, also the SYSTEM ENGINEER X- POINTER breaker.
02 12 44 59	CC	Roger. Negative on the PQGS. Negative on the ASCENT HELIUM REG, and negative on the CROSS-POINTER.
02 12 45 17	LMP	Okay. On the second row, I'm going to leave the FLOODLIGHT breaker open.
02 12 45 24	CC	Concur.
02 12 45 31	LMP	And we're again up to - Do you want the CWEA enabled?
02 12 45 39	CC	Negative on the CWEA.
02 12 45 44	LMP	Okay.
02 12 46 02	LMP	Okay. Since we're - are we going to power up the AGS or should I concern myself with the ATCA breaker?
02 12 46 14	CC	Negative on the AGS. However, Fred, we need the ATCA breaker in.
02 12 46 28	LMP	Okay. ATCA breakers IN. Yes. I guess for the backup power supply. Hey, how about ATCA AGS.
02 12 46 43	CC	Negative on ATCA AGS.
02 12 47 05	LMP	And I'm leaving the SUIT FLOW CONTROL breaker open.
02 12 47 20	CC	Let's close the SUIT FLOW CONTROL breaker - -

02 12 47 22	CDR	And, now ...
02 12 47 23	CC	- - so it doesn't take any current.
02 12 47 30	LMP	Okay. Without suits, it doesn't do us much good either though.
02 12 47 52	LMP	Okay. And are we going to continue to be able to operate off the OMNIs, Jack. So can I leave the S-band antenna powered down?
02 12 48 18	CC	Okay, Fred-o. We don't plan to use the steerable antenna, although we want to leave the heaters on. So it looks you ought to open up COMM S-BAND ANTENNA, but leave S-BAND ANTENNA HEATERS closed.
02 12 48 33	LMP	Roger. COMM S-BAND is OPEN, S-BAND HEATER breaker is still CLOSED.
02 12 49 26	LMP	And, on the bottom row, Jack, I'm going to leave the HEATER DISPLAY breaker out, which we had pulled before, and EPS DISPLAY. But I question, do we want the ASCENT ECA breaker in, as prescribed?
02 12 49 47	CC	Stand by. That's a negative on the ASCENT ECA breaker. Leave it open.
02 12 50 02	CC	And, Aquarius, we need POO and DATA - -
02 12 50 04	CDR	And that's a - -
02 12 50 05	CC	- - and we'll give you state vector and target load.
02 12 50 12	LMP	Okay. We need the UP LINK breaker in then now.
02 12 50 17	CC	That's affirmative.
02 12 50 23	CDR	Okay. And, Jack, will you give us that - how about the ORDEAL breaker? Can I pull that? We don't need that, do we?
02 12 50 32	CC	Negative on the ORDEAL. Leave it open.
02 12 50 48	LMP	And how about the ASCENT ECA breaker on panel 11? Jim has it in over there.
02 12 51 02	CC	And panel 11 ASCENT ECA can be open.

02 12 51 07	CDR	It's open.
02 12 51 27	CC	Okay, Aquarius. We're GO on the circuit breaker configuration as you have it now.
02 12 51 36	SC	Roger.
02 12 52 04	CC	And, Aquarius, tests in the simulator just showed that if you want to let the PGNS DAP hold your attitude for you, it will.
02 12 52 16	CDR	Okay, very well.
02 12 52 30	CDR	And, Jack, because it will take quite a while to get back to the attitude, I think we ought to think about going there very shortly.
02 12 52 37	CC	Roger. I have a pad for you. I have a P30 maneuver pad.
02 12 52 48	CDR	Roger. Stand by.
02 12 52 53	CDR	... - -
02 12 52 54	LMP	Go right ahead, Jack.
02 12 52 58	CC	Okay. We want you to hold your maneuver until we finish making the load. We haven't completed it yet. Are you ready to copy P30 maneuver pad?
02 12 53 07	CDR	That's affirm.
02 12 53 09	CC	Okay. Here we go. The purpose is midcourse correction for free return. NOUN 33: 061:29:42.84; minus 0021.3, plus 0004.1, minus 0031.2; HA and HP are NA; DELTA-V 0038.0; 031, 120, 298, minus 00213, plus 00041, minus 00312; COAS NA. And I have your LM GDA angles. Pitch 5.86, roll 6.75. Your DPS throttling, 5 seconds at 10 percent, burn the rest at 40 percent. Your ullage will be two jets for 10 seconds.
02 12 54 57	LMP	Okay, Jack, we have a P30 maneuver pad, a midcourse for free return. NOUN 33: 061:29:42.84; minus 0021.3, plus 004.1, minus 0031.2; HA and HP N/A; DELTA-V_R 0038.0; 031, 120, 298; minus 00213, plus 00041, minus 00312. COAS N/A; GDA angles; pitch 5.86, roll 6.75; DPS throttle 5 seconds at 10 percent; burn the rest at 40 percent. And we need a two-jet, 10-second ullage.

02 12 56 02	CC	That's a good readback, Fred. I'd like to verify, however, in NOUN 81, in V_Y, it's plus three balls 41.
02 12 56 14	LMP	Okay. NOUN 81, V_Y is plus 0004.1.
02 12 56 21	CC	Good readback. Let's press on with the checklist.
02 12 56 27	CDR	Okay. And, Jack, find out about using TTCA to maneuver with.
02 12 56 32	CC	Okay. We're finished with the computer, it's yours, and we recommend using the TTCA to maneuver with.
02 12 56 41	CDR	Roger.
02 12 56 43	LMP	Okay, I'm back on the checklist, page 6. Jack, under PGNS turn-on and self-test. We've done everything except the self test here on this page. Do you want to do that at this time?
02 12 57 28	CC	Okay. Aquarius, negative on the PGNS self test. Page 7.
02 12 57 37	LMP	Okay. I'll scratch page 6 and on page 7, we're not going to activate the - or rather we had the S-band activated, ECS Activation I have all done. And, at the bottom of the page, the docked IMU coarse aline is done.
02 12 58 03	CC	Roger.
02 12 58 14	LMP	We've - Okay, we've also completed, I guess in essence, all of page 8.
02 12 58 22	CC	That's affirmative and page 9 to boot. Scratch VHF. We've done the T_{ephems}.
02 12 58 36	LMP	Okay. You've updated it, that's right. We cranked in the time.
02 12 58 52	CDR	And, Houston, let's go to activation - or get into page 10 and see what we did there.
02 12 58 58	CC	Okay. The only item on page 10 is to deploy the landing gear.
02 12 59 06	CDR	Okay, we'll do that now.

02 13 00 10	LMP	Okay. The landing gear are down and locked, Jack, and looking ahead now at page 11, we've done all of that.
02 13 00 24	CC	We verify that. Page 12.
02 13 00 31	LMP	Okay, and I assume in amongst all those numbers you pumped up, we got a REFSMMAT and STATE VECTOR, is that correct?
02 13 00 39	CC	That's affirmative. You've got that. So you can delete page 12.
02 13 00 52	LMP	Hey, on 13, you've read us up the fine aline angles and we've cranked those in.
02 13 01 01	CC	Affirmative.
02 13 01 08	LMP	Okay, so now we're up to - we've got to do DAP set, the gimbal/throttle test.
02 13 01 13	CC	That's - Okay, Aquarius. We recommend omitting the DAP set, gimbal/throttle test - Just make sure the gim - DECA POWER and DECA GIMBAL circuit breakers are closed.
02 13 01 33	LMP	Okay, we're going to proceed now with the DAP set, gimbal/throttle test, is that correct? Or did you say delete it?
02 13 01 40	CC	Aquarius, delete the DAP set, gimbal/throttle test. Just ensure that the DECA POWER and the DECA GIMBAL are closed.
02 13 01 49	CDR	Okay. Houston, DECA POWER is OPEN at this time. Do you want me to close it?
02 13 01 54	CC	Affirmative, Jim. Close the DECA POWER.
02 13 02 00	CDR	It's CLOSED. We deleted that.
02 13 02 27	LMP	Okay. Also out of that list, Jack, we need the COMMANDER's THROTTLE set to THROTTLE and MIN.
02 13 02 58	LMP	Houston, if I recall the launch set of the gimbals, the GDAs are not correct here, and where are we going to get those set for the burn?
02 13 03 14	CC	Stand by 1.

02 13 03 33	CC	Okay. Here's the word on the DAP set, gimbal/ throttle test. Let's do step 1 and step 2, and that'll get our gimbal set.
02 13 03 50	LMP	Roger.
02 13 04 20	LMP	Okay, Jack, we're going to have to back up on this, if we're going to follow the procedure here, which has us go MODE CONTROL; PGNS, AUTO, we're going to have to pull the TCA breakers to keep from firing jets.
02 13 04 53	CC	Stand by, Fred.
02 13 05 28	CC	Stand by on step 1, Fred. We're getting the word for you. How do you like this SIM?
02 13 05 42	CDR	It's a beauty.
02 13 06 09	CC	Okay, Aquarius, we recommend you do the DAP set and gimbal/throttle test as per the checklist. Go PGNS AUTO and proceed.
02 13 06 21	CDR	Well, we're going to fire our thrusters as soon as we go to AUTO because we've got those thrusters in - the thruster circuit breakers. Do you want us to do that and stop?
02 13 06 50	CC	Okay, Aquarius, we're recommending you go to AUTO. Let the thrusters fire and settle down and proceed with the test.
02 13 07 06	CDR	We're in PGNS AUTO.
02 13 07 09	CC	Roger, your DAP is set, you're in wide deadband. That ought to do the trick.
02 13 07 15	CDR	Roger.
02 13 07 19	CC	Okay, we're looking at it, Aquarius. We're ready to proceed with the test.
02 13 07 26	LMP	Okay, we're proceeding.
02 13 07 52	LMP	Okay, and Houston, you - you're looking at the weights now. Those are still good, right?
02 13 08 01	CC	You're GO on the weights.

02 13 09 05	CC	Aquarius, Houston. We'd like you to recycle on the DAP load and change your DAP to 32021. Over.
02 13 11 05	CC	Okay, Aquarius. We're looking at your gimbal and we notice that we got a four-jet ullage loaded in the DAP and we gave you two jets on the pad. But, let's go with what we've got loaded. It'll be a four-jet ullage.
02 13 11 18	LMP	Okay.
02 13 11 40	LMP	Okay, Houston. How does the GDAs look now?
02 13 11 45	CC	The GDAs are GO as they are. Press on.
02 13 12 09	CDR	Okay, Houston, we're going to do the DPS pressurization and checkout.
02 13 12 16	CC	Stand by 1.
02 13 12 34	CC	Okay, your gimbals are within 0.3 and we're ready for the DPS pressurization and checkout.
02 13 13 33	LMP	Okay, Houston, do you want to follow up on page 15 with RCS checkout? In essence, we've kind of already done that.
02 13 13 47	CC	You're right, Aquarius. Let's delete the RCS checkout. And a DPS looks GO.
02 13 15 43	CDR	Houston, we're going to do a PGNS AUTO maneuver to the attitude.
02 13 15 49	CC	Stand by on that. Aquarius, we recommend driving it around there manually with a TTCA.
02 13 15 58	CDR	Okay, we'll have to use the TTCA. Roger.
02 13 21 10	CDR	We're going to AUTO now, Houston, to try to damp the rates. We're at the attitude.
02 13 21 22	CC	Roger, Jim. We verify the attitude.
02 13 21 27	CDR	Roger.
02 13 23 37	LMP	And, Houston, we'd like to confirm, do you want the VERB 65 ENTER in there?
02 13 23 45	CC	Affirmative on the VERB 65.

02 13 23 49	LMP	Okay.
02 13 24 12	LMP	Okay, Jack. I got another question on page 18. At 1 minute, I concur with MASTER ARM ON, but I wonder why I have to have the ABORT STAGE breaker in. We sure don't want any staging now.
02 13 24 38	CC	Aquarius, delete the ABORT STAGE circuit breaker CLOSE. Leave it open.
02 13 24 46	LMP	Roger. Will delete.
02 13 24 55	LMP	Okay. Also, Jack, since we have four-jet ullage versus two, do you want - still want 10 seconds ullage or do you want 5 now?
02 13 25 09	CC	Okay, Aquarius, we'll use automatic ullage.
02 13 25 18	LMP	Okay. We'll just let the 7-1/2-second AUTO ullage do it.
02 13 25 23	CC	Roger, and we'd like to do this in manual throttle, so on page 17 about two-thirds of the way down, THROTTLE CONTROL, MANUAL, vice AUTO.
02 13 25 35	LMP	Okay. We're set to MANUAL.
02 13 25 58	CDR	What's the 203 ... ?
02 13 26 05	CC	ENTER on the 203, Jim.
02 13 26 11	CDR	We've got 203 in the DSKY now and it looks as though it requires work, can we pass it?
02 13 26 16	CC	Aquarius, ENTER on the 203.
02 13 26 22	CDR	Wait a minute.
02 13 26 51	CC	Aquarius, we'd like to verify that your throttle is in the MIN position.
02 13 26 58	CDR	That's affirm.
02 13 27 00	CC	And, in the event that you have to do a manual takeover, turn the ENGINE GIMBAL OFF, MODE CONTROL to ATTITUDE HOLD, and use the hand - use the TTCA.
02 13 27 16	CDR	Roger.
02 13 28 14	LMP	Okay, 1 plus 30 to burn.

02 13 28 20	CC	Roger.
02 13 28 45	LMP	Okay, MASTER ARM's ON; 1 minute.
02 13 28 53	CC	Roger, Aquarius. You're GO for the burn.
02 13 29 55	CDR	40 percent.
02 13 30 04	CC	Okay, Aquarius. You're looking good.
02 13 30 25	CDR	AUTO shutdown.
02 13 30 40	LMP	Okay. You're looking at 1685 now, Jack.
02 13 30 46	CC	Okay. You're GO in the residuals, proceed.
02 13 30 55	LMP	Okay. When you say GO on the residuals, you mean don't trim them. Is that right?
02 13 31 00	CC	That's affirmative. No trim required.
02 13 31 06	CDR	Roger.
02 13 31 08	LMP	Okay.
02 13 32 17	CC	Aquarius, check your MASTER ARM OFF, please.
02 13 32 44	CDR	Okay, Houston. Burn's complete. Now we have to talk about powerdown, and what do you want us to do with the PGNS?
02 13 32 52	CC	Roger. We're looking at that right now, and you'll be the first one to get the word.
02 13 33 19	CDR	And, Houston, it's doubtful right now whether we'll be able to see the stars in this configuration. The only way we could possibly get alinement is with the Earth and the terminator or the Moon and its terminator and I'd sure like to have you look at a powerdown - keeping the PGNS if at all possible.
02 13 33 49	CC	Roger, Jim. We'll get the word for you.
02 13 35 24	CDR	And, Houston, we're in an ATT HOLD mode, can we turn off the buses?
02 13 35 40	CC	Stand by on that one, Jim.

02 13 38 13	CC	Okay, Aquarius. We're working on what's going to happen next. In the meantime, we'd like to take some high-power items off the line, so on panel 11, open DECA POWER, and open DECA GIMBAL. On 16, open the ATCA breaker.
02 13 38 36	LMP	Okay, on 11, we got DECA POWER, DECA GIMBAL, OPEN. On 16, we got the ATCA breaker OPEN.
02 13 39 37	CDR	And, Houston, while you're thinking, see if you can come up with a procedure of perhaps using the command module optics with manual drive to perhaps look for stars.
02 13 39 51	CC	Roger.
02 13 41 24	CDR	And, Jack, Aquarius. While you're thinking - before we had our COMM problems, we were wanting to know what to - whether we should hook up the side hatch urine dump system. So we wouldn't freeze up the normal urine dump system.
02 13 41 45	CC	Roger. We gave you a GO on that earlier. Sorry, you must have missed it. Use the side hatch for urine dump.
02 13 41 54	CDR	Okay.
02 13 41 56	CC	And, how are the stars out the window now?
02 13 42 13	CDR	Well, I'll look again, Jack, but at this attitude, the Sun is reflecting off of - off of quad 4 so bright that it's ruining any night vision and we still got particles floating around us; I'll have to take a long look and see if I can see any star patterns.
02 13 42 34	CC	Roger. And Aquarius, we're going to have to hand you over to a different site now, and we think maybe things will work better if this time we turn off the S-band transmitter/receiver, and bring it back up in 5 minutes. You copy?
02 13 42 59	CDR	Okay. Stand by 1.
02 13 43 10	CDR	Okay. I understand you want us to turn off the S-band transmitter/receiver and bring it up in 5 minutes. Is that correct?
02 13 43 15	CC	That's affirmative.

02 13 43 20	CDR	Tell us when.
02 13 43 42	CDR	And you want us to maintain attitude control.
02 13 43 46	CC	Affirmative on the attitude control.
02 13 43 48	CDR	That's auto attitude control. Okay. You maintain auto attitude control.
02 13 43 56	LMP	Okay, Jack, I'm back on the line now. On the S-band, you want me to turn off the transmitter/receiver and the power amps are off for 5 minutes. Is that - when you give me the word - is that what you want?
02 13 44 10	CC	Aquarius, leave the power amplifier the way it is. Turn the transmitter/receiver off for 5 minutes. Now.
02 13 44 19	LMP	Okay. You tell me - you tell me when.
02 13 44 22	CC	Okay. Turn it off now. See you in 5 minutes.
02 13 44 26	LMP	Okay. It's gone off. It's gone off for 5 minutes.

END OF TAPE

02 13 52 44	CC	Aquarius, Houston. How do you read?
02 13 52 52	LMP	Okay. You're loud and clear there, Jack.
02 13 52 54	CC	Roger. Same here. We're - We're still discussing the next move.
02 13 53 04	LMP	I figured it. Let's just make it a good one.
02 13 53 18	CC	We're looking real close at water usage profiles, and right now things are kind of swinging toward leaving the IMU powered up and powering down the LGC, but we'll have more word for you shortly. And we recommend for sleeping that you leave one guy on watch. We recommend you don't make any urine dumps if you can help it, because it'll make the debris problem worse than it is now. And we have some items that you might want to transfer to the LM, some towels, some penlights, fecal bags, UTS. And do you have any more items that we can help you out with at the moment?
02 13 54 17	LMP	Okay. Stand by on your latter list there, Jack. I understand no urine dumps. I guess we'll work through the UCD and all the bags we got; and real quick there, can you give a DAP load that we want in here now to conserve the RCS.
02 13 55 21	CC	Okay. For attitude control coordinates, we're recommending manual control VERB 76 and watch your middle gimbal angle. Your DAP load that you have now looks good.
02 13 55 37	LMP	Okay. It's ATT HOLD VERB 76 for the guy on watch. And the DAP load we got right now is okay.
02 13 58 17	CC	Aquarius, our decision for the time is to leave the IMU powered up, power down the LGC, and power down other nonessential items. We'll be coming up with a more precise checklist as soon as we can get it. Over.
02 13 58 36	LMP	Okay. The decision is to keep the platform, power down the computer, and we'll be standing by for further word on the powerdown, Jack.
02 13 58 47	CC	Roger.

02 13 59 33	CC	And, Aquarius, for your information, we now have 136-mile perigee. Confirmed by Doppler.
02 13 59 47	LMP	Okay. 136-mile perigee now. That's very nice.
02 14 00 09	LMP	Oh, wait a minute, Jack. Did you say pericynthion or perigee?
02 14 00 13	CC	I meant pericynthion.
02 14 00 18	LMP	Ah. That's better.
02 14 05 19	CDR	And, Houston, we pulled out your UPDATA LINK circuit breaker, so if you want to update it for anything, let us know and we'll put it back in.
02 14 05 27	CC	Roger, Jim. We will.
02 14 09 41	CC	Aquarius, AFT OMNI, please.
02 14 09 47	CDR	AFT OMNI.
02 14 14 26	LMP	Houston, do you read Apollo 13?
02 14 14 30	CC	This is Houston. Go ahead. Reading you weakly.
02 14 14 36	CDR	Okay, Jack. We don't want to bug you, but you ought to be thinking - or what your thoughts are concerning what the next burn will be. I got to figure out a watch schedule and the sleep schedule and just how we can meet the next maneuver.
02 14 14 55	CC	Roger. We're getting you a flight plan update. We're still computing on your next burn, and we're getting ready to give you a procedure for powerdown.
02 14 16 34	CC	Aquarius, one idea on managing the OMNI antennas. It might make it easier on everybody if we disabled the UPLINK SQUELCH and managed the antennas by switching when we hear the noise. Over.
02 14 16 58	CDR	Roger. Will do.
02 14 26 07	CC	Okay, Aquarius. Here's what we're going to do. We'd like you to point the LM X-axis either north or south. That's the positive X-axis. It appears to us that it would be closer to orient the LM plus X-axis toward the south. Do that with the LGC powered up using the TTCA. After that, we

propose to power down the LGC to save some power. However, this means that we lose the use of the TTCA, and we'll have to control the spacecraft with the hand controller in the DIRECT mode. Request your - your position on these two items.

02 14 27 34 CC Aquarius, Houston. How do you read?

02 14 27 45 CDR Okay, Jack. Understand. You want us to point the LM X - plus X-axis to the south using the TTCAs with the LGC powered up. Then, by powering down the LGC, we'll lose a TTCA. I wasn't too successful in controlling the spacecraft in attitude only, but I might be able to keep it out of gimbal lock.

02 14 28 14 CC That's affirmative, Jim. We'd keep your ball powered up and go to DIRECT on the hand controller. And maintain attitude in a DIRECT position.

02 14 28 39 CDR Okay. Understand; and do you want some sort of a PTC mode, Jack?

02 14 28 47 CC Affirmative. We'll take whatever PTC mode you can set up, Jim.

02 14 28 54 CDR Okay. And since you know our approximate attitude, how about just getting me something to find you on the DSKY for a southerly plus X-direction.

02 14 29 04 CC Roger. Stand by 1.

02 14 30 35 CDR And one other question, Houston. When you say power down the DSKY or the LGC, do you mean going into 06 or multiple circuit breaker?

02 14 30 48 CC Stand by on powering down the DSKY, Jim. We'll give you the procedure for that. The procedure that we - -

02 14 30 57 CDR Okay.

02 14 30 58 CC - - the procedure that we have is listed in several places. It's in the Contingency checklist under "Power down" on page 1, second paragraph.

02 14 31 21 CC And we'll give you that word when we want you to do that. That's LGC only, not to power down the IMU. But we'd like to have you hold off on that until we send you the word. Over.

02 14 31 38	CDR	Understand.
02 14 33 57	CC	And, Aquarius, while we're working on this, we have a proposed flight plan update for your working and resting cycles. And - You ready to copy?
02 14 34 14	LMP	Okay. Do you want me to write this in the flight plan, per se, Jack?
02 14 34 19	CC	You can probably write it on a piece of scratch paper. This is pretty easy.
02 14 34 31	LMP	Okay. Go ahead. We got a lot of scratch paper.
02 14 34 39	CC	Okay. We're suggesting that the LMP rest while the CMP and CDR are awake. LMP ought to hit the sack at about 63 hours, coming up in 25 minutes. And you get to rest for 6 hours. You get up at 69 hours. At 70 hours, the commander and the command module pilot sleep for 6 hours until 76 hours. Around 70 - 76-1/2 to 77 hours, we'll do a P51 and a 52. At 78:30, we'll load P30 and aline AGS to PGNS. Our ignition time for a second burn will be, presently, 79:25:26.5, and we'll have a pad for you shortly. We suggest that all of you eat after the burn. That'll be 81 to 82 hours. Let the CMP and CDR eat while you are sleeping. And that you grab a bite as soon as you can. Over.
02 14 37 05	LMP	Okay, Jack. As I read that, the LMP is to go to sleep at 63:00 for about 6 hours. During that period, the CDR and CMP should try to get a bite to eat. I'm to awake at 69 hours. CDR and CMP sleep at 70 hours, and they are to awake at 76 hours. And we should plan on doing our P51, P52 at 76 hours or 76:30. At 78:30, we're going to load a P30 and aline AGS to PGNS. Second maneuver is to take place at 79:25:26.5 for ignition time. Then we're all to eat at 81 to 82 hours.
02 14 38 05	CC	Okay. With a minor modification, your P51, P52 will be about 77 hours, and that's the period of darkness. And the commander and the CMP ought to eat around 68 to 69 hours, and you should eat between 69 to 70 hours just after you get up. We have left an hour in there where everybody is awake together to talk things over. Go ahead.

02 14 38 44	LMP	Okay. I'll eat after I wake up between 69 and 70.
02 14 38 53	CC	All right we have additional - -
02 14 38 55	LMP	- - and I've got the correction to P - -
02 14 38 59	CC	Go ahead, Fred.
02 14 39 00	LMP	Yes. We got the word the P51, P52 is going to be done around 77 hours, while we're in darkness.
02 14 39 11	CC	That's affirmative. And we have a work-rest cycle laid out for further on, which we can relay to you later.
02 14 39 22	LMP	Okay.
02 14 39 40	CDR	Okay. And, Houston, you have advice on what attitude you want me to go to.
02 14 39 50	CC	Okay. That'll be the next bit of information. I'll get that for you, Jim.
02 14 39 56	CDR	Okay.
02 14 41 43	CC	And, Aquarius, just to get you thinking in that direction, we've run a fairly thorough analysis, and we've found out that it's going to be cheaper to keep the LGC and the DSKY up and turn the inverter and the ball off. It's going to save us 1 amp and also some water, so it looks like what we're going to do. And we'll have to monitor the middle gimbal angle. And we'll get the procedure on that, and it'll also be an easier control mode where we'll be able to use the TTCA through the - through the DAP.
02 14 42 17	CDR	That sounds great, Jack.
02 14 47 28	CC	Aquarius, Houston. We've got a procedure for you. Ready to copy?
02 14 47 40	CDR	Ready to copy.
02 14 47 42	CC	Okay. It's pretty easy. We see you've already got VERB 16 NOUN 20 called up there and so we want you to, in maneuver and PGNS ATTITUDE HOLD, use the TTCA. We want you to, on the commander's ball, pitch to 267.5 and yaw to minus 4.5. And when you do this in VERB 16 NOUN 20, on the DSKY, you ought to read plus 00120, plus 26750, and plus 00450. Go ahead.

02 14 48 34	LMP	Okay. We're to drive the commander's ball to a pitch of 267.5, yaw minus 4.5. And we should have in 16 20 at that time, plus 00120, plus 26750, plus 00450.
02 14 48 56	CC	That's a good readback. We'll watch the maneuver.
02 14 56 25	CDR	Houston, Aquarius.
02 14 56 27	CC	Go ahead, Aquarius.
02 14 56 31	CDR	Roger. You didn't mention roll on the ball. Do you want roll zero?
02 14 56 42	CC	The roll ought to be plus 1.2, Jim.
02 14 56 49	CDR	Roger.
02 15 03 41	CDR	Houston, Aquarius.
02 15 03 44	CC	Go ahead, Jim.
02 15 03 48	CDR	Okay. We're just about there in pitch and in ... middle gimbal angle, but that other gimbal angle didn't look like it pulled the right way. I tried both methods.
02 15 04 02	CC	Yes. I been looking at that, too, and we're asking why, and we'll get an answer for you.
02 15 04 20	LMP	Yes. Houston, I wonder if you're accounting for being a bit off the bellyband here, and I've gone through GASTA.
02 15 04 38	CC	And, Fred-o, I know you're supposed to start sleeping here pretty soon, but we got a new PC plus 2 pad, P30 maneuver pad for you.
02 15 04 56	CDR	Stand by.
02 15 05 32	LMP	Okay. Go ahead, Jack.
02 15 05 35	CC	Okay, Fred. P30 maneuver purpose is PC plus 2, DPS to this time, we're going to the MPL. And NOUN 33, 079, 27, 4013, plus 08144, minus 00443, minus 02226, apogee is N/A, perigee is plus 00205, 08455, 420, 268, 261, plus 08155, minus 00443, minus 02187, COAS is N/A. Your GDA ought to be okay as it is from the last burn, but pitch ought to be at 5.85; in roll, it's 6.74. Your ullage will be two jets for 10 seconds. Your DPS

throttle will be 10 percent for 5 seconds, 40 percent for 21 seconds, and the remainder at full throttle. And for your information, this will put you in the water at 142 plus 47. Over.

02 15 07 46 LMP Okay. DPS, pericynthion plus 2 into the MPL, 079, 27, 4013, plus 08144, minus 00443, minus 00226, N/A, plus 00205, 08455, 4 plus 20, 268, 261, plus 08155, minus 00443, minus 021, 2187, N/A. GDA should be okay as is, which hopefully is pitch 5.85, yaw 6.74. Two-jet ullage for 10 seconds, the DPS throttle 10 percent for 5 seconds, 40 percent for 21 seconds, 100 percent for the rest of the burn. And this should put us into the water at 142 plus 47.

02 15 09 03 CC Okay, Fred. I have a correction in NOUN 81. DELTA-V_Z is minus 02226. Read back.

02 15 09 22 LMP Okay. DELTA-V_Z in NOUN 81 is minus 02226.

02 15 09 28 CC Okay. Good readback.

02 15 09 41 LMP Somehow that didn't add up with the DELTA-V_X to give a DELTA-V_R of that magnitude. It seems like it'd been bigger.

02 15 09 52 CC Okay. We'll take another look at it, Fred.

02 15 12 29 CDR Okay, Houston. I'm not having too much luck holding this particular attitude.

02 15 12 42 CC Okay, Jim. Stand by 1.

02 15 14 17 CC Okay, Aquarius. When you get her pretty much in attitude there, and it looks like you're as close as we need to be, we'd like to try a control mode and see if it will work; sort of a semi-PTC. We'll leave the ball powered up for this, and if this doesn't work, why, we'll have to revert to ATTITUDE HOLD mode. But - Stand by 1, please.

02 15 15 03 CC We'd like you to think about this control mode, Jim, and see if you think it might work from what you know right now. We're a little skeptical, but we'd like to put it to you. So, once you get in a pretty good attitude, monitor in VERB 16 NOUN 20, go to PGNS MINIMUM IMPULSE, VERB 76, as we have, and set up a yaw rate - yaw rate to the right. Monitor the middle gimbal on

		R_3 on the DSKY and see if she'll kind of stabilize out. If not, the only other suggestion we've got is to go to PGNS ATTITUDE HOLD. We'll keep the ball up until you make this evaluation.
02 15 15 45	CDR	Okay, Houston. You cut out, say again.
02 15 15 51	CC	Okay. Where'd you lose me, Jim?
02 15 15 56	CDR	I lost you when you said try the control mode; you're a little skeptical.
02 15 16 01	CC	Okay. From what you say, we have to be a little skeptical of this procedure, but we'd like to have you try it and have you evaluate it. You can monitor the middle gimbal on R_3. Before we power down the ball, we want your evaluation. The next best choice is PGNS ATTITUDE HOLD. Over.
02 15 16 24	CDR	Okay. I'll try it.
02 15 16 53	CDR	Okay. Go ahead with the control mode procedure.
02 15 17 30	CDR	Hello, Houston; Aquarius.
02 15 17 33	CC	Go ahead, Aquarius.
02 15 17 36	CDR	Okay. I'm not ... you. I can monitor register 3. I can probably keep it out of ... - going into gimbal lock.
02 15 17 49	CC	Roger. How are pitch and roll?
02 15 18 40	CDR	Okay. I think I can control the gimbal angles in 16 20 with the compressors the way they are, but I'll have to try MINIMUM IMPULSE - Just a minute.
02 15 19 04	CMP	Okay, Jack. I've a question - one more question about Odyssey.
02 15 19 08	CC	Go ahead.

END OF TAPE

02 15 19 14	CMP	Okay, I still have the PYRO A sequence A and PYRO B sequence B circuit breakers in. Do you want those out?
02 15 19 23	CC	Stand by 1.
02 15 19 37	CC	Odyssey, Houston. The two circuit breakers you referred to, leave them in.
02 15 19 45	CMP	Okay. Copy. Leave them in.
02 15 19 59	CDR	Okay, Houston. I can control yaw in minimum impulse, but stand by on pitch.
02 15 20 17	CC	And, Fred-o, the DELTA-V_R resultant computes with the components.
02 15 20 29	CDR	Fred's off the COMM now, Jack.
02 15 20 32	CC	Roger. Your PAD is good.
02 15 20 35	LMP	And, Jack, we didn't get that whole sentence there.
02 15 20 39	CC	Okay. I said that the DELTA-V_R that Fred questioned computes well with the component - its rms.
02 15 20 49	LMP	Okay. Copy.
02 15 20 54	CDR	Okay, now. Jack, let's go over this once more. You wanted me to try out control of the spacecraft in the PULSE mode. Is that correct?
02 15 21 03	CC	That's affirmative. Set up a yaw rate and monitor the middle gimbal angle.
02 15 21 16	CDR	Okay. I can do that. I'm not too sure whether I can control roll or pitch in pulse, but I can control yaw in pulse - yaw in pulse on the ball.
02 15 21 30	CC	Roger. And remember we're not going to have a ball there, so that we're going to be monitoring CDUs on the DSKY, and if we get it off, it will be pretty hard to figure out where to fly back to; and, well, in addition, have to control the OMNIs while we're doing this.

02 15 21 52	CDR	Roger.
02 15 22 06	CDR	Without the ball, I still have use of the TTCA for control of the - angles.
02 15 22 12	CC	Affirmative. You'll have the TTCA for pitch and roll.
02 15 22 18	CDR	Okay. I think I can do that without the ball, and if you just give me the TTCAs I think I can control the spacecraft using 16 20.
02 15 22 31	CDR	I'm going to yaw right.
02 15 22 49	CDR	Okay, Jack. I am now - The REGISTER 1 is in the DECREASE mode.
02 15 23 36	CDR	And, Houston, do you see anything wrong with this spacecraft motion?
02 15 23 46	CC	We have a data drop on right now, Jim; we'll look at it as soon as it comes up.
02 15 24 52	CC	Okay, Aquarius. We're going to dispense with this control mode. We'd like you to fly the machine back to the original attitude that you had, and we'll go PGNS ATTITUDE HOLD, and then we've got to get that ball off the line to save some power. And then, in order to keep even heating, every 15 or 30 minutes, we'll give you a call to give us 90 or 180 degrees of roll - of yaw.
02 15 25 27	CDR	Okay. You want me to go back to original attitude. I'll be going back to it now.
02 15 28 36	CDR	Okay, Houston; Aquarius. I'm flying it back over towards the initial angles you gave me of a pitch of 257. I'll get near the bellyband in roll and yaw; then I'll go to PGNS ATT HOLD.
02 15 28 47	CC	That's affirmative, Jim. And then we're going to have you go through a powerdown procedure.
02 15 28 56	CDR	Okay.
02 15 29 02	CC	And you'll need VERB 77 with ATT HOLD when you get there.
02 15 29 08	CDR	Will do.

02 15 31 48	CDR	Okay, Jack. Have I gotten your 360 on yaw and roll? I'm going to go to ATT HOLD.
02 15 31 56	CC	Roger. And then we want to get the ball part down.
02 15 32 02	CDR	Okay. Stand by.
02 15 32 52	CDR	Okay. I'm now in PGNS ATT HOLD. And are you reading my DSKY angles?
02 15 32 58	CC	Roger. We see them.
02 15 33 03	CDR	Now, you want me to power down the ball, and if you'll give me the procedure for that, I'll do it right away.
02 15 33 06	CC	Okay. We'll buy what you've got on the DSKY there, and we'd just like to go through an overall powerdown procedure, and in so doing we'll catch the ball and inverter and it will only take a few minutes. So are you ready to start on panel 11?
02 15 33 23	CDR	Roger. Jack will copy, and I'll do the work.
02 15 33 27	CC	Okay. Panel 11, top row, open all the circuit breakers.
02 15 33 35	CDR	All circuit breakers on top row coming open.
02 15 33 48	CDR	They're all open, top row.
02 15 33 50	CC	Okay. Second row, close the first six on the left through the ISOL VALVE and open all to the right of that.
02 15 34 07	CDR	Okay. First six on the left are closed - That's through the ISOL VALVE, but I opened up every one from there on.
02 15 34 13	CC	Okay. Third row, open up the next five - correction - Open up the first five on the left, close AOT HEATER, close SIG CONDITIONER 1. Close ATTITUDE DIRECT, and open the rest on row three.
02 15 34 46	CDR	Do you want ATCA (PGNS) open?

02 15 34 53	CC	Leave ATCA (PGNS) closed; four breakers on the third row must be closed. AOT HEATER, SIG CONDITIONER 1, and ATCA (PGNS), ATTITUDE DIRECT CONTROL. Our mistake, good going.
02 15 35 13	CDR	Okay. I'm opening up ENGINE START OVERRIDE right now. And that row's taken care of.
02 15 35 30	CC	Okay. On the fourth row. Open - From the left, open the first five - correction - Close the first five, and open CABIN FAN 1. Close the three GLYCOL PUMP circuit breakers; open all the COMM breakers, except for COMMANDER'S AUDIO; close it. All the PGNS breakers, open - correction - Open the first three PGNS breakers, close LGC/DSKY, IMU STANDBY, IMU OPERATE.
02 15 36 23	CDR	That's complete, Jack.
02 15 36 27	CC	Okay. And EPS, close BAT FEED TIES, CROSSTIE BAL LOAD, and open the CROSS TIE BUS. Close the next three; open ASCENT ECA CONTROL, ASCENT ECA, and INVERTER 1. Close DC BUS VOLT. Go ahead.
02 15 37 02	CDR	That's complete, Jack. Panel 11 is configured.
02 15 37 09	CC	Okay. Let's go over to panel 16, top row, and starting from the left - Open the first four.
02 15 37 27	CDR	Stand by, Jack.
02 15 37 38	CDR	Okay. Starting from the left, open the first four.
02 15 37 43	CC	Okay. And close the ISOL VALVE, keep your TCA breakers closed, close the CROSSFEED, open the next two displays. Close the MAIN SOV and the PROPULSION breakers should all three be open.
02 15 38 08	CDR	Roger. The main valves are closed, and the DISPLAY ENGINE OVERRIDE LOGIC's coming open, and the PQGS and ASC He REG are open.
02 15 38 18	CC	That's affirmative. The second row: they should all be open except for three breakers under instrumentation. Close SIG SENSOR, PCM/TE, and SIG CONDITIONER 2. Over.
02 15 38 41	CDR	Roger. Do you want SUIT FLOW CONTROL open?
02 15 38 57	CDR	ENGINE ARM coming open and ASA I guess will be open. Is that correct?

02 15 39 01	CC	We just got a change on that. Let's keep the ASA closed.
02 15 39 09	CDR	How about SUIT FLOW CONTROL and ENGINE ARM?
02 15 39 22	CC	Okay, Jim. SUIT FLOW CONTROL can be open, and ENGINE ARM - ENGINE ARM open.
02 15 39 40	CDR	Okay. Let's go to row 3.
02 15 39 44	CC	Okay. Row 3 under COMM. Open DISPLAYS, close SE AUDIO, open VHF A TRANSMITTER and B RECEIVER, close the PRIMARY S-BAND circuit breakers, both of them. Open the S-BAND ANTENNA, PMP closed, TV open, and all the rest of them open under ECS, except CO_2 SENSOR, closed.
02 15 40 24	CDR	Roger.
02 15 40 31	CC	Okay. Under row 4: under HEATERS, your RCS QUAD heaters should - four of them - be closed, open DISPLAYS, open S-BAND ANTENNA, open SEQUENCE CAMERA. Under EPS, open DISPLAYS, close DC BUS VOLT, open INVERTER 2, open ASCENT ECA CONTROL and ASCENT ECA, close DESCENT ECA, DESCENT ECA CONTROL, TRANSLUNAR BUS TIE, close CROSS TIE BAL LOADS, open CROSS TIE BUS, close BAT FEED TIES. Over.
02 15 41 29	CDR	That's been completed, Jack.
02 15 41 55	CC	Okay, Jim. And we've already got a change to what we just told you. Under ECS, close the CABIN REPRESS, and insure that the ASA BREAKER is closed under S and C.
02 15 42 16	CDR	The ASA BREAKER is closed, but I closed the CABIN REPRESS.
02 15 42 25	CC	Okay, Jim. Looks like what we have to do is - In order to maintain even heating, we just have to yaw the whole machine about 90 degrees per hour in increments. So we'll give you a call when it's time to yaw 90 degrees.
02 15 43 04	CDR	Okay. We have to YAW the machine as I understand it, Houston, and you'll give it to me in increments of 90 degrees.
02 15 43 11	CC	That's affirm.

02 15 44 16	CC	Okay, Jim. Your present configuration has the following features. We got the electrical BUSES cross tied through the BAL LOAD circuit breakers, and we have AUTO CABIN REPRESS. One thing we'd like to do right now is to give you an uplink, so immediately we have to, on panel 11, close the UPDATA LINK circuit breaker. Go to POO and DATA. Over.
02 15 44 52	CDR	Okay. We're going to POO and DATA. The circuit breaker is closed.
02 15 48 57	CDR	Houston, Aquarius. Did you say that you had a new pad for us to copy?
02 15 49 02	CC	Jim, I passed that newest pad that we have to Fred about 30 minutes ago. That's our latest. It's PC plus 2, and it begins with NOUN 33 of 79 hours 27 minutes and 40.13 seconds. You got that one?
02 15 49 25	CDR	Okay. We've got that one. What kind of a ATT HOLD MODE do you want us to do? Do you want us to do WIDE DEADBAND? I didn't ... on the DAP.
02 15 49 40	CC	Jim, the deadband is good the way it is. It's 5 degrees, if you want to stay in it. And stay in the PGNS ATT HOLD mode.
02 15 49 49	CDR	Okay.
02 15 50 33	CC	Two things, Jim. We want you to know that there's some pretty big attitude errors in, so if you go to AUTO, the computer is going to try to crank you around, and the other thing is don't drink water out of the LM.
02 15 50 54	CDR	Okay. You might think about this. You know we lost our oxygen pressure in the command module.
02 15 51 56	CC	Aquarius, we're finished with the uplink. The computer is yours, and you can open the UPDATA LINK circuit breaker.
02 15 52 18	CDR	Okay. We've opened up the UPDATA LINK, and we've gone OFF of DATA, and I've got 16 20 in the computer.
02 15 52 28	CC	Roger, Jim. I guess we're going to just kind of perk away here now.

02 15 52 37	CMP	Okay, Jack. One more question about Odyssey here.
02 15 52 45	CC	Go ahead, Jack.
02 15 52 50	CMP	Okay. How about the service module O_2 supply valve? Do you want that off?
02 15 53 01	CC	Affirmative. Service module O_2 supply off, Jack.
02 15 53 06	CMP	Okay. On the way.
02 15 53 17	CC	And, Jim, we see a PROGRAM ALARM in there. We think it's just got to do with pulling the UPDATA LINK circuit breaker - UPLINK too fast.
02 15 53 30	CDR	Roger. I don't see it. Should I reset?
02 15 53 40	CC	Go ahead and reset, Jim.
02 15 56 11	CDR	Houston, Aquarius.
02 15 56 16	CC	Go ahead, Aquarius.
02 15 56 21	CDR	One thought that might occur here is that if we have low descent water pressure, we might consider taking the PLSS water and fill it in reverse. If that works, you might look at a procedure for that.
02 15 56 34	CC	That's a good thought. Let us bounce that around a little.
02 15 57 12	CC	Okay, Jim. That's a good thought, and we've looked at that, and it looks like that's feasible. So if and when we need to do that, we will.
02 15 58 11	CDR	And, something else, Jack. When it's time for me to make my 90-degree yaw, what I planned on doing was going to NOUN 76 hold and just pulse and yaw several times until the yaw start and hope that pitch and roll stay within the limit.
02 15 58 37	CC	Roger. It sounds like a good plan and you can use your TTCA in MIN IMPULSE to take care of pitch and roll.
02 15 58 47	CDR	Okay.
02 16 00 21	CC	Aquarius, Houston. We see ASCENT O_2 tank number 2 building up again, so we'd like to use something out of it, so turn on ascent O_2 tank number 2 and turn off descent O_2.

02 16 00 39	CDR	Roger. Opening up ascent O_2 tank number 2, and turning off descent.
02 16 03 01	CC	And, Aquarius, Houston. We're starting to think about CO_2 buildup up in the command module there so we've got a recommendation, and what we're recommending is that you take the commander's hoses in the LM and put a cap over the red return hose and then figure out a way to fasten those hoses so they blow up into the CSM by extending them up through the tunnel as far as possible. And we'll get some flow out the blue side, circulate up and around the command module and to keep the CO_2 level down.
02 16 03 43	CDR	Roger. We're thinking of that too, and one problem is that the COMM is connected securely to the hose, so we've got to get the COMM cable off somehow to get that - So we'll still have COMM down here in the LM and you have the hose up there.
02 16 05 10	CDR	Houston, we're trying to extend that commander's hose by use of the vacuum hose.
02 16 05 22	CC	Sounds like a good plan if you can work that out, Jim.
02 16 06 58	CC	Aquarius, if you can shake Jack loose there, I've got a - some procedures for him to write down.
02 16 07 09	CDR	Okay. Stand by.
02 16 07 33	CMP	Okay, Jack. Is this a long one?
02 16 07 37	CC	Oh, it's about 12 - 15 lines. It's a matter of verifying some valves and so forth.
02 16 07 50	CMP	Okay. Go ahead.
02 16 07 53	CC	Okay. We want you to go in when you can and verify the following valves and leave them as we outline here. REPRESS PACKAGE valve, off; EMERGENCY CABIN PRESSURE, off; DIRECT O_2, off; DEMAND REG, off; both WATER ACCUMULATORS, off; MAIN REG A and B, open; WATER GLYCOL - correction - WATER and then GLYCOL TANK INLET and OUTLET, both. Now if you want to get some water, we recommend that you momentarily turn the SURGE TANK on to pressurize the system and then turn it off and take out water as required. Over.

02 16 09 33	CC	That's it, Jack. And another note on taking water; if you don't drain enough water so that - -
02 16 09 49	CC	Say again, Aquarius.
02 16 09 53	CDR	That wasn't us, Jack.
02 16 09 58	CC	Okay. One more note on the water, Jack. If you don't bleed the pressure off when you - don't take enough water to bleed the pressure off completely, the pressure that's left on there is going to drain away in a period of 1 to 3 hours. So it's a small amount of oxygen, but we might as well save it. So if you want to eliminate that problem you could completely drain the pressure off by putting the water in a water bag and saving it that way.
02 16 10 36	CMP	Okay. That's a good idea.
02 16 10 38	CC	So that's the end of my - -
02 16 10 39	CMP	What I'll do - let me repeat - Okay. Let me repeat it all back to you. REPRESS PACKAGE VALVE, off; EMERGENCY CABIN PRESSURE, off; DIRECT O_2, off; both the DEMAND REGs, off; both H_2O ACCUMULATORS, WATER GLYCOL ACCUMULATORS, off; MAIN REG A and B, open; WATER and GLYCOL TANK INLET and OUTLET, open; for water, momentarily pressurize the SURGE TANK, take out water as required. You're recommending drain out all the water until I can't get any more water out of it in order to conserve the oxygen.
02 16 11 34	CC	Okay. We just want you to turn off the water accumulators and not the glycol accumulator. Over.
02 16 11 49	CMP	Okay. These are the water accumulators on 382, right?
02 16 11 57	CC	That's affirm. The accumulators on 382.
02 16 37 40	CDR	Houston, Aquarius.
02 16 37 43	CC	Aquarius, Houston. Go.
02 16 37 48	CDR	Roger, Jack. We're asking whether P51 and a P52 are required in the back side of the Moon.

02 16 37 56	CC	I think so, Jim, but stand by while I verify it.
02 16 38 23	CC	Aquarius, Houston.
02 16 38 28	CDR	Go ahead.
02 16 38 30	CC	We think we know where the platform is, Jim. The tracking looks real good from the last burn. We feel just a P52 will be required.
02 16 38 39	CDR	Okay.
02 16 38 54	CMP	Joe, has your continued tracking changed our pericynthion altitude any?
02 16 39 01	CC	Stand by. We'll get the latest on that, Jack.
02 16 39 50	CC	Aquarius, Houston.
02 16 39 54	CMP	Go ahead.
02 16 39 56	CC	Roger, Jack. We're still looking at 137 miles and Doppler's confirming it. We will have a good update after 67 hours.
02 16 40 08	CMP	That's good. I want to say you guys are doing real good work.
02 16 40 13	CC	So are you guys, Jack.
02 16 47 06	CC	Aquarius, Houston.
02 16 47 13	CDR	Go ahead, Houston.
02 16 47 14	CC	Okay, Jim. We've come up with a COMM recommendation which we hope will save some power by powering down the power amplifier, if it works. And I'd like to read up the steps to you and have you think about them for a minute, and we recommend trying it before the first yaw maneuver. Over.
02 16 47 43	CDR	Okay. You can read up the steps.
02 16 47 48	CC	Okay. Step 1, BIOMED off; step 2, go to LOW BIT RATE; step 3, go to DOWNVOICE BACKUP; step 4, POWER AMP to PRIME; step 5, panel 16, POWER AMP CIRCUIT BREAKER open; step 6, RANGE FUNCTION switch, off. Read those back to me, and then I'll have a remark.

02 16 48 39	CDR	Okay. BIOMED, off; LOW BIT RATE; DOWNVOICE BACKUP; POWER AMP to PRIME; circuit breakers, panel 16, POWER AMP CIRCUIT BREAKER, open. RANGE FUNCTION switch, off.
02 16 48 56	CC	Okay. And the note says that you should be able to hear us. If we can't hear you in a couple of minutes, you should close the POWER AMP circuit breaker on panel 16, and we expect to save an amp or more on this. It should work in the present attitude. When we go to the new yaw attitude, we're thinking about powering up the steerable, leaving the POWER AMP off and, if we can get good COMM in that mode, we'll still save some power. So if you concur, why don't you go ahead.
02 16 49 44	CDR	Okay. In this mode, you should hear us - or we should hear you, but if you can't hear us, then we ought to close POWER AMP circuit breaker again. Is that right.
02 16 49 54	CC	That's affirm. We'll just run a little COMM check after you get done and see how we're doing.
02 16 50 03	CDR	Okay, fine. And if that all fails, we'll go back to our original configuration.
02 16 50 06	CC	That's affirm.
02 16 51 01	CDR	All amps PRIMARY.
02 16 51 04	LMP	POWER AMPs in PRIMARY.
02 16 51 06	CDR	Okay. Circuit breakers 16, POWER AMP circuit breaker, open; COMM; POWER AMP circuit breaker, open.
02 16 51 18	LMP	There's only one. Ready?
02 16 51 23	CDR	RANGE ... switch off.
02 16 51 28	LMP	It is off. ...
02 16 51 35	LMP	Yes, I think so; yes, that's off.
02 16 51 49	CDR	... Okay, Houston; Aquarius. How do you read me?
02 16 51 53	CC	Aquarius, this is Houston. We read you with a lot ... static. How do you read us? Over.

02 16 52 03	CDR	We read you with a lot of noise, the noise seems to indicate ... read you better.
02 16 52 15	CC	I didn't copy your last remark, Jim. I heard that you had a lot of noise in the background also.
02 16 52 23	CDR	Okay, Houston; Aquarius. How do you read us now?
02 16 52 27	CC	Just the same, Jim. You're readable but it's very noisy.

END OF TAPE

02 16 52 45	CDR	Okay. We can still read you. Do you want us to remain in this configuration?
02 16 52 51	CC	Stay there for the next minute or two anyway, Jim, while we evaluate it.
02 16 53 23	CDR	Okay. I'll tell you what we need, Jack. Try to get this squared away again. We - See if you can't report the right procedures here. ... the procedures, the whole works, before we get all balled up here.
02 16 53 41	LMP	Yes. Okay. You guessed it.
02 16 53 53	CDR	I've come up with nothing here.
02 16 54 47	LMP	... we can use.
02 16 54 54	LMP	Stand by for ... Give me - ... over on my side there. My - ...
02 16 55 21	LMP	Find anything back in there?
02 16 55 23	CDR	No, wait a minute.
02 16 55 40	LMP	Better get a ... there, a paper towel. ...
02 16 55 47	CDR	Let's just check in here ...
02 16 55 53	LMP	Yes.
02 16 55 54	CDR	... Well, we should have some around here somewhere.
02 16 55 57	LMP	Yes. They are ...
02 16 56 07	CDR	Oh, here they are. ...
02 16 56 52	LMP	Why don't you put that right up there, just like that. Is that all you've got on it? There you go.
02 16 58 01	LMP	...
02 16 58 09	CDR	It sure stays on, I'll tell you that. It's built like a regular ...
02 16 58 20	CDR	Hey, look out that left-hand window. ... I can't see a thing.

02 16 58 35	LMP	...
02 16 58 49	CDR	Well, is there anything ... done earlier?
02 16 59 22	CDR	Okay. What we do here is, ...?
02 16 59 29	LMP	...
02 16 59 33	CDR	... the command module.
02 16 59 56	CDR	Find the flight plan, too, while up there.
02 17 02 48	CDR	Okay. Why don't you recopy this procedure on page 4-42.
02 17 02 59	LMP	We going to keep a log of all the procedures?
02 17 03 15	CDR	We ought to copy down the ones that get water, too. ... Keep them all in one spot.
02 17 03 23	CC	Aquarius, Houston. Over.
02 17 03 29	CDR	Go ahead, Houston.
02 17 03 31	CC	Okay. Speak slow because there's a lot of noise in the background. Have you completed your first 90-degree yaw maneuver? And, if you haven't, we recommend it. Over.
02 17 03 45	CDR	Okay. We have not. We have not completed it. We will start. We want you to monitor the maneuver. Over.
02 17 03 53	CC	Okay, Jim. And I want to pass you up a short procedure for activating the S-band steerable antenna, which we'd like you to do after you complete the 90-degree yaw. Are you ready to copy? Over.
02 17 04 14	CDR	Ready to copy.
02 17 04 16	CC	Okay. First, on panel 11, close the S-BAND ANTENNA circuit breaker. Then go to Activation, page 28, steerable antenna activation - -
02 17 04 30	CDR	Roger. Copy.
02 17 04 34	CC	- - and complete steps 2, 3, and 4 of Activation 28. You'll have to do a VERB 64 to get the pitch and yaw angles, and the last step is on panel 16, S-BAND ANTENNA HEATER circuit breaker to CLOSE. Over.

02 17 05 03	CDR	Joe, we didn't get all of that. We just have, "Complete steps 2, 3, and 4 of activation" and then 68 or 28.
02 17 05 13	CC	Jim, that's - -
02 17 05 15	CDR	Then do a VERB 64 to get -
02 17 05 39	CC	Aquarius, Houston. That procedure I just passed you, please disregard it. Over.
02 17 05 50	CDR	Disregard it. Okay. Do you want me to start my yaw maneuver now? And I'll be yawing to my right. One-way maneuver.
02 17 05 59	CC	Roger. Right yaw is acceptable, but wait 1 before you start the maneuver.
02 17 06 09	CDR	Roger.
02 17 06 33	CC	Aquarius, Houston.
02 17 06 38	CDR	Go ahead.
02 17 06 39	CC	Okay. You are GO to commence the yaw maneuver. If we don't have COMM after you complete the yaw maneuver, bring the power amplifier back on. Over.
02 17 06 54	CDR	Roger. Understand. We'll start the yaw.
02 17 06 57	CC	Okay.
02 17 07 19	CMP	...
02 17 07 28	CDR	... 277.
02 17 11 20	CMP	They're almost getting bigger and bigger, Jack. It's over here now.
02 17 11 52	CDR	Hey, you got a list ... off over here.
02 17 11 55	CMP	All that stuff ...
02 17 11 57	CDR	... to do is put water in it.
02 17 13 43	CDR	What do I turn that to?
02 17 13 51	CMP	...
02 17 14 17	CDR	... Yes ... down to 270 ...

02 17 15 32	CDR	It's jumping now.
02 17 17 15	CDR	Why don't you go RATE/RATE now, before we ...
02 17 19 28	CMP	We're on the ascent tank, too.
02 17 19 33	CC	Houston, Aquarius. Did you call?
02 17 19 38	CDR	Negative, Houston. We did not call. How you reading us?
02 17 19 42	CMP	Get up front and turn that antenna ...
02 17 19 49	CDR	And, Houston, could you give us an approximate time to turn off the ascent O_2 in case we're losing point with you?
02 17 19 59	CC	Roger, Jim; and copying about half your words.
02 17 20 08	CDR	Roger, Houston. We'd like a time to go back to descent O_2 in case we lose communications with you.
02 17 20 20	CC	Jim, Houston. That's affirmative. You may go back to descent O_2. Over.
02 17 20 30	CDR	Roger. Going back now.
02 17 20 33	CC	Copy that.
02 17 21 37	CDR	We're ... up-side down.
02 17 21 39	CMP	Yes.
02 17 22 13	CMP	Think we'll have any trouble getting that ... with that ... in there?
02 17 22 19	CDR	Probably not, if everything holds together because we already made one burn.
02 17 22 24	CMP	And the temperatures look good. When you make a burn, does that do something ...?
02 17 22 32	CDR	...
02 17 22 46	CDR	Well, Jack. This is going to be difficult.
02 17 22 55	CMP	... ...
02 17 23 09	CMP	I'll tell you, we'll have to start thinking about ...

02 17 23 19	CDR	How about ...?
02 17 23 53	CDR	How about ...?
02 17 24 09	CDR	Yes, we got ...
02 17 26 47	CDR	... once every hour?
02 17 30 14	CDR	How about that ... tank ...?
02 17 30 23	CDR	How much of that oxygen are you going to use for -
02 17 30 30	LMP	We got - water glycol ... off. ... need any more water? ... again?
02 17 31 36	CDR	... out there?
02 17 31 38	LMP	Yes, why don't we ...?
02 17 31 53	CMP	... out? Can you get that?
02 17 32 44	CDR	... down there. ...
02 17 33 56	CDR	Houston, Aquarius. Are you ...?
02 17 34 02	CC	Aquarius, Houston. Say again, please. ...
02 17 34 09	CDR	Roger. We have a radio check at a new attitude.
02 17 34 14	CC	Okay, Jim. We copy the angles. How are you receiving the voice now? Over.
02 17 34 23	CDR	Your voice is excellent.
02 17 34 28	CC	Okay. Real good. You are clear. We still have a lot of noise, but if you talk slow I think we can manage.
02 17 35 20	CC	Aquarius, Houston.
02 17 35 28	CDR	This is Aquarius. Go ahead.
02 17 35 31	CC	Roger, Jim. We're trying to improve our COMM down here. We'd like to try going function switch from DOWN VOICE BACK UP to VOICE. Over.
02 17 35 48	CDR	... DOWN VOICE BACKUP ... switch going from DOWN VOICE BACKUP to VOICE.
02 17 36 00	CC	Roger that.

02 17 36 57	CC	How do you read now, Jim?
02 17 37 37	CC	Aquarius, Houston. Request a short count. Over.
02 17 38 16	CC	Aquarius, Houston. We're not reading you at all. Request you go back to DOWN VOICE BACKUP. Over.
02 17 38 34	CDR	All right. Houston, Aquarius in DOWN VOICE BACKUP. How do you read? Over.
02 17 38 41	CC	Okay, Jim, we read you now and you'd better stay in this configuration.
02 17 39 03	LMP	Well, ... try ...
02 17 39 43	CC	Aquarius, Houston. Over.
02 17 39 50	CDR	Go ahead, Houston.
02 17 39 52	CC	Okay, Jim, since we're in LOW BIT RATE now, we cannot monitor the DSKY for program alarms, et cetera, and we recommend that, in order for you to do so on board, you push in the following circuit breakers: On panel 11 and panel 16 the ANUNCIATOR/DOCK/COMPONENT circuit breakers. That will allow you to monitor your DSKY warning lights. Over.
02 17 40 34	CDR	Okay ...
02 17 40 37	LMP	..., OFF.
02 17 40 42	CDR	Roger, Houston. Would you say one more time ... please?
02 17 40 47	CC	Okay, Jim. The circuit breakers are the ANUNCIATOR/DOCK/COMPONENT circuit breakers on panel 11, third row, far right, under LIGHTING; and on panel 16, also under LIGHTING, second row, third from the left. Over.
02 17 41 23	CDR	Roger, Houston. We have those two circuit breakers - engaged.
02 17 41 30	CC	Okay, real good.
02 17 51 02	CDR	Houston, Aquarius.
02 17 51 16	CC	Aquarius, this is Houston. Go ahead.

02 17 51 21	CDR	Joe, it appears that the best detent possibly to put the stars in the AOT, would be either number 2 or 4. The rendezvous radar antenna is now in the way. You might think of a procedure to get rid of it with minimum power and then we maybe we'll be able to see stars in a couple of minutes here in a lower detent.
02 17 51 48	CC	Okay, Jim. I think I understood that the rendezvous radar antenna is in the way and you would like a procedure to get it out of the way. Is that right?
02 17 52 00	CDR	That's affirm; at the proper time, and with minimum power.
02 17 52 06	CC	Roger. Understand. We'll work that.
02 17 58 28	CC	Aquarius, Houston. Over.
02 17 58 34	CDR	Go ahead.
02 17 58 36	CC	Okay. Jim, we have a handover coming up on the hour; that's in a minute and a half. On the hour, we would like you to turn the S-BAND TRANSMITTER/RECEIVER switch to OFF, and 5 minutes later turn it back to PRIMARY. Over.
02 17 59 17	CDR	Okay, Houston. Shortly you want us to turn the S-BAND TRANSMITTER/RECEIVER to OFF; 5 minutes later, turn it back to PRIMARY.
02 17 59 29	CC	That's affirmative, Jim. After the handover apparently they want to make sure that they lockup with you and not the IU.
02 17 59 43	CDR	Roger. And let me know when you want me to turn it off.
02 17 59 51	CC	Roger. You can turn it off now.
02 18 00 18	CDR	And, Houston, when do you want me to turn that S-BAND TRANSMITTER/RECEIVER off?
02 18 00 24	CC	Aquarius, Houston. Turn it off now.
02 18 00 31	CDR	Turning it off now.
02 18 08 25	CC	Okay, Aquarius; Houston. We have data back and I assume we have COMM. Over.

02 18 08 35	CDR	Houston, this is Aquarius. The COMM is very, very, very noisy. Over.
02 18 08 41	CC	Aquarius, Houston. Copy that. It's noisy on our end, too; stand by while we think about it.
02 18 09 08	CDR	Houston, Aquarius. I am unable to ... now ...
02 18 09 17	CC	Jim, Houston. I think you just called, but I didn't copy you.
02 18 10 32	CC	Aquarius, Houston. Over.
02 18 10 38	CDR	Go ahead, Houston.
02 18 10 41	CC	Jim, recommend you push the POWER AMPLIFIER circuit breaker on panel 16 in. Over.
02 18 10 51	CDR	Roger. POWER AMPLIFIER circuit breaker panel 16 going in.
02 18 11 16	CDR	POWER AMPLIFIER circuit breaker is in.
02 18 11 19	CC	Okay, Jim. How is the COMM now? Over.
02 18 11 27	CDR	A lot of background noise. Let me turn off the SQUELCH.
02 18 11 32	CC	Okay. You're quite a bit better.
02 18 11 41	CDR	Whenever I enable SQUELCH, I lose you. Over.
02 18 11 45	CC	Roger. Stand by. You are much better down link.
02 18 12 01	LMP	Look at NOUN 65.
02 18 12 04	CDR	Okay.
02 18 12 28	CC	Okay, Jim. This is Houston. We recommend that you set the FUNCTION switch from DOWNVOICE BACKUP to VOICE. Over.
02 18 12 40	CDR	Roger. FUNCTION switch going from DOWNVOICE BACKUP to VOICE.
02 18 13 10	CC	Okay, Jim. How's the COMM now?
02 18 13 12	CDR	FUNCTION switch ... There's still a lot of background noise, Joe.
02 18 13 21	CC	Okay. We'll look at it some more. Your COMM down to us is excellent now.

02 18 18 27	CDR	Houston, Aquarius.
02 18 18 31	CC	Aquarius, Houston. Go ahead.
02 18 18 36	CDR	The noise we're experiencing is similar to what we had sometime before when you switched stations.
02 18 18 56	CC	Roger, Jim. INCO is checking into what we can do about the noise. It may be a problem with the new site.
02 18 19 12	CDR	Roger.
02 18 23 07	CC	Aquarius, Houston. Is the noise any better now? Over.
02 18 23 17	CDR	This is Aquarius. Negative.
02 18 23 20	CC	Roger.

END OF TAPE

02 18 33 34	CDR	Houston, Aquarius.
02 18 33 36	CC	Aquarius, Houston. Go ahead.
02 18 33 42	CDR	Roger. Will you let us know when you want us to yaw another 90 degrees right?
02 18 33 49	CC	Will do, Jim. Stand by 1.
02 18 33 54	CC	Okay, Jim. We're ready now to yaw another 90 degrees to the right.
02 18 34 02	CDR	Roger.
02 18 36 14	CC	Aquarius, Houston.
02 18 36 20	CDR	Go ahead.
02 18 36 21	CC	We are going to try to improve the COMM and telemetry by temporarily breaking lock and re-acquiring. You may hear some noise in your headset.
02 18 36 33	CDR	Okay. Couldn't be any more noise than we're getting now.
02 18 36 36	CC	Right.
02 18 38 56	CDR	Hello, Houston; Aquarius.
02 18 38 59	CC	Aquarius, Houston. Go ahead.
02 18 39 03	CDR	Okay. Now that there's no noise, you can give ...
02 18 39 15	CC	Jim, I didn't copy that. Your COMM is pretty good, though. How is it with us?
02 18 39 26	CC	Good. Okay.
02 18 40 07	CDR	Houston, do you want to reconfigure the DOWN VOICE BACKUP again?
02 18 40 12	CC	Aquarius, Houston. I don't think so at this time. Our voice is good now. How's yours?
02 18 40 22	CDR	Ours is very good.
02 18 40 26	CC	Okay, why don't we stay where we are for a few minutes.

02 19 02 42	CDR	Okay. Houston, Aquarius. We're deadbanding in the new attitude.
02 19 02 48	CC	Aquarius, Houston. Roger that, and your COMM is good.
02 19 32 09	CC	Aquarius, Houston. Over.
02 19 32 15	CDR	Go ahead, Houston.
02 19 32 16	CC	Okay, Jim. In order to save on an amp or 2 of power here, we'd like you to go to the DOWN VOICE BACKUP COMM configuration, which is pulling the power and circuit breaker and going to DOWN VOICE BACKUP. If we get into a COMM problem, all you have to do is reverse that configuration, and it should be good again. Over.
02 19 32 50	CDR	Okay, we'll go to DOWN VOICE BACKUP and pull the POWER AMPL circuit breaker, and if we get into trouble, we'll come back again.
02 19 32 57	CC	Okay, real fine, and we estimate the next yaw maneuver should start at about 68:02. Over.
02 19 33 08	CDR	Okay. Could you give me that in minutes?
02 19 33 12	CC	I sure can. That's going to be in 29 minutes from now, Jim.
02 19 33 18	CDR	Okay. Thank you.
02 19 33 20	CC	Okay.
02 19 33 51	CDR	Okay, Houston. We're in DOWN VOICE BACKUP and the POWER AMPLIFIER is pulled.
02 19 34 00	CC	Jim, Houston. Roger that. You are readable through the noise. How are we? Over.
02 19 34 09	CDR	You are loud and clear.
02 19 34 12	CC	Very good.
02 19 34 30	LMP	Yes, I guess ... at this time ... out ... configuration ..., and we have to get ... ...
02 19 34 58	CDR	Okay. What else do we have to ...
02 19 36 18	LMP	...
02 19 36 30	CDR	Okay.

02 19 36 35	LMP	...
02 19 37 21	LMP	...
02 19 38 19	LMP	...
02 19 38 30	CDR	I guess they're going to take ...
02 19 38 35	LMP	...
02 19 39 12	LMP	Well, there's another good one ...
02 19 39 17	CDR	... going off?
02 19 39 20	CMP	...
02 19 39 28	CDR	No. ... we had battery power for a while, we could ...
02 19 39 33	LMP	It's locked.
02 19 39 35	CDR	...
02 19 39 40	LMP	I don't think that was ...
02 19 39 55	LMP	... powered up ...
02 19 40 01	CDR	... got one.
02 19 40 03	LMP	... ... all powered down.
02 19 40 07	CDR	...
02 19 40 10	LMP	... have to get ...
02 19 41 02	CDR	... get our ... are off.
02 19 41 05	LMP	Yes.
02 19 41 08	CDR	... all three ...
02 19 41 15	LMP	...
02 19 41 25	LMP	Seems like ... the burn ...
02 19 44 24	CDR	... ...
02 19 45 01	LMP	...
02 19 46 11	LMP	...
02 19 46 19	CDR	... We're going to have to do something to get all this water out of here.

02 19 46 23	LMP	I'll set up ... before I turn the thing on.
02 19 46 27	CDR	Okay, we'll get this thing -
02 19 46 32	LMP	...
02 19 46 34	CDR	...
02 19 46 47	LMP	...?
02 19 46 48	CDR	Yes.
02 19 46 56	LMP	... ...
02 19 47 02	LMP	There you go.
02 19 47 06	CDR	...?
02 19 48 50	LMP	... this one.
02 19 48 53	CDR	Okay.
02 19 52 20	LMP	...?
02 19 52 21	CDR	That's right.
02 19 52 22	LMP	Thank you.
02 19 52 26	CMP	...?
02 19 52 28	LMP	I'll wake you up.
02 19 52 30	CDR	...
02 19 52 31	CMP	All right.
02 19 58 37	SC	(Coughing)
02 19 58 44	LMP	About four ...
02 19 58 53	CDR	Okay.
02 19 59 07	LMP	Go ahead.
02 19 59 19	CDR	...
02 19 59 44	LMP	...
02 19 59 56	LMP	... ...?

02 20 00 01 CDR Yes.

02 20 00 13 CDR ... Over on the ...

END OF TAPE

02 20 03 33	CDR	Well, I'm afraid this is going to be the last lunar mission for a long time.
02 20 03 40	LMP	... copy.
02 20 04 37	CDR	Are we in DOWN VOICE BACKUP ...
02 20 04 39	LMP	Yes.
02 20 08 27	CDR	Maybe it should reverse itself. I think ...
02 20 08 31	LMP	...
02 20 08 33	CDR	Yes.
02 20 25 48	CDR	... radio check.
02 20 25 52	CC	Aquarius, this is Houston. Go ahead.
02 20 25 59	CDR	Maneuver complete.
02 20 26 02	CC	Roger, Jim. We show you on telemetry. Looks solid at the new attitude. Just by the way of information, the latest tracking data shows the pericynthion to be holding somewhere above 136 miles, and the pad you have is still good. Over.
02 20 26 24	CDR	Roger. Understand.
02 20 26 28	CC	Okay, and, Jim, we wonder whether you've attempted to get drinking water out of the command module po-ti [sic] tank yet. It's - Is that going all right or do you have any questions on it. Over.
02 20 26 42	LMP	... do it at 169 hours.
02 20 26 46	CDR	We're all ... do it at 169 hours - or 69 hours.
02 20 32 32	LMP	I need a command module activation ...
02 20 32 38	CDR	Houston, Aquarius. Over.
02 20 37 52	CDR	Houston, Aquarius.
02 20 37 55	CC	Aquarius, Houston. Go ahead.

02 20 38 01	CDR	As we approach the burn, you want to go through the same check that we did for the last burn. That is, we want to make sure we have everything powered up ... circuit breaker by circuit breaker in conjunction with your direction. And for ... we ought to have a procedure for powering up the command module again when we have to go back into the command module ...
02 20 38 29	CC	Okay, Jim. We copied that. First of all, you want to go through the circuit by circuit breaker careful powered-up procedure for the next DPS burn, and we're working on that. Secondly, you want a procedure for powering the command module up again when you have to re-enter it and power it up and we're talking about that and working one up, and we'll get both those for you ...
02 20 39 00	CDR	Roger.
02 20 39 06	CMP	Joe, can you also get us an idea about how far out we can expect to make it on the command module batteries.
02 20 39 16	CC	Okay, Jack. It sounds as though we probably don't want to power up the command module before EI minus 2 hours. That doesn't mean we can't start our procedure a good deal before that, but we don't want to power it up much before EI minus 2. Over.
02 20 39 42	CMP	Okay. I was just thinking in case something - we had the sort of problem here about how we would go about getting in the command module ... we need to power up - and - in order to make it back into Earth.
02 20 40 00	CC	Right, Jack. It's quite clear that we're going to have to very carefully make up a full check-list for you on that; we'll do it.
02 20 40 26	CMP	What they're going to do is ... power Aquarius up ...
02 20 40 38	CDR	Oh, well, we've got to have something to ... Besides, we can get rid of the LM ... decide then what they'll do.
02 20 40 51	CMP	My guess is what they'll do - Well, I guess, aline the GDC ... and get EMS ...

02 20 42 21	CMP	And - we haven't even figured out yet the ... batteries, have we?
02 20 42 26	CDR	Oh, I'm sure we have.
02 20 42 30	CMP	... - hundred ampere-hours. We had it figured out that we had 550 ampere-hours left. ...
02 20 42 43	CDR	...
02 20 42 48	CMP	... bigger than 133 hours. ... Oh, yes, I guess - Yes, he's ... the descent Thursday afternoon. He had it figured out that - for a splashdown at ... number of hours - 74 hours, and we've figured out that we - I don't know how we arrived at this - but he added up all the ...
02 20 45 01	CC	Aquarius, Houston. Over.
02 20 45 07	CDR	Go ahead, Houston.
02 20 45 09	CC	Roger, Jim. We just thought of something; namely, that we probably should get the lithium hydroxide canisters out of the command module reasonably soon just to make certain that they don't stay in there and possibly swell up until they'd be hard to get out. I wouldn't wake up Fred for that, but it's something you should do possibly before you go to sleep.
02 20 45 45	CDR	Roger. Will do.
02 20 45 47	CC	Okay.
02 20 47 00	CMP	..., Fred-o. We're 68 hours, about, and 46 minutes. Did you sleep good?
02 20 47 17	CDR	... lithium hydroxide ...
02 20 47 19	CMP	Yes, I think I'll do that right now. Fred-o, get on the ...
02 20 47 25	CDR	Okay, Jack, take the lithium hydroxide canisters out. Tie them down, or something like that ... command module. And then get us some food ...
02 20 48 53	CDR	How much time did you say these batteries had?
02 20 48 56	CMP	... 800 ampere ...

02 20 50 21	LMP	Aa-ah. Think I'll get an aspirin - a couple of aspirin again ...
02 20 51 43	LMP	I'd like a couple of aspirin, too.
02 20 51 49	LMP	Well, would you like some pictures?
02 20 54 06	CDR	Be sure you get all the water out you can. ...
02 20 55 49	LMP	You're holding your attitude right now. What time have you got to ...?
02 20 55 57	CDR	Probably another 5 minutes.
02 20 58 35	CDR	How much water in the ...
02 20 59 30	LMP	What time was it when we powered up the LM, do you recall? 58 hours?
02 21 06 38	CDR	How did the water come out?
02 21 06 43	CMP	Okay, ... That's another big ..., man. If we have to start drinking water out of the ... drink damn near a gallon a day.
02 21 07 54	CDR	I'm also figuring that when we've got to go back in there, we'll ... take the drogue and the food ... back here - take these - put these back in there. ...
02 21 12 53	LMP	Hello, Houston. How do you read?
02 21 13 27	LMP	Hello, Houston; Aquarius.
02 21 13 34	CC	Aquarius, Houston; did you -
02 21 13 43	LMP	Okay, you hear me, Joe?
02 21 13 46	CC	Oh, not very good, Jack; suggest that for communication here, we go to POWER AMPLIFIER circuit breaker IN and FUNCTION switch to VOICE.
02 21 14 03	LMP	Okay, I didn't want to get through or anything. I just wanted to check and see if we had you at all in this mode.
02 21 14 10	CC	Oh, yes, we do have COMM. You're extremely noisy but if you read loud and slow we can easily copy it.

02 21 14 22	LMP	Okay. Joe, I read you loud and clear on this mode.
01 21 14 29	CC	Roger, we understand that. It is strictly a downlink problem and you can stay in the DOWN VOICE BACKUP mode if you want. If we get involved in conversation, I think we'll want to go back to NORMAL voice.
02 21 16 42	CDR	How you doing, Jack?
02 21 17 35	CDR	Do you have an hour on your clock for ...
02 21 18 00	LMP	Joe, this is Aquarius; wonder if you can give me the GET time of initial powerup?
02 21 18 13	CC	Fred, Houston. Understand you'd like to know the GET of your initial powerup, is that correct?
02 21 18 23	LMP	Yes, the second time in here.
02 21 18 26	CC	Okay, stand by.
02 21 19 56	CC	Aquarius, Houston. Over.
02 21 20 02	CDR	Go ahead.
02 21 20 05	CC	Okay, we don't have a percise time for the starting of that procedure yet; we are working on it real hard. It won't be for several hours; and we'll pass it up to you just as soon as we get it. Over.
02 21 20 21	CDR	Okay, and, Joe, you want us to start a PTC maneuver at this time?
02 21 20 27	CC	Stand by and I'll check.
02 21 21 06	CC	Aquarius, Houston.
02 21 21 12	CDR	Go ahead.
02 21 21 13	CC	Roger, Jim. We would like the next yaw maneuver in about 6 minutes. Over.
02 21 21 20	CDR	Roger.
02 21 21 22	CC	Okay.
02 21 23 10	CDR	Oh, yes, yes. Keep opening - open the jets slowly ... Keep working at it.

02 21 24 02	CDR	Is there some way that we could ... water in the PLSS.
02 21 24 16	CC	Aquarius, Houston. Over.
02 21 24 21	CDR	Go ahead.
02 21 24 23	CC	Okay. Our estimate is that we will start powering up for the DPS burn at about 76 hours elapsed, which is about 6-3/4 hours from now.
02 21 24 40	CDR	Roger, Joe. Understand.
02 21 24 42	LMP	Okay, Joe, about 76 hours or so and I guess you misunderstood. My question was what was the GET way back when, when I first came across to the LM and transferred to LM power? How long have we been living on the LM, now?
02 21 25 00	CC	Oh; Roger. Stand by. I'll give you that. Yes, I just didn't understand.
02 21 29 28	CC	Aquarius, Houston. Over.
02 21 29 35	CDR	Go ahead, Houston.
02 21 29 36	CC	Okay, the time of transfer to LM power was 57 hours, 11 minutes. For your information, we seem to be reasonably fat on power. In fact, we are looking at a procedure that we might recommend to you later on after the burn and so forth of powering up one of the command module main buses via the LM umbilical. This would enable us possibly to charge up the command module batteries. Over.
02 21 30 16	LMP	Okay, Joe. That sounds great. I just thought that to pass the time, I'd do a little backseat quarterbacking, here.
02 21 30 29	CC	Roger.
02 21 34 22	CDR	How's the water doing?

END OF TAPE

02 21 47 30	CC	Aquarius, Houston. Over.
02 21 47 35	CDR	Go ahead, Houston.
02 21 47 37	CC	Roger. We request AFT OMNI at this time. Over.
02 21 47 43	CDR	AFT OMNI.
02 21 47 45	CC	That's affirm.
02 21 48 35	CDR	Yes. ... is going to be 123.
02 21 48 40	LMP	You mean you're ... 12247?
02 21 48 55	LMP	...
02 21 48 59	CDR	Yes.
02 21 49 06	LMP	I'm trying to ... this heater over here.
02 21 49 08	CDR	Yes. I'll ... that.
02 21 49 34	LMP	Jim, that spacecraft's looking pretty close; a about 86 or ...
02 21 49 50	CDR	Well, ...
02 22 52 15	CC	Aquarius, Houston. Over.
02 22 52 20	LMP	Go ahead, Houston.
02 22 52 23	CC	Okay, Fred. I have a few words for you on some things we want to do in the next few hours, and in order to get good COMM for that and also in order to give FIDO a few minutes of ranging, I want to have you put the POWER AMPLIFIER circuit breaker in panel 16 in, the VOICE FUNCTION switch to VOICE, and RANGING FUNCTION switch to RANGING. Over.
02 22 53 17	LMP	Now I'm in NORMAL voice and RANGING is up.
02 22 53 22	CC	Okay, Fred. And you're loud and clear down here now. Okay. What we're getting a procedure ready for you is to do an AOT Sun check at approximately 74 hours or in just a little over 3 hours. That will be a detent 2; we'll have a detail procedure up shortly and it will include a rendezvous

radar redesignation to get it out of the way and a P52 maneuver to the attitude. It's our feeling that if that checks out within 1 degree that your platform will be okay for the burn without a subsequent P52. If it's not within 1 degree, we are working up an Earth/Sun alinement procedure to aline the platform, and we'll have that up to you later. Okay. Assuming that the Sun check is okay, we will then give you a star for a confidence check on the back side when you're in the darkness. We'll be updating a burn pad to you prior to LOS going around the Moon. We'll have another look at you after AOS, and we'll update the pad if required. Right now that update should be very small. Over.

02 22 54 48 LMP Okay. Stand by 1.

02 22 55 52 LMP Okay. Joe. As I read that, at 74 hours we're going to do an AOT Sun check at detent 2, which is going to require the rendezvous radar out of the way. And we use P52 AUTO maneuver to get there, or at least the angles out of that, and if this passes within 1 degree, you're saying the platform is okay for the maneuver, and we won't need a subsequent P52. But even if it is okay, you'll give us a star which we can use for our check when we're in darkness. If this check flunks, you'll pass us on up then an Earth/Moon aline procedure.

02 22 56 45 CC Okay, Fred. That's correct, except the aline procedure that we're working on is an Earth/Sun aline, and other than that, that's correct. Incidentally, this TC plus 2 maneuver looks like it will still be around a 900-foot-per-second maneuver and that it will get you back to the mid-Pacific line at 142 hours.

02 22 57 15 LMP Okay. That was an Earth/Sun check, John. We're getting a little close to the Moon now. And the TC plus 2 maneuver still looks about 900 foot per second to get us at mid-PAC, at about 142 hours.

02 22 57 32 CC That's right.

02 23 05 12 CC Aquarius, Houston.

02 23 05 19 LMP Go ahead, Joe.

02 23 05 21	CC	Okay, Fred. We got a good batch of ranging and now we'd like you to reverse the configuration, RANGING to OFF, VOICE FUNCTION to DOWN VOICE BACKUP, POWER AMPLIFIER circuit breaker out; we'll be talking to you.
02 23 05 41	LMP	DOWN VOICE BACKUP with the POWER AMP breaker open now. How do you read?
02 23 05 47	CC	We read you satisfactorily, Fred.
02 23 05 53	LMP	Okay.
02 23 06 17	LMP	Jim and Jack are in the upstairs bedroom taking a nap now.
02 23 06 24	CC	I didn't know that was upstairs.
02 23 06 34	LMP	We have the first space station.
02 23 06 37	CC	(Laughter)
02 23 09 04	LMP	And, Houston, Aquarius.
02 23 09 08	CC	Aquarius, Houston. Go ahead.
02 23 09 13	LMP	One other thing you might have somebody look at - I don't want to bother the guys upstairs - the drain hose that we've got in the command module, I wonder if we can find out if it will plug into the PLSS and in which case we can keep transferring - later on at least - the command module water into the LM via the PLSS.
02 23 09 43	CC	Okay, Fred. You're almost up with us. We are looking real hard at getting water from the command module waste tank into the PLSS, using that hose and then dumping it from the PLSS into the LM ascent tank, and we think it is feasible; we're checking it out to make sure.
02 23 10 08	LMP	Okay.
02 23 10 29	LMP	Okay. I have time to do another maneuver here, Joe.
02 23 10 36	CC	Okay, Fred. Let me verify that.
02 23 10 55	CC	Fred, Houston. That is verified. You can go ahead with the yaw maneuver.

02 23 11 02 CMP Roger.

END OF TAPE

02 23 29 06	LMP	Okay. Just made another maneuver. We allowed for a little too much roll, there. I wonder if that's too much, or should I try to take it out now that I got it stopped.
02 23 29 18	CC	Fred, this is Houston. - -
02 23 29 19	LMP	Twenty degrees roll left - Yes. All right; go ahead.
02 23 29 27	CC	Okay, Fred. I didn't copy the beginning of your message.
02 23 29 38	LMP	Okay, I - I was talking to Jim, there.
02 23 29 42	CC	Sorry.
03 00 27 43	CC	Aquarius, Houston. Over.
03 00 27 49	CDR	Go ahead, Joe.
03 00 27 51	CC	Roger. Listen, Charlie Duke wants to talk to you - to you about the AOT star check; and, so that we can have good COMM, I'd like to reconfigure with the POWER AMPLIFIER circuit breaker in and the VOICE FUNCTION switch to VOICE and while we're at it, we'd like the RANGING FUNCTION switch to RANGING. Over.
03 00 28 15	CDR	Okay.
03 00 28 47	CC	Aquarius, Houston. Over.
03 00 28 49	LMP	Houston, Aquarius.
03 00 28 51	CC	Roger, Fred-o. Reading you - -
03 00 28 52	LMP	Okay, Houston, Aquarius. Go ahead.
03 00 28 54	CC	Okay, Fred-o. Reading you 5-by. The procedure I'm going to read up to you is a Sun check for the - to see if we're going to need an alinement or not. If you'll get out your G&N dictionary and open it to P52, page 34, we'll start at the bottom. Over.
03 00 29 23	LMP	Okay. Stand by 1.
03 00 29 32	LMP	Sounds like you broke out, Charlie.

03 00 29 36	CC	Yes, finally, Fred-o. I've no longer got the red spots.
03 00 29 48	CC	Okay. Stand by, Aquarius. We'll be back with you momentarily.
03 00 29 55	LMP	Okay.
03 00 31 16	CC	Aquarius, Houston. You ready with your G&N dictionary? Over.
03 00 31 24	LMP	Okay. I'm on page 34 now, looking at P52.
03 00 31 28	CC	Okay, Fred-o. At the bottom of the page, we want step 1, on the flashing 0406, we want an option 3, and that'll pull us over to 6; and, on the 5025, we want you to do the ENTER on the 5025, and that'll bring up flashing 0170, and load in R_1 200. Over.
03 00 32 03	LMP	Okay. Let me see if I'm with you. We call up P52 and, on the flashing 0406, we PRO on a 3 REFSMMAT which leads us to a flashing 5025. We ENTER on that. On the flashing 0170, we want to ENTER a 200.
03 00 32 24	CC	That's affirmative; and after that, you PRO on that, and you come up with a flashing 0688, and we'll have to load NOUN 88. And if you're ready to copy, I have the Sun half-unit vectors at 74 hours GET. Over.
03 00 32 47	LMP	Okay. Go ahead.
03 00 32 48	CC	Okay. At Sun half-unit vectors, X, R_1, is plus 0.45498, Y plus 19024, Z plus 08250. Over.
03 00 33 20	LMP	Okay. We PRO on - after entering the 200. We'll get a flashing 0688. We then load the Sun unit vectors for 74 hours, which are R_1 plus 5 - correction, plus 45498, R_2 plus 19024, R_3 plus 08250.
03 00 33 48	CC	Roger. That's good, Fred-o. And that'll bring you to step 8, and you get a flashing 5018 when you PRO on the NOUN 88. Okay. At 5018, we want to do an AUTO maneuver to - to the attitude, so just do the - the PRO with the GUIDANCE CONTROL, PNGS; MODE CONTROL, PNGS, AUTO; and we'll take

this attitude. Now, that's going to put us at - at attitude for the Sun check. Now, we're being a 1.4-degree deadband in this program in a docked configuration; so, to help you out, you could call VERB 62 to get your needles - and it - when the needles go through zero or null out and - in that deadband - then you take a look in the AOT and see how close the Sun is. And we want within plus or minus 1 degree. Over.

03 00 34 52	LMP	Okay. So we PRO on the NOUN 88, and we end up with a flashing 5018; and you want an AUTO maneuver here rather than using the TTCA, so we PRO with GUIDANCE, PNGS; MODE CONTROL, AUTO. We've got a 1.4-degree deadband with a VERB 62 will give us the needles to try to zero them in and, at that time I look through the AOT and, if it's like Apollo 11 Sun check, all we've got to have is the Sun somewhere in the - out there somewhere on the Sun as it passes. Is that correct?
03 00 35 30	CC	I think that's a little tight; that's about a quarter degree. We can go a little bit out of that. Stand by 1. Fred, we'll get you an answer on that one. And also, if you'll stand by, we'll give you a DAP load for this maneuver. Over.
03 00 35 51	LMP	Okay. We'll - You'll give us a DAP load.
03 00 35 54	CC	Roger. Stand by.
03 00 37 39	CC	Aquarius, Houston. Fred-o, on that - to pass that check, the Sun is at - will septend an arc of one-half degree in the AOT, so you can be two diameters off and still pass the check. Over.
03 00 37 59	LMP	Okay. It's a half a degree, and so we can be two Sun diameters off and still pass.
03 00 38 07	CC	That's affirmative. And we want you to maneuver with a DAP of 0.2 of a degree a second. Over.
03 00 38 19	LMP	Okay. You want us to use a DAP of 0.2.
03 00 38 24	CC	Okay. That DAP load, Fred-o, is 31120. Over.
03 00 38 38	LMP	Okay. 31120.

03 00 38 41	CC	Roger. Now, if we pass that check, you can just terminate P52 right there, and we'll give you an attitude to go to a burn attitude, and from this we can get a star check. If you don't pass, we'd like you to do an alinement at 75 hours. And, if you're ready to copy, we have some Sun half-unit vectors and some Earth half-unit vectors at 75 hours. Over.
03 00 39 25	LMP	Stand by 1, Charlie.
03 00 40 00	CC	Okay. Go ahead for 75 hours - Sun and Earth half-unit vectors.
03 00 40 05	CC	Roger. First with the Sun; for X, plus 45483; for Y, plus 19053; for Zebra, plus 08262; Earth half-unit vector at 75 hours, plus 32120, minus 34155, minus 17370. Over.
03 00 40 56	LMP	Okay. Sun half-unit vectors: R_1 plus 45483, R_2 plus 19053, R_3 plus 08262; Earth half-unit vectors: R_1 plus 32120, R_2 minus 34155, R_3 minus 17370.
03 00 41 24	CC	Roger, Fred-o. Good readback. Now, on the Earth, we estimate it - if you have to do this alinement, that the Earth will be about a 2-degree Earth. And it'll be approximately three-quarters lighted. Now, to mark on the Earth, we'd like you to take an imaginary line between the horns of the crescent and mark midway between the horns. Over.
03 00 42 00	LMP	Okay. We got a 2-degree Earth that's three-quarter lighted, and we're to imagine a line between the horns of the Earth and mark right in the center of that line.
03 00 42 14	CC	That's affirmative. Now, on - on this star check - correction, the Sun check, Fred, at - On the 5018, I got some FDAI angles for you if you're ready to copy. Over.
03 00 42 34	LMP	Okay. You're talking about the check at 74 hours GET, right?
03 00 42 39	CC	Roger. Okay. At 74 hours when you start this maneuver, the 5018 should look like R_1 of 2703 degrees, pitch R_2 is 0903, and R_3 of 2908. Over.

03 00 43 11	LMP	Okay. How about making those all five digit readouts; read them again, Charlie.
03 00 43 16	CC	Okay. Pardon me. It's 27030, 09030, 29080.
03 00 43 33	LMP	Okay. The 5018 should look like R_1 plus 27030, R_2 plus 09030, R_3 plus 29080.
03 00 43 48	CC	Roger. That's good readback. Now, we got one more procedure for you; and, right now, we got the rendezvous radar stowed and we won't be able to see anything out of detent 2, so we'd like you to position the radar to 0283; and we have a procedure for that. And we'd like you to do that right before you get the attitude. Over.
03 00 44 22	LMP	Okay. Stand by.
03 00 44 45	LMP	Okay. Go ahead.
03 00 44 47	CC	Stand by.

END OF TAPE

03 00 45 25	CC	Aquarius, Houston. On those 5018 angles we had at 74 hours, Fred, that was based on a VERB 49 to this attitude, and they will be incorrect for for the two axis maneuvers, so you can just scratch them. Over.
03 00 45 47	LMP	Okay. You're saying the angles you gave me for the 5018, that was for a VERB 49, so they won't be good for the 5018, and we should scratch them.
03 00 45 56	CC	That's affirmative. Okay. If you're ready to copy, I've got this rendezvous radar procedure. Over.
03 00 46 09	LMP	Okay. Go ahead.
03 00 46 11	CC	Okay. It's about a 10-stepper, but real easy. Okay. On CB 16, EPS INVERTER 2, close. CB 11, AC BUS A BUS TIE INVERTER 2, close. Panel 14, verify INVERTER switch 2. CB 11 RENDEZVOUS RADAR 2, close. RENDEZVOUS RADAR, release. RENDEZVOUS RADAR to LGC on panel 3. Are you with me? Over.
03 00 47 26	LMP	Roger. I'm right up with you at step 6. Go ahead.
03 00 47 29	CC	Okay, Fred. Good show. Step 6: VERB 41 NOUN 72 ENTER, plus all balls, plus 28300. Step 7: Monitor movement with VERB 16 NOUN 72. Step 8: CB 11 RENDEZVOUS RADAR 2, open. Are you with me? Over.
03 00 48 13	LMP	Stand by 1.
03 00 48 28	LMP	Okay. Go ahead now.
03 00 48 30	CC	Roger. Step 9 is a VERB 44. Step 10: CB 16, EPS INVERTER 2, open. Over.
03 00 48 53	LMP	Okay. I got it.
03 00 48 56	CC	Okay.
03 00 48 57	LMP	Do you want me to read it back now?

03 00 48 58	CC	I got one more for you. You'll copy this and give me it all on the readback. Okay. Once you get the attitude and you want to use the - you want to get the AOT lamp, we got to go CB 16 EPS INVERTER 2, close; CB 11, AC BUS A AOT LAMP, close. After the P52, you can open CB 16 EPS INVERTER 2, and open CB 11 AC BUS A AOT LAMP and AC BUS A BUS TIE INVERTER 2. Over.
03 00 50 01	LMP	Okay. Stand by 1.
03 00 51 10	LMP	Okay. Let's see if I got it all. For rendezvous radar parking: first of all we want CB 16 EPS INVERTER 2, closed, CB 11 AC BUS A BUS TIE INVERTER 2, closed. Then on panel 14, verify INVERTER 2 selected. And CB 11 RENDEZVOUS RADAR 2 closed, both breakers. Then we are to pull the RENDEZVOUS RADAR RELEASE handle. On panel 3, we then want RENDEZVOUS RADAR to LGC. A VERB 41 NOUN 72 ENTER with plus all zips, plus 28300 in registers 1 and 2. GO on that. Then we monitor movement with the 16 72. After it gets parked, CB 11 RENDEZVOUS RADAR 2 open, followed by VERB 44 ENTER. And CB 16 EPS INVERTER 2 open. Now, when it comes time for the alinement to get an AOT lamp, CB 16, EPS INVERTER 2 closed, CB 11 AC BUS A AOT LAMP closed, and after the alinement is completed at CB 16, EPS INVERTER 2 open, CB 11 AC BUS A AOT LAMP open, CB 11 AC BUS A BUS TIE INVERTER 2 open.
03 00 52 54	CC	Good readback, Aquarius. We'll - To get those needles on the VERB 62, we got to power up the commander's FDAI. We'll have that procedure for you shortly. Over.
03 00 53 11	LMP	Okay.
03 00 53 29	CDR	Charlie, Jim here.
03 00 53 32	CC	Roger. Go ahead.
03 00 53 36	CDR	Have you run a Earth set alinement in the simulator with a docked configuration?
03 00 53 43	CC	Is the question, "Have we run a - an alinement in the docked configuration?" That is affirmative.

03 00 53 54	CDR	Okay. Did you have any trouble controlling the vehicle, and what techniques did you use?
03 00 54 02	CC	Briefly, to control pitch and roll, use the TTCA, as we've practiced; for yaw you can use the ACA. Over.
03 00 54 24	CDR	Okay. You have no special techniques going back and forth between the yaw and the X and Y lines. Over.
03 00 54 33	CC	Not right now, Jim. Dave Scott's been running these things and we'll get them up to you shortly. Over.
03 00 54 43	CDR	Okay.
03 00 54 44	CC	We think the alinement's going to be okay, so we don't have to do this P52 fullup alinement. We think the check is going to be okay. Like to remind you since you are in ATT - if check does not pass, since you are in attitude for the Sun, that we'd - We want the Sun half-unit vectors first. Over.
03 00 55 07	CDR	Roger. Understand.
03 00 56 14	CDR	Okay, Houston. It's been over an hour since we did our last PTC. You want us to do another one now?
03 00 56 22	CC	Stand by 1. Over.
03 00 57 09	CC	Aquarius, Houston. We'd like you to go ahead and yaw 90 for the PTC. Keep a close eye out on your middle gimbal angle. You're about 30 degrees from gimbal lock, and we'll call you an OMNI switch halfway through the maneuver. Over.
03 00 57 30	CDR	Roger.
03 00 59 27	LMP	Okay. And, Houston, Aquarius. You might know when you've had enough ranging so we can get the power amp back off again.
03 00 59 36	CC	Roger, Fred-o. We got one more procedure, and we can shut it down, and that's to get the needles and the FDAI for this maneuver. That 5018 could take you to gimbal lock, and we think it's

		a good idea to power up the commander's ball. We've got a four-stepper, if you're ready to copy. Over.
03 01 00 15	LMP	Okay. Go ahead.
03 01 00 16	CC	Okay. Verify that you got AC power, in other words, the INVERTER 2 selected and the BUS TIE INVERTER 2 AC BUS A closed. We'll be under FLIGHT DISPLAYS, GASTA closed, commander FDAI, closed. On the AC BUS A, CBs GASTA closed, COMMANDER FDAI closed. Over.
03 01 01 04	LMP	Okay. It's verify we have AC, which is panel 16 INVERTER 2 closed. CB INVERTER 2 closed. Then on panel 11 under FLIGHT DISPLAYS, we want the GASTA and the COMMANDER's FDAI breakers closed. Also under panel 11, AC BUS A GASTA and COMMANDER's FDAI breakers closed.
03 01 01 25	CC	That's affirmative. Over.
03 01 02 11	CC	Aquarius, Houston. After the OMNI switch, we would like you to get the ranging off, the VOICE switch to DOWN VOICE BACKUP, and the POWER AMP CB on 16 open. Over.
03 01 02 31	LMP	Okay. After the OMNI switch, we'll get the POWER AMP off and go back to DOWN VOICE BACKUP FTA and the RANGING off. It's your call.
03 01 02 43	CC	Roger. Stand by.
03 01 02 55	CC	Fred-o, we got about 2 minutes to the OMNI switch. You can go ahead and power the RANGING down and and the DOWN VOICE BACKUP, and we'll give you a call on OMNI switch. Over.
03 01 03 09	LMP	Okay.
03 01 03 19	LMP	How do you read Aquarius now on DOWN VOICE BACKUP?
03 01 03 24	CC	Roger, Aquarius. We are reading you about the same, about 2-by.
03 01 03 34	LMP	Okay.
03 01 04 16	CC	Aquarius, Houston. Select FORWARD OMNI. Over.
03 01 04 26	LMP	...

03 01 04 28	CC	Roger.
03 01 08 55	LMP	Do you read down there, Houston?
03 01 09 03	CC	Apollo 13, Houston. We read you weakly. Go ahead.
03 01 09 11	LMP	Okay. Vance, if Buzz or Neil are around you might ask them if they had to use the AOT lamps to shoot the Sun like they did on 11.
03 01 09 25	CDR	Well, where's the ...
03 01 09 34	LMP	Right down below me here?
03 01 09 37	CC	Fred, breaking in. You're very weak. Understand if Buzz or Neil are down here, you'd like to ask them if they used the AOT lamp to what? Over.
03 01 09 52	CDR	To see the Sun, Vance. It might be possible to see the reticle without even having the light on.
03 01 09 58	CC	Oh, I see. See if it's possible to see the reticle without the light on. Okay. We'll make a check. And one other thing, you might move that rendezvous radar antenna to park any time now. You can start any time you want.
03 01 10 19	CDR	Okay.
03 01 10 30	LMP	... it's out of the way.
03 01 10 54	CC	Apollo 13, Houston.
03 01 11 01	CDR	Go ahead, Vance.
03 01 11 03	CC	Jim, Neil is here. He advises that you will not need the lamp on for the Sun check but that you will need it on for the Earth check. Over.
03 01 11 18	CDR	Understand.
03 01 11 32	LMP	Okay. Let's park the radar. Are you ready?
03 01 11 35	CDR	Okay. Let me - First of all, let me see how we're doing here. That's going down. That's better. That's coming up. That's right. Let's - Okay. Let's park the radar. How - How long is it going to take?

03 01 11 48	LMP	Not too long. Okay, INVERTER 2 ... Here, hold the light for me, Jim. Right here on the ... panel. Hold it still. ... AC BUS A BUS TIE.
03 01 12 13	CDR	Okay.
03 01 12 14	LMP	AC BUS A.
03 01 12 15	CDR	Okay.
03 01 12 17	LMP	BUS TIE INVERTER 2.
03 01 12 18	CDR	BUS TIE INVERTER 2. PRO.
03 01 12 22	LMP	Okay. Panel 16 verify and select INVERTER 2.
03 01 12 28	CDR	Okay.
03 01 12 31	LMP	Okay. On CB 11, give me the RENDEZVOUS RADAR breakers, with 30-second spread.
03 01 12 37	CDR	Okay. ... at 15, I ...
03 01 12 45	LMP	Okay. ... 30 seconds.
03 01 12 48	CDR	Okay. Go ahead.
03 01 12 50	LMP	Right.
03 01 13 16	LMP	Okay. Thirty seconds. AC breaker.
03 01 13 19	CDR	Okay. Got a big dip.
03 01 13 21	LMP	Okay. Reach up here and give me the ... panel ...
03 01 13 24	CDR	Okay. She's pulled.
03 01 13 33	LMP	Okay. Panel 3, check the LGC.
03 01 13 36	CDR	LGC.
03 01 13 37	LMP	Okay. Give me a VERB 41 NOUN 72.
03 01 13 40	CDR	Still going good, right?
03 01 13 46	LMP	Okay. And they're all zips, 28300.
03 01 13 55	CDR	00.

03 01 13 56	LMP	Go.
03 01 13 57	LMP	... 16 72 ...
03 01 14 14	CDR	It's going now. ... signal light.
03 01 14 15	LMP	Right.
03 01 14 23	CDR	... is running away. Docking light.
03 01 14 26	LMP	What?
03 01 14 27	CDR	Command module docking light. Okay. You got them. They're in.
03 01 14 41	LMP	Okay. Two RENDEZVOUS RADAR breakers, pull them. ... ...
03 01 14 49	CDR	...
03 01 14 55	LMP	CB 16 INVERTER 2 open.
03 01 15 02	CDR	Okay.
03 01 15 10	CDR	You know that light on the command module ...?
03 01 15 43	CC	Apollo 13, Houston. Over.
03 01 15 46	CDR	... get that thing ...
03 01 15 51	CC	Roger. One correction. We think that the cheapest way for you to maneuver to change attitude is with minimum pulse ACA. That's to do the star mark.
03 01 16 10	CDR	We had - Okay. As soon as possible we'll get that star data ... we can get to maneuver attitude by using TTCA.
03 01 16 23	CC	Roger.
03 01 16 25	CDR	And, just out of curiosity, we got rid of the radar very nicely. It's hanging right in the middle of the - the forward digit is the docking light on the command module. Can you believe that? I don't think it will hurt our Sun check, but it'll sure make P52 ...
03 01 16 53	CC	Sorry, Jim, but we are only reading you about 1 by 1.

03 01 16 56	LMP	Look at that big ... out there.
03 01 17 04	CDR	... out there.
03 01 18 21	CDR	It looks like a piece of wrapping for ... line.
03 01 18 49	CDR	You're watching that. Right?
03 01 19 52	CDR	It's going to get smaller before it gets larger.
03 01 21 10	CDR	Okay. I guess they can close it.
03 01 22 03	CDR	Okay. Did you read your figures ...?
03 01 22 06	LMP	Yes.
03 01 22 07	CDR	Okay.
03 01 22 45	CDR	Okay. ... P22. What's our next time line?
03 01 22 50	LMP	... about 73:30 ...
03 01 23 56	CDR	Did you get that or did he give it to you?
03 01 23 58	LMP	He gave it to me.
03 01 24 01	CDR	Okay. Because I thought he said 2 degrees per second. Like to check on that.
03 01 24 09	LMP	Okay, Houston; Aquarius.
03 01 24 11	CC	Go ahead, Fred.
03 01 24 16	LMP	Okay. Jim thinks he heard something different than I copied on the DAP load. Is REGISTER 1 supposed to be 31120?
03 01 24 32	CC	That's correct, Fred. That was to be 31120.
03 01 24 40	CDR	Okay.
03 01 24 41	LMP	Okay.
03 01 24 47	CDR	And, Houston, how do you want us to ...
03 01 25 13	CDR	... 3, 2, C and D, 2, 2, 0, ... Okay. We're at high bit rate.
03 01 25 53	LMP	Okay. ... give ... a call.

03 01 26 01	CDR	Well, they probably don't know what to do there.
03 01 26 06	CDR	Okay. And, Houston; Vance.
03 01 26 09	CC	Go ahead, Jim.
03 01 26 13	CDR	Just want to get a time check with you. When do you want us to start powering up the ball? We just got to out PTC attitude.
03 01 26 21	CC	Understand you'd like to know when to power up the -
03 01 26 24	CDR	We think to take about 15 - -
03 01 26 25	LMP	...
03 01 26 29	LMP	Yes. The ball inside the maneuver, we think it will take us about 15 minutes to get there. We'd like you to confirm that.
03 01 26 40	CC	Stand by 1.
03 01 26 54	LMP	... god damn ...
03 01 27 28	CDR	What would that take to use ... use the command module or what? To load the PLSS ...
03 01 27 30	LMP	... ... Let's see, about 10 or 11 ...
03 01 31 29	CDR	When is that Sun check time supposed to take place?
03 01 31 32	LMP	74 hours 29 minutes ...
03 01 31 40	CDR	Okay, Houston; Aquarius. I'd just like to do the little Sun check. Do you want me to do it now?
03 01 31 45	CC	Jim, Roger. We just came up with a maneuver time of approximately 15 minutes, so if you start any time between now and about the next 2 minutes it would get you into attitude by 73:15. Over.
03 01 32 06	CDR	Roger. We'll start the maneuver at this time. Okay. Let's go.
03 01 32 12	LMP	Okay. SPS ... - -
03 01 32 13	CDR	If we don't keep working, we'll never develop it.
03 01 32 29	LMP	... now. Power up your FDI.

03 01 32 31	CDR	All right.
03 01 32 34	LMP	Okay. Give me 16 ... Apparently. ... panel 11 ...
03 01 32 42	CDR	Yes.
03 01 32 43	LMP	... GASTA.
03 01 32 45	CDR	Okay.
03 01 32 47	LMP	And COMMANDER FDI.
03 01 32 49	CDR	Okay.
03 01 32 51	LMP	And on your H_A, yaw right side, lift main line ... ...
03 01 33 01	CDR	Okay.
03 01 33 04	LMP	Now ... 30 second ... Okay. Now let's get ready to run this back. ...
03 01 33 16	CDR	Okay.
03 01 33 26	CDR	Okay. DEADBAND OPTION.
03 01 33 48	LMP	Okay. ... ...
03 01 34 04	LMP	Okay ... on this ... vector. Okay, R_1 plus 45498 ... Okay, plus 190 ..., plus 08256. Okay, now we show zips ... Okay. VERB 62 ENTER. Okay. ... and the main ... in AUTO ... ...
03 01 36 09	CDR	Houston, are you monitoring our P52 technique?
03 01 36 20	CC	- - Apollo 13 - -
03 01 36 24	CDR	Roll, yaw, roll, pitch, and yaw.
03 01 36 29	CC	Jim, that's negative. We don't have any data on you. Low bit rate.
03 01 36 36	CC	We don't have high bit rate.
03 01 36 49	LMP	Houston, do you read Aquarius?
03 01 36 51	CC	Roger. Reading you, Fred. Go ahead.
03 01 37 05	CC	Go ahead. Houston is reading you.
03 01 37 06	LMP	Houston, Aquarius.

03 01 37 08	CC	Reading you loud and clear. Go ahead.
03 01 37 14	CDR	Are you monitoring our P52 technique?
03 01 37 19	CC	That's negative, Jim. We do not have high bit rate data on you now. Over.
03 01 37 28	CDR	Okay. Thank you.
03 01 37 30	CC	Roger.
03 01 37 33	LMP	And be advised, Vance, that we are getting several echos in our COMM downlink here.
03 01 37 42	CC	Roger. We'll check into it.
03 01 37 58	CDR	... ... and ... alinement.
03 01 38 04	CC	Apollo 13, Houston.
03 01 38 11	CDR	Go ahead, Houston.
03 01 38 12	CC	Jim, request you give us high bit rate now. We might be able to fix you up on the 120 antenna.
03 01 38 21	CDR	Okay. High bit rate.
03 01 38 25	CC	Roger.
03 01 39 10	LMP	And, zero, zero, zero.
03 01 39 15	CDR	Yes.
03 01 39 20	CC	Apollo 13, Houston.
03 01 39 26	LMP	Go ahead.
03 01 39 27	CC	Fred, we can't lock up on your high bit rate. Request you go back low bit rate.
03 01 39 36	LMP	Hey, we lost you there, Vance.
03 01 39 39	CC	Roger. Advise, we are not locking up on your high bit rate, so you can go back low bit rate. Over.
03 01 39 49	LMP	Low bit rate.
03 01 41 14	LMP	Right here, Jim. There it is. Looks like it ...
03 01 41 25	CDR	I don't have all the confidence in the world in this Earth-Sun P52.

03 01 42 18	CDR	You know how many times I screwed up on my arithmetic.
03 01 42 24	LMP	Yes. Don't count your chickens before they hatch.
03 01 42 28	CDR	Listen, I'm not.
03 01 42 40	CDR	We're ... going to be two diameters out, huh?
03 01 42 42	LMP	Yes.
03 01 42 43	CDR	Okay. Tell me what that technique is to get the lamp on, in case I don't see it.
03 01 42 48	LMP	They'll have to give you AC again and you punch in your breaker - Well, let's see - I've still got H_P on for the FDIs, so you're in business now. All you need is the lamp breaker, the AC BUS A AOT lamp breaker, that is.
03 01 43 57	CDR	Let me know when these start going. There's the Sun. Give me the - Give me the AOT.
03 01 44 08	LMP	Okay.
03 01 44 09	CDR	Never mind. I don't need it. Go ahead. I got it. Never mind.
03 01 44 16	LMP	Reticle brightness, want it up? Got the reticle?
03 01 44 19	CDR	I got the reticle ...
03 01 44 29	LMP	... Call it, Jack; you can see it better.
03 01 44 33	CMP	...
03 01 44 35	CDR	Okay.
03 01 44 37	LMP	... ...
03 01 44 52	CDR	... we got it a great big one.
03 01 45 00	LMP	Yes. I show it about maybe a third of a diameter to the left.
03 01 45 11	CDR	Okay. Take a look.
03 01 45 14	LMP	Check your needles. You're off in roll, Jim.
03 01 45 32	LMP	Pitch and yaw are in, but we're off in your roll needle. Better get that ...

03 01 45 41	CDR	Okay. It brings it in. Say when.
03 01 46 05	CDR	Okay. We got it. I think we got it. What diameter was it?
03 01 46 16	LMP	Yes. It's coming back in. Just a second.
03 01 46 25	CDR	Yes, yaw's coming back in.
03 01 46 40	CDR	Just about it.
03 01 46 44	LMP	Okay. Yaw is in ...
03 01 46 46	CDR	What have you got?
03 01 46 47	LMP	... upper right corner of the Sun.
03 01 46 52	CDR	We've got it.
03 01 46 59	LMP	You're hot ...
03 01 46 59	CDR	Houston, Aquarius.
03 01 47 01	CC	Go ahead, Aquarius.
03 01 47 05	CDR	Okay. It looks like the Sun check passes.
03 01 47 10	CC	We understand it checks out. We're kind of glad to hear that.
03 01 47 17	CDR	It's not quite centered, but it's about a diameter, a little bit less than a diameter, just to one side.
03 01 47 24	CC	Sounds good.
03 01 47 31	CDR	Now. Let's get the AOT lamp on.
03 01 47 34	LMP	Okay, Jim.
03 01 47 36	CDR	Which ... to get the AOT lamp on?
03 01 47 38	LMP	Okay. Pull the - your AOT lamp breaker.
03 01 47 44	CDR	Got it.
03 01 47 45	LMP	Okay. And, Houston, can we proceed with our powerdown now? Getting the ball back off and AOT lamp, et cetera, AC secured.
03 01 47 57	CC	Stand by on that one for a minute, Fred.

03 01 48 00	LMP	- - the ball ... get back to - Okay. What we'd like now, I guess, is the next attitude to go to, Vance, and we will work on getting there while we still have the ball.
03 01 48 21	CC	Roger. We copy.
03 01 48 24	CDR	...
03 01 49 04	CDR	Okay. Seventy-four hours.
03 01 49 14	LMP	Yes. We're not there yet, really. I've got 11 minutes to check ... out.
03 01 50 05	LMP	Yes. Bring your ... down.
03 01 50 57	LMP	Get set. Keep ... It's better in here. Slow now ...
03 01 51 31	CC	Apollo 13, Houston.
03 01 51 36	CDR	Go ahead.
03 01 51 38	CC	Jim, in a moment we will have an attitude for you to go to, and recommend that you keep your FDI up while maneuvering to that attitude. After you get there, then we will have you widen the deadband and eventually go into a PTC about the burn attitude.
03 01 52 05	CDR	You were cut off slightly, Vance.
03 01 52 08	CC	Roger. We will have an attitude for you to maneuver to in a moment. And you should leave your FDI up for that. The attitude is as follows if you are ready to copy. Over.
03 01 52 26	CDR	Got the book.
03 01 52 32	LMP	Go ahead, Vance.
03 01 52 53	CC	Okay. This is FDAI attitudes for the maneuver. Yaw 060 degrees, pitch 083 degrees, roll 272 degrees.
03 01 52 59	CDR	Let's not read that in the R_1, R_2. I don't want VERB 69 twice. I want VERB 49, 58g's so I can fly the needle.

03 01 53 18	CC	Jim. Those are not VERB 49 angles. Those are strictly FDAI attitudes. Over.
03 01 53 30	CDR	Okay. I understand, Vance. It's much easier if the ball is up to fly the needles; that gives me a drift of VERB 49, 58g maneuver. We could fly that manually.
03 01 53 50	CC	Stand by. We'll try to get you a VERB 49 angle.
03 01 54 06	LMP	Flying on maneuvers.
03 01 54 08	CDR	...
03 01 54 50	CDR	On that last check, what did it look like?
03 01 54 57	LMP	... ...
03 01 56 20	CDR	This is the first three-man LM we've had.
03 01 56 25	CC	Apollo 13, Houston.
03 01 56 26	LMP	And, Vance, which - What hack you got now on GET?
03 01 56 33	CC	Okay. Stand by on that, Fred. First, let me read up your VERB 49 attitude, if you are ready to copy.
03 01 56 45	LMP	Go ahead.
03 01 56 46	CC	Okay. Yaw 27100, pitch 35500, roll 33000. Over.
03 01 57 05	CDR	Ask him if you keep it in AUTO maneuver there.
03 01 57 09	LMP	Okay. VERB 49, yaw plus 27100, pitch plus 35500, roll plus 33000. And do you think it's cheaper to manually make that maneuver or take the 0.2-degree range and go in AUTO maneuver?
03 01 57 50	CC	Fred, we're recommending AUTO maneuver. Over.
03 01 57 57	LMP	Okay. AUTO maneuver, and could you give me a GET right now.
03 01 58 04	CC	Okay. I understand you want GET of the burn. Stand by 1.
03 01 58 10	LMP	That's negative, Vance. What is you clock reading right now?

03 01 58 14	CC	Okay. When I give you a hack, it will be 73:59, and that's about 40 seconds away.
03 01 58 27	LMP	Okay. I think we will make one last check there with the half-unit vectors for 74 hours before we leave this attitude.
03 01 58 36	CC	Okay. And I'm going to calculate in the 2 seconds in giving you the time hack coming up on 73:59:00 when I give the mark. Okay. Stand by.
03 01 58 59	CC	MARK.
03 01 59 06	LMP	Looked good.
03 01 59 09	CC	Okay. I understand you got it.
03 01 59 11	LMP	You want me to PROCEED one more time on that, Jack?
03 01 59 15	CMP	Roger. Yes, go ahead.
03 01 59 45	CDR	Oh, it's on; it's a center.
03 01 59 56	CDR	That's it, she's right on still. Okay. I have, too. That's better than I expected.
03 02 00 05	LMP	Okay. Let's do a VERB 74 and get out of here.
03 02 00 12	CDR	If we can. Go to POO? Okay. I'm going to go to -
03 02 00 19	LMP	...
03 02 00 31	LMP	737100. Roger. 35500, plus 33000. ...
03 02 00 52	CDR	Okay. That's - -
03 02 00 56	LMP	Yaw, pitch, and roll.
03 02 01 01	CDR	Let me see. No, that's yaw, pitch, and - Okay. Everything's ... ... That's roll, pitch, and yaw.
03 02 01 29	LMP	Roll, pitch, and yaw.
03 02 01 32	CDR	Everything ... yaw.
03 02 01 46	CDR	The roll's going to be down here, but the yaw will be off the bellyband. ... procedure, or don't you have a procedure?
03 02 02 08	CDR	Roll, pitch, and yaw, but drift's the one. That would be gimbal lock if it wasn't for being off ...

03 02 02 32	CDR	And, Houston, I see that this maneuver gives us a roll of 27172, a pitch of 08301. Is that what they gave us?
03 02 02 47	CC	This is Houston. Please repeat.
03 02 02 55	CDR	Houston, did you give us VERB 49 in yaw, pitch, and roll, or register 1, 2, and 3?
03 02 03 03	CC	We gave it as yaw, pitch, and roll.
03 02 03 09	CDR	Okay. We wrote it as roll, pitch, and yaw.
03 02 03 23	CC	Okay, Jim. We read it to you as yaw, pitch, and roll, and we should have given it to you registers 1, 2, and 3; but we did not. So register 1 is 33000, register 2 is 35500, and register 3 is 27100.
03 02 03 52	LMP	Okay, Vance. Register 1 will be 33000, register 2 35500, register 3 27100.
03 02 04 05	CC	Hey, Fred? Stand by on that.
03 02 04 11	LMP	Okay. Plus 27100. Okay. Stand by. Right now you can enter ...
03 02 04 43	CC	Okay. Apollo 13, Houston.
03 02 04 49	CDR	Go ahead.
03 02 04 51	CC	Okay, Jim. We sorted it out, and it is correct the way we gave you the first time. So, R_1 27100, and in the LM, that's yaw; R_2 35500, and that's pitch; R_3 33000, and that's roll in the LM. Over.
03 02 05 24	CDR	I agree with you. Okay. 5018, it's there, and 5018, and that's what it will be. Okay.
03 02 05 32	CC	That's right. That's VERB 49.
03 02 05 46	CMP	There are 25. 25, ENTER.
03 02 05 51	CMP	Okay. Plus 27100, plus 35500, plus 33000.
03 02 06 07	LMP	Okay.
03 02 06 57	LMP	So far we're ... what can we do about it?
03 02 07 48	CC	Apollo 13, Houston. You better watch that middle gimbal. Over.

03 02 07 56	LMP	Roger. We're watching that middle gimbal. We have as a roll, 27172. Our yaw is - that's register 3 - 3300. How did we get this?
03 02 08 36	CC	And, Apollo 13. We have a procedure for you describing how to widen the deadband to 5 degrees later on. But stand by for that.
03 02 08 51	CC	Apollo 13, you're heading for gimbal lock. You better stop everything.
03 02 09 01	LMP	Yes, we're back in ATT HOLD now. We're trying to stop it.
03 02 09 04	CC	Roger.
03 02 09 09	CDR	I'm going to roll it.
03 02 09 25	LMP	Can you give it a roll up now, Jim?
03 02 09 27	CDR	Yes.
03 02 09 39	CDR	I don't understand why we got that.
03 02 10 30	CC	Apollo 13, Houston. It looks like VERB 49 maneuver will just take you right through there. You're going to have to go around it. Over.
03 02 10 41	CDR	Okay. That's what we're in the process of doing.
03 02 10 43	CC	Si, si.
03 02 10 47	LMP	We're manually working our way around it, Vance.
03 02 10 53	CC	Okay.
03 02 10 54	CDR	Pitch is 083.
03 02 11 02	CDR	How do I work my way around it? I'm 58g's, and I want yaw 231, right? I think they screwed up on our - our numbers again.
03 02 11 26	LMP	Zero out the needles; we're heading that way, and then we'll stop and talk about it.
03 02 11 53	CDR	No. Pitch is 83. Pitch should be up here. ... ... What's the number, 552?
03 02 12 11	LMP	Pitch should be 83 degrees. ...
03 02 12 24	CDR	Roll 232; that's a long way to roll, ... yaw is 62 ...

03 02 12 30	LMP	... yaw.
03 02 13 20	CDR	... roll.
03 02 13 28	LMP	...
03 02 13 44	CDR	Okay. What's that read; there's 180.
03 02 13 57	LMP	Roger.
03 02 14 04	CDR	... is over here. Houston, 13.
03 02 14 10	CC	Go ahead, 13.
03 02 14 15	CDR	There's something screwed up on our burn attitude. We're not getting the proper readings on the ball and the needles are centered. I'm not too sure what's wrong. Let's go through this procedure again.
03 02 14 30	CC	Okay. Stand by 1. Let us look at it.
03 02 14 31	LMP	- - angles you gave us, Vance, aren't correlating the VERB 49 numbers.
03 02 14 38	CC	Okay. We'll check into it.
03 02 14 53	CDR	We know the ball is good. Why don't we just get a 40?
03 02 15 38	LMP	You better watch out; it's heading that way.
03 02 15 50	CC	Apollo 13, Houston.
03 02 15 56	CDR	Go ahead, Houston.
03 02 15 57	CC	Okay, Jim. To answer your last question, do you have PGNS checklist page 57 handy?
03 02 16 09	CDR	Right, we do. I'll check it.
03 02 16 12	CC	As soon as you open up to that, I'll explain it.
03 02 16 40	LMP	Okay. Go ahead, Vance.
03 02 16 42	CC	Okay. Under VERB 49, crew-defined maneuver, the flashing 0622 are the angles that we gave you that were loaded. The flashing 5018 actually represents FDAI angles, and so what you read on 5018 should - -

03 02 17 05	LMP	Right. I understand.
03 02 17 06	CC	- - should not correspond with NOUN 22.
03 02 17 13	LMP	Yes. We appreciate that, Vance. It's just that right now we're trying to follow center needles that appear to be possibly taking us away from the place we know we want to be in the ball.
03 02 17 34	CC	Okay. You're tending toward the gimbal lock area again. Heads up.
03 02 17 42	LMP	Roger.
03 02 18 00	CDR	There's our 83. - -
03 02 18 36	CC	Apollo 13, Houston.
03 02 18 41	CDR/LMP	Go ahead.
03 02 18 43	CC	13, request you put in the POWER AMPL circuit breakers so that we can take a look at your angles.
03 02 18 54	LMP	You got it.
03 02 18 56	CC	Thank you. And now high bit rate.

END OF TAPE

03 02 19 47	CC	Okay, 13; we're getting your high bit rate now and taking a look at your angles.
03 02 23 01	CC	Apollo 13, Houston.
03 02 23 11	CDR	Go ahead.
03 02 23 12	CC	Okay, Jim, we just took a look at your angles, and you're looking good here. Your PGNS is looking good. We can't yet explain the attitude error needle thing, but I suggest you continue on in your maneuver.
03 02 23 32	CDR	Roger. Okay. We've just about got roll.
03 02 26 41	CC	13, Houston. We see you now in the AUTO maneuver. How are your error needles looking now?
03 02 26 50	CDR	Okay. They look like they are working their way in, Vance.
03 02 26 54	CC	Okay. You think maybe they are working right now?
03 02 27 00	CDR	Yes. Because we got a 270-degree roll, our pitch and yaw needles are reversed.
03 02 27 06	CC	Okay.
03 02 27 22	LMP	Say, how do you read, Vance? ...
03 02 27 28	CC	Fred, you are starting to fade out. Request AFT OMNI, OMNI AFT.
03 02 27 37	LMP	Okay. You've got AFT OMNI.
03 02 27 39	CC	Thank you.
03 02 28 34	CC	13, Houston.
03 02 28 53	CDR	Okay, Houston; Aquarius. We appear to be there - at the burn attitude. And now do you want us to change the DAP?
03 02 29 01	CC	Roger, Jim. We have a procedure to give you for widening the deadband to 5 degrees for the PTC in the next 3 or 4 hours, if you're ready to copy.

03 02 29 13	CDR	Okay, stand by.
03 02 29 29	CDR	Go ahead.
03 02 29 30	CC	Okay. VERB 21, NOUN 01, ENTER; 3011, ENTER; 44, ENTER. Now, that's the procedure for widening the deadband to 5 degrees with the DAP. Later on, prior to the burn, you would return the deadband to 1.4 degrees, and if you're ready to copy, I'll read you that.
03 02 30 11	CDR	Stand by.
03 02 30 13	CC	Okay.
03 02 30 38	CDR	Go ahead.
03 02 30 40	CC	Okay. To return the deadband later to 1.4 degrees: VERB 21, NOUN 01, ENTER; 3011, ENTER; 200, ENTER. Over.
03 02 31 03	LMP	Okay, Vance. To widen the deadband, we'll enter a VERB 21, NOUN 01, ENTER; 3011, ENTER; 44, ENTER. Before the burn to go back to narrow deadband, it's VERB 21, NOUN 01, ENTER; 3011, ENTER; 200, ENTER.
03 02 31 22	CC	Roger. Readback correct.
03 02 32 30	CDR	And, Houston, I'll guess we'll do this PTC in yaw, and do you want them all powered down?
03 02 32 45	CC	Stand by.
03 02 33 06	CC	Okay, Apollo 13. Over.
03 02 33 11	CDR	Go ahead.
03 02 33 13	CC	Okay, that's affirm. You'll be doing the PTC in yaw, and we'll give you a call at each time you change yaw - yaw attitude. Aside from that, request low bit rate off; then DOWN VOICE BACKUP OFF; then POWER AMPL OFF; and then FDA OFF.
03 02 33 42	LMP	Okay, Vance. On the power down, we go low bit rate; DOWN VOICE BACKUP, we'll pull the POWER AMPL breaker; and we'll power down the FDI and the AC.
03 02 33 55	CC	That's affirm. And the AOT, too.

03 02 34 59	CDR	Okay, are you all set for old a -
03 02 35 02	LMP	Okay, Houston; Aquarius. How do you read DOWN VOICE BACKUP?
03 02 35 07	CC	Reading you loud - loud and clear now, Fred.
03 02 35 13	LMP	Okay.
03 02 35 18	CDR	Oh, Vance, do you want to stay in this attitude for a certain length of time before we start maneuvering?
03 02 35 26	CC	Roger. Jim, we'll keep you there for about an hour, and then we'll have our first 90-degree rotation.
03 02 35 36	CDR	Okay. How wide do I make the deadband?
03 02 35 52	CC	Say again.
03 02 37 15	CDR	... the other OMNI's in.
03 02 37 27	LMP	Yes. My forward OMNI is in.
03 02 37 29	CC	Apollo 13, Houston. Forward OMNI should be best.
03 02 37 36	LMP	We're there.
03 02 39 14	CDR	I don't see why the hell he ...
03 02 39 19	LMP	I know. I don't know. I don't know where that 5 degrees ...
03 02 39 40	CMP	Cut it.
03 02 39 48	CDR	...
03 02 40 24	CDR	Oh-h. ... that thing against the ...
03 02 42 15	CDR	I'm just going to try and close my eyes for a little.
03 02 42 19	LMP	Go ahead.
03 02 50 32	CC	Aquarius, Houston.
03 02 50 37	LMP	Go ahead.

03 02 50 39	CC	Fred, one - one point on the PTC requests that, about an hour or less from now when you make your 90-degree change, that you do it in PGNS AUTO as opposed to ATT HOLD. Reason is that if you're in ATT HOLD, it establishes a new null point each time you stop the - the maneuver. Over.
03 02 51 10	LMP	Okay. You want us to make the maneuver with PGNS AUTO rather than the PGNS ATT HOLD. Is that right?
03 02 51 18	CC	Yes. That's correct.
03 02 51 33	CC	And, Fred, advise that it - it is a manual maneuver.
03 02 51 53	CC	13, Houston. You'd be using X-axis override. It will be a manual maneuver, but with the PGNS AUTO mode.
03 02 52 07	LMP	Okay.
03 02 52 10	CC	And if you're ready to copy, Charlie is going to be on in a minute with some recommended checklist changes for your upcoming burn. Over.
03 02 52 25	LMP	Okay. Stand by 1.
03 02 52 26	CDR	I'm going to erase this.
03 02 53 19	CC	Hello, Aquarius; Houston. Do you read? Over.
03 02 53 28	LMP	Yes. Stand by 1 ...
03 02 53 48	LMP	Okay. Which book are you going to give me some words in, Charlie?
03 02 54 04	LMP	Houston, Aquarius. Which book do you want us to have out? ... contingency ...?
03 02 54 16	CC	Houston. This is Houston, Aquarius. Say again. Over.
03 02 54 23	LMP	Houston, Aquarius. Which book do you want me to update here, Charlie, the contingency QR DPS?
03 02 54 38	CC	Okay, Fred-o, we'd like you to get out the contingency checklist; turn to page 1, the 2-hour activation. Over.

03 02 54 51	LMP	Okay. I'm right there.
03 02 54 54	CC	Okay. On page 1, the only thing we have to do is EPS Activation, step 2, CB(16) EPS: DISPLAY, CLOSE. Over.
03 02 55 18	LMP	Okay. On page 1, we need EPS DISPLAY, CLOSE, under EPS Activation, step 2.
03 02 55 27	CC	Okay. Turning over to page 2, we'd like you to complete step 5 and step 6 with the following changes. POWER/TEMP MONITOR, AC BUS, INVERTER 2, then INVERTER 1. Fourth line CB(11), EPS: INVERTER 2, OPEN. Over.
03 02 56 08	LMP	Okay, on step number - or page 2, we should do step 5 and modify step 6 second line to read INVERTER 2, then INVERTER 1, to the last line of step 6 CB(11), EPS INVERTER 2, OPEN.
03 02 56 30	CC	Okay. That will be on CB(16), Fred-o, but it's INVERTER 2 OPEN. Okay, on the Mission Timer Activation. Do step 1, correction, lines 1 and 2. Omit "set mission timer on CSM mark" and insert a VERB 16, NOUN 65, set mission timer. Over.
03 02 57 04	LMP	Okay. We'll do the Mission Timer Activation except we'll set it on VERB 16, NOUN 65.
03 02 57 11	CC	Okay. Proceeding on to step, correction, page 3, CWEA checkout. Step 1, perform step 1. Warning lights will be ASCENT PRESS, CES AC, and CES DC. Under the caution lights, we may have a heater light. And that's all. Okay, perform - under the circuit breaker 16 - -
03 02 57 46	LMP	I can't understand you. I'll switch OMNIs.
03 02 57 49	CC	Say again. Over.
03 02 57 54	LMP	I'm going to switch to OMNIs here, Charlie, you're starting to fade out.
03 02 58 00	CC	Understand. Switching OMNIs. Over.
03 02 58 02	LMP	Okay. How do you read? ..., how do you read me now?
03 02 58 08	CC	Okay, you're a little better. How me? Over.

03 02 58 14	LMP	Okay, Houston. Coming in loud and clear. I got your caution/warning checkout, step 1, do; the warning lights we'll have will be ASCENT PRESS, CES AC, CES DC. The only caution lights we may have will be a heater light and go ahead and proceed from there.
03 02 58 32	CC	Okay, good. The component light, we won't have the H_2O SEP. Okay, on CB(16) right under that, "HEATER DISPLAY, CLOSE," you can scratch that out. Perform all of step 2 and perform step 4 with the following changes. On panel 11, under AC BUS B, are you ready to copy? Over.
03 02 59 09	LMP	Go ahead.
03 02 59 10	CC	Okay, under AC BUS B: S-BAND ANTENNA, OPEN; ORDEAL, OPEN. Under AC BUS A: TAPE RECORDER, OPEN. Row 2 under RCS SYSTEM A: MAIN SOV. Starting with a QUAD TCA; all four CLOSED. Under FLIGHT DISPLAYS: CROSS - COMMANDER CROSS-POINTER, OPEN; COAS, OPEN; ORDEAL, OPEN. For row 3 under HEATERS: RENDEZVOUS RADAR STANDBY, OPEN; LANDING RADAR, OPEN. Under STAB/CONTROL: ATTITUDE DIRECT CONTROL, CLOSE. Under ED: LOGIC POWER A, OPEN; and under LIGHTING: UTILITY, OPEN. Are you with me? Over.
03 03 00 37	LMP	Yes. I'm still with you, Charlie; go ahead.
03 03 00 39	CC	Okay, Fred-o, good show. On row 4, starting with ECS: SUIT FAN 1, CLOSE; GLYCOL PUMP AUTO TRANSFER, CLOSE. Under COMM: VHF B TRANSMITTER, OPEN; VHF A RECEIVER, OPEN. Under PGNS: SIGNAL STRENGTH DISPLAY, OPEN; IMU OPERATE, CLOSE. Under EPS, row 5: CROSS TIE BUS, OPEN; and INVERTER 1, CLOSE. Over.
03 03 01 35	LMP	Okay, stand by just 1.
03 03 02 01	LMP	Okay, panel 11 configuration, top row: AC BUS B, I want the S-BAND ANTENNA, OPEN, ORDEAL, OPEN; AC BUS A, TAPE RECORDER, OPEN. Second row, under RCS SYSTEM A, I want MAIN SOV through QUAD 1 TCA, all CLOSED. COMMANDER's X-POINTER under FLIGHT DISPLAYS, OPEN; COAS, OPEN; ORDEAL, OPEN. Third row: RENDEZVOUS RADAR STANDBY HEATER, OPEN; LANDING RADAR HEATER, OPEN. Under STAB/CONTROL: ATTITUDE DIRECT breaker, CLOSED; ED: LOGIC POWER A, OPEN;

LIGHTING: UTILITY, OPEN. Under ECS: SUIT FAN 1, CLOSED; AUTO TRANSFER, CLOSED. Under COMM: VHF B TRANSMITTER, OPEN; VHF A RECEIVER, OPEN. Under PGNS: SIGNAL STRENGTH DISPLAY, OPEN; IMU OPERATE, CLOSED. Bottom row, EPS: CROSS TIE BUS, OPEN; INVERTER 1, CLOSED.

03 03 03 19	CC	Roger, Fred. Good readback. Starting with panel 16. Under FLIGHT DISPLAYS, row 1: SE CROSS-POINTERS, OPEN; RCS SYSTEM Bravo - QUAD 1 TCA's, CLOSE; QUAD 2, CLOSE; QUAD 3, CLOSE; QUAD 4, CLOSE. Second row, under LIGHTING: FLOOD is your choice. You can either use them or not. Under ED: LOGIC POWER Bravo, OPEN; ECS: SUIT FLOW CONTROL, OPEN. Third row, under COMM: DISPLAY, OPEN; VHF A TRANSMITTER, OPEN; VHF B RECEIVER, OPEN; S-BAND ANTENNA, OPEN. Fourth row, under HEATERS: DISPLAY, OPEN; under EPS: INVERTER 2, OPEN. And that's it. Readback. Over.
03 03 04 52	LMP	Okay, panel 16, top row, FLIGHT DISPLAYS: SYSTEM ENGINEER CROSS-POINTER, OPEN; RCS SYSTEM B: QUADs 1 through 4 TCAs, all CLOSED. Second row, LIGHTING: FLOODS we'll probably have open - our choice. ED: LOGIC POWER B, OPEN; ECS: SUIT FLOW CONTROL, OPEN. Under COMM: DISPLAY, OPEN; VHF A TRANSMITTER, OPEN; VHF B RECEIVER, OPEN; S-BAND ANTENNA, OPEN. Bottom row, HEATERS: DISPLAY, OPEN. Under EPS: INVERTER 2, OPEN.
03 03 05 34	CC	Roger. Good readback. Okay, continuing on. Nothing on page 6; nothing on page 7. Nothing on page 8 or 9. Nothing on page 10 or 11. On page 12, we want the - to perform - -
03 03 05 59	LMP	Hold it. Hold on just a minute, Charlie.
03 03 06 01	CC	Okay.
03 03 06 18	LMP	Okay. Go ahead, page 12. I'm there.
03 03 06 21	CC	Okay Fred-o. On page 12, we want the MSFN updates. We've got some vectors for you and a P30 pad. And we'll - when you get to that state, we'll let you know when we want to uplink. Okay. Under "AGS Activation and Self Test," perform the entire procedure. On page 13, under "AGS Aline," do step 1; under "DAP Set, Gimbal/

Throttle Test," do step 1 with the following change. Under "THROTTLE CONTROL," we want it "AUTO." Over.

03 03 07 13 LMP Okay. I'll catch up here. On page 12, you'll give us MSFN updates, some vectors, and a P30; and we're to do the entire "AGS Activation and Self Test." On page 13, we'll do the "AGS Align" and under "DAP Set, Gimbal/Throttle Test," step 1, I've changed "THROTTLE CONTROL MANUAL" to "THROTTLE CONTROL AUTO."

03 03 07 43 CC Good readback. Turning over to page 14, step 2, we want you to change the DAP NOUN 46 to 31021. Then after the NOUN 47, insert "VERB 34, ENTER." Over.

03 03 08 15 LMP Okay. On page 14, a VERB 48, DAP load, NOUN 46 changed to 31021. I assume you will give us any updated weights if we need any, and after the NOUN 47, a "VERB 34, ENTER." So, I - you're saying our gimbals look all right.

03 03 08 35 CC That's affirmative on the gimbals, Fred. Nothing else on page 14. Proceed to page 15, and under "RCS CHECKOUT," we'd like to scratch that wording and just say "Verify the following switches: GUIDANCE CONTROL, PGNS;" step 3 - correction - it's line 3, change "ATTITUDE CONTROL (3)" to "MODE CONTROL;" "MODE CONTROL (BOTH)" to "AUTO." Verify ACA PROP, LMP ENABLE; ACA/4 JET, LMP ENABLE; TTCA/TRANSLATION, LMP, ENABLE. That is all on page 15. Over.

03 03 09 45 LMP Okay. On page 15, we'll change the heading "RCS CHECKOUT" to "Verify following switches," and those switches are "GUIDANCE CONTROL, PGNS;" third line, "ATTITUDE CONTROL (3)" to "MODE CONTROL" now; and then "MODE CONTROL (BOTH)" to "AUTO" and ACA PROP, LMP ENABLE; ACA/4 JET, LMP ENABLE; and TTCA/TRANSLATION, LMP ENABLE.

03 03 10 11 CC Roger. Now stand by 1.

03 03 10 17 CDR Okay. Hand me the eyepiece. I got Scorpio.

03 03 10 22 LMP You have?

03 03 10 23 CDR Yes. And Antares.

03 03 10 30	LMP	Where's the other one? I'll put it back in here.
03 03 10 32	CC	Hello, Aquarius. Houston. On activation page 16, if you are ready. Over.
03 03 10 41	LMP	Okay. Stand by just 1, Charlie. Jim's going to fish around and see if he's got - he thinks he's got Scorpio. I'm the AOT now. Okay, Charlie, go ahead. I'm on 16 now.
03 03 11 01	CC	Okay. Fred. On page 16, perform the "Docked DPS BURN (PGNS)," that entire sequence down - down through the end of the page, except cross out that "CSM Maneuver to Burn Attitude, then CMC - FREE." Over.
03 03 11 27	LMP	Yes. I kind of deduced that one, Charlie. Page 16, "Docked DPS BURN (PGNS)," except we'll forget the CSM maneuver.
03 03 11 35	CC	Okay. And you can forget the "APS Follow-up," too. Okay, on page 17, perform all of the AGS entries and at 4 minutes, we got a change. First line, CB(16) INVERTER 3, CLOSE; line 2, scratch out "Select INVERTER 1." At - proceeding on down the page, after "ATTITUDE MONITOR," we'd like you to place the RATE SCALE to "25 degrees a second." Okay, proceeding on down four more lines to "BALANCE COUPLE," we'd like to turn "BALANCE COUPLE-OFF." That's to keep the upfiring jets off of the CSM, in case we have to damp any rates in AGS, though we don't think we will. Then perform the rest of that page as written. Over.
03 03 12 44	LMP	Okay, on page 17. Do the AGS load at minus 4 minutes; it's CB(11), INVERTER 2, CLOSE, and scratch "Select INVERTER 1." RATE SCALE changed to "25 degrees a second." "BALANCE COUPLE," we'll turn "OFF;" and, incidentally, on the AGS dampen rates point, it brings up the discussion we'd had before, Charlie, on takeovers. You might discuss what it's going to cost us DELTA-V-wise, if we get a control problem, to just shut her off and it take 30 minutes to regroup for a good manual burn.
03 03 13 26	CC	Fred, we already got that story for you, pretty well in hand. We're reviewing it right now.

And I'd like to defer that question until later on. Basically, we're just going to shut down and take what we got, and we got a midcourse of about - the maximum of 5 foot per second, anywhere in the burn to get back to free return. That - that's basically the story. We'll give you the mission rules for this burn momentarily. I'd like to proceed on to page 18, at minus 1 minute, scratch "MASTER ARM - ON." Stand by.

03 03 14 07	LMP	Okay, on page 18, and I've already done that at 1 minute; "MASTER ARM - ON," I'll scratch - -
03 03 14 14	CDR	- - Slipped that ... and I won't have anything to do - -
03 03 14 15	LMP	- - I've already scratched "CB(16) ABORT STAGE - CLOSE" for the previous burn.
03 03 14 20	CC	Okay. We want you to close the CB(16) ABORT STAGE. Over.
03 03 14 33	LMP	Okay. You got some special reason for that?
03 03 14 36	CC	Yes, sir. We like - In case we don't get a manual ON - I mean, an AUTO ON, we're going to back up using the abort stage in the descent-engine command override at ignition plus 1 second. Backing up to page 17, at minus 4 minutes, you read "CB(11) INVERTER 2," it should be "CB(16) INVERTER 2." Over.
03 03 15 03	LMP	Okay, I got you, Charlie. 17, "CB(16) INVERTER 2, CLOSE."
03 03 15 08	CC	Okay, back to page 18. We'll continue on as is at 30 seconds, 10 seconds, 7 seconds, minus 5 seconds. At "ignition," no ignition and we'll add here, "no ignition, START pushbutton - push; still no ignition, DESCENT ENGINE COMMAND OVERRIDE, ON." Over.
03 03 15 45	CDR	I got it out there, but I can't get to see it closer.
03 03 15 58	LMP	Okay, on channel - on page 18, right on down the line, everything holds until after "ignition"; "if no ignition, START pushbutton - push; still no ignition, DESCENT ENGINE COMMAND OVERRIDE switch ON."

03 03 16 14	CC	Okay, good readback, Fred-o. At plus 15 seconds, scratch "MASTER ARM - OFF;" and at - proceeding on down to "At Engine Cutoff," it's - after the "MODE CONTROL: PGNS to ATT HOLD," we'd like a "VERB 76," and the "Damp Excessive Rates Via the LM Y, Z Translation." Over.
03 03 16 48	LMP	Okay, scratch "MASTER ARM - OFF" at plus 15, and "At Engine Cutoff" after "MODE CONTROL: PGNS - ATT HOLD," we want a "VERB 76 ENTER," and "Damp Excessive rates Via LM Y, Z translation." And a question on the - propellant quantity, we expect it to get down below 37 percent on this burn. Does that compare with that burn time when you get down to it.
03 03 17 16	CC	That's negative. At this - this burn, we're looking at - not reaching 37 percent, so I don't think we'll have to perform that step. We will verify that for you. Okay. One other statement: "At Engine Cutoff, if manual start, then at 30 feet per second to go, throttle to 40 percent. At DELTA-V equals zero, stop push-button, push." Over.
03 03 18 11	LMP	Okay, Charlie. If a manual start, that was throttle to 40 percent at - Was that 30 foot per second to go?
03 03 18 19	CC	That's affirmative. At 30 foot per second to go.
03 03 18 30	LMP	Okay. Then it's stop pushbutton at VGO equals zero?
03 03 18 36	CC	That's affirmative. What we want to do, if we got a manual start, we're going to have to shut down manually, and, to get a better guided cut-off at 30 foot per second to go, we want you to throttle at 40 and acceleration is within reason there, and we feel like we can get a good manual cut-off. Over.
03 03 18 56	LMP	Okay.
03 03 18 59	CC	Okay. Now, Fred, that was good in the checklist. That's all. We'll have the powerdown checklist for you momentarily, and we'd like to ask you if you plan to use the DPS burn card. If you do, we have some changes to that. Over.

03 03 19 20	LMP	Okay. Let me get ahold of this ... right now.
03 03 19 26	CC	Let me know when you are ready to copy. Over.
03 03 19 31	LMP	I'm ready.
03 03 19 32	CC	Okay. The first two lines are okay. CB - third line, CB(11) and (16): STAB/CONTROL, all CLOSED except CB(11) AEA, OPEN; ABORT STAGE, OPEN; AELD, OPEN. CB(16) AELD, OPEN. Over.
03 03 20 09	LMP	Okay, on the DPS burn card, third line should read CB(11) and (16): STAB/CONTROL CBs all CLOSED, except CB(11) AEA, OPEN; ABORT STAGE, OPEN; AELD, OPEN; CB(16) AELD, OPEN.
03 03 20 25	CC	Okay. Good readback. Proceeding on down the page. "BALANCE COUPLE" switch, "BALANCE COUPLE OFF." Okay, down to the TTCA - it's the last line before minus 2 minutes - "TTCA COMMANDER THROTTLE, MINIMUM; LMP TTCA to JETS." At minus 2 minutes, scratch "400 plus 1." At minus 1 minute, scratch "MASTER ARM, ON." At minus 10 seconds, add "MANUAL ULLAGE." At plus 5 seconds, scratch "DESCENT ENGINE COMMAND OVERRIDE, ON;" add "TTCA, 40 percent." Okay, the same comments apply about the manual start: "At the ignition time, if no start, manual START pushbutton, push; if still no start, DESCENT ENGINE COMMAND OVERRIDE, ON." And the same comments apply to shutting down at manual start. Over.
03 03 21 54	LMP	Okay. The same comments. I'll start at the top again here. Okay. "BALANCE COUPLE" should be changed to "OFF." Under TTCA, it should be "LMP TTCA" to "JET." Scratch "400 plus 1" at minus 2; scratch "MASTER ARM, ON" at minus 1. Add at minus 10 seconds "MANUAL ULLAGE"; add ignition - can add the comment about "If no start, START pushbutton, push; still no start, DESCENT ENGINE COMMAND OVERRIDE, ON." At the plus 5-second point, scratch "DESCENT ENGINE COMMAND OVERRIDE, ON," and add "TTCA to 40 percent," and the same comment applies at engine stop to perform.
03 03 22 39	CDR	We really don't use this card at that time.

03 03 22 42	CC	Roger, Fred-o. Now we aren't - also at minus 30 seconds, we aren't looking at an AGS burn so you can scratch "ABORT pushbutton, push," and at DELTA-V equal to zero, scratch "ABORT pushbutton, reset." Over.
03 03 23 02	LMP	Okay. Minus 30 for AGS burn, "ABORT pushbutton, push" is scratched, and at DELTA-V equals zero, "ABORT pushbutton, reset" is scratched.
03 03 23 11	CC	Okay, you got it, babe. We'll have some mission rules for you momentarily, and the powerdown checklist and also a PTC setup. Over.
03 03 23 24	LMP	Okay.
03 03 23 27	CDR	Houston, Aquarius.
03 03 23 29	CC	Go ahead, Jim. Over.
03 03 23 34	CDR	Roger. Be advised I'm now seeing Antares and Nunki in the AOT, and I just wanted to know whether you want me to try to do a P52.
03 03 23 48	CC	Roger. Stand by. We copy the stars you are seeing. Stand by on a P52.
03 03 23 56	LMP	Not very far apart. Put the card back up, Jim - -
03 03 24 01	CDR	It's better than Antares and Shaula.
03 03 24 05	LMP	Yes. Sure is. That's right.
03 03 24 16	CDR	We got pretty good ... I'll do an AUTO P52 to Antares. That's the way I'll get it up there.
03 03 24 23	CC	Hey, Houston - correction - Aquarius, Houston. We're satisfied with our present alinement. We don't want you to waste any more RCS gas trying to do this P52, and be advised you guys are hot mike, if you haven't heard. Over.
03 03 24 44	CDR	Okay, understand.
03 03 24 47	LMP	How's your memory there, Charlie?
03 03 24 51	CC	Okay, we're putting Vance back on. Stand by.
03 03 25 10	CDR	What was that - -

03 03 25 20	CDR	Okay, okay, let's go back to that P52 ... now the attitude.
03 03 25 26	LMP	The burn attitude?
03 03 25 28	CDR	Yes. I want to make sure I got it.
03 03 25 30	LMP	Oh, you strayed off?
03 03 25 31	CDR	Yes.
03 03 25 34	LMP	Okay. ... Okay. You want these numbers? Or do you want the numbers from these.
03 03 25 47	CDR	What?
03 03 25 48	LMP	Pads. You got the G&N dictionary?
03 03 25 51	CDR	I got 13 20 going now.
03 03 25 57	LMP	Wait a minute.
03 03 26 10	CDR	... Just a ... These are those 13 20 angles here. Up here. Right here.
03 03 26 56	CDR	Hey, great.
03 03 27 20	LMP	One on. And Houston, Aquarius.
03 03 27 27	CC	Go ahead, Fred.
03 03 27 32	LMP	Oh, about how long we got before we're going to have to go to work here, Vance. Kind of like to get a bite to eat, maybe.
03 03 27 40	CC	Okay. We have a - a couple of pads to give you and stand by. Let's - we'll check to see if we have anything else.
03 03 27 56	LMP	Hold on to that, baby. Where's that G&N book? You got it over there?
03 03 28 02	CDR	Here we go. Here, you want me to start copying - -
03 03 28 06	LMP	- - ... the bag - -
03 03 28 07	CDR	- - off there.
03 03 28 09	CC	Aquarius, Houston.

03 03 28 11	LMP	No, you've got it right here.
03 03 28 14	CDR	Go ahead.
03 03 28 15	CC	Okay. About all we have to do is to send up your state vectors and target loads, and that will have to wait a couple of minutes until we get ready to do so. And if you're ready to copy, I can give you the P30 maneuver pad for PC plus 2, and after that, probably you should eat and then we'll regroup again to send up other things. Over.
03 03 28 45	LMP	Okay. I'm ready to copy a P30, a PC plus 2.
03 03 28 49	CC	Okay. Okay, this is a preliminary P30 LM maneuver PC plus 2. Starting NOUN 33: 079:27:40.07; plus 0819.2, minus 0020.0, minus 0218.9; NA; plus 0020.9, 0848.2; 420, 274, 082; plus 0820.3, minus 0020.0, minus 0215.0. Comments. Ullage is two jets for 10 seconds. CSM weight, 62480. LM weight 33576. And the following is the DPS throttle profile: 5 seconds at minimum followed by 21 seconds at 40 percent, and the remainder at MAX. Over.
03 03 31 21	LMP	Okay. PC plus 2. 079:27:40.07; plus 0819.2, minus 0020.0, minus 0218.9; NA; plus 0020.9, 0848.2; 420, 274, 082; plus 0820.3, minus 0020.0, minus 0215.0; the rest N/A. Under remarks: ullage, two jets 10 seconds; CSM weight 62480; LM weight 33576. DPS throttle profile: 5 seconds at idle; 21 seconds at 40 percent; remainder at MAX.
03 03 32 50	CC	Roger; that's correct, Fred. If you'll take out a maneuver pad, I'll give you some landing information. Over.
03 03 33 04	LMP	Okay, you're talking in the CSM update book?
03 03 33 08	CC	Yes, that's affirm.
03 03 33 13	LMP	You got it right here. Make sure and scratch the ... - -
03 03 33 19	CDR	... - -
03 03 33 20	LMP	- - though.
03 03 33 43	LMP	Okay, which - which one we want? P37?

03 03 33 50	CDR	What kind of a maneuver pad do you want, Vance?
03 03 33 54	CC	This is a CSM maneuver pad for - to monitor PC plus 2. And it's going to be mainly blank except I want to give you your NOUN 61 latitude and longitude range to go for the EMS and that sort of thing.
03 03 34 15	LMP	Okay, go ahead.
03 03 34 18	CC	Okay, at the top, purpose is monitor PC plus 2; everything is blank until you get down to NOUN 61. Latitude as follows: minus 21.47, minus 165.00; 1166.0, 36291, 142:39:20. Over.
03 03 35 07	LMP	Okay, monitor PC plus 2 pad. NOUN 81: minus 21.47, minus 165.00; 1166.0, 36291, 142:39:20.
03 03 35 28	CC	Roger; that's correct, Fred-o. And we - now would like to get you in a configuration to uplink your state vector and target load. So, if you're ready to copy, I have some circuit breaker changes for you. Over.
03 03 35 47	LMP	Okay, go ahead.
03 03 35 50	CC	Okay, circuit breaker panel 11 UPDATA LINK, CLOSE; PRIMARY POWER AMPL, panel 16, CLOSE; VOICE FUNCTION to VOICE; RANGE - RANGING FUNCTION to RANGING; TM bit rate, HI; and then POO and DATA.
03 03 36 28	LMP	Okay, we're now in POO and DATA, and switches and breakers are configured. You got it.
03 03 36 32	CC	Okay, thank you. You're coming in loud and clear.
03 03 43 36	CC	Aquarius, Houston. Over.
03 03 43 42	CDR	Go ahead, Houston.
03 03 43 44	CC	Hey, Jim, I have about three things. First thing, the computer is yours again. The second thing, no PTC maneuvering will be required from now until burn, so you can just sit in the burn attitude. And the third thing is we'd like to back out of this procedure we just put you into to updata link, which would mean going from TM bit rate HI back to LO, RANGING to OFF, VOICE to DOWN VOICE, PRIMARY POWER AMPL to CLOSE.

03 03 44 25	LMP	Hold up, Vance.
03 03 44 26	CC	Okay.
03 03 44 29	CDR	We have a PROGRAM ALARM, Vance. 1106.
03 03 44 38	CC	Stand by - -
03 03 44 39	LMP	- - that high bit rate.
03 03 44 49	LMP	Okay, that apparently was just my putting the UPDATA LINK switch OFF that set that bit.
03 03 44 54	CC	Roger. We concur on that. And I'll read this back to you a little more slowly, Fred.
03 03 45 05	CC	Okay, are you ready to copy?
03 03 45 06	LMP	Okay. Go ahead.
03 03 45 07	CC	Okay. TM bit rate to LO; RANGING to OFF, VOICE to DOWN VOICE, PRIMARY POWER AMPL to off - that's on panel 16 - and - or OPEN - and circuit breaker 11 UPDATA LINK to CLOSE - or to OPEN. Over.
03 03 46 16	LMP	Okay, Vance, how do you read on DOWN VOICE BACKUP now?
03 03 46 20	CC	Okay, Fred, reading you loud and clear now.
03 03 46 26	LMP	Okay. I've got the POWER AMPL off, DOWN VOICE BACKUP, PCM to LO bit rate, and the UPDATA LINK breaker on 11 is pulled.
03 03 46 47	CC	Okay. Copy. Thank you.
03 03 47 16	CC	Apollo 13, Houston.
03 03 47 21	CDR	Go ahead.
03 03 47 22	CC	Okay. On this last readback, we'd just like to verify that the PRIMARY POWER AMPL was pulled opened. Over.
03 03 47 37	LMP	That's affirm. I used the breaker on 16, PRIMARY S-BAND POWER AMPL breaker is OPEN.
03 03 47 44	CC	Okay. Thank you.

03 03 49 00	CDR	Boy, we must be getting pretty close to the Moon.
03 03 49 03	LMP	What's that?
03 03 49 19	CDR	It's in a ATT HOLD.
03 03 49 21	LMP	Five degrees.
03 03 50 24	LMP	Hey, Jack. Bring me down one of the ...
03 03 50 37	LMP	And ...
03 03 50 40	CMP	... need two of them, I guess ...
03 03 50 49	LMP	...
03 03 50 52	CDR	Yes. I've been meaning to tell you about that, yes.
03 03 51 05	CDR	You know where this ... water?
03 03 51 07	LMP	What's that?
03 03 51 09	CDR	You know where this ... water?
03 03 51 10	LMP	Where?
03 03 51 11	CDR	The LGC.
03 03 51 18	LMP	...
03 03 51 22	CDR	...
03 03 51 56	LMP	... there she is ...

END OF TAPE

03 03 54 19	CMP	Pretty close? How's the hoses coming?
03 03 54 35	CDR	That screen goes - goes on - Fred's hose up there.
03 03 54 39	CMP	Yes. Here, take that one. ... another few minutes ...
03 03 54 49	CMP	Let's not forget to haul these out of here.
03 03 55 03	CMP	Thank you.
03 03 55 04	CDR	Get the hose screens?
03 03 55 06	CMP	Yes.
03 03 55 10	CDR	I'll ...
03 03 55 12	LMP	Houston, Aquarius. How do you read?
03 03 55 33	LMP	Hello, Houston; Aquarius. How do you read?
03 03 55 37	CC	Aquarius, Houston. Loud and clear.
03 03 55 42	LMP	Okay. Vance, I guess I understood you all were amassing a couple of - list of things that you were thinking about later on - we'd be taking back from the LM across into the CSM. A couple of items to add to that list, we've pilfered the - the intake hose screens out of the CSM and we have them mounted on the LM hoses now to catch the debris in here. We probably ought to take those back.
03 03 56 16	CC	Okay. We got that. Intake hose screens.
03 03 57 10	CC	I guess that item isn't going to change your c.g. too much, Fred-o.
03 03 57 19	LMP	Let's hope not.
03 03 58 25	CMP	... command module water.
03 03 58 32	LMP	Yes. No, ...
03 03 58 59	LMP	Yes.
03 04 01 18	CMP	... Get out one of those big ... bags.

03 04 01 27	CDR	Much debris in there?
03 04 01 29	CMP	...
03 04 01 30	CDR	Trying to put debris in?
03 04 01 31	CMP	Yes.
03 04 01 34	CMP	... Jim. Ready to go.
03 04 03 53	CMP	How's that for ... (laughter).
03 04 04 21	CMP	... didn't see any ...
03 04 04 53	LMP	Yes. Oh, what I'd like to do is find out how many - Yes - What happened to the two little midcourses that's got to be with this vehicle.
03 04 04 58	CMP	Yes. ...
03 04 05 03	CDR	Now we just take the CSM and strip it down. Start putting the ... stuff in here.
03 04 05 14	CMP	Why are you worrying about that? Why are you worried about stripping down the vehicle?
03 04 05 19	CDR	Well, you don't want - You don't want the drogue and the probe in.
03 04 05 23	CMP	Oh, yes.
03 04 05 26	CDR	And, you do want room for the PLSSs. So, we'll grab this ... suit valve and ... them in there.
03 04 05 43	CMP	...
03 04 05 47	CDR	Well, the suit ... oxygen ... the cabin.
03 04 05 57	LMP	...
03 04 06 04	CDR	(Clears throat) We're not planning to reenter with suits.
03 04 06 17	CDR	... a suit would help you out is for protection.
03 04 06 20	LMP	Yes, ...
03 04 06 41	CDR	They work on the REPRESS valve.
03 04 06 43	CMP	Yes, ...

03 04 06 59	CMP	You know ... suit ...
03 04 07 10	CDR	Breathe through the canister.
03 04 07 11	CMP	...
03 04 07 14	CDR	Yes, breathe through the canister.
03 04 08 12	CMP	My job is to maintain ...
03 04 08 21	LMP	You got all those things ...?
03 04 08 24	CDR	Roger.
03 04 10 45	LMP	...
03 04 10 48	CMP	Yes, I think they forgot that.
03 04 10 54	CDR	Sun must be coming back.
03 04 10 57	CMP	Yes. ...
03 04 11 12	CDR	Yes, I got two stars, circling back, Nunki and Antares ... back up again.
03 04 11 45	CMP	Actually, you can see ...
03 04 12 04	CMP	What? Huh?
03 04 12 30	CMP	That's the one you put up there, ... I would like to ...
03 04 12 39	CDR	... to trade it in.
03 04 12 40	CMP	...
03 04 12 42	CDR	Doesn't that also fit this big container back here?
03 04 12 46	CMP	...
03 04 12 48	CDR	That's a little ...
03 04 12 56	CMP	I wouldn't mind - ... ...
03 04 13 08	CMP	Okay. ...
03 04 13 45	CMP	... seems to me.
03 04 13 57	CMP	Guaranteed to work.

03 04 14 07	LMP	Okay. ...
03 04 14 12	CDR	Hey, can't you pilfer more there? Yes. ...
03 04 14 18	CMP	... what you do - what you do, you put your -
03 04 14 36	CMP	Not bad ...
03 04 14 56	CDR	Now, let's see, this burn's ... to our back, I suppose. Let's hope it works.
03 04 15 49	CDR	Now, let's see. What should we be doing here now?
03 04 15 56	CDR	Okay. The next thing is power for the burn. Did they give you a time to start powerup?
03 04 16 01	LMP	No. ...
03 04 16 08	CMP	Yes, we ought to get a ... You know, we ought to get ... - -
03 04 16 16	CDR	They will.
03 04 16 17	CMP	- - ...
03 04 16 21	CDR	Hello, Houston; Aquarius.
03 04 16 26	CC	Go, Aquarius.
03 04 16 32	CDR	Let's just recap the situation now. We're not going to do any more PTC. We'll maintain this attitude. You have already updated us on P30 load. We would like from you an LOS time, and a powerup start time for the PC plus 2. And an AOS time.
03 04 17 02	CC	Okay. We copy that.
03 04 17 26	CC	We're going to also get back with you shortly, Jim, for - with some burn guidelines for PC plus 2.
03 04 17 38	CDR	All right. Very well.
03 04 18 51	CDR	Have they powered up the mission timer - the event timer?
03 04 18 57	LMP	...
03 04 18 59	CDR	Oh, I see. Are they going to?

03 04 22 13	CC	Apollo 13, Houston.
03 04 22 20	CDR	Go ahead, Houston.
03 04 22 22	CC	Jim, we were just discussing burn star monitoring and we were curious to know if you can see Nunki in detent 2 at this time. Over.
03 04 22 45	CDR	That's affirmative. I can see Nunki in detent 2.
03 04 22 49	CC	Okay. Thank you. Roughly, in what part of the field of view?
03 04 23 01	CDR	Nunki is in the upper right-hand corner.
03 04 23 05	CC	Okay. Thank you.
03 04 23 10	CDR	And Scorp - And Antares is barely visible in the bottom of the field of view.
03 04 23 17	CC	Okay.
03 04 24 24	CMP	...
03 04 24 39	CDR	Hey, I bet I know how I could get an alinement. Give them a cursor spiral angle. Instead of maneuvering the spacecraft, I'll give them cursor spiral.
03 04 24 58	LMP	Do that for AGS and ...
03 04 25 09	LMP	... How's the ...?
03 04 27 17	CDR	Houston, for what it's worth, we can probably give you a cursor spiral angle on Nunki and possibly Antares or more than likely Shaula.
03 04 27 34	CC	Roger, Jim. According to our calculations, Nunki should be, at burn time, pretty close to the center of the AOT. We've been talking that possibility over.
03 04 27 50	CDR	Roger.
03 04 27 55	CC	Also, as a matter of general interest, the Sun should be in - at the bottom part of the CDR's window at the bottom of the LPD vertical line.
03 04 28 15	LMP	Be at T_{ig}, which is at - -
03 04 28 19	CC	That's affirm.

03 04 28 21	CDR	It must be that - You're right, because it's behind us now.
03 04 28 31	CMP	Wait a minute, ... holding insertion attitude.
03 04 28 38	LMP	Yes, we're not at the T_{ig} attitude.
03 04 28 40	CMP	Oh.
03 04 29 44	CC	Apollo 13, Houston.
03 04 29 49	CDR	Go ahead.
03 04 29 51	CC	Jim, whenever you're through eating and ready to copy the info, I can send you the burn rules.
03 04 30 05	LMP	Do you want this?
03 04 30 08	CMP	Write them right on - ...?
03 04 30 10	CDR	Why don't you write them right in here?
03 04 30 12	LMP	Okay.
03 04 30 22	LMP	Okay. I'll start on that.
03 04 30 25	CDR	Okay, Vance.
03 04 30 27	LMP	Go ahead.
03 04 30 28	CDR	We're all set to go.
03 04 30 31	CC	Okay. Okay. First of all, general philosophy is that these rules should be similar to LOI mode I abort with the tight limits. Now, I'll go through them one by one for you to copy. Okay. You should shut down, if any of the following happen. Thrust monitor readout, 77 percent or below; DPS propellant tank pressure - that's the inlet pressure - onboard readout, 160 or below; fuel to OX DELTA-P, greater than 25 psi - and that would have to be a ground call to you - attitude error plus or minus 10 degrees, with the exception of the start transient; attitude-rate limits, plus or minus 10 degrees a second. And you should shut down if you get any of the following alarms: ENGINE GIMBAL, ISS, plus PROGRAM ALARM, LGC, CES DC, and if you get an inverter light after switching inverters. Are you with me?
03 04 32 52	LMP	Roger.

03 04 32 54	CC	Okay. - -
03 04 32 55	CDR	Affirmative.
03 04 32 57	CC	And proceeding on. If, during the burn, the engine stops, if you have a flashing NOUN 97, you should PROCEED, then ullage, ENGINE START to PUSH, and DESCENT ENGINE OVERRIDE ON. Okay. Now just general information. If you didn't burn PC plus 2, probably P - P plus 4 would be the earliest MCC. AGS is going to backup in a rate-fail mode only, which you know. We're talking over the star check. Will have to get back with you on that. If, for some reason, there is no PC-2, you have a free-return trajectory with the landing at 152:02:00, and that would be after a small midcourse-5, which would probably be around 4 feet per second at 93 hours. And you have recovery forces in the Indian Ocean; you're in good shape there. And the Indian Ocean is where this landing would be. Okay. You still with me?
03 04 35 13	LMP	Roger.
03 04 35 15	CC	Okay. After - -
03 04 35 17	LMP	Yes. I'm with you.
03 04 35 19	CC	Okay. After PC plus 2, there are no trim requirements; and, if you have a shutdown during PC plus 2, subsequent midcourse maneuvers required with - Well, the earliest one would be PC plus 4. If you don't do a PC plus 2, but we still want to do one - MCC later. At PC plus 4, the increase in DELT - in DELTA-V, or the penalty, would be about 24 feet per second, with a landing in the mid-Pacific at 142:46:30. Now, you should expect new pads, state vectors, and targets for PC plus 2 at about GET 78. Over.
03 04 36 56	CMP	Tell them to stand by.
03 04 36 57	LMP	Stand by, Vance.
03 04 36 58	CC	Okay.
03 04 37 07	LMP	Okay. How do you read?
03 04 37 09	CC	Loud and clear.

03 04 37 13	LMP	Okay. Burn rules. We should shut down for the following: if we have the thrust monitor at 77 percent or below; number 2, if the DPS propellant ullage pressure is less than 160 psi; 3, if the fuel oxidizer DELTA-P is greater than 25, and that'll be a ground callout; 4, if the attitude error is plus or minus 10 degrees except for starting transients. Okay. Rate limits are plus or minus 10 degrees per second. And we're to shut down with the following alarms: an ENGINE GIMBAL light, an ISS with a PROGRAM ALARM, an LGC, a CES DC, and an inverter light, if it's still on after we've tried switching inverters. If, during the burn, the engine shuts down when the NOUN 97 flashes, we should PRO, do manual ullage, and START pushbutton, push, and DESCENT ENGINE COMMAND OVERRIDE, open. If we don't do a PC-2, our next burn will it be at PC-4 for an added 24 foot per second. We'll land mid-PAC at 142:46:30. Okay. We'll have the AGS up for backup rate command, or rate damping, I guess. And the free return that we're on, if we don't - that we're on now, if we don't do PC-2 or 4, lands us at 152:02:00 in the Indian Ocean. And there's no trim requirements on this burn, and we should expect a new uplink and a new final maneuver pad from you at 178 hours.
03 04 39 23	CC	78.
03 04 39 29	LMP	Okay. I'm sorry, 1 - Yes, 78 hours. It only seems like it's been that long.
03 04 39 35	CC	I can understand.
03 04 39 54	CC	Okay, Fred. Your readback was correct.
03 04 40 00	LMP	Okay.
03 04 40 16	LMP	Okay. And, Vance, did you ever have any LOS/AOS times, and - and a startup time for us to jump into this activation checklist?
03 04 40 29	CC	Okay. Let me - Let me poll the house again on that one.
03 04 40 37	CDR	What?
03 04 40 39	LMP	Okay. One word is that the - In an optimum fashion there, going through that 2-hour activation generally took somewhere from about an hour and 15 to an hour 20.

03 04 40 56	CC	Okay. I guess then we ought to allow you a little more than that, huh?
03 04 41 06	LMP	No, I was thinking that we don't have to do about four pages of it, that we probably need just about that, and that will make up for the difference of any added time we need maneuvering et cetera.
03 04 41 19	CC	Okay.
03 04 42 07	CDR	We'll need a - Can I get a flashlight? You got a flashlight. We might need a spare flashlight - Yes. Okay. We might need a spare flashlight: have you got one? Okay. Okay. The Sun has gone ... down.
03 04 42 31	CDR	Man, look at those stars. Houston.
03 04 42 40	CC	Go ahead, Aquarius.
03 04 42 45	CDR	Roger. We are in the shadow of the Moon now. The Sun is just about set as far as I can see and the stars are all coming out.
03 04 42 54	CC	Okay. And if you are ready to copy, we have LOS/AOS times for you.
03 04 43 04	CMP	Flashlight. Okay.
03 04 43 16	LMP	Go ahead, Vance.
03 04 43 18	CC	Okay. LOS 77:08:35, AOS 77:33:10. Sunrise - First I'll give you sunset which is past, but that was supposed to be at 76:32:45 and sunrise 77:16:48.
03 04 43 58	LMP	Okay. LOS at 77:08:35, AOS at 77:33:10. Sunset at 76:32:45, sunrise at 77:16:48.
03 04 44 13	CC	Roger. We'll get back with you on the powerup time and, if you're ready to copy, have angles to load into NOUN 22 for your VERB 49 maneuver to burn attitude. Over.
03 04 44 35	LMP	Okay. Go ahead with the VERB 49 value.
03 04 44 38	CC	Okay. R_1 plus 27210, R_2 plus 35570, R_3 plus 33010. Second item, as you know, due to maneuver with a PROCEED and a PROCEED; and, after your attitude, a reminder that P40 will not set you back to a narrow deadband. To get back to the

		1.40-degree deadband, you have to use the procedure I gave you, which is VERB 21, NOUN 01, ENTER, 3011, ENTER. And 200, ENTER.
03 04 45 47	LMP	Okay. VERB 49, register 1, plus 27218; register 2, plus 35570; register 3, plus 33010; and to get the narrow deadband back we want a VERB 21, NOUN 01, ENTER, 3011, ENTER, 200 ENTER.
03 04 46 11	CC	Roger. And a correction on your - on your first number for register 1. That should be plus 27210. And another comment; after you get into the narrow deadband at that attitude, why, you might tell us where you see Nunki.
03 04 46 34	CDR	Roger. Will do, Vance.
03 04 46 36	CC	Thank you.
03 04 46 37	LMP	Okay. And you corrected register 1; it's plus 27210.
03 04 46 43	CC	Roger.
03 04 46 45	CDR	And would you like us to make that maneuver at this time?
03 04 47 10	CDR	It's down below us, isn't it?
03 04 47 13	CC	Stand by.
03 04 47 19	LMP	Can't see it.
03 04 47 26	CMP	Can we have some more light in here now?
03 04 47 29	CDR	I have a light.
03 04 48 20	LMP	What do you see out your upper window?
03 04 48 32	CDR	Stars.
03 04 48 37	LMP	Yes. It looks like - looks like the light is coming from around those clouds.
03 04 48 48	CDR	Well, you won't get AOS/LOS until 77.
03 04 48 53	LMP	...
03 04 49 18	CMP	Yes.
03 04 49 19	CDR	...

03 04 49 22	CMP	Yes.
03 04 49 37	CDR	Let's see, AOS is at 2 hours before the burn?
03 04 49 45	LMP	Just about.
03 04 50 01	CC	Apollo 13, Houston.
03 04 50 05	CDR	Go ahead, Houston.
03 04 50 08	CC	Jim, we recommend you go ahead and make your VERB 49 maneuver, but just stay there in VERB 49 and don't go ahead to narrow the deadband just yet. And, when you're in that attitude, why, of course, then you can make your star check. And one other item is, I don't think we got back with you, but that hour 15 for powerup sounds fine with us.
03 04 50 40	CDR	Okay. At this time, I'll start my VERB 49 maneuver, but will not narrow the deadband, and we will take a look at Nunki. Okay, Vance.
03 04 50 52	CC	Roger.
03 04 51 09	CDR	Almost, huh?
03 04 51 46	LMP	Jim? Jim?
03 04 52 30	CMP	...
03 04 52 32	CDR	No, it shouldn't.
03 04 52 45	CMP	...
03 04 52 46	CDR	It shouldn't.
03 04 52 54	CDR	I was below that ...
03 04 52 57	CMP	...
03 04 52 58	CDR	That's a good idea.
03 04 53 03	CMP	...
03 04 53 34	LMP	... how many lights you're going to see. You can coach Jim on that.
03 04 53 44	CDR	Sure. We're there.
03 04 54 22	LMP	Nunki?

03 04 54 24	CDR	Yes. I can just barely see it. I see Antares much better.
03 04 54 37	CDR	Why is the wide deadband on? Stand by. Is - Is Scorpio moving down?
03 04 55 20	CDR	What's that cloud I see over there?
03 04 55 23	SC	I don't know. It looks like a Milky Way.
03 04 55 27	CDR	Just a -
03 04 55 36	CDR	Huh!
03 04 55 48	CDR	Houston, Aquarius.
03 04 55 55	CC	Aquarius, Houston. Go ahead.
03 04 56 00	CDR	Okay. We have completed our maneuver. We're in our wide deadband, and Nunki is close to the top of my display of the AOT. Right now, Antares seems to be more closer towards the center. However, we are in our wide deadband.
03 04 58 18	CC	Right; understand. We'll have to make a better check later, I guess.
03 04 57 26	CDR	I can't for the life of me figure out what that dark stuff is.
03 04 57 38	LMP	Yes. Did you look at it, Jack?
03 04 57 46	CMP	Yes. Okay. But I didn't recall what ...
03 04 58 17	CMP	See it there. Like two black clouds.
03 04 58 24	CDR	Well, you know what this burn is buying us; 10 hours.
03 04 58 29	CMP	Yes.
03 04 58 32	LMP	And how.
03 04 58 54	CDR	Might be a good idea.
03 04 59 41	CMP	Hey, that's pretty extensive, Jim. You can locate it and get it halfway through the ...
03 05 00 25	CMP	Strange.
03 05 00 53	CDR	It's on the AOT. Well, maybe not.

03 05 01 02	LMP	I don't think so.
03 05 03 08	CDR	I know what that is. That might be the debris that was thrown out there.
03 05 03 15	CMP	- - into the cloud?
03 05 03 19	LMP	It's all dark now.
03 05 03 24	CDR	From the explosion.
03 05 03 27	LMP	... we made a maneuver.
03 05 03 30	CDR	No, from our explosion.
03 05 03 32	CMP	Take a look. It covers a wide area. God, that dark cloud. ... Like a pair of contrails. Only if you switch the detent, they go on around. How long to LOS? Is that right?
03 05 04 06	CDR	I'd sure like to try the detent 2, but I guess our damn platform's okay, isn't it?
03 05 04 11	CMP	Yes.
03 05 04 17	CDR	Yes.
03 05 05 03	CMP	...
03 05 05 38	CMP	...
03 05 06 03	CC	Aquarius, Houston. Over.
03 05 06 09	CDR	Go ahead, Houston.
03 05 06 11	CC	Okay, Jim. We have a little over 2 minutes until LOS, and everything's looking good here.
03 05 06 21	CDR	Roger. Yes. I take it that we don't have to start our activations until we receive AOS from you.
03 05 06 39	CC	Roger. That's correct.
03 05 08 08	CDR	You ... up our edibles? ... water? ...

END OF TAPE

03 05 33 50	CDR	Good morning, Houston. How do you read?
03 05 34 37	CC	Aquarius, Houston. Over.
03 05 34 42	CDR	Stand by for AOS.
03 05 35 02	CDR	Houston, how do you read Aquarius?
03 05 35 05	CC	Aquarius, Houston. Reading you about 3 by 3.
03 05 35 43	CMP	Houston, Aquarius. How do you read?
03 05 35 49	CC	Okay, Fred. Reading you fairly well now. How do you read?
03 05 35 53	CMP	Okay. I read you loud and clear, ...
03 05 35 58	CC	Roger.
03 05 38 34	LMP	Jack, why don't you get the other ...
03 05 39 23	CDR	Well, go this way.
03 05 39 31	CDR	All right. We're going up on Mare Smythii, now.
03 05 40 55	CMP	We'll see where ... zooming off.
03 05 41 02	CDR	Oh, yes, yes, we're no longer 139 miles. We're leaving.
03 05 41 08	CMP	Yes, look at that curvature.
03 05 41 18	CDR	That might be Crisium over there, Fred.
03 05 41 37	CMP	Oh, yes; way off on the horizon, there, yes.
03 05 41 44	CDR	Hey, if you want to use the 250? There's a beautiful shot of Tsiolkovsky which we very seldom have.
03 05 42 04	CDR	Well, at this stage of the game beggars can't be choosers, I guess.
03 05 42 08	CMP	Yes, and we can't afford the amps to use the heaters.
03 05 42 36	CDR	Here you go.
03 05 43 33	CDR	All right. You're in zero phase up here.

03 05 43 46	CDR	Are we - back to DOWN VOICE BACKUP?
03 05 43 48	CMP	What's that?
03 05 43 49	CDR	We DOWN VOICE BACKUP?
03 05 43 50	CMP	Yes.
03 05 43 51	CDR	Houston, Aquarius.
03 05 43 55	CC	Go ahead, Aquarius.
03 05 44 01	CDR	Roger. We still want an activation start time for a burn.
03 05 44 07	CC	Understand. You want a powerup time, is that affirm?
03 05 44 14	CDR	That's affirm.
03 05 44 21	CC	Okay. Stand by.
03 05 44 48	CDR	Okay. Look it. Let's get the cameras squared away; let's get all set to burn. We got one chance now.
03 05 44 55	CMP	Okay.
03 05 44 56	CDR	We're not going to hack it at 152 hours.
03 05 45 02	CC	Aquarius, Houston. Over.
03 05 45 08	CDR	Go ahead, Houston.
03 05 45 10	CC	Jim, regarding the start time for the powerup, you mentioned an hour and 15 minutes. We think that is adequate. This is crew preference depending on how much time you think you need. We would go along with an hour and 15 minutes - -
03 05 45 46	CDR	Okay - Okay, sounds good.
03 05 47 24	CDR	Okay, Fred-o. You been through most of that checklist for an hour? Let's get it out and ...
03 05 47 50	CMP	78 hours and ...
03 05 47 56	CDR	Okay. Let's ...
03 05 48 09	CDR	Hey, Jack. Did you ... camera back up ...?

03 05 48 18	LMP	Okay. Page 1.
03 05 48 19	CDR	Okay.
03 05 48 22	LMP	Page 2, I'm going to power up the ...
03 05 52 38	CC	Aquarius, Houston. Over.
03 05 52 43	CDR	Go ahead, Houston.
03 05 52 46	CC	Okay, Jim. We have about three items for you. We have a maneuver pad, P30 LM maneuver, again; and the maneuver pad for the CM for splashdown. We also have a checklist change with contingencies, - LM contingencies checklist. And, I'll stand by while you're gathering the books.
03 05 53 15	LMP	Okay. I'm at - I got the contingency book, so give me that one first.
03 05 53 20	CC	Okay. Page 18 ...
03 05 53 26	CDR	Okay. I'm at page 18.
03 05 53 28	CC	Okay. About half-way down. When propellant quantity equals 30 percent, or rather 37 percent, we would like to change that line to read - when time to go is equal to 10 seconds - Of course, the line under that remains the same then, DESCENT HE REG 1 to CLOSE.
03 05 53 58	CDR	Okay. When time to go equals 10 seconds, DESCENT HELIUM REG 1, CLOSE.
03 05 54 05	CC	That's affirm. Before I start on the pads, another comment. The general indications that we gave you before about the Sun being in the commander's window and about stars in the AOT, such as that might be used as general indication for your attitude for the burn, that's all out the window. We are just going on the Sun check that we made earlier and we don't feel that we have information that is good enough to give you the star and the Sun in the window information.
03 05 54 58	CDR	...
03 05 55 05	CC	Okay. You're very weak now. When you are ready to take the P30 LM maneuver pad, I'll be reading it up.
03 05 55 20	CDR	Okay. Go ahead with the ...

03 05 55 24	CC	Okay. This is P30, LM maneuver pad, PC plus 2 hours, starting with NOUN 33, 079:27:38.30, plus 0833.0, minus 0050.9, minus 0213.9, N/A, plus 0020.5, 0861.5, 4:24, 272, 081, and the rest is N/A except for comments as follows. Ullage, two jets, 10 seconds; CSM weight, 62480; LM weight, 33452 and the DPS throttle profile is the same as before, 5 seconds at minimum, 21 seconds at 40 percent, and the remainder of the time at MAX. Over.
03 05 56 02	LMP	Okay, Vance. ... 079:27:38.30, plus 0833.0, minus 0050.9, minus 0213.9, N/A, plus 00205, 08615, 4:24, 272, 081 and the rest N/A. Ullage two jets 10 seconds, CSM weight 62480, LM weight 33452, DPS throttle profile same as before, 5 seconds, 40 percent for 21 seconds, 40 percent, and the remainder at MAX throttle ...
03 05 58 30	CC	Okay, Aquarius; Houston. You're coming in about 1 by 1 now. Advise that I heard everything except the beginning NOUN 33 values and the comments. Please repeat the readback on those.
03 05 58 48	LMP	Okay. I'm going to UP with the POWER AMP here, Vance.
03 05 59 15	LMP	Houston, how do you read Aquarius now?
03 05 59 17	CC	Hey, you're loud and clear now.
03 05 59 23	LMP	Okay. I got the POWER AMPS now, PC plus 2 hours, 079:27; 38.030, plus 08330, minus 00509, minus 02139, N/A, plus 00205, 08615, 4:24, 272, 081; rest N/A. Ullage two jets, 10 seconds, CSM weight 62480, LM weight 33452; DPS throttle profile the same, 5 seconds idle, 40 percent at 21 seconds. Remainder at MAX.
03 05 59 50	CC	Roger. Forty percent for 21 seconds, I believe is what you read back. And all the rest is correct. Now, for the maneuver pad for the CSM. Over.
03 06 00 29	LMP	Okay. Stand by.
03 06 00 55	CMP	Okay. Go ahead.
03 06 00 58	CC	Okay, Fred-o. This is maneuver pad monitor PC plus 2 hours; all N/A until you get to NOUN 61, latitude minus 21.65, minus 165.00, 1163.5, 36292, 142:39:22. Over.

03 06 01 48	CMP	Monitor plane change plus 2; NOUN 81 minus 21.65 minus 165.00, 1163.5, 36292, 142:39:22.
03 06 02 06	CC	Roger. That was starting with NOUN 61, and that's correct.
03 06 02 25	CC	By the way, Aquarius, we see the results now from 12's seismometer. Looks like your booster just hit the Moon, and it's rocking it a little bit. Over.
03 06 02 44	CMP	Well, at least something worked on this flight.
03 06 03 00	CC	And I just want to verify one thing, we could - -
03 06 03 02	CMP	Yes, I'm sure - -
03 06 03 03	CC	- - Go ahead.
03 06 03 09	CMP	I say I'm sure glad we didn't have a LM impact, too.
03 06 03 16	CC	Right. Just wanted to verify - We had poor reception when I was talking to you before - I wanted to verify that you understand that the Sun check you made earlier in the AOT was good, and that's what we're riding on. Anything that we told you in the past about looking at the Sun in the front left window or looking at stars, like Nunki through the AOT, why, we want to forget.
03 06 03 50	CDR	Roger. Understand, Vance. I think Nunki would be kind of hard to see anyway with the Moon right here.
03 06 03 58	CC	Right.
03 06 04 27	CDR	And, Vance, we plan to start powering up at 78:12. Is that a good time or do you think we ought to hold off a little longer?
03 06 04 46	CC	Jim, we think that's very good.
03 06 04 53	CDR	Right.
03 06 08 23	CC	Apollo 13, Houst - Aquarius, Houston.
03 06 08 31	LMP	Go ahead.

03 06 08 33	CC	Fred, after the burn, we'll get the powerdown instructions, or checklist changes to you. At the same time, we'd like to get a consumables status to you. All I'll say right now is that we think you look in reasonably good shape.
03 06 08 52	CMP	Okay. Very good.
03 06 09 46	CMP	Okay. Houston, Aquarius.
03 06 09 48	CC	Go ahead.
03 06 09 52	CMP	Okay. One CAUTION AND WARNING light here showing that you didn't call out - it's the PRE AMPS - I suppose because we don't have the ATCA breaker in yet.
03 06 10 08	CC	Okay. That's okay.
03 06 17 38	CDR	Houston, are you planning to give us a state vector update.
03 06 18 04	CC	That's - That's affirm, Jim. All we need is UPDATA LINK circuit breaker closed on panel 11, and POO and ACCEPT and we can ship it up to you. POO and DATA.
03 06 18 32	CDR	Okay, Vance. We're in DATA and POO and the circuit breaker's in. Go ahead.
03 06 18 39	CC	Okay. We'll ship her up to you.
03 06 21 45	CC	Aquarius, Houston.
03 06 21 53	CDR	Go ahead, Houston.
03 06 21 54	CC	Jim, request verify RANGING FUNCTION switch is in RANGING. We need that, if it's not there now.
03 06 22 14	CDR	You got it, Vance.
03 06 22 15	CC	Thank you.
03 06 23 05	CC	Aquarius, Houston. The computer is yours.
03 06 28 15	CC	Aquarius, Houston. Did you call?
03 06 28 22	CDR	We didn't call, Houston.
03 06 28 25	CC	Okay.

03 06 29 41	CC	Aquarius, Houston. Over.
03 06 29 48	LMP	Houston, are you calling Aquarius?
03 06 29 51	CC	Roger, Fred. I would like to confirm that you are getting drinking water out of, potable water out of the command module and, if you can make any estimates of how much you use as time goes on, and how much you have used, we would appreciate it for our consumables analysis.
03 06 30 12	LMP	Okay.
03 06 30 26	LMP	Okay, Jack. Tried the procedure and out of that pressure, we got 10 drinks made. That's roughly 80 ounces.
03 06 30 56	CC	Okay, Fred, we had a little static on that one, but I think you said that 80 ounces of water has been used out of the CM. Is that right?
03 06 31 08	LMP	Yes. Jack worked the procedure and filled as many of the drinks as he could, and he made up ten bags of approximately 8 ounces a bag.
03 06 31 23	CC	Okay. We copy that.
03 06 36 06	CC	Aquarius, Houston.
03 06 36 14	CDR	Go ahead, Houston.
03 06 36 16	CC	Jim, just a bit of information, if for any reason you had to slip T_{ig}, our people here feel it wouldn't do much harm if you slipped it up to 30 minutes. The procedure, of course as you know, is not to PRO on the flashing 99 and we thought you might like to be aware that T_{ig} time isn't all that critical.
03 06 36 43	CDR	Roger. Understand.
03 06 41 07	LMP	Okay, Vance; Aquarius.
03 06 41 10	CC	Go, Fred.
03 06 41 15	LMP	Okay. I think it's finally coming through to us here, what you said just a little while ago. Were you suggesting that we move the T_{ig} up 30 minutes?

03 06 41 25	CC	No, not at all. We're just giving you excess information. Just saying if you had any problem at all it could be slipped.
03 06 41 38	LMP	Oh, okay. Slipped 30 minutes. Okay. That's better.
03 06 41 42	CC	Right.
03 06 41 55	CC	You guys are pretty fast, though.
03 06 42 05	LMP	Yes. It kind of surprised us.
03 06 42 08	CC	I guess that's what happens when you cut a lot out of a checklist.
03 06 42 14	LMP	Yes. Yes, we're taking about a thousand pictures in between steps there, too.
03 06 45 33	LMP	Okay, Houston; Aquarius, radio check.
03 06 45 39	CC	Loud and clear, Fred.
03 06 45 43	LMP	Okay. I had a change in the background noises, wondered if you were still there.
03 06 45 47	CC	Right.

END OF TAPE

03 07 06 25	CC	Apollo 13, Houston.
03 07 06 28	CDR	Houston, Aquarius. Go ahead, Houston.
03 07 06 31	CC	Okay, Aquarius. We have some new information regarding what you should see out the commander's window at T_{ig}. Over.
03 07 06 44	CDR	Okay. Go ahead.
03 07 06 48	CC	According to calculaticns - calculations, you should see the Moon. It'll be a full Moon. You should see most of the disk and it should be somewhere on your vertical LPD line, probably at about 14 on the LPD scale. Over. Roughly centered on 14.
03 07 07 38	CDR	Okay, Houston. I concur. I'm looking at 14 on the LPD and the angle is just about centered. It's south of Crisium, but its - The line is just slightly to the north of center.
03 07 08 08	CC	Okay, Jim. That sounds very good. We see that you have a slight yaw angle, so it should be north of center.
03 07 08 48	CDR	I can even see Mount Marilyn from here.
03 07 18 07	CC	Aquarius, Houston. Over.
03 07 18 13	CDR	Go ahead, Houston.
03 07 18 15	CC	Jim, you are GO for the burn. GO for the burn.
03 07 18 20	CDR	Roger. I understand. GO for the burn.
03 07 24 16	CC	Aquarius, 2 minutes and 40 seconds to go on the mark.
03 07 24 19	CC	MARK.
03 07 24 22	CC	Or that was - Stand by.
03 07 24 24	CDR	What was that mark?
03 07 24 26	CC	Stand by. That was incorrect. Three minutes - Counting down to 3 minutes, and I'll give you a mark, and I'll take into consideration 2 seconds.
03 07 24 37	CC	MARK.

03 07 24 41	CDR	Roger. We got you.
03 07 26 43	CC	One minute.
03 07 26 46	CDR	Roger.
03 07 27 51	CDR	We're burning 40 percent.
03 07 27 54	CC	Houston copies.
03 07 28 09	CDR	One hundred percent.
03 07 28 11	CC	Roger.
03 07 28 31	CC	Aquarius, Houston. You're looking good.
03 07 28 36	CDR	Roger.
03 07 29 52	CC	Aquarius, you were looking good at 2 minutes. Still looking good.
03 07 29 58	CDR	Two minutes. Roger.
03 07 30 43	CC	Aquarius, you're GO at 3 minutes.
03 07 30 49	CDR	Aquarius. Roger.
03 07 31 46	CC	Don't forget DESCENT REG 1, off; 10 seconds to go.
03 07 32 05	CDR	SHUTDOWN.
03 07 32 07	CC	Roger. Shut down.
03 07 32 31	CDR	Are you reading our 1640, Houston?
03 07 32 36	CC	Roger. We're reading it.
03 07 32 41	CDR	We'll proceed. Here's our residuals.
03 07 32 52	CC	Roger. Very small.
03 07 33 07	CC	Good burn, Aquarius.
03 07 33 12	CDR	Go ahead.
03 07 33 13	CC	I say, that was a good burn.
03 07 33 18	CDR	Roger. And now we want to power down as soon as possible.
03 07 33 23	CC	Roger. Understand.

03 07 33 56	CDR	Houston, Aquarius.
03 07 33 58	CC	Go ahead.
03 07 34 02	CDR	Suggest maybe you just read off the circuit breakers you want us to power down. As you did yesterday, for us.
03 07 34 09	CC	Okay. We have a procedure ready to send up to you here in about 2 minutes. Let us know when you're all ready to take it.
03 07 34 18	CDR	Okay.
03 07 34 23	LMP	Okay. Is it going to be better to write this on a blank page, Vance, or can we use some portion of the powerdown list there in the contingency book that already exists.
03 07 34 33	CC	Stand by 1.
03 07 36 03	CC	Aquarius, Houston. Over.
03 07 36 07	CDR	Go ahead.
03 07 36 08	CC	Slight delay here, Jim. It will be a couple of minutes before we read that up to you, and we're looking at the contingency checklist powerdown and that's on page 5. You might be getting that out while we get all ready to give it to you.
03 07 37 03	LMP	Could you give us that page number again. Page 5 doesn't make sense.
03 07 37 14	CC	Okay. Make that power 5 in the contingency checklist, Fred. And it's the - -
03 07 37 24	LMP	- - that's better.
03 07 37 25	CC	- - middle part of the page, it starts emergency powerdown, and we'll mark that up.
03 07 37 42	LMP	Okay. I'm to 5 emergency powerdown.
03 07 37 48	CC	Okay. But hold off on it because we might have to start PTC up again here. And that's the point that's being resolved right at the moment, so stand by.
03 07 38 02	LMP	Okay.

03 07 42 19	CC	Aquarius, Houston. Over.
03 07 42 25	CDR	Go ahead, Houston.
03 07 42 26	CC	Okay. We're ready to give you the procedure which will power you down a good bit, and after the PTC is going, maybe we can give you further information. Are you ready to copy? Starting at the middle of the page, power 5.
03 07 42 48	LMP	Okay. Go ahead, Vance.
03 07 42 51	CC	Okay. After number 1, first line, cross out "And VHF-A." Second line, cross out "SIMPLEX operation." Third line, cross out "Prime." That refers to PRIME POWER AMP, OFF. That - that "PRIME" should actually be replaced by OFF. And that's the second prime that line. Also in the third line. the last word "OFF" should be crossed out and replaced by "PCM." Fourth line is okay. Fifth line, which is "VHF VOICE, ON, OFF, OFF," cross out. "Lighting, FLOODS," which is the next line should be "OFF," but add the following, "Or OVERHEAD/FORWARD prefer OFF." Okay. Step 2 remains the same; no change for the moment. Stand by. Skip step 2. Do not do it. Just go on to step 3, which is "Configure circuit breakers per the chart." That takes us to page power 6. Why don't you give me a readback on what you had on power 5, Fred-o.
03 07 44 48	LMP	Okay. On power 5, emergency powerdown. Item 1, first line, I scratch the "And VHF-A." Second line "SIMPLEX operation." Third line, I replace the second prime which is the POWER AMP with an "OFF," and the last word in that line is "OFF," replaced it with "PCM." Fourth line is okay. Fifth line, I scratch the whole line. Lighting, we haven't needed floods yet so we will just leave them off, exterior lighting off. Scratch line 2 and I am now on power 6, wait for your update on the CB panels.
03 07 45 31	CC	Okay. Power 6. Okay. Power 6 refers to panel 11. You should go per the chart with the exception of those breakers that I call out. First line is okay. Or, let's say, first row. Second row, QUAD 4, TCA, closed; QUAD 3, TCA, closed; QUAD 2, TCA, closed; and QUAD 1, TCA, closed. The rest of that row is okay. Row 3, about halfway over,

ATCA (PGNS), closed. Okay. The rest of that line is okay. Fourth line, HEATER - stand by. Okay. That line is all okay with the exception of the last three circuit breakers, Fred, under PGNS, which is LGC DSKY, IMU STANDBY, IMU OPERATE. Those three should be closed, at least for the time being. And finally, the fifth line; it's okay as is. And would you give me a read-back on that?

03 07 47 35 LMP Okay. I disagree on the fifth line. It appears that we ought to have the ASCENT ECA CONTROL open.

03 07 47 49 CC Okay. We'll check into that one and while we are listening to the rest of your readout.

03 07 47 57 LMP Okay. And top row is correct as is. Second row we want the QUAD TCAs 1 through 4 closed. On the third row, we want the ATCA (PGNS), closed. On the fourth row we want the PGNS LGC DSKY, IMU STANDBY, IMU OPERATE, all closed, and you're saying the bottom row as is.

03 07 48 23 CC Okay. We'll go along with what you said on the ASCENT ECA CONTROL. That should be open.

03 07 48 38 CDR Okay. Continue, Vance.

03 07 48 41 CC Okay. Next page, power 7, panel 16. First row, close the four QUAD TCA circuit breakers, that is, QUAD 1, TCA; QUAD 2, QUAD 3, and QUAD 4 TCA. Okay. Rows 2, 3, and 4 are okay.

03 07 49 17 LMP Okay. Panel 16, top row, we want to close QUAD 1 through 4 TCA breakers, and you're saying the other three rows are as is. Again, I have the exception the ASCENT ECA CONTROL on 16 should also be open.

03 07 49 35 CC Okay. We concur on that, and we have a late arrival in row 3. Stand by.

03 07 49 52 CC Okay, Fred. One addition, third row. The S-BAND POWER AMP. Request that you pull that circuit breaker and leave the switch in PRIMARY.

03 07 50 10	LMP	Okay. Yes, that's the way we were doing it before. I'll pull the POWER AMP CB, and then I'll go back to the first stage and put the POWER AMP to PRIME.
03 07 50 22	CC	That's correct; that should be changed back to PRIME. And that's - That's it.
03 07 50 42	CDR	Good work, Vance.
03 07 50 46	CC	Thank you.
03 07 51 00	LMP	RESET, OFF and LOW. Okay. Lighting bus off; EXTERIOR LIGHTING is off. Okay. You want to get your breakers, Jim? We ought to probably go back to that wide deadband.
03 07 51 24	CDR	Okay. The BUS TIE INVERTERs are coming off the line.
03 07 51 28	CMP	Yes. Go ahead. Sorry, I put the switch off, that'll kill caution and warning.
03 07 52 02	CDR	Okay. Let's see. So we're going to lose the ball again.
03 07 52 06	CMP	Yes.
03 07 52 11	LMP	I'll get 16 NOUN 20 up.
03 07 52 53	CDR	Do you have me move AUTO TRANSFER this time?
03 07 53 07	CDR	Why do I still have a VHF-A receiver off?
03 07 53 13	CMP	You don't, do you?
03 07 53 15	CDR	Yes.
03 07 53 16	CDR	Let's give them a call, panel 11.
03 07 53 19	LMP	Okay, Vance. I'm on - Do you read me now, hot mike?
03 07 53 23	CC	Roger. Loud and clear, Fred.
03 07 53 26	LMP	Okay. Jim just noticed we got a VHF breaker in on panel 11 still, I think, that probably should be opened.
03 07 53 41	CC	Okay. That's affirmative. Pull the VHF-A receiver.

03 07 53 54	LMP	Okay. Pull it, Jim.
03 07 53 55	CDR	I got it already. Okay. Now, why are we putting the cabin fan on?
03 07 54 06	CDR	Oh, oh, oh. Oh, yes. Okay.
03 07 54 23	CDR	Okay. I'm going to pull inverter 1.
03 07 54 24	LMP	Okay. Not very long since they had the switch off on you, anyway.
03 07 54 31	CDR	Okay.
03 07 54 32	LMP	Roger. - -
03 07 54 33	CDR	- - but my only question is, I got the CROSS TIE BUS circuit breaker in? Could be - Yes, this one right here.
03 07 54 50	LMP	Good line. It's on. Because that line is open.
03 07 55 21	LMP	I'll look over at that caution in a minute.
03 07 55 53	LMP	Vance, Aquarius.
03 07 55 56	CC	Roger. Go ahead, Fred.
03 07 56 01	LMP	Yes. We've managed the first 30 hours or so here without the caution and warning; we don't need to keep it up now, do we?
03 07 56 27	CC	Okay, Fred. That's one that we're leaving up until the PTC is established. We have a procedure for PTC to try with you, which we're hopeful will work pretty well. And I'll read that up as soon as you get what you're doing now done.
03 07 56 43	LMP	Okay.
03 07 56 44	CDR	Why don't you go ahead, and I'll get this PTC procedure. It's by the photo log, and I'll just get that.
03 07 57 05	LMP	And one other question, Houston. You really want to pull the ASA breaker? You want to give up the AGS probably for good now, huh?
03 07 57 33	CDR	Houston, I'm standing by to copy the PTC procedures
03 07 57 39	CC	Okay. I'll get back with you on your question in a minute, Fred. Now, here comes the PTC

procedure. Step 1, GUIDANCE CONTROL to PGNS; two MODE CONTROL, ATT HOLD; VERB 76, ENTER; maneuver to PTC attitude; and that incidentally is roll 0, pitch 90, and present yaw. We realize you can't monitor that on your FDAI, but you can on a verb, with a VERB 16 NOUN 20.

03 07 58 20	CC	With me?
03 07 58 40	CDR	Roger. GUIDANCE CONTROL, PGNS; MODE CONTROL, ATT HOLD, VERB 76, ENTER; maneuver to PTC attitude which is roll 0, pitch 90, and yaw, which is the present yaw. Is that correct?
03 07 58 54	CC	That's correct. Okay. Next. Mode - at - When you're established at the attitude, MODE CONTROL AUTO. Key in VERB 16 NOUN 20 to monitor rates; when less than 0.1 degree a second, rate in all - in each axis, then disable plus-X thrusters. Okay. Next VERB 25, NOUN 07, ENTER; 1257, ENTER; 252, ENTER; 1, ENTER; VERB 77, ENTER; VERB 48, ENTER; put in the DAP 22110 and PROCEED; VERB 34, ENTER; then VERB 16, NOUN 20; and monitor rates. On rates less than 0.01 degrees per second in all axis: VERB 76, ENTER; MODE CONTROL, ATT HOLD; then 30 clicks of right yaw to start the maneuver. Over.
03 08 01 48	CDR	Okay, Vance. PTC procedure: GUIDANCE CONTROL, PGNS; MODE CONTROL, ATT HOLD; VERB 76, ENTER; maneuver to PTC attitude; roll 0, pitch 90, yaw 0; my ball now, of course, is inoperative, so I'll have to get that on the DSKY. The 5 is MODE CONTROL, AUTO; 6: VERB 16, NOUN 20, monitor rates; rates less that 1 degree per second in each axis, disable, and I didn't hear that last part. The next one was VERB 25, NOUN 07, ENTER; 1257, ENTER; 252, ENTER; 1, ENTER; VERB 77, ENTER; VERB 48, ENTER; 22110, PROCEED; VERB 34, ENTER; VERB 16, NOUN 20, ENTER; monitor rates. Rates less than 0.01 degrees per second in all axis. VERB 76, ENTER; MODE CONTROL, ATT HOLD; then 30 clicks of right yaw to stop - to start - maneuvers.
03 08 03 04	CC	Roger. That's correct, Jim. To - to answer your questions and correct one point, yaw should be your present yaw, whatever it is, and that's up with roll 0, pitch 90, present yaw. The other thing is, you said disable and you didn't hear the rest. That's disable plus-X thrusters. And, finally, near the end, the 22110 referred to DAP loading.

03 08 03 48	CDR	Roger. Now, to maneuver to PTC roll 0, pitch 90 and yaw is - and pitch is here, roll is here. Yaw - whatever yaw we have in. Okay, Vance. In our initial maneuver to PTC attitude, I am going to have to use - to display 16 20 and I'll have to use the TTCA to get there.
03 08 05 01	CC	Jim, Roger. Your use of the TC - TTCA and just a reminder that in maneuvering that - that - that roll is in R_3 and yaw is in R_1.
03 08 05 17	CDR	That's affirm. And I'm going to take out roll first to get it zero and then I'm going to take care of pitch.
03 08 05 24	CC	Okay.
03 08 06 07	CDR	Okay. GUIDANCE CONTROL, PGNS; MODE CONTROL to ATT HOLD. VERB 73 clears. Okay. We've got to get that out. ... it stopped moving.
03 08 06 54	CDR	Here we go.
03 08 07 32	CDR	... the battery. ...
03 08 08 27	CDR	Do you know what the plus-X thrusters are?
03 08 08 41	CDR	Yes, okay. I just wanted to make sure you do. I got them over here.
03 08 08 55	CC	Aquarius, Houston. Over.
03 08 08 59	CDR	Go ahead.
03 08 09 01	CC	Okay. A couple of things, Jim. One is that you can use the TTCAs to maneuver, but you're going to save a lot of fuel if you'd try MINIMUM IMPULSE. So, that might be a better recommendation. The other thing is, we'd like to give you a GO before you disable the plus S - X thrusters, and before you do a VERB 76, and MODE CONTROL to ATT HOLD. Over.
03 08 09 40	CDR	Okay; understand. You want a GO before I - I'm - Of course, I just did a 76, and the MODE CONTROL is in ATT HOLD, at this time. But, this is later on down.
03 08 10 04	CC	Yes. All we wanted to do was take a look at things before you disabled the plus-X thrusters, and before you go to MIN IMPULSE at the end there - that VERB 76, ENTER; MODE CONTROL, ATT HOLD.

03 08 10 20	CDR	Roger. Understand. And I'm maneuvering my roll now to zero.
03 08 10 25	CC	Roger.
03 08 10 51	CDR	Yes. Those are the plus-X, right?
03 08 11 03	LMP	Houston, Aquarius.
03 08 11 07	CC	Go ahead, Aquarius.
03 08 11 11	LMP	Ah -
03 08 11 12	CC	Go ahead.
03 08 11 13	LMP	In what fashion did you want us to disable those plus-X thrusters? Just pulling those appropriate TCA breakers, or did you want to actually go in and mask those jets?
03 08 11 33	CC	Okay, Fred. We didn't explain that. The VERB 25, NOUN 07, ENTER sequence does that.
03 08 11 43	LMP	Okay. I didn't read the whole procedure. Jim just mentioned he wanted to disable plus-X.
03 08 11 49	CDR	I just did.
03 08 11 50	LMP	Okay.
03 08 12 32	LMP	And, Vance, are you still trying to get me an answer on that - pulling that ASA breaker?
03 08 12 44	CC	That's affirm, Fred. This - The word here is, pull it.
03 08 12 53	LMP	Okay. Sure didn't get much work out of the AGS this time.
03 08 14 43	LMP	It's going slightly.
03 08 14 45	CDR	So is this one.
03 08 15 26	LMP	Yes. You got a ways to go in pitch.
03 08 15 29	CDR	Yes.
03 08 15 30	LMP	... 80.
03 08 16 46	CDR	You want to rest a little bit?

03 08 16 52	LMP	What time is it, 9:30? Yes. I got up about what? I think I got about 10.
03 08 18 49	CDR	We're now in the hands of tracking.
03 08 18 52	LMP	Yes. It looks different than before.
03 08 19 09	LMP	Hard to do P37s in the LM. Hard to do a P37 in the LM.
03 08 19 52	CDR	Well, you can see where - -
03 08 19 55	LMP	You almost can see - -
03 08 19 57	CDR	- - See Ptolemaeus, Alphonsus - There's Herschel.
03 08 20 13	LMP	Yes, you can barely see it in the corner there.
03 08 20 18	CC	Aquarius, Houston.
03 08 20 23	CDR	Go ahead, Houston.
03 08 20 25	CC	Okay. Just some info. We're working up a procedure for you to use to - to use command module LiOH canisters to connect to your hoses - the outlet hoses in the LM so that, as time passes in the mission, you can continue scrubbing the LM atmosphere. And this whole thing requires - modifying a kit so that you can attach the hose modifying a LiOH canister, so you can attach the hose to it. So, sometime in the future, we will be coming up to you with that procedure. Second point - Second point is, we're standing by to watch your maneuver for the PTC procedure. Over.
03 08 21 16	CDR	Okay. I'm in process now, Vance, of maneuvering to zero yaw, 90-degree pitch, using MINIMUM IMPULSE.
03 08 21 25	CC	Okay.
03 08 21 42	LMP	And, Vance, I assume it had also been brought up that we got two extra secondary cartridges - one in each PLSS.
03 08 21 55	CC	Roger.
03 08 22 07	CDR	We ought to start working on that MOD right now.
03 08 22 13	CC	Yes. We wish we could send you a kit and it would be kind of like putting a model airplane

		together or something. As it turns out, this contraption will look like a mailbox when you get it all put together.
03 08 22 28	LMP	What do we make it out of, Vance?
03 08 22 32	CC	One canister with a - -
03 08 22 35	LMP	- - How about planning a rendezvous procedure?
03 08 22 38	CC	- - with a plastic roof.
03 08 22 50	CDR	Just for information, Houston, during - Just prior to going around the Moon, we saw a lot of debris that was floating by us, including some - one rather large piece, looked like the wrapping off of a line of some sort that is - still is with us.
03 08 23 10	CC	Roger. Copy, Jim.
03 08 23 16	CDR	Even after our free-return midcourse yesterday.
03 08 23 24	CC	Okay. We copy that.
03 08 23 40	CDR	No matter what I do, I can't stop that. Roll either way won't do it.
03 08 23 49	LMP	Jim?
03 08 24 06	LMP	Well, I don't see any way around it, Jim. It sure doesn't seem to be doing much, does it? It won't go down.
03 08 24 29	CDR	I don't know. I wonder if they tried that in the simulator. I can't seem to get roll to go up. It goes down on me, no matter how I hit the controllers.
03 08 24 45	CDR	Got pitch zero.
03 08 24 56	CDR	You can really see a change in rate?
03 08 24 59	LMP	... jar here, see if it'll couple in roll.
03 08 25 15	LMP	No?
03 08 25 26	LMP	There we go.
03 08 25 45	LMP	That does it.
03 08 25 54	LMP	I'm glad, too.

03 08 26 00	CDR	I don't know what caused it.
03 08 27 36	CDR	Here we still have 67-percent fuel level. I wonder how come they didn't ... DELTA-V curve?
03 08 27 56	CC	Aquarius, Houston.
03 08 27 59	CDR	Go ahead.
03 08 28 01	CC	Jim, we don't have any data on your movements right now. How does it look like this procedure's going to work out so far as getting an attitude set up, the first part of the procedure?
03 08 28 19	CDR	Well, Vance, I've been trying to use MINIMUM IMPULSE only attitude control to get my roll and yaw - the roll and pitch, rather. But, with the attitude control only in this configuration, I - I can't command these - the roll the way I want to. So, I had to go to TTCA to get my roll to build up towards zero, it was going - decreasing towards 270. I really don't know what the combination is in the attitude control, that you can get the control to pitch and roll the way you want it to. You've got to use the TTCA.
03 08 29 00	CC	Roger. Copy.
03 08 29 04	CDR	I now have both pitch and yaw - or pitch and roll going toward the designated amounts, now passing through 23 degrees in pitch, and I'm going up past 321 degrees in roll. And I am letting go that direction and when I get there, 90 in pitch and zero in roll, I'll go to AUTO and damp the rates.
03 08 30 00	CDR	Get a little sleep? That's okay.
03 08 30 28	CDR	We've got to rig up a method of using those lithium hydroxide canisters.
03 08 30 53	LMP	Okay, Houston. We just got a MASTER ALARM and an ECS light. I take it the partial pressure CO_2 is - Yes - That's what tripped it.

END OF TAPE

03 08 31 15	LMP	There's that mother.
03 08 31 19	CC	Aquarius, Houston. Say again.
03 08 31 20	CDR	All right. CO_2. Our CO_2 value is getting high. We had a DPS ECS light and a blinking component light.
03 08 31 37	CC	Okay. Copy.
03 08 32 14	CC	Stand by on that PTC O_2.
03 08 32 20	CDR	Say again, Houston.
03 08 32 41	CDR	Hello, Houston. How do you read? Over.
03 08 32 43	CC	Okay. Read you loud and clear now, Jim.
03 08 32 48	CDR	Okay. Did you hear what I just said about the ECS light and the blinking CO_2 component light?
03 08 32 54	CC	Okay. We got that and - Stand by 1.
03 08 33 01	CDR	Okay.
03 08 33 17	LMP	Not much.
03 08 33 34	CDR	Jack, we might have to have you rig up this CO_2 rig they're talking about.
03 08 33 42	CC	Go ahead. Houston. Over.
03 08 33 43	CMP	Oh! We've got a long ways to go.
03 08 33 47	CDR	Go ahead.
03 08 33 49	CC	Okay, Jim. We're going to have to get back with you in a couple of minutes on whether or not we switch over at this time to your other canister. Second point, it might help in setting up this PTC if you concentrate on roll first, and get that going; and then work on pitch, when roll is established, and sort of take whatever yaw you get.
03 08 34 21	CDR	Okay. Vance, I tried that but when I start doing roll only I get pitch coupled in with it. But both of them rolling up toward this desired amount, though. I'm up to 46 and in pitch and 326 in roll.

03 08 34 42	CC	Okay. Understand you've tried it.
03 08 34 55	CDR	Once I get roll zeroed, I don't think it'll be too bad.
03 08 35 53	SC	(Laughter)
03 08 36 01	CDR	So what did they put on my LEVA?
03 08 36 15	LMP	Oh, boy.
03 08 36 23	CMP	...?
03 08 36 25	LMP	No. He didn't want it. There she goes, gang. The Moon.
03 08 36 40	CC	Aquarius, Houston.
03 08 36 45	CDR	Go ahead, Vance.
03 08 36 46	CC	Okay, Jim. Since the first recommendation on how to maneuver PTC didn't work out, we have another one. And you might try this. Put yaw at zero, then start the roll, and the pitch after that.
03 08 37 27	LMP	Vance, do you read?
03 08 37 29	CC	Yes. I do now. Go ahead.
03 08 37 33	LMP	Okay. You guys just tell me what sort of material you had in mind to build this mailbox out of, and Jack and I will go to work on trying to construct that thing. Assume we'll use the space-age baling wire or the gray tape?
03 08 37 51	CC	That's affirm. We have a lengthy procedure here; but, in short, you use plastic as a covering for the whole thing. You put some kind of a stiffener at the top so the plastic doesn't suck against the LOI - LiOH enter - entrance side. You'll - You need gray tape to stick the whole thing together, and you need something like a sock to put in the - the bottom so that the outlet side is plugged up. As it turns out, the flow is rather U-shaped through the cartridge, Fred. It, if you plug up the bottom, it comes in one side of the top and goes out the other.
03 08 38 45	LMP	Okay. (Sigh) Hold on a minute. Let - Let us go get a cartridge and with it in hand, I'll speak to you some more.

03 08 39 01	CC	Aquarius, Houston. Over.
03 08 39 03	CDR	Okay, Vance. Go ahead.
03 08 39 06	CC	Okay. Really, I think we should give you a more detailed procedure on that; and, in general, those are the materials that are to be used, but let us get back with a detailed procedure on how to make this cartridge arrangement work.
03 08 39 27	LMP	Okay.
03 08 39 38	CDR	And to answer your question about PTC, Vance, it's rather difficult to use yaw in zero right away. So what I'm doing, yaw is working toward zero, right now. Pitch is working toward 90, and roll is working toward - zero. So, we - We're just going to take some time to get there, that's all.
03 08 40 08	CC	Roger. Quite a bit of noise now. I understand you're still having a problem getting there with the PTC.
03 08 40 19	CDR	We are getting there slowly.
03 08 40 21	CC	Okay.
03 08 40 42	CC	Aquarius, Houston. Let's try FORWARD OMNI.
03 08 41 38	LMP	I don't know, it looks ...
03 08 41 47	LMP	I don't know, it looks that way.
03 08 42 41	LMP	Okay, Houston. How do you read, now?
03 08 42 56	LMP	Houston, how do you read?
03 08 42 57	CC	Loud and clear, now. Go ahead.
03 08 43 02	LMP	Okay. I switched to FORWARD OMNI, now.
03 08 43 05	CC	Roger. ...
03 08 43 07	LMP	Okay.
03 08 43 53	CDR	They're ... off. They can't stop pitch.
03 08 43 57	LMP	...
03 08 44 00	CDR	That would only use fuel.

03 08 44 06	CDR	... and stick it around that way.
03 08 44 30	CDR	Must have the wrong thing, there.
03 08 45 52	LMP	Oh, yes. That was pretty.
03 08 46 53	LMP	That didn't sound very good.
03 08 47 05	CMP	Yes, hang on to that.
03 08 49 01	CDR	...
03 08 49 31	CDR	They're a hell of a long ways away.
03 08 49 33	LMP	Right.
03 08 49 38	CDR	Yes, we're not moving that fast to Earth.
03 08 49 40	LMP	Not yet.
03 08 49 59	LMP	Hey, we're already ... this time, huh?
03 08 50 02	CMP	Yes.
03 08 50 05	LMP	... to the trajectory.
03 08 50 08	CDR	Huh?
03 08 50 09	LMP	...
03 08 50 10	CDR	Yes, I've been trying to get roll out. Roll to zero. Just go ahead to zero, I'm going to put it in ATT HOLD. Then it'll take out yaw, leaving pitch the way it is; then we're going to pitch down.
03 08 50 48	LMP	We've got to think about when we have to start changing that canister.
03 08 50 55	LMP	Fifteen even.
03 08 50 57	CDR	Huh?
03 08 50 58	LMP	... to 15.
03 08 51 00	CDR	What is it right now?
03 08 51 02	LMP	Nothing. We're not reading anything.
03 08 51 07	CDR	Well, that's the one they wanted you to leave in.

03 08 51 10	LMP	...
03 08 51 14	CDR	It's in. That's how it triggers the - Okay, Jack. I'm going to push in on this thing to stop it.
03 08 51 35	CMP	Yes.
03 08 51 51	LMP	That just turned the MASTER ALARM back on. Now that it's on steady, I'll leave it on. I can't understand why I got a power - Oh, I know. That's right. ... That reading is correct.
03 08 53 03	CDR	Yaw. I'm going the wrong way though, aren't I?
03 08 54 32	LMP	(Laughter).
03 08 54 54	LMP	Okay. What we're going to do, Jack, ... over there ...
03 08 55 19	CC	Aquarius, Houston. Over.
03 08 55 25	CDR	Go ahead, Houston.
03 08 55 26	CC	Jim, it looks pretty good except that the pitch is going out in the wrong direction, now. Over.
03 08 55 37	CDR	I concur. What I'm going to do is get roll to zero and I'm trying to bring yaw into zero and as soon as I get those two pretty well matched up, then I'm going to take the pitch and try to pitch it down.
03 08 55 49	CC	Okeydoke.
03 08 57 33	CDR	Okay. Now I've got pitch going down; I've got roll almost zero and yaw is almost zero.
03 08 57 42	CC	Okay. Copy, there, Jim.
03 09 01 26	CDR	Houston, what's an acceptable pitch attitude, that you'll take?
03 09 01 56	CC	Aquarius, Houston.
03 09 02 12	CC	Aquarius, Houston. Over.
03 09 02 17	CDR	Roger. What's the acceptable pitch attitude that we can have for PTC? I can go into AUTO any time now, I'm looking at 118 degrees in pitch, practically zero roll, and about 40 degrees of yaw.

03 09 02 31	CC	Ninety degrees pitch.
03 09 02 37	CDR	I'm looking at 118 degrees of pitch.
03 09 02 48	CC	Stand by.
03 09 03 06	CDR	I'm trying to talk to them.
03 09 03 09	CC	Stand by a minute, Jim. The pitch is the important thing, but - but stand by 1.
03 09 03 19	CDR	Okay. It's coming down. What's that? Well, I guess I'd better eat something. Hey, this one has some of that candied jelly ... you know, we've gone a hell of a long time without any sleep. I said we've gone a hell of a long time without any sleep.
03 09 03 47	CDR	We'll have to start thinking about getting the ... back to sleep again because - I know - I - I didn't get hardly any sleep last night at all.
03 09 07 16	CMP	Hey, Fred? These jettison bags with the - are real airtight stuff, if you want to use them for wrapping for a lithium hydroxide bag or something like that.
03 09 07 33	LMP	Yes, this stuff is really tight.
03 09 07 46	CDR	Yes.
03 09 10 12	CC	Aquarius, Houston. Over.
03 09 10 16	CDR	Go ahead, Houston.
03 09 10 17	CC	Okay, Jim. Would you stable your - stabilize your rates here at the attitudes you're at now and go ATT HOLD. Over.
03 09 10 29	CDR	Okay. Will do. I'm now at 103 degrees - 106 degrees pitch, and 2.5 degrees roll.
03 09 10 36	CC	Roger.
03 09 11 04	LMP	...?
03 09 11 06	CDR	No.
03 09 12 16	CDR	... mine are ... Hey, I got you a clean one.
03 09 12 22	LMP	Okay.

03 09 12 23	CDR	Last one's in the trash bag. Oh, I thought - if you wanted a ..., you'll have to use the lithium hydroxide ...
03 09 13 18	CDR	Okay, Houston. Are you monitoring my angles? It appears that it might be less then 1 degree per second.
03 09 13 30	CC	Stand by. We'll check them, Jim.
03 09 14 29	CC	Aquarius, Houston.
03 09 14 34	CDR	Go ahead, Houston.
03 09 14 36	CC	Jim, that's affirm. We're monitoring and you're almost there, but we'd like to let them stabilize a little bit longer. Over.
03 09 14 48	CDR	Okay. We'll - We'll just hold.
03 09 14 51	CC	And if - if you can now go into your eat period or do something else while the rates are stabilizing, why, we recommend you relax somewhere and get some chow.
03 09 15 07	CDR	Right-o. We'll do that.
03 09 18 03	CC	Aquarius, Houston. Over.
03 09 18 08	CDR	Go ahead.
03 09 18 10	CC	Okay, Jim. Looks like your rates are damped sufficient. Recommend that you go ahead with the VERB 25, NOUN 07, ENTER bit on down through the VERB 34, ENTER, and then wish you'd stand by for us to look at it again before you go beyond that. Over.
03 09 18 36	CDR	Okay, Houston. I'll go through VERB 25, NOUN 07, down through VERB 34 ENTER, and I'll stand by.
03 09 18 47	CC	Right-o.
03 09 19 46	CDR	Okay, Houston. That's complete.
03 09 19 55	CC	Roger. Houston copies, and we'll - -
03 09 19 58	CDR	You ... monitor our rates?
03 09 19 59	CC	Roger.

03 09 20 08	CC	We - -
03 09 20 09	CDR	You want to monitor the rates; we're 16 20.
03 09 20 12	CC	Roger. That's the way it should be done, and we're standing by for the rates to damp out some more.
03 09 20 21	CDR	Okay.
03 09 20 51	CMP	How you coming?
03 09 20 56	CDR	Oh, we're taking stock of how much we got there, maybe sort of think about rationing some of it. I mean just to make sure we've got enough to last us and that we get enough water out. I'd hate to run out of water on the last day. Take a look and see how much we got, and fill them up and just hold them there. Yes, and I'll tell you the stuff that's good to eat now will be the candies, the sandwich spreads. Maybe the freeze - the dehydrated stuff. If you have to rehydrate it, it'd be kind of difficult. No, wet packs are good.
03 09 22 24	CDR	As a matter of fact, we might use those little - Well, how about the PLSSs?
03 09 22 34	CDR	Yes, I know, but I mean the PLSSs are bombs, too.
03 09 22 39	CMP	...
03 09 22 41	CDR	We're damping rates.
03 09 22 44	CMP	...
03 09 22 47	CDR	Well, maybe we ought to use the OPS first.
03 09 25 57	CDR	You guys moving around?
03 09 26 07	CDR	Okay.
03 09 27 25	CC	Apollo 13, Houston. Over.
03 09 27 30	CDR	Go ahead, Vance.
03 09 27 32	CC	Jim, just a reminder. Any waste water dumped at this point would really jiggle up the PTC preparation, so request you save that until we're spun up. Over.

03 09 27 49	CDR	Right. I don't think we're doing any.
03 09 27 52	CC	No. No, I don't think so, but I just wanted to make sure you were aware of it - I thought you were.
03 09 28 03	CDR	We're saving all the water we can.
03 09 30 12	CMP	... for a minute?
03 09 30 16	CDR	With the new space ..., we're ... We've just about slowed down. You're damping right.
03 09 31 53	LMP	There she is.
03 09 32 34	LMP	And, Houston, Aquarius.
03 09 32 39	CC	Houston. Go ahead.
03 09 32 43	CMP	Okay, Vance. A couple of items we uncovered for that cartridge MOD. One is the special dust covering bag that we were going to use on the tote bags, that is pretty thick and nonporous; and we went up to the upstairs kitchen and drained water a couple of more times, and made up a whole bunch of drink bags, again; and from the pantry, we retrieved a fairly large - enclosed - enclosure made of plastic that those drink bags are in that I think we can scissor and also make do for a cover, taping it on, if that's appropriate.
03 09 33 34	CC	Okay. Jack Lousma here has a refined version of the procedure on how to make these the easy way, and I think before too long he ought to be reading that up to you. If - -
03 09 33 52	CMP	Okay.
03 09 33 53	CC	It's not time critical to get this up to you. It's just that, before you get too far in assembling these on your own, we'd kind of like to give you the benefit of experience down here.
03 09 34 10	CMP	Okay. Who - Who built them back there.
03 09 34 17	CC	Tony did some of it, and Jack's been working on it, too. So we've had a big effort on it.
03 09 34 27	CMP	Great.

03 09 34 37	CC	We would encourage you to wait until tomorrow to receive that procedure, but we can send it up sooner, if you insist. Over.
03 09 34 47	CMP	No, that's all right, Vance. Before we have to worry about that I guess we got another primary and three secondaries to go through.
03 09 34 58	CC	That's right.
03 09 35 18	CMP	You know, sometimes those cartridges have - I guess they rejuvenate.
03 09 35 29	CC	Aquarius, Houston. Over.
03 09 35 32	LMP	Man, that's a wicked low pressure down there. I wish I was on it. (Laughter).
03 09 35 44	CC	Aquarius, Houston.
03 09 35 47	LMP	... up ...
03 09 35 49	CDR	Go ahead, Houston.
03 09 35 50	CC	Okay, Jim. Your rates are once again looking good so we can continue on with the rest of this procedure. Request you go ahead with the VERB 76 ENTER, and MODE CONTROL to ATT HOLD, and then the last step, 30 clicks yaw right.
03 09 36 13	LMP	Jets are firing again.
03 09 36 18	CDR	Okay. I'll do a VERB 76 ENTER with the MODE CONTROL ATT HOLD and then 30 clicks of right yaw to set the maneuver.
03 09 36 26	CC	VERB 76 ENTER.
03 09 36 31	CDR	Roger.
03 09 36 36	CDR	There's your VERB 76, ENTER. MODE CONTROL to ATT HOLD. Now you want me to do 30 clicks of right yaw?
03 09 36 58	CDR	Vance, did you say for me to hold on the right yaw or do you want me to start it now?
03 09 37 04	CC	No, no need to hesitate, you can start now.
03 09 37 10	CDR	Okay.

03 09 37 20	CC	After you get that going, then we'll think about powering down the PGNS.
03 09 37 39	CDR	Okay. There were 30 clicks of right yaw.
03 09 37 43	CC	Okay. We'd like to look at it for just a little while before we power down the PGNS, so stand by.
03 09 38 00	CDR	Understand you're planning to power down the PGNS?
03 09 38 06	CC	Right. We want to get the amps down.
03 09 38 09	CDR	Okay.
03 09 38 10	LMP	... finish ...
03 09 38 19	LMP	That's bad news.
03 09 38 20	CMP	Take 26 pictures of you?
03 09 38 23	LMP	Why not?
03 09 38 29	LMP	You want to bring all the film back empty?
03 09 38 38	CMP	I'd like to just ... and shoot it.
03 09 39 10	CDR	Well, that means I've got to -
03 09 39 14	CMP	Hey, let me see if I can get this started here.
03 09 39 18	LMP	Okay.
03 09 39 37	LMP	Hey, Jim.
03 09 39 40	CDR	Yes, we'll probably get there ...
03 09 41 39	CC	Aquarius, Houston. Request AFT OMNI.
03 09 41 54	LMP	You got it, Vance?
03 09 41 56	CC	Roger. That did it. Thank you.
03 09 42 27	CMP	Gad, there's Ptolemaeus and Alphonsus.
03 09 42 30	LMP	Yes, sure enough.
03 09 42 32	CMP	See them right over the edge.
03 09 43 11	CMP	Here, let me shoot a few pictures of the old Moon here.

03 09 43 15	CDR	Yes. (cough) Which ones ... Did you put it back?
03 09 43 19	LMP	Yes.
03 09 43 21	CDR	Looks like we got ... to do with Earth? Ptolemaeus?
03 09 43 24	LMP	We need it to aline again.
03 09 43 42	CMP	You don't think that burn was enough, do you?
03 09 43 43	LMP	Was that a midcourse? The RCS is worse.
03 09 43 50	CDR	The RCS ... attitude.
03 09 44 29	LMP	... ought to come up the side. Then, you got us in the right plane, Jim. We're in the right plane. We're pointed off and we'll swerve on again with the Earth, Moon, and Sun.
03 09 44 52	CDR	In another respect, it might be easier to get a -
03 09 45 05	LMP	Look in the rear detent now. Go to -
03 09 45 15	CMP	How's that?
03 09 45 17	LMP	Awful.
03 09 45 19	LMP	Oh, that's right. That blasted service - command module is back there. Scratch that one. That one?
03 09 45 33	CDR	It's not much better. Okay, let's go this one.
03 09 45 38	LMP	Keep the ...
03 09 45 41	CC	Aquarius, Houston. Over.
03 09 45 46	CDR	Go ahead.
03 09 45 47	CC	Jim, we have some status information for you, if you're ready to copy on a piece of scratch paper.
03 09 45 58	LMP	Stand by, Vance.
03 09 45 59	CC	Okay.

03 09 46 04	CDR	We're ready for you.
03 09 46 06	LMP	Put that away and get some status paper here.
03 09 46 11	CDR	Go ahead, Vance.
03 09 46 13	CC	Okay. First, midcourse correction will probably be at GET 104 hours, and all we look for is a 4- to 6-feet-per-second DELTA-V. Okay. That's the first item. Now, I will give you a rundown on consumables. Okay. In the LM, you have 1498 - that is 1 4 9 8 amp-hours remaining. That means over 61 hours you'd - That would average out to 24.5 amps. We expect that, after powerdown, that you will use 1 4 or 14 amps per hour, and that would leave a reserve of 500 amp-hours at the end of the mission. Are you with me?
03 09 47 29	CDR	Roger. We're with you.
03 09 47 30	LMP	I saved my - number was yesterday.
03 09 47 33	CC	Okay. In the LM, you have - -
03 09 47 36	CDR	We're with you.
03 09 47 37	CC	Roger. In the LM, you have 215, that is 2 1 5, pounds of water, usable. That would average out over 61 hours to 3.5 pounds per hour available. Okay.
03 09 48 15	CC	Okay. And after you power down, we expect that you will be using water at the rate of 3.2 to 2.7 pounds - That's at 14 amps per hour electrical usage rate. One note, this does not - When we speak here of water available, this does not include CSM water and PLSS water, so that's added on. Okay, next, LiOH. Using the CSM cans, you will have 16 cans at 12 hours per can to give you 1 9 2, or 192 hours, of LiOH. And, in the LM, using its cans, you have 44 hours remaining.
03 09 49 29	CDR	Vance, is that with the PLSS secondaries?
03 09 49 34	CC	That's affirm. That's affirm. That includes PLSS secondaries.
03 09 49 47	CC	Okay; oxygen. You have remaining 44 pounds in the LM. At a usage rate of 0.36 pounds per hour, that leaves you 120, or 1 2 0, hours of oxygen. Okay. Next, RCS. RCS A stands at 6 2 percent

and B at 6 2 percent. We only expect 2 percent to be used for the PTC, so you're in good shape for RCS. Next, DPS DELTA-V. You have 1190 feet per second remaining. And, finally, CSM EPS. We estimate that you have 99 amp-hours. That's an estimate. And that's it. Over.

03 09 51 19	CDR	Okay. I copy.
03 09 51 24	CC	Okay. And just a question. It would be interesting to hear from Jack to see if he thinks that main B bus is good. If he has any idea of how, if whether it's good or not, this would influence our steps in the future; for example, we might want to try to test main B to see if it is, in fact, good so that we'd know how to set switches for entry.
03 09 52 00	CDR	Roger. Just a minute. They want to know whether you think main bus B is any good for the command module.
03 09 52 14	CDR	Vance, while Jack's got on the loop, let me pose the question of how we're planning on doing this midcourse, if we are going to power down the PGNS.
03 09 52 27	CC	Would you stand by on that, Jim? We'd like to give you a procedure for that later on.
03 09 52 34	CDR	Okay. Got a midcourse at 104 hours. He's going to give us a procedure for that later on.
03 09 52 48	CC	In short, Jim, we don't expect any problem, but we'll explain further later on.
03 09 53 00	CDR	Okay.
03 09 53 02	CC	Deke says get a night's sleep. He says you've been working hard, and you ought to relax a little bit and be ready for tomorrow.
03 09 53 17	CMP	Vance, this is Jack.
03 09 53 19	CC	Go ahead, Jack.
03 09 53 23	CMP	Okay. Let me give you my observations on main bus B. Things happened pretty fast there, and we first heard the impact or explosion or whatever caused it, I'm not sure. The next - About 1 second later, there was a MASTER ALARM which was the MAIN BUS B UNDERVOLT. I looked at the

voltage, and the voltage was good at this time so I'm suspecting it was a spike. Fuel cell 3 was also good, with good flow. However, Fred, at that point, was coming into the command module and got over into his seat. At that time, we shortly had an AC BUS 2 light about the time he got into his seat. He looked at the MAIN BUS B and the MAIN BUS B was reading ZERO. It, however, - and the fuel cell flows were ZERO. I'm kind of suspecting that perhaps we do have a MAIN - a current MAIN BUS B. But that's merely a guess. I never did try to reset it. We were having other problems with the MAIN BUS A, having an UNDERVOLT and a few other things like that. I'd kind of like to hear what your feelings are down there.

03 09 54 55 CC Well, Jack, we copy your information. And we'd like to hold off because we're still working the problem. So we'll have to give you information later.

03 09 55 14 CC Thank you.

03 09 55 23 CC Aquarius, request AFT OMNI.

03 09 55 37 CMP Vance, are you back with me?

03 09 55 40 CC Roger. We're with you.

03 09 55 44 CMP Okay. We lost lock there. We switched OMNIs. Just for my own - kind of to get my thoughts in order, I'd kind of hear what - I'd like to hear what kind of entry you're planning. EMS or PGNS or what?

03 09 56 02 CC Okay. PGNS entry is being planned, and people are at work on checklist changes and that sort of thing.

03 09 56 14 CMP Okay. Real fine.

03 09 56 17 CC And - we'll - We'll give you the CSM stuff tomorrow, but basically we expect that main bus B is good and we're going to work up a procedure to test it.

03 09 56 32 CMP Okay. Those are my thoughts, too.

03 09 56 34 CC But - -

03 09 56 36 CMP You think main bus B is good, don't you?

03 09 56 39	CC	That's affirm. We think it is, but we want to check it out anyway. We think you guys are in great shape all the way around. Why don't you quit worrying and go to sleep.
03 09 56 51	CMP	Oh, that - That's our boss, Deke.
03 09 56 58	CDR	Well, I think we just might do that - or part of us will.
03 09 57 25	CMP	I mixed up. How many more of those - Are we hot mike? - -
03 09 57 28	CDR	Yes.
03 09 57 36	CMP	Yes, I'm mixed up. You had 15? I mixed up seven more. So we got 22. By the way, there's still some water that's - it's not enough pressure to mix up another drink, but there is some water out of there, if you want to get some water out of the drink cup.
03 09 57 59	LMP	That's good; I could use some.
03 09 58 00	CMP	We ought to use that oxygen up and not waste it. (Cough)
03 09 58 17	CDR	You monitoring right now?
03 09 58 23	CMP	Yes. Just stand by.
03 09 58 25	CDR	What'll it take to ...
03 09 58 29	CMP	Yes.
03 09 58 30	LMP	You only got two ... there, so ...
03 09 58 34	LMP	I will.
03 09 58 49	CMP	You wouldn't believe it, but I'm now in command of the LM. Okay. Vance, I'm probably the only CMP that's ever witnessed a DPS burn sitting on the ascent engine head.
03 09 59 33	LMP	Did you get some? Is there any coming out still? They didn't answer. I think we made it. How's this working out?
03 09 59 52	CDR	Okay. No problem.

03 09 59 55	CMP	They are, huh? How are we going to get an alinement?
03 10 00 03	CDR	We'll pull one out someways, I guess. We've gotta watch that one right there.
03 10 00 18	LMP	It's decreasing now. It'll - it'll - It's cold. I noticed that in the command module. It'll wobble.
03 10 00 51	CDR	Houston, Aquarius.
03 10 00 59	LMP	Switch OMNIs to TRANSMIT.
03 10 01 02	CDR	Houston, Aquarius.
03 10 01 04	CC	Go ahead, Aquarius.
03 10 01 08	CDR	Roger. Are you planned to set up here very shortly - a powerdown procedure?
03 10 01 15	CC	That's affirmative, if you'll take out your contingency book and turn to page Power 6. Over.
03 10 01 23	CDR	Roger. Stand by. Contingency Power 6. Get the book over here. Contingency Power 6.
03 10 01 33	LMP	Well, I hope this ...
03 10 01 37	CC	And while you're doing that, let's put ATTITUDE CONTROL, three, switches to MODE CONTROL.
03 10 01 50	CDR	All three ATTITUDE CONTROL switches have been in MODE CONTROL.
03 10 01 53	CC	Okay. And when you get to Power 6, you ought to see a circuit breaker page, panel 11.
03 10 02 03	CDR	Have a pencil? Let's see it - thank you.
03 10 02 12	CDR	Okay. I have Power 6, panel 11.
03 10 02 17	CC	Okay. On Power 6, panel 11 - The top three rows, configure them as you see them.
03 10 02 31	CDR	Okay, now, Jack ... We have put the TCAs in for the previous procedure. Do you want those out, now?
03 10 02 48	CC	That's affirmative, Jim. Pull them out. TCAs open.

03 10 02 54	CDR	Okay. I'm changing those to ... back again. First three rows. And you're pulling the ATCA PGNS, huh?
03 10 03 04	CC	That's affirmative. Pull ATCA PGNS open.
03 10 03 11	CDR	Okay. I've done that.
03 10 03 20	CC	Okay. Are you ready for the fourth row?
03 10 03 25	CDR	Affirm.
03 10 03 27	CC	Okay. Now when we get in the fourth row, we're going to open the IMU OPERATE circuit breaker; and what that means is that we're going to lose the capability to watch your CDUs, so we're not going to be able to see your attitude. Therefore, we will not be able to advise you on which antenna to select for communications. The way we want you to handle that is to turn the LM UPLINK SQUELCH off, and when you hear the noise, switch antennas. We'll be able to see you switch antennas, and it's going to take us about 3 to 5 minutes to establish a lockon again after you switch. After each time that you switch antennas, we will initiate a voice check. And basically when you see the Earth out the window, you can be on FORWARD antenna, and when the Moon's up in the window use the AFT antenna. You copy?
03 10 04 41	CDR	Okay. We're going to pull the IMU OPERATE circuit breaker, so you won't be able to see our attitude. Therefore, you won't tell us how to switch antennas and we'll enable the - I will turn the - up the SQUELCH OFF so that when we start getting any static, we'll switch antennas and as a thumb rule we could use - with the Earth forward, we use the FORWARD antenna and when we see the Moon we use the AFT antenna.
03 10 05 12	CC	That's affirmative, Jim. In other words, we're leaving the antenna switching up to you, and after you switch antennas it's going to take 3 to 5 minutes for us to establish a lockon again, and we'll initiate a voice check. And I'm ready to go on panel 11, row 4.

END OF TAPE

03 10 05 34	CDR	Okay.
03 10 05 36	CC	Okay. On row 4, under HEATERS RCS SYSTEM A/B-1: open QUAD 1 through 4; under ECS, the only change is - under GLYCOL PUMP close AUTO TRANSFER; under COMM, the only change is: open VHF A RECEIVER, open COMMANDER AUDIO; under PGNS, the only change is: close and leave closed IMU STANDBY circuit breaker, so we can have heaters. Read back.
03 10 06 30	CDR	Okay. On row 4, we're going to open all four of the heaters - the RCS SYSTEM A and B - the first four circuit breakers. We're going to close the AUTO TRANSFER. We're going to open the VHF A RECEIVER and the COMMANDER AUDIO. And we're going to close the IMU STANDBY. The LGC DSKY and the IMU OPERATE will be open.
03 10 07 05	CC	That's affirmative, Jim. All other breakers in that row are as you see them in the checklist. And on row 5, the only change is that we want you to, under EPS, open ASCENT ECA CONTROL. Over.
03 10 07 25	CDR	Roger. I think we already have that opened - ASCENT ECA CONTROL is probably already open.
03 10 07 36	CDR	Okay. So let me confirm. We'll have one COMM system, that will be the LMP system, and we'll have to do our own antenna switching; therefore, we'll have to wait about - Okay, why don't you switch? Aft antenna.
03 10 08 04	CDR	We'll have to wait for you to get a lockon again. Is that correct?
03 10 08 14	CC	That's affirmative, Jim. You'll be working off of the LMP's panel over there.
03 10 08 22	CDR	Okay. What else do you have for me?
03 10 08 24	CC	Okay. Panel 16, that's on page Power-7. Top row, the only change is: under RCS SYSTEM B, open PQGS/DISPLAYS. Over.
03 10 08 50	CDR	Okay. I may go over this with you, Jack, because this checklist has been written over two or three times now on our various procedures. Top row, the first two are open, the next three are closed, and we're going to open now the QUAD TCA's 1, 2, 3, 4; CROSSFEED will be closed,

and the TEMP/PRESS DISPLAYFLAG will be opened, and we're going to open up the PQGS, MAIN SOV will be closed, and the ... will be opened.

03 10 09 26 CC That's affirmative, Jim. And there's no change to the second row. Over.

03 10 09 38 CDR Okay. Again let me go through this with you. The first four are going to be closed. The next sev - eight will be - the next nine will be open from LOGIC POWER B through DESCENT ENGINE OVERRIDE. How about the CWEA? Is that going to be closed?

03 10 10 08 CC That's affirmative, Jim. We want the next five closed.

03 10 10 15 CDR Okay.

03 10 10 16 CC Okay. In the third row, under COMM: DISPLAY, open; SE AUDIO, closed; VHF A TRANSMITTER, open - That's a change - VHF B RECEIVER, open; PRIMARY S-BAND, POWER AMPLIFIER, open; TRANSMITTER/RECEIVER, closed; S-BAND ANTENNA, open; PMP, closed; TV, open. Under ECS: DISPLAYS, open; GLYCOL PUMP SECONDARY, open; LGC PUMP, open; CABIN FAN CONTROL, open; CABIN REPRESS, closed; and all the next four closed also. Read back.

03 10 11 12 CDR Okay. We have DISPLAY, open; SE AUDIO, closed; VHF A TRANSMITTER, open; VHF B RECEIVER, open; POWER AMP's going to be open; TRANSMITTER/ RECEIVER, closed; S-BAND ANTENNA, open; PMP, closed; TV, open; DISPLAY is open; next three are open; CABIN REPRESS, closed; and all the rest closed.

03 10 11 36 CC That's affirmative, Jim. And in row 4, under HEATERS, we want them all - Correction - we want all the QUAD HEATERS open. Correction - we want all the QUAD HEATERS closed.

03 10 11 53 CDR All the - -

03 10 11 54 CC We want DISPLAY, open; S-BAND ANTENNA, closed - to avoid a MASTER ALARM, CAMERA - SEQUENCE CAMERA, open; And under EPS, we want DISPLAYs, open; DC BUS VOLT, closed; INVERTER 2, open; ASCENT ECA, closed; ASCENT ECA CONTROL, open; DESCENT ECA, closed; DESCENT ECA CONTROL, closed; TRANSLUNAR BUS TIE, close; we want the CROSS TIE BUS, open; the BAT LOADS, closed; BAT FEED TIEs, closed. How do you read?

03 10 12 46	CDR	Okay. The four RCS HEATERS will be closed; DISPLAYS, open; S-BAND ANTENNA, closed; CAMERA SEQUENCE will be open; DISPLAY will be open; DC BUS VOLT will be closed; INVERTER 2 open; ASCENT ECA will be closed, but the ASCENT ECA CONTROL, open; DESCENT ECA, closed; DESCENT ECA CONTROL, closed; TRANSLUNAR BUS TIE, closed; and CROSS TIE BUS, open; and BALANCE LOADS, closed; and the BAT FEED TIEs, closed. I have one question, Jack. On panel - on the second line there under LIGHTING, why are we keeping the FLOODS and TRACK closed? Or are they going to be open?
03 10 13 33	CC	Negative. We have the LIGHTING breakers all closed. Control the lighting with the switches and rheostats. Over.
03 10 13 44	CDR	Okay. We don't need the floodlights, I don't think, but we can do it that way, I guess.
03 10 13 51	CC	And under row 4, under RCS SYSTEMS A/B-2, QUAD HEATERS, you notice that we've closed those circuit breakers, but what we want you to do is to - on panel 3, turn the RCS A/B-2 QUAD switches 1, 2, 3, and 4, off. Over.
03 10 14 28	CC	And we're going to watch your quad temps for you, and when we need to warm them up a little bit, we'll tell you to throw those four switches on - on panel 3.
03 10 14 43	CDR	Okay. Now are we sure that this PTC mode is good enough so we don't ... get crossed up later and get out of configuration.
03 10 14 53	CC	Stand by 1 on that, Jim. Okay, Jim, as far as we can tell right now, the PTC looks as good as any PTC we've ever seen in a CSM, so we're going to go with what we've got.
03 10 15 16	CDR	Okay.
03 10 15 18	CC	Okay, and if you turn over the page on Power 8, we have the spacecraft functions remaining to you. We've got low bit rate TM. However, we don't have any VHF. We have CWEA. We have GLYCOL PUMPS. We have SUIT FANS. We have CABIN REPRESS for you, and stand by in ATTITUDE CONTROL here. Okay, in ATTITUDE CONTROL, we'll have hardovers for uses in emergency, and for

		normal usage we want to have a 15-minute delay to get the heaters on to warm them up before use. How do you read?
03 10 16 06	CDR	Okay. For emergency, we have the hardovers and for normal use it requires a 15-minute request to get the heaters on.
03 10 16 16	CC	That's affirmative.
03 10 16 28	CC	Okay, Jim, that concludes our powerdown procedure, and we're waiting for you to get with it.
03 10 16 37	CDR	Okay, Jack, we'll start. I sure hate to lose the PGNS. I sure hope that procedure for the midcourse is a good one.
03 10 16 45	CC	It is.
03 10 16 55	CMP	You want me to help you here?
03 10 16 57	CDR	Yes, you can - Okay. First we power down, panel 11. All of them open.
03 10 17 15	CDR	Closed.
03 10 17 24	CMP	Yes.
03 10 17 56	CDR	Stand by for a MASTER ALARM. ...
03 10 17 57	CMP	Okay.
03 10 18 12	CDR	Here it comes.
03 10 18 54	CMP	LTG. You just did it.
03 10 19 18	CDR	I'll give you this when I'm finished. After we go through this, then you can go through it again and doublecheck it.
03 10 19 23	CMP	Right.
03 10 20 07	CMP	Now, the flood lights are on, right? No, I kind of don't think we need them though, do you?
03 10 20 15	CDR	Don't pull those. Give me the - first of all. We'll get back there. Those four are close, open, open, ENGINE ARM, open, ...
03 10 22 36	CDR	Say, Houston; Aquarius.

03 10 22 38	CC	Go ahead, Aquarius.
03 10 22 40	CMP	It will take him a minute to ...
03 10 22 43	CDR	You're familiar with our particular spacecraft that on panel 16 HEATERS RCS SYSTEMS A and B, QUAD 1 HEATER circuit breaker has been pushed in, and sealed in, and if it's ever pushed out, it's doubtful if we'll ever be able to reset it.
03 10 23 06	CC	Okay, Jim, on the four QUAD HEATER breakers, we want you to leave them closed. And we'll operate the heaters with the switches on panel 3. Over.
03 10 23 19	CDR	Okay.
03 10 23 27	CMP	No.
03 10 24 07	CDR	Okay. We'll do it right there.
03 10 24 11	CDR	Okay. And I'm closing the HEATERS on panel 4, QUAD 1 through 4, OFF.
03 10 24 23	CC	Okay. It's time for you guys to get to bed and get Fred up.
03 10 24 33	CDR	(Laughter) I still have one question, Jack. I still think that - I still say that the - on the LIGHTING in our panel 16, the FLOOD lights and the TRACK should be open. We're not using them.
03 10 24 48	F	Do you have any argument about -
03 10 24 53	CC	No problem, Jim. Go ahead and open them, TRACK and FLOOD, that's all right.
03 10 25 03	CMP	Okay, TRACK and FLOOD are OPEN.
03 10 25 07	CDR	Now, why don't you go through that, Jack, and make sure those - -
03 10 25 10	CMP	Yes.
03 10 25 12	CDR	- - ...
03 10 25 15	CMP	Okay, I'll take this.
03 10 25 16	CDR	Okay, Jack, my only other concern now is the CO_2 rise in the spacecraft. I guess you're keeping a handle on that?

03 10 25 26	CC	That's affirmed, Jim. We have you up to 10.6 now, and we're willing to go a little higher on that. We have another cartridge and we have a procedure for making the command module cartridges up. We'll pass that on later.
03 10 25 42	CDR	Oh, yes. I'm not worried about that. I just wanted to make sure that you - -
03 10 25 46	CMP	Are they going to - -
03 10 25 47	CDR	- - that - We just don't want to go to sleep here and forget about the rise in CO_2.
03 10 25 51	CMP	Are they going to use ... - -
03 10 25 52	CC	Roger. We're watching it for you - -
03 10 25 54	CDR	Yes, they're getting it ...
03 10 25 55	CC	- - We have it here. It's now 10.7 and we have a medical go to 15 millimeters.
03 10 26 03	CMP	That's a new one.
03 10 26 04	CDR	There's a new first for you.
03 10 26 19	CC	Okay, Jim, we estimate we've got 1 more hour on the primary cartridge, and 6 or 7 hours on the secondary.
03 10 26 31	CDR	Okay. Fine. Say, it's a spare primary cartridge back there, too, isn't it? So that's good for another, how long?
03 10 27 10	CMP	Yes. Yes. That's yours though, isn't it?
03 10 27 14	CC	And you're right, Jim. We've got another primary cartridge back there behind the ascent engine cover.
03 10 27 21	CDR	Right, yes. We know. Thank you.
03 10 27 43	CMP	Yes, yes, I just -
03 10 27 51	CMP	Okay. I guess you've done everything right on that panel. Let me check the middle one. Yes. You powered down and then you leave me. Tell me, I've got it.
03 10 28 05	CC	Okay, Jack, we just thought it's about time you got a LM checkout.

03 10 28 16	CMP	But he's giving it to me inert. Of course, I'm giving him my command module, too, which is rather inert right now, too.
03 10 28 32	CC	Well, you've got to walk before you run, you know.
03 10 36 42	CC	Aquarius, Houston.
03 10 37 07	CC	Aquarius, Houston. Over.
03 10 37 15	CMP	Go ahead, Jack.
03 10 37 19	CC	Roger. For your information, Jack - -
03 10 37 20	CMP	You're loud and clear.
03 10 37 21	CC	- - all of our analysis is based on powerdown to 14 amps, but we're reading on you right now 12.3 and so we're better off than we were in our analysis.
03 10 37 38	CMP	That sounds good.
03 10 38 12	CMP	Jack, I thought you were going to get the sleep shift where there wasn't any excitement?
03 10 38 18	CC	Well, I tried, but I didn't make it. I thought you were supposed to be sleeping now.
03 10 38 31	CMP	Well, Fred-o is getting something to eat, and Jim is starting to sack out so I'm taking the COMM here until Fred gets set.
03 10 38 42	CC	Okay.
03 10 39 19	CMP	As I just - Yes, are you ready to take over? Well, he just - he just asked - said he thought I was supposed to be sleeping. And I told him that I was waiting for you to - Okay. You were off the NET when they explained the - But don't they - Can't we monitor our CDU's any more to tell when to switch antennas, so they've just - When they can see it switch - it will take a couple of minutes for them to get up. And they'll always make a voice check with you.
03 10 40 28	CMP	It came out here. I caught it. Okay. Now, are you getting squared away, I'll give you the COMM here.

[illegible]	CMP	I don't know. Is this right? It's close to [illegible]
[illegible]	CMP	They're - we're showing right now [illegible] amps. Their analysis is based on 14 so they're in better - Okay. Headset's yours.
03 10 42 12	LMP	Okay, Jack. How do you read?
03 10 42 17	CC	Hearing you loud and clear, Fred. OMNI.
03 10 42 21	LMP	Okay.
03 10 42 22	CC	Okay, I heard the - -
03 10 42 23	LMP	I see you luck out with all the good shifts.
03 10 42 27	CC	Yes, I got all the good deals. I heard Jack brief you on the COMM mode so, you got any questions about that?
03 10 42 40	LMP	Okay.
03 10 43 06	CC	And how is your PTC going? I heard Jack tell you that we can't see your CDU's. How's it going?
03 10 43 17	LMP	Well, let's see, we may be offsetting slightly, the Sun looks like it may be a little higher now. Here comes the Earth by and it looks about the same perspective. I'll have to wait to see the Moon on the other side, Jack. ...
03 10 43 37	CC	Okay, Fred, I can't hear you any more on account of the background noise. I assume that - I think I heard Jack tell you what we're going to do about COMM. UPLINK SQUELCH, off. You'll take care of the antennas because we can't see your attitude. We'll give you a voice check when come up. It'll take us 3 to 5 minutes to come up. And to make it astronaut-proof, when you see the Earth, use a forward antenna; when you see the Moon, use the aft one.
03 10 44 08	LMP	Yes, that's pretty straightforward. Okay, I see the Earth so I've very wisely shifted to FORWARD.
03 10 44 17	CC	Good boy.
03 10 45 09	LMP	Got another battery?
03 10 45 12	CMP	... really sick.

03 10 45 14	LMP	Earth will be by over there in a minute.
03 10 47 24	LMP	And, Jack, you still up?
03 10 47 28	CC	Still here, Fred.
03 10 47 32	LMP	Okay, when I was upstairs, just a minute ago, I noticed what appeared to be some new ventings from down the service module way. I noticed that out window 1, and also saw one chunk of metal - loose metal about 4 inches square that was tumbling around - silver in color, and it looked like it had come from somewhere down in the service module.
03 10 48 04	CC	Okay. You saw some venting out window 1 - -
03 10 48 05	LMP	And I -
03 10 48 08	CC	Go ahead.
03 10 48 10	LMP	Yes, that's where I happened to be looking. The lighting was such that it showed up out there. What reminded me of it was I'm looking out the LM window now and I see a good part of the new star field it's created for us. There are about a thousand little sparklies out here.
03 10 48 30	CC	Okay, so you're seeing some venting out window 1, and you saw a 4-inch-square piece of loose metal which was silver, and - Are you still seeing the venting or has it zeroed out now?
03 10 48 48	LMP	I don't know. I left upstairs, I'm down in the LM now, Jack. I guess when Jack goes up he can take a look and let me know. Okay, I'll think about switching aft here directly. I see the Moon, and the Moon looks pretty good, Jack, so I guess our PTC still doing pretty good.
03 10 49 09	CC	Okay, and we won't have any COMM delay if the PTC stays good.
03 10 49 32	LMP	Yes, sure enough the Moon is getting smaller.
03 10 49 37	CC	Good, and we want to ask you another question about the venting. Is this - would you suppose - some new venting or is this venting that you just hadn't - that's been going on all the time, but which you hadn't looked at recently?

03 10 49 56	LMP	I can't really say, Jack, we've been so tied up down in the LM, I guess we kind of forgot about the other half. But I've been upstairs several times and hadn't particularly noticed any flow by the windows before, so I - my first assumption was that it was some new venting. It really wasn't very heavy.
03 10 50 23	CC	Okay. Copy. Thank you.
03 10 50 25	LMP	And Jack's going up to take a look now.
03 10 50 27	CC	Okay. And for your information, all of our numbers are based on amperage usage of 14 amps. And we're using only 12.3, so we're a little fat on our analysis.
03 10 50 49	LMP	Very good. Way to be.
03 10 50 52	CC	And we're in a - -
03 10 50 53	LMP	I'll tell you, this Aquarius has really been a winner.
03 10 51 01	CC	Well, that's one of several. And we want to tell you something that I told Jim earlier, and that concerns control. Right now you have control in hardover if you need it, but when we go to some normal control modes, since we have the quad heaters off. We want to have a 15-minute notice for attitude control request. Over.
03 10 51 35	LMP	Okay, Jack. Offhand, I can't imagine that since we got the platform powered down why we'd need to worry about the instantaneous control. But at any rate, we need 15-minutes warmup with the heaters before we can start using thrusters.
03 10 51 54	CC	Right. And another thing we've done is to pull your ECS and EPC DISPLAY breakers and so - But we left your CAUTION and WARNING powered up. So if you get ECS-type or EPS CAUTION and WARNING you'll have to power up those meters with the DISPLAY breakers. And we are watching for you your PIPA temperatures, your ASA TEMP, your propellant temperatures except for the DPS propellant, and we're watching your quad temps for you.
03 10 52 31	LMP	Okay. That's very good, Jack. You're watching them. That's good enough.

03 10 52 41	CC	And everybody's fine at home El Lago.
03 10 52 50	LMP	Great.
03 10 52 51	CC	And, Fred, your CO_2 is building up. It's at 11.3 on our gage, and we've got a medical buildup to 15 millimeters, at which time we'll switch over to secondary. Looks like we've got plenty of lithium hydroxide, about 192 hours including the CSM cartridges. And as you know, we've got a way to use those. And as soon as we get them written in some good words, why, we'll pass that along. You might be able to make one.
03 10 54 13	LMP	Okay. Yes, we'll sure give her a try. And I'm showing onboard about 12-1/2 millimeters of mercury.
03 10 54 24	CC	Roger. And I have a flight plan update when you get a time to copy it sometime, I'll pass it along. There's no hurry on it.
03 10 54 35	LMP	Okay. Stand by 1. Jack's back now.
03 10 54 48	LMP	Okay. Jack just came back and he said it's still coming out; it's only coming out on the commander's side. So he saw it out the same window I did, window 1. And it's between the minus Y and minus Z axis.
03 10 55 07	CC	Okay. And of course - -
03 10 55 08	LMP	Jack says it's definitely the service module which was - which was my impression, too.
03 10 55 14	CC	Okay. So you're sure it's the service module, and, of course, the thing we're interested in knowing, is it something that is residual from before, or is it something new. And if you have any ideas about that, why we'd sure like to have them.
03 10 55 41	LMP	Yes. Yes, Jack, I'll answer him your question in a minute, but make Jack's first impression here, is that it's not near the intensity that it was right after our mishap. And I'll have to agree with that. I'd say - he said it was a half and I said it was maybe down to a third. And Houston would like to know if you have any impressions as to whether it is still a residual from that or maybe something new.

03 10 56 25	LMP	I don't know why after I felt that. Yes, I felt it was some new something - new venting, too.
03 10 57 06	LMP	Okay. Switch to FORWARD OMNI.
03 10 57 11	CC	Fred-o, if you think it's practical, we're ready to give you some - we're working on some camera settings for pictures of the venting. And, if you have a camera out and ready to go, let us know which one it is so we can get the settings for that camera. What do you think about that?
03 10 57 30	LMP	Okay. Jack's got the one with the 250-millimeter lens on it. That's the standard EL. And I have a surface camera out that I've been shooting hundreds of Earth/Moon pictures with, camera 1. And we also have the Reseau upstairs that's pretty handy. The command module DC camera. So you can about - -
03 10 58 00	CC	Okay. I copy that - -
03 10 58 01	LMP	- - take your choice, because - -
03 10 58 04	CC	I copy the 250 millimeter, the Reseau is available, but I didn't get what other one is.
03 10 58 14	LMP	Okay. I got my Hasselblad surface camera down in the LM here handy, too, camera 1.
03 11 00 04	LMP	And, Jack, if we're going to do any picture taking out the command module windows, I think we'd better do that pretty quick, or hold up until Jim and Jack get their rest done.
03 11 00 21	CC	We concur with that.
03 11 01 23	CC	Okay, Fred, we're not going to bother the skipper up there. We won't be taking any pictures out of the command module window until after rest period.
03 11 01 34	LMP	Okay.
03 11 10 59	LMP	Shifting to FORWARD OMNI.
03 11 11 44	CC	Okay. Fred, for your information, your CO_2 reading onboard is a little higher than what we're reading here on the ground, and so when it gets to 15 on your meter, switch to secondary. And we'd like to get a status about every 30 minutes - we'll give you a call on that. But just to let us know we're still thinking about you, we'd like you to go BIOMED RIGHT, please.

03 11 12 14	LMP	Okay. Going BIOMED RIGHT.
03 11 13 57	LMP	Hey, how do you read me on this COMM mode on S-band?
03 11 14 03	CC	5 square, Fred. How me?
03 11 28 03	CC	We're still here, Fred. How's it going?
03 11 28 11	LMP	Okay. My CO_2 reading is now just below 13.
03 11 28 21	CC	Say again what it is.
03 11 28 25	LMP	It's just - just below 13.
03 11 28 29	CC	Okay. Just below 13. And just for your information, we've got people working on several subjects. We're working on the midcourse coming up to determine our control system and how to do it with the control system we select, what we should do about the alinement. We've got the LMS and a couple of crews cranked up working on that. And we're also working on our entry, how and when we ought to activate the CSM. And we're working on the CSM systems status. Tomorrow sometime we're going to have a MAIN BUS B checkout, so we've got a lot of people swinging pretty hard here and I've got some f-stop settings for you for the lunar-surface camera. At 1/250th, we'd like you to take targets of opportunity. Each picture use three f-stops, because we don't know exactly which one is going to work the best, so use 4, 5.6, and 8 and 1/250th for the surface camera. Copy?
03 11 29 52	LMP	Okay. Use the surface camera at 1/250th, 4, 5.6, and 8. And I've been doing quite a bit of shooting at covering two of those numbers in the range 5.6, and 8. I've also been shooting some at 11, so I'll just drop it down a little more. The Moon is still so big and bright there that I got a feeling that the Moon is probably up around the f/8 to f/11 range.
03 11 30 26	CC	Roger, I didn't catch that last part. Maybe when the COMM gets a little better you can say it again.
03 11 30 43	LMP	Okay. How do you read now, Jack?
03 11 30 45	CC	That's a lot better, Fred.

03 11 30 48	LMP	Okay, I just said the Moon is still so bright, that I think probably the higher range of f-stops will be better; f/8, maybe even f/11.
03 11 31 02	CC	Okay.
03 11 31 11	LMP	I can just barely, on the left corner of the Moon now, make out the foothills of Fra Mauro formation. We never did get to see it when we were in close, there.
03 11 31 33	CC	Okay. I'm reading on my monitor here, Fred, that you're 16214 miles away from the Moon moving at about 4500 feet per second.
03 11 31 56	LMP	Okay.
03 11 32 21	LMP	From the sounds of all the work that is going on and is still going on, this flight is probably a lot bigger test for the system on the ground than up here.
03 11 32 41	CC	Yes, you've been - you've been working it out a little bit.
03 11 32 55	LMP	Yes. I've really got a tough job right now switching OMNIs.
03 11 33 08	CC	Well, everybody down here is 100-percent optimistic. Looks like we're on the up side of the whole thing now.
03 11 33 21	LMP	Yes, I guess we had better be in good shape, particularly ourselves, rested for that entry day. I think that is going to be a pretty busy one.
03 11 33 33	CC	Right, and we're working on procedures for that. Ken's been doing quite a bit of work on getting ready for entry.
03 11 33 47	LMP	Very good.

END OF TAPE

03 11 47 12	CC	How's it going, Fred?
03 11 47 18	LMP	Okay. Just fine.
03 11 47 20	CC	Okay. We're considering a midcourse correction at 104 hours - about 20 hours from now - 18 hours from now, and it's only 7 feet per second. The other option is to keep PTC up, since we may not be able to get back into it again, and delay it. So, that's the type of thing we're thinking about, but - just wanted to let you know that you're pretty much right in the middle of the fairway there and our present tracking, with no midcourse, has you - with a Gamma of 7.11, as opposed to 6.51. So, you're already in the corridor. You're just a half a degree between the center and the outer limits and we're going to tweek that up.
03 11 48 15	LMP	Okay. That sounds good.
03 11 48 20	CC	And - we don't - Well, we think there might have been a misunderstanding earlier on the potable water. Don't worry about drinking water. Drink all you want. There's plenty of it. There's 38 pounds, and the Surgeon recommends that you use some of the fruit juices as well. Over.
03 11 48 43	LMP	Okay. Yes, we went up and - and used the procedure to pressurize surge tank, and Jack and I made up a total of 22 drinks of - drinking water.
03 11 49 02	CC	Okay.
03 11 49 19	CC	And I assume that Jack is up there sleeping now too, right?
03 11 49 26	LMP	Yes. That's affirm. They're both up there.
03 11 49 40	LMP	I hate to say it, Jack, but I think our PTC is about to wobble off a little bit. I've noticed that the Earth is coming by somewhat lower in the window and the Moon is going by somewhat higher.
03 11 49 59	CC	Okay. Understand. PTC, Earth is coming by lower and Moon is coming by higher.
03 11 50 09	LMP	Yes.

03 11 51 58	CC	And, Fred, on this jerry-rigged command module lithium hydroxide canister, what we're going to do is we're going to have to make at least two up and use two at a time - one on each set of hoses. What we'll do is we'll connect one of these jerry-rigged boxes to the red fittings and air will be sucked through the lithium hydroxide and then blown out the blue fitting. And we're also going to, when we do this, remove the LM lithium hydroxide canister from the suit loop, either the primary or the secondary, and we're getting the words together to make it easy to build one of these things, and it looks like it will probably take two guys, so, I think we probably ought to plan to do that later. In addition, we have to go up and get a couple of canisters out of the command module, so it looks like maybe a smart idea would be to delay a little bit and have you build a couple of these later on. What do you think?
03 11 53 17	LMP	Yes. I agree, Jack. Jack Swigert and I went upstairs earlier and both got a canister, and we were scratching around for some material and thinking about using them, and that's actually why - when we made up all the water to drink because we needed the plastic container that they were housed in in the pantry, and we had that ready to use with some material plus some of the - the extra porous bags that were going to be used for the dump control that we may just cut up and use, too.
03 11 53 54	CC	Did you come up with a design or - -
03 11 53 56	CDR	Plus we got lots - -
03 11 54 00	LMP	No. We just thought we'd see what we had in the way of material and stand by for your word. Of course, we also have lots of stiff-backed cardboard flight data.
03 11 54 15	CC	Yes. We have decided to use a canister and, you know that the liquid-cooled garment has a bag around it that we think we can use, too, or that we know we can use. We've tried it. So what you have is the - a bag within a bag and inside that is the liquid-cooled garment. The bag that is closest to the liquid-cooled garment is the one we need, and we've got two of them. And then,

of course, we've got to use some tape and, as you say, one of the backs to flight data file time line book or something like that, and, just using those materials, we can make this jerry-rigged canister. So, the bag that we're looking for is the one that is right next to the liquid-cooled garment, and, if we're very careful about where we cut it, we can make a pretty good rig.

03 11 55 28	LMP	Okay.
03 11 55 31	CC	It looks like we'll have to use that bag over again, though, because we only got two of them, and I expect that we'll have to make more than two of these canisters up.
03 11 55 44	LMP	Roger.
03 11 56 35	CC	Fred, in about 4 minutes, we're going to hand you over to a different communications site, and it's going to take us about a minute or so to reestablish uplink, so you can be prepared for that.
03 11 56 51	LMP	Okay, Jack.
03 12 00 40	CC	Fred-o, we've handed over now. How do you read?
03 12 00 46	LMP	Loud and clear, Jack.
03 12 00 48	CC	Same here.
03 12 00 56	LMP	In fact, you're coming in a little louder.
03 12 01 03	CC	Fred, you'll have to say again. Can't read you there. There's too much background noise. Maybe we need a new antenna.
03 12 01 14	LMP	Okay. I'm on the other OMNI now. I just said that you're coming in even louder than previously.
03 12 01 24	CC	Roger. Maybe it's because I'm standing up. You're coming in better now, too.
03 12 04 46	LMP	And, for your information, Jack, I'm just going to tear into some beef and gravy and other assorted goodies.
03 12 05 01	CC	I presume that you're doing this with the full permission and - of the commander.
03 12 05 19	LMP	And this - at this moment, who do you think is the commander?

03 12 05 31	CC	If I was him, I'd make you sign out everything you ate, so I'd know.
03 12 05 56	LMP	Well, I'm sneaking inside of the LM where he doesn't have ... Incidentally, this PTC must have some - must have a wobble mode around our X-axis there because now the Moon and Earth are back in the right perspective.
03 12 06 18	CC	Good. Let's see if it goes the other way.
03 12 06 40	CC	These guys down here are saying they knew it all the time.
03 12 06 56	LMP	Well, that's right. They do good work. Whoever heard of doing a P52 in the LM?
03 12 08 48	CC	Say, Fred, sometime when you're not too busy chewing on that beef, how about telling us what the CO_2 reads?
03 12 09 03	LMP	Okay, I'm reading 13, 1 3.
03 12 09 07	CC	Okay. It looks like our reading is getting kind of close to yours.
03 12 14 39	LMP	Yes. It appears the wobble is going the other way, Jack, because the Earth is now rising and the Moon is starting to get lower in the window.
03 12 14 52	CC	Roger. Could you give us an LPD number periodically?
03 12 15 02	LMP	LPD number? Yes, okay.
03 12 15 09	CC	In fact, if you could give it two or three REVs in a row, why then we could predict where it's going and maybe help us set it up again if we have to.
03 12 15 22	LMP	Okay.
03 12 15 36	LMP	Okay. The center of the Earth has just gone by at an LPD number of 4.
03 12 15 42	CC	Roger. LPD 4, center of the Earth.
03 12 20 59	LMP	And the center of the Moon is about LPD 21.
03 12 21 04	CC	Okay. LPD 21. Is that the center of the Moon, you say?

03 12 21 11	LMP	That's affirm.
03 12 22 52	CC	And, Fred, we're doing a little better on our water than we had anticipated. Our numbers were designed for 3.5 pounds per hour; we're using about 3.0, and expect to go a little bit less.
03 12 23 11	LMP	Beautiful.
03 12 23 32	LMP	When this flight's all over, we'll really be able to figure out what a LM can do.
03 12 24 02	CC	Maybe it'll make the ...
03 12 24 09	LMP	If it had a heat shield, I'd say bring it home.
03 12 27 18	LMP	Okay. The Earth went - just went by about - clear above the LPD index. It was - it was, if it were extended, the number would be minus 6.
03 12 27 34	CC	Okay. Way up there at minus 6.
03 12 27 41	LMP	Yes, there's actually no such number. I just extended the line beyond zero which, for a negative rate, is what it would be if there was one.
03 12 27 53	CC	Right. If minus 6 was there, that's where it would be. Right?
03 12 28 02	LMP	That's right.
03 12 28 13	CC	Do you still have that super-dense star field?
03 12 28 25	LMP	It's still there. I'm looking at it right now. I can look at - the Sun is right behind me, then all these sparklies show up. Yes. It kind of looks like I'm right in the middle of the - of the Milky Way. There are several thousand little sparklies at various ranges out as far as I can see ...
03 12 29 18	LMP	They're kind of interesting. They're all moving ... and sparkling there. And I can ... - at least I think I can what will occasionally give you a real star from the bunch of sparklies, but it really does break up the capability to pick out a star pattern, particularly through ...
03 12 29 52	CC	Okay. So far, we haven't identified what the sparklies are and what is venting.

03 12 30 12	LMP	Yes, I got a ... feeling that we probably won't get any ... until we power up.
03 12 34 08	CC	How you feeling, Fred?
03 12 34 16	LMP	Oh, as soon as I chug down this grape drink and grapefruit - orange drink, I think I'll be in pretty good shape.
03 12 34 38	CC	How much sleep did you get between the burn and the time you got up for this exercise?
03 12 34 50	LMP	Oh, I'd guesstimate about 4 hours, Jack. Wait a minute, which burn you talking about?
03 12 35 03	CC	It was the burn we just made. Did you get any sleep between it, and the time you got up for this watch?
03 12 35 12	LMP	Oh, no. I didn't - I haven't been to bed since all the action the night before, and I went to go to bed for about 4 hours then ...
03 12 35 22	CC	Yes.
03 12 35 38	CC	Well, we're just trying to figure out who's likely to be the most tired up there. You or Jim.
03 12 35 55	LMP	I think we'll get caught up pretty good in the next couple of days.
03 12 36 00	CC	Say again.
03 12 36 04	LMP	We ought to get caught up pretty good in the next couple of days.
03 12 38 56	LMP	Okay, Jack. The Earth has started back down. The hack on the LPD there was 1 degree.
03 12 39 06	CC	Okay. One degree on the center of the Earth.
03 12 42 13	CC	That was a good TV show you put on the other night, Fred, during LM entry.
03 12 42 26	LMP	Yes. It would have been an even better one about 10 minutes later.
03 12 42 50	CC	Yes. Things sure turned to worms there in a hurry after that show.

03 12 43 17	LMP	Yes. You're right.
03 12 43 28	LMP	Okay. The center of the Moon now is about minus 2 degrees DELTA-V.
03 12 43 35	CC	Minus 2 degrees, center of the Moon.
03 12 44 44	CC	Charlie said to say hello.
03 12 44 51	LMP	Who's that?
03 12 44 53	CC	Charlie.
03 12 44 58	LMP	Is he still around there?
03 12 45 16	LMP	Unless my watch is wrong, it says it's almost 2 a.m. back there.
03 12 45 22	CC	No. That's the bearded one.
03 12 45 29	LMP	Oh! Okay.
03 12 46 15	LMP	Hey, tell Charlie that I'll be back down there personally to thank him for this baby.
03 12 46 28	CC	Sure will. I did.
03 12 50 21	LMP	Okay. The Earth went by there, Jack, at LPD about 18 degrees.
03 12 50 28	CC	Roger. We copy 18 degrees for the center of the Earth.
03 12 53 56	LMP	Okay. The Moon - I'd estimate it up around minus - somewhere 17 to minus 20 degrees LPD.
03 12 54 07	CC	Okay. Moon's minus 17 to minus 20.
03 12 55 14	CC	How would you like to spend a week on an aircraft carrier getting back?
03 12 55 28	LMP	If I can get on an aircraft carrier, I don't care how long it takes, Jack.
03 12 56 28	CC	They're going to take you by helo to Samoa. You'll spend the night in Samoa, get on a 141, and be at Ellington shortly thereafter.
03 12 56 46	LMP	Okay. Kind of sounds like the original plans for the ...

03 12 57 24	CC	Had you worrying that you're going to spend the night on the ship, helo to Samoa and directly to Ellington.
03 12 57 35	LMP	Very good.
03 12 58 27	LMP	Boy, these thrusters are sure ... ...
03 12 58 35	CC	Fred, I'm not reading you. Maybe we'd better wait until we change antennas or unless you can speak up a little louder.
03 12 58 43	LMP	How do you read now?
03 12 58 45	CC	Better.
03 12 58 49	LMP	Okay. The thrusters ... and the ... outside ... and they hardly look like they ... ...
03 12 59 12	CC	Gee, I'm sorry, Fred. We're just not reading you right now. Maybe we'll have to wait a little bit.
03 12 59 20	LMP	Okay.
03 12 59 29	CC	Let's try it now. If you can speak up, the background noise has gone down a little bit.
03 12 59 37	LMP	Okay. How do you read now?
03 12 59 39	CC	A little better.
03 12 59 44	LMP	I was just commenting - I've been looking here at the thrusters on quads 1 and 4. We've got a slight discoloration on the outside of the barrel. The nozzles look like they hadn't ever been fired, - like they're brand new. ... of like those skinny things on the interior on the upper nozzle ...
03 13 00 14	CC	You say the coloration of the thrusters appears they haven't been fired on quads 1 and 4?
03 13 00 24	LMP	I'm saying all of them look clean again. I guess they've fired so clean that they don't seem to ... at all. ... different color, ... copper, bronze, color of the oxygen cell. They've been fired because I watched them fire. Okay. The Earth's going by at an LPD of 42.
03 13 00 58	CC	Roger. Copy LPD 42. Is that affirm?

03 13 01 03	LMP	That's affirm.
03 13 01 17	CC	And, Fred, that may be why the COMM is a little bit degraded, more background noise, because we're getting out of attitude a little bit there.
03 13 01 28	LMP	Roger.
03 13 03 38	LMP	How do you read on AFT OMNI now ...?
03 13 03 43	CC	I'm reading you, Fred. I've got a lot of background noise. Looks like it might come and go with attitude.
03 13 03 54	LMP	Yes. I think that's probably - just looking through the command module at you now.
03 13 04 45	LMP	How do you read now, Jack?
03 13 04 47	CC	About the same, Fred.
03 13 04 52	LMP	Okay.
03 13 05 08	LMP	Okay. And the Moon just went by at about minus 14 degrees.
03 13 05 13	CC	Okay, the Moon at minus 14.
03 13 05 24	LMP	That - that's correct.
03 13 05 28	CC	Okay. Your landing in - your weather in the landing area, which is about 560 miles south of Samoa, is now predicted to be about 1500, scattered, high broken. Waves are going to be 5 feet, the winds are going to be 15 knots, visibility 10 miles, showers in less than 10 percent of the area, and you will be landing at 08:00 local, roughly.
03 13 06 04	LMP	Hey, that all sounds pretty good.
03 13 08 29	CC	Say, Fred, did you get the dope on the Saturn IV impact - S-IVB impact?
03 13 08 41	LMP	Yes. Just as we came around the corner, Vance, they told us that it hit - I don't recall the position now, but it was a ... impact ... and recorded it on the ... seismometer.
03 13 09 04	CC	Yes. It impacted 74 nautical miles from the ALSEP, and the passive seismic detected major seismic activity on all long period channels and this

was - this activity was detected for 4 hours afterwards with decreasing amplitude. And the impact also was detected by the high-energy channels ... The high-energy channel of the SIDE.

03 13 09 58 LMP Yes. That ought to add ...

END OF TAPE

03 13 11 42	LMP	Okay. The Earth LPD number that time was 32.
03 13 11 48	CC	Roger. Thirty-two.
03 13 14 57	LMP	How do you read now, Jack?
03 13 15 02	CC	I'm reading you, Fred. I've got a lot of background noise, though.
03 13 15 08	LMP	Jack, I can definitely tell we're moving away from the Moon, now. I got it all in the monocular at one time. We're right over the top of FPA 8 right now.
03 13 15 23	CC	You're right over the top of what?
03 13 15 24	LMP	On a point between it and Censorinus - FPA 8 and - the point halfway between there and Censorinus.
03 13 15 46	CC	Fred-o, would say the checkpoint over which you're right now?
03 13 15 56	LMP	Okay. And incidentally, the DELTA-V on the Moon was zero, so it's coming back down. The point looks like we're just about straight over is around Censorinus and the point between it and FPA 8.
03 13 16 19	CC	Okay.
03 13 22 07	LMP	Okay. And, Jack, the Earth LPD angle is 24 degrees.
03 13 22 14	CC	Roger. Earth at 24. And it looks like you're getting up to about 15 on the CO_2, so we want you to select SECONDARY and swap out the primary cartridge. Over.
03 13 22 30	LMP	Okay. I'll select SECONDARY and swap out the primary cartridge.
03 13 22 53	CC	Okay, Fred. And when you select - When you swap out the primary cartridge, don't reselect PRIMARY. Stay on SECONDARY until we use the secondary up. Over.
03 13 23 10	LMP	Okay. I'm changing out primary and - stay in SECONDARY until we use it up.

03 13 29 43	LMP	And the change out is complete, Jack.
03 13 29 50	CC	Okay. Copy the changeout complete, and we're reading 4.5 on the CO_2 here.
03 13 30 01	LMP	Okay. I'm ...
03 13 32 21	LMP	Okay. And the Earth LPD was 8 degrees.
03 13 32 25	CC	Did you - Did you say 8 degrees, Fred?
03 13 32 31	LMP	Affirmative.
03 13 32 34	CC	Okay.
03 13 36 52	LMP	Well, I missed the Moon on that one, Jack. But I would guess - estimating back a little bit, the LPD angle was somewhere around 42.
03 13 37 03	CC	Fred, I'm having a hard time reading you, but I think you're giving me a LPD angle.
03 13 37 12	LMP	Roger. That's it, Jack. The Moon is about 42.
03 13 37 16	CC	You say the Moon is at 22?
03 13 37 23	LMP	Four two, 42.
03 13 37 24	CC	Okay, 4 2. Thank you.
03 13 50 27	CC	How you doing there, Fred?
03 13 50 33	CDR	...
03 13 50 51	CC	Okay, Fred. I can just barely hear you saying something in the background and I can't make out what it is.
03 13 51 02	CDR	Hello, Houston; Aquarius.
03 13 51 06	CC	Hello there, Aquarius. Go ahead.
03 13 51 11	CDR	Roger. And Fred is being relieved now. He's - went back to get some rest. This is Lovell here who's got the duty.
03 13 51 21	CC	Gee whiz. You got up kind of early, didn't you?
03 13 51 28	CDR	It's cold back there in the command module.

03 13 51 38	CC	Well, what we were really thinking about doing was letting you sleep a little bit longer because we figure you're pretty worn out.
03 13 51 55	CDR	Well, I'll go back and forth once in a while to get a ...
03 13 52 01	CC	Is Jack up there with you?
03 13 52 08	CDR	No, Jack's still sacked out.
03 13 52 41	CC	Okay, Jim. We're kind of watching this PTC a little bit. Fred's been giving us a few LPD angles as we swang by the center of the Earth - center of the Moon. We noticed that the COMM has been degrading just a little bit so you might have to talk up.
03 13 53 09	CDR	Roger. Understand.
03 13 53 11	CC	And we just went on to the secondary CO_2 canister. Fred swapped out the primary, but we want to stay on the secondary until it is all used up.
03 13 53 30	CDR	Okay. I'm going to use the tape ... CO_2.
03 13 53 42	CC	We're reading a partial pressure CO_2 of 4.2 millimeters. We're cleared to use the secondary until it reaches 15.
03 13 53 57	CDR	Okay. That's good.
03 14 01 47	CC	Aquarius, in comparing our initial estimates of water usage and electrical power usage, it appears that we're right on the money on water usage, and we're using a little less amperes than we had originally expected in our first analysis, so we're either right on the money or just a little bit ahead of the game in that regard.
03 14 02 18	CDR	Well, that sounds encouraging, Jack.
03 14 02 24	CC	And there are a few temperatures that we're watching for you. You have the heaters powered down. We're looking at them, and those include the PIPAs, the ASA, the quad temps, and your propellants, except for the DPS propellant.

03 14 02 49	CDR	Okay. I've got them here.
03 14 03 02	CC	We have, as you probably know, several groups working on procedures from here on out. We have a group working on midcourse corrections to determine a system, the attitudes, how to do it, alinement techniques, and so forth. We have a group working on the entry, including how and when we're going to activate the CSM. We have a group working on the CSM system status, and in a few hours - Later on tomorrow, from where we see it, we're going to go to some base configuration on the CSM and we're going to conduct a MAIN BUS B check. Right now the COMM is kind of degrading, and I can't hear what you're about to say very well. But I just want to keep you advised as to how things are going here. And remember you've got duty on the antennas.
03 14 05 00	CC	Aquarius, are you reading Houston?
03 14 05 04	CDR	...
03 14 05 10	CC	Okay, Jim. I can hear you talking but I can't tell what you're saying because you're way down in the background noise.
03 14 05 20	CDR	Okay. Can you hear Aquarius now? Over.
03 14 05 23	CC	Oh, yes. That's much better. Did you get my report on the various types of people and what they're doing around here?
03 14 05 30	CDR	Roger. Sounds like you had things well organized. You might also consider what kind of a stowage configuration ... and what we can leave behind in Aquarius.
03 14 05 50	CC	Okay, Jim. I didn't catch that suggestion on account of the background noise; maybe we can pass it on when it gets more favorable.
03 14 06 07	CDR	I'm thinking in terms of stowage. Whether we would leave the suit, ... the Hycon camera in Aquarius, prior to ...
03 14 06 26	CC	Okay. I heard you say something about using the Hycon camera in Aquarius.

03 14 06 36	CDR	Negative, Jack. I'm thinking of reentry stowage attitude. Whether we should - what we should leave behind in Aquarius. Leave the suits behind; leaving such big items as the Hycon cameras in Aquarius. Over.
03 14 06 53	CC	Oh, understand. You're thinking about stowage. What'll we leave behind in Aquarius when we fall back into Odyssey. Is that right?
03 14 07 04	CDR	That's affirmative.
03 14 07 06	CC	Okay. We've people working on that, too.
03 14 07 26	CC	And we presently are tracking you at 22 500 miles from the Moon, moving out at 4400 feet a second.
03 14 07 43	CDR	Aquarius. Roger.
03 14 10 36	CC	And, Jim, earlier in the evening, we thought there was a misunderstanding about the amount of potable water you can drink, but we want to advise you that you can drink as much water as you want to. There's 38 pounds in the potable tank, and that's about all you'll need. The doctors suggest you drink as much fruit juices as you want, too.
03 14 11 02	CDR	Roger, Jack.
03 14 13 52	CC	Jim, earlier in the evening, Fred-o reported some venting out of window number 1 in the command module. He also reported a piece of loose metal about 4 inches square, silver, floating by, and one thing we were trying to establish is whether or not this is a new venting or whether this is part of the residual venting of our original problem. Do you have any more words or comments? And one thing he was doing was taking some photographs and we authorized photographs, targets of opportunity, using the lunar-surface camera number 1, and use the setting of 1/250 of a second, and not knowing precisely what f-stop to use, we suggested taking three of each, using settings of f:4, f:5.6, and f:8. Over.
03 14 14 57	CDR	Roger, Jack. The venting really seems to ... I reported earlier, I alsc spotted the large piece go by and prior to our ... burn ... The venting you see now is much greater ... went into the dark mode, you could easily distinguish stars

and didn't have the bright articles and bright objects, and I also have the camera here to take photographs. ...

03 14 16 09	CC	Okay, Jim. Once again I hear you talking back there but I can only pick out a few words; maybe we'll have a better time.
03 14 16 54	CC	Aquarius, we're trying to improve our communications. Could you turn the BIOMED off and give us a voice check, please?
03 14 17 09	CDR	Voice check follows: 1, 2, 3, 4, 5, 5, 4, 3, 2, 1; voice check out.
03 14 17 18	CC	Okay, Jim. That seemed to be better.
03 14 31 02	CC	How are you doing there, Aquarius?
03 14 31 08	CDR	We're doing good, Jack.
03 14 31 10	CC	Okay. Sometime when you get two guys available there and you could construct one of these lithium hydroxide rigs, I'd like to have you get the materials together, and we'll go through the steps together.
03 14 31 28	CDR	Okay. Sounds good. And how do you read me now?
03 14 31 33	CC	Well, there is a lot of background noise, and sometimes it is worse than others and right now I hear you better than I have in the past.
03 14 31 45	CDR	Okay, Jack. I'm kind of curious the amount of perturbations our PTC attitude is taking. I notice that we are getting off attitude, and I'm just kind of curious how far we can let this go.
03 14 32 03	CC	We were tracking the attitudes with Fred earlier and it looked like what we were doing was oscillating about some point, but coming back. Are you detecting some kind of divergence now?
03 14 32 21	CDR	Not too much. I notice that it's different than when I went to sleep. We are more at an angle now with the terminator of the Earth, so when we started out, we were just about parallel with the terminator, and now we are canted off somewhat. I haven't seen any trends, though, of going back and forth.

03 14 33 08	CC	And, Jim, our current plan is to not correct the PTC. We're going to take whatever we get and live with it. And we can kind of keep track of what's going on a little better if when you swing past the Earth and swing past the center of the Moon, if you could read off the LPD angles for the center of the Earth and the center of the Moon. Over.
03 14 33 34	CDR	Roger. Will do, Jack. And I'm looking into the AOT now to the right - No, the number 4 detent, and we are venting something back there; I can see particles moving on past the command module. What it is, I don't know.
03 14 33 59	CC	Okay. Can you identify the quadrant?
03 14 34 18	CDR	Well, I'm looking through the right rear reticle now of the AOT, and when I was back in the command module, I could see it out of the CM 1 window. The particles are rather small, but they are coming out with some force. That's probably what is disturbing our PTC attitude.
03 14 34 50	CC	Yes, that sounds quite probable, Jim. That's about the same report we got from Fred, but we haven't been able to identify what they might be and probably won't be able to until we crank up the CSM. If there's any change in that status, why, we just want to keep advised of it.
03 14 35 11	CDR	Roger. Understand.
03 14 36 09	CC	And, Aquarius, we are setting a pretty good vector on you now. And it looks like you're a little bit outside of the corridor. We're looking at a 7-foot-per-second midcourse at 104 hours. We are going to come up with an entry interface minus 8 pad to use in the event of a loss of COMM situation
03 14 36 39	CDR	Roger. Understand, and I hope you have that procedure for attitude.
03 14 36 48	CC	We are ginning up a procedure for attitude for you, Jim. For the no-COMM case, it may be a little different than what the guys working on the procedures come up with for the burn at 104 hours.
03 14 37 09	CDR	Roger.

03 14 37 36	CC	What I'm saying, Jim, is the guys who are working on this attitude situation for the burns haven't made their final conclusions yet, but in the interim period, we want to come up with something you can use, in the event that you lose COMM.
03 14 37 53	CDR	I concur.
03 14 40 54	CDR	Houston, Aquarius. The Earth is going through the 10-degree line or angle of the LPD.
03 14 41 02	CC	Okay. We copied 10 degrees. Is that Earth or Moon, Jim?
03 14 41 08	CDR	That is Earth.
03 14 41 10	CC	Okay. Earth 10 degrees. Thank you.

END OF TAPE

03 14 45 53	CDR	And, Houston ... As we ... No! ... has an angle of about 24 degrees on the LPD.
03 14 46 03	CC	Okay. We read 24, Jim.
03 14 46 09	CDR	That's affirm.
03 14 53 46	CDR	Jack, ... the LPD on the Moon now is 22 degrees.
03 14 53 51	CC	Okay. I'm reading you better, Jim. Say again, please.
03 14 53 57	CDR	Roger. The LPD now on the Moon is 22 degrees. I missed the Earth last time. I'll get it this time.
03 14 54 04	CC	Okay. Twenty-two degrees, and looks like we've come up with a procedure for the attitude control on the upcoming burns. Probably the ones that we'll use from here on out.
03 14 54 23	CDR	Okay, Jack. Stand by 1.
03 14 54 30	CC	It's going to be a few minutes before I'm ready to read it up to you.
03 14 54 38	CDR	Okay.
03 14 59 23	CDR	Jack, on the first of the LPD angles is about a minus 2 degrees and just slightly above the top line.
03 14 59 36	CC	Okay. Just went by minus 2 degrees. Is that on the Earth?
03 14 59 43	CDR	That's the Earth. Now, I don't know whether we're oscillating back and forth or not, Jack, or whether it's a continual motion. We'll have to see here.
03 14 59 52	CC	Roger.
03 15 02 35	CDR	Okay, Jack. The Moon now has an LPD angle of 10 degrees
03 15 03 01	CC	Roger. The Moon at 10 degrees.

03 15 04 24	CC	Okay, Jim. Just as kind of a lead-in to this procedure that we're going to use for the mid-course burn, I'd like to say that we're going to use AGS and it's going to be a manual burn. The attitude will be controlled manually; the start/stop on the engine will be controlled manually. So we have a pretty good vector on you now, and it turns out you're coming in a little bit too shallow. So what that means is we're going to make our burn to come in a little more steeply, and we're going to be coming in around the dark side of the Earth. Therefore, to come in more steep, our thrust should be in the direction of the Sun. Does that all make sense to you?
03 15 05 29	CDR	I think so. We're going to use AGS for a burn monitor. The burns are going to be manual, and they're going to be started manually and stopped manually.
03 15 05 40	CC	Okay. And your reentry is around the dark side of the Earth, and since we're coming in shallow, we're going to have to burn toward the Sun to make it steeper. Do you follow that?
03 15 06 05	CDR	That's affirm. Especially these burns will be perpendicular to our flight path and to the Sun giving a steeper entry angle.
03 15 06 28	CC	Okay, Jim. I heard you say perpendicular to your flight path, which is affirmative, and I didn't get the rest of your statement.
03 15 06 46	CDR	I understand the technique, Jack. We're burning to give us time to steepen our entry angle, and it will be perpendicular to our flight path for corridor control.
03 15 07 01	CC	Okay. That's affirmative. So, in general terms, what we're going to have to do is to power up the AGS and bring up the AGS eight-ball, and then to set up your attitude, put the COAS in the front window, and guidance control will be in AGS, of course. But manually orient the spacecraft to place the center of the Earth directly out the Z-axis. Then rotate about the Z-axis to place the point of the crescent on the Y-axis of the COAS. And this will have your plus X-axis in the direction of the Sun as we discussed before. So the crescent will be up with the point down. Copy that?

03 15 08 19	CDR	Okay, Jack. We'll have to go over that again. The COAS will be out front window; we'll place the Earth in the center of the COAS, and, let's see, the center of the Earth right now is parallel to the LPD which is about parallel to our X-axis. And we'll have to rotate about 90 degrees to get our X-axis pointing toward the Sun.
03 15 09 14	CC	Okay, Jim. So we want to get the Y-axis of the spacecraft parallel to the terminator by putting the points of the crescent on the Y-axis.
03 15 09 35	CDR	Roger. Understand.
03 15 09 57	CDR	Seriously, Jack, when I stop the spacecraft looking at - at the Earth, I'm going to have to roll - in LM terms, roll the spacecraft 90 degrees to get the tip of the Earth all on the Y-axis.
03 15 10 45	CC	That's affirmative, Jim. You're going to have to roll 90 degrees to point your plus X-axis at the Sun and put the crescent - the points of the crescent on the Y-axis. The points of the crescent on the Y-axis with the COAS pointed at the center of the Earth will take care of your yaw and your pitch.
03 15 11 16	CDR	Roger.
03 15 11 38	CC	Okay, Jim. After you get that orientation to come in a little more steeply, we perform an AGS body-axis aline which is at 400 plus 5 on the DEDA. If the AGS ball is up at this time, the AGS ball will go to 000. We can talk more about control modes later, but we'd recommend doing this, of course, in AGS ATTITUDE HOLD - ATTITUDE HOLD. Put your YAW to MODE CONTROL and leave PITCH and ROLL in PULSE, therefore, controlling your attitude with the TTCA. We don't want to use the gimbal, so have ENGINE GIMBAL OFF. We'll make these burns at 10-percent thrust. We'll use a manual start and stop. For ullage, we'll use the PLUS-X TRANSLATIONAL button, and ullage will be for 10 seconds. Over.
03 15 13 06	CDR	Okay. I understand what you're saying, but you'll have to repeat it here.

03 15 13 15	CC	Okay. We'll perform the burn in GUIDANCE CONTROL to AGS. And MODE CONTROL to ATTITUDE HOLD. Your ATTITUDE CONTROL switches will be ROLL to PULSE, PITCH to PULSE, and YAW to MODE CONTROL. So the AGS will control your yaw and you will use the TTCA to control pitch and roll. ENGINE GIMBAL OFF; 10-percent thrust. Start and stop manual. For ullage, use the plus-X translational button; 10 seconds ullage. Over.
03 15 14 45	CDR	Okay. For the burn there will be go to GUIDANCE CONTROL AGS, MODE CONTROL ATT HOLD, ATTITUDE CONTROL switches will be ROLL PULSE, PITCH PULSE, YAW MODE CONTROL. We'll use TTCA control for pitch and roll. ENGINE GIMBAL will be OFF; we'll be using 10-percent thrust; we'll start and stop manually, the ... control ullage will be a PLUS-X TRANSLATIONAL button. And also our thrust will still be, but before that we are going to do an AGS aline ... ball ...
03 15 15 26	CC	That's affirmative, Jim. After you get oriented in the attitude you want to burn in, do an AGS aline which is - an AGS body-axis aline which is 400 plus 5. When you get ENTER, this will bring ball up to 000, and I want to confirm that you - that you said ENGINE GIMBAL OFF. O-F-F. Over.
03 15 15 52	CDR	Roger. Confirm that ENGINE GIMBAL will be off.
03 15 16 11	CDR	And, Jack, how long do you estimate the length of the burns will be?
03 15 16 17	CC	Okay. The length of the burns are going to be probably less than a minute. And we want you to have cut-off based on time. So we will give you a burn time. And I have a P30 maneuver pad for midcourse-7 in the event that we lose COMM if you are ready to copy.
03 15 16 56	CDR	Okay, Jack. Ready to copy.
03 15 17 06	CC	Okay, Jim. P30 LM maneuver pad: the purpose is midcourse-7. NOUN 33 is 134:59:42.98. NOUN 81 is N/A. H_A is N/A. H_P is plus 0020.5. DELTA-V_R is 0019.3. Burn time, 0:39; 008, 000; the rest is N/A; thrust will be at 10 percent. Read back.

03 15 18 19	CDR	All right. This is midcourse-7 corridor control, and it's in case we lose COMM: 134:59:42.98; NOUN 81 is N/A; 42, N/A; plus 0020.5; 0019.3. Burn time, 0:39; 008, 000. All the rest is N/A: thrust 10 percent.
03 15 19 04	CC	Okay, Jim. That's a good readback, and in the event of lost COMM, use the procedures that I gave you. It may be that between now and tomorrow these procedures will change a little bit, so we'll go with what we've got now, and stand by for something better if it comes. Over.
03 15 19 28	CDR	Okay, Jack. I'm looking at your burn pad and I see that the ... total gimbal ... 19.3 feet per second.
03 15 19 44	CC	Okay, Jim. We verify 19.3 feet per second for 39 seconds.
03 15 20 51	CDR	The old midcourse technique sounds like something that we came up with on Apollo 8.
03 15 21 00	CC	Yes, everybody wondered if you would remember that; by golly, you did.
03 15 21 17	CC	Hey, Jim, I got a little bit more information - maneuver pad, I got LAT/LONG range to go, VERB 10 and GET; if you got a place to copy that down, I'll give it to you for EMS.
03 15 21 38	CDR	Okay. Stand by.
03 15 22 12	CDR	Go ahead.

END OF TAPE

03 15 22 17	CC	Okay, Jim. I just have the last three blocks. NOUN 61: latitude, minus 021.62; longitude, minus 165.37; range to go, 1162.9; VERB 10:36291; GET of .05g is 142:41:30; read back.
03 15 22 59	CDR	I didn't get the latitude, but the longitude is minus 165.67; range to go, 11629; velocity 36291; 142:41:30.
03 15 23 24	CC	Okay, Jim. The latitude is minus 021.62; I have a correction on the longitude - minus 165.37. Go ahead.
03 15 23 46	CDR	Roger, Jack. The latitude is minus 21.62; longitude is minus 165.37, and this goes in conjunction with that midcourse 7 pad you gave us.
03 15 24 02	CC	That's affirmative. That means no maneuvers between now and midcourse 7. And this is a horizontal in-plane burn, plus X, toward the Sun, 19.3 feet per second.
03 15 24 52	CDR	Roger. ...
03 15 26 31	CC	And, Jim, on the - Setting up the AGS, right after you do the 400 plus 5, you should do a 400 plus all balls. And one other point we want to clarify is that we know that you're sure that this burn will be made with the plus X-axis pointing at the Sun to make the entry angle steeper. You got it?
03 15 27 10	CDR	That's right, Jack. What I'm going to do is - We'll stop with the Earth in the commander's window, the COAS down, and then I'm going to maneuver the spacecraft so that I have the lighted portion of the Earth at the top of the window; that is, the COAS will be along the plus-Y of the spacecraft and the top of the window - of the rendezvous window, I should be looking into the Sun. That means I'll be burning towards the Sun and steepening the angle.
03 15 28 03	CC	That's affirm, Jim. I - You got the attitude right, and did you copy about doing a 400 plus all balls after - you do the 400 plus 5? That is, a 400 plus 5 and a 400 plus all zeros back to back.

03 15 28 22	CDR	Roger. I have copied that.
03 15 30 15	CDR	Jack - this is Aquarius. I'm not too sure how long or with what force the venting is going to do to our trajectory. However, you might keep a check on that. It may have been going on for some time.
03 15 30 47	CC	Roger, Jim. We've been taking a look at it. We haven't been able to detect it on the Doppler, however.
03 15 30 56	CDR	Roger.
03 15 31 08	CC	But we think it's pretty small.
03 15 34 05	CDR	And, Houston, Aquarius.
03 15 34 09	CC	Go ahead, Aquarius.
03 15 34 14	CDR	Jack, would you give me a time hack on an even GET so I can start my watch.
03 15 34 24	CC	Okay. Coming up on 87 hours and 35 minutes, we will be there in 30 seconds. Set it for 87.35.
03 15 34 37	CDR	Just give me a hack at 88 hours.
03 15 34 43	CC	Okay. I'll give you a hack at 88 hours. That'll be another 25 minutes.
03 15 34 51	CDR	All right. Thanks.

END OF TAPE

03 15 41 53	CDR	Houston, Aquarius.
03 15 41 56	CC	Go ahead, Aquarius.
03 15 42 00	CDR	Okay, Jack. Let's just talk over how I'm going to get to the attitude and then do the burn. What I'm talking about is the control techniques. The way it looks now I'll try to stop the spacecraft in yaw with the Earth out my window. Then we'll be in GUIDANCE or we'll be AGS CONTROL; we'll be in - yaw will be in MODE CONTROL. Then we'll be using the TTCAs to control the pitch and then control the roll. I don't see another way we can control the combination that we have here without using the TTCAs. Then we will also use the TTCA during engine burn. Do you people concur with that technique?
03 15 43 05	CC	Jim, that sounds like the one that is best to use to me. Let me talk it over with the rest of the guys here, and we'll advise you.
03 15 43 16	CDR	Okay.
03 15 46 43	CC	Jim, in that control mode, that sounds like the best way to go. The only thing you'll have to do is to get ATTITUDE HOLD in the AGS, and so before you start to maneuver, you'll have to bring the AGS up, and get a 400 plus all zeros in there, and then AGS will respond in yaw when you go to MODE CONTROL. That is, AGS will control your yaw in MODE CONTROL and your pitch and roll can be taken care of in PULSE with a TTCA. After you get in attitude, then, you'll have to re-do an AGS body axis aline which is 400 plus 5, then go back to 400 plus all zeros again.
03 15 47 36	CDR	Right, Jack. That was my next question. I don't want to aline the AGS ball 000 until I am in position, so we use that as a primary attitude burn monitor device.
03 15 48 05	CC	And, Jim, you can do a 400 plus all zeros any time you want to; that just tells the AGS that you want it to control your attitude should you go to ATTITUDE HOLD in MODE CONTROL.

03 15 48 19	CDR	Roger. I understand, but after we get to the attitude, we'll do a 400 plus 5 to get the AGS aline ball, and then we'll do a 400 plus zero.
03 15 48 31	CC	Affirmative.
03 15 49 14	CC	Another thing, Jim, is while you're maneuvering to that attitude using AGS to control your yaw, if you find out enroute to that attitude that you didn't quite have the yaw where you wanted it to be, you can use your ACA and tweak up the yaw, and your AGS needles go right back to zero because you zero the attitude errors.
03 15 49 46	CDR	Roger. Sounds good.
03 15 50 48	CC	Jim, you'll be splashing down about 560 miles southeast of Samoa at about 0800 local time. The weather forecast for the area is good; 1500, scattered, high broken, 10-mile visibility. The seas will be 5-foot waves, 15 knots, and you'll be going to Samoa by boat and/or aircraft. You'll spend either the night on the boat or in Samoa, and return to Ellington by 141 on Saturday, the following day.
03 15 51 37	CDR	Roger. Would you tell the people of the LRL to turn it off.
03 15 51 46	CC	Oh, no. We're going to do the whole bit.
03 15 53 21	CDR	And don't forget my hack at 88 hours, Jack.
03 15 53 24	CC	Say again, please, Aquarius.
03 15 53 30	CDR	I want to get my time hack at 88 hours.
03 15 53 53	CC	Roger. That will be in about 6-1/2 more minutes.
03 15 54 42	CDR	Roger.
03 15 56 20	CC	Jim, we got a couple of news-type items. President Nixon has chosen a judge from Minnesota for the position of Associate Justice in the Supreme Court. A bill giving federal employees a 6-percent pay raise passed the House and went to the President; includes the military. And the air traffic controllers returned to work.

03 15 56 57	CDR	Well, that's great. You think they'll consider this for flight pay?
03 15 57 33	CC	Well, we might be able to work out some arrangement.
03 15 58 35	CDR	Standing by for the 88-hour time hack.
03 15 58 43	CC	Say again, Jim.
03 15 58 47	CDR	Standing by for the 88-hour time hack.
03 15 58 52	CC	Okay. We got a minute to go.
03 15 59 54	CC	Okay. Coming up on the 88-hour mark. I'll give you a 2-second delay. Stand by to mark.
03 15 59 59	CC	MARK.
03 16 00 05	CDR	I got it.
03 16 10 10	CC	How are you doing, Jim?
03 16 10 16	CDR	Pretty good, Jack. Say, you might have the people look at our DPS burn card to see what changes have to be made on it for the burn.
03 16 10 30	CC	Heard you say look at the DPS burn; you'll have to say what about it again, please.
03 16 10 39	CDR	Roger, Jack. You might take a look at our DPS burn card, our checklist card that we have in the LM, and see what changes might have to be put in that checklist.
03 16 10 50	CC	Okay, DPS burn card.
03 16 25 18	CC	How're you doing there, Jim?
03 16 25 23	CDR	Okay, Jack. It appears that we're going - funny diversion here; the PTC attitude in - in pitch. I'm going to do a LPD check now, but the last time the Moon went around, it was above - way away above the LPD angle and I see the Earth coming around now which is going to be pretty low. They oscillate back and forth, but each time they seem to get a little farther away from the center line. You might think of some procedure to reestablish PTC, if it's necessary.
03 16 26 02	CC	Okay.

03 16 27 09	CC	Jim, the only way we know of getting the as good or a better PTC than you've got right now is to crank up the G & N and we - We don't want to do that. So our plan is to just take whatever we get out of this, and later on, it may turn out by the time you get to burn attitude, you'll be right where you want to be.
03 16 27 37	CDR	Okay. We'll just leave her go.
03 16 30 36	CDR	Houston, Aquarius.
03 16 30 38	CC	Go ahead.
03 16 30 42	CDR	What's our course of action to set up PTC after this midcourse at 107?
03 16 30 51	CC	We thought you'd ask that.
03 16 31 06	CC	The only thing we can try to do, Jim, is to set the thing up manually and see what happens. There must be a better answer than that - -
03 16 31 17	CDR	Okay.
03 16 31 18	CC	- - and one course of action is to omit the midcourse and make a total midcourse, say, about 8 hours before entry. We haven't decided yet.
03 16 31 37	CC	Right now we're talking about a 7-foot-per-second midcourse at 104 hours. And extrapolate that down to about 8 hours before entry. We gave you a pad for that - that's about, only 19 feet per second, so if it doesn't change too much - and we can get all kinds of DPS.
03 16 32 01	CDR	Understand. Sure like to keep this vehicle in the corridor though.
03 16 55 07	CDR	Houston, Aquarius.
03 16 55 10	CC	Go ahead, Aquarius.
03 16 55 16	CDR	Can you think of any normal venting phenomena that might occur like maybe - a hydrogen tank that's over-pressurized relieving in the window?
03 16 55 31	CC	Yes, we thought of that, Jim.

03 16 55 52	CC	That is one possibility that we've thought of, Jim, because - We heated up that tank, and we haven't been using any hydrogen and, therefore, it could be venting in the overboard release.
03 16 56 10	CDR	Right. The only other thing I can think of when I look at it through the AOT is - it did appear to be coming from one spot; but that's the only difference although I can't see where it is coming from because it's beyond the curvature of the command module. But, it appears like it might be coming from more than this one spot.
03 16 56 34	CC	Okay. Thank you. We hope that when we crank up the command module tomorrow that we'll be able to - or later on today - that we will be able to identify more closely what it's been coming from. But, the guidance guys say that they haven't been able to see the results of any venting in their data and it would take a very, very small amount to perturb their data.
03 16 57 02	CDR	Well, that's a note of encouragement.
03 16 58 28	SC	(Music)
03 16 58 57	CC	You got a Chinese band going up there?
03 16 59 04	CDR	Oh, sorry. I forgot all about hot mike.
03 16 59 10	CC	Sounds pretty good.
03 17 05 51	CC	Jim, we've had you scheduled for an eat period about an hour ago. I suppose you've taken care of that. The other thing is we're kind of interested in knowing how long you're going to be at stick there, or if you're going to go back to bed or what?
03 17 06 12	CDR	Okay, Jack. We're - We're going to set up a regular watch and sleep period here. Fred was up for a long time, so I got up a little bit early to relieve him. Jack and Fred are now asleep, so I'm going to let them sleep as long as they can, and then we'll have an eat period and then I'll go back to bed for a bit. And we'll separate the schedule.

03 17 06 40	CC	Okay. We're right at the point now where, according to the flight plan that we had made up for you, that you would have all finished eating and you and Jack would have the duty while Fred went to sleep. So, essentially, according to the plan we've got, you got up about 3 or 4 hours early. And - The next time that we have that as a rest period for you is at 96 hours, which is 7 hours from now, and an hour before that, say at 95 hours, all three of you would eat, and then you and Jack would hit the sack again and Fred would have the duty until 102 hours. We'd be glad to take care of this work-rest cycle for you.
03 17 07 40	CDR	Okay. That's good. Let me - Let me wait until they get up, or at least Jack gets up. He should be getting up before Fred. And we'll try to get back on the schedule. I hate to wake everybody up right now though, if they're sleeping.
03 17 07 54	CC	Okay. Your choice on that. As soon as Jack gets up, I'd suggest we go ahead and break up these lithium hydroxide canisters and make a couple of them. Jack could work on that. It's going to take four sets of hands, I think.
03 17 08 15	CDR	Okay. We'll make that the project, getting the lithium hydroxide canister squared away.

END OF TAPE

03 17 58 23	CC	Aquarius, Houston. Over.
03 17 58 29	CDR	Go ahead, Houston.
03 17 58 31	CC	Hi, Jim. We've got a flight handover in about 2 minutes, and we'll have a temporary loss of COMM. You don't need to switch antennas. Over.
03 17 58 42	CDR	Okay; fine.
03 18 00 56	CC	Aquarius, Houston through Madrid for a COMM check. How do you read?
03 18 01 02	CDR	Loud and clear, Joe. How me?
03 18 01 05	CC	Okay, Jim.
03 18 06 38	CDR	... asleep?
03 18 06 46	CMP	I ... Maybe ... ...
03 18 06 57	CDR	They have got a procedure for ... the lithium hydroxide ...
03 18 07 16	CDR	... on secondary. We'll let it go to 15. Why don't you get on a headset, and I'll be down ... for ...
03 18 07 37	CDR	Houston, Aquarius.
03 18 07 41	CC	Aquarius, Houston. Go ahead.
03 18 07 46	CDR	Okay. Jack's up with me now and you all ... procedure for making these lithium hydroxide devices, and soon as he gets on his helmet, he'll be ready to copy, and then he'll get started making one.
03 18 08 05	CC	Roger that, Jim. Understand - -
03 18 08 07	CDR	On second thought -
03 18 08 09	CC	Go ahead.
03 18 08 13	CDR	I'll give Jack the headset for a while and he'll copy down your instructions.
03 18 08 30	CC	Okay, Jim. I didn't copy your second thought. Over.

03 18 08 38	CDR	I'll give Jack the headset and let him copy the instructions.
03 18 08 43	CC	Okay, Jim. The way I thought it might be best to do it would be to have you gather the equipment and let us talk you through your procedure while you do it. Now, maybe you could give Jack the headset and - and - get the equipment together, and we'll talk you through the procedure. I think it'll be a little easier to do that way than if you tried to copy it all down - and then go do it.
03 18 09 11	CDR	Okay. Do you have any equipment listed? I'll just get it and give it to him and I can just sit here where I am.
03 18 09 17	CC	Okay. I think the equipment you'll need will be two command module lithium hydroxide canisters, a roll of the gray tape, the two LCGs, because we're going to use the bags from the LCGs, and one - one LM cue card - one of those cardboard cue cards which you will cut off about an inch and a half out from the ring. Now, I think that's all we'll need. Over.
03 18 10 03	CDR	Okay. ... Okay, Houston.
03 18 10 23	CDR	Hello, Houston.
03 18 10 25	CC	Go ahead, Jim.
03 18 10 28	CDR	Okay. That's two lithium hydroxide canisters, one roll of that special gray tape, two LCGs which we're going to use the bags from, one LM cue card and ...
03 18 10 53	CC	Okay. That's affirmative, Jim. If you'll just cut the cue card, which is a handy piece of stiff paper the right size, about an inch and a half from the rings. Just cut off the ring holes, in other words, and you'll have a card about 11 inches long and probably 6 inches wide, something like that.
03 18 11 19	CDR	Okay, ... I'll have Jack gather up the stuff.
03 18 11 22	CC	Okay.
03 18 11 28	CDR	... that roll of gray tape.

03 18 11 34	CMP	... Okay. ... and ... plastic bags.
03 18 11 48	CDR	Yes. Bring it down here. One LM cue card. I get that.
03 18 20 14	CMP	Okay. I got the canisters.
03 18 20 24	CDR	...
03 18 20 38	CMP	...?
03 18 21 16	CMP	...
03 18 21 26	CDR	Okay, Houston; Aquarius.
03 18 21 32	CC	Yes. Aquarius, Houston. Go ahead.
03 18 21 37	CDR	We have gathered the materials, and I can put Jack on the headset and he can copy the instructions ... do you see any need for - or should I copy it to give them to him, or do you think they're too detailed?
03 18 21 55	CC	Why don't you put him on the headsets, Jim, and I'll read it out to him.
03 18 22 02	CDR	Okay.
03 18 22 30	CMP	Okay, Joe. ...
03 18 22 33	CC	Okay, Jack. Did anybody ever tell you that you got a 60-day extension on your income tax. Over.
03 18 22 42	CC	Yes. I think - I think somebody said that when you are out of your country, you get a 60-day extension.
03 18 22 50	CC	Okay; right. Okay. I'm ready to start into the procedure. When you answer me back, speak up - speak up into the microphone, because our downlink is pretty noisy. The first thing we want you to do, and we'll do this on one canister, and then let you go ahead and repeat it on the second. So take one of the LCGs and cut off the outer bag. By cutting along one the heat seals; do it carefully and close to the heat seal, because we may have to use the outer bag if we damage the inner bag. So go ahead and do that, and then we'll do the next step.
03 18 23 37	CMP	Okay. Take an LCG, cut the outer bag by the heat seal. Be careful not to damage the inner bag. Right?

03 18 23 46	CC	Right. Just cut along one side.
03 18 24 50	CMP	Hey, Houston, Odyssey - or Aquarius. We've done that.
03 18 24 55	CC	Okay, Jack. Now - now remove the inner bag from the outer bag, and cut the inner bag, also, along one of the heat seals down one side.
03 18 25 15	CMP	Okay. Remove the inner bag from the outer bag, cut the inner bag along the heat seal along one side.
03 18 25 22	CC	Okay. That's correct. Do that, and report.
03 18 26 20	CMP	Okay, Joe. We've got that done.
03 18 26 22	CC	Okay, Jack. Now you can put the LCG itself; that is, take it out of the inner bag, put it in the outer bag, and stow it some place; we recommend U-1, but you can stow it wherever it's convenient.
03 18 26 40	CMP	... outer bag ... and stow it back in ...
03 18 26 48	CMP	Okay, Joe. We've got that.
03 18 26 50	CC	Okay. Now pick up one of the lithium hydroxide canisters, and let me describe which end is which. It's approximately square on one - one of the vented flat ends, has the strap, and that end we call the top, the end opposite we call the bottom. Is that clear? Over.
03 18 27 21	CMP	Right.
03 18 27 34	CMP	Okay. I've got it, Joe.
03 18 27 37	CC	Okay. Now then, we're - we want you to take the tape and cut out two pieces about 3 feet long, or a good arm's length, and what you're - what we want you to do with them is to make two belts around the sides of the canister, one belt near the top and one belt near the bottom, with the sticky side out; wrap it around, sticky side out, as tight as possible. It'll probably take both of you to get it nice and snug. Over.
03 18 30 01	CMP	Okay, now -
03 18 30 15	CMP	Okay. Now we've got to make the belt real taut here.

03 18 30 23	CDR	How's that?
03 18 30 35	CMP	Real tight. And then ...
03 18 33 13	CMP	Okay, Joe.
03 18 33 18	CC	Okay, Jack. Did you have - -
03 18 33 19	SC	- - Hey, Houston, are you reading?
03 18 33 24	CC	Jack - -
03 18 33 25	CMP	- - We've got the two belts around the top and the one around the bottom all done.
03 18 33 30	CC	Okay, fine. The next step now is to anchor that tape, and the way we want you to do that is to cut about a 2-foot length off the roll and then tear it lengthwise so that you have two strips about 2 feet long and about a half an inch wide. And you'll wrap those around the canister at right angles, more or less, to the tape that you've got so that it goes across the top and across the bottom; and when it goes across the top and the bottom, put it so that it's outboard of the center hole and try to get it over one of the ridges between the screens, so that it won't block the flow. Is that clear? Over.
03 18 34 15	CMP	Yes, Joe. Very good.
03 18 34 17	CC	Okay. Press on.
03 18 34 22	CMP	Okay. I've got a cut length right here and we'll tear it lengthwise ... and I'm going to go around right here at this ridge all the way around at right angles and anchor it ...
03 18 34 43	CMP	Yes.
03 18 34 46	CMP	Joe, just to clarify that, sticky end down. Right? On the tape that I am putting on now?
03 18 34 54	CC	I didn't quite copy that, Jack. Say again.
03 18 34 58	CMP	Okay. That will be the sticky end down on the container, right?
03 18 35 05	CC	Oh, that's correct. I forgot to say that. That's right.

03 18 35 33	CMP	... hold that one right here, if I can set it.
03 18 37 28	CMP	Okay, Joe; Aquarius. We've got that done.
03 18 37 32	CC	Okay, Jack. The next step is to get the EVA cue card and use it to form an arch over the top of the canister; just tuck one short end under one ridge on the top the other one against the ridge on the other side so that it forms a rounded arch over the top of the canister. You see, Jack, what we're going to do is slip the bag over this whole assembly and the cue card will serve to keep the bag from being sucked down against the screen. Over.
03 18 38 10	CMP	Okay. I got the idea.
03 18 38 13	CC	Okay. And when you've done that, to hold the arch in place, just run a strip of tape across the side of the - that is, across the top of the arch, and anchor it down to the sticky strips along each side.
03 18 38 31	CMP	Okay. I got the idea. Okay. Let me just repeat it here. Take a cue card, form an arch over the top, bringing it under the side here. When we're through, run a piece of tape from the sides across the top of that to anchor to the other side.
03 18 38 51	CC	That's correct.
03 18 38 56	CMP	Okay. It worked.
03 18 39 00	CMP	The top. ... Across the top.
03 18 39 18	CMP	Looks like you're going to have to cut the cue card slightly.
03 18 39 32	CMP	Doesn't have to be really ... over that the only thing we're ... we can just take the scissors and cut off the edge here. The only thing this does, Jim, is prevent this from being sucked down into the container.
03 18 40 28	CMP	Still going to need some more tape. Cut off the end. Okay. Whack off the bottom. ...
03 18 43 34	CMP	Okay, Joe. We've got that arch built, and it's all taped in securely.

03 18 43 41	CC	Okay, Jack. The next step is to stop up the bypass hole, which is the hole in the center of the bottom of the canister; we want to stop that up because we don't want to bypass the flow; and I forgot to tell you to get something to stick in that hole. We recommend that you either use a wetwipe, or cut off a piece of sock and stuff it in there, or you could probably even crumble up some tape and use that. Over.
03 18 44 13	CMP	Okay. We'll start plugging up the bypass hole.
03 18 44 17	CC	Okay.
03 18 44 18	CMP	Plug that hole. We can either - we can put some either - Let's cut a piece of your towel there.
03 18 44 27	CC	Sounds good.

END OF TAPE

03 18 47 14	CMP	Okay, Houston; Aquarius. We have the bypass hole all plugged up.
03 18 47 21	CC	Okay, Aquarius. The next step is take the inner LCG bag that you cut open, and slip it over the top of the canister, when you do that, orient it so that the ears of the bag, that is, the corners should stick out on the closed end - are oriented along the open ends of the arch, because we're going to snip one of those corners to stick the hose in. Pull it down until it fits snugly over the arch. Over.
03 18 47 56	CMP	Okay, Joe. Slip the bag over the canister so that the arch is at the bottom of the bag and that the ears are along oriented along, let's see - I guess it would be - would be at the sides of the arch.
03 18 48 19	CC	Depends on what you mean by sides - over the - the open ends of the arch.
03 18 48 26	CMP	Right, the open ends of the arch.
03 18 48 28	CC	Okay.
03 18 49 17	CMP	Okay, Joe. We've got that done.
03 18 49 20	CC	Okay. Now press the bag against the sticky belts that we put on the sides of the canister. If there is any excess material, just kind of pleat it, so that it makes a fairly tight seal, and then take another 3-foot strip of sticky tape and wrap it around the outside of the bag opposite the bottom - the bottom sticky belt - to make a nice tight seal.
03 18 49 50	CMP	Okay. I'll do it. Okay. Now they want two strips around here to make a tight seal.
03 18 52 38	CMP	Okay, Joe. We've got the canister inside the bag, two strips around the sides of the bag, real tight, and both sealed.
03 18 52 47	CC	Okay; real fine. Now there's probably a couple of inches of excess bag sticking our around the bottom of the canister. To prevent this from sucking in against the bottom screen, we'd like you to trim it off with the scissors, and when you've done that, we'd like you to cut two more

strips of tape about 12 inches long or so, cut the - tear them lengthwise to get four pieces 12 inches long and 1/2-inch wide, and then use those four strips to secure the bag by passing the strips from the sides of the canister outside the bag around the bottom of the canister and back up the other side, and when you do this, just as you did on the top, make them go outward of the hole and in between the screens. Over.

03 18 53 42	CMP	Okay. You want me to trim the excess material that's sticking off here; trim it at the edge of that canister? Or do you want any excess left over?
03 18 53 52	CC	No, you don't need to have any excess. Just trim it approximately level.
03 18 53 59	CMP	Okay. Let's do that first.
03 18 54 01	CC	Okay.
03 18 54 58	CMP	Okay. Now, Joe, you want to cut four strips, 12 inches long each, 1/2-inch in diameter. Tape that along the outsides of the bag across the ribs.
03 18 55 15	CC	That's correct, Jack. That's just for additional security on the bag. When you get those done, you'll have - You'll have two strips going one way, and the other two will be perpendicular to them.
03 18 57 58	CMP	Okay, Houston; Aquarius. We've got the four strips in place.
03 18 58 03	CC	Okay. We're in business now with the bag, and the next step to perform is to get ready to put the red suit hose, either the commander's or the LMP's because we're - we're going to want you to have both of these made up eventually, into the top of the - of the bag, and to do that you, first of all, have to assure that the - that the red hose is separated from the blue hose. I don't know whether this has been done already, but if it hasn't, what you have to do is cut the outer Beta-cloth sheath down the full length of the - of the hoses and then also cut the rubber ties that secure the two hoses together, and the hoses should come apart and the COMM cable should - should come off. Over.

03 18 59 04	CMP	Okay. Take the - I'm going to want to separate the red hose from the blue hose by cutting this Beta-cloth sheath. Okay. That's in work.
03 18 59 15	CC	Okay.
03 19 00 52	CMP	Okay, Houston; Aquarius. I have the LMP's red hose separated from the others.
03 19 01 00	CC	Okay. Real fine. Now the next step is to cut a diagonal hole in one ear of the - of the plastic bag near the arch. You can pick either one and cut about a 1-1/2 or 2 inch diagonal hole, big enough to slip the red hose through. And when you've done that, you'll just slip the red hose through so that it goes about to the center of the canister. It's - it's - It's not critical except that the opening should be down, and then tape the bag to the hose where it goes in so that it's nice and snug. Over.
03 19 01 40	CMP	Okay. Copy that. We want a 1-1/2 inch hole right here at this ear, and put the hose in here, end down and toward the canister and then we tape the seal around here.
03 19 02 10	CMP	Let's try it. We can always make it bigger if we have to. Fred, get those. ... the center of the arch.
03 19 02 52	CMP	Got to - Got to come in towards the center, all the way to the center. No, no.
03 19 06 17	CMP	Yes. I can't get those big knobs.
03 19 08 39	CMP	... All we have to do is ... tape around here ... tight fit. ...
03 19 10 16	CDR	There it is right there.
03 19 10 18	CMP	Okay, Houston; Aquarius.
03 19 10 20	CC	Aquarius, Houston. Go ahead.
03 19 10 26	CMP	Okay. Our do-it-yourself lithium hydroxide canister change is complete. Joe, the only thing different is that our arch on this piece of cardboard is not big enough to position the red hose with the inlet down, and the inlet - The inlet to - to the red hose is lying on its side, but I think it'll still work.

03 19 10 53	CC	Okay, Jack. I concur. I think it'll work, too. There's one step that I omitted, which you can do now quite conveniently, and it's this. Where you stuff the towel in the bypass hole on the bottom, we recommend that you cut a few short pieces of tape and just tape that over so it doesn't fall out. Over.
03 19 11 17	CMP	Okay. Will do. Jim, I've got one more little thing to do, and that's ... seal that top.
03 19 12 28	CMP	Okay, Joe. That's done.
03 19 12 30	CC	Okay, Jack. Now the remaining steps are simply suit-loop configuration steps to get this thing into full operation, and our ECS people want to hold off on that until the canister you're working on gets to 7.6 millimeters of mercury, which will probably be another 45 minutes or an hour - it - We're reading 4.7 now. So what we'd like you to do in the interim is to set up the second command module canister the same way you just did the first one, using the commander's hose, and get that all set and probably about that time it'll be time to - to switch over. For your information, when you've got that done and if you've had your breakfast and so on, the next thing I've got for you is a switch-configuration list for the command module, which will represent the - the powerdown, square-1 starting configuration for all our - our preentry checks. Over.
03 19 13 39	CMP	Okay. We'll start setting up the commander's hose configuration the same as the LMP's hose. And I'll get - instead of - I guess you want me to use my launch ... - launch checklist which I'd ...
03 19 14 00	CC	That's affirmative, Jack. What we have done is marked up the lift-off configuration checklist, and we'll run through it whenever you get around to it.
03 19 14 11	CMP	And, I assume that ...
03 19 14 38	CMP	What I'd better do is before I put this thing back in operation, they're going to complete that other canister. I don't know. It should be in operation now. ...

03 19 15 05	CMP	Okay, Houston; Aquarius.
03 19 15 07	CC	Aquarius, Houston. Go.
03 19 15 12	CMP	Okay, Joe. Should this canister be in operation now because it's already mounted on the hose?
03 19 15 17	CC	Well, yes. We haven't completely configured the suit loop to get full flow through there, and it's okay the way it is. What I recommend you do with the commander's hose is get the bag all ready, but not stick the hose in until we call you on it. Okay.
03 19 15 39	CMP	Okay. Will do.
03 19 16 45	CMP	It won't go around?
03 19 17 04	CMP	Yes. Or else a strip of tape.
03 19 17 55	CMP	Okay, Jim. We've got to start setting up the commander's. ...
03 19 18 22	CDR	You can get one of the cards, and I'll start cutting the ... bag.
03 19 20 33	CMP	Yes. ... show. How about that ... because I've got two in my ...
03 19 20 52	CMP	Yes. Here, we'll store them back where I got it.
03 19 21 06	CC	Hello, Aquarius; Houston.
03 19 21 10	CMP	Go ahead.
03 19 21 11	CC	Roger, Jack; Tom here. Just thought I would pass on to you and Jim that got a little data priority going today, and going to convene to CPCB and we'll have you all kinds of good procedures for later on. Over.
03 19 21 24	CMP	Okay. Thank you, Tom. You guys are really working overtime.
03 19 21 29	CC	We're getting a little coordination down here.
03 19 21 41	CC	Aquarius, Houston. You might pass on to Jim, he had such a long day yesterday, we thought we were going to have to play him some guitar music to get him to sleep last night. Over.

03 19 21 52	CMP	That's exactly what he did. Tom said you had such a long day yesterday, he thought he was going to have to play some guitar music to get you to sleep.
03 19 22 13	CMP	Okay. Let's get this tape around the outside.
03 19 25 47	CMP	Kind of looks like the Earth has gotten kind of angled a little bit, but it's, for as many hours as ..., I think it's been great. You know how to do this? How? ... the terminator.
03 19 33 55	CMP	Okay. Now we got to get two strips ... tight.
03 19 36 52	CMP	Tom said the CPCB is getting ...
03 19 37 01	CDR	... he's never been through a command module activation.
03 19 37 22	CMP	That looks good. Now we got trim up that extra.
03 19 39 30	CMP	... Well, I don't really - Part of that is - See, Jim, I have the same problem that you have. I can't control pitch very well with my RHC - I have to use the THC and that was the control problem. No, I don't think that there's any control problem. I don't know why, because - Well, you have to ... ... you still have barber pole on the - on the ...
03 19 43 16	CMP	... Oh, wait a minute; I'm sorry I didn't see it. ...
03 19 43 20	CMP	...
03 19 43 30	CMP	... (laughter).
03 19 45 30	CMP	I'll tell you, why don't you put - under your restraining cable; just stow it under your restraining cable there. And that will keep, then, until we're ready for them.
03 19 45 48	CMP	Can I have my juice?
03 19 45 53	LMP	... there's an orange in yours.
03 19 46 06	CMP	Yes, I've got to get the launch checklist. And we're going to go over initial switch configuration. And get all those ...

03 19 46 45	CMP	I kind of have an idea that as soon as we hit darkness, we'll be doing a P51, P52. Hope we're going to be ...
03 19 49 30	CMP	When you get through, you could get me that R- the checklist up in R-3 ...
03 19 53 03	CMP	Okay, Houston; Aquarius.
03 19 53 11	CC	Aquarius, Houston. Go ahead.
03 19 53 15	CMP	Okay, Joe, I'm ready to start on that command module switch configuration. That's on page L 1-1.
03 19 53 24	CC	Okay, Jack. Understand you are ready for the switch configuration checklist. And I have in front of me the lift-off configuration, page L 1-1. Are you with me? Over.
03 19 53 39	CMP	I'm right with you.
03 19 53 41	CC	Okay. I'll read these in bunches of three or four at a time, some of them are the same, some of them are changed, and you can read them back every few steps. EMS FUNCTION to OFF; EMS MODE to STANDBY, no change; GTA, off, down, no change; and GTA cover, secure, no change. Over.
03 19 54 08	CMP	Okay. EMS FUNCTION, OFF, MODE, STANDBY, GTA, off; GTA cover secure.
03 19 54 15	CC	Roger. CMC ATTITUDE to IMU, no change; FDAI scale, 5/5, no change; FDAI SELECT number 1; and FDAI SOURCE, GDC. Over.
03 19 54 36	CMP	Okay. CMC ATTITUDE, IMU; FDAI scale, 5/5; FDAI, select 1; SOURCE GDC. Hey, what you do is just read the ones that have the changes, Joe, and I'll read back to you, everything, where you stop.
03 19 54 54	CC	Okay; fine. The next one that changes is three down, where we go, "MAN ATTITUDE PITCH to RATE COMMAND." Over.
03 19 55 09	CMP	Go ahead.
03 19 55 15	CC	Okay. The next one, two, three, four are unchanged. And then we want TRANSLATION CONTROLLER POWER to OFF, ROTATION CONTROL POWER NORMAL, two, to OFF; and ROTATION CONTROL POWER DIRECT, two, to OFF. Over.

03 19 55 36	CMP	Okay.
03 19 55 39	CC	Okay. The next two are unchanged. And we want the 3 BMAG switches in RATE 2. Over.
03 19 55 54	CMP	Okay.
03 19 55 57	CC	Okay. The next one, two, three, four, five, six, seven, eight are unchanged, and we get down to the ELS AUTO switch which we want in MANUAL. Over.
03 19 56 13	CMP	Okay.
03 19 56 14	CC	Okay. And we want CM RCS LOGIC, OFF, down, and the rest of the page is unchanged. Over.
03 19 56 27	CMP	Okay. Let me read back the whole page.
03 19 56 29	CC	Okay. Go.
03 19 56 32	CMP	EMS FUNCTION, OFF; MODE, STANDBY; GTA, down; GTA cover, secure; CMC ATTITUDE, IMU; scale, 5/5; FDAI SELECT, 1; SOURCE, GDC; ATT SET, GDC; MANUAL ATTITUDE ROLL, PITCH, YAW, RATE COMMAND; LIMIT CYCLE, OFF; DEADBAND, MIN; RATE, HIGH; THC POWER, OFF; ROTATION CONTROL POWER NORMAL, two, OFF; ROTATION CONTROL POWER DIRECT, two, OFF; SPACECRAFT CONTROL, SCS; CMC MODE, FREE; BMAG, ROLL, PITCH, YAW ...
03 19 57 25	CC	Jack, Houston. You are not coming through. And request you talk a little more directly into the mike. I've got the BMAGS in RATE 2. And start from there. Over.
03 19 57 39	CMP	... SPS thrust to NORMAL; DELTA-V thrust, two, OFF; SCS TVC PITCH and YAW to AUTO; SCS gimbal MOTORS PITCH and YAW OFF; DELTA-V/CG, LM/CSM; ELS LOGIC, OFF; ELS AUTO to MANUAL; CM RCS LOGIC OFF, down; CM PROPELLANT DUMP, OFF; PROPELLANT PURGE, OFF; IMU CAGE, OFF; EMS ROLL and .05g, OFF.
03 19 58 09	CC	Okay. That's 100 percent, Jack. Let's go to page 2. And we start with alpha Pc to Pc, and LAUNCH VEHICLE/SPS INDICATORS to GPI. Over.
03 19 58 26	CMP	Okay. Keep going.

03 19 58 28	CC	Okay. The next three are unchanged. And then the EVENT TIMER START to STOP. Over.
03 19 58 38	CMP	Okay.
03 19 58 39	CC	Okay. The next ones, on panel 1 are unchanged, and on panel 2, go all the way down to SM RCS propellant talkbacks, and in parenthesis scratch out "eight," and put "four to gray," and then pencil in a line "SM RCS propellant talkbacks, four, to barber pole." Over.
03 19 59 20	CMP	Let me ask you. SM RCS propellant talkbacks, four, barber poles. And you want the switches? And you think ...?
03 19 59 33	CC	I guess that's the config - Stand by 1, and I'll check that.
03 19 59 54	CC	Okay, Jack. The switches all remain in their present position, which is center, but we - Because we have no power on the bus, the bottom row of talkbacks will be spring loaded to the barber pole position and that's for your information. Over.
03 20 00 12	CMP	Oh, that's right. Oh, I knew that. I'm not thinking too well.
03 20 00 19	CC	Okay. Now the next one, two, three, four, five are the same, and we want EDS AUTO to OFF. Over.
03 20 00 33	CMP	Okay.
03 20 00 34	CC	Okay. The next three are the same, and then we want PROPELLANT DUMP to RCS COMMAND; 2 ENGINE OUT to OFF and LAUNCH VEHICLE RATES to OFF. Over.
03 20 00 53	CMP	Okay. Let me read back the whole page.
03 20 00 55	CC	Go.
03 20 00 58	CMP	Alpha/Pc to Pc; LAUNCH VEHICLE SPS INDICATOR to GPI; TVC GIMBAL DRIVE PITCH and YAW to AUTO; EVENT TIMER RESET, up; EVENT TIMER START to STOP; EVENT TIMER MINUTES, SECONDS to center; POSTLANDING VENT valve, push; PROBE EXTEND/ RELEASE to OFF; EXTEND/RELEASE talkbacks, two of them, gray; DOCK PROBE RETRACT, PRIMARY and SECONDARY, off; extend RUNNING LIGHTS/EVA LIGHTS, OFF; extend RUNNING LIGHTS - RENDEZVOUS

LIGHT, OFF - got to get a - there you go - TUNNEL LIGHT, OFF; LM POWER LIGHT, OFF; SERVICE MODULE RCS Helium, four, center; HELIUM 1 talkback, four, gray; UP TELEMETRY COMMAND MODULE and IU to BLOCK; COMMAND MODULE RCS PRESSUREs, off; SERVICE MODULE RCS INDICATOR, PROPELLANT QUANTITY; SERVICE MODULE RCS Helium 2, four, center; HELIUM 2, four, talkbacks, gray; SERVICE MODULE RCS HEATERS, four, OFF; SERVICE MODULE RCS PROPELLANT, four, center, on, up; SERVICE MODULE PROPELLANT talkback, four, gray, and four, barber pole; RCS COMMAND, center; RCS TRANSFER, center.

03 20 02 38	CC	Okay - -
03 20 02 40	CMP	Joe, are you with me? - -
03 20 02 41	CC	Jack, Houston. The COMM kind of gets better and worse and the last one I copied was RCS TRANSFER to center. Start from there.
03 20 02 51	CMP	Okay. And that's exactly where I was. COMMAND MODULE RCS PROPELLANT 2, center, on, up; PROPELLANT talkbacks, two, gray; SERVICE MODULE RCS SECONDARY FUEL PRESSURE, four, center, and CLOSED; EDS AUTO, OFF; COMMAND MODULE/LM FINAL SEP, two, off; COMMAND MODULE/SERVICE MODULE SEP, two, down; S-IVB/LM SEP, off, down, guarded; PROPELLANT DUMP to RCS COMMAND; 2 ENGINE OUT and LV RATES, OFF.
03 20 03 27	CC	Okay. That's correct. Let's go to page 3, and the first one on page 3, TOWER JETT, two to OFF. Over.
03 20 03 41	CMP	Okay.
03 20 03 42	CC	Okay. The next one, two, three, four, five, six, seven are the same, and then we get CAUTION/WARNING NORMAL to ACK, CAUTION/WARNING CSM to CM, and CAUTION/WARNING POWER to OFF. Over.
03 20 04 05	CMP	Okay. Got it.
03 20 04 06	CC	Okay. The next one, two, three, four are the same, and then we get to the H_2 HEATERS, two, OFF; and the O_2 HEATERS, two, OFF. Got that?
03 20 04 21	CMP	Yes. ... we don't have any H_2 or O_2 ... Okay.

03 20 04 29	CC	Okay, Jack. Those are the only changes on page 1-3.
03 20 04 37	CMP	Okay. POWER JETT, two, OFF. And then I'll just go on down: CAUTION and WARNING NORMAL to ACKNOWLEDGE; CAUTION and WARNING CSM - CAUTION and WARNING CSM to CM; CAUTION and WARNING POWER, OFF; H_2 and O_2 HEATERS, OFF.
03 20 04 58	CC	That's correct, Jack. Those are the only changes on 1-3. Now, let's go to 1-4. No changes on the remaining three panel 2 switches. On panel 3, the first one, two, three, four are unchanged and then we want FUEL CELL HEATERS, three, to OFF. Over.
03 20 05 19	CMP	Okay.
03 20 05 21	CC	Okay. The next one, two, three, four, five, six, seven, eight are the same, and then we want FUEL CELL 1 MAIN BUS A to OFF; and, skipping one, we want FUEL CELL 2 MAIN BUS A to OFF. Over.
03 20 05 45	CMP	Okay.
03 20 05 46	CC	Okay. Skip two, and then we want FUEL CELL 3 MAIN BUS A talkback to gray. Over.
03 20 06 00	CMP	Okay.
03 20 06 01	CC	Okay. The next one, we want MAIN BUS A RESET to OFF; skip one, and we want FUEL CELL 1 MAIN BUS B talkback to gray. Over.
03 20 06 17	CMP	Okay.
03 20 06 18	CC	Okay. Skip one, and we want FUEL CELL 2 MAIN BUS B talkback, gray; and, the next one, we want FUEL CELL 3 MAIN BUS B to OFF. Over.
03 20 06 31	CMP	Okay. Copied that.
03 20 06 32	CC	Okay. Skip one, and we want MAIN BUS B RESET to OFF. Over.
03 20 06 42	CMP	Okay.
03 20 06 43	CC	All right. Then the next one, two, three, four, five, six are the same, and then we want S-BAND TRANSPONDER to center, OFF; skip one, and we want S-BAND POWER AMPLIFIER, HIGH to center, OFF; and the POWER AMPLIFIER talkback to barber pole. Over.

03 20 07 10	CMP	Okay. Read back the changes on this page - Stand by. I ... another OMNI.
03 20 07 27	CC	Jack, Houston. Start in again. I wasn't copying that.
03 20 07 34	CMP	Okay. I've just got to switch OMNIs. Okay. Reading the changes, Joe, on pages 1-4, FUEL CELL HEATERs three, OFF, coming down to FUEL CELL 1 MAIN BUS A center - MAIN BUS A to OFF; MAIN BUS - FUEL CELL 2 to MAIN BUS A, OFF; FUEL CELL 3 to MAIN BUS A, talkback, gray; MAIN BUS A RESET to OFF; FUEL CELL 1 to MAIN BUS B talkback, gray; FUEL CELL 2 to MAIN BUS B talkback, gray; FUEL CELL 3 to MAIN BUS B to OFF; MAIN BUS B RESET, OFF; S-BAND TRANSPONDER to OFF; S-BAND POWER AMPLIFIER, HIGH to OFF; POWER AMPLIFIER talkback barber pole.
03 20 08 33	CC	Okay, Jack. That's completely correct on 1-4. Let's go to 1-5, and on that page the first one, two, three, four, five, six are the same, and we want UP TELEMETRY COMMAND to OFF. Over.
03 20 08 53	CMP	Okay.
03 20 08 55	CC	Okay. The next one, two, three are the same, and we want VHF AM B to center. Over.
03 20 09 06	CMP	Got it.
03 20 09 08	CC	The next one, two, three, four are the same, and we want S-BAND SQUELCH to OFF, and FUEL CELL REACTANT VALVE to NORMAL. Over.
03 20 09 22	CMP	Okay.
03 20 09 23	CC	Okay. The next one, two, three are the same, and then we want TAPE RECORDER FORWARD to center; TAPE MOTION talkback, barber pole; SCE POWER to center; and PMP POWER to center. Over.
03 20 09 46	CMP	Okay.
03 20 09 47	CC	Okay. Skip the next one, and we want AC INVERTER 1 to OFF, and AC INVERTER 2 to OFF. Over.
03 20 10 01	CMP	Okay.
03 20 10 02	CC	Okay. Skip the next one, and we want INVERTER 1 AC 1 to OFF, and skip two and we want AC 1 RESET to OFF. Over.

03 20 10 14	CMP	Okay.
03 20 10 15	CC	Okay. Skip 1, and we want INVERTER 2 AC 2 to OFF; and skip 1, and we want AC 2, BUS to RESET - AC 2 BUS RESET to OFF.
03 20 10 34	CMP	Okay.
03 20 10 35	CC	That was AC 2 BUS RESET, wasn't it? Okay. Skip the next one, and on panel 4, we want SPS GAGING to OFF; TELCOM GROUP 1 to OFF; TELCOM GROUP 2 to OFF; and GLYCOL PUMPS to OFF. Over.
03 20 11 00	CMP	Okay. Reading back UP TELEMETRY COMMAND to OFF; VHF AM B, center; S-BAND SQUELCH to OFF; FUEL CELL REACS VALVES to NORMAL; TAPE RECORDER FORWARD, center; TAPE MOTION, barberpole; SCE POWER, center; PMP POWER, center; AC INVERTER 1, OFF; AC INVERTER 2, OFF; INVERTER 1 to AC 1, OFF; AC 1 RESET, OFF; INVERTER 2 to AC 2, OFF; AC 2 BUS RESET, OFF; and coming to panel 4, SPS GAGING; TELCOM, GROUP 1; TELCOM, GROUP 2; and GLYCOL PUMPS all OFF.
03 20 12 03	CC	Okay. That's correct on 1-5, Jack. Let's go to the 1-6. And the first line we want SUIT COMPRESSORS, both, to OFF. Over.
03 20 12 46	CC	Okay, Jack; Houston. It's noisy again; I didn't copy your Roger on that.
03 20 12 55	CMP	Okay. How do you read now, Joe?
03 20 12 58	CC	You're loud and clear now, and let's go to panel 5. We want FUEL CELL PUMP AC 1, OFF; AC 2, OFF; and that's the FUEL CELL 1 PUMP, AC 1, OFF; FUEL CELL 2 PUMPS, AC 2, OFF; FUEL CELL 3 PUMPS, AC 2, OFF; G/N POWER, OFF, and both the MAIN BUS TIEs OFF. Over.
03 20 13 27	CMP	Okay.
03 20 13 28	CC	Okay. Skip two, and then we want INTERIOR INTEGRAL LIGHTING, OFF; and INTERIOR FLOODLIGHT, OFF. Scratch out "Full dim or full bright." Over.
03 20 13 45	CMP	Okay.
03 20 13 47	CC	Okay. And circuit breakers on panel 5 we want all open. Over.
03 20 14 08	CMP	Okay.

03 20 14 15	CC	Okay. On panel 6, skip the first one. We want POWER to OFF, and skip down then to SUIT POWER to OFF. Over.
03 20 14 26	CMP	All right.
03 20 14 27	CC	Okay. On panel 7 we want EDS POWER, OFF. TVC SERVO POWER 1 and 2, OFF; FDAI/GPI POWER, OFF; and LOGIC 2 slash 3 POWER, OFF. Over.
03 20 14 49	CMP	Okay. I'll read back. SUIT COMPRESSOR 1 and 2, OFF; FUEL CELL PUMPS 1, 2, and 3, OFF; G/N POWER, OFF; MAIN BUS TIES, OFF; INTERIOR INTEGRAL LIGHTING, OFF; INTERIOR FLOODLIGHTING, OFF; then coming down, all circuit breakers on panel open; panel 6, the POWER should be OFF; SUIT POWER should be OFF; panel 7, all 5 of those switches should be OFF.
03 20 15 39	CC	Okay, Jack. That's correct. Go to page 1-7. SCS ELECTRONICS POWER, OFF; SCS SIGNAL CONDITIONER/ DRIVER BIAS 1 and 2, OFF; and BMAG POWER, both, OFF; and DIRECT O_2 valve to close. Over.
03 20 16 08	CMP	Okay. SCS ELECTRONICS POWER, OFF; both SIGNAL CONDITIONER/DRIVER BIAS POWER, OFF; BMAG POWER, two of them OFF; DIRECT O_2 to close.
03 20 16 21	CC	Okay. Now on panel 8, I'm going to have to read you a number of circuit breakers that we want open, and so start with CB panel 8 all closed except leave the two that we have there CM/RCS HEATERS, open, and FLOAT BAG open, and add the following. I'll read them up one at a time, and you can Roger. SCS LOGIC BUS, four, to open. Over.
03 20 16 52	CMP	SCS LOGIC BUS, four, open.
03 20 16 56	CC	Right. SPS PITCH and YAW, four, to open.
03 20 17 09	CMP	SPS PITCH and YAW, four, to open.
03 20 17 13	CC	Roger. SPS GAGING, four, to open.
03 20 17 26	CMP	SPS GAGING, four, open.
03 20 17 31	CC	Okay. And SEQ ARM, two, open.
03 20 17 53	CMP	Okay. Are you with me? SEQ ARM, two of them open.
03 20 17 58	CC	Roger. The next is EDS, three, to open.

03 20 18 05	CMP	EDS, three, open.
03 20 18 08	CC	Roger. The next are ELS BAT A, BAT B, two, open.
03 20 18 27	CMP	ELRS BAT A and BAT B, two of them, open.
03 20 18 30	CC	Roger. POSTLANDING VENT FLIGHT slash POSTLANDING to open.
03 20 18 50	CMP	Okay. POSTLANDING and POSTLANDING VENT, open.
03 20 18 57	CC	Okay. That was the - Yes, the POSTLANDING VENT, that's FLT/PL to open. The next are SCS DIRECT ULLAGE, two, to open.

END OF TAPE

03 20 19 15	CMP	SCS DIRECT ULLAGE, two, open.
03 20 19 21	CC	That's correct, and the next ones are SM RCS HEATER A MAIN B, and HEATER C MAIN B, open.
03 20 19 45	CMP	Okay, SERVICE MODULE RCS HEATER MAIN B, open, and HEATER C MAIN B, open.
03 20 19 53	CC	That's correct, and SM RCS HEATER B MAIN A, open, and HEATER D MAIN A, open. Over.
03 20 20 22	CMP	Okay. Got those, too.
03 20 20 25	CC	Okay, Jack. That's the last of the additions to this page. Go back to the regular checklist, and go to the AUTO RCS SELECT switches. We want all 16 of them open. Over. That is OFF.
03 20 20 43	CMP	Okay. Okay. They're sitting at OFF right now. All 16 AUTO RCS switches OFF.
03 20 20 57	CC	Okay. Then we go down to interior NUMERIC LIGHTING-LIGHTING, OFF: INTERIOR INTEGRAL LIGHTING, OFF; and INTERIOR FLOOD LIGHTING, OFF. Over.
03 20 21 13	CMP	Okay.
03 20 21 15	CC	Okay. Skip 3. We want SECs LOGIC, two OFF, down, and SECs PYRO ARM, two OFF, down. Over.
03 20 21 31	CMP	Okay.
03 20 21 33	CC	Okay, and on panel 9: POWER to OFF. Over.
03 20 21 42	CMP	All right.
03 20 21 49	CC	Okay, Jack. I don't think you need to read back all the circuit breakers because we copied them as you went. If you just want to read back - the panel 8, panel 9 changes.
03 20 22 05	CMP	All right, let's do it. SCS ELECTRONICS POWER, OFF. ... panel 8. All 16 RCS switches, OFF. INTERIOR NUMERICS LIGHTING, OFF; INTERIOR INTEGRAL, OFF; INTERIOR FLOOD LIGHTING, OFF. SPS LOGIC, two, down and OFF. PYRO ARM, down and OFF. Then panel 9 is POWER to OFF.

03 20 22 42	CC	Okay; that's correct, Jack. Let's go to page 1-8. In the second line, SUIT POWER's OFF. Over.
03 20 23 12	CMP	Okay.
03 20 23 20	CC	Okay, Jack. COMM sounds a little - -
03 20 23 23	CMP	- - ... too many changes here.
03 20 23 28	CC	- - COMM sounds better now, Jack - -
03 20 23 30	CMP	Okay, we're back. We - -
03 20 23 32	CC	Good. SUIT POWER was OFF, and then go to panel 10, POWER, OFF, and SUIT POWER, OFF. Over.
03 20 23 42	CMP	Okay. I got it.
03 20 23 44	CC	Okay. And that's the only changes on pages 1-8. Over.
03 20 23 51	CMP	Okay. SUIT POWER, OFF; panel 10, POWER and SUIT POWER, OFF.
03 20 23 57	CC	That's correct. Go to page 1-9 and on panel 100, skip the first four. We want IMU POWER, OFF. Over.
03 20 24 11	CMP	Okay.
03 20 24 12	CC	Okay. Skip the next one, and we want NUMERICS LIGHTING, OFF; FLOOD LIGHTS, OFF; and INTEGRAL LIGHTS, OFF. Over.
03 20 24 25	CMP	All right.
03 20 24 26	CC	Okay. On panel 101, skip the first three. We want URINE DUMP to OFF, and WASTE WATER DUMP to OFF. Over.
03 20 24 39	CMP	Got it.
03 20 24 41	CC	Okay. On panel 122, the only change is CONDITION LAMPS to OFF. Over.
03 20 24 51	CMP	All right.
03 20 24 53	CC	Okay. Panel 162, no change. Panel 163, no change. Now add, in panel 201, FOOD WARMER to OFF. Over.

03 20 25 13	CMP	Okay. Got it.
03 20 25 14	CC	Okay. On panel 225. It will read the same except I have three additional circuit breakers that we want open, and I'll read them up one at a time. The first one is S-BAND FM TRANSMITTER DSE, GROUP 1, open. Over.
03 20 25 46	CMP	S-BAND TRANSMITTER DSE, GROUP 1, open.
03 20 25 51	CC	Roger that. The next one is FLIGHT BUS, MAIN A and MAIN B, and that's two breakers, both open.
03 20 26 06	CMP	FLIGHT BUS, MAIN A, and FLIGHT BUS, MAIN B, two of them, open.
03 20 26 13	CC	Okay. That's correct. The last change is CTE, both open. Over.
03 20 26 26	CMP	Could you say that again?
03 20 26 29	CC	Affirmative. CENTRAL TIMING EQUIPMENT, CTE, both open. Over.
03 20 26 37	CMP	Okay, CTE, two, open.
03 20 26 41	CC	Affirmative. And that's all the changes on page 1-9.
03 20 26 48	CMP	Okay. Let me read it back here. ... order ... POWER, OFF. NUMERICS LIGHTING, FLOOD LIGHTING, and INTEGRAL LIGHTING, three of them, OFF. Panel 101, URINE DUMP HEATERS, URINE DUMP to OFF, WASTE H_2O to OFF. Panel 122, CONDITION LAMPS, OFF. Panel 201, FOOD WARNER, OFF. Panel 225, add additions that I read: S-BAND TRANSMITTER DSE, GROUP 1; FLIGHT BUS, MAIN A and MAIN B, CET, two to open.
03 20 27 27	CC	Okay. That's correct, Jack. Let's go to page 1-10. And on panel 226 - -
03 20 27 33	CMP	All right. We are going to switch on these. Got a switch on the ...
03 20 27 39	CC	Okay.
03 20 27 51	CMP	Okay. How you reading?
03 20 27 53	CC	Okay. Satisfactory, Jack. You ready for panel 226?

03 20 27 58	CMP	Let's go.
03 20 28 00	CC	Okay. On panel 226, we want all open accept; so change word "Closed" to "Open" and then scratch out the next three lines because we want them open, too. Over.
03 20 28 18	CMP	Okay. All open accept and you're going to give the ones you want open.
03 20 28 24	CC	Right. I'll give you the opens now. We want LIGHTING: FLOOD, MAIN A, MAIN B, and FLIGHT/ POSTLANDING, closed.
03 20 28 51	CMP	Okay. LIGHTING: FLOOD, MAIN A; LIGHTING: FLOOD, MAIN B, closed; and FLIGHT/POSTLANDING, closed.
03 20 28 59	CC	Roger, Jack. EECOM tells me that's all one circuit breaker, and the next one is LIGHTING: NUMERICS/INTEGRAL, LEB AC2, LMDC-AC1, and R MDC-AC1 to closed, and that's one circuit breaker also.
03 20 29 26	CMP	Okay. I don't know whether I can read that all back. Okay, LIGHTING: NUMERIC/INTEGRAL and I didn't get the rest of it, Joe -
03 20 29 40	CC	Okay. Stand by 1 second while I make damn sure about this.
03 20 30 59	CC	Jack, Houston. Over.
03 20 31 02	CMP	Go ahead.
03 20 31 04	CC	Okay. On the 226 circuit breakers that I read up, they are - there are six circuit breakers involved and they're all - they're the first six from the left on the bottom row of the panel. They're under LIGHTING. We want the three FLOOD circuit breakers out and the three NUMERIC/ INTEGRAL circuit breakers - I don't mean out, I mean closed. Those six closed and the rest open. Over.
03 20 31 39	CMP	Okay. There are three FLOOD circuit breakers and three NUMERIC circuit breakers and you want all six of those closed.

03 20 31 49	CC	That's affirmative, Jack, and all the rest open. Okay. Panel 227, no change, and panel 229, one addition to the circuit breakers we want open, and those are the TIMERS, MAIN A and MAIN B, two, to open. Over.
03 20 32 17	CMP	Okay. Okay, you want the TIMING circuit breakers, two of them, open.
03 20 32 24	CC	That's affirmative. Okay. On panel 250 - -
03 20 32 27	CMP	- - panel 229.
03 20 32 29	CC	- - we want all closed accept, and then scratch out all the ones that are there.
03 20 32 40	CMP	Okay. All closed accept. Okay. I'm ready to copy.
03 20 32 50	CC	Wait 1 minute. Yes, EECOM caught me; I said that wrong. We want you to change the word "Closed" to "Open," and then scratch out the ones that are there.
03 20 33 03	CMP	Okay. All open ...
03 20 33 10	CC	Okay. The two that we want closed are SEQUENCER A and SEQUENCER B. Over.
03 20 33 37	CMP	Okay. Panel 250.
03 20 33 42	CC	Say again, Jack. COMM is just improving.
03 20 33 48	CMP	Okay. I had to switch OMNIs here. And the two you want all open on panel 250 except SEQUENCE A and SEQUENCE B.
03 20 33 59	CC	That's correct. Panel 251, no change; panel 252, WASTE STOWAGE VENT valve, closed. Over.
03 20 34 12	CMP	WASTE STOWAGE VENT valve, closed.
03 20 34 15	CC	Roger. And, on panel 275, we want all the circuit breakers open; no exceptions. Over.
03 20 34 26	CMP	Panel 275, all open; no exceptions.
03 20 34 30	CC	Okay, and that's all for page 1-10. You want to read any of that back? I think you've got it all.

03 20 34 39	CMP	No, I think I've got it all.
03 20 34 41	CC	Okay. Let's go to page 1-11. On panel 276, no change; on panel 278, we want all circuit breakers open; no exceptions. Over.
03 20 34 57	CMP	Panel 278, all open.
03 20 35 00	CC	Roger. Now we'll skip all the way down to panel 306 where we want the MISSION TIMER to STOP and the EVENT TIMER to STOP. Over.
03 20 35 23	CMP	Okay. Panel 306, MISSION TIMER, STOP; and EVENT TIMER, STOP.
03 20 35 28	CC	Okay. And those are all the changes on 1-11, Jack.
03 20 35 35	CMP	Okay. Ready for 1-12.
03 20 35 37	CC	Okay. On page 1-12, panel 325, we want both CABIN PRESSURE RELIEF valves to NORMAL. Over.
03 20 35 49	CMP	Okay. Both to NORMAL.
03 20 35 52	CC	Okay. On panel 326, we want the REPRESS PACKAGE valves to OFF; the SM O_2 SUPPLY valves to OFF; the SURGE TANK O_2 valve to OFF. Over.
03 20 36 10	CMP	Okay. REPRESS, SERVICE MODULE O_2 SUPPLY, SURGE TANK O_2, three of them, to OFF.
03 20 36 19	CC	Roger. You did include the REPRESS PACKAGE there. Okay, GLYCOL RESERVOIR IN valve to CLOSED. BYPASS to OPEN, and OUT valve to CLOSED. Over.
03 20 36 37	CMP	Okay. GLYCOL RESERVOIR IN valve CLOSED; BYPASS valve OPEN; and RESERVOIR OUT valve CLOSED.
03 20 36 51	CC	That's affirmative. Panel 350, no change. Panel 351, MAIN REGULATOR valves, two, to CLOSED, and the H_2O/GLYCOL TANK PRESSURE REGULATOR valve, OFF, and RELIEF valve, OFF. Over.
03 20 37 17	CMP	Okay. MAIN REG valve, two, to CLOSED. WATER/GLYCOL TANK PRESSURE REG and RELIEF valves, both OFF.

03 20 37 27	CC	Okay. That's affirm. Those to the left, changes on 1-12. Let's go to 1-13.
03 20 37 35	CMP	Okay. Ready to copy.
03 20 37 37	CC	Okay. Go down to panel 380, O_2 DEMAND REG valve, OFF, and SUIT CIRCUIT RETURN VALVE, pulled to OPEN. Over.
03 20 37 56	CMP	Okay, both O_2 DEMAND REG valves are OFF and SUIT CIRCUIT RETURN VALVE pulled OPEN.
03 20 38 05	CC	That's correct. Go to panel 382. The first one, two, three, four are unchanged. We want SEC EVAP H_2O CONTROL valve OFF, and PRIM EVAP H_2O CONTROL valve to OFF. Those both are both counterclockwise. Over.
03 20 38 35	CMP	Okay, Houston. Reading back 382, SECONDARY EVAPORATOR H_2O CONTROL valve's OFF, and PRIMARY EVAPORATOR H_2O CONTROL valve, OFF.
03 20 38 49	CC	That's correct. Those are the only changes on 1-13, and there are no changes on 1-14, and you've got it all, Jack. Over.
03 20 39 01	CMP	Okay. Real good, Joe. ... configures for that panel.
03 20 39 08	CC	Okay. You can get those configures when you can. And the next order of business I've got for you is a procedure to verify that MAIN BUS B is good. And a little after that, we'll want to read up to you, for your future information, a procedure for transferring LM power to the command module. Over.
03 20 39 33	CMP	Okay. That sounds good. You want to get this PLSS configuration done first before you give those other procedures, huh?
03 20 39 44	CC	Yes, I think so. Stand by 1 second and I'll see if FLIGHT has any words for us before you start that.
03 20 40 22	CC	Jack, Houston. Over.
03 20 40 26	CMP	Go ahead.

03 20 40 27	CC	Okay, we don't have anything for you. Our only concern is that you'll wake up somebody; is there anybody sleeping right now?
03 20 40 37	CMP	No. We're all sitting here eating. I'm just going to get a bite to eat. Then I'll write down that switch configuration, or I'll copy the procedure now, if you want.
03 20 40 48	CC	Yes, okay. Understand they are all up. Did you say you wanted to copy the other procedure now? Over.
03 20 40 57	CMP	I can if you want. It's your choice.
03 20 41 00	CC	I'd rather you went ahead with the switch configuration, Jack.
03 20 41 06	CMP	Okay, let's do that and then I'll be back with you.
03 20 41 10	CC	Okay. See you later. And tell Jim that Deke wants him to go to bed.
03 20 41 21	CMP	Okay. I'll tell him that right now.
03 20 41 24	CC	Okay.
03 20 41 25	CMP	I'll tell you, I'll get my switch set done first before I eat so I won't disturb Jim any.
03 20 41 31	CC	Aquarius, Houston. Over.
03 20 41 36	CMP	Go ahead.
03 20 41 37	CC	Stand by 1 minute, Jack, before you go in there. FLIGHT has got one other item for you.
03 20 41 48	CMP	Deke wants you to go to bed.
03 20 42 17	CMP	Right now.
03 20 42 30	CMP	... like that ... I got up about 1 hour ...
03 20 43 31	CMP	You know what I thought - I think what we saw venting was the result of our DELTA-Vs stirring up things, popping the relief valve. Yes. We don't see anything venting now. ...
03 20 44 03	CMP	Okay, Houston. We are standing by.

03 20 44 12	CC	Aquarius, Houston. Over.
03 20 44 16	CMP	Okay, Joe.
03 20 44 18	CC	Okay, Jack. You can go ahead and set up that switch configuration. What we are discussing is having you activate the MAIN BUS TIE motor switches a little later on simply to verify that they will be okay, because the batteries are probably getting a little bit cool. But we'll be back to you with a procedure and discussion about that after you get the switch configuration set up. Over.
03 20 44 47	CMP	Okay, I'm going to go get the switch configuration done now before Jim goes to bed so I don't disturb him.
03 20 44 55	CC	Okay. Real fine.
03 20 45 00	CMP	Jim thinks Deke sounds like Frank Borman on Apollo 8.
03 20 45 04	CC	(Laughter) Okay. Sorry about that.
03 20 45 11	CMP	I'm going to give the COMM to Fred-o, now.
03 20 45 59	CDR	Houston, Aquarius.
03 20 46 02	CC	Aquarius, Houston. Go ahead.
03 20 46 07	CDR	Okay, before I hit the sack, Joe, I just want to make sure - How are you still planning an MCC at 107 and what's the latest find?
03 20 46 16	CC	Okay, Jim. We are still gathering our thoughts on the MCC, but some of the considerations go like this: FIDO tells us that we can do that correction probably as late as 118 hours, with no significant DELTA-V penalty, and with plenty of tracking thereafter to make sure that we've done the right thing, and to set you up for a late MCC if we need it, which we probably wouldn't. We are happy with the PTC mode that you are in now, and, although we are working up a - an AGS PTC mode to use after the mid-course correction, we'd kind of like you to stay in this PTC for a while because it is doing good. We are looking at the weather in the landing area. We don't think we'll have a problem but we are checking it real close,

and if there is any changing that we want to do, we want to get it into this midcourse correction. And for reasons like that, we are considering possibly delaying the midcourse correction from 104 hours to some time between there and 118. We'd like to know what you think about it. Over.

03 20 47 33	CDR	We have no druthers. As long as we do the midcourse and there is plenty of tracking thereafter to correct for another midcourse; that's my only concern.
03 20 47 44	CC	Okay, Jim. Roger that. And based on FIDO's input that he'd like to do it not later than 24 hours before EI, we will be doing it prior to 118 hours.
03 20 47 57	CDR	Okay.
03 20 48 38	LMP	Hello, Houston; Aquarius.
03 20 48 43	CC	Aquarius, Houston. Go.
03 20 48 48	LMP	Question, Joe. Jim has been talking to me about how we are going to do this midcourse, and awhile back when we went through this power up, we had pulled the STAB/CONTROL ASA breaker. I was wondering - we lost the heaters in the ASA - I was wondering how it looked? What kind of shape it's going to be in?
03 20 49 18	CC	Okay. Stand by on that one, Fred.
03 02 49 24	LMP	Okay.
03 02 49 48	CC	Fred, Houston.
03 02 49 52	LMP	Go ahead.
03 20 49 53	CC	Roger. I am told that we'd see 38 degrees for that package, and it'll be okay for the burn. We're massaging the detail procedures for this burn at this time and we expect to have a real clean setup to you in plenty of time.
03 20 50 12	LMP	Okay, very good.
03 20 50 30	LMP	And I don't know if Jack passed it on to you, but Jack and I just finished logging about 6 hours sleep, each.

03 20 50 51	CC	Roger, Fred. Copy that. Is it a little chilly up there?
03 20 50 58	LMP	Yes. We made the mistake of putting up the window shades, which we won't do again; and with this powered-down mode, we're not generating much internally, and it really did get chilly.
03 20 51 13	CC	Yes. I guess you'll have to generate your own heat in there for a while.
03 20 51 19	CC	Deke says unstow the Exer-Genie.
03 20 51 26	LMP	Okay.
03 20 57 47	CC	Aquarius, Houston. Over.
03 20 57 52	LMP	Go ahead, Houston.
03 20 57 54	CC	Fred, just wanted to let you know in advance that we're coming up on the redline CO_2 value for the secondary canister, and we expect to get there in something like a half hour, at which time we'll be asking you to switch over to the command module canisters. I have the rest of that procedure ready and I just wanted to warn you a little bit in advance. Over.
03 20 58 20	LMP	Okay. And I've got a question for you, Joe.
03 20 58 25	CC	Go ahead.
03 20 58 31	LMP	Okay. The - I need to find out if the condensate container that we were going to use to strain some water in on the lunar surface - is that container also completely airtight? Okay to use it to put fluid in through here in zero g?
03 20 59 01	CC	Fred, I didn't copy what you wanted to use it for. Over.
03 20 59 09	LMP	...
03 20 59 21	CC	Fred, Houston. We'll have to stand by for 1 minute. We are in a noisy state of COMM.
03 20 59 29	LMP	Okay. How do you read now, Joe?
03 20 59 31	CC	Oh, that's much better. Go ahead.

03 20 59 36	LMP	Okay. I was just going to say we haven't had an overboard waste water dump since clear back around the other side of the Moon. About this time, we're running out of the bags we've got on board here.
03 21 00 03	CC	Okay. I'm - I'm stupid this morning, Fred. I'm not quite sure what you are getting at.
03 21 00 14	LMP	Okay, Joe. We need some place to put the urine.
03 21 00 18	CC	Okay. It sounds to me as if the suggested receptacle is perfectly satisfactory. Do you think you can use it in its present configuration?
03 21 00 34	LMP	Oh, yes. We got all the innerconnects - hookups we need, but I wasn't sure if that gadget was devised solely with the 1/6g environment in mind, and whether it might leak somehow in zero g.
03 21 00 50	CC	I'll have them verify that, but off the top of my head, I'm sure it's going to be all right. We'll check it, Fred.
03 21 00 59	LMP	Okay.
03 21 05 22	LMP	Okay. How do you read, Joe?
03 21 11 53	LMP	Houston, Aquarius.
03 21 12 01	CC	Aquarius, Houston. Go ahead.
03 21 12 06	LMP	Okay, Joe. One thing I've noticed, that a couple of circuits there now - the pulse ... - at least the number of them, is markedly decreased, and ... rather bad and, apparently, that added venting we had out of the service module was some overboard relief valve, maybe letting go, because it appears to have stopped now.
03 21 12 38	CC	Okay, Fred. Copy that. Thank you.
03 21 23 14	LMP	Houston, Aquarius.
03 21 23 17	CC	Aquarius, Houston. Go ahead.
03 21 23 24	LMP	What do you read down there for partial pressure CO_2?
03 21 23 29	CC	Oh, let's see. We're reading 6.6 right now, Fred. What do you read?

03 21 23 38	LMP	I'm reading about 12.5. I guess we've got a gage problem ... I did just get a MASTER ALARM and no caution light; we kind of figured that's what it was, with CO_2 approaching its limit. Maybe it didn't quite come out here.
03 21 23 59	CC	Okay. Let me get a go, and I think it's time for us to go ahead and put these other canisters on. Stand by 1.
03 21 24 08	LMP	Okay. We went to 15 on the primary last night before I changed it and - -
03 21 24 16	CC	Roger that, Fred. We wanted to - -
03 21 24 18	LMP	- - I don't have a steady - I don't have a steady ECS light on at this time, Joe, so it must have just been a momentary.
03 21 24 28	CC	Okay. We know when you went to 15 last night on primary. We want to switch out today at 7.6. Let me check and see if we're ready.
03 21 24 41	LMP	Okay.
03 21 25 13	LMP	Yes. That's what it is, Joe. I've got something going on this alarm ... ECS light.
03 21 25 24	CC	Fred, Houston. The COMM isn't too sharp and I didn't copy.
03 21 26 34	CC	Okay, Aquarius; Houston - -
03 21 26 37	LMP	Houston, Aquarius. How do you read?
03 21 26 38	CC	- - Why don't you try it now? You're loud and clear now, Fred.
03 21 26 42	LMP	Okay. I was just - I'm getting MASTER ALARMS every few seconds and I am catching a glimmer now of the ECS light. For the time being, I have ... - ... open. Okay, now we got the ECS light on steady.
03 21 27 07	CC	Okay. Copy that. You have the MASTER ALARM, with the ECS light. We are ready to go ahead and get you on the command module canisters. And as the first step, I'd like to know whether you've inserted the commander's red hose to the second canister bag. Over.

03 21 27 29	LMP	Okay. Yes. Sure enough; the commander's red hose is inserted into the canister bag.
03 21 27 39	CC	Okay, Fred. The next thing I'd like you to do is to take some more gray tape and tape over half the outlet area of each of the blue nozzles; the commander's and the LMP's. The reason we're doing this is we're going to be running this loop through the secondary LiOH canister hole with the canister removed, and we don't have the flow restriction we need to keep the separator from overspeeding. Over.
03 21 28 11	LMP	Okay. Yes, that's right. So we want to tape over half of the - both the blue and the red commander hoses. Is that right?
03 21 28 22	CC	Negative, Fred. That's half of the commander's blue hose and half of the LMP's blue hose - the outlet hoses.
03 21 28 31	LMP	Oh, okay. I'll tape over half of each of the outlets. Stand by.
03 21 28 37	CC	Okay.
03 21 31 40	LMP	Okay. I'm going to turn off one suit flow valve at a time while I am doing the taping, Joe.
03 21 31 51	CC	Say again, please, Fred.
03 21 31 56	LMP	Okay, while I'm doing the taping, I'll have that particular suit flow valve in the suit DISCONNECT position momentarily.
03 21 32 03	CC	Okay. Fine.
03 21 43 46	LMP	Okay. How do you read now, Joe?
03 21 43 49	CC	Okay, Fred. Reasonable COMM. Are you ready for the next step? Over.
03 21 43 57	LMP	Okay. One correction - the red hose that's connected up right now to the lithium cartridge in the LMP's - Wait a minute.
03 21 44 17	CC	Okay, Fred. Understand only the LMP's red hose is actually plugged into the canister bag. In that case, we would like you to follow the procedure for inserting the other red hose in the

other canister bag as follows: you cut a diagonal hole in one corner of the bag. Look at the other bag and see how it was done. Stick the hose in about 6 inches. Try to get the outlet nozzle down if you can, or else sideways, and then just tape up the hose to the bag to make a nice tight seal. Over.

03 21 45 02	LMP	Okay. Jack's back in here. I guess he can do that. Stand by.
03 21 45 08	CC	Okay.
03 21 45 58	LMP	How do you read, Joe?
03 21 46 00	CC	Okay, Fred. Is that done? Over.
03 21 46 06	LMP	No. That's still in works. I just wanted to comment you might pass on to Steve Grega, we thank you a lot for those rendezvous procedures. They went to making up these little boxes.
03 21 46 29	CC	Okay. We appreciate your appreciating it. We're just having a ball down here working on all kinds of new procedures, Fred. The CPCB is in session, and we expect to have your entry procedures out here by Saturday or Sunday at the very latest.
03 21 46 50	LMP	Saturday or Sunday?
03 21 46 52	CC	At the very latest!
03 21 47 14	LMP	Take your time, Jack.
03 21 47 36	LMP	Why don't you run that other hose back up in the tunnel so Jim can get some air.
03 21 47 54	LMP	Yes. I got it.
03 21 51 52	LMP	And Joe, how you read now?
03 21 51 55	CC	Satisfactory, Fred. Go ahead.
03 21 52 01	LMP	Okay. Back to the condensate container. I guess the only question I really need answered is will it leak?
03 21 52 11	CC	Is will it leak? Oh, yes. Stand by 1.
03 21 52 22	LMP	And we've checked all the fittings and I know I can hook everything up to our UCDs. So, if it doesn't leak, we can transfer.

03 21 52 31	CC	Okay, Fred. We still don't have a final answer on whether or not it'll leak. If you need it, I'd go ahead and use it; and standing by for your completion of the hose-insertion procedure.
03 21 52 52	LMP	Okay. The hose-insertion procedure ... the second cartridge is complete.
03 21 52 59	CC	Okay. That's complete. The next step is to switch to the primary CO_2 canister and remove the secondary canister and stow it. Over.
03 21 53 14	LMP	Okay. I'm going to have to get off COMM here; I'll let Jack get the headset.
03 21 53 19	CC	Okay.
03 21 53 28	CMP	Hey, Joe. I'm on the headset now.
03 21 54 06	LMP	Is that secondary? ... secondary?
03 21 54 24	LMP	Both cartridges are out.
03 21 54 33	CMP	Okay, Joe. Fred has the secondary cartridge out. We're back on primary now.
03 21 54 39	CC	Okay, Jack. The next step is to place the command module canisters with the hoses attached in a suitable location to permit the bottom of the canister to be exposed to free airflow and tape them in place. Ideally, well, it doesn't matter. Just - just pick out your own spot.

END OF TAPE

03 21 55 05	CMP	Okay. I'm going to tell you where they are. They're both situated, as you say, with the bottom of the canister exposed to free air, and one is sitting right by the - the LMP's is sitting right by the EPS panel, and the CDR's is up in the tunnel.
03 21 55 26	CC	Jack, Houston. The COMM got real noisy there, and I didn't copy that. Stand by a moment.
03 21 56 02	CMP	Okay, Joe. How do you read now?
03 21 56 04	CC	Okay. That's real good, Jack; go ahead.
03 21 56 09	CMP	Okay. The canisters are situated as you - as you would like with the bottom of the canister exposed to free air.
03 21 56 17	CC	Okay.
03 21 56 18	CMP	The position of the LMP's canister - The LMP's canister is sitting on the EPS panel now, and the CDR's canister is positioned up in the tunnel.
03 21 56 31	CC	Okay. Real fine, Jack. The next step is to physically separate both blue hoses a good distance away from the canister so that we don't short circuit the flow, and tape them in place; and the ideal location for them would be up in the tunnel so as to get some flow into the command module. Over.
03 21 56 57	CMP	Both hoses in the - up into the command module?
03 21 57 03	CC	Oh, you can use your judgment on that, Jack. We'd like at least one, and the recommendation that I got was to put them both up in the tunnel.
03 21 57 15	CMP	Okay. We have the LMP's blue hose up by the LMP's window and the - Of course, the red hose is separated by some 4 feet. And the - Okay. We're going to - and the other hose - the - has the extension on it - The CDR's blue hose, of course, has the extension on it, and it's blowing way up in the command module. And the red hose is about - Oh, it's right at the docking ring where the blue latches are, so there's about 4 or 5 feet difference from there, too. Is this satisfactory?

03 21 58 03	CC	Okay, Jack. That sounds satisfactory. The next steps are - are suit-loop configuration steps, and the first one is to - -
03 21 58 14	CMP	Okay. SUIT DIV - -
03 21 58 17	CC	- - is to place the SUIT DIVERTER valve to the PULL EGRESS position.
03 21 58 26	CMP	Okay. SUIT DIVERTER valve to PULL EGRESS.
03 21 58 31	CC	That's affirmative - -
03 21 58 32	CMP	That's done - -
03 21 58 33	CC	Okay. The next step is CABIN GAS RETURN to EGRESS. Over.
03 21 58 43	SC	...
03 21 59 24	CC	Okay, Jack. Did you copy CABIN GAS RETURN to EGRESS? Over.
03 21 59 32	CMP	No, I didn't get that, Joe. CABIN GAS RETURN to EGRESS.
03 21 59 37	CC	That's correct.
03 21 59 43	CMP	Okay. That's done.
03 21 59 45	CC	Okay. Next, SUIT CIRCUIT RELIEF to CLOSE. Over.
03 21 59 52	CMP	SUIT CIRCUIT RELIEF to CLOSE.
03 21 59 55	CC	Roger.
03 22 00 01	CMP	Okay. I got that done.
03 22 00 03	CC	Okay. And the last step is select secondary CO_2 canister. We'll let it flow through the empty hole, and let's see how we do.
03 22 00 13	CMP	Select secondary CO_2 canister.
03 22 00 16	CC	Roger, Jack. That completes that procedure, and the next thing I've got for you is a procedure for going back into the command module and powering up the main buses temporarily using the BUS TIE switches. We want to do this for two reasons: first of all, we want it absolutely verified that

there are no loads on the main buses, that we've got everything off and that the buses look good; and the second thing we want to do is to power the bus - the main buses, with the BUS TIE motor switches, and then depower them by pulling the circuit breakers, leaving the MAIN BUS TIE switches in the on position, just to assure that they'll be there when we need them, whether the batteries get cold or not. Over.

03 22 01 33	CMP	Okay, Joe. How you read?
03 22 01 36	CC	Better now, Jack. Satisfactory. Did you copy my rationale for the main bus powerup?
03 22 01 45	CMP	Yes, I did. You want to remove - You want to power up both buses, with the BUS TIE motor switches; first of all, to see that there are no loads on the buses, and second, and then depower the buses by pulling the circuit breakers to insure that the motor switches don't - that the BUS TIES stay on so that they're there when we need them.
03 22 02 09	CC	That's correct, Jack. Are you ready to copy the procedure?
03 22 02 15	CMP	Okay. Go ahead.
03 22 02 16	CC	Okay. As the first step, I have one change to the basic configuration that we gave you, and it's two more circuit breakers that we want open. On panel 225 - Are you ready to write that down? Over.
03 22 02 35	CMP	Yes. I'm all ready, Joe. Go ahead.
03 22 02 48	CMP	Joe, I'm all ready. Go ahead.
03 22 02 50	CC	Okay. On panel 225, we want the RENDEZVOUS TRANSPONDER FLIGHT BUS circuit breaker open, and the S-BAND FM TRANSMITTER/DSE FLIGHT BUS circuit breaker open. Over.
03 22 03 24	CMP	Okay. TV RENDEZVOUS TRANSPONDER FLIGHT BUS, open; TV S-BAND TRANSMITTER/DSE FLIGHT BUS open on panel 225.

03 22 03 35	CC	Okay. That's correct, Jack. And now we'll go into the main bus powerup procedure. And the first step there, is on panel 5. We want the BAT CHARGER BAT A CHARGE circuit breaker closed, and the BAT CHARGER BAT B CHARGE circuit breaker closed. Over.
03 22 04 15	CMP	Okay. That's BAT CHARGER BAT A CHARGE, BAT CHARGER BAT B CHARGE, both closed on panel 5.
03 22 04 25	CC	That's affirmative. We need them closed to power the switches. Next on panel 5, we want the EPS SENSOR SIGNAL MAIN A and MAIN B circuit breakers closed. Over.
03 22 04 52	CMP	Okay. Panel 5, CB EPS sensor's signals MAIN A and MAIN B closed.
03 22 05 00	CC	Okay. That's affirmative. We need them closed so that you can read out your volts and amps. Next step, on panel 250, we want circuit breaker BAT A POWER ENTRY and POSTLANDING and BAT B POWER ENTRY and POSTLANDING, closed. Over.
03 22 05 35	CMP	Okay on panel 250, CB BAT A POWER, ENTRY and POSTLANDING, closed; BAT B POWER ENTRY and POST-LANDING, closed.
03 22 05 50	CC	That's affirmative. And at that point, we'd like you to check the BAT bus voltages on both BAT buses to make sure we don't have any shorts. Over.
03 22 06 09	CMP	Okay. Read the BAT bus voltages on BAT BUS A and BAT BUS B.
03 22 06 13	CC	That's affirmative. The next step on panel 275: circuit breaker MAIN A, BAT BUS A, closed, and circuit breaker MAIN B, BAT BUS B, closed. Over.
03 22 06 44	CMP	Okay. On 275, circuit breakers MAIN A, BAT BUS A, closed; MAIN B, BAT BUS B, closed.
03 22 06 56	CC	That's affirmative. The next step on panel 5: we want the MAIN BUS TIE A/C switch to the BAT A/C position, and verify proper voltage on MAIN BUS A, and read the amps on BAT A to make sure we don't have a short. Over.
03 22 07 29	CMP	Okay. ...

03 22 07 46	CC	Okay, Jack; Houston. We're in bad COMM again; let's wait a minute.
03 22 08 03	CMP	Okay. How do you read ...?
03 22 08 04	CC	That's better, Jack. Go ahead with your readback.
03 22 08 10	CMP	Okay. Place MAIN BUS TIE A/C, on, read MAIN BUS A current and voltage.
03 22 08 19	CC	Okay. That's affirmative. The next step will be the MAIN BUS TIE B/C switch to the on position and read MAIN B voltage and battery B amperage as above. Over.
03 22 08 49	CMP	Okay, MAIN BUS TIE B/C on; read MAIN B voltage and current.
03 22 08 55	CC	Okay. That is correct. Then to reconfigure from this configuration, Jack, we want you to leave the MAIN BUS TIE switches in the on position and pull the circuit breakers out in reverse order that we had you close them. Over; and do you want me to read them up individually?
03 22 09 17	CMP	No, let me see if I've got it here. I go down to panel 275, open CB MAIN A, BAT BUS A and CB MAIN B, BAT BUS B. Then I go down to 250, and pull CB BAT A POWER ENTRY/POSTLANDING and BAT B POWER ENTRY/POSTLANDING and then up on panel 5, pull EPS SENSOR SIGNAL MAIN A, SENSOR SIGNAL MAIN B, BATTERY CHARGER BAT B CHARGE, BATTERY CHARGER BAT A CHARGE. And then close - I don't know whether you want me to close the RENDEZVOUS RADAR TRANSPONDER FLIGHT BUS and S-BAND TRANSMITTER/DSE FLIGHT BUS.
03 22 10 03	CC	Okay, Jack. We don't want you to close those last two. Those are changes to your basic configuration, and we want to leave them open for now. Over.
03 22 10 15	CMP	Okay. I'll do that. Was the rest of the readback okay?
03 22 10 17	CC	That's correct. Readback was 100 percent, and we'll wait to hear from you.

03 22 10 32	CMP	Okay, Joe. And just for confirmation, I went through the switch list you gave me. We are in exactly that configuration with one exception, and that is over on panel 382. I have not, the a - H_2O ACCUMULATOR is in the OFF position so that if we need any more water, we can get it.
03 22 11 05	CC	Okay. Roger, Jack. Copy that. On panel 382, you've left the H_2O ACCUMULATOR valves in the OFF position, and we concur.
03 22 11 16	CMP	Okay. And there's one other thing that I don't know whether you're aware of. We have no lithium hydroxide canisters in panel two fif- in - canisters now. So when we get ready to power up, you'll have to remind us when you want us to add some.
03 22 11 38	CC	Okay, Jack. We copy that. That's correct, and I'll add that to our basic checklist so that we won't forget it.
03 22 11 47	CMP	Okay. Real fine, Joe, and I'm on my way back into the command module.
03 22 11 51	CC	Good deal.
03 22 11 53	CMP	Thank you.
03 22 12 04	LMP	How do you read, Joe?
03 22 12 19	LMP	And, Joe, how do you read Aquarius?
03 22 12 23	CC	Aquarius, Houston. Pretty good. Go ahead.
03 22 12 29	LMP	Okay. I'm back on the line now, but Jack really ... headed back to the upstairs bedroom.
03 22 12 39	CC	Okay. Roger that, Fred.
03 22 13 01	CC	Aquarius, Houston. Over.
03 22 13 06	LMP	Go ahead.
03 22 13 07	CC	Okay, Fred. We recommend that you push your MASTER ALARM circuit breaker in so you'll have audio and visual on that, and, also, we medical types are getting to feel left out down here, and we'd like you to give us BIOMED ... position, if you're plugged in for it, and we'll see whether it affects the voice or not. Over.

03 22 13 36	LMP	Okay.
03 22 14 22	LMP	Hey, Houston; Aquarius. On DOWN VOICE BACKUP S-band, how do you read me?
03 22 14 28	CC	Aquarius, Houston. Read you now satisfactory.
03 22 14 36	LMP	Okay. And that's my ...
03 22 14 39	CC	Okay. Thank you very much, Fred.
03 22 14 46	LMP	Actually, a good deal of that little power pack heats up and ...
03 22 14 53	CC	Roger that.
03 22 19 11	LMP	Houston, Aquarius.
03 22 19 14	CC	Aquarius, Houston. Go ahead.
03 22 19 18	LMP	Okay, Jack just ... himself back down. And after he put on the 250 BAT A, BAT B breakers, he read BAT bus volts as 32.3 on A, 37.0 on B; he then punched in the 275 breakers, which tied the batteries to the buses, and at that time he read the A bus volts 32.0 on A, zero amps; 37.0 on B, zero amps.
03 22 19 59	CC	Aquarius, Houston. The COMM got noisy there, and I want to make sure we get these numbers right, so I'd like to ask you to repeat them ...
03 22 21 00	LMP	Okay. How do you read now, Joe?
03 22 21 01	CC	Okay; probably okay, Fred. Read it nice and slow so we'll be sure to get it. Over.
03 22 21 10	LMP	Okay. Jack pushed in the 250 BAT A, BAT B entry breakers. He read battery bus volts as 32.3 on A, 37.0 on B. Then he pushed in the 275 breakers tying the BATs to the main buses. In this configuration, MAIN A is at 32.0 volts, zero amps; MAIN B is at 37.0 volts, zero amps. So it looks like the buses are okay.
03 22 21 47	CC	Okay, Fred. Copy those numbers and thank you very much. I assume you got them off all right.
03 22 22 00	LMP	That's affirm. We got all the breakers pulled again.
03 22 22 03	CC	Okay. Real fine.

03 22 32 33	LMP	Hey, Houston; Aquarius. How do you read?
03 22 32 38	CC	Aquarius, Houston. Go ahead.
03 22 32 43	LMP	Okay. How did our ... configurations appear to be working down there?
03 22 32 54	CC	I'm sorry, Fred, but we got noisy again there.
03 22 33 02	LMP	Okay. Let me know when you want me to try it.
03 22 33 05	CC	Okay. That sounds better already. Go ahead.
03 22 33 11	LMP	Okay. I'd just like to ... how's - how's our lith-o cartridge setup ... appear to be working down there.
03 22 33 21	CC	We are reading 0.2 on our CO_2 sets here, and we're all delighted. It seems to be working fine.
03 22 33 31	LMP	Boy, that is great.
03 22 33 40	CC	And Fred, Houston. In a little while here, I'm going to have a procedure that I want to read up to you and have you copy down for future use. It's a procedure for powering the command module main bus off the LM, and it's something that we feel that's going to come in real handy later on for such things as popping off the command module entry batteries, and also possibly for doing some preheating and preliminary powering up of the command module before we get rid of the LM. We'll have that for you in probably 10 or 15 minutes. Over.
03 22 34 25	LMP	Okay, okay, Joe. That's good. Sounds good.
03 22 34 31	CC	Roger.
03 22 36 11	CC	Aquarius, Houston.
03 22 36 16	LMP	Go ahead.
03 22 36 18	CC	Okay, Fred. Our procedure-generating mill has generated another very short one for you here. It's a procedure for getting an onboard read-out - -
03 22 36 27	LMP	Stand by 1, Joe.
03 22 36 38	CC	Okay.

03 22 37 02	LMP	Okay, Joe. Go ahead.
03 22 37 05	CC	Okay, Fred. This is a procedure for getting a read-out of the descent propellant tank temps. It's no big problem, but our LM people say that the bottom of the descent stage is probably cooling off, and we just want to verify that the descent water tank will be okay. Right now, it looks as though it won't freeze until several hours after it's empty, but we want to have you read these temperatures out to us so we can see how good our predictions are. The procedure is, on panel 16, close the PROPELLANT DISPLAY/ENGINE OVERRIDE LOGIC circuit breaker. Over.
03 22 38 12	LMP	Okay. The PROPELLANT DISPLAY OVERRIDE circuit breakers are closed. ... the propellant.
03 22 38 21	CC	Right, Fred. The next step is simply to turn the PROPELLANT TEMP PRESS MONITOR switch to DESCENT 1, read the fuel and OX temps, turn it to DESCENT 2, read the fuel and OX temps; tell us what they are.
03 22 38 44	LMP	Okay. On DESCENT 1, I get a fuel temp of 66.5 degrees, OX ... on DESCENT 2, I get ...
03 22 39 05	CC	Okay, Fred. We're in noisy COMM here; I got DESCENT 1 fuel 66.5; stand by a second.
03 22 39 35	LMP	Okay. How do you read, now ...?
03 22 39 37	CC	That's better. Go ahead.
03 22 39 47	LMP	Okay. You got 66.5 on DESCENT 1 fuel temp, oxidizer temp is 66 degrees.
03 22 39 53	CC	Okay. Copy - -
03 22 39 54	LMP	On DESCENT TANK 2, fuel is reading 60 - Okay. DESCENT 2 fuel is reading 68 degrees; oxidizer, 65 degrees.
03 22 40 03	CC	Okay. Copy that, Fred. Thank you. We'd like you to pull the circuit breaker, and we'll probably come to you again in 5 or 6 hours for another check.
03 22 40 14	LMP	Okay. The panel 16 ... ... ENGINE ... OVERRIDE is open.

03 22 40 19	CC	Roger.
03 22 46 28	CC	Aquarius, Houston. Over.
03 22 46 59	CC	Aquarius, Houston. Over.
03 22 47 05	LMP	Go ahead.
03 22 47 10	CC	Okay. We're chasing a small glitch that we saw a while ago in the O_2 flow rate which is now normal again, but what we'd like you to do is, first of all, to tell us whether, during that canister procedure, you moved O_2 DEMAND REG A to any position other than CABIN, and then we'd like you to move it to OFF momentarily and back to CABIN for us.
03 22 47 39	LMP	Okay. To answer your question, Joe, it's no. I checked the CABIN all the time. Qualitatively, when we switched to this configuration, it didn't seem like the frequency or the suit fan noise ... decreased ... logged down a little bit, but I'll follow your procedure. You want me to take REG A, go to close and back to CABIN; is that correct?
03 22 48 10	CC	That's correct, Fred.
03 22 48 15	LMP	Okay. We're in close.
03 22 48 18	CC	Okay.
03 22 48 22	LMP	Now, I'm back to CABIN.
03 22 48 24	CC	Okay. Thank you very much, Fred. I'll get back to you if we see anything.
03 22 50 17	SC	(Music - The Age of Aquarius)
03 22 50 42	CDR	... Thank you.
03 22 50 47	CC	Hey, have you guys got a woman on board?
03 22 50 57	LMP	No way I could handle that.
03 22 51 30	LMP	And, Joe, do you have the ... out for the ...?
03 22 51 39	CC	I'm not sure I copied that, Fred. If you asked me whether I had that powerup procedure, I don't have it for you, yet. Over.

03 22 51 54	LMP	No. The question was, do you have a ... from the Moon burn.
03 22 52 04	CC	Still didn't understand, Fred. I'm sorry.
03 22 52 08	LMP	Okay. We'll be able to get better COMM.
03 22 52 09	CC	Roger.
03 22 53 00	LMP	Okay.
03 22 53 55	CC	Fred, Houston. You want to try it, now?
03 22 54 12	LMP	How do you read, Houston?
03 22 54 14	CC	That's pretty good, Fred.
03 22 54 19	LMP	Okay. Two things: first of all, we noticed a ...
03 22 54 30	CC	Gol darn it. Just as you started talking, it got noisy again, Fred; try it again.
03 22 54 37	LMP	Okay.
03 22 54 45	CC	Try it now, loud and slow.
03 22 54 51	LMP	Okay. Jack had a question on how far out from the Moon are we now?
03 22 55 04	CC	On how far out what?
03 22 55 08	LMP	From the Moon we are now?
03 22 55 10	CC	Oh. Our little plot shows you just touching the 180-thousand-mile line. So you're about 40 K out from the Moon.
03 22 55 20	LMP	Okay. Okay. And the other thing is, we've noticed some fresh new particles floating around outside, so possibly the service module is starting to vent a little bit again.
03 22 55 39	CC	Okay. Copy that, Fred. On the O_2 flow thing, we clearly saw the DEMAND REGULATOR go to OFF and back to CABIN. TEL MU [?] thinks that it's no big thing that you've seen a little change in flow due to the different resistance we've got in the circuit.

03 22 56 01	LMP	Roger.
03 22 56 28	CC	Aquarius, Houston.
03 22 56 33	LMP	Go ahead.
03 22 56 35	CC	Okay, Fred. Recommend you go to OFF on the BIOMED switch. We never did get any BIOMED and it might clear up the COMM a little bit.
03 22 56 49	LMP	Okay. How you read now?
03 22 56 52	CC	Okay, Fred. That might be a little better.
03 22 57 41	LMP	We're on the 180 - K line, right now.
03 22 57 44	CDR	...?
03 22 57 47	LMP	We're about 40 050.
03 22 58 04	CMP	... It's 550 over there.
03 22 58 11	LMP	Okay. It's ... there.
03 22 58 16	CMP	Just split the difference.
03 22 58 19	CDR	Yes.
03 22 58 21	LMP	Okay. I got a copy of the ... K ...
03 22 58 25	CMP	Is that right?
03 22 58 26	LMP	EECOM.
03 22 58 35	CMP	That midcourse should be interesting. You know, the mode we're going to do it in.
03 22 58 42	LMP	Manual AGS ... DPS burn. We're controlling ... TTCA attitude. ...
03 22 58 49	CMP	... down under ...
03 22 58 52	LMP	Fortunately.
03 22 58 54	CMP	We can't help them too much. Actually it isn't bad ... but ... ... goddamned unfortunate. In part, I get a feeling ... now when I get ... Just before ... goes to zero in 1 second I'm going to pull them out ...

03 22 59 35	CMP	Another burn that's never been done.
03 22 59 43	LMP	Go to the - Go to the technique for a lash and ... it's the burn technique.
03 22 60 02	LMP	I'm sure they got something written out, maybe ...
03 22 60 09	CMP	A what?
03 23 00 13	LMP	Well, hell, Jack. All you - you don't use a very good one ... Just if you'll go ... at your attitude reference for ... and the g-meter backup. Because, really, you can almost ... The command module and your odds are 60 to 40 that you're going to hit Earth blunt-end first, without any reference.
03 23 00 38	CMP	... I didn't realize that. That proves you've got a little bit above 50-percent odds that you're going to enter blunt end, and -
03 23 00 49	LMP	We made an entry like that in Apollo 8 in a ... with Houston, ol' Buzz went and turned on the command module heaters and left them on. The activators, they went, "Shooo!" both tanks; we had no gas. Just had a real slow rate ... We actually went out in the console and started debriefing, but left it running and watched it; and the son of a bitch did a hop-skipout, a hopout, underneath ..., but not much, and then we did a long hop ... but - The second reentry, also, it did one ... both times. It lucked out twice and made a real peculiar ... They went to zero g ...
03 23 01 45	CMP	Yes.
03 23 02 01	LMP	Yes, we did, Jack. ...
03 23 03 36	CMP	... But we're in this wobble.
03 23 03 40	LMP	... pass ... then it'll come back down.
03 23 06 02	LMP	Hey, Aquarius; Houston. How do you read me?
03 23 06 04	CC	Aquarius, Houston. Okay. Go ahead.
03 23 06 11	LMP	Okay, Joe. It - Our wobble in this PTC has picked up where the Moon is running by pretty high in the window and the Earth pretty low; so I expect - On the side where the Moon's present,

we're having a little bit of trouble with the COMM ... breakout there in a couple of places.

03 23 06 37	CC	Okay. Roger that, Fred.
03 23 08 33	LMP	... pressure gage as far as the noise ... get the thing from the AFT. ...
03 23 09 10	CMP	Houston, Aquarius.
03 23 09 13	CC	Aquarius, Houston. Go.
03 23 09 20	CMP	Okay, Joe. I'm all set to copy that procedure for powering up the command module from the LM, whenever you want to give it to me. When did you, I guess you want to put battery A out of the CHARGE, huh?
03 23 09 32	CC	Jack, we're not certain when the best time is to implement this procedure, and what we want to do at this time is read it up to you, so you'll have it and understand it and we'll - We'll be able to do it quickly when the time comes. And I don't have it for you quite yet. Over.
03 23 09 56	CMP	(Laughter) Okay. All right. I'll be standing by to copy it whenever you get it.
03 23 10 03	CC	Okay, Jack.
03 23 11 34	CC	Aquarius, Houston. Over.
03 23 11 42	CMP	Joe, I got to switch antennas here. Okay, Joe, I read you on the FORWARD antenna.
03 23 11 52	CC	Okay, Jack, I have the procedure now to read up to you. Before I do, I want to mention something that will be of interest to Fred. We are looking at the SHe tank pressure rise and we expect it to blow. We don't know exactly what time it will go, somewhere around 105 hours or perhaps later than that. We've got plenty of blowdown capability. We just thought you ought to be informed.
03 23 12 23	CMP	Okay. Stand by. I'll tell him, now.
03 23 12 27	CC	Okay.
03 23 12 28	CMP	Fred, they said they're looking at the SHe tank pressure rise, and they expect it to blow somewhere around 105 hours ... Okay. Fred thought they did. ...

03 23 12 48	CC	Okay. Real fine. Are you ready for the procedure, now, Jack?
03 23 12 55	CMP	Yes. Joe, how long is it? Is it a big long one, or a short one, or a medium sized ... about how many pages?
03 23 13 01	CC	It's about - I'd say 15 to 20 steps, Jack. Some of it is LM stuff, and the rest of it is in CSM.
03 23 13 15	CMP	Okay. I got a fresh page here, and I'm ready to copy.
03 23 13 18	CC	Okay. I'll give you the LM steps first. They have to be done first, and the first step is on panels 11 and 16, circuit breakers ASCENT CA, ASC ECA, two to close.
03 23 13 42	CMP	Okay. Panels 11 and 16 CBs ASCENT ECA to closed.
03 23 13 50	CC	Okay. Next step: panels 11 and 16 CB ASCENT ECA CONTROL, two, to close. Over.
03 23 14 11	CMP	Okay. On 11 and 16 CBs ASCENT ECA CONTROLs to close.
03 23 14 19	CC	Okay. That's correct. The next step is BAT 5 and 6 NORMAL FEED to high; those are switches.
03 23 14 41	CMP	Okay. BATs 5 and 6 NORMAL FEED, ON.
03 23 14 46	CC	That's correct. Next step: BATs 1 and 3 to OFF slash RESET. Over.
03 23 15 05	CMP	BATs 1 and 3 to OFF slash RESET.
03 23 15 09	CC	That's correct. Next step: wait 30 minutes for preconditioning.
03 23 15 23	CMP	Okay. That's wait 30 minutes for preconditioning.
03 23 15 29	CC	That's correct, and the last LM step for now is BATs 2 and 4 to OFF/RESET.
03 23 15 50	CMP	Okay. BATs 2 and 4 to OFF/RESET.
03 23 15 55	CC	That's correct. Now we'll go to the CSM, and the first step there is connect LM/CSM umbilical. Over.

03 23 16 13	CMP	Okay. Connect LM/CSM umbilical.
03 23 16 17	CC	Okay. The next step, on panel 5, CB LM POWER-1 MAIN B and LM POWER-2 MAIN B, both, closed. Over.
03 23 16 43	CMP	Okay. On panel 5, CB LM POWER-1 MAIN B and 2 MAIN B, both, closed.
03 23 16 52	CC	That's correct. On panel 5, CB EPS SENSOR SIGNAL MAIN B to close. Over.
03 23 17 11	CMP	EPS SENSOR SIGNAL MAIN B closed on panel 5.
03 23 17 16	CC	That's correct. Next step, panel 250: CB BAT B POWER ENTRY/POSTLANDING; closed. Over.
03 23 17 40	CMP	Okay. On panel 250: CB BAT B POWER ENTRY/ POSTLANDING, closed.
03 23 17 50	CC	That's Charlie. Verify MAIN BUS voltage; then, LM POWER switch on panel 2 to CSM. Over.
03 23 18 14	CMP	Okay. That's verify the MAIN BUS voltage, and switch LM POWER to CSM.
03 23 18 23	CC	Okay. That's correct. Then go back to 275, CB MAIN B BAT BUS B to open. Hey, Jack, that's the step I skipped for you, I'm afraid. Before verifying MAIN BUS voltage, you have to, on panel 275, close CB MAIN B BAT BUS B. Over.
03 23 19 07	CMP	Okay, Joe. How are you reading on the AFT OMNI.
03 23 19 11	CC	You're okay now. Go ahead.
03 23 19 15	CMP	Okay. After putting the BATTERY B POWER ENTRY/ POSTLANDING on, then I want to push the - on panel 275 MAIN B to BAT BUS B in, huh?
03 23 19 38	CC	That's right. Then you go to verify MAIN BUS voltage, LM POWER to CSM, and then, on panel 275, circuit breaker MAIN B BAT BUS B to open. Over.
03 23 19 53	CMP	Okay. After verifying the MAIN BUS voltage connecting the LM POWER to CSM I want to pull MAIN B BAT BUS B, or MAIN B to BAT BUS B, open.
03 23 20 06	CC	That's correct. And then on panel 250, circuit breaker BAT B POWER ENTRY/POSTLANDING to open, and verify MAIN BUS B voltage.

03 23 20 37	CMP	Okay. Panel 250 BAT B POWER ENTRY/POSTLANDING, open, and then verify the MAIN BUS voltage.
03 23 20 44	CC	Okay. That's correct. The last steps are to get the LM back on descent batteries. The first step is BATs 1, 2, 3, and 4, HI VOLTAGE, ON. Over.
03 23 21 12	CMP	Okay. Then the next step is a LM step, BATs 1, 2, 3, and 4, HI VOLTAGE, ON.
03 23 21 19	CC	That's correct; and the last step in the LM, BATs 5 and 6 to OFF. Over.
03 23 21 33	CMP	Say again; you cut out there, Joe.
03 23 21 36	CC	Okay, Jack. The last step in the LM, BATTERIES 5 and 6 to OFF. Over.
03 23 21 47	CMP	Okay. BATs 5 and 6 go OFF.
03 23 21 51	CC	That's correct. That should configure you. Note that circuit-breaker protection on that circuit limits the available current to 15 amps. We think we can do quite a bit with it though. And the LM/CSM umbilical will be hot and MAIN BUS voltage may be monitored by selecting MAIN B on the gage. Over.
03 23 22 16	CMP	Okay. Real fine.
03 23 22 18	CC	Good deal, Jack.
03 23 22 22	CMP	Okay. And I'll be ready to implement this whenever you call it up.
03 23 22 26	CC	Roger that.
03 23 22 54	LMP	And how do you read, Joe?
03 23 22 56	CC	Pretty good, Fred.
03 23 23 00	LMP	Okay. While Jack was on COMM, I was looking out the docking window here, and I could see another good shower of particles coming out of the service module. And the position this time appears to be on the other side. Before, we'd always seen them out of window 1, and where I'm looking at it from here, it looks like it'd be down below window 6 somewhere in the service module. Jack's going upstairs to see what it looks like up there.

03 23 23 33	CC	Okay. Good deal. We copy that, Fred. And to show you how relaxed we are about the entry, Ken is looking at - giving you guys a chance to - prior to going into entry, PREP to snap a few pictures of the service module.
03 23 23 56	LMP	Ken is, huh? (Laughter)
03 23 24 02	CC	Yes, he's got all that film up there, and he doesn't want to waste it.
03 23 24 06	LMP	Oh, I thought maybe you'd want me to do a PLSS EVA to go shoot pictures or something.
03 23 24 11	CC	Okay, okay.
03 23 24 22	LMP	You're right; we got a lot of pictures.
03 23 24 34	LMP	I guess I agree it surely would be nice to document it someway if we can, but it doesn't look like ...
03 23 24 45	CC	Yes, we think it'd be a lot of help.
03 23 25 41	LMP	Joe, how do you read me?
03 23 25 45	CC	Aquarius, Houston. Go ahead.
03 23 25 50	LMP	Okay. The condensate transfer worked great.
03 23 25 57	CC	Stand by a minute, Fred. We're in a bad COMM mode.
03 23 26 16	LMP	Okay. How's that?
03 23 26 17	CC	That's better.
03 23 26 21	LMP	Okay. The waste transfer into the condensate can works real well, Joe.
03 23 26 29	CC	Okay. Good deal.
03 23 26 33	LMP	So, I guess we can keep FIDO happy with no overboard dumps.
03 23 26 39	CC	Roger that.
03 23 27 14	LMP	Yes, that brings up one more possibility, Joe.
03 23 27 19	CC	Say again, Fred.

03 23 27 23	LMP	Brings up another possibility. Now that we've got all of that stowed into the bags and the condensate can, we could probably blow all of that through the PLSS ..., I wonder how the sublimator would work on waste water.
03 23 27 39	CC	It might work if we had to do it, Fred.

END OF TAPE

03 23 27 14	LMP	That brings up one more possibility, Joe.
03 23 27 19	CC	Say again, Fred.
03 23 27 23	LMP	Brings up another possibility. Now we've got all that stowed and the bags and the condensate can, we can probably blow all of that through the PLSS setting. I wonder how the sublimator would work on waste water.
03 23 27 38	CC	It might work if we had to do it, Fred. Right now we're looking at a comfortable excess of water through the sublimator. We were talking among ourselves this morning about having you try out the PLSS to ascent tank water-transfer situation and we decided not to do it, not to recommend it, because we figure it'd take us 30 hours to empty one of the ascent tanks, which you have to do in order to get PLSS water to it, and we'd rather use the descent water and we don't think we've gotten any sweat. Over.
03 23 28 21	LMP	Okay, Joe. I don't think there's any question about it from the plumbing standpoint that we could do that if we had to.
03 23 28 36	CC	Okay. Copy that.
03 23 40 35	LMP	And, how do you read, Joe?
03 23 40 40	CC	Read you pretty good, Fred. Go ahead.
03 23 40 45	LMP	I think our PTC wobble is growing worse. The Earth now is really up to the top of the window. I have to get way down almost to the floorboards to view it. Conversely, the Moon is way down at the bottom of the window.
03 23 41 06	CC	Okay.
03 23 41 09	LMP	A lot more wobble.
03 23 41 10	CC	Roger - -
03 23 41 11	LMP	Far more wobble than I noticed on my previous watch.

03 23 41 19	CC	Okay. Copied that, Fred. And our thermal people will be looking at it. One of the things we're talking about relative to the midcourse correction is we'd like not to do it before the SIIe tank goes, if it's going to go, just so it won't give us a problem reestablishing PTC. And right now our people think that the burst disk will pop around 106 hours.
03 23 41 52	LMP	Okay.
03 23 44 27	LMP	The L-shaped bag is ...
03 23 46 33	CC	Aquarius, Houston. Over.
03 23 46 39	LMP	Go ahead.
03 23 46 40	CC	Okay, Fred. Since you went ahead and used the PLSS condensate container, we got the procedure in for using it. I'm not going to read it up to you except that it cautions a little bit about shaking it too much or about filling it too full, because they feel that if you do that the vent valve might unseat and the bag might leak a little bit. Over.
03 23 47 10	LMP	Okay. We haven't removed it from its stowage spot. We just left it right in place, and just - he mated the tank at the end of the cable and hooked right into that.
03 23 47 25	CC	Understand. That's satisfactory and recommended that you leave it in the stowage spot. That should help the situation.
03 23 47 37	LMP	Roger.
03 23 48 27	LMP	We got a - we got another flow shower going on outside. Particles, seeing them vented against the service module. Jack thinks it may be an H_2 vent. ...
03 23 48 41	CC	Okay. Copy that. What window are you looking at it out of, Fred?
03 23 48 48	LMP	Out the LM docking window.
03 23 48 50	CC	The docking window. Roger that. Somebody just handed me your latest consumables status report, and you're using between 11 to 12 amps an hour real steady, and it looks real good.

03 23 49 07	LMP	Roger.
04 00 20 45	CMP	Joe, what are you showing for GET now?
04 00 20 50	CC	I think you wanted the GET, Jack, and the present GET is 96 hours 21 minutes. Over.
04 00 21 01	CMP	Okay, thank you.
04 00 21 03	CC	Okay.
04 00 21 16	CC	And Jack, Houston. For your information, FIDO tells me that we are in the Earth's sphere of influence and we're starting to accelerate.
04 00 21 29	CMP	I thought it was about time we crossed. Thank you.
04 00 21 33	CC	Roger.
04 00 21 39	CMP	We're on our way back home.
04 00 21 49	CMP	There's something that puzzles me, Joe. Vance mentioned yesterday that the planned entry is a CMC-guided entry, so I'm kind of curious as how are we going to get the alinement.
04 00 22 09	CC	Did you say how we're going to get guidance? Over.
04 00 22 14	CMP	No. How are we going to get a platform alinement?
04 00 22 18	CC	Okay. We got a number of interesting ideas on that and the latest one I've heard is to power up the LM platform and aline it, and aline the CM platform to it.
04 00 22 32	CMP	Okay. That sounds good.
04 00 22 34	CC	Okay. And we're working out detailed procedures on that, Jack.
04 00 22 39	CMP	Okay.
04 00 37 01	CC	Aquarius, Houston. Over.
04 00 37 06	CMP	Go ahead, Joe.
04 00 37 07	CC	Okay. We are taking our final look at the mid-course procedures and we have a question as to the

present position of one of the switches. The switch is the AGS STATUS switch on panel 6. We'd just like to know where it's at.

04 00 37 27	CMP	Okay. Stand by.
04 00 37 44	CMP	Okay, Joe. The AGS STATUS switch is OFF.
04 00 37 47	CC	Okay. OFF. Thank you.

END OF TAPE

04 01 14 26	SC	Houston, Aquarius.
04 01 14 37	CC	Aquarius, Houston. Go ahead.
04 01 14 42	SC	Okay, Vance. I just heard a little thump, sounded like down in the descent stage, and I saw a new shower of snow flakes come up that looked like they were emitted from down that way. We've already decided though - I wonder what the SUPERCRIT pressure looked like now.
04 01 15 02	CC	Okay. Understand you saw a thump in the descent stage and a few snow flakes. We'll take a look down here, see if we see anything.
04 01 15 46	CC	Aquarius, Houston.
04 01 16 06	CC	Aquarius, Houston.
04 01 16 10	LMP	Go ahead.
04 01 16 12	CC	Fred, we don't see anything wrong. For example, your SHe appears to be okay as far as we can see. The thing we don't have data on, is the ... tank down there.
04 01 16 30	LMP	Okay. And I doubt if it would have been that anyway.
04 01 16 35	CC	Okay. While we have you on the horn - -
04 01 16 37	LMP	We're still getting -
04 01 16 42	CC	Roger. Still getting it.
04 01 16 43	LMP	Go ahead.
04 01 16 45	CC	While you're on the horn, be advised our calculations show you might be running out of potable water in the CSM pretty soon. Also, that you might start to have hydrogen tank venting in the CSM and a question. Next time Jack looks through the sextant and telescope, we'd like him to see how it looks. Do you have anything on the optics, any specks or anything?
04 01 17 20	LMP	Okay, ...

04 01 20 05	LMP	Houston, Aquarius. How do you read?
04 01 20 09	CC	Aquarius, we read you 4 by 4. Go ahead.
04 01 20 15	LMP	Okay. It looks like the PTC is deteriorated enough that ... the docking window of the LM, and ...
04 01 20 55	CC	Aquarius, Houston. We got part of your transmission. Understand the PTC has deteriorated quite a bit and you'd like to know what to do about it. Is that affirm?
04 01 21 10	LMP	Negative. How do you read now, Vance?
04 01 21 12	CC	Okay. A little better.
04 01 21 16	LMP	Okay. The only comment was that it has deteriorated to where the Moon is now coming through the overhead docking window now, in a portion of each pass, and about that time I just lose COMM on either antenna, so there's going to be a short period of time on each revolution where we're not going to have COMM.
04 01 21 38	CC	Okay, Fred. We understand that and one more item for clarification on the water. We don't really know what your usage of potable is. That was purely an estimate assuming a fairly healthy usage.
04 01 21 57	LMP	Okay.
04 01 24 14	LMP	Hey, Houston; Aquarius.
04 01 24 20	CC	Aquarius, Houston. Go ahead.
04 01 24 25	LMP	Okay. Jack just took a look through the optics - through one REV, and he said they look good, loud and clear. He doesn't have any current condensate on either the sextant or telescope.
04 01 24 40	CC	Okay, Fred. Thanks for the info.
04 01 36 07	LMP	How do you read, Vance?
04 01 36 11	CC	Okay. I'm reading you weakly, Fred. Go ahead.

04 01 36 17	LMP	With all this other procedures you've been working on there, I thought I was going to have a new one for you. How to get four gingerbread cubes apart; I think they were stuck together with epoxy.
04 01 36 53	CC	This is in the food bag?
04 01 36 59	LMP	Yes.
04 01 37 01	CC	That's to stand loads of launch and boost.
04 01 37 07	LMP	Roger. Tool B did the trick.
04 01 37 28	LMP	Yes.
04 01 37 34	CC	Hey, Fred. John says you can use the dikes on it to get them apart.
04 01 37 42	LMP	Yes, that probably wouldn't have crumbled them as badly.
04 01 37 49	LMP	I generally don't use the subtle approach. You can tell we're feeling pretty good, Vance, when we start complaining about the food.
04 01 37 58	CC	Yes. That's good to hear.
04 01 38 11	CC	I think everybody's feeling better down here, too.
04 01 41 15	CC	Aquarius, Houston.
04 01 41 20	LMP	Go ahead.
04 01 41 21	CC	Fred, we have you on the Goldstone big dish now, and our COMM is much better. If you'd like would you turn the BIOMED switch on to either crewman there.
04 01 41 36	LMP	Okay. Stand by. I'll have to plug in first.
04 01 41 38	CC	Okay.
04 01 42 03	LMP	Okay, Vance. How do you read on baseband.
04 01 42 08	CC	We read you just - Stand by.
04 01 43 02	CC	Okay, Fred. We're receiving your MED data; it was a little slow in coming in.

04 01 43 09	LMP	Okay.
04 02 23 04	LMP	Houston, Aquarius. Are you calling?
04 02 23 08	CC	Negative. No call from here.
04 02 23 13	LMP	Okay.
04 02 26 14	LMP	And, Vance, this is Aquarius.
04 02 26 19	CC	Go ahead, Fred.
04 02 26 23	LMP	Okay. Jim's coming back on the line, and I'll be unhooking on the BIOMEDs, and you want us to go back to the SPA DOWN VOICE BACKUP?
04 02 26 44	CC	Stand by.
04 02 26 48	LMP	Okay. Jim doesn't have his BIOMED rigged on right now, so ... DOWN VOICE ...
04 02 27 07	CC	Okay, Fred. You're too weak on that last. I understand you're disconnecting, and your BIOMED will be off. Say again about Jim, please.
04 02 27 24	LMP	Okay. How do you read now?
04 02 27 26	CC	Okay.
04 02 27 30	LMP	Okay. All I said was Jim doesn't have his BIOMED rigged right now so I'll go back to DOWN VOICE BACKUP SPA and Jim's coming on the line.
04 02 27 49	CC	Okay. We copy you're in DOWN VOICE BACKUP.
04 02 28 53	CDR	Well, I'm thinking about the last 10 hours. We've lost our suit compressors.
04 02 29 02	CDR	Because we don't want to use the power.
04 02 29 18	CDR	Well, that's what I'm saying. We can use these fans right here and use the circulate air right through the use of those fans.
04 02 29 34	CDR	Are we on mike now?
04 02 29 45	CDR	Hello, Houston; Aquarius.
04 02 29 49	CC	Roger, Jim. Good morning.

04 02 29 53	CDR	Good morning, Vance. How's things going down there?
04 02 29 56	CC	Oh, quiet and smooth.
04 02 29 59	CDR	Oh, it's afternoon down there.
04 02 30 06	CC	Right. We thought maybe it was morning to you.
04 02 30 12	CDR	Well, I've sort of lost track. But I had a good sleep.
04 02 30 17	CC	Glad to hear it. Doctor just said he wondered how many hours?
04 02 30 29	CDR	Oh, let's say whenever I left Jack, and Fred came up and we ate for about an hour, and then I went to bed, so whatever that time was. It must be about 5 hours, something like that; 4 or 5 hours.
04 02 30 42	CC	Good. Glad to see you catching up.
04 02 31 42	CC	Aquarius, Houston.
04 02 31 50	CDR	Go ahead, Vance.
04 02 31 51	CC	Jim, the next time that it's convenient, could you get the readout of the REPRESS package in the command module for us? Over.

END OF TAPE

04 02 32 02	CDR	Will do.
04 02 32 04	CC	Okay.
04 02 32 08	CDR	When you go back there, Fred, they want the REPRESS package readout.
04 02 32 15	CC	We don't want you to wake anyone up to get it.
04 02 32 21	CDR	No. No one's asleep now.
04 02 33 37	CDR	It has? ..., was it? ... you get forward to it and a pretty good view of the venting.
04 02 34 13	CDR	And, Houston, Aquarius. It looks like service module venting has ceased, at least momentarily.
04 02 34 19	CC	Roger. Understand service module venting has ceased momentarily. How about the descent stage? Does Fred report venting down there? Do you still see that?
04 02 34 33	CDR	Stand by.
04 02 34 36	CDR	What is your report on descent stage venting - Was it venting? Anything else going on? Any more venting?
04 02 34 51	LMP	No.
04 02 34 52	CDR	No. Fred hasn't seen anything else from the descent stage. And I understand that we can expect the - the SHe - tank pressure to build up to relief here about 105 hours.
04 02 35 06	CC	Roger. A little later than that - like 106 - 107.
04 02 35 13	CDR	Okay.
04 02 35 43	CDR	Did you get some interior photos?
04 02 35 48	LMP	Yes.
04 02 35 52	CDR	Okay. I'd like to show them the arrangement of these hydroxide canisters. Do you have?
04 02 36 10	CC	Aquarius, Houston.

04 02 37 11	CDR	Did they give Jack any more procedures on command module powerup?
04 02 37 16	LMP	...
04 02 37 18	CDR	Did they give Jack any more procedures on command module powerup?
04 02 39 04	CDR	Well, they think it might be up here.
04 02 39 06	LMP	Okay.
04 02 39 08	CDR	The main thing we got to think about, and when we have to get to them, is the procedures for LM jettison, the transfer of the LM to CSM mode (cough), LM jettison.
04 02 39 23	LMP	...
04 02 39 24	CDR	Yes.
04 02 40 33	CDR	... the LM mode?
04 02 41 17	LMP	All we have to do is turn the BIOMED ... on, and we'll be in there.
04 02 41 34	CDR	Houston, Aquarius.
04 02 41 39	CC	Roger. Go ahead, Aquarius.
04 02 41 44	CDR	We would like permission to turn the BIOMED on to get off the hot mike mode. I don't think that we have to be on it now if you have the big dish on, do you?
04 02 42 05	LMP	Yes. Yaw's coming - or roll's coming up for it, and we were going to burn.
04 02 42 13	CC	Roger, Jim. We concur. Go ahead and turn it on.
04 02 42 18	CDR	Okay. Fine; thank you.
04 02 42 22	CC	One other point. The philosophy of timing this midcourse is based a little bit on doing it just before the SHe tank is supposed to vent. That way, we hope that we would have - - be powered up and you would have control when the venting occurs, in case you were tossed around a little bit. Over.

04 02 42 45	CDR	Okay. Understand. Philosophy on the midcourse is doing it prior to venting of the CHe tank, which means we'll be doing this around 105 hours, I suppose, or 105:30 and so I'll have control of the spacecraft if it should give us some perturbation.
04 02 43 06	CC	Roger. Then, after that, we would establish PTC again.
04 02 43 16	CDR	Roger.
04 02 48 01	CDR	Houston, Aquarius.
04 02 48 05	CC	Go ahead, Aquarius.
04 02 48 09	CDR	Our REPRESS package pressure is 820.
04 02 48 14	CC	Okay. REPRESS pressure 820. Thank you.
04 02 54 17	CC	Aquarius, Houston.
04 02 54 23	CDR	Go ahead, Houston.
04 02 54 26	CC	Jim, could you switch your BIOMED switch to the position opposite to where it is now? We are getting a subcarrier, but no data. Over.
04 02 54 45	CDR	Now you know, Houston, I don't have BIOMED on.
04 02 54 53	CC	Okay. And we have a small addition to the procedure that was read up to you earlier, which involves power transfer from the LM to the CSM.
04 02 55 17	CDR	Stand by 1.
04 02 55 19	CC	Okay.
04 02 55 59	CDR	Okay, Houston. Go ahead.
04 02 56 02	CC	Okay. At the end of the procedure, after the step BAT 5 and 6, OFF, add the following: circuit breakers, panels - panels 11 and 16, ASCENT ECA CONTROL, both open. Over.
04 02 56 37	CDR	Okay. After the step BAT 5 and 6, OFF, step 3 will be circuit breakers panels 11 and 16 ASCENT ECA CONTROL, both open.
04 02 56 50	CC	That's correct, Jim. And this is to guard against a single-point failure that - a remote possibility that would preclude you from getting the batteries back on.

04 02 57 04	CDR	Roger.
04 02 58 20	CC	Go ahead.
04 03 49 43	CDR	Houston, Aquarius.
04 03 49 47	CC	Go ahead, Jim.
04 03 49 52	CDR	Okay. We just had a battery warning ... Battery 2.
04 03 50 07	CC	Stand by, Jim. The COMM's no good here right now.
04 03 50 20	CDR	Houston, Aquarius. How do you read now?
04 03 50 23	CC	Go ahead. Loud and clear.
04 03 50 26	CDR	Okay. We just had a battery warning MASTER ALARM, and it looks like it's battery 2.
04 03 50 38	CC	Roger.
04 03 50 48	CC	Roger, Houston - This is Houston. Could you close the POWER AMP circuit breaker, and we'll get some high bit rate?
04 03 50 56	CDR	Roger.
04 03 51 08	CDR	It's closed.
04 03 51 09	CC	Okay. And we need high bit rate.
04 03 51 49	CDR	Are you picking it up, Houston?
04 03 51 53	CC	Roger. And we want to open the BAL LOAD CROSS TIE on panel 16. Over.
04 03 52 00	CDR	Say again.
04 03 52 01	CC	Open the BAL LOAD CROSS TIE breaker on panel 16. Over.
04 03 52 08	CDR	Open BALANCE LOAD CROSS TIE breaker on 16. Roger.
04 03 52 11	CC	That's affirm.
04 03 52 13	CDR	It's open.
04 03 53 12	CDR	If you're getting high bit data, we could do an OFF/RESET and go back on on battery 2. We're standing by for that.

04 03 53 29	CC	Okay. Could you turn off battery 2, and leave it off and let us look at it?
04 03 53 36	CDR	Say again. You want us to turn off battery 2, and leave it off until you look at it?
04 03 53 39	CC	That's affirmative.
04 03 53 42	CDR	Okay. Battery 2 coming off the line.
04 03 54 27	CC	Okay, Aquarius. So you want to stay in this configuration for awhile, and let's look at the battery.
04 03 54 34	CDR	Roger. We'll stay in this configuration.
04 03 54 41	CC	Want to close the BAL LOADS circuit breaker back now.
04 03 55 00	CC	13, Houston. We want to close the BAL LOADS circuit breaker on panel 16 now, again.
04 03 55 08	CDR	We have it closed; the closed - BALANCE LOADS circuit breaker is closed.
04 03 55 13	CC	Roger.
04 03 55 41	CC	Aquarius, Houston. Request RANGE FUNCTIONS switch to RANGE ...
04 03 55 49	CDR	All right. RANGE FUNCTIONS switch going to RANGE.
04 03 55 53	CC	Right-o.
04 03 57 33	CC	Aquarius, Houston.
04 03 57 49	CC	Aquarius, Houston.
04 03 57 54	CDR	Go ahead, Houston.
04 03 57 56	CC	Jim, on the battery problem, we have determined that it is not overcurrent or reverse current. We suspect it's over-temp, but don't know for sure, so we're going to watch it for awhile.
04 03 58 12	CDR	Okay.
04 04 00 20	CC	Aquarius, Houston.

04 04 00 25	CDR	Go ahead, Houston.
04 04 00 27	CC	Jim, Charlie has some procedures to read up for you here; I think you'll need your activiation checklist, if it's handy.
04 04 00 38	CC	Aquarius, that's the contingency checklist.
04 04 00 40	CDR	Okay. I'll just - Okay. Stand by, Charlie.
04 04 01 12	CDR	Okay, Charlie. I've got the contingency checklist, and standing by.
04 04 01 16	CC	Okay, Jim. We'd like you to turn to page - page 24, which is the "30-Minute Activation," and this is going to be a procedure for the midcourse burn that we got coming up at 105 with the AGS up. Over.
04 04 01 36	CDR	Roger. On the midcourse at 105, and I'm on page 24.
04 04 01 41	CC	Okay; "30-Minute Activation," omit steps 1, 2, and 3; perform step 4, "RCS system A/B-2." Over.
04 04 01 58	CDR	Roger. Omit steps 1, 2, and 3; perform step 4.
04 04 02 03	CC	Roger. And on the "EPS Activation," same page, perform step 1; and in step 2, perform line number - line number 6, "EPS DISPLAY-CLOSE." Over.
04 04 02 28	CDR	Okay. On "EPS Activation," perform step 1, and perform step 2, line 6 only; is that correct?
04 04 02 37	CC	That's affirmative, Jim. The rest of the stuff is already closed at this time, so that's all we'll have to do is close the EPS DISPLAY breaker.
04 04 02 57	CDR	Okay.
04 04 02 58	CC	All right. Turn to page 25. On page 25, omit step 3; perform step 4. On step 4, last line, scratch "CB(16) EPS: INVERTER 2, closed." Over.
04 04 03 25	CDR	Roger. Omit step 3; perform step 4, except for the last line. Circuit breaker 16, EPS INVERTER 2, closed.

04 04 03 34	CC	Roger. That's correct. On step 5, perform step 5. Under "Primary Glycol Loop Activation," step 1, line 1, "CB(16) ECS: DISPLAY - CLOSE." That's a crew option; you can have it if you want to. Omit the rest of step 1 and step 2. Perform step 3. Over.

END OF TAPE

04 04 04 11	CDR	Okay. On primary glycol loop activation, crew option on step 1, first line; the rest of it we'll omit. Step 2, we'll omit, and we'll do step 3.
04 04 04 27	CC	That's affirmative, Jim, with the following DELTAs on step 3, and if you'll turn to page 26, I'll give you the DELTAs on the activation circuit breaker list. Over.
04 04 04 43	CDR	Okay. I'm there.
04 04 04 45	CC	Roger. On line 1, correction, row 1, under AC BUS A: TAPE RECORDER should be open; DECA GIMBAL, open. All the other ones as shown on the page. Over.
04 04 05 12	CDR	Okay. On row 1, AC BUS A: TAPE RECORDER and DECA GIMBAL will be open. All the rest as shown.
04 04 05 20	CC	Roger. And we don't know the status of your windows. If you - During this burn, we're going to have to look out the forward window to get the alinement with the COAS, so you might need the commander window heater and you can, of course, use that breaker if needed, since we do have the AC power. On row 2 - Go ahead. Over.
04 04 05 46	CDR	I don't think we'll need it, Charlie.
04 04 05 47	CC	Okay; fine, Jim. On row 2, under RCS SYSTEM A: ASCENT FEED 2 and ASCENT FEED 1 should be open. Under FLIGHT DISPLAYS: MISSION TIMER should be open; GASTA, open; ORDEAL, open. Under AC BUS A: GASTA, open. The rest are as shown on the page. Over.
04 04 06 28	CDR	Okay. On row 2, we're going to open up ASCENT FEED 2 and ASCENT FEED 1 under RCS SYSTEM A. We're going to open up the MISSION TIMER, and FLIGHT DISPLAYS: the GASTA and the ORDEAL; and the AC BUS A: the GASTA.
04 04 06 46	CC	That's affirmative. Okay. Row 3, under PROPELLANT: DESCENT HELIUM REG/VENT should be open. Under HEATERS: RENDEZVOUS RADAR STANDBY, open; LANDING RADAR, open. Under STAB/CONTROL: ATCA (PGNS), open. Under ED and LIGHTING: all four open. Over.

04 04 07 35	CDR	Okay. Row 3, under PROPELLANT - propulsion: the DESCENT HELIUM REG/VENT will be open: the STANDBY RENDEZVOUS HEATER will be open and the LANDING RADAR HEATER circuit breaker will be open. I just changed antennas; and, keeping on down the line, ATCA PGNS will be open and the last four circuit breakers, two under ED and two under LIGHTING, will be open.
04 04 08 07	CC	That's affirmative. Okay. Under row 4, under ECS: GLYCOL PUMP AUTO TRANSFER, close. Under COMM: UP DATA LINK, open; VHF B and VHF A should be open. Under PGNS: LGC/DSKY, open; IMU OPERATE, open. Over.
04 04 08 50	CDR	Okay. Under row 4, the AUTO TRANSFER will be close. UPDATA LINK, open; VHF A and B, open; DSKY, open; and IMU OPERATE, open.
04 04 09 09	CC	That's affirm. On the last row, the only DELTA is under the CROSS TIE BUS and it should be open. Over.
04 04 09 20	CDR	Say that again, Charlie.
04 04 09 22	CC	Okay. Under the last row, under EPS is the only DELTA and that is under the CROSS TIE BUS. It should go open. Over.
04 04 09 34	CDR	Roger. The CROSS TIE BUS should go open.
04 04 09 38	CC	That's affirm. Going on to page 27, Activation, panel 16. Under RCS SYSTEM Bravo: ASCENT FEED 1, ASCENT FEED 2 should be open. Under PROPULSION: PQGS should be open; ASCENT HELIUM REG, open. Over.
04 04 10 12	CDR	Okay. Line 1, on panel 16, ASCENT FEEDs 1 and 2 will be open. And the PQGS will be open, and the ASCENT HELIUM REG will be open.
04 04 10 24	CC	That's affirmative. On the next three rows, we only get the nine DELTAs, so I'll go through the next three rows completely and then you can read those back. Under LIGHTING - -
04 04 10 36	CDR	Okay.
04 04 10 37	CC	Under LIGHTING: FLOOD, open; TRACK, open. Under ED LOGIC - Correction, under ED: LOGIC, open. Under STAB/CONTROL: DESCENT ENGINE OVERRIDE,

		open. Under ECS: SUIT FLOW CONTROL, open. Under row 3, COMM: DISPLAY, open; VHF A TRANSMITTER, open; VHF B RECEIVER, open. Under ECS: DISPLAY, that's crew option. Last row, under EPS: INVERTER 2, open. Over.
04 04 11 45	CDR	Okay. On the last three rows, we have FLOOD and TRACK circuit breakers, row 2, open; LOGIC POWER B, open; DESCENT ENGINE OVERRIDE, open; SUIT FLOW CONTROL, open. On the third row - row, DISPLAY, open; VHF A and - VHF - VHF A TRANSMITTER, open; VHF B RECEIVER, open. And under ECS: we have DISPLAY, open, at crew option. And the last one, INVERTER 2 under EPS, will be open.
04 04 12 23	CC	Roger. That's a good readback. Under that ECS DISPLAY, it shows it closed. If, with it closed, you can have some readout of - onboard readout of your ECS system - draws a lot less than a half amp so it's up to you whether you want it or not. Okay, on page 28.
04 04 12 42	CDR	Roger.
04 04 12 44	CC	On page 28, step - perform step 4 with the following changes in the warning light status. Under the warning lights, you will probably - you will have ASCENT PRESSURE and an LGC light. Scratch "RCS A and RCS B REG." Under caution lights, you'll have a PRE AMPS light. Over.
04 04 13 20	CDR	Roger. Under warning, we'll have ASCENT PRESSURE and LGC; and under caution, we'll have a PRE AMP.
04 04 13 27	CC	Affirmative. Under "VHF/S-band Activation and Checkout," scratch step 1. Under step 2, change "DOWN VOICE BACKUP" to VOICE." Scratch step 3. Under "PGNS turn on," scratch entire procedure. Under "DAP Set/Gimbal Drive," scratch entire procedure. Over.
04 04 14 13	CDR	Okay. Under "VHF/S-band Activation and Checkout," scratch step 1. Do step 2 with the following change, "DOWN VOICE BACKUP" to "VOICE." Scratch step 3. Scratch the entire remaining events that page. Over.
04 04 14 32	CC	That's affirmative, Jim. Going on to page 29. We've got - At this point, there's a write-in required. It's about a six or seven liner, and I'll try to go fairly slowly and let you write it down, if you're ready to copy. Over.

04 04 15 03	CDR	Ready to copy.
04 04 15 05	CC	Okay. At this point, we'd like you to "Verify RCS heaters in AUTO for 15 minutes."
04 04 15 19	CDR	Is that the first step, Charlie?
04 04 15 20	CC	That's affirmative. What we're trying to do here is we're getting you set up in an attitude so you can damp your rates and come out of PTC. And this is the configuration I'm reading you now, the next - in the next six lines, the procedure for getting you into a configuration to damp the rates and stop PTC. Over.
04 04 15 43	CDR	Okay. So the first thing will be to - "Go to AUTO on the RCS SYSTEM A and B"?
04 04 15 50	CC	It's the "Verify that the heaters have been in AUTO for 15 minutes." Back on the first page of this procedure, you put the heaters in AUTO and you pushed the breakers in, and we'd like for them to warm up the quads for 15 minutes before we start to - stop at - stopping PTC. Over.
04 04 16 12	CDR	Roger, "Verify heaters RCS on for 15 minutes."
04 04 16 16	CC	Okay. Step 2: "BALANCE COUPLE, OFF; DEAD BAND, MINIMUM; ATTITUDE CONTROL: PITCH and ROLL to PULSE; YAW to DIRECT; MODE CONTROL: AGS, ATT HOLD; GUIDANCE CONTROL to AGS; damp rates; pitch and roll with the TTCA, yaw with the ACA with the Earth in the front window." Over.
04 04 17 45	CDR	Okay, let's see if I got it. Step 2 is "BALANCE COUPLE's OFF; DEAD BAND, MIN; ATTITUDE CONTROL: PITCH and YAW at PULSE; YAW, DIRECT. MODE CONTROL will be in AGS, ATT HOLD; GUIDANCE CONTROL will be in AGS; we'll damp the rates; pitch and roll with the TTCA, and yaw with the ACA; and we'll probably have to have some reference point, so I have to try and stop on the Earth." Over.
04 04 18 14	CC	Roger, Jim. We were hoping that in your PTC that you occasionally see the Earth coming through the window; and, if that's true, then we'd like you to have to - just damp the rates with the Earth in the forward window. And then we'll give you the burn attitude via the forward window on the Earth momentarily. Over.

04 04 18 44	CDR	Roger.
04 04 18 46	CC	Okay. That was the entire procedure for damping the rates, only - though I only gave you - said it was step 2, that was the entire procedure. Now, continuing on to what's printed on page 29 - Correction, you had one error in the readback under ATTITUDE CONTROL. It was PITCH and ROLL to PULSE; YAW to DIRECT. Continuing on, on page 29 with the printed procedure, the first four lines, scratch. Step 3, scratch. Under "AGS Activation," one change: add a step. First step will be "Verify ASA CB(16) in for 10 minutes." The rest of the AGS activation is as printed. Over.
04 04 20 02	CDR	Okay. "Verify ASA circuit breaker 16 in for 10 minutes"; and, I take it, 10 minutes back in our procedures we'll have a note saying to put that in.
04 04 20 14	CC	It's - the circuit breaker goes in on the circuit breaker activation page, Jim. So, by the time we get here and have the rates all damped, we feel that - that the PIPAs will be up to temperature by this time, and we can go ahead and turn it - turn the AGS on at this time. Over. But we just want you to verify that.
04 04 20 36	CDR	Okay. And one other question, Charlie. I'd like to know if the note you gave me about damping the rates is before the other information on page 29.
04 04 20 49	CC	That's affirmative. Add that in to the top of the page. The - What we're really doing - Let's - let's put it in to right before the "AGS Activation." The other - the other procedure on the top of the page belongs with the "DAP Set Gimbal Trim," and we're just omitting all of that procedure. So the addition that - on the damping, the rates should really go in right before the "AGS Activation." Over.
04 04 21 20	CDR	Understand.
04 04 21 22	CC	What we're really trying to do is get you in a posture so that when you see the Earth come through the window, you can damp her out and hold - hold the Earth in the window. Proceeding on to the rest of page 29, under "RCS PRESS," scratch the entire three steps as printed. On page 30, scratch step 4 under the "RCS PRESS." Over.

04 04 21 55	CDR	Roger. Under "AGS Activation," well, I included that step on the ASA circuit breaker and we'll do step 1 and 2 under "AGS Activation." But then we'll scratch steps 1, 2, and 3 under "RCS PRESS" and, on page 30, we'll scratch step 4.
04 04 22 12	CC	Affirm. Under "DPS PRESS," step 1, line 1, scratch. Line 4, "DESCENT HELIUM REG 1, talkback barber pole." Under step 2, scratch; step 3, scratch; "LANDING GEAR DEPLOY," scratch. Over.
04 04 22 47	CDR	Okay. Under "DPS PRESS," we'll scratch the first line and we'll have the "DESCENT HELIUM REG, talkback to barber pole." We'll scratch steps 2 and 3, and we'll scratch the "LANDING GEAR DEPLOY."
04 04 23 03	CC	Roger. Now we got, on the back of page 30, Jim, you've got a blank page in your checklist, or should have, and we'd like to add a procedure to get you to burn attitude. Over.
04 04 23 20	CDR	Okay. A procedure to get the burn attitude.
04 04 23 24	CC	Okay. First statement is a statement: "Verify AGS in OPERATE for 5 minutes." Then we go to "AGS address 400 plus 5, then 400 plus zero. ATTITUDE CONTROL: PITCH and ROLL to PULSE; YAW, MODE CONTROL. Maneuver using TTCA pitch and roll." The computer is controlling yaw, but you can override with ACA. You with me? Over.
04 04 25 08	CDR	Okay, Charlie. I'm with you so far.
04 04 25 11	CC	Okay, Jim. "When in attitude, ACA out of detent to zero error needle. Then set VENT TIMER," and we'll give you a countdown on that when you get to that step. Over.
04 04 25 52	CDR	Okay. "When in attitude, ACA out of detent to null needles, and set DET."
04 04 25 58	CC	Roger. Now, that - the burn attitude will be coming up on a pad, but, basically, we're looking for a local horizontal retrograde burn, which means, using a COAS, if you put the horizontal line on the COAS on the horns of the Earth and then roll to place the X-axis in the direction of the Sun, we'll - that will put us in both burn attitude; and you can check that via the Sun which will be in the AOT detent 2. Should lie right

along the cursor at the top. We'll have some more words on that for you momentarily. Now, I'd like to go on to page 31 if you're ready. Over.

04 04 27 01 CDR Okay. I figure I have a handle on the attitude, the way the Earth should look in the COAS, and you're going to give me some words on what the Sun would look like in the AOT. Is that right?

04 04 27 14 CC That's affirmative, Jim. We haven't got a picture of it yet. It's going to be in the top part of the COAS - Correction, top part of the AOT at the top of the - the top of detent 2 and the top part of the AOT, and it should, in attitude, if you're right on the Sun, should split the cursor, though that roll angle is not too critical; if we're in about 10 degrees, we'll be okay. We - but I think - we think you should be able to get it better than that. On page 31, under the "DPS Burn Technique," you can scratch the bottom part below the little diagram there since the gimbal is locked. Over.

04 04 28 07 CDR Understand scratch the bottom part underneath the diagram because the gimbal is locked.

04 04 28 12 CC That's affirmative; and, since the gimbal was trimmed out at the big burn yesterday, we should be still through the c.g., and we'd like to make sure that Jack sits in the same place for this burn that he did yesterday. That way, we'll - you should have no trouble controlling attitude. Now I'm ready to go over to page 32. Over.

04 04 28 42 CDR Okay. Let me see if I have that right, now. You want Jack to sit in the same attitude so that the gimbals are the same place so you don't have trouble controlling attitude. I got it.

04 04 28 50 CC Okay. Now on page 32, top of the page, first line, scratch "VERB 76." Third line, "MODE CONTROL: AGS, ATT HOLD." At "Minus 6 minutes," scratch lines 1, 2, and at "Burn Attitude," scratch "VERB 40 NOUN 20." Scratch lines 2, 3, and 4. Now at "Burn Attitude," we want you to do a "400 plus 5" and then a "VERB - a 400 plus zero." And we have a caution note at this point. Over.

04 04 29 57 CDR Go ahead.

04 04 29 59	CC	Okay. The caution is after "400 plus zero": Do not go out of detent on ACA again." Over.
04 04 30 33	CDR	Okay. After the last "400 plus zero," "Do not go out of detent with ACA." Is that correct?
04 04 30 38	CC	That's a Roger, Jim. What happens is, of course, we set - when you go out of detent, you reset the AGS error needles and you - and you lose your attitude reference. You establish a new attitude reference, and it might not be the burn attitude since, at this point, we're controlling attitude with the TTCA. Now, picking up with the "VERB 37, ENTER," scratch. Scratch everything down to the "404 plus zero," and we want you to perform those AGS steps with 404 down through 470. Over.
04 04 31 23	CDR	Okay. We'll scratch everything down to "404 plus zero," and we'll perform those four steps.
04 04 31 29	CC	Roger. Turning over to page 33. Minus 4 minutes. Okay. Moving down the page, it's about line 7, to "ENGINE GIMBAL": "ENGINE GIMBAL, OFF." Down to "MODE CONTROL," make that read "MODE CONTROL: AGS, ATT HOLD," and then scratch "PROPELLANT QUANTITY MONITOR, DESCENT 1." Over.
04 04 32 16	CDR	Okay. At 4 minutes, "ENGINE GIMBAL" will be "OFF"; "MODE CONTROL" will be to "AGS, ATT HOLD"; "PROPELLANT QUANTITY MONITOR, DESCENT 1," scratched.
04 04 32 27	CC	Roger. Picking up at minus 1 minute, scratch "MASTER ARM, ON." Minus 35 seconds, scratch first two lines. At minus 10 seconds, change that to "Minus 9 seconds"; so, at "Minus 9 seconds," it will be "Manual Ullage." At 2 seconds, scratch "CMC MODE, FREE," and scratch "ACA out of detent." At - after "IGNITION," at plus 1 second, "Terminate Ullage." Are you with me? Over.
04 04 33 36	CDR	Okay. At 1 minute, "MASTER ARM," we scratch. At 35 seconds, scratch the first two lines. "Manual Ullage" will start at 9 seconds; we're scratching the blocks at 02 seconds; and the line beneath that, at plus 1 second, we "Terminate Ullage."
04 04 33 56	CC	That's affirm. Picking up at plus 5 seconds; scratch the rest of the page. "TTCA, attitude control; and MASTER ARM, OFF." Over.

04 04 34 14	CDR	Scratch the remainder of the page.
04 04 34 18	CC	Okay. Now, like to verify that under the 35 seconds, minus 35 seconds, the only thing you have remaining is "ENGINE ARM to DESCENT." Over.
04 04 34 30	CDR	That's affirm. That's the only thing I have.
04 04 34 32	CC	Okay. Turning to the next page and the last page, Jim, 34. Top of the page, "Monitor DELTA-V_X via 470." Scratch next two lines, "When propellant quantity equals 37" and the "DESCENT HELIUM REG." Scratch "TTCA commander, reduce to 10 percent." Now we want you to add a line; "shut" - It's a shutdown criteria, "shutdown on burn time minus 1 second." Over.
04 04 35 35	CDR	Okay, "The shutdown is on burn time minus 1 second." Let me give you an example. If we have a 30-second burn, we're going to shut down at 29 seconds. Is that correct?
04 04 35 47	CC	That's affirmative. We'll give you the pad, be coming up here from FIDO in a couple of hours, I guess, when we stabilize out on our tracking. The reason for - If you're ready to copy out a couple of more steps, and then I'll explain the reason we want to shut down on this burn time minus 1 second. Picking up on "When DELTA-V_X - -
04 04 36 09	CDR	Okay.
04 04 36 10	CC	- - When DELTA-V_X equal to the final DELTA-V_X," scratch that line. Scratch "ATTITUDE CONTROL: YAW, to PULSE." Add - Correction, scratch "Damp excessive rates via LM Y, Z translation" and add at that point "Null" error needles. Trim address 470 to 0.1 foot per second." Over.
04 04 37 04	CDR	Okay, going through. After the "Shutdown on burn time minus 1 second," we scratch the next line; and we scratch "ATTITUDE CONTROL: YAW, to PULSE"; we scratch "Damp excessive rates via LM Y, Z translation"; we add the line "Null" error needles, trim - Null the error needles and trim address 470 to - What was the value there, Charlie?
04 04 37 30	CC	"0.1 foot per second." The reason we are shutting down on the burn time is, since the ASA breaker has been out for so long, we're not real confident that our AGS PIPAs are going to be super-sharp.

So we want to make sure that we just get a burn time - no overburn; so we're shutting down on burn time minus 1 second. And then that will allow us a plus-X translation to trim 470 if it looks okay. If we had an overburn, we'd be in - -

04 04 38 09 CDR Okay.

04 04 38 10 CC - - if we had an overburn, we'd be impinging on our command module to try to trim it out, so that's our reasoning there. Over.

04 04 38 20 CDR Okay. Understand.

04 04 38 21 CC Okay. Picking up in the middle of the page, that - a block "CMS resume attitude control," scratch. Scratch the next line; "PRO VERB 96." Scratch the third line; "PROPELLANT QUANTITY MONITOR, OFF." Over.

04 04 38 43 CDR Okay. We'll scratch the blocks, and we'll scratch the "PRO VERB 96"; then we'll scratch "PROPELLANT QUANTITY MONITOR, OFF."

04 04 38 51 CC Roger. Now, at the bottom of that page, I have a procedure for you to reestablish PTC. Over.

04 04 39 30 CDR To reestablish PTC. Go ahead.

04 04 39 33 CC Okay. First line, "ATTITUDE CONTROL, three to PULSE"; line 2, "Roll with the TTCA until attitude is roll, plus or minus 90; pitch, 0; yaw, 0." Over.

04 04 40 39 CDR Okay. Step 1, "ATTITUDE CONTROL, three to PULSE"; 2, "Roll with the TTCA ... pitch is 0 and yaw is 0," and I think that will be on the AGS ball.

04 04 40 56 CC That's affirmative. You broke up there for a minute, Jim. We'll do that on the AGS ball from the burn attitude. We just want you to roll either way 90 degrees, keep pitch 0 and yaw 0. Now, step 3; "When at - when at attitude, ACA out of detent." Step 4; "ATTITUDE CONTROL: YAW, to MODE CONTROL. When rates are less than 0.05, ATTITUDE CONTROL: YAW, to PULSE."

04 04 41 52 CDR Okay, Charlie. Can you hold up here a second? I lost you.

04 04 41 55 CC Roger.

04 04 42 00	CDR	Start with step 3 again. "When attitude - When at attitude, ACA out of detent."
04 04 42 09	CC	That's Roger. Next step, step 4: "ATTITUDE CONTROL to YAW" - Correction, "ATTITUDE CONTROL: YAW, to MODE CONTROL." Over.
04 04 42 33	CDR	Okay. Step 4 is "ATTITUDE CONTROL: YAW, to MODE CONTROL."
04 04 42 37	CC	Roger. Step 5: "When rates are less than 0.05 degrees per second, ATTITUDE CONTROL: YAW, to PULSE."
04 04 43 08	CDR	Okay. "When rates are less than 0.05 degrees per second, ATTITUDE CONTROL: YAW, to PULSE."
04 04 43 16	CC	Roger. Step 6: "Spin up to 0.3 degree per second in yaw," and that takes about 21 pulses. Step 7 - Yes.
04 04 43 49	CDR	Okay. Go ahead.
04 04 43 51	CC	Okay. Step 7: "MODE CONTROL, AGS, OFF."
04 04 44 09	CDR	Okay. Step 6 was "Spin up to 0.3 degrees per second in yaw"; that's about 21 pulses. Step 7 was "MODE CONTROL, AGS, to OFF."
04 04 44 19	CC	That's affirm. Step 8: "Power down per power" - Correction, "Power down per contingency checklist page Power 5." Over.
04 04 44 46	CDR	Okay. And step 8 is Power down per contingency checklist Power 5," and I take it that's been revamped considering our situation. Okay.
04 04 44 56	CC	That's affirmative, Jim. That's the one we gave you last night after the big burn, and we'll use that one as modified by - by us. This - we tried this PTC under AGS in the simulator and, of course, no slosh or anything, but it seemed to work pretty good by nulling the rates using the TTCA in pitch and roll and letting the AGS do it in yaw. You null the rates by looking at the error needles and just watching those, and when they don't - when they stop moving, then you got it within the limits of what we want. Over.

04 04 45 40	CDR	Okay. And I guess, Charlie, you have no - Do you have a ATT hold mode in pitch and roll at all in this configuration we're in, or do we have to use the TTCA?
04 04 45 52	CC	We feel like we have to use the TTCA. The AGS gains are not too good in pitch and roll in this configuration. It'll hold it in yaw but it won't in pitch and roll. Over.
04 04 46 07	CDR	Okay.
04 04 46 09	CC	And you'll have - During the burn, of course, you'll be controlling pitch and roll via the error needles with the TTCA also, and it's the little scheme that we've practiced in some of the SIMs. Over.
04 04 46 28	CDR	Right. Understand.
04 04 46 37	CDR	And, Houston, want to make sure that we allow enough time to get to the proper attitude for the burn so that we can be sure we establish the proper attitude and don't have to rush the burn.
04 04 46 51	CC	Roger, Jim. We - we're looking right now, tentatively, at starting this about 45 minutes before the burn and our sensitivity is - not too bad on this burn. We can go 30 minutes either way and not affect our DELTA-V. Over.
04 04 47 11	CDR	Okay. Fine. And do you have a handle on just how long the burn will be? In time?
04 04 47 17	CC	It's looking like at about 7.8 seconds and about 15 - Correction, 7.8 feet per second and about 15 seconds. Over.
04 04 47 30	CDR	In about 18 seconds?
04 04 47 32	CC	Negative. 15. 1 5.
04 04 47 37	CDR	1 5. Okay.
04 04 47 39	CC	And one other point is that we'd like to remind you that this is going to be in blowdown and both REGs B closed but we've got plenty at the 10 percent.
04 04 47 54	CDR	Understand.

04 04 47 57	CC	And, Jim, in the simulator with our configuration that we had here, the thing is real stable at 10 percent, so we don't think you'll have to tweak very much at all using the TTCAs. Over.
04 04 48 11	CDR	Okay. Understand.
04 04 48 14	CC	And I'll give you back to Vance. Thank you.
04 04 48 20	CDR	And thank you.
04 04 50 08	CC	Aquarius, Houston.
04 04 50 13	CDR	Go ahead, Houston.
04 04 50 15	CC	Jim, regarding your number 2 battery, we think that it's probably a sensor failure, a temperature sensor failure that's caused this alarm, rather than an actual overtemp of the battery; the reason being that we haven't seen any higher temperatures in the glycol loop. We expect to put the battery back on about 101 hours. That'll be about 10 minutes, and then we'll look at it some more there. Over.
04 04 50 49	CDR	Okay. Concerning number 2 battery, you think it might be a sensor failure because you haven't seen any changes, and you're going to put the battery back on the line in about 10 minutes.
04 04 50 58	CC	That's affirm.
04 04 51 02	CDR	Okay.
04 04 58 47	CDR	Houston, Aquarius.
04 04 58 51	CC	Go ahead, Jim.
04 04 58 55	CDR	For information, Vance, about a half hour ago, I guess, Jack and I couldn't see constellations at certain spacecraft attitudes, stars. We could see the - Scorpio and Sagittarius and we could see Altair or Acrux and Alpha Centuri, Vega, stars of that magnitude, and our venting has stopped which allows us now to differentiate between the particles and the stars.
04 04 59 28	CC	Roger; copy. Understand you can see the stars pretty well. Were you, at that time, in an attitude facing away from the Sun? I presume this is very attitude critical.

04 04 59 44	CDR	Yes. It is somewhat, Vance. If we have the Sun shining off the quads, it sort of ruins our vision; and also, if the Earth or the Moon are in the general field of view, we can't see anything.
04 04 59 58	CC	Okay. Thank you.
04 05 01 40	CC	Aquarius, Houston.
04 05 01 46	CDR	Go ahead, Vance.
04 05 01 48	CC	Jim, we're ready to put that battery back on the line. Request you open the CROSS TIE BAL LOAD circuit breaker, panel 16, and then put back - BAT 2 back on the line.
04 05 02 05	CDR	Okay. First of all, we'll open the BALANCE CROSS TIE breaker on panel 16.
04 05 02 12	CC	That's affirm.
04 05 02 27	CDR	Okay. The CROSS TIE BALANCE LOAD circuit breakers is in now, Vance. Now you want us to put battery 2 back on. Is that affirm?
04 05 02 34	CC	Did you say it was in, or did you pull it out?
04 05 02 39	CDR	No. It's in; do you want it out?
04 05 02 42	CC	That's affirm. We'd like it out, and then BAT 2 on the line.
04 05 02 47	CDR	Okay. Coming up. BAT 2 is on the line. We have a MASTER ALARM and a BATTERY light.
04 05 03 02	CC	Copy. And - and we think that's probably an indication of the sensor problem, but stand by.
04 05 05 02	CC	Aquarius, Houston.
04 05 05 07	CDR	Go ahead, Houston.
04 05 05 09	CC	Jim, it looks to us like your battery is good, that this is in fact a sensor problem; therefore, request you close the CROSS TIE BAL LOADs on - circuit breaker on panel 16. Advise - -
04 05 05 26	CDR	Okay.
04 05 05 27	CC	- - advise that you will not have any malfunction indication on any of your batteries now, but we can watch it from the ground. Over.

04 05 05 39	CDR	Okay. We'll close the CROSS TIE BALANCE LOAD circuit breaker at this time.
04 05 05 47	CC	Roger. Copy.
04 05 05 49	CDR	That's closed, and we don't have any warning on any of the batteries, but you can monitor from the ground.
04 05 05 53	CC	That's affirm.
04 05 06 03	CC	And, Jim, we have a lengthy procedure here for powering up the CSM and turning on instrumentation so we can check the TM, and this will take a large piece of scratch paper whenever you're ready to copy.
04 05 06 22	CDR	This is to power up the CSM?
04 05 06 24	CC	That's affirm.
04 05 06 27	CDR	Okay. I'll tell you what, I'll have Jack get configured. He can copy that down and I'll have him - we'll get the stuff. Stand by.
04 05 06 33	CC	Okay.
04 05 07 35	CMP	Okay, Vance, how do you read the Aquarius?
04 05 07 39	CC	Okay, read you loud and clear, Aquarius. Is it cool in there now?
04 05 07 44	CMP	Okay. Yes, it's pretty cool. This is the third officer on this LM crew here. Ready to copy.
04 05 07 55	CC	Okay. Jack, this is a lengthy procedure, take probably two or three pages. It assumes that you are in your nominal configuration, which was sent up - or in your day-flying configuration, which was sent up to you earlier today.
04 05 08 15	CMP	Okay. I can verify that we are in that configuration with the exception of panel 382, the water accumulator, which I've left off in case we wanted to get some more drinking water out of the command module, and I'll put those in the proper configuration before we do anything.
04 05 08 38	CC	Okay. Ready to copy?
04 05 08 43	CMP	Okay. Go ahead.

04 05 08 45	CC	Okay. Panel 4: TELCOMM, GROUP 1, to AC1. Panel 5: close the following circuit breakers: ECS, PRESS GROUP 1, MAIN B; ECS, PRESS GROUP 2, MAIN B; ECS, TEMP, MAIN B; ECS, SECONDARY LOOP TRANSDUCER, MAIN B; ECS RAD, CONTROL/HEATERS, MAIN B; BAT RELAY BUS, BAT B; BAT CHARGER, BAT B, CHARGE - or to B, CHARGE; INVERTER CONTROL, 2; INVERTER CONTROL, 1; EPS SENSOR SIGNAL, AC1; EPS SENSOR SIGNAL, MAIN B; EPS SENSOR UNIT, AC BUS 1; WASTE/POTABLE WATER, MAIN B; INSTRUMENTS, ESS, MAIN B; that's ESSENTIAL, MAIN B. Are you with me?
04 05 11 32	CMP	Okay, Vance. Are you with me?
04 05 11 34	CC	Roger. Why don't you read that group back, and then we'll proceed on.
04 05 11 39	CMP	Okay, sounds good. Because I don't know where I - how far I lost you. Okay, panel 4; TELCOMM, GROUP 1, to AC1. On panel 5, close the following circuit breakers: ECS, PRESSURE GROUP 1, MAIN B; ECS, PRESSURE GROUP 2, MAIN B; ECS, TEMP, MAIN B; ECS, SECONDARY LOOP TRANSDUCER, MAIN B; ECS RAD, CONTROL/HEATERS, MAIN B; BAT RELAY BUS, BAT B; BAT CHARGER, BAT B; INVERTER CONTROL, 2; INVERTER CONTROL, 1; EPS SENSOR SIGNAL, AC1; EPS SENSOR SIGNAL, MAIN B; EPS SENSOR UNIT, AC1; WASTE/POTABLE H_2O, MAIN B; INSTRUMENTATION, ESSENTIAL, MAIN B.
04 05 12 41	CC	Okay. That's all correct. Is that reading rate okay for you?
04 05 12 48	CMP	Yes, that's fine.
04 05 12 50	CC	Okay, and leave a little space if you can to the right of these because when we talk about the backup procedure, why then we can just use the same listing, and I'll - I'll tell you open instead of close these circuit breakers, or at least most of them. Over.
04 05 13 12	CMP	Okay.
04 05 13 14	CC	Okay. Next, panel 3: TRANSPONDER, PRIMARY; POWER AMPL, to PRIMARY, that's a verify; POWER AMPL, HIGH; MODE, VOICE, to OFF; POWER, SCE, to NORMAL; PMP to NORMAL; S-BAND ANTENNA, OMNI D, that's Delta. Okay, why don't you read that one back?

04 05 14 16	CMP	Okay. On panel 3: TRANSPONDER to PRIMARY; POWER AMPLIFIER to PRIMARY; POWER AMPL, HIGH; MODE, VOICE, to OFF; POWER, SCE, to NORMAL; PMP to NORMAL; S-BAND ANTENNA, OMNI D, D as in Doggy.
04 05 14 37	CC	Hey, very good. Okay, panel 225: circuit breaker FLIGHT BUS, MAIN B, to close; circuit breaker CTE, MAIN B, to close. Panel 250: CB BAT C BAT CHARGER/EDS 2 to close.
04 05 15 18	CMP	Hey, Vance, just a minute. Slow down, would you?
04 05 15 21	CC	Okay.
04 05 15 24	CMP	Okay. I got distracted here. On panel 225: CB FLIGHT BUS, MAIN B, close; and then I lost you after that.
04 05 15 37	CC	Okay. After that, CB CTE, MAIN B, to close. Next, panel 250: CB BAT C BAT CHARGE/EDS2 to close; CB BAT C POWER ENTRY/POSTLANDING to close. Next, panel 275: CB MAIN B, BAT BUS B, to close; CB INVERTER POWER 2, MAIN B, to close. Okay. Incidentally, anything that I've given you up until now is not sequence critical, but from now on, it should be - you should be sure to do it in the sequence we give you. Why don't you read that back, Jack?
04 05 17 38	CMP	Okay. Let me give you all of panel 225 again. CB FLIGHT BUS, MAIN B, close; CB CTE, MAIN B, close. On panel 250: CB BAT - B BAT CHARGE, that should be BAT C, Charlie, isn't it? BAT CHARGE/EDS2 closed?
04 05 18 01	CC	That's right. That's - -
04 05 18 02	CMP	CB BAT B POWER ENTRY -
04 05 18 06	CC	Okay. That should be BAT Charlie.
04 05 18 08	CMP	Let me finish. Okay. That's what I thought. BAT Charlie BAT CHARGE/EDS2, close; BAT Baker POWER ENTRY/POSTLANDING, closed. On panel 275: CB MAIN B, BAT BUS B, closed; CB INVERTER POWER 2, MAIN B, closed.
04 05 18 32	CC	Okay. That's correct except for the second circuit breaker on panel 250, which is CB BAT Charlie POWER ENTRY slash POSTLANDING, close.

04 05 18 50	CMP	Okay. BAT Charlie POWER ENTRY/POSTLANDING.
04 05 18 57	CC	Okay, now back to panel 250. CB BAT Bravo POWER ENTRY/POSTLANDING, close. Next, MDC 3, AC INVERTER 2 to MAIN B. AC INVERTER 2, AC BUS 1, on up. Next, panel 5: AC INVERTER AC BUS 1 to RESET and then center. Panel 3: UP TLM to COMMAND RESET then OFF. Then select best OMNI. Readback, please.
04 05 20 48	CMP	Okay, Vance. The following steps are sequence critical. Panel 250: CB BAT B POWER ENTRY/POSTLANDING, closed. That's BAT Baker. MDC 3, AC INVERTER 2, to MAIN B; AC INVERTER 2, AC1, on. ...
04 05 21 27	CC	How do you read now, Jack?
04 05 21 31	CMP	Okay, Vance. Did you - how far did you - did you copy any of my steps there?
04 05 21 37	CC	Okay, I heard you through AC INVERTER 2, AC BUS 1 to on, and you were cut out by noise. Go ahead.
04 05 21 48	CMP	Okay, Now comes to one I didn't understand. You said go over to MDC 5 and A in - AC INVERTER, AC BUS 1, RESET, then center, and then back to MDC 3; UP TELEMETRY, COMMAND RESET then OFF, and then select best OMNI.
04 05 22 10	CC	Roger. The readback's correct, but let me recheck that. Stand by.
04 05 22 31	CC	Jack, we were incorrect on panel 5; that should have been panel 3.
04 05 22 39	CMP	Okay, that's good. I got it.
04 05 22 44	CC	Okay. Now, when you're in this configuration, the following onboard readouts are required. Panel 3: BAT C voltage, PYRO BAT A voltage, PYRO BAT B voltage, SPS HELIUM PRESSURE. And the following readouts on panel 101: CM RCS injector temperatures, those are positions 5 Charlie, 5 Delta, 6 Alfa, 6 Bravo, 6 Charlie, 6 Delta; and the battery manifold pressure, which is 4 Alfa. And standing by for readback.
04 05 24 40	CMP	Okay. You want me to read out on MDC 3: BAT B voltage, PYRO A voltage, PYRO B voltage, SPS HELIUM PRESSURE. On panel 101: command module RCS injector temperatures; 5 Charlie, 5 Dog, 6 Alfa, 6 Baker, 6 Charlie, 6 Dog. The battery manifold pressure, 4 Alfa.

04 05 25 09	CC	Okay. Now - that was correct but I want to recheck the very first one, that was BAT Charlie voltage. Is that what you read back?
04 05 25 18	CMP	Okay. Okay, BAT Charlie voltage. Seems like we're having a difference - I can't understand BAT Charlie from BAT Dog.
04 05 25 30	CC	Okay. Now, that - that complete procedure for getting into it, as far as getting into it's concerned. What I will give you now is how to back out of it after you're through with your readings. Are you ready to copy?
04 05 25 52	CMP	Okay.
04 05 25 55	CC	Okay. Now you'll back out fairly quickly after you go into this procedure. All we'll need is about 5 minutes of TM, and so if you're ready to copy, here it comes.
04 05 26 11	CMP	Go ahead.
04 05 26 13	CC	Panel 3: POWER AMPL to OFF. Incidentally, copy this down on a piece of scratch paper as I read it, and then later I'll refer back to your first list where you can write things in the right-hand margin.
04 05 26 38	CMP	Okay.
04 05 26 41	CC	Okay - -
04 05 26 42	CMP	Go ahead. You want - Repeat the one on panel 3 again, Vance.
04 05 26 48	CC	Okay. POWER AMPL, OFF.
04 05 26 59	CMP	Okay. Go ahead.
04 05 27 01	CC	TRANSPONDER, OFF. AC INVERTER, 2, to OFF. Okay. Next, panel 250: CB BAT Bravo, POWER ENTRY/ POSTLANDING to open. Stand by 1.
04 05 28 22	CC	Okay, Jack. What I just gave you now on the backout is the only thing that's order critical. From here on, you can go to the steps for initiating the procedure, and backtrack. In other words, you should go to each of the panels that I read up and put the circuit breakers back to the base-line configuration - or the switches. Over.

04 05 28 56	CMP	Okay, now here's - to accent, here's the sequence-critical sets: POWER AMPL, OFF; TRANSPONDER, OFF; AC INVERTER, 2, OFF; and the last one on panel 250, CB BAT Baker POWER ENTRY/ POSTLANDING, open; and then hit the steps in reverse order that you gave them to me, and back out, like then I would start on MDC 3 UP TELEMETRY, OFF - to OFF; and then AC INVERTER - AC1 BUS 1 to OFF; and then AC INVERTER, 2, OFF; AC INVERTER, 2, MAIN B to OFF. Is that the type of order that you want to back out of?
04 05 29 59	CC	That's affirm, but - just for kicks, let's go through these panels again, and I'll give you the - the position, just to make sure there can be no doubt.
04 05 30 18	CMP	Okay. Go ahead.
04 05 30 20	CC	Okay. And once again, in the - in the area where I said order was not critical, it's still not critical when you back out. But now I'll go ahead. Okay, panel 4: TELCOMM, GROUP 1, AC1, it will not be AC1, it'll go to OFF. Panel 5: all circuit breakers on that panel which were positioned will now come to opened. Over.
04 05 31 01	CMP	Okay. Panel 4: TELCOMM, GROUP 1 will go OFF. Panel 5: all the circuit breakers that we closed will go back to open.
04 05 31 12	CC	Okay. Panel 3: the first three lines have been taken care of already in my beginning in the backout procedure, so starting with MODE, VOICE, that should go back to VOICE. POWER, SCE, OFF; PMP, OFF; S-BAND ANTENNA, OMNI Bravo. Panel 225: CB FLIGHT BUS, MAIN B, open; CB CTE, MAIN B, open. Read back.
04 05 32 19	CMP	Okay, Vance. I'm going to have to switch OMNIs. I'm starting to get some static here.
04 05 32 23	CC	Okay.
04 05 32 34	CMP	Okay. How do you read on AFT OMNI?
04 05 32 37	CC	Loud and clear.
04 05 32 44	CMP	Okay. On panel 3: the first three steps we took care of; MODE, VOICE, to VOICE; POWER, SCE, OFF; POWER PMP to OFF; and S-BAND OMNI would go back

to Bravo. Panel 225: FLIGHT BUS, MAIN B, will go open; and CB CTE, MAIN B, will go open.

04 05 33 11 CC That's affirm. The two circuit breakers on panel 250 will go open; the two circuit breakers, panel 275, will go open. Okay, the circuit breakers on panel 250, we took care of already. Panel 3: AC INVERTER, 2, we took care of. AC INVERTER 2, AC BUS 1 should now go OFF. And the remaining two switches on panel 3 we took care of. And "Select best OMNI" remains the same. Okay. Read back.

04 05 34 25 CMP Okay. The two switches - two circuit breakers on panel 250 will go back to open; the two circuit breakers on panel 275 back to open; the POWER ENTRY/POSTLANDING circuit breaker, we already took care of earlier; AC INVERTER 2; we took care of earlier; AC INVERTER 2 to AC BUS 1 will go to OFF; and AC INVERTER, AC BUS 1, we took care of - No, that'll go to OFF; and UP TELEMETRY, COMMAND RESET will go OFF.

04 05 35 14 CC That's correct, Jack. Okay, that's it. And I think we're about ready to go with this procedure whenever you are.

04 05 35 28 CMP Okay. First we got to go through that procedure to power the CSM from the LM, is that Charlie?

04 05 35 35 CC No. No, this is independent of power from the LM. This is a - this is purely a CSM - -

04 05 35 42 CMP Okay.

04 05 35 43 CC This is purely a CSM powerup so we can take a look at your telemetry and see how cold the vehicle is and that sort of thing.

04 05 35 55 CMP Okay. It's going in work.

04 05 36 03 CMP Okay, now I won't - I won't have any voice with you, so - Is that right? You don't want me to get connected up - you want me to just take these readings and come back and tell you what I have, huh?

04 05 36 17 CC That's affirm. There'll be no voice. And - -

04 05 36 22 CMP Okay. Okay. In work.

04 05 36 27	CC	I - we presume, though, that there'll be somebody in the IM that we can call if we have to get word to you.
04 05 36 35	CMP	Oh, yes. There'll be somebody to be standing by, they'll run up into the bedroom and tell me to stop what I'm doing.
04 05 36 44	CC	Okay, and let us know when you start.
04 05 36 51	CMP	Okay. I'm going to start right now, Vance.
04 05 36 54	CC	Okay.

END OF TAPE

04 05 37 12	CC	Aquarius, Houston.
04 05 37 30	CC	Aquarius, Houston. Over.
04 05 37 36	CDR	Okay, Houston; Aquarius. Switching watches, and Jack's going up into the command module.
04 05 37 43	CC	Okay, Jim. We have four steps here to give you to request that you get back on DOWN VOICE BACKUP, if you're ready to copy?
04 05 38 03	CDR	Ready to copy.
04 05 38 04	CC	Okay. Bit rate to LO bit rate. VOICE, FUNCTION switch to DOWN VOICE BACKUP. POWER AMPs CB, open; RANGE FUNCTION switch in RANGING; that's verify.
04 05 38 47	CDR	Okay. Bit rate, LO; VOICE FUNCTION, DOWN VOICE BACKUP; POWER AMP S-BAND, open; and RANGE FUNCTION to RANGE; and that's a verify. And I still have the BIOMED on RIGHT here, so we don't have hot mike.
04 05 39 08	CC	Okay. Thank you.
04 05 39 12	CDR	And, you want that in work, now?
04 05 39 14	CC	That's affirm.
04 05 39 17	CDR	Okay.
04 05 39 50	CDR	Okay. Houston, Aquarius. How do you read?
04 05 39 53	CC	Loud and clear, Jim.
04 05 39 57	CDR	Okay. I have a question for you, Houston, if you have time.
04 05 40 00	CC	Sure, go ahead.
04 05 40 05	CDR	And I'm copying down the reestablishing - PTC maneuver that Charlie gave me. Step 5 was, "When rates are less than 0.05 degrees per second, ATTITUDE CONTROL YAW to PULSE." And just how am I to get my rates down to 0.05 degrees per second. My - My rate indicator, at the best, is 0.1 of a degree.

04 05 40 37	CC	Stand by.
04 05 41 38	CC	Aquarius, Houston.
04 05 41 43	CDR	Go ahead.
04 05 41 44	CC	Jim, this has been tried in the simulator by Charlie and others, and what they recommend is that you null your rates on the error needles until you see no movement whatsoever, and then wait another couple of minutes, and that should do it. That's the only way we can tell. Over.
04 05 42 09	CDR	Okay. I'll give it the old college try.
04 05 42 12	CC	Okay. And if you can't attain that, why, of course, just the best you can do. We'll have to give it a try. Maybe it won't be quite like the simulator.
04 05 42 24	CDR	Right.
04 05 48 43	CMP	Okay, Houston; Aquarius.
04 05 48 47	CC	Go ahead, Aquarius.
04 05 48 50	CMP	Okay, Vance. I've gone all the way through your procedure - all the way down to "Select best OMNIs," but I'm not getting any MAIN BUS B voltage and this I don't understand.
04 05 49 03	CC	Roger.
04 05 49 04	CMP	I can read - I can read BAT - BAT BUS B voltage at 36.5. ...
04 05 49 43	CC	Okay, Jack. Do you read now?
04 05 49 48	CMP	I am not sure, Vance.
04 05 49 51	CC	Okay. You faded out due to noise in the orientation. If you close the POWER AMP circuit breaker, we can hear you better. Over.
04 05 50 07	CC	That's panel 16.
04 05 50 11	CMP	Okay.
04 05 50 13	CC	Okay. You faded out at the very beginning, so please go through that again. We understand you don't get anything on MAIN B.

04 05 50 39	CMP	Okay, Vance. How are you reading now?
04 05 50 43	CC	Okay. We're hearing you better. Stand by 1.
04 05 52 24	CC	Okay, Jack. Please, repeat back now your conversation. You were cut out for - a while ago.
04 05 52 36	CMP	I don't have any idea where we cut out, Vance. I just said that we performed the procedure exactly as you say. We're down into the SEP critical portion to where I said, "select best OMNI." However, we're not getting any MAIN BUS B voltage reading. I can read BAT BUS B, Baker, at 36.5; BAT Charlie at 37.0, but I have negative MAIN BUS B readings.
04 05 53 08	CC	Okay. Stand by.
04 05 53 24	CC	Okay, Jack. There are two - There's a switch and a circuit breaker that were positioned this morning that we'd like to have you check - Correction, just the switch. Panel 5, check your bus tie. MAIN BUS TIE BAT B/C on.
04 05 53 47	CMP	That is verified on. I checked that.
04 05 53 50	CC	Okay.
04 05 55 22	CC	Okay, Jack; this is Houston. Over.
04 05 55 29	CMP	Go ahead, Vance.
04 05 55 31	CC	Okay. We're getting data from you, Jack, so that much looks good. On panel 5, request verification that EPS SENSOR SIGNAL circuit breaker is MAIN B. Over.
04 05 55 47	CMP	Okay. - -
04 05 55 48	CC	Or it's - -
04 05 55 49	CMP	- - Stand by. - -
04 05 55 50	CC	- - that MAIN B is closed.
04 05 55 53	CMP	Okay.
04 05 56 10	CC	Okay, Jack. And, we see your MAIN BUS B voltage at 28-1/2.

04 05 56 17	CMP	Okay. You can see it. Good. Okay then. Okay, Vance. That circuit breaker is in.
04 05 56 28	CC	Copy.
04 05 56 42	CMP	Well, Vance, if you're getting data from them, let me go back up there and finish the ...
04 05 56 52	CC	Okay, Jack. Please repeat, you're cutting out.
04 05 56 54	CMP	Okay, Vance. Okay. We just changed OMNIs here. I say, if you're getting data from us, that's the important thing. Let me go back up into the bedroom there and get the readings you wanted, so we can get this stuff powered down. Is that okay?
04 05 57 10	CMP	Okay, we'll get - -
04 05 57 11	CC	- - by all means and - -
04 05 57 12	CMP	- - down there - -
04 05 57 13	CC	- - select best OMNI - -
04 05 57 14	CMP	- - and then go back up.
04 05 57 22	CMP	Okay, Vance. We'll go back up - We've got voltage now, and we'll go back up and take the readings that you want.
04 05 57 34	CC	Okay. And select best OMNI.
04 05 57 44	CMP	Okay. I'm going back up into the bedroom, Vance. How do you read?
04 05 57 47	CC	Loud and clear.
04 05 57 51	CMP	Okay. I'm going back up to the bedroom. We'll select best OMNI and continue on with the procedure.
04 05 57 58	CC	Roger.
04 05 58 47	CDR	Okay, Vance. Jim's up. How do you read?
04 05 58 50	CC	Reading you loud and clear, Jim.
04 05 58 54	CDR	Okay.
04 05 59 07	CDR	And, Houston, I noticed through the AOT and

		through the overhead docking window that we are venting again.
04 05 59 16	CC	Okay, Jim. Understand; the service module is venting.
04 05 59 22	CDR	That's affirm.
04 06 01 17	CC	Aquarius, Houston.
04 06 01 22	CDR	Go ahead, Houston.
04 06 01 24	CC	Jim, would you holler into the bedroom and tell Jack that when he has his onboard readouts that we wish he'd back - use the backout procedure and shut down again - per the procedure we gave him.
04 06 01 39	CDR	Roger. As soon as he - As soon as he gets his onboard readouts to use the powerdown procedure and shut down. Is that right?
04 06 01 47	CC	That's affirm.
04 06 01 49	CDR	Okay. Jack just - Jack just told me that he's through, and he's going to go through the back-out procedures again, the first one he's got is the shutdown.
04 06 01 54	CC	Okay.
04 06 08 19	CDR	Houston, Aquarius.
04 06 08 24	CC	Go ahead, Aquarius.
04 06 08 28	CDR	Jack's ready to give you the readings if you are ready to copy them.
04 06 08 31	CC	Stand by.
04 06 08 40	CC	Okay. Go ahead.
04 06 08 51	CMP	Okay, Vance. The readings that you wanted; are you ready?
04 06 08 57	CC	Ready to copy, Jack.
04 06 09 01	CMP	BAT Charlie, 37.0; pyro A, 37.0; pyro B, 37.0; SPS helium pressure, 3450; and just for kicks, nitrogen A, 2300; nitrogen B, 2400; CM RCS injector temperatures: 5 Charlie, 4.5; 5 Dog,

3.5; 6 Alfa, 4.0; 6 Baker, 4.6; 6 Charlie, 4.0; 6 Dog, 3.8; battery manifold pressure, 4 Alfa, 1.4.

04 06 10 11	CC	Okay, Jack. We got it. Thank you very much.
04 06 10 17	CMP	Okay. How does the telemetry look on our - on the old Odyssey?
04 06 10 21	CC	It doesn't look too cold. Looks pretty good.
04 06 10 27	CMP	Okay. Thank you very much.
04 06 10 30	CC	You bet.
04 06 10 31	CMP	We're going to need him.
04 06 10 37	CC	How does it feel, Jack?
04 06 10 42	CMP	I'll tell you, Deke, it's cold up in there. I don't know whether we'll be able to sleep up there tonight; it must be about 35 or 40 degrees.
04 06 10 52	CC	Roger. That's just what I was worrying about.
04 06 10 59	CMP	Right now, we're getting two sets of CWGs on.
04 06 11 12	CMP	It's not uncomfortable at all in Aquarius, but it definitely is cold in Odyssey.
04 06 11 18	CC	Roger.
04 06 11 45	CDR	Okay, Vance. Jim's back on.
04 06 11 50	CC	Go ahead, Jim.
04 06 11 54	CDR	We just had a change in watch; that's all.
04 06 11 57	CC	Okay.
04 06 14 38	CC	Aquarius, Houston. Over.
04 06 14 44	CDR	Go ahead, Houston.
04 06 14 46	CC	Jim, two items: in the command module, we wish to verify that the PYRO BATTERY selector was left in the main position. And we're ready to have the POWER AMP circuit breaker on panel 16 pulled, whenever you are ready.

04 06 15 43	CDR	Okay, Vance. Fred just tells me that he put it there, and we're checking that again about the PYRO BATTERY selector in the main position.
04 06 15 54	CC	Okay. Understand that you are checking it.
04 06 15 59	CDR	And I will pull the POWER AMP circuit breaker.
04 06 16 01	CC	Roger.
04 06 25 49	CDR	Houston, Aquarius.
04 06 25 54	CC	Go ahead, Jim.
04 06 25 57	CDR	How does number 2 battery look to you now?
04 06 26 07	CC	Stand by.
04 06 26 48	CC	Aquarius, Houston.
04 06 26 53	CDR	Go ahead.
04 06 26 55	CC	Jim, it looks like it was probably a sensor problem; the battery number 2 is load-sharing well. And we see no indications of higher temperatures in the glycol loop or anything that would make us think that it is heating up.
04 06 27 14	CDR	Okay. Thank you.
04 06 27 16	CC	Roger.
04 06 51 18	CDR	Houston, Aquarius.
04 06 51 24	CC	Roger. Go ahead.
04 06 51 30	CDR	I just want to talk over a little philosophy here. Fred told me that at one time you came up and told him that we were a little steep on the entry angle, and now our burn is going to make us - give us a steeper angle. I just want to make sure that we're all talking about the same thing, that, in essence, at this particular situation, we're shallow, are not steep, and we are going to increase the angle.
04 06 52 08	CC	Jim, the situation is that, at the moment, we're a little bit shallow, and retrograde midcourse is going to put us more in the center of the corridor. Over.

04 06 52 27	CDR	Okay; fine. I just wanted to make sure. Fred had written down, some time ago, that - that our angle now was about 71 and we were going to do a midcourse of 7 feet per second because ite appears that we're going to shallow it out. I think we're all talking the same language now.
04 06 52 47	CC	Roger. And, I guess it follows, but your perigee is a little bit high right now, too; so that will be bringing it back - back down, that is.
04 06 52 57	CDR	Yes. Yes, that's the important thing.
04 06 53 16	CC	One other question, Jim. Our readings down here say your LM cabin's about as cold as the command module cabin. Is that right?
04 06 53 29	CDR	Well, we really don't know. There's usually two people in the LM cabin, and it's a lot - It seems to be a lot more compact, and so we don't notice the coldness down here as we do in the command module.
04 06 53 41	CC	Okay.
04 06 56 32	CDR	Houston, Aquarius.
04 06 56 35	CC	Go ahead.
04 06 56 40	CDR	Some time ago, I copied down a long COMM midcourse-7 corridor control burn at a GET of 134:59:42.98. Is that burn pad still valid?
04 06 57 07	CC	Jim, that's affirm. That pad is still valid.
04 06 57 14	CDR	And that is assuming no midcourse 7 here at 105 hours.
04 06 57 19	CC	That's affirm.
04 06 57 58	CC	Aquarius, Houston.
04 06 58 03	CDR	Go ahead.
04 06 58 04	CC	Jim, we're setting up your burn for 105:30, and we'll be working up a pad, et cetera, based on that time. Over.
04 06 58 17	CDR	Roger. The time will 105:30.
04 06 58 21	CC	And, additional point; I guess this one's for Jack. Do we have any idea why we couldn't read

		the MAIN BUS B voltage a while back when first he didn't get it and then later he did?
04 06 58 40	CDR	Yes. I think we have a reason for that. Stand by.
04 06 59 04	CDR	It appears, Vance, that the battery charge circuit breaker which appeared to be in, wasn't in. Fred pulled it and reset it, and then he started getting readings.
04 06 59 17	CC	Roger. Which circuit breaker was that?
04 06 59 28	CDR	It was - It was the battery charge circuit breaker that allows you to read volts, but we haven't - don't know the exact name for it yet.
04 06 59 39	CC	Okay. Understand.
04 06 59 48	CDR	The name is BATTERY CHARGER BAT B CHARGE Jack tells me.
04 06 59 52	CC	Okay. BATTERY CHARGER BAT B CHARGE.
04 07 00 22	CC	Aquarius, Houston.
04 07 00 25	CDR	Go ahead.
04 07 00 28	CC	Have you opened your - just curiosity - Have you opened your food locker just aft of the LM data file? Over.
04 07 00 51	CDR	Yes. It's been opened.
04 07 00 55	CC	Okay. Just checking. Thanks.
04 07 00 57	CDR	... meal had come through.
04 07 01 00	CC	Good.
04 07 01 14	CDR	It came at the right time.
04 07 01 18	CC	Good.
04 07 03 30	CC	Aquarius, Houston. Over.
04 07 03 36	CDR	Go ahead.
04 07 03 38	CC	Jim, we have some CSM temperatures here for you that might be of interest, if you're ready to copy.

04 07 03 56	CDR	Roger. Go ahead.
04 07 03 58	CC	Okay. Your quad package temperatures range from 85 degrees to 44 degrees. Your CM RCS injectors range from 44 degrees to 21; and your heat shield is well above its lower limits in all the various locations. Temperatures appear to be cycling based on Sun angle, and it's no sweat. They all look very good.
04 07 04 45	CDR	Sounds good.

END OF TAPE

04 07 27 08	CDR	Were you calling, Houston?
04 07 27 12	CC	Negative, Jim.
04 07 27 16	CDR	Okay.
04 07 42 51	LMP	And, Houston, how do you read Aquarius?
04 07 42 54	CC	Read you loud and clear, Fred. How do you read?
04 07 42 59	LMP	Okay. ...
04 07 43 01	CC	Roger. We were just about to send you up some items of information pertaining to the burn. Are you ready to copy?
04 07 43 13	LMP	Stand by.
04 07 43 15	CC	Okay.
04 07 43 40	LMP	Okay. Go ahead, Vance.
04 07 43 43	CC	Okay, Fred. First of all, preparations for this, starting with contingency checklist, page 24, we would recommend should start at 104:30 GET, and we'll be happy to receive any comments you have on that, though. Second point: when you're in the burn attitude, you should see the Sun at the very top of the AOT. It'll be splitting the cursor, when your cursor's set at zero. One thing to be aware of though, that it'll slip right out of the AOT very easily since it'll be very sensitive to roll and yaw. Understand that's in detent 2, by the way. Next point: the burn is very insensitive to burn time and attitude. In other words, if necessary, we can slip it if there's any problem at all, and attitude isn't too critical. So that brings us to the point that we only have one real burn rule; that is, if - rate about any axis gets to 10 degrees a second, that's the limit to stop the burn. Next point, after you finish the burn, and before you trim, request that you leave DEDA in address 470 up a while so we can take a look at it, and let us holler when we've seen it, and then proceed on. Over.
04 07 45 54	LMP	Okay, Vance. You're saying we should start into the PREP in the contingency book at about 104:30, and I'll talk this over in a minute with Jim and we'll get back with you on it. When in the burn

		attitude, we should see the Sun right at the top of the AOT, and I assume this is detent number 2. Jim and I'd already been talking about that, and just eyeballing the terminator in the Earth, we figured the Sun at about something like a 70-degree angle - 65-degree angle, so that'll be right up there. We get one burn rule that says if the rates are greater than 10 degrees per second, shut her down. And, after we trim, you want me to leave 470 up for a while so you all can have a look at it, and you'll tell me when to get rid of it.
04 07 46 52	CC	That's right, Fred. And, if you have any questions at all regarding the alinement, why please let us know. We'll be happy to answer them, like alining on the Earth, as was described before. Also, you should know that the pitch is the most critical attitude so far as errors are concerned in this burn; but, as I said, it's still not very sensitive.
04 07 47 30	LMP	Yes, the - and unfortunately, the way we're looking out the window through the COAS, we can aline the yaw and roll pretty well, but it's the - Sun that has to get us pitch.
04 07 47 43	CC	Right. And - and a correction on this DEDA 470 thing. Request that we let you - Give you a GO before you trim. Over.
04 07 47 57	LMP	Say - Say again, Vance, on that last.
04 07 48 00	CC	Roger. We would like to see address 470, and give you a GO before you trim. Over.
04 07 48 10	LMP	Oh, okay. I - I see. Okay. After burn, we'll leave 470 up a while and wait for your word to do the trim.
04 07 48 18	CC	That's correct. How was the sleep?
04 07 49 59	LMP	Okay. And -
04 07 50 15	LMP	Okay. Vance, are you there?
04 07 50 17	CC	Roger. Go ahead.
04 07 50 21	LMP	Okay. The picture that Jim gave me on his view through the COAS was within the - the partial Earth, the lit portion laying in the top half of the COAS with the cusp laying right on the

		Y-Y line. And so the - The whole dark part of the Earth would be at the bottom part of the Earth, except a very thin crescent of the dark part to a line - line above the Y-Y line.
04 07 50 59	CC	Okay. That is correct.
04 07 51 00	LMP	And that in essence - that in - Yes, that in essence would put our X-axis pointing toward the Sun.
04 07 51 07	CC	That's correct. The plus X-axis pointing toward the Sun and perpendicular to the terminator of the Earth.
04 07 51 18	LMP	Okay.
04 07 51 20	CC	Two other points, Fred. One is that we don't expect hardly any misalinement of your engine for the burn, so we don't really expect any rates throughout the length of the burn, especially since it's at very low thrust. Second point, request you verify that your suit temperature rheostat's in FULL COLD. That - if it - If it were in FULL COLD, that might help your cabin temperature situation. It might bring the temperature up.
04 07 52 02	LMP	Okay.
04 07 52 19	LMP	Okay. The latter was a good point. We had it in FULL HOT.
04 07 52 24	CC	Very good.
04 07 52 25	LMP	And Roger on the - Roger on the rates, too.
04 07 52 30	CC	Okay.
04 07 53 18	LMP	Okay, Vance. Is the T_{ig} time going to be approximately - Is it 105 or 105:30?
04 07 53 26	CC	It's 105:30.
04 07 53 31	LMP	Okay. Your 104:30 time to start in is - sounds pretty good. That'll give us lots of time to get set up with the attitude business, in case we have any trouble stopping PTC and getting there and - That will give us a little time to be sitting and waiting, all set up.

04 07 53 49	CC	Okay, Fred. Good.
04 07 58 53	LMP	Aquarius, Houston. Over.
04 07 59 00	LMP	Are you calling, Vance?
04 07 59 02	CC	Right, Fred. We just noticed a 2-pound drop in your water quantity. Have you guys had a drink recently or do you know any reason why it might have dropped? Over.
04 07 59 16	LMP	Negative.
04 07 59 21	CC	Thank you.
04 08 00 28	CC	Aquarius, Houston.
04 08 00 33	LMP	All right. Go ahead, Vance.
04 08 00 35	CC	Fred, that may be a funny in the data. The rate's gone back to normal; and we'll keep an eye on it, but we don't think you should worry about it too much.
04 08 00 50	LMP	Let's hope not.
04 08 19 06	LMP	And, Houston, Aquarius.
04 08 19 07	CC	Go ahead, Aquarius.
04 08 19 12	LMP	Are we going to get any sort of a pad on this?
04 08 19 20	CC	That's affirm, Fred. Estimating we'll have it to you in about 15 minutes.
04 08 19 28	LMP	Okay.
04 08 19 47	LMP	And, Houston, you might just let us know if there's any chance it's going to slip further down the road, because we're going to kind of hold to that 104:30 start time. And if you're going to delay any, we'll delay accordingly.
04 08 20 03	CC	Roger. We won't have any trouble making that, Fred, I'm told.
04 08 20 12	LMP	Okay.
04 08 31 01	CDR	Hello, Houston; Aquarius.
04 08 31 08	CC	Go ahead, Aquarius.

04 08 31 12	CDR	Roger. We have about 104 degrees now. How does that ...?
04 08 31 23	CC	Okay. FIDO's hustling here. We'll try to get it right up to you. Stand by.
04 08 32 10	CDR	...
04 08 32 13	CC	Aquarius, Houston. Over.
04 08 32 18	CDR	We have ...
04 08 32 37	CC	Aquarius, Houston. Over.
04 08 32 41	CDR	Vance, we have the quad heaters on, now.
04 08 32 44	CC	Roger. Copy, Jim. And the - Jack's going to read you the pad right now, so I recommend you go ahead and get started. You shouldn't be delayed by the pad at all.
04 08 33 24	CC	Aquarius, Houston. I've got your burn pad.
04 08 33 37	CDR	Roger, Houston. Stand by. Are you ready - Stand by to copy. Okay. Ready to copy.
04 08 33 43	CC	Okay. A P30 maneuver pad on the DPS: purpose is midcourse 5, NOUN 33, 105:30:00.00, NOUN 81 is N/A, H_A is N/A, perigee, plus 0019.8, 0.007.8, 0.15, the rest is N/A. Shut down the engine at 1 second prior to the end of burn time. Shut down at 14 seconds manually. Ullage is four jets for 10 seconds, 10-percent throttle. Go ahead.
04 08 35 00	LMP	Okay, Jack. We've got a DPS midcourse 5: NOUN 33, 105:30:00.00; NOUN 81, N/A; H_A N/A; plus 0019.8, 0007.8, burn time 0.15, the rest of the pad, N/A. Shut down manually at 14 seconds, ullage four jets for 10 seconds, and the entire burn is at 10-percent throttle.
04 08 35 36	CC	Okay, Fred. I want to verify that your DELTA-V_R is 0007.8.
04 08 35 48	LMP	Okay. I read you back 0007.8.
04 08 35 53	CC	Okay. Good readback. You got it.

04 08 38 38	CC	Aquarius, Houston, I have some additional entry data that goes with the pad I just read up. It's five items. Let me know when you're ready to copy. It's on a maneuver pad.
04 08 38 55	LMP	Okay. I'll try to squeeze them in there, Jack. I'm rapidly running out of pads.
04 08 39 08	LMP	Go ahead.
04 08 39 11	CC	Okay. It's N/A all the way down to NOUN 61. Your latitude is minus 21 - -
04 08 39 20	LMP	Hold on a minute; hold on. You need the - Hold on, Jack, I need the other pad book, that CSM pad.
04 08 39 26	CC	That's affirm.
04 08 39 45	LMP	Okay. Now I'm ready.
04 08 39 47	CC	Okay. NOUN 61: latitude, minus 21.67, minus 165.37, 1163.1, 36292, 142:41.02. Read back.
04 08 40 20	LMP	Okay. NOUN 61; minus 21.67, minus 165.37. 1163.1, 36292, 142:41.02.
04 08 40 43	CC	Good readback.
04 08 42 32	LMP	And you should have high bit rate now, Jack.
04 08 42 51	CC	Okay, Fred. We're getting it now.

END OF TAPE

04 08 46 42	CDR	Houston, Aquarius.
04 08 46 44	CC	Go ahead, Aquarius.
04 08 46 47	CDR	Did you have readouts on our quad temps to know when we can start? We're taking a time hack. We'd just like a verification with you.
04 08 46 55	CC	Roger. Your quad temps look good from here.
04 08 50 03	CDR	Okay, Houston; Aquarius. We're going to stop PTC at this time.
04 08 50 09	CC	Roger, Aquarius. Go ahead.
04 08 52 51	CC	How about if you do - --
04 08 52 56	LMP	Say again, Jack.
04 08 52 59	CC	Negits on my last, Fred.
04 08 53 12	LMP	Okay, Jack. How do you read now?
04 08 53 20	CC	Go ahead, Aquarius.
04 08 53 26	LMP	Okay. I thought you called, Jack. We're maneuvering around here to fish for the Earth.
04 08 54 26	LMP	And, Houston, Aquarius. How's the ASA package temp look now?
04 08 54 52	CC	Okay, Fred. The ASA package temp is looking good. It's around 98 degrees, and we'd like to see it go up about 15 to 20 degrees.
04 08 55 03	LMP	Okay. Why don't you give me the word before I proceed with the AGS. We really don't need it right this instant.
04 08 55 10	CC	Roger. We'll be watching it.
04 08 58 11	CC	Aquarius, Houston. The ASA package temp is up now so you can activate the AGS.
04 08 58 19	LMP	Okay. Very good.
04 09 01 07	LMP	Okay, Jack. So we can make sure and get our timer set here, I wondered when your - you've

got about 48 minutes to the burn which should be coming up pretty quick - you'd give us a hack so we could set our event timer at 12.

04 09 01 32	CC	Roger, Fred. I understand you want a mark at 12 minutes prior to the burn. Is that affirm?
04 09 01 39	LMP	Roger. We think we got it set now. We just wanted to check it. If we don't, then I'll set it to 13, and you can give me another hack at 47 to go.
04 09 01 56	CC	Okay. We got 33 to go.
04 09 01 59	CC	MARK.
04 09 02 03	CC	My mistake. It was 33 - -
04 09 02 05	LMP	Right on.
04 09 02 06	CC	Roger. It was reading 33 on my mark. Right?
04 09 02 32	LMP	Okay. You got about 105:03 GET now down there?
04 09 02 39	CC	That's affirmative, Fred. Going through 105:03:45.
04 09 03 44	CC	MARK.
04 09 03 48	LMP	Okay.
04 09 04 03	LMP	Okay, Jack. Give me the next number you want me to set then, and I'll take another hack here.
04 09 04 08	CC	Roger. You're counting up, right?
04 09 04 12	LMP	Roger.
04 09 04 49	CC	Okay, Fred. On my mark, be 35 minutes to the burn.
04 09 04 58	LMP	Standing by.
04 09 05 13	CC	We missed her, Fred. Let's get it on the next minute.
04 09 05 17	LMP	Okay.
04 09 05 52	CC	Okay, Aquarius. On my mark, it's going to be 34 minutes to the burn, and you'll be reading 36. Stand by.

04 09 05 59	CC	MARK.
04 09 06 03	LMP	Okay. We got it cranked up.
04 09 10 29	CDR	Okay, Houston. We have our attitude set.
04 09 10 35	CC	Roger, Jim.
04 09 10 39	CDR	I hope the guys in the back room who thought this up right knew what they were saying.
04 09 10 50	LMP	And I'm looking through the AOT there, Jack, and the Sun's right in the top and it's about maybe 2 degrees to the right of the cursor. So that looks real good.
04 09 11 01	CC	Roger. Good going.
04 09 12 04	CC	Okay, Aquarius. The attitude looks good here and your choice when you want to start the burn.
04 09 12 16	CDR	We're counting down, aren't we, or do you want us to start any time?
04 09 12 22	CC	Your choice.
04 09 12 28	CDR	You guys are getting easy.
04 09 12 32	CC	It's not time critical, Jim.
04 09 12 36	CDR	I understand.
04 09 15 59	LMP	And, Houston, we reset our clock and we're making the burn in about - I'll give you a hack here at 2 minutes to go.
04 09 16 11	CC	Roger, Fred. And let us know when you're going to ullage, will you?
04 09 16 16	LMP	Okay.
04 09 16 25	LMP	Okay. Stand by. 2, 1.
04 09 16 28	LMP	MARK it.
04 09 16 29	LMP	Three minutes to go. Correction, 2 minutes to go, Jack.
04 09 16 34	CC	Roger. Two minutes. We got it.

04 09 17 01	CC	Aquarius, Houston. Check engine gimbal off, please.
04 09 17 07	LMP	It's verified to off. And -
04 09 17 28	LMP	MARK it.
04 09 17 29	LMP	One minute.
04 09 17 31	CC	Roger, Fred.
04 09 17 58	LMP	ENGINE ARM to DESCENT.
04 09 18 18	LMP	ULLAGE.
04 09 18 48	LMP	Okay. You're looking at 470.
04 09 18 53	CC	Roger. We copy 7.4.
04 09 18 59	LMP	Roger. 7.4 and I had about 0.2 showing, I guess, when we started.
04 09 19 05	CC	Roger. We verify that. Okay, Aquarius. Trim it to 7.6.
04 09 19 18	LMP	Okay. You want plus-X now to get 7.6. Is that correct?
04 09 19 23	CC	That's affirmative.
04 09 19 42	LMP	Okay. You're looking at it, Houston.
04 09 19 46	CC	Okay. Looks good. Nice work.
04 09 19 51	LMP	Let's hope it was.
04 09 20 23	CC	Okay, Aquarius. We're ready to follow you through on setting up PTC and powerdown. Your choice.
04 09 20 30	LMP	Okay. We're pressing into getting PTC established right now.
04 09 26 49	CC	Aquarius, Houston. We'd like to change the number of yaw pulses we gave you before as 21. We'd like to reduce that to 12. Twelve pulses yaw right, and that'll take you about 3 seconds to get them in if you don't want to count them.
04 09 27 08	LMP	Okay. We'll make it 12 versus 21.

04 09 29 50	CDR	Okay, Houston. I'm just about there now and as soon as I get 90, we'll start damping rates.
04 09 29 57	CC	Roger, Aquarius.
04 09 33 58	CDR	Okay, Houston. I'm trying to damp rates now. We're at the proper roll attitude and pitch.
04 09 34 05	CC	Roger, Aquarius.
04 09 34 22	CC	Working a little bit better this time.
04 09 34 29	CDR	Are you copying any attitudes down there, rates, et cetera?
04 09 34 56	CC	Okay, Aquarius. We're seeing some extremely low rates at this time, really below our capability to measure them.
04 09 35 09	CDR	Roger.
04 09 36 25	CDR	Houston, I think I've got pitch and roll just about squared away. I let yaw just slightly drift; it's drifting in a clockwise direction and I'm about all set now to put in my 12 clicks to the right.
04 09 36 44	CC	Roger, Jim. Ready to look at it with you.
04 09 37 59	CDR	Twelve clicks right.
04 09 38 13	LMP	Okay, Jack. Are we clear now to proceed with the powerdown?
04 09 38 22	CC	That's affirmative, Fred. We're ready to press on with powerdown. I've got two changes for you. Step 1 of the emergency powerdown on page power - 5. Over.
04 09 38 36	LMP	Go ahead.
04 09 38 37	CC	Okay. Leave your POWER AMPLIFIER switch in PRIMARY vice OFF and put your RANGING switch to RANGE, vice OFF/RESET.
04 09 38 53	LMP	Okay. We're in PRIM in the POWER AMP and RANGING on RANGING.
04 09 38 59	CC	Affirmative.

04 09 39 11	CDR	Okay. I'm going to pull. Well, here, let's just look at the checklist.
04 09 39 14	LMP	Okay. Configure CBs. There you go.
04 09 39 18	CC	Aquarius, Houston, hold off 1 on powerdown, please.
04 09 39 23	LMP	Okay. We'll hold off. And we're looking at a SHe pressure, incidentally, of about 1830 now.
04 09 39 37	CC	Roger. We concur with that. And it looks like you got a little pitch rate going on here. Do you copy the same?
04 09 39 47	CDR	Okay. My pitch needle is just slightly up now. I could try to take it out if you want me to.
04 09 39 58	LMP	Not - Wait, wait. There you go.
04 09 40 07	CC	Just hold off on it 1, Jim. We'd like to take a look at it.
04 09 40 14	CDR	Okay.
04 09 40 21	CC	Aquarius, we'll need high bit rate, please.
04 09 40 26	LMP	Flashlight, Jack. Jack, flashlight over here a minute.
04 09 40 31	CC	Aquarius, we need the POWER AMPLIFIER back in high bit rate, please.
04 09 40 37	LMP	You got it.
04 09 40 48	CDR	You got a couple in the roll pretty soon.
04 09 41 02	CDR	What is it, 1.7?
04 09 41 34	CDR	You have another set of them by the PGNS.
04 09 41 44	CDR	Now we got to turn on the heaters you want to save -
04 09 41 59	CDR	What's that flitting out there in the breeze? Are we venting again? Take a look, Jack.
04 09 42 17	CDR	Well, once we get squared away, Joe, I think I am going to have to go to the space center and take a good healthy one and leave just about everything. I've held up long enough.

04 09 42 32	LMP	That's coming from above. Another one just - is just coming down right over here. Well, there's the old terminator at Fra Mauro. We'd been landing about 2 hours ago, huh? Right on the - -
04 09 42 56	CDR	Houston, Aquarius.
04 09 42 57	LMP	- - to the right of the terminator.
04 09 42 59	CC	Go ahead, Aquarius.
04 09 43 03	CDR	Just for information, although I thought I'd never have to use it, that technique looked like it was a pretty good one.
04 09 43 13	CC	Roger, Jim. And we'd like you to give us your idea of how the PTC looks. We're not sure we're seeing what we ought to here.
04 09 43 26	CDR	Okay. I still have my ball powered up and I'm coming around past 270 right now. I've got a slight roll and pitch offset in there. My pitch needle about halfway up and my roll needle is about 4 degrees over now.
04 09 43 48	CC	Okay, Jim. With that info we'll go on the PTC, and let's proceed with the powerdown.
04 09 43 59	CDR	Okay. We'll proceed with the PTC and proceed with the powerdown. I guess if we have to we can reestablish PTC at a later date. Okay. Okay.
04 09 44 22	LMP	First row. Ullage. AGS.
04 09 44 31	CMP	Your AGS on?
04 09 44 33	LMP	My what? My what? Oh, yes. Go ahead.
04 09 44 38	CDR	Okay. The four INVERTERS of this AC BUS volt, Fred.
04 09 44 44	LMP	Okay. Go ahead.
04 09 44 52	CDR	Okay. Let's - give the last thing to Jack and I'll keep it all out. Okay? RCS SYSTEM A. That's in. TCAs are going off. Why do they need the ISOL valves in the ASCENT FEED in?
04 09 45 17	LMP	You're not sucking any power unless you take these switches and move them.

04 09 45 21	CDR	How come we pulled them out, then, in this burn?
04 09 45 23	LMP	Because you didn't want them to get moved inadvertently, I guess. It doesn't matter, Jim, they can be out or in in terms of powerdown. They just don't count.
04 09 45 46	CDR	Okay. I got 1, 2, 3.
04 09 45 54	LMP	ISOL valve should be in 2.
04 09 45 56	CDR	Yes. Okay. Third row. Attitude DIRECT CONTROL I still have in.
04 09 46 41	LMP	Jack, how do you read now in baseband?
04 09 46 44	CC	Reading you 5-square, Fred. How me?
04 09 46 48	LMP	Okay. I'll stay this mode, if it's all right, so we won't be hot miked.
04 09 46 56	CC	Roger.
04 09 52 28	CC	Aquarius, Houston. You're cleared to open the POWER AMPLIFIER circuit breaker and go to LOW BIT RATE, leaving the POWER AMP switch in PRIMARY.
04 09 52 40	LMP	Okay. I'll pull the prime S-BAND POWER AMP breaker and go LOW BIT RATE.
04 10 04 25	LMP	Houston, Aquarius.
04 10 04 28	CC	Go ahead, Aquarius.
04 10 04 34	LMP	About how far out are we now, Jack?
04 10 04 49	CC	Okay, Aquarius. You're 150 000 miles and you're coming in at 4500 feet a second. That's from the Earth.
04 10 05 01	LMP	Okay. We're at 100 - Yes. 150 K, 4500 feet a second.
04 10 05 27	CC	And, Aquarius, how much TTCA control did you have to do in the burn?
04 10 05 34	LMP	How much - What was that, Jack?
04 10 05 36	CC	How much control of the TTCA did you have to do during the burn?

04 10 05 44	LMP	I wasn't noticing Jim too much. I'd say I put in maybe about six or seven inputs. I don't think it ever got off more than a couple of needle widths.
04 10 06 02	CC	Roger, Fred. Thank you.
04 10 06 11	LMP	I think it's probably the same for Jim. I wasn't noticing his input but the - his needle was hanging in there pretty good.
04 10 06 20	CC	Roger. Thank you, Fred.

END OF TAPE

04 10 33 40	CC	Aquarius, Houston. How do you read?
04 10 33 45	CMP	I read you loud and clear, Jack.
04 10 33 48	CC	Okay, Jack. What's your status, who's sleeping, and who's working?
04 10 33 55	CMP	Well, right now we're all three kind of working. Do you have any recommendations?
04 10 34 04	CC	Yes, looks like to us from here that you and Fred ought to get some sleep, and that you ought to eat in about 6 hours. And that the Skipper ought to go to bed about 113 hours.
04 10 34 23	CMP	Okay.
04 10 34 24	CC	I've got some other information. We shouldn't have some good dope on your trajectory for about 2 hours. Looked like to us that the burn was real good, however, and we're taking a close look at it, and we'll get back with you on that in about 2 hours from now. Another thing that we're expecting to have happen is that the SHe tank is going to reach its burst limit. The earliest time we predict this will happen will be at 107 hours on about 25 minutes. And the latest probable time is at 110 hours, and this is supposed to be a nonpropulsive vent, but you might hear it and you might see something.
04 10 35 06	CMP	Okay. That's good news. We were wondering about that. And I'll relay all the other information you gave me.
04 10 35 14	CC	Okay. And if the SHe tank does burst during this time frame before we get trajectory info, why, that will delay our trajectory info somewhat. Your consumables, your water is now good through 152 hours.
04 10 35 32	CMP	Jack, wait a minute. Let me copy some of this down.
04 10 35 34	CC	Okay.
04 10 35 48	CMP	Okay. I'm ready now.

04 10 35 54	CC	Okay. We're predicting that you still have more water than you need. And one thing we'd like for you to do is when you're going to sleep up there in the command module take a look through the optics and see if you can see any stars.
04 10 36 17	CMP	Okay, Jack, I will do. Jim and I were able to spot constellations from the windows of the LM when there's no venting taking place. Could you give me some time on these consumables, what you're predicting they're good for? I think you started to give them times, didn't you, or was I just hearing things.
04 10 36 56	CC	We started to give you some times. We think we might be able to give you some better ones pretty soon. But it looks like your water is good through 154 hours, and you've got takusan O_2 through 272 hours, plenty of lithium hydroxide, and your amp-hours ought to be good through 199 or 200 hours. Over.
04 10 37 34	CMP	Okay; good. Copy that.
04 10 37 44	CC	We expect that your water rate is going to drop off and at the time, DELTA will go up to 160 - 165 hours quite shortly. Another thing we're interested in is what's your status on rest and medication.
04 10 38 03	CMP	Okay. None of us, I know of, had any medications, and right now as far as rest, I suppose we're no tireder than normally in this situation. I'm going to relay the work-sleep cycle.
04 10 38 20	CC	Okay. And don't forget to look through the optics when you go up in the command module.
04 10 38 30	CMP	(Laughter) Okay. I'll do that.
04 10 40 04	CMP	Jack, as luck would have it, we just now started to vent a little from the command module ...
04 10 40 46	CC	Aquarius, Houston. Sorry about that but there's too much background noise to read you. I think we'll have to wait until you come up on a new antenna. Over.

04 10 40 58	CC	Okay, Aquarius. Go ahead now. I think I can hear you.
04 10 41 03	CMP	Okay. Okay, Jack. I was going to say, as luck would have it, the command module picked this time to start venting again, so I probably won't be able to get a good hack out of stars out of the telescope.
04 10 41 20	CC	Okay. Thank you. And if you can think of it, when the time comes up, when you're not venting, how about remembering to take a look through them and give us a word?
04 10 41 31	CMP	Okay. Will do.
04 10 44 04	CMP	Houston, Aquarius.
04 10 44 24	CC	Go ahead. Over.
04 10 45 01	CC	Aquarius, Houston. Did you call?
04 10 45 05	CMP	Yes, Jack. I just got a question. How long are you predicting our command module canisters to last in here?
04 10 45 20	CC	Okay, Jack. We've got 14 cartridges that'll last 157 hours, plus we've got the LM primary cartridge with 23 hours, and we've got two PLSS cartridges with 7 hours apiece.
04 10 45 35	CMP	Okay. I was just curious as to how much time we've got out of these two cartridges.
04 10 45 42	CC	Stand by 1. I'll get a prediction on that. By the way, I hope you're keeping track of the ones you've used and the ones you've not.
04 10 45 51	CMP	Yes, right now, we have numbers 7 and 8 in the LM here.
04 10 46 00	CC	Roger.
04 10 46 03	CMP	They were two brand new fresh ones.
04 10 50 13	CC	Aquarius, Houston. In regards to the CO_2 canisters, by the way the PCO_2 is reading 1.6 down here now. We expect that we can get 6 more hours out of the two canisters that we have there - 6 hours at least. However, at 112 hours,

		when we've got several people up, we're going to rig up two more and we have the new simplified procedure for doing this. However, in the meantime, should we need to have a canister change, we plan to switch to the LM primary canister. Over.
04 10 50 52	CMP	Okay. Copy that, Jack.
04 10 51 08	CC	And, Aquarius, how's your PTC holding up?
04 10 51 14	CMP	Well, we got a little bit off Jack. The - It starts high in the LMP's window and goes low in the CDR window.
04 10 51 37	CMP	So we've got a little bit of a wobble on it. Of course, the command module venting doesn't help, either.
04 11 02 44	CMP	Houston, Aquarius.
04 11 02 46	CC	Go ahead, Aquarius.
04 11 02 50	CMP	Jack, in reference to your question about the PTC, on this last complete revolution, the Sun first appeared in the very top right corner of the LMP window, passed over the CDR window, and was visible through the overhead window, and now the Moon is - came pretty well through the center of both windows this last time.
04 11 07 20	CC	Okay. Thank you, Jack. Copying that.
04 11 07 23	CC	Aquarius, Houston. We'd like to get a little better idea of how PTC is going. So, what we'd like for you to do is what we did last time. That is to give us a reading on the center of the Earth and the center of the Moon on the - LPD.
04 11 07 49	CMP	On the LPD. Okay, It's shifted. Let's see, the Moon's gone by and the Earth didn't come into the LPD last time.
04 11 08 03	CC	Okay. But when it goes by the plane of the LPD, tell us where it was. Okay?
04 11 08 10	CMP	Okay. Will do.
04 11 13 34	CMP	Okay, Jack. This pass, the Earth came into view at the top left-hand corner of the LMP's window

and was going down. However, when it passed it wasn't as high up as the last pass. It did pass into view at the CDR window, but too high up to get an LPD reading.

04 11 13 57	CC	Roger. Understand it went high in both windows then.
04 11 14 04	CMP	Yes, last time it wasn't even visible in the CDR's window; this time it was visible if you squatted down, but too high up to get an LPD reading.
04 11 14 14	CC	Okay, Jack. That's good. Thank you.
04 11 21 51	CMP	Okay, Houston; Aquarius.
04 11 21 53	CC	Go ahead. Over.
04 11 21 57	CMP	Okay. The moon came into view at the middle of the LMP's window, passed through the CDR's window at an LPD of 5 degrees.
04 11 22 11	CC	Roger. Understand.
04 11 35 55	CMP	Houston, Aquarius.
04 11 35 58	CC	Go ahead, Aquarius.
04 11 06 02	CMP	Okay, Jack. On this pass, the Earth came into the view at the top part of the LMP's window, and we got an LPD angle on it as it passed through the CDR's window of a minus 4 degrees.
04 11 06 18	CC	Okay. A minus 4. Thank you, Jack - -
04 11 06 19	CMP	It's - it's above the - Okay. Are you familiar with the minus 4 being halfway through the sky part, huh?
04 11 06 28	CC	Affirmed.
04 11 44 43	CMP	Okay, Houston; Aquarius.
04 11 44 47	CC	Go ahead, Aquarius.
04 11 44 51	CMP	Okay. On this pass, the Moon came into view at the top part of the LMP's window, came across higher. Jim estimates the LPD angle at a minus 15 degrees.

04 11 45 09	CC	Okay. A minus 15 on the moon, and sounds like it's set up pretty well.
04 11 45 21	CMP	Everybody's happy with it down there?
04 11 45 55	CC	Aquarius, it's a little too early to tell exactly how the PTC is going. We'd like to get a few more points, so keep reading them off, and we're still looking for that SUPERCRIT to go anytime.
04 11 46 08	SC	Okay.

END OF TAPE

04 11 59 10	CDR	Houston, Aquarius.
04 11 59 13	CC	Go ahead, Aquarius.
04 11 59 17	CDR	The Earth was just fairly high in the CMP's window and across the 14-degree LPD line.
04 11 59 27	CC	Okay, Skipper; 14 degrees. Thank you.
04 12 08 45	CDR	Houston, Aquarius.
04 12 08 47	CC	Go ahead, Aquarius.
04 12 08 51	CDR	The Moon went by the LPD at 6 degrees, plus 6 degrees.
04 12 08 56	CC	Okay. Earth at plus 6. Thank you.
04 12 09 02	CDR	That's the Moon, the Moon.
04 12 09 04	CC	Okay. The Moon. Thank you.
04 12 23 30	CDR	Houston, Aquarius.
04 12 23 33	CC	Go ahead, Aquarius.
04 12 23 37	CDR	The Moon passed by at a minus 8 degrees on the LPD. No, that's the Earth. The Earth passed by at a minus 8 degrees.
04 12 23 48	CC	Okay. The Moon went by at a minus 8 degrees.
04 12 24 02	CC	Okay, Jim. We got it. The Earth went by at a minus 8 degrees. On a basis of the data - -
04 12 24 08	CDR	That's right.
04 12 24 09	CC	On the basis of the data we have so far, your entry angle is 5.99. The block data we gave you on the pad for a no-COMM midcourse-7 last night is no longer valid because we made this midcourse.
04 12 24 38	CDR	Okay. Understand, the no-COMM pad is no longer valid because of the midcourse. Entry angle based on the last 2 hours' tracking is 5.99, and I take it you're going to keep tracking for some time now to see whether we need another midcourse or not.

04 12 24 55	CC	That's affirmative.
04 12 25 05	CDR	Are you planning any no-COMM midcourse at 134 and change anyway right now, or are you going to wait?
04 12 25 14	CC	We're discussing that now, Jim, and it looks like we're going to wait on the tracking. For the time being, since you're in the corridor, why, there's no need to pass it up. But we're going to keep looking at the tracking, and we'll probably come up with one.
04 12 25 34	CDR	All right. I'm not too sure what the venting is going to do to us so - when this SHe tank ruptures, what it's going to do for us.
04 12 25 47	CC	Roger. We don't presently expect the SHe tank to have any effect on your trajectory, and the pressure's up to 1921 now.
04 12 25 59	CDR	Hey, it's going a lot better than we ever expected. What a way to get a data point.
04 12 26 35	CDR	And, Jack, just think. You thought you were going to sleep through all your watches.
04 12 26 41	CC	Say again, Jim.
04 12 26 48	CDR	I said, you thought you were going to sleep through all you watches.
04 12 26 58	CC	Well, you keep waking me up.
04 12 27 04	CDR	Sorry about that.
04 12 54 31	CC	Aquarius, Houston. You notice anything?
04 12 54 37	CDR	Yes, Jack. I was just about ready to call you. Underneath quad 4, I noticed a lot of sparklies going out.
04 12 54 50	CC	Can you hear or feel anything?
04 12 54 54	CDR	No, I sure can't, but I think it changed our - it changed out PTC. Let me check and see what the drift is.
04 12 55 09	CC	Okay. She's going down through 600 now.

04 12 55 18	CDR	I think we're probably going to have to reestablish PTC. Yes, we got pretty fast yaw drifting, Jack.
04 12 55 57	CDR	Houston, Aquarius. What are your plans?
04 12 56 01	CC	We're thinking about them right now. Did you say it yawed some?
04 12 56 08	CDR	Yes, I was in a right yaw and now I'm in a left yaw; at a much faster rate than the one we put in PTC.
04 12 56 28	CC	Okay, Jim. We're talking it over. Stand by.
04 12 57 20	CDR	What's the SHe tank down to now, Jack?
04 12 57 24	CC	Okay, Jim. It's going through 125 pounds now. And we understood you to say - -
04 12 57 30	CDR	Okay.
04 12 57 31	CC	- - that it reversed your yaw. Is that affirmative?
04 12 57 37	CDR	Sure did, Jack. It reversed my yaw completely and put in a little pitch, I think.
04 12 57 53	CDR	But more than anything, it reversed my yaw.
04 12 57 56	CC	Roger. Have you effectively established PTC in the opposite direction then?
04 12 58 04	CDR	Well, you could say that. I'm not too sure just what kind of pitch or roll I've got, coupled with the yaw. I just saw the Earth go by the LMP's window here, not too long ago at a rather faster rate than we had going the other direction.
04 12 58 38	CDR	Perhaps you can tell how fast I'm having to shift OMNIs.
04 12 58 42	CC	Yes, we can tell the COMM cycling back and forth.
04 12 58 52	CDR	Is that what they call a nonpropulsive vent?
04 12 58 56	CC	Right. I'd hate to see a propulsive one.
04 12 59 01	CDR	You and me both.

04 12 59 04	CC	It's going through 50 pounds now. So, are you seeing fewer sparklies?
04 12 59 12	CDR	Yes. Much fewer. Not any at all, now. I'm not sure whether that vent gave me reverse yaw and roll - left roll - that's - if that's what it gave me.
04 12 59 34	CC	You say you think it might have given you some left roll as opposed to opposite yaw.
04 12 59 45	CDR	I'm sure it gave me the yaw, Jack, but I'm not too sure ...
04 12 59 50	CC	Okay. We'd kind of like to watch it, see what happens for a little while before we make a recommendation. However, we'll need some inputs from you on that.
04 13 00 02	CDR	Well, we're in no trouble up here as far as - as far as the yaw goes. Everything's fine. It's faster than we had set up before. We just wanted to get into proper thermal constraint, and it's going to take me 15 minutes to get the thrusters up anyway.
04 13 00 58	CC	Okay, Skipper. We don't see any thermal problems as a result of this change. If we see some communications problems, we may have to do something different, but so far, so good. And we'd kind of like to hear from you on LPD numbers, if you get anything going by the window.
04 13 01 28	CDR	Okay. Will do.
04 13 02 03	CMP	Okay, Jack. The Earth just went through at an LPD of 26 degrees.
04 13 02 09	CC	Okay. The Earth went through at 26 degrees going the opposite direction this time - left to right. Is that right?
04 13 02 17	CMP	From left to right. That's affirmative.
04 13 02 32	CC	Of course, the only other thing that we'd be concerned about is what change in your velocity this might have had and what DELTA-V it imparted, and we'll have to look at that for a while before we are able to determine it. And, if there is no significant change, why, we prefer just to leave it the way it is.

04 13 02 54	CMP	Okay, Jack. We're going to get a time on a revolution here, and maybe that'll help you out.
04 13 03 02	CC	Right. And, for your information, the tank went at 1937.
04 13 03 11	CDR	That's two thousand - 1937?
04 13 03 14	CC	Right.
04 13 04 12	CMP	Okay, Jack. The Earth went through again at 18 degrees on the LPD.
04 13 04 19	CC	Okay. Earth at 18. Thank you.
04 13 04 23	CMP	Okay. And we didn't see the Moon that time.
04 13 05 41	CMP	Okay, Jack. The Moon went through that time at 32 degrees on the LPD.
04 13 05 46	CC	Roger. Moon at 32. Thanks.
04 13 08 27	CMP	Okay, Jack. Well, we didn't get the Earth that time. The Moon came back through at about 10 degrees, and now we're getting to the Earth again. Stand by.
04 13 09 08	CMP	Okay. The Earth came through the LPD at 62 degrees that time. And the total time for the two revolutions, - I missed the Earth revolution before, but the total time for the Earth's two revolutions was 3 minutes and 50 seconds.
04 13 09 33	CC	Say again the time and the - and also the LPD number. You're in the background noise, Jack.
04 13 09 39	CMP	Okay. Okay, Jack. LPD that time was 62 degrees and that was for two revolutions, being at that distance we missed the Earth - The time before we didn't see it. And the time was 3 minutes and 50 seconds.
04 13 09 59	CC	Okay. Three minutes and 50 seconds. Is that rate uncomfortable for you?
04 13 10 34	CMP	Jack, Jim said it isn't uncomfortable. It's a little annoying as for the OMNI switching, and also he said it's kind of - He said this Earth/Moon relationship's kind of ... because he doesn't know when to ...

04 13 10 50	CC	Roger.
04 13 13 30	CMP	Okay, Jack. We've got a MASTER ALARM and we've got a battery light flickering.
04 13 13 36	CC	Okay. Copy a battery light. What battery?
04 13 14 16	CC	Aquarius, how about cycling the power temp monitor to find out which battery it is, please.
04 13 14 25	LMP	Yes. That's in work, Joe.
04 13 14 39	LMP	Okay. It's that same old ...
04 13 14 54	CC	Okay, Fred. I can hear you now. Say again, please.
04 13 15 01	LMP	Okay. It's the same old - same old one. The only light I'm getting is on BAT 2.
04 13 15 35	CC	Okay, Fred. We copy your same old friend, battery 2. Could you give us high bit rate for a while, please?
04 13 16 13	CC	Aquarius, Houston. High bit rate, please.
04 13 16 19	LMP	How you getting it now, Jack?
04 13 16 23	CC	We got it.
04 13 20 54	CC	Okay, Aquarius. You can go low bit rate, POWER AMP, OFF and DOWN VOICE BACKUP now. Voltages and currents look normal on battery 2; so ignore the battery light.
04 13 21 12	CMP	Okay, Jack. POWER AMP, OFF, back to low bit rate, and I'll go back to sleep.
04 13 21 21	CC	The battery light staying on?
04 13 21 30	CMP	Yes. We got a steady on BAT 2, BAT FAULT LIGHT and the battery caution light.
04 13 21 49	CC	Okay. And the Skipper in the sack now?
04 13 21 56	CMP	Say again?
04 13 21 57	CC	Is the Skipper in the sack now?
04 13 22 08	CMP	Okay. Hold on a minute, Jack.

04 13 24 17	CC	Aquarius, Houston.
04 13 24 22	CDR	Go ahead, Houston.
04 13 24 24	CC	Okay, Jim. Since the antenna switch is kind of annoying, we've talked them into buying only half of the data. If it gets too troublesome for you to switch antennas, why, just leave it on one antenna and we'll listen to you half of the time.

END OF TAPE

04 13 24 43	CDR	Okay. It's not really much trouble. That's all we're doing about it. We'll try to keep up with it. And you're satisfied with this attitude so far. I guess you're going to watch the thermal and find out whether perhaps we're going to some other PTC attitude.
04 13 24 55	CC	Roger. Thermal appears to be no problem. We're looking at what DELTA-V might have been imparted due to this, and it looks like we're not going to change the PTC attitude.
04 13 25 14	CDR	Okay. Then DELTA-V was a part of it; I hope it raised that angle a little bit.
04 13 25 44	CC	Yes. We'll be looking at the data here, and give you a better answer in next 30 minutes or so.
04 13 25 52	CDR	Okay. Meanwhile, back to the drawing board about nonpropulsive vents.
04 13 26 06	CC	And, with your kind of luck, it probably lowered the angle some more.
04 13 26 13	CDR	Thanks for the confidence.
04 13 26 43	CC	And, Jim, we're going to have a handover here pretty soon, about 3 minutes, we may lose uplink for 30 seconds or a minute.
04 13 26 54	CDR	Okay.
04 13 30 30	CC	Aquarius, Houston. We're handed over. How do you read?
04 13 30 36	CDR	Read you loud and clear, Jack.
04 13 30 42	CC	Okay. I'm hearing you now, and the noise has come up again, but it will go down.
04 13 30 52	CDR	How do you read now?
04 13 30 53	CC	Okay. That's a lot better, and we figure your battery glitch was just that thermal switch triggered a mal - a CAUTION and WARNING, just cycled once, and triggered a MASTER ALARM again. We'll watch the batteries for you, since you don't have any CAUTION and WARNING on now.

04 13 31 13	CDR	Okay. Appreciate that.
04 13 43 33	CC	Okay, Jim. Your luck is holding. Tracking shows that your entry angle has gone up to minus 6.24. This is on the basis of all the data we've collected between the midcourse up to the time the SHe tank went. So, we'll continue to look at it, and see if SHe tank did anything to it at all. So it's - The data has gone from 5.9 to a minus 6.24.
04 13 44 07	CDR	That sounds pretty good. We're really getting in there.
04 14 00 53	CC	How are you doing, Jim?
04 14 00 59	CDR	Not bad. Not bad at all.
04 14 01 10	CC	Is Jack in the sack, or is he with you?
04 14 01 16	CDR	Jack and Fred both are going to sleep. It's sort of humorous; Fred's sleeping place now is in the tunnel, upside down with his head resting on the ascent engine. Jack is on the floor of the LM, with a restraint ... wrapped around his arm to keep him down there.
04 14 01 39	CC	You say Jack is on the floor, and Fred is with his head on the ascent engine.
04 14 01 46	CDR	That's right, with his feet up into the tunnel.
04 14 08 18	CC	Okay, Skipper. Your luck is really hanging in there. Your water's good up to 161 hours now.
04 14 08 26	CDR	Hey, that sounds great.
04 14 08 40	CC	That doesn't include PLSS water or command module water.
04 14 08 49	CDR	Okay. Jack, I'd just like to know what - what plans or thoughts being contemplated for the PLSSs or the OPS, whether we're going to use their LiOH canisters or take the devices back in the command module with us, or just what will be your plans.
04 14 09 15	CC	Yes. We're talking all that over now. We haven't decided.

04 14 09 22	CDR	Okay.
04 14 14 58	CC	Everything's running real smooth over in Timber Cove, Jim.
04 14 15 05	CDR	Sounds pretty good. How about at El Lago?
04 14 15 11	CC	Same. Everything's smooth there, too.
04 14 15 16	CDR	Good.
04 14 23 19	CC	Jim, we've had a lot of people working on the entry procedures, and they'll be continuing to do so. We got a few ideas we'd like to toss at you so you can start thinking about them if you think you're in a position to discuss them without waking up the other guys. What do you think?
04 14 23 36	CDR	Yes, go ahead. It's okay.
04 14 23 40	CC	Okay. One of the first things we want to do is charge the battery in CSM, so we can get some LM power over there to do that, and we have procedures ginned up to do it. In regards to reentry, we're planning our last midcourse at 5 hours before entry interface, and, if we have to make one, that is. And then we'd like to jettison the service module at 4 hours and a half, roughly, before entry interface, and take the next 3 to 3-1/2 hours for taking pictures, cranking up the command module G&N, taking care of stowage, and other odds and ends. And we'd hang on to the LM until 1 hour before entry interface, and then we'd jettison that. And these procedures are going to be run integrated in the CMS and LMS tomorrow morning, and, hopefully, later on in the day, we'll do it again with Mission Control on the loop. A couple of other things we'd like to toss at you: one question is what do we do with the OPS. The thought is that there is adequate O_2 in the command module and that the OPS represents high pressure source and a stowage problem, and people are thinking about leaving them in the LM. The other thing is that we think you might want to make this a suited entry, suiting up prior to LM jettison, because what we're doing is, when we jettison the LM, we're going to do it like

we did in Apollo 10 - just let the beauty go, and if we weren't suited, why, we'd be betting on the hatch seal to take care of us. So we thought we'd toss these few ideas at you. Some of them are ones that are particularly pertinent questions at this time.

04 14 25 46	CDR	Okay. A suited entry would sort of ... the 1-hour LM jettison back and ... back and forth up to that time. ... impede our progress back and forth. ...
04 14 26 10	CC	We're losing you, Jim.
04 14 26 13	CDR	Okay. I think I've got you back. I guess the midcourse at 5 hours prior to ...
04 14 26 25	CC	Affirmative, Jim. Midcourse 5 hours prior to entry interface.
04 14 26 35	CDR	If that's the case, all I'm worried about is having that all squared away. It's long before that ... I want everything in its place. All the stowage cleared away, all the ... ready to go and know exactly what to do and ... so that we can do the midcourse, and ... get into the command module ... jettison the service module, and then know exactly how to get into the LM.
04 14 27 13	CC	Roger. All those procedures will work - will be worked out precisely, and we agree that the stowage and all of those peripheral details ought to be taken care of before midcourse.
04 14 27 31	CDR	And, I guess, that last midcourse, we'd want to start looking at midcourse fairly early, if we have the power to do so, mainly because of attitude control. This last time was fairly easy, but I'm not too sure how long we can continue to ...
04 14 28 09	CDR	I have ... in, and it seems about as cold as it is now, we'll probably be going into suits long before entry.
04 14 28 22	CC	Yes. That's what we were thinking.

04 14 28 50	CC	I guess the two things which are somewhat unresolved at the moment are what to do with the OPS and what to do about the suited entry. We thought we'd toss those at you to see what you thought about them.
04 14 29 06	CDR	Okay. As far as the OPS is concerned, we have enough oxygen in the spacecraft ... to get us through. I have no ... command module ... suit loop prior to entry. I was looking at ... OPS ... sources of oxygen ... also in the - in the front of the suit loop or ... circulate ...
04 14 30 06	CC	Jim, I'm sorry. We're not catching what you're saying. The COMM is getting kind of bad right now.
04 14 30 15	CDR	Okay, Jack. How do you read now?
04 14 30 18	CC	I've still got you with quite a bit of background noise, but if you talk up like that, I think we can hear you.
04 14 30 26	CDR	Okay. My only concern about leaving the OPS and/or the PLSS in the command module is how soon do we have to live off the command module consumables prior to entry, and the PLSS has a fan and has a lithium hydroxide ... use the command module system. Also, the OPS ... right now ... command module ... command module oxygen and electrical power is ... but I had just as soon be ... back in the LM.
04 14 31 10	CC	It sounds like the general gist of your comments are that if things remain pretty much as they are now in the command module, you'd just as soon leave the OPS in the LM. Is that affirm?
04 14 31 24	CDR	That's affirm.
04 14 31 31	CC	Okay. And maybe you'd like to think over the suited entry bit a little while.
04 14 31 40	CDR	Okay.
04 14 32 01	CDR	Houston, Aquarius.
04 14 32 02	CC	Go ahead.

04 14 32 06	CDR	Okay ... How we aline the command module right for entry, especially if you have the LM in back. Over.
04 14 32 21	CC	Roger. That's one subject that's been getting a lot of attention, and let me see if I can get some general ideas on that at the moment.
04 14 32 33	CDR	Okay.
04 14 35 36	CC	Jim, I can give you the general idea of the proposed procedure for bringing the command module G&N up. It's the presently proposed one. We may come up with a better one, but here's what we're looking at right now. First thing we plan to do is to - using the LM COAS, sight on the Earth with the LM just as we did in the midcourse. Then we'll do a body-axis aline, 400 plus 5 on the AGS, to put the AGS ball at 000. And then we can give you an AGS ball attitude to fly to, to point the CSM optics at the Moon. And, if you can see stars, why, we can use those too. Then we can give you an equivalent set of CDU angles to put into NOUN 20 and to torque the platform over. So, now we're coarse alined. Then we do a fine aline by shooting at the Moon and then at the Sun. Do you follow all that?
04 14 37 05	CDR	Okay, Jack. Let me see if I have it. What we do is point the LM at the Earth as we did for the midcourse COAS, and we do a body-axis aline on the AGS. Then you give us an AGS ball attitude to fly to. ... the LM, and then we ... point the ... at the Moon. Then you would update the - give us some CDUs to coarse aline. ... fine aline ... on stars or the Moon or the Earth. Stand by. Okay. We had another MASTER ALARM, Jack. I don't see any lights down there, except the battery light's still there. You want - - ... display ECS. Okay. And the number 2 battery still has a light on it. I suspect it may be the same problem that we had before ... ...
04 14 38 30	CC	Okay. Let us talk it over a second, and we'll tell you what to do.
04 14 39 00	CC	Jim, is the battery light kind of flickering?
04 14 39 06	CDR	Yes. That's affirm, Jack.

04 14 39 16	CDR	Yes. The battery light's flickering, and it triggers off the MASTER ALARM.
04 14 39 21	CC	Okay. Well, that - temperature sensor on battery 2 is kind of cycling back and forth and every time it does, it triggers a MASTER ALARM, Jim.
04 14 39 37	CDR	Okay. Same old problem, huh?
04 14 39 39	CC	Yes.
04 14 40 13	CC	And, Jim, finally on the P52, we're considering using the - the Moon and then the Sun for the fine aline.
04 14 40 24	CDR	Okay. The Moon and the Sun for the fine aline. Understand. We'll go through this again here ...
04 14 40 55	CDR	Okay, Jack. Once - Once I get the spacecraft at the proper attitude ...
04 14 41 22	CC	Jim, I didn't copy your last question due to background noise.
04 14 41 29	CDR	Okay. Once - Once you get the AGS ball alined ... command module ...
04 14 41 49	CC	After we do the body axis aline on the AGS, we can tell you what attitude on the AGS ball to fly to in order to point the CSM optics at the Moon or at some star. And then we can, knowing where the optics are pointed, give you an equivalent set of CDU angles to put in NOUN 20 to torque the platform.
04 14 42 22	CDR	Okay. I see.
04 14 42 30	CC	That's the current thinking. It may change between now and tomorrow, but right now, that's the way it looks, Jim. It'll probably be some take-off on that anyway.
04 14 42 43	CDR	Okay. Are they planning on a G&N entry or using another system, like EMS or something like that?
04 14 42 54	CC	It will be a G&N entry.
04 14 43 01	CDR	Nothing like going first class.
04 14 43 06	CC	Yes. That'll be a switch, won't it?

04 14 46 00	CC	Jim, are you broken into the food locker in the LM yet?
04 14 46 06	CDR	That's affirm, Jack. I sure have. ... away.
04 14 46 14	CC	You say you did find everything in order in there, huh?
04 14 46 20	CDR	Yes, everything was great.
04 14 46 22	CC	Okay. I'll pass it.
04 14 46 40	CC	I had a question about that earlier.
04 14 46 46	CDR	Right.
04 14 48 13	CDR	Houston, Aquarius.
04 14 48 16	CC	Go ahead.
04 14 48 19	CDR	I understand that one of your reasons for a suited entry is the fact that the command module hatch ... hasn't been good. It doesn't seem to be any different, but in the other ... our hatch is no better than other spacecraft.
04 14 48 58	CC	No, the situation, Jim, is that your hatch is as good as any other hatch but that we won't have a chance to verify it until so late in the game, like 1 hour before entry interface, in this case; whereas before, why, we had a chance to evaluate it in lunar orbit. Over.
04 14 49 23	CDR	Oh, okay.
04 14 49 27	CC	And that might make your time line a little too crowded, getting your suits on there at the last minute; say, less than an hour before entry interface.
04 14 49 44	CDR	Okay.
04 14 50 30	CC	Jim, the next action item we want to pursue is transferring some LM power up to the command module MAIN B so we can start charging battery, and I guess what we ought to do is start on that one when somebody else gets up to help you there. So, when you decide to get the other guys up, or to have someone help, why, let us know and we'll start working on that.

04 14 51 03	CDR	Okay. I'll let you have Jack, and Fred's ... When in the time line ...?
04 14 51 18	CC	Say again, Jim. I didn't catch that.
04 14 51 23	CDR	When in our time - What's the GET do you plan on ...
04 14 52 07	CC	Jim, I didn't catch all of what you said, but I think you wanted to krow when the procedures for entry are going to be available and read up to you. If that's the case, why, we're talking about 120 hours or so. As far as the - charging battery A, we want to do that as soon as the other guys get up to help you. We've already passed up some of that procedure, and we have a couple of DELTAs to it.
04 14 52 37	CDR	Roger. Jack's already up. He asked ... curious when you wanted to do it. Did you understand that? ... Is that correct?
04 14 53 00	CC	Jim, we're having trouble hearing you. The next order of business is to charge battery A, and when you get somebody to help you there, why, we'll go ahead and get done with it.
04 14 53 13	CDR	Okay. Sounds good.
04 14 53 17	CC	And, before you start working on it let us know. because we've got some DELTAs to the battery charging procedure.
04 14 53 26	CDR	Roger. I'm putting Jack on the line now to copy down the DELTAs ...
04 14 53 54	CMP	...
04 14 54 02	CC	Aquarius, did you call?
04 14 54 06	CMP	Yes, Jack. I'm on the line. ...
04 14 54 17	CC	Okay. Go ahead now. I can hear better.
04 14 54 22	CMP	Okay, Jack. Joe Kerwin passed me up the procedure for powering the CSM from the LM. Has it changed?
04 14 54 32	CC	Yes. If you'll get that out, I'll read you the DELTAs.

04 14 54 42	CMP	Okay. I've got it.
04 14 54 47	CC	Okay. The second step was in the LM circuit breakers panel 11 and 16: ASCENT ECA CONTROL, close, two of them. Cross that out. In the next line, we had BATTERY 5 NORMAL FEED, on; cross out BATTERY 5 ani put BATTERY 6 in there. In the next line was - -
04 14 55 17	CMP	... Jack ... Hey, Jack; I have for step 3, I have BAT 5 and BAT 6 NORMAL FEED, on. You just want BAT 6?
04 14 55 30	CC	That's affirmative. Just BAT 6, Jack. And the next line, you had BATTERY 1 and 3. Make that BATTERY 1, 2, 3, and 4. Just add BATs 2 and 4. All four descent BATs. And then the next two lines about waiting 30 minutes, cross that out. And the next line about BATTERIES 2 and 4 OFF/ RESET, cross that out, too.
04 14 56 09	CC	And, Jack, the - -
04 14 56 10	CMP	Okay. Let me read -
04 14 56 12	CC	Go ahead.
04 14 56 14	CMP	Let me read you all the steps as I've got them, Jack, and make sure we've got them right. ... ASCENT ECA, two, closed. Step 2 will now be BAT 6, NORMAL FEED, on. Step 3, BATS 1, 2, 3, and 4, OFF/RESET.
04 14 56 44	CC	Okay. That part's all right, Jack. And we had - about 11 or 12 steps for the command module. They go as is with no change. And then we had a couple of more procedures for the LM. Stand by 1.
04 14 57 12	CMP	Okay. Jack, let me read you command module procedures just to make sure I have them right, also.
04 14 57 18	CC	Okay. Go ahead with the command module procedures.
04 14 57 23	CMP	Okay. Connect LM and CSM umbilicals. Step 2, panel 5: LM POWER 1 AC and 2 AC, closed, circuit breakers. Step 3, panel 5: EPS SENSOR SIGNAL, MAIN B, closed. Step 4, panel ... closed. Then there's step 5: MAIN B BAT BUS B, closed.

Verify MAIN BUS voltage, then switch the LM power to CSM. Step 7: CB MAIN B BAT BUS B, open. And on panel 250, BAT POWER ENTRY and POSTLANDING, open. Verify MAIN BUS voltage.

END OF TAPE

04 14 58 49	CC	Okay, Jack. The CSM procedure's okay, and then we had to go back to the LM and do something. And the first line is okay, cross out "BAT 5 and 6 OFF," delete that. And delete the next line also, that says "Panel 11 to 16 ASCENT ECA CONTROL, open." Then we had a couple of notes which remain the same. Go ahead.
04 14 59 20	CMP	Okay. I didn't get the notes, but I'll read you the steps as I have them now. One step, BAT 1, 2, 3, and 4 ... and at this point should have BATTERIES 1, 2, 3, 4, and 6 ON. Is that affirmative?
04 14 59 39	CC	That's affirmative. So now we have BAT 1, 2, 3, 4, and 6, ON, and I got two notes. Number 1 is: your circuit breaker protection limits - your circuit breaker protection - limits the current to 15 amps. Number 2 note is: now the umbilical between the LM and the command module is hot. And the MAIN BUS voltage can be monitored by selecting MAIN B.
04 15 00 46	CMP	Okay, Jack. These notes are: circuit breaker protection limits current to 15 amps. The tube, the umbilical between the CSM and LM is hot. I can monitor MAIN B for the bus voltage.
04 15 01 04	CC	That's affirm, Jack.
04 15 01 22	CMP	Okay, Jack. One question here. If we transfer power like this, we're not going to cut us short on power remaining in the CSM ..., are we ...?
04 15 01 37	CC	Say it again, Jack. I didn't get it.
04 15 01 43	CMP	Okay. Stand by. If we configure the CSM for powering up the LM, we aren't going to cut it short on LM power requirements to get us back in the entry interface, are we?
04 15 02 03	CC	That's a negative, Jack. According to the latest update, we've got ampere-hours out to 203 hours.
04 15 02 20	CMP	Stand by. ...
04 15 02 40	CMP	Okay, Jack. One question from Jim is, he wants to know whether the procedure has been tried ...

04 15 03 04	CC	Okay. Try it again, now, Jack. What did Jim want to know?
04 15 03 10	CMP	Okay. He would like to know whether the procedure has been tried and whether it has been found to be okay; and there's no danger of shorting out any of our batteries or anything we have on board the LM now.
04 15 04 20	CC	Okay, Jack. This procedure has not been tried out as such; however, the hardware paths through which the current flows are the same ones which we used during translunar trajectory, and there's not a problem with shorting out a descent battery. Over.
04 15 04 47	CMP	Okay. I'll relay that to Jim.
04 15 05 09	CC	Jack, of course, the reason for all of this is that we see we're 20 amp-hours short on one of the entry batteries, and we've got to juice that up to get you home with.
04 15 05 25	CMP	Okay.
04 15 05 30	CC	Okay. What we owe you from here on out is the actual battery A charge procedure, and then a procedure to turn this all around, again.
04 15 05 48	CMP	Okay. Do you have it there, and how long is it ...
04 15 06 15	CC	Okay, Jack. I have the procedure in front of me. It's about 18 steps, and the reason it's so long is because we're starting from this basic configuration which we gave you earlier. It concerns a charge on battery A, of course, which is our low one. So, when you're ready to copy it, let me know.
04 15 06 40	CMP	Okay. Let's go at it.
04 15 06 46	CC	Okay. Are you ready to read - copy it?
04 15 06 53	CMP	Go ahead.
04 15 06 54	CC	Okay. On panel 250, circuit breaker BAT A, POWER ENTRY/POSTLANDING, close; on panel 275, circuit breaker INVERTER POWER 2, MAIN B, close. Next several circuit breakers are on panel 5;

		circuit breaker BAT RELAY BUS, BAT A, close; circuit breaker EPS SENSOR UNIT, AC BUS 2, close; CB EPS SENSOR SIGNAL, AC2, close; CB BATTERY CHARGER, MAIN B, close. Are you still with me?
04 15 08 28	CMP	Okay, Jack. I'll read back those steps you gave me so far. Panel 250 CB BAT A, POWER ENTRY/POSTLANDING, close; panel 275, CB INVERTER POWER 2, MAIN B, close; panel 5, CB BAT RELAY BUS, BAT A, close; CB EPS SENSOR UNIT, AC BUS 2, close; CB EPS SENSOR SIGNAL, AC2, close, CB BAT CHARGER, MAIN B, close.
04 15 09 06	CC	Okay. Good readback, Jack. The only one is number 1 - number 4. I didn't get your readback, but it's EPS SENSOR UNIT AC BUS 2, close. You got that?
04 15 09 22	CMP	Yes. I read that back CB EPS SENSOR UNIT, close.
04 15 09 30	CC	Okay. To continue - to continue on - the same panel, panel 5: circuit breaker, BATTERY CHARGER, AC POWER, close; circuit breaker BATTERY CHARGER, BAT A CHARGE, close; circuit breaker INVERTER CONTROL 2, close; circuit breaker INVERTER CONTROL 3, close; I've got a switch for you, MAIN BUS TIE, BAT A/C, OFF; and another switch, BATTERY CHARGE to AC2. Read those back.
04 15 10 51	CMP	Okay, Jack. CB BAT CHARGER to AC POWER, close. Stand by. Okay. I had to get a light here. CB BAR CHARGER, BAR A CHARGE, close; CB INVERTER CONTROL 2, close; CB INVERTER CONTROL 3, close; the two switches, MAIN BUS TIE, BAT A/C, OFF; and the second one, BAT CHARGER TO AC2.
04 15 11 30	CC	How about reaching over there on your right-hand side and turning the BIOMED off? See if we can improve the COMM a little bit.
04 15 12 02	CMP	Okay. How do you read, now?
04 15 12 03	CC	Okay. I'm reading you real good now, and I want to verify that the main bus tie that we switched OFF was BAT Alfa Charlie.
04 15 12 15	CMP	That's verified; MAIN BUS TIE, BAT Alfa Charlie, OFF. And that should ...

04 15 12 22	CC	Okay. And in panel 3, I've got a switch for you. AC INVERTER 2 to MAIN B.
04 15 12 39	CMP	Okay. AC INVERTER 2 to MAIN B.
04 15 12 42	CC	Okay. And switch INVERTER 2, AC BUS 2 to on; and another switch, AC BUS 2 RESET, to reset and center; switch BATTERY CHARGE to Alfa; switch DC INDICATOR select BAT CHARGER; and then what we want you to do is to report the charger current and voltage to MSFN every 10 minutes for the first half hour, and then once every 30 minutes after that. And that'll be on our call, Jack. Read back the switches that I just gave you.
04 15 13 58	CMP	Okay, Jack. It's panel 3, AC INVERTER 2, MAIN B; INVERTER 2, AC BUS 2, on; AC BUS 2 RESET to reset and center; BAT CHARGER to A; AC INDICATOR select to BAT CHARGER. Report amps and volts to MSFN every 10 minutes for the first 30 minutes, and then every 30 minutes on a MSFN call.
04 15 14 29	CC	Okay. That's a good readback, Jack. Now the only thing we owe you is a turnaround from this, which we will have.
04 15 14 40	CMP	Okay. Let me ask one question, here. About how long do you think it'll take to charge these batteries?
04 15 14 45	CC	It's going to take you about 15 hours.
04 15 15 09	CMP	Jack, about how many amperes of LM power will this 15 hours ...?
04 15 15 21	CC	Stand by. We'll get it for you - -
04 15 15 22	CMP	How many, Jack?
04 15 15 26	CMP	Okay. He got it. He got the question.
04 15 15 49	CC	Okay, Jack. That's going to take 120 amp-hours out of the LM, which is equivalent to 10 hours, which will put us back to 193 hours, and that's plenty.
04 15 16 07	CMP	Okay. Let me relay that to Jim here. It'll be 120 amp hours, which leaves us - which puts us back from 203 hours ... to 193 hours.

04 15 16 20	LMP	Yes, there's that much to spare.
04 15 16 35	LMP	Okay, Jack. One question here. If we have any problems setting up this LM power to the CSM, is the quickest way to get out of it, return to the normal configuration, as it is for me to just switch the LM POWER to CSM to RESET then OFF?
04 15 16 57	CC	Stand by 1.
04 15 17 02	CMP	I would like to give one quick step in case that gave Jim report some sort of problem for us to get out of it quickly.
04 15 17 11	CC	Okay. Let us talk it over for a minute, Jack.
04 15 17 16	CMP	Okay. Real fine. And while you guys are talking it over, you might read back - Have you got the procedure for reversing this? I'll copy that.
04 15 20 00	CMP	Okay, Jack. Are you with me?
04 15 20 03	CC	Yes. We're still here, Jack. What we want to do is follow you through on this, so we're going to get high bit rate to do it. In answer to your question, to undo this procedure quickly, in the event a problem develops, be sure that you don't touch the LM POWER switch because it's got a RESET position. But the way to undo it is go into the CSM and on panel 5 open two circuit breakers. And they're some of the first ones we read to you. Open LM POWER-1 MAIN B, and open LM POWER-2 MAIN B. You copy that?
04 15 20 45	CMP	Okay. Understand. If I want to get out of this real quickly, I have to open just two circuit breakers in the CSM; that's on panel 5, LM POWER-1 MAIN B, LM POWER-2 MAIN B.
04 15 20 58	CC	Okay. And before you go ahead with this, let's establish high bit rate and wait 1 on that. And then as we go through the procedure we want you to wait when you get power on MAIN B so we can take a look at MAIN B without any loads on it before we start charging the batteries.
04 15 21 31	CMP	Okay. I understand you want high bit rate on the LM or CSM just before we start this?

04 15 21 40	CC	That will be high bit rate on the LM, and stand by for it.
04 15 21 45	CMP	Okay.
04 15 21 52	CC	Okay, Jack. Before we go ahead with this, what we want to do is read you the reverse - the normal reverse procedure.
04 15 22 00	CMP	Okay. I'm ready to copy.
04 15 22 56	CC	Okay, Jack. I got the start on how you reverse this procedure. Ready to copy?
04 15 23 04	CMP	Go ahead, Jack.
04 15 23 06	CMP	Okay. First you want to reverse the battery charge procedure. To do that, on panel 3, switch BATTERY CHARGE, off; AC INVERTER 2, off; panel 5, MAIN BUS TIE BAT Alfa Charlie, on, up; panel 250, circuit breaker BAT Alfa, POWER ENTRY, and POSTLANDING, open. Read back.
04 15 23 59	CMP	Okay, Jack. On panel 3, BATTERY CHARGER, off, AC INVERTER 2, off; on panel 5, MAIN BUS TIE Alfa Charlie, on; panel 250, CB BAT A, POWER ENTRY and POSTLANDING, open.
04 15 24 23	CC	That's affirmative, Jack, and then if you'll go back to the rest of the circuit breakers on that list, and just opposite - Open them all up. Stand by 1.
04 15 24 52	CC	Okay, Jack. Go back to the battery charge procedure I gave you. And, in order to terminate charge, just - You'll just have to write "Open" or "Off" next to the circuit switch that I gave you. So on panel 250, that circuit breaker you've already opened; on panel 275, INVERTER POWER-2 MAIN B, open; panel 5, BAT RELAY BUS BAT A, open; EPS SENSOR UNIT AC BUS 2, open, EPS SENSOR SIGNAL AC2, open; BATTERY CHARGER, MAIN B, open; BATTERY CHARGER AC POWER, open; BATTERY CHARGER, BAT A CHARGE, open; INVERTER CONTROL 2, open; INVERTER CONTROL 3, open; you've already done the MAIN BUS TIE; and then BAT CHARGE switch to AC 1. Over on panel 3, you have already set the AC INVERTER 2 to OFF

and then INVERTER 2 AC BUS 2, OFF; AC BUS 2 RESET to OFF. You have already put the BATTERY CHARGER switch to OFF; and your DC Indicator select to MAIN B. Over.

04 15 26 46 CMP Okay, Jack. Do you want me to read it back to you?

04 15 26 51 CC No, if you've got something in the right-hand column for all of those, we don't want to have to do it. And now one more thing I owe you is how to untransfer LM power to the CSM, and I'll get that for you in a jiffy.

04 15 27 22 CMP Okay. I'll be standing by to copy it.

04 15 27 25 CC Okay. We have a last minute change to that.

04 15 33 12 CMP Houston, 13.

04 15 33 23 CC Go ahead.

04 15 33 27 CMP Okay, Jack. One thing - I guess you probably all have considered it, but what heavy things can we store down there where the SRCs normally go to help increase our L over D?

04 15 33 43 CC I understand the question is what kind of heavy things can you store where the SRCs go.

04 15 33 50 CMP Yes. They go down in the LEB underneath the computer, and the heavier things you have down there increases the L over D. We don't have any SRCs, so I was just wondering what heavy things - We could probably put some cameras, television cameras, things like that that normally pretty heavy down there in - that, in our SRC. No, we can't put the in our SRC, but we could put them in that container down there which would help decrease our L over D. Anything else you can think of would be greatly appreciated because we don't even have a throwaway station, so we're down a little bit in L over D.

04 15 34 33 CC Okay. Let me pass that question along, and get somebody working on it.

04 15 35 03 CC Souvenirs, I guess.

04 15 35 09	CMP	What souvenirs? (Laughter) All I've got is a Marine Corps foxhole-digging shovel.
04 15 35 19	CC	You've got all you need then, buddy.
04 15 35 27	CC	Okay. Ready to copy the power removal from the command module/LM umbilical.
04 15 35 35	CMP	I'm ready to copy. Go ahead.
04 15 35 40	CC	Okay. This assumes that all the descent batteries are on line and ASCENT BATTERY 6 is on NORMAL FEED, as we said earlier. First thing you do is go in the CSM and look on panel 5 circuit breaker. LM POWER-2 MAIN B, open; LM POWER-1 MAIN A, open; circuit breaker EPS SENSOR SIGNAL MAIN B, open.
04 15 36 18	CMP	Hey, Jack.
04 15 36 20	CC	Go ahead.
04 15 36 31	CMP	... You got just a little bit scratchy there because of the antenna problem. Let me read this back to you.
04 15 36 53	CMP	Okay. What I got, Jack, was the procedure assumes that all DESCENT BATTERIES are ON, and BAT 6 is on NORMAL FEED. Now we're going into the LM and on panel 5, we take LM, or CB LM POWER-2, MAIN B, open. And that's as far as I got.
04 15 37 18	CC	Okay, the second one is on panel 5 also. Circuit breaker, LM POWER-1, MAIN A, open; circuit breaker EPS SENSOR SIGNAL, MAIN B, open. Okay, read those back for the CSM, and I'll give you some steps in the LM.
04 15 37 40	CMP	Okay.
04 15 37 58	CMP	Okay. CB LM POWER-2, MAIN B, open; CB LM POWER-1, MAIN A, open; CB EPS SENSOR SIGNAL, MAIN B, open. Stand by 1, Jack.
04 15 38 15	CMP	Jack, I don't think we ever closed CB LM POWER-1, MAIN A. We closed LM POWER-2, MAIN B, and LM POWER-1, MAIN B. Both of them on MAIN B.
04 15 38 36	CC	Yes, you're right. Both of them should be MAIN B.
04 15 38 42	CMP	Okay. Copy that.

04 15 38 47	CC	Okay. Ready to copy the LM?
04 15 38 52	CMP	Okay. Go ahead.
04 15 38 55	CC	Okay. On panel 16 circuit breaker, EPS, BAT FEED TIES, two, open; and now you've got to listen real carefully for high volts and low volts. BATTERY 1, HIGH VOLTS, to OFF/RESET; BATTERY 2, LOW VOLTS, to OFF/RESET and then ON; BATTERY 2, HIGH VOLTS, to OFF/RESET and then ON; BATTERY 1, HIGH VOLTS, ON; and then the circuit breaker on panel 16, EPS: BAT FEED TIES, both of them, closed. Read back.
04 15 40 20	CMP	Okay. On the LM side of the house is on panel 16. CB EPS BAT FEED TIES, two, open; BATTERY 1, HIGH VOLTAGE, OFF/RESET; BATTERY 2, LOW VOLTAGE, OFF/RESET then ON; BATTERY 2, HIGH VOLTAGE, OFF/RESET then ON; BATTERY 1, HIGH VOLTAGE, ON. Panel 16, CB BAT FEED TIES, two, closed.
04 15 40 56	CC	Okay. That's a good readback. It concludes the procedure going both ways and now we just have to stand by.
04 15 41 06	CMP	Okay, when do you plan to start this?
04 15 41 10	CC	Darn soon.
04 15 41 15	CMP	Did you say not soon?
04 15 41 17	CC	No, we're going to do it pretty soon, but we want to have high bit rate, and we don't want you to give that to us until we tell you.
04 15 41 29	CMP	Okay. I think I'll go back and try to undamp up there. Do you have anything more for the command module?
04 15 41 43	CC	We're discussing two items, but we don't have them ready right now.
04 15 41 56	CMP	One of them, I hope, is a foolproof alinement procedure.
04 15 42 37	CMP	Okay, Jack. Just for curiosity's sake, does FIDO have any information as to whether that helium - that helium tank dump affected our trajectory at all?
04 15 43 21	CC	Okay, Aquarius. Our tracking data shows that since the helium dump, our entry angle has not changed

from its value of 6.24, and somebody calculated that if we had a propulsive vent, that helium could roughly, at the maximum, only impart a DELTA-V of a half a foot per second or less, anyway. But we're continuing to track and as soon as we get some more info, we'll pass it along.

04 15 43 57	CMP	Okay. That's swell, Jack. Thank you.
04 15 44 00	CC	Sure.
04 15 44 01	CMP	Your 6.24 sounds good.
04 15 44 14	CDR	I'm still awake, I guess.
04 15 44 22	CMP	They said that it would be a while because they want to get high bit rate. They don't want to put high bit rate. ...
04 15 46 40	CC	Okay, Aquarius. We're ready. So we want some high bit rate. To do that, go over to panel 16 under COMM and close the PRIMARY S-BAND POWER AMPLIFIER. On your COMM panel -
04 15 46 56	CMP	Okay. Okay, Jack. Wait 1. While - I'd like to get the whole crew up for this if you don't mind.
04 15 47 04	CC	Okay.
04 15 47 09	CMP	... they're ready to start. Yes, you want to get Fred-o up.
04 15 47 20	CMP	We want to transfer some power - I want to go to high bit rate here first, then want to transfer LM power to CSM, Fred.
04 15 47 39	CMP	Okay, Jim, I'll give you the COMM.
04 15 47 40	CC	Aquarius, there's no great big rush. If you want to let Fred come up to speed slowly, why maybe that'll help out.
04 15 47 55	CMP	Okay. ...
04 15 48 47	CDR	And Houston, Jack is showing Fred the procedures before we start up.
04 15 48 57	CC	Say again, Jim.
04 15 49 02	CDR	...

04 15 50 27	CC	Aquarius, how do you read?
04 15 50 32	CDR	Loud and clear.
04 15 50 33	CC	Okay. I'm hearing you now. I think I missed your last transmission, Jim.
04 15 50 41	CDR	Okay. Jack is showing Fred the procedures. Want to get him familiarized with them, and how to get out of any problems before we proceed.
04 15 50 54	CC	Roger. No rush. Just let us know when you're ready. We don't want old Fred-o to slip a gimbal there.
04 15 51 05	CDR	Yes. We're watching him.
04 15 53 24	CDR	Boy, if you took 120 hours out. Oh. ... Okay. ...
04 15 54 15	LMP	Houston, Aquarius.
04 15 54 18	CC	Hello, Fred. Go ahead.
04 15 54 23	LMP	Okay, I guess the only question I have is in the first - the very first portion involving the LM here where it has me turn on the only BAT 6, and then turn off all the DESCENT BATTERIES. Are you still reading me?
04 15 54 53	CC	Okay. I read you until after turn off BAT 6 - Correction, turn on only BAT 6.
04 15 55 03	LMP	Okay, the question is "Only one ASCENT BATTERY BAT 6 on the line," immediately followed by turning off four DESCENT BATs. Is that correct?
04 15 55 18	CC	That's affirmative, Fred. That question has been banged around and we decided to go that way.
04 15 55 38	LMP	Let's see, we will be powering other BUS via the CROSS TIE BALANCE LOADS breaker. Is that correct?
04 15 55 47	CC	That's affirmative, and we're reading a current of 11 amps right now.
04 15 55 55	LMP	Okay. Okay. I guess I'm ready, then. That's 11 amps?
04 15 56 00	CC	And after you turn BAT 6 on the line, you might as well take a look at the BATs 1 through 4 and so forth, and make sure that it's okay to turn them off.

04 15 56 16	LMP	Roger. Are you ready, gang?
04 15 56 21	CC	Yes, we're ready for the POWER AMPLIFIER and the HIGH BIT RATE, and NORMAL VOICE, on the FUNCTION switch, please.
04 15 56 32	LMP	Okay.
04 15 56 58	CC	Okay, gang; we've got the HIGH BIT RATE, now.
04 15 57 04	LMP	Roger.
04 15 57 29	CC	Okay, we see BAT 6, ON, and it looks good, Fred-o.
04 15 57 38	LMP	Okay. Am I cleared to proceed with the next step, getting 1, 2, 3, and 4, OFF/RESET?
04 15 57 46	CC	Affirmative. You're cleared for BATs 1 through 4, OFF/RESET.
04 15 57 54	LMP	Okay.
04 15 58 13	CC	Okay. Still looks good.
04 15 59 13	LMP	Okay, Houston. We need a call from you when to have Jack to proceed up into the Odyssey and start up there.
04 15 59 31	CC	Okay, Aquarius; and Jack can get with it right now.
04 15 59 38	LMP	Okay.
04 16 06 11	LMP	Okay, Houston; Aquarius. We've completed the powerup and things look good upstairs. Are we GO for proceeding with battery charge?
04 16 06 28	CC	Okay, Aquarius; you're GO on the battery charge.
04 16 06 34	LMP	Roger.
04 16 07 36	LMP	Boy, this is really a switch, isn't it, Jack?
04 16 07 48	CC	That's an understatement. You're not known for that.
04 16 07 54	LMP	Yes. I think if you add up the - Yes - if you add up the operating time, I think the LM beats the CSM by a considerable margin on this flight.
04 16 08 34	CC	Grumman just hired you.

04 16 08 38	LMP	Yes.
04 16 08 51	CC	You're out there at 134000, coming in at about 4900 feet a second.
04 16 08 58	LMP	Very good.
04 16 10 04	CC	The SUPERCRIT tank went off at about 19:37, just about like expected.
04 16 10 11	LMP	Yes. It - it also must of not did very much, except the rates. I was asleep then and I didn't hear a thing.
04 16 10 25	CC	Is the command - service module still venting?
04 16 10 36	LMP	Jack said it was just before he went up. Right now, the Sun's over there, and I can't really tell - -
04 16 10 42	CC	And - -
04 16 10 43	LMP	- - I'll look again in 1 minute.
04 16 10 44	CC	We asked him a long time ago if he was able to see any stars out the optics. I don't think we ever got an answer.
04 16 10 52	LMP	Okay.
04 16 11 04	LMP	That's a pretty good sleep station I had rigged up, Jack. I took one of the sleep restraints out of the command module, zipped up in it, and then hooked the tie, right at the top of the zipper, onto the LM upper hatch handle. So it kind of held me there, and then just drifted up in the tunnel upside down with my face toward the hatch, so the sunlight didn't get in my eyes and that worked pretty good.
04 16 11 35	CC	Did you sleep pretty well that way?
04 16 11 39	LMP	Yes, no problem at all.
04 16 11 44	CC	Is Jim sleeping that way now, or is he standing next to you?
04 16 11 49	LMP	He's standing next to me.
04 16 11 51	CC	About time for him to go to bed.

04 16 11 57	LMP	Okay. The voltage upstairs is 34.3 and the charger is reading 2.5 amps.
04 16 12 06	CC	Okay 34.3 and 2.5. And ... says ... - -
04 16 12 11	LMP	- - pretty cold. Good.
04 16 12 12	CC	Say again your last.
04 16 12 16	LMP	They came - both came down here rubbing their hands, shivering. It's pretty cool upstairs.
04 16 12 26	CC	Are you keeping warm in the LM?
04 16 12 41	LMP	Yes. It's pretty reasonable down here.
04 16 13 25	LMP	Okay. And right now, it looks like ... right now, it looks like the command module isn't venting, Jack, so I'm going to try to take a look at the optics.
04 16 13 48	CC	Okay. You say it is not venting?
04 16 13 52	LMP	Yes. That's the word. We've just looked through the AOT and you can't see anything back there.
04 16 14 00	CC	Okay. And everything's fine in El Lago.
04 16 14 06	LMP	Very good.
04 16 15 42	CC	Aquarius, we're ready to secure the high bit rate.
04 16 15 48	LMP	Okay.
04 16 16 32	LMP	Houston, Aquarius; how do you read?
04 16 16 38	CC	I'm hearing you with a lot of background noise, Fred-o.
04 16 16 42	LMP	Okay. How now? I just switched OMNIs again.
04 16 23 32	CC	Aquarius, could you get a - amps and volts readout from Odyssey, please?
04 16 23 45	LMP	Okay. Stand by.
04 16 24 08	LMP	The CMP is dotting across there. You'd be amazed at how proficient you get at transfering to the tunnel after the first 1000 times.

04 16 24 31	CC	I didn't get your last there, Fred-o. We'd like you to verify that your POWER AMPLIFIER circuit breaker is open.
04 16 24 44	LMP	Okay. That's verified. POWER AMPL breaker is open.
04 16 24 48	CC	Roger.
04 16 25 00	LMP	Okay, Jack; that's 34.6 volts and just a little bit under 2.5 amps.
04 16 25 08	CC	Okay, Fred. I copied 2.5 amps. Say again the volts, please.
04 16 25 15	LMP	34.3 and that was just a little bit below 2.5.
04 16 25 21	CC	34.3; thank you.
04 16 25 33	LMP	Okay. ... point ...
04 16 26 06	CC	Fred-o, I didn't copy the last. Say again the voltage, please.
04 16 26 17	LMP	Okay, and the voltage is 34.6 - 34.6 amps, slightly less than 2.5.
04 16 26 26	CC	34.6 and a little below 2.5. Thank you.
04 16 26 34	LMP	We're - the way we are torquing around to the side here, Jack - We are getting some intervals where I can't hardly get to it with either of the OMNIs.

END OF TAPE

04 16 32 52	LMP	Houston, Aquarius.
04 16 32 54	CC	Go ahead, Hous- Aquarius.
04 16 32 59	LMP	Okay. Jack reports from upstairs that he can see stars and constellations out of the optics but the Sun angle is such that it is reflecting off the LM - portion of the LM quad and other thruster ... right now. ... really moving around ...
04 16 33 29	CC	Okay. The part I got was that he can see stars and constellations and there is some sunlight reflected off the quads. That's all I got.
04 16 33 41	LMP	Yes. The point being that, at least in the present orientation, you have to kind of wait until Sun isn't reflected off the LM to see them.
04 16 33 59	CC	Okay. What you're saying is you kind of have to wait until the - there is no Sun reflection on the LM to see the stars. Is that right?
04 16 34 08	LMP	Yes. That's for the present orientation, of course.
04 16 34 25	LMP	But later on, if you can stop it moving around and ... ...
04 16 34 35	CC	Okay - -
04 16 34 36	LMP	...
04 16 34 47	CC	Okay, Fred-o. And we need a volts and amps reading.
04 16 34 56	LMP	Okay. And bring it back upstairs.
04 16 35 36	LMP	Okay. The volts, 35.0; amps, 2.4.
04 16 35 39	CC	Okay. 35.0 and 2.4. Thanks, Fred.
04 16 38 39	CC	The weather prediction for your landing area is still good; 2000 scattered, high scattered; 4-foot seas, 15-knots wind. There's a hurricane 500 miles to the west, which doesn't pose a problem.
04 16 39 02	LMP	A hurricane or a typhoon?

04 16 41 24	CC	Delay my last. It's degraded to a tropical storm.
04 16 47 17	CC	Aquarius, Houston. We need another readout amps and volts, and that will be our last one for a half hour. Over.
04 16 48 33	LMP	Okay. The reading is 37.8 volts, 2.3 amps.
04 16 48 40	CC	Say again, Fred.
04 16 48 43	LMP	37.8 volts, 2.3 amps.
04 16 48 49	CC	37.8 and 2.3. And that will be our last one for a half hour. Thank you. And I'm about to exercise my fifth general order here, and pass it along to Joe.
04 16 49 07	LMP	Yes. It must be getting around a mealtime.
04 17 13 46	CC	Aquarius, Houston. Over.
04 17 13 53	SC	...
04 17 13 55	CC	Okay. This is your friendly do-it-yourself-kit COMM with a suggested procedure in the lithium hydroxide situation. You're looking good. We read 1.8 millimeters, and you do have sufficient LM ... to last you the rest of the flight. However, being on the conservative side, we would like to use one more set of command module canisters to guard against some possible problems with the LM, primary canister. And I have a simplified procedure for doing that, if you want to listen to it now. Over.
04 17 15 15	CC	Okay. I think I read that you were ready. I forgot ... earphones. This simply consists of getting a second pair of cartridges out of the command module, putting one band of sticky tape, that is the gray tape, with the sticky side out, around the sides of each new canister near the top, taking a piece of EVA cue card and cutting it into four squares about 2 or 3 inches on a side, bending those at a right angle to form corner support, attaching them to the sticky tape, so that they'll stick up and overlap the old canister, and then simply putting the old canister next to the new canister and taping it up real good so it sticks together. The only other procedure is to remove the towel plug from the old cartridges and put it in the bottom of the new cartridge. And that's it. Over.

04 17 16 29	LMP	Okay. As I read you, we get the gray tape and fold it so that we get - the back sticks around the outside of the canisters, then we mount to that four sides of our ... cards like our EVA ... cards; then we overlap those cards down around the base of the canister. Then we - then we ... over the ... at the top. ... Then we take the towel from the old ones and put them in the bottom of the new ones. ... ...
04 17 17 35	CC	Okay, Fred. I think you got it. I didn't completely copy your readback, but it's just that simple. We're just putting the new cartridge - the top of the new cartridge against the bottom of the old one, moving that towel plug, using the cue cards as little corner stiffeners, and taping her up.
04 17 17 59	LMP	Okay. The top of the new against the bottom of the old.
04 17 18 03	CC	Roger that. That way you don't have to touch the hose.
04 17 20 08	LMP	Hey, for a change, I took the ... LM ... this morning, Joe.
04 17 20 16	CC	Okay. Go ahead.
04 17 20 20	LMP	I got ...
04 17 20 46	CC	I'm afraid I didn't copy that, Fred, and while I was listening, EECOM told me that he'd like another battery charge ... readout.
04 17 22 31	LMP	Houston, Aquarius.
04 17 22 34	CC	Aquarius, Houston. Go.
04 17 22 38	LMP	You want us to start on this lithium right now, Joe, or is it necessary?
04 17 22 45	CC	It's not time-critical, Fred, but if you have the people awake now, you might go ahead and do it. Incidentally, you probably know this, but the next several hours are going to be pretty quiet from our point of view. We're working on the entry procedures and should be ready to read them up to you in about 8 hours; and between now and then there's not an awful lot going to be going on, so you guys could be catching up on your sleep schedule. Over.

04 17 23 22	LMP	Okay, Joe.
04 17 23 24	CC	And we would like another readout on the amps and volts.
04 17 23 31	LMP	Roger.
04 17 24 53	LMP	Okay. The volts, Joe, are 38.9 and the amps are 1.9.
04 17 25 01	CC	Okay. Copy that, Fred. Thank you very much; 38.9 and 1.9. And EECOM is simply making as smooth a plot as he can to verify the amount of amps we're putting back into the battery. That's why he wants it at half-hour intervals. If that schedule begins to interfere seriously with your rest cycle or so, give us a call. Over.
04 17 25 34	LMP	Okay.
04 17 25 55	LMP	Yes. Jim's sleeping now, and Jack and I are awake and I just finished sleeping around, I guess, about another 5 or 6 hours, so I'm not particularly inclined to go back to sleep right now.
04 17 26 09	CC	Okay.
04 17 38 29	LMP	Houston, Aquarius.
04 17 38 32	CC	Aquarius, Houston. Go ahead.
04 17 38 37	LMP	Okay. We've got one of them ready to go, and it looks like we could do a pretty good job just using the tape strips. First combining them together and then just using a piece of paper and the bag ... get a pretty good seal ...
04 17 38 54	CC	Hey; okay, Fred. We suspected that you'd gotten at least one on. We've noticed a partial pressure drop from the 1.8 to 0.8, which is real good.
04 17 39 10	LMP	Okay. You might run that by the CPCB and see if they approve our in-house ...
04 17 39 17	CC	Roger that.
04 17 39 35	CC	Aquarius, Houston.
04 17 40 22	CC	Aquarius, Houston.

04 17 40 26	LMP	Go ahead, Joe.
04 17 40 28	CC	Roger. We're convening the CPCB on that change, Fred, but FLIGHT has given you an interim go-ahead. Over.
04 17 40 38	LMP	Okay.
04 17 55 51	LMP	And, how do you read now?
04 17 55 55	CC	Not too bad, Fred.
04 17 55 59	LMP	Okay. We've got both canisters completed now.
04 17 56 03	CC	Okay. Roger that, Fred. And you're reading 0.1 again on the CO_2. Incidentally, are you guys having good luck getting water out of the command module?
04 17 56 17	LMP	We - We haven't tried that yet today.
04 17 56 20	CC	Okay.
04 17 56 27	LMP	Yes. This is quite an apparatus hanging on to these hoses now. And that ECS design engineer ... because it sure seems to work.
04 17 56 42	CC	Roger that.
04 17 57 27	CC	And, Aquarius, Houston. At your convenience, we'd like another volts and amps readout.
04 17 57 36	LMP	Okay.
04 17 59 08	LMP	How do you read, Joe?
04 17 59 11	CC	Pretty good, Fred.
04 17 59 14	LMP	Okay. Volts, 39.0; amps, 1.7.
04 17 59 21	CC	39.0, 1.7. Thank you.

END OF TAPE

04 18 05 24	CC	Aquarius, Houston. Go ahead. You're pretty weak.
04 18 05 30	CMP	I didn't call you, Joe.
04 18 05 35	CC	Say again.
04 18 05 39	CMP	I didn't call.
04 18 05 41	CC	Oh, sorry about that. Incidentally, Fred, if switching OMNIs every couple of minutes bugs you, you can skip it for now. We can always wait until you come around.
04 18 05 54	CMP	No, it doesn't. This is Jack, Joe. Fred ... It doesn't bother me at all.
04 18 06 02	CC	Okay.
04 18 06 03	CMP	Just happy to know that you're standing by.
04 18 06 06	CC	Roger that. Except I'm sitting by.
04 18 06 19	CMP	Did that CO_2 drop?
04 18 18 30	CMP	Joe, how far out are we now and how fast are we closing?
04 18 18 35	CC	Okay, Jack. The plot shows you about 130 000 miles out, which is about, gee, 10 000 closer than you were when I came on a couple of hours ago. And let me check with FIDO for your rate of closure.
04 18 19 23	CC	Hey, Jack. Over.
04 18 19 29	CMP	Go ahead.
04 18 19 30	CC	Your smiling FIDO says you're making 5040 in a 5000-mile zone
04 18 19 39	CDR	I can't ... I ...
04 18 29 41	CC	Aquarius, Houston. Over.
04 18 29 46	CMP	Go ahead, Joe.
04 18 29 48	CC	Roger, Jack. Hate to keep bugging you, but we would like another volts and amps reading. Over.

04 18 29 56	CMP	Okay. We'll get it for you.
04 18 29 58	CC	Good show.
04 18 30 59	CMP	Joe, did our sticky MOD on that - those CO_2 canisters work? I'm sorry - ...
04 18 31 07	CC	Jack, I think you asked if the canister MOD was working and the answer is, it sure as hell is.
04 18 31 49	CMP	Okay, Joe. I got the voltage. It's 39.0 amps and 1.75.
04 18 31 58	CC	Copy 39.0 and 1.75.
04 18 55 46	CMP	Houston, do you read Aquarius?
04 18 55 51	CC	Aquarius, Houston. That's affirmative.
04 18 55 55	CMP	Okay. We had a dropout there for a few minutes. ... on either antenna.
04 18 56 04	CC	Gee whiz, Jack, I - when did it happen? Over.
04 18 56 13	CMP	Just now. I just got you back.
04 18 56 16	CC	Okay. We had a handover, but that was about a half an hour ago, and I didn't call you on it. Let me check with INCO and see if he thinks everything's okay. Your COMM sounds just as good as it's ever been.
04 18 56 31	CMP	Yes. I'm in real good shape.
04 18 56 54	CC	Jack, Houston. Over.
04 18 56 58	CMP	Go ahead.
04 18 57 00	CC	Roger. We're checking into it. We think we lost lock in Madrid for a while, and we've got it back now.
04 18 57 07	CMP	Okay. Real fine. ...
04 18 57 11	CC	Okay.
04 18 57 13	CMP	You might also check with FIDO whether we ... perigee ...

04 18 57 23	CC	You're getting a little weak. Did you say you wanted to verify what - what your vacuum perigee is? Over.
04 18 57 30	CMP	Yes. ...
04 18 58 35	CC	Jack, Houston. Over.
04 18 58 39	CMP	Go ahead.
04 18 58 41	CC	Okay. The good FIDO gives us a vacuum perigee at the present time of 23.6 with a flight path angle of minus 6.25 degrees. That's without a midcourse. He's kind of tossing around the idea of doing a midcourse-7 maneuver at 5 hours before entry. If we do it, it looks like it won't be more than 2 feet per second. Over.
04 18 59 15	CMP	Okay.
04 18 59 50	CC	And, Jack, Houston. We verified that that COMM problem was a ground problem.
04 18 59 59	CMP	Okay. Thank you. That FIDO is really cooking today.
04 19 00 03	CC	Oh, he's having a ball.
04 19 00 08	CMP	It must be because we haven't made any waste water dumps.
04 19 00 11	CC	(Laughter)
04 19 00 17	CMP	You can tell Jay and David that I went for a whole flight and didn't use the bathroom.
04 19 00 24	CC	(Laughter) He copies that. David's here; he says you've kept him so busy he hasn't had time to work on his stereo all week.
04 19 07 54	CC	Aquarius, Houston. Over.
04 19 07 59	CMP	Go ahead.
04 19 08 01	CC	Jack, we'd like another volts and amps reading at your convenience.
04 19 09 25	CMP	Okay, Houston. It's 39.2 volts; 1.6 amps.

04 19 09 34	CC	Okay. Thank you. We copy; 39.2 volts, and 1.6 amps.
04 19 09 42	CMP	Right.
04 19 38 41	CDR	Houston, Aquarius.
04 19 38 46	CC	Aquarius, Houston. Go.
04 19 38 50	CDR	I just relieved the watch; just thought I'd find out how things are going.
04 19 38 56	CC	Okay, Jim. Good morning; and understand you relieved the watch, and the rest was kind of blurry. Did you have any questions?
04 19 39 09	CDR	No questions, Joe. Just ...

END OF TAPE

04 19 39 10	CC	Okay. That was - That was loud and clear, that one there. Now we don't have a heck of a lot going on as you know we're working on the entry procedures. I've got preliminary copies, but we're not ready to pass - to pass it up to you. Looks like you're about 125 000 miles out, starting to - starting to really pick up speed, and the Astros won last night, and that's about all I've got. Over.
04 19 42 21	CC	Aquarius, Houston. Over.
04 19 42 26	CDR	Go ahead.
04 19 42 29	CC	Okay, Jim. It's about time, at your convenience, for another volts and amps reading on the command module. For your information, we put 6 amp-hours back in the battery already and we've got about 14 to go. It's looking real good, and I also just got the word that the entry weather tomorrow is looking better all the time. Really looks great.
04 19 42 55	CDR	That's good. When I went to bed last night, ... a lot of rain ...
04 19 43 04	CC	Couldn't copy that, Jim. Sorry.
04 19 44 11	CDR	Houston, Aquarius.
04 19 44 14	CC	Aquarius, Houston. Go ahead.
04 19 44 17	CDR	Roger. 39.2 on the volts; 1.4 on the amps.
04 19 44 23	CC	39.2 and 1.4. Thank you.
04 19 44 54	CC	Aquarius, Houston.
04 19 45 00	CDR	Go ahead, Joe.
04 19 45 01	CC	Roger. Just for your information, in case it happened when you were off watch, the master caution circuit breaker is still pulled, and we're seeing the - the malfunction indication on the descent battery now, but all the parameters still look just as good as ever, and that's just for information.
04 19 45 28	CDR	Okay. I see the battery light flickering now.

04 19 45 33	CC	Okay. Recommend you ignore it.
04 19 45 37	CDR	Okay.
04 20 26 40	CC	Aquarius, Houston. Over.
04 20 26 44	CDR	Go ahead, Houston.
04 20 26 46	CC	Jim, it's volts and amps time again, at your convenience.
04 20 26 53	CDR	Okay.
04 20 28 31	CDR	Houston, Aquarius.
04 20 28 35	CC	Go ahead, Aquarius.
04 20 29 27	CC	Aquarius, Houston. If you gave me those readings, I didn't copy them. Over.
04 20 29 51	CDR	Houston, Aquarius. Do you read?
04 20 29 53	CC	Aquarius, Houston. Okay; go ahead.
04 20 29 58	CDR	Volts, 39.3; amps, 1.25.
04 20 30 06	CC	Okay. Copied 39.3 and 1.25. Jim, did Jack tell you what your trajectory looks like? Over.
04 20 30 18	CDR	Haven't got up to ... on it. How about giving me a rundown?
04 20 30 21	CC	Okay. We are looking at a vacuum perigee right now of 23.6; flight path angle of minus 6.25; and if we decide we want to trim that up, we're looking at a midcourse of about 2 feet per second. Your consumables, of course, are getting better all the time; we've got 163 hours of water, 230 hours of oxygen, and 172 hours worth of electrical power. Over.
04 20 30 55	CDR	That sounds good.
04 20 30 56	CC	Roger.
04 21 00 36	CC	Aquarius, Houston. Over.
04 21 00 40	CDR	Go ahead, Houston.
04 21 00 42	CC	Okay, Jim. We would like to get another check from you on the propellant tank temperatures,

as we did yesterday. And the procedure is to, on panel 16, circuit breaker PROPELLANT, DISPLAY/ENGINE, OVERRIDE/LOGIC to close. Then go to your display and read the tank 1 and tank 2 temperatures for us, and then open the circuit breaker again. Over.

04 21 01 14	CDR	Okay. I'm closing now - the DISPLAY/ENGINE, OVERRIDE/LOGIC.
04 21 01 18	CC	Roger.
04 21 01 26	CDR	Okay. And the reaction control temperatures are 65 in A and 65 in B.
04 21 01 34	CC	Okay, Jim. We'd like the descent tank temperatures, too. Over.
04 21 01 59	CDR	67; oxidizer is 63; descent tank 1 ... is 64; the oxidizer is ... Did you copy? Over.
04 21 02 22	CDR	Hello, Houston. Did you copy the - the DPS display temperatures?
04 21 02 27	CC	Jim, I copied 63 and 64, which I think were the descent 1 temps, and that's all I got.
04 21 02 37	CDR	Okay. I'll go over it again. I'm on descent 1, now and fuel is about 64, and oxidizer is 65, and I'll go to descent 2 - -
04 21 02 47	CC	Okay. Thank you very much - -
04 21 02 48	CDR	- - our descent 2. Okay. I've got descent 2 now right up on 67 and 66.
04 21 02 55	CC	Roger. We copy that, and once again we'd like to get the volts and amps check in the command module. Over.
04 21 03 07	CDR	Okay. I'm going to go up there and get it. Jack is - and Fred are asleep, so I'll be off the air a minute.
04 21 03 12	CC	Okay. Real good.
04 21 05 31	CDR	Houston, Aquarius.
04 21 05 33	CC	Aquarius, Houston. Go.
04 21 05 37	CDR	Volts, 39.3; amps, 1.2 zip.

04 21 05 45	CC	Okay. We copy 39.3 and 1.20. And, Jim, I've got one more item for information for you. At - In about 45 minutes or so, you will get an H_2O quantity caution light on the descent tank. We expect this. It occurs at 16 percent. And it's no problem, because we intend to run the tank dry just for drill. To reset the - the light, on panel 2, just set the O_2 H_2O QUANTITY MONITOR to the CAUTION/WARNING RESET position and the light will go away. Over.
04 21 06 26	CDR	Okay. I understand. We're going to get a H_2O warning light here shortly, and I'll reset it.
04 21 06 35	CC	Okay. Good deal.

END OF TAPE

04 21 34 07	CDR	Houston, Apollo 13.
04 21 34 12	CC	Aquarius, Houston; go ahead.
04 21 34 16	CDR	Okay, Joe, we got the WATER warning light.
04 21 34 20	CC	Okay. Roger that.
04 21 46 57	CC	Aquarius, Houston. Over.
04 21 47 02	CDR	Go ahead, Houston.
04 21 47 04	CC	Okay, Jim. The experts would like another volt and amp reading.
04 21 47 11	CDR	Okay; have them stand by.
04 21 47 13	CC	Okay, no rush.
04 21 49 46	CDR	Houston, Aquarius.
04 21 49 49	CC	Aquarius, Houston; go ahead.
04 21 49 53	CDR	Voltage is 39.3, amps 1.26.
04 21 50 00	CC	Copy 39.3 and 1.26.
04 21 51 17	CDR	Houston, Aquarius.
04 21 51 19	CC	Aquarius, Houston; go.
04 21 51 24	CDR	Joe, you might pass to our friends in Crew Systems that lunar boots make great footwarmers.
04 21 51 31	CC	I guess you need them up there, too. Is - is anybody sleeping in the command module right now, Jim?
04 21 51 39	CDR	Negative, Joe. It's just too cold in there. I got Fred stashed over here to my left. He's asleep and Jack's ...
04 21 51 46	CC	Roger.
04 21 52 22	CDR	You can eliminate the chilldown procedure for reentry.
04 21 52 27	CC	(Laughter) Well, we figured we were in that mode now.

04 22 25 50	CC	Aquarius, this is Earth. Over.
04 22 25 55	CDR	Go ahead, Earth; Aquarius here.
04 22 25 57	CC	Roger. Earth is here, also; and, Jim, it is time for another one of those volt/amp checks. For your information, we've got that battery back up to 30 amp-hours now. Over.
04 22 26 10	CDR	Hey, that sounds great. Jack's gone up to check it.
04 22 26 17	CC	Roger.
04 22 26 34	CDR	Aquarius, Earth.
04 22 26 37	CC	Go ahead.
04 22 26 41	CDR	You know, I think Aquarius is ...
04 22 26 49	CC	We've got garble now, Jim; I'm sorry.
04 22 26 55	CDR	I said Aquarius ...
04 22 26 57	CC	Roger.
04 22 27 25	CDR	Houston, Aquarius.
04 22 27 27	CC	Go ahead.
04 22 27 30	CDR	Voltage 39.3, amps 1.26.
04 22 27 36	CC	Okay. Copy that, Jim.
04 22 27 56	CC	Jim, Houston. Have you guys put on any extra clothes to try and ward off the nip of Jack Frost? Over.
04 22 28 06	CDR	Well, the lunar boots and two pair of underwear, and everyone is ... crawl into their sleep restraints.
04 22 28 14	CC	Yes.
04 22 28 15	CDR	We're a little reluctant to break out the suits.
04 22 28 18	CC	Yes, that's understandable. You can always use them if you have to. I guess it's pretty hard to get extra coveralls on, huh?

04 22 28 44	CDR	Well, Joe, I didn't think we had any extra inflight garments aboard, but we're going to check right now.
04 22 28 50	CC	Well, stand by.
04 22 43 33	CC	Aquarius, Houston.
04 22 43 36	CDR	Go ahead, Houston.
04 22 43 38	CC	Roger. Jim, we noticed you just went to AUTO and back to CLOSE on the SUIT RELIEF valve. Is everything okay?
04 22 43 48	CDR	We didn't do that intentionally. Stand by.
04 22 43 54	CC	Okay, maybe you didn't. Incidentally, you're less than 24 hours to go.
04 22 44 00	CDR	Roger. What happened was, our lithium hydroxide device here got caught in the suit relief valve. It is closed now. That's where you want it, right?
04 22 44 12	CC	Okay.

END OF TAPE

04 22 44 30	CC	Okay.
04 22 44 45	CDR	And, Joe, just a reminder; now that you mention it - that it's less than 24 hours to go, what I'd like to do, and I have aboard all the procedures that you are working up; so I can run through them with the crew, and make sure that we get all our signals straight.
04 22 45 05	CC	Roger that, Jim. We are trying to get the procedures finished and up to you as quickly as we can. They exist. What's going on now is the guys are running them in the CMS/LMS, integrate, to make darn sure that the attitudes are correct and the time line is nice and relaxed and all that good stuff. And they won't be finished that run for another few hours. However, we expect to have an overall time line and a sequence of events for you before that time, and we'll start with the procedures as soon as they get ready. Over.
04 22 45 50	CDR	Okay. That's good. I think ... ought to go back to the original procedures we have on board and modify them as we have the time to.
04 22 46 18	CC	Okay, Jim. Roger. We're going to do that to the maximum extent possible. And it looks reasonably feasible. To begin with in the command module we're going to have to send you some separate sequences for powering it up a little bit at a time. The closer we get to entry the more we get on the checklist. By the time we're about at EI minus 45 we're on the checklist all the way.
04 22 46 39	CDR	Okay.
04 22 46 49	CDR	And just as a reminder, don't forget our stowage problem. We - We still have to do quite a bit of stowage of the drogue and probe in the LM, and, et cetera.
04 22 46 59	CC	Roger that. We've got a team working on that, and incidentally, one of the information items that they want to know is which lithium hydroxide containers in the command module are empty. They just want to know that for weight and balance - and there's no rush about it - -

04 22 47 18	CDR	...
04 22 56 43	CDR	Aquarius, Houston.
04 22 56 46	CC	Go ahead, Aquarius.
04 22 56 50	CDR	Another note of interest to the crew systems people - Tell them that they don't have to bother putting the refrigerator onboard. I just brought out some hot dogs, and they're practically frozen.
04 22 57 05	CC	(Laughter) Okay. We copy that, Jim.
04 23 11 05	CC	Aquarius, Houston.
04 23 11 10	CDR	Go ahead.
04 23 11 11	CC	Okay. We'd like another volt, amp reading, Jim.
04 23 11 16	CDR	Okay. Stand by, Joe.
04 23 11 18	CC	Roger.
04 23 12 40	CDR	Houston, Aquarius.
04 23 12 41	CC	Go ahead, Jim.
04 23 12 44	CDR	Volt 39.4, amp 1.23.
04 23 12 49	CC	Okay. Roger that. And, Jim, we ought to have a - an entry time line to discuss with you in one hour.
04 23 59 32	CC	Aquarius, Houston. Over.
04 23 59 36	CDR	Go ahead.
04 23 59 38	CC	Guess what.
04 23 59 42	CDR	What?
04 23 59 43	CC	Your volts and amps time, Jim.
04 23 59 48	CDR	That goes like the Amos and Andy show.
05 00 00 58	CDR	Houston, Aquarius. Guess what.
05 00 01 01	CC	Aquarius, Houston. What? Over.
05 00 01 06	CDR	39.4, 1.27.

05 00 01 12	CC	Are you really going up there, and looking at them?
05 00 01 17	CDR	That's what the meters say.
05 00 01 18	CC	Okay. We copy, Jim.

END OF TAPE

05 00 17 26	CC	Aquarius, Houston. Over.
05 00 17 30	CDR	Go ahead.
05 00 17 32	CC	Okay, Jim. We show the SUIT CIRCUIT RELIEF valve is back in the AUTO position, and we'd like to have it off for good scrubbing. Over.
05 00 17 50	CDR	Have you seen ... out there?
05 00 17 58	CC	Okay. Thank you, Jim.
05 00 18 02	CDR	... up there - about ... of the scrubbers. If you think ...
05 00 18 08	CC	Roger. No sweat. Jim, in a few minutes I'm going to be coming at you with the - with the overall time line for tomorrow morning. You might want to think about taking a few notes, although we don't have detailed procedures for you at this time. Maybe you want to have Fred or Jack listen. Over.
05 00 18 33	CDR	Right. We're all set to copy.
05 00 18 35	CC	Okay.
05 00 21 00	CC	Aquarius, Houston. Over.
05 00 21 03	CDR	Go ahead.
05 00 21 05	CC	For our benefing while we do this briefing, Jim, we'd like to have the, the COMM better, and we can sure spare the power; so we'd like you on panel 16 to close the POWER AMPLIFIER circuit breaker, and on panel 12 we'd like you to move the VOICE FUNCTION switch to VOICE. Over.
05 00 22 22	CC	Okay, Aquarius; Houston. How do you read?
05 00 22 26	CDR	Read you loud and clear.
05 00 22 27	CC	Okay, and you're real good. It's a - It's a pleasure not to have all that noise. Let me tell you what I want to do, Jim. As I said, we're not going to give you detailed procedures, now. What we expect to have for you shortly are procedures which we'll try and get up to you in the following form. First, we'll have a time line,

sort of a flight plan thing, which will have the times of all the major events and any configurations, switch settings, and so forth which are peculiar to our configuration and which, therefore, you won't find in the checklist. This, for instance, will be true of the way we power up the command module; and second, of course, we'll have any redlines to the checklist so that you can enter the checklist where possible to - to perform functions, and the time line will simply refer you to the checklist when that's appropriate. Okay?

05 00 23 32 CDR Okay. Sounds good. You're going to give me an overall time line now, I take it; is that right?

05 00 23 36 CC That's affirm. I'm going to first of all just quickly run through the times of the major events, and then we'll go back and fill in some of the details. Okay. Entry interface is at 142 hours 40 minutes; 6-1/2 hours, roughly prior to that or at about 136:10, we'll start this whole thing going by applying IMU HEATER POWER, by checking the CM/RCS temperatures and preheating the CM/RCS if required, and we suspect we'll probably want to do that. We'll have detailed procedures up for it later. At about 6 hours prior to EI or about 136:40, we will commence powering up the LM, powering up the AGS, using the modified LM/DPS RCS 30-minute checklist, which you have used for the previous midcourse. Then shortly, just before 5 hours, prior to EI or at about 137:49, we'll want you in the attitude for a LM AGS body axis alinement, using the Earth terminator like we did before; and as soon as we have that, we'll perform MCC-7, which looks like, now, about a 2-foot-per-second burn or about 15 seconds of RCS. And I'm told that it's down to 1-1/2 now, so it's comfortably within the RCS margin. Okay. When we do that, we'll immediately start the maneuver to the service module jettison attitude, which will be in plane since we're jettisoning it earlier than we usually do. We don't need, and don't want, the out-of-plane component. So it'll be in plane with the service module pointed back out along the radius vector. We will then commence to get the command module ready for service module SEP, including command module RCS checkout and hot fire, and at approximately 4 hours and 30 minutes prior to EI

or 138:10, we'll jettison the service module. We'll pitch the LM up until we aquire the service module in the ... and try and get some photographs, but we're not going to fool around with LM translation maneuvers for pictures because we don't want to screw up - foul up your flight path angle at that time. Okay. That gives us 2 hours to - of more or less open time here to finish up, if we're late on that, to go on over to checklist and prepare for powering up the command module. We're going to start the command module full powerup at EI minus 2 hours and 30 minutes or 140:10 GET. We'll get the computer on the line, we'll get the IMU up, we'll start uplinking your state vectors, and so forth, and alining the command module platform. At about 1 hour and 30 minutes at the latest, giving us an hour to do this command module stuff, we will start the maneuver to the LM jettison attitude. You'll then start to close out the LM. Of course, we don't have our stowage all configured way before this. We'll close the hatch, do a pressure integrity check, and at EI minus 1 hour, or 141 hours and 40 minutes, we'll jettison the LM. As soon as we do that, you can start the maneuver to the entry attitude. When you're there, do a sextant star check, take down the optics, and at that point we'll be giving you your final entry pad. You can initialize the EMS, and you'll essentially be right back on the checklist at that point. There's one - one little difference from your nominal entry. You're a little bit earlier in the morning, so it going - it's going to be nighttime when you get to EI. However, we're fortunate enough to have the Moon in a perfect position for a horizon check. We'll give you a Moon check instead of a horizon check, and you can track it right down to moonset, which is going to be at EI roughly minus 3 minutes. And that's it for the quick time line. Do you have any questions right now?

05 00 28 11 CDR I don't believe so, Joe, right now. We'll have to look at those time lines, and think about it for a little bit.

05 00 28 18 CC Okay. Real fine. We're ready to talk in some more detail about the alinement procedures, the CM powerup procedures, and so forth, but why don't we give you a few minutes to digest what you've already heard.

05 00 29 44	CDR	Houston, Aquarius.
05 00 29 47	CC	Go ahead, Aquarius.
05 00 29 50	CDR	Two questions so far on heating up the CM/RCS. We assume that's LM power, and we assume that we're going to have to power up both CM buses, right?
05 00 30 00	CC	Okay, Jim. I didn't want to talk about that because we're not quite ready to recommend a procedure. We can't power up the CM/RCS per the normal checklist on the LM power because we haven't got quite enough amps. It may be that we'll want you to heat - to do the preheat one ring at a time and we're looking at that. Another possibility is that we may want to take down LM power at that time, do the preheat, and then go back to LM power until we have to take it down finally. Over.
05 00 30 38	CDR	Okay. Understand. Second question: when we finish MCC-7, that maneuver to SM JETT attitude will be angles given to us, by you, using the AGS aline ball, right?
05 00 30 52	CC	That's affirmative. Once we get that AGS alined and get a time hack on it, the good people down here will be able to give us AGS - AGS, 8-ball attitudes for the service module separation attitude, for the command module alinement attitude, which we are going to pass you up the - a Moon/Sun P52-type alinement. We'll have AGS 8-ball attitudes for those, and we'll be able to uplink through the command module once we get the computer up a preferred REFSMMAT, which will be identical to the LM attitude at the time of the burn. And we'll go into details on that later.
05 00 31 43	CDR	Okay. Just stand by 1. I'll give it to you.
05 00 31 48	CC	Will do.
05 00 32 49	CDR	Houston, Aquarius.
05 00 32 51	CC	Go ahead, Jim.
05 00 32 55	CDR	We would like to have plenty of ... the control characteristics are of the LM/command module, and

whether we can use the attitude control - controller only to maneuver the combination to photograph the service module at 4 plus 30.

05 00 33 12 CC Okay. Good thinking. We are - it's - There has been a lot of consideration of what kind of maneuvers to let you do to photograph the LM, I mean the service module. We consider it quite low priority; the feeling is that it will be real nice to get pictures of the service module, but they are not required for our troubleshooting program. As far as the - the attitude control authority, and so forth, we will get you more detailed word on that later; we are working it. It appears that using the ACA instead of the TTCA after service module JETT will give you excellent attitude control authority, and that's what we recommend.

05 00 34 03 CDR Okay. And I'm ... - use an AGS ATT HOLD configuration to keep the attitudes - turn the LM JETT attitudes.

05 00 34 14 CC That's affirm. We are - We are probably going to recommend a tight deadband AGS attitude hold for that.

05 00 34 23 CDR Okay.

05 00 34 45 CDR Houston, Aquarius.

05 00 34 47 CC Go ahead.

05 00 34 49 CDR Okay. The star check at the entry attitude, is it a sextant star check or a COAS star check?

05 00 35 00 CC It'll probably be a sextant star check, Jim. It really depends on how good that platform is that we get. And we expect it to be plenty good enough for a sextant star check.

05 00 35 14 CDR Okay.

05 00 35 15 CC While we are on that subject, Jim, I want to mention one thing to Jack. As I said, this CSM alinement procedure we are going to recommend is a Moon/Sun, and there are Sun filters stowed; they are stowed in compartment R-1; however, they are for the telescope only, of course, not the sextant. One is for the long eye-relief

piece, the other for the normal eyepiece. And if he has any questions about that, we'll be glad to talk about it.

05 00 35 54 CDR Okay.

05 00 36 07 CDR And because it will be too late to do much about a hatch integrity check if it fails, you want us to have our suits on sometime during this period?

05 00 36 20 CC Okay, Jim. We are laying for you on that one; it is a subject that we wanted to - to bring up with you. We have been considering it, and our feelings are - Of course, it is up to you, but as we see the pros and cons, you just put your finger on the pro. We do a hatch integrity check shortly before EI minus 1 hours, and if we bust it, you would have a hard time scrambling into the suits. On the other hand, the disadvantages of wearing the suits are that they might slow you down considerably, not even counting the time to don them, and someone is even very concerned that after such and such a period of time in the suits, you might get too warm, and we might have to power up the SUIT LOOP to ventilate the suits and we don't particularly want to do that because it cost quite a bit of power. Consequently, our recommendation was going to be that you not wear the suit, since we have no reason to believe that the integrity check will show us anything but a slightly increased leak rate, and we can certainly hack that. What do you think? Over.

05 00 37 38 CDR Well, I have confidence in the hatch, as long as it goes in and locks in smoothly; I see no reason why we need the suits, and one thing we are going to do during our spare time is to practice putting that hatch on, make sure we get it on and locked.

05 00 37 55 CC Okay. Real good. And with that precaution, think we can concur on that decision.

05 00 38 11 CDR And that's all the questions we had about the time line you gave us.

05 00 38 14 CC Okay. Let me take a check here and see if there is anything anybody else wants to input to you, right now.

05 00 38 54	CC	Aquarius, Houston.
05 00 38 58	CDR	Go ahead.
05 00 38 59	CC	Roger. One detail that I thought you ought to know about the service module JETT is that we're going to recommend a push-pull maneuver, that is in the attitude I described. We'll want you to go half a foot per second plus-X on the LM, then jettison the service module, then go half a foot per second minus-X, which will be less time because you're suddenly a heck of a lot lighter. Over.
05 00 39 33	CDR	Okay. Understand. You want me to go a half a foot per second plus-X, JETT the service module, and go a half a foot per second minus-X.
05 00 39 45	CC	That's affirm. We think that will give you plenty of separation, and also will be a slow enough rate so you'll have a chance to get some photos.
05 00 41 06	CC	Aquarius, Houston.
05 00 41 08	CDR	Go ahead.
05 00 41 10	CC	Okay. One more thing we want to update you on with a little detail. As we told you, the ascent SEP attitude was in plane and the LM JETT attitude will be more similar to a normal service module SEP attitude, that is it will be LM up, out the radius vector and 45 degrees right, out of plane toward the south. We are going to recommend that prior to JETT, the configuration be with the LM overhead hatch closed, with the vent valve open, and we'll JETT with the tunnel pressurized. Over.
05 00 42 10	CDR	Okay, Joe. Understand that the LM JETT attitude will be similar to service module normal jettison, which will be up and out of plane, and as soon as I finish maneuvering to left JETT attitude, I'll scramble up and close the LM hatch, making sure the vent valve is open, and then we'll vent it - or jettison it with the tunnel pressurized.
05 00 42 36	CC	That's affirmative. And Deke says don't forget to close the command module hatch on your way in.

05 00 42 45	CDR	I'm already scared that Jack will have it closed before I get up there.
05 00 42 49	CC	(Laughter)
05 00 43 08	CC	Okay, Jim. I think that's about all we have for you right now. Whenever you feel like you don't have any more questions at the moment, we'd like you to reconfigure for down voice backup and we'd like you to do that to move the VOICE FUNCTION switch to DOWNVOICE BACKUP as usual, but instead of pulling the circuit breaker, we'd like you to throw the POWER AMP switch to off.
05 00 44 00	CDR	Okay, Joe. I have one more question, here. If we get a little bit ahead of time on the command module full powerup after we jettison the service module, I'd like to go to LM JETT attitude early, and make sure we get that part squared away and sit there for a while before LM JETT of 1 hour. Now, will we be using LM power up to that time? There's two cables which we'll probably have to disconnect on the way up through the tunnel if we're still going to use LM power?
05 00 44 30	CC	That's affirmative. Let me get word on when we expect to go off LM power.
05 00 44 54	CC	Aquarius, Houston.
05 00 44 58	CDR	Go ahead.
05 00 44 59	CC	Roger. We expect to go off LM power at the time we start powering up the CSM or about minus 2-1/2 hours. That is not a hard number, and we'll be updating you on it. As far as going to the LM JETT attitude, that's completely permissible as soon as you have a powered up command module and a satisfactory platform, you can go there immediately. We're giving you a maximum of 1 hour just for grins. Over.
05 00 45 34	CDR	Okay. Fine. And that will be a LM maneuver, I assume, because we lost the service module, so no strain there.
05 00 45 42	CC	Affirm.

05 00 45 49	CDR	And, Jack, would like to know what entry angle the midcourse-7 will give us?
05 00 45 58	CC	Oh, it'll put us right in the middle of the corridor, Jim.
05 00 46 04	CDR	Okay.
05 00 46 05	CC	6.50 degrees. And, Jim, Houston. I guess, as a last item, we expect that it will take us about an hour to update your checklist and your time lines sometime later on today, and we'd just like you to consider that. I expect it'll be 3 or 4 hours before we have all that stuff ready.
05 00 46 32	CDR	Okay. We'll be standing by for that, and now POWER AMPLIFIER switch is going to go off, and then we'll be going to DOWN VOICE BACKUP.
05 00 46 39	CC	Okay.
05 00 55 13	CC	Aquarius, Houston.
05 00 56 58	CDR	Houston, Aquarius.
05 00 57 07	CC	Aquarius, Houston. Go ahead.
05 00 57 27	CDR	Houston, Aquarius.
05 00 57 28	CC	Roger, Jim. We're receiving you now. Go ahead.
05 00 55 34	CDR	Okay. I thought you were calling, but I guess we had a ground switching problem down there.
05 00 55 40	CC	Yes. We lost the lock for a little while there, Jim. Well, good day. Could you give us battery A voltage ... reading, please, and battery charger current, as you have been doing.
05 00 55 54	CDR	Okay, Vance. Stand by.
05 00 55 56	CC	Okay.
05 00 59 11	CDR	Houston, Aquarius.
05 00 59 13	CC	Go ahead, Jim.
05 00 59 16	CDR	Okay. Volts are 39.5; amps, 1.25.

05 00 59 23	CC	Roger. Copy 30.5 and 1.25. Thank you.
05 01 47 31	CC	Aquarius, Houston. Over.
05 01 47 37	CDR	Aquarius here. Go ahead, Houston.
05 01 47 40	CC	Say, Jim, could you give us another reading on the battery A voltage and BAT charger current on the CSM, please.
05 01 47 49	CDR	BAT amps coming up.
05 01 47 51	CC	Okay. And sometime when you have some time to copy, I have an entry stowage list to give you which specifies which equipment will be moved between vehicles before splashdown.
05 01 48 13	CDR	Okay. I'm -- I'll be able to copy that in a minute.

END OF TAPE

05 01 49 21	CDR	Houston, Aquarius.
05 01 49 23	CC	Go ahead, Aquarius.
05 01 49 25	CDR	Volts, 39.4; amps, 1.25.
05 01 49 30	CC	39.4, and say again amps.
05 01 49 36	CDR	1.25.
05 01 49 38	CC	Roger. Copy. Thank you.
05 01 50 49	CDR	Okay, Vance. We're ready to cover - to copy the stowage list.
05 01 50 55	CC	Okay, Jim. Now, I'll give it to you in two parts. The first is LM to command module equipment transfer. The second part will be the reverse, command module to LM equipment transfer. And both parts represent Deltas from the launch stowage, and here comes the first list, LM to command module equipment transfer. First, DSEA, and I'll give you the stowage location, too. That goes in R-13.
05 01 51 42	CDR	Vance, what was that again?
05 01 51 46	CC	DSEA; that's recorder in - will go in the command module; it's recommended you stow it in R-13. Over.
05 01 52 02	CDR	Okay, the DSEA - that's the recorder - will be stowed in R-13.
05 01 52 07	CC	That's affirm. Next. LM flight data file. That will go in R-1, R-2, and R-3. Next. Three PPKs in A-8.
05 01 52 43	CDR	Okay.
05 01 52 44	CC	Okay. 16-millimeter and 70-millimeter exposed film in R-13. Okay, next. O_2 hose screen caps on the O_2 hoses. Next: two 70-millimeter Hasselblad cameras, and stow these in B-6 in the empty LiOH volume.
05 01 53 45	CC	Okay, next. Black-and-white TV camera, and recommend stow that on top of A-7 and A-11 in decontamination bag. Next: flag kit, stowage location A-8. Next: LM fecal bags, used, R-9, waste management system chute.

05 01 54 51	CC	Okay, that's the first list, Jim.
05 01 54 58	CDR	Okay.
05 01 55 10	CC	And, if you want to read that one back, why then I'll - I'll give you the second one.
05 01 55 22	CDR	This is the LM to command module transfer, and this is the Delta from the launch stowage. Number 1: DSEA ...; number 2: LM flight data file in R-1, R-2, R-3; three PPKs in A-8 ... -
05 01 56 15	CDR	... A-8; and used LM fecal bags in R-9.
05 01 56 23	CC	Okay, that's affirm, Jim. We had a lot of noise, and we didn't get the middle part, but I think that's fairly - should be fairly clear to you, and don't bother with the readback of that that we missed, unless you have any doubts. And then I'll, if you're ready to copy, I'll give you the second list.
05 01 56 47	CDR	Okay.
05 01 56 49	CC	Okay. This is CM to LM equipment transfer. Cabin fan filter and bag, and that, in the LM, should go in the ISA. Okay, next: decontamination bags, except for the ones used to wrap camera, should go in the ISA.
05 01 57 33	CC	Okay. Two LCGs, if you don't have them on already, to the IS - ISA. I realize you wouldn't have them on, because you're cold enough already.
05 01 57 57	CDR	That's right.
05 01 57 59	CC	Okay, and finally, four LiOH cans, the ones used in the LM, and those can go in the jettison bag in the LM. Okay, a couple of notes. After loading the ISA, recommend secure it to the right-hand restraint system.
05 01 58 40	CC	And secure the jettison bag to the PLSS on the floor. And that's all.
05 01 59 07	CDR	Okay, Vance. This is command module to LM: cabin fan filter and bag in the ISA; decontamination bags, except for the ones we use for the TV camera, in the ISA; two LCGs in the ISA; four LOiH [sic] cans in the JETT bag; and we'll secure the ISA on the right-hand side - on the right-hand restraint system, and we'll secure the JETT bags to the PLSS on the floor.

05 01 59 36	CC	Roger. That's it.
05 02 13 01	CC	Aquarius, Houston. Over.
05 02 13 39	CC	Aquarius, Houston.
05 02 13 47	CDR	Go ahead.
05 02 13 49	CC	Jim, would you give us PCM to HI bit rate. We think maybe we might be able to lock up on your high bit rate now. Over.
05 02 15 11	CC	Aquarius, Houston.
05 02 15 16	CDR	Go ahead.
05 02 15 17	CC	Okay, Jim. We're getting it intermittently. We think we might get it steady and improve circuit margins if you would, in addition, on panel 16, open the PRIMARY POWER AMPL circuit breaker, and I'll give you next step in a minute.
05 02 15 39	CDR	Okay. PRIMARY POWER AMPL is opened.
05 02 15 41	CC	Okay. And on panel 12, POWER AMPL to PRIMARY.
05 02 15 50	CDR	POWER AMPL to PRIMARY.
05 02 15 52	CC	Roger.
05 02 17 57	CC	Aquarius, 13.
05 02 18 02	CDR	Go ahead, Houston.
05 02 18 04	CC	Or rather, Houston. Jim, it looks like we got a lockon, which is going to improve our data flow here. Only thing is, we'll probably lose data and probably voice, too, during a portion of each roll. So you might expect that. The other thing is, if anyone has on any BIOMED, would you switch your switch to - your BIOMED switch to that position.
05 02 18 37	CDR	Understand the first, Vance, and no one has on any BIOMED - -
05 02 18 44	CC	Okay.
05 02 18 45	CDR	- - Fred and Jack are maneuvering things around right now, and mine is long since departed the scene.

05 02 18 51	CC	Okay. Copy.
05 02 19 30	CDR	Vance, you might be interested - the way we're - the way we got this thing arranged, we have one helmet attached to the COMM lines attached to the LM hoses, and the guy that's got the duty wears the helmet, so the other people are free to maneuver.
05 02 19 48	CC	Right. That's understandable. One guy's on the leash, huh?
05 02 19 58	CDR	Yes. ...
05 02 25 10	CC	Aquarius, Houston.
05 02 25 15	CDR	Go ahead.
05 02 25 17	CC	Jim, when you get finished moving your stowage around and it's convenient, we'd like to terminate the battery charge for a little while to bring up the CM TM so we can take a look at the temperatures again, like we did yesterday. Advise that right now on your batteries, you have 111 amp-hours; and, eventually, we hope to have them up - peaked up to about 116. One other point, we - we can either read that procedure up again which involves cranking up the telemetry, or, if Jack still has it, we can use his notes and - but I have one or two changes to - to make on them. Over.
05 02 26 11	CDR	Okay, understand that you'll want us to terminate battery charge for a while, and crank up the CM TM to read out temperatures. And you have a few changes to Jack's checklist, and I'll turn the COMM over here to Jack shortly, as soon as he's finished, and we'll get along with it.
05 02 26 33	CC	Okay, we'll be standing by for - there's no hurry on it.
05 02 38 10	CDR	Houston, Aquarius.
05 02 38 15	CC	Go ahead, Jim.
05 02 38 18	CDR	Just out of curiosity, Vance, what's our distance and velocity now?
05 02 38 24	CC	Hey, stand by 1. You're speeding up, I think.
05 02 38 47	CC	Jim, we have you 101 000 miles out, and your velocity is 5848. Starting to speed up.

05 02 38 56	CDR	Okay. Thank you.
05 02 38 58	CC	Sure enough.
05 02 41 59	CMP	Okay, Houston; Aquarius.
05 02 42 03	CC	Go ahead, Jack.
05 02 42 06	CMP	Okay, Vance. Jim said that you want to terminate battery charge on battery A.
05 02 42 13	CC	That's affirm, Jack. Request to - Before you terminate it, get the usual readout on voltage and current; and we'd also like a time of termination, and understand you have the termination procedures. Is that affirm?
05 02 42 35	CMP	Okay. That's affirm. Stand by. Let me just make sure I've got everything here before I go off on a tangent.
05 02 42 43	CC	Okay, Jack, and your battery-charge termination procedure remains unchanged, but when we go to power up the CM and look at your TM, we have a couple of additional steps.
05 02 43 23	CMP	Okay. Vance, I do have the procedure for stopping the battery charge. And do you want me to copy this procedure now, or do you want me to come back and give you the volt, amps, and time and - after I complete this termination?
05 02 43 47	CC	Okay. Just - just give us the volts and amps just before you start the termination of the procedure, and understand you say you have the charge - the procedure for taking the charge off. Is that affirm?
05 02 44 09	CMP	That's affirm.
05 02 44 11	CC	Okay. And just give us a hack on the time - -
05 02 44 13	CMP	And you want to - you want to review it at all?
05 02 44 19	CC	Negative. Unless you want me to. I'll tell you what; I could run through it very quickly just to verify that we're getting started off on the correct path here.
05 02 44 31	CMP	Yes. Okay, the first four or five things that I have is panel BAT CHARGE to OFF on panel 3; AC

INVERTER 2, OFF; panel 5: MAIN BUS TIE, BAT A/C ON; panel 250: CB BAT A POWER ENTRY/POSTLANDING, open; panel 275: INVERTER POWER 2, MAIN B, open; and then, the - just to go ahead and reverse the position of the switches and circuit breakers that I started out with, and these don't have to be in reverse order. Is that Charlie?

05 02 45 12 CC Roger, that's - that's Charlie. Have at it.

05 02 45 17 CMP Okay, we'll get a volts and amps right now.

05 02 45 20 CC Okay.

05 02 46 12 CMP Okay, Vance. The volts and amps: 39.4; amps, 1.25.

05 02 46 22 CC Okay, Jack. We copy that. Incidentally - -

05 02 46 27 CMP Okay. We're going up to termin - Go ahead, Vance.

05 02 46 33 CC Never mind, Jack. I'll bring this up later when you've finished the procedure.

05 02 46 47 CMP Okay. I'm going off the air; I'll put Fred-o on. I'm going to stop the battery charge.

05 02 46 55 CC Okay.

05 02 47 30 LMP Now, how do you read, Vance?

05 02 47 32 CC Hey, loud and clear, Fred. Understand you've been doing some spring housecleaning, moving stowage around up there.

05 02 47 40 LMP Boy, you wouldn't believe this LM right now; it's nothing but bags from floor to ceiling.

05 02 47 46 CC Hey, that brings up a question. We were wondering where you guys plan to stow the probe and drogue? It occurred to us that one possibility was to stow it in the LM, down about where the LMP normally stands, underneath the IS - ISAer. Perhaps you have a better idea. Over.

05 02 48 12 LMP Yes, I do, Vance. ... would go in the LM, but I thought maybe we ought to stow it where the CDR stands. How's that?

05 02 48 22 CC Okay. I can tell that you're just getting - getting that one over because Jim just got off the loop.

05 02 48 33	LMP	Yes, he's sleeping. No, that's - that's actually where we normally had been stowing it for normal LM JETTs.
05 02 48 44	CC	Okay, and - Hey, we just - we'll record that, and figure that you'll stow the probe and drogue over in the - where the CDR stands. We have a - a change to this - equipment transfer list that I just read up to Jim. Why don't you make a note of this one item? Forget about the LM - -
05 02 49 07	LMP	Stand by; stand by 1.
05 02 49 08	CC	Okay.
05 02 49 14	LMP	I think Jack hauled off the piece of paper with that - all that on it. Why don't you hold it until Jack gets done doing the battery charge?
05 02 49 24	CC	Okay.
05 02 49 39	CC	And, Fred, request PCM on LO bit rate, now.
05 02 49 44	LMP	Okay. And there was one piece of flight data that we needed that we didn't bring along this time.
05 02 50 00	CC	What was that?
05 02 50 04	LMP	That's a big book with a lot of just plain old blank pages in it.
05 02 50 10	CC	Yes, when you - when you get off nominal, why you just need scratch paper, don't you?
05 02 50 17	LMP	Yes.
05 02 51 28	LMP	Okay, Vance. I got the stowage list now.
05 02 51 32	CC	Okay, I gave you two lists - -
05 02 51 33	LMP	And Jack's got - and Jack said he's completed - the - secured the battery charge now.
05 02 51 44	CC	Okay, and we're recording the time that that was complete. You have two lists there, one is LM to CM equipment transfer and the second list is the reverse. Request you scratch the last item on the first list, which is returning used bags to the CM.

50 02 52 11	LMP	Okay. We didn't have any of those, so that didn't pose any problem anyway.
05 02 52 20	CC	Okay.
05 02 53 28	CC	Aquarius, Houston.
05 02 53 29	CMP	Okay, Vance. Aquarius is back on.
05 02 53 32	CC	Okay, Jack. Understand you completed securing the battery charge. Now if you are ready to copy, Jack, I would like to give you the two changes that we have to the powerup for the CM procedure. Over.
05 02 53 55	CMP	Okay. Stand by 1.
05 02 53 56	CC	Okay.
05 02 54 59	CMP	Okay, Vance. You say you have some changes in the procedures that I used before to get telemetry and to check out the CSM system?
05 02 55 07	CC	Yes, that's correct, Jack; they're pretty simple. About halfway through the procedure, we have a step on panel 3, which is POWER AMPL, HIGH; we'd like to change that to POWER AMPL, LOW.
05 02 55 29	CMP	Okay. Copy. POWER AMPL, LOW.
05 02 55 33	CC	And the next change, Jack, is panel 275. Scratch the step "CB MAIN B, BAT B, close - BAT BUS B, close."
05 02 55 50	CMP	Okay. You want to delete the step "CB MAIN B, BAT BUS B, close."
05 02 55 55	CC	Roger. As you know, we're going to do this on LM power, so this reflects that.
05 02 56 04	CMP	Okay. Real fine.
05 02 56 07	CC	Okay, and have at it. We - we'd like to have the TM up for about 5 or 10 minutes to look at the data from the CM; look at your temperatures, et cetera. And after that, we'll go back to charging the battery again, and the charge will probably go until around GET 126.
05 02 56 27	CMP	Okay. Do you want the same readouts from me that I gave you before?

05 02 56 34	CC	That's affirmative, Jack. And just to make sure that there is no mistaking the procedure, it starts out for the backout part: panel 3, POWER AMPL, OFF; TRANSPONDER, OFF; AC INVERTER 2, OFF; then goes to panel 250, et cetera.
05 02 57 07	CMP	That's - that's the way I read it.
05 02 57 09	CC	Okay.
05 02 57 13	CMP	Okay; going back up into the refrigerator.
05 02 57 17	CC	Hey, I thought it was the bedroom.
05 02 57 22	CMP	Well, it's got a new name now, because it is about 30 degrees cooler.
05 02 57 30	CC	Roger. Returning to the deep freeze - -
05 02 57 31	CMP	- - Hey, Vance. One thing that I wanted to ask you - is on the stowage list where you have us putting the black-and-white TV camera on top of A-7 in an A ... decontamination bag, I was wondering if it would be possible or if you - there would be any problem in putting it into B-6 along with the two 70-millimeter Hasselblad cameras?
05 02 58 02	CC	Jack, I don't think there'll be any problem, if you can get it in, but let us get - work that and get back with you. Okay?
05 02 58 10	CMP	All right. I was just thinking. I'm trying to get as much weight as possible down there in that LEB. We have no SRCs and then our waste tank is - you know - rather depleted. I think it's about down to 40 percent or so. So I'm trying to get as much L over D as I can, and any heavy items we can get down there, I'd be greatly appreciative of you bringing it to our attention.
05 02 58 39	CC	Okay. We copy that, and we owe you an answer on your last question.
05 02 58 46	CMP	Okay. And I'm in work, going to give you some telemetry.
05 02 58 51	CC	Okay.
05 03 06 21	CC	Aquarius, Houston. We're receiving CSM data now.
05 03 06 27	LMP	Roger.

05 03 09 08	CC	Aquarius, Houston.
05 03 09 15	LMP	Say again, Vance.
05 03 09 17	CC	Fred, we just lost data on Aquar - on Jack. Would you have him select best OMNI, please?
05 03 09 27	LMP	Okay.
05 03 11 34	CC	Aquarius, Houston.
05 03 11 39	LMP	All right. Go ahead.
05 03 11 41	CC	Fred, we have enough data; recommend that Jack take off the TM and power back down again, using his backout procedure. Just let us know when he does it.
05 03 11 56	LMP	Okay.
05 03 11 59	CC	And, after that, we'll start the battery charge, and we'll have to know when he starts that.
05 03 12 07	LMP	Okay. He's starting to back out now. Just out of curiosity, what - did you all get a readout on what the cabin temp was up there?
05 03 12 20	CC	Yes, we're getting 45 to 46 degrees.
05 03 12 31	LMP	Now you see why we call it the refrigerator.
05 03 12 35	CC	Yes, it's kind of a cold winter day up there, isn't it? Is it snowing in the command module yet?
05 03 12 50	LMP	Is it what, Vance?
05 03 12 52	CC	Is it snowing in there yet?
05 03 12 59	LMP	Oh, snowing. No - no, not quite. The windows are in pretty bad shape, and I guess the service module - we'll be trying to shoot out of the LM window, because every window in the command module is just covered with water droplets. It's going to take a lot of scrubbing to get those cleared off.

05 03 13 21	CC	Roger. Understand. Pete says to tell you that you'll have some time on the beach in Samoa to thaw out after this cold experience.
05 03 13 37	LMP	Hey, that sounds great.
05 03 14 01	LMP	Vance, have you all thought about what cameras you wanted to use? Right now, we've got configured a Hasselblad with a 250, and I've got the lunar-surface number 1 Hasselblad, and I've got the lunar surface sequence camera, also, rigged and ready to go. Did you have any other druthers about the ...
05 03 14 26	CC	You are referring to the photography of the service module, is that right?
05 03 14 32	LMP	That's right.
05 03 14 33	CC	We have some procedures in work, and I've seen them, Fred. I think pretty soon we'll be shooting them up to you to specify which cameras and settings. But that - that sounds pretty close.
05 03 14 50	LMP	Okay, you might let them know that, if they hadn't thought of it, that we got this lunar-surface sequence camera on board which has its own battery pack setup, and to shoot quite a few pictures with, and that could also be used for this.
05 03 15 04	CC	Roger. I know we are planning to use that camera, among others.
05 03 15 11	LMP	Okay.
05 03 18 11	LMP	Okay, Houston; Aquarius. Jack has backed out of powering up the CM, and now he's proceeding to restart battery charge on BAT A.
05 03 18 25	CC	Okay. Real good, Fred. We copy.
05 03 21 32	LMP	Okay. And we are charging battery A now.

END OF TAPE

05 03 21 37	CC	Roger. Charging battery A, Fred.
05 03 22 03	CC	And, Fred, request now first reading of voltage - BAT A voltage and charger current. Over.
05 03 22 17	CMP	Okay, Vance. I can give it to you. I read it right after I started it. BAT A voltage was 39.4 and the current had jumped up to 1.4.
05 03 22 32	CC	Okay. 39.4 and 1.4. Thanks, Jack.
05 03 22 37	CMP	Okay. How about - You ready for some other readouts, that you wanted there?
05 03 22 40	CC	Ready to copy.
05 03 22 44	CMP	Okay. BAT B, 37.0; pyro A, 37.0; pyro B, 37.0; SPS helium pressure, 3400; and nitrogen A and B - just for throwing it in for kicks, 2200 and 2400, respectively; and the injector temperature - stand by - The Sun went down. Okay. The injector temperature, 5 Charlie, 3.9; 5 Dog, 3.2; 6 Alfa, 3.6; 6 Baker, 3.9; 6 Charlie, 3.5; 6 Dog, 3.4; the battery manifold pressure, 1.4.
05 03 24 01	CC	Okay. We copy all that, Jack. Thank you.
05 03 24 04	CMP	Okay.
05 03 24 20	CMP	You say, you figure you are going to be charging BAT A until about 126?
05 03 24 32	CC	Roger. About 126:30 is an estimate, Jack.
05 03 24 40	CMP	Okay. You figure it will be fully charged then, huh?
05 03 24 43	CC	Yes. That's right. We'll have all the batteries up to about 116 amps-hours.
05 03 24 55	CMP	That's good news.
05 03 24 58	CC	That's better than 99, huh?
05 03 25 05	CMP	You're right.
05 03 25 38	CMP	How did all our systems look on ..., Vance?
05 03 25 43	CC	I didn't hear any complaints, but just a minute; let me make a detailed check.

05 03 26 42	CC	Aquarius, Houston.
05 03 26 47	CMP	Go ahead.
05 03 26 48	CC	Jack, it's a general statement. It looks like temperatures have cooled off in the ballpark of 6 to 8 degrees cooler than what they were yesterday. Looks like everything is still within tolerance, but we're working up a detailed sheet of temperatures to send up to you, for your interest.
05 03 27 16	CMP	Okay. That sounds good.
05 03 29 33	CMP	Houston, Aquarius.
05 03 29 42	CC	Go ahead, Aquarius.
05 03 29 45	CMP	Vance, Joe brought up the alinement at EI minus 2 plus 30. Were you going to send up or have a discussion about that later on.
05 03 30 00	CC	That's correct, Jack. We just about have procedures in hand detail checklist-type procedures to send to you. In other words, a time line with reference to entry checklist and any changes in the entry checklist. So, if you have a few pages of scratch paper, why, I think we'll have that to you within an hour.
05 03 30 26	CMP	Okay. I'll be standing by.
05 03 30 38	CC	One other thing, Jack - You still with me?
05 03 30 43	CMP	Yes, go ahead. The stowage people have tried out this black-and-white TV camera into B-6 idea and they say even with the lens off, they can't get it in. So, I still recommend that it be stowed where we had it on the list. That's A-7.
05 03 31 05	CMP	No problem.
05 03 32 12	CMP	All right, go ahead.
05 03 32 18	CC	Jack, request another voltage/readout on BAT A and current on BAT charger.

05 03 36 29	CMP	Okay, Vance. The volt 39.3, amp 1.3.
05 03 36 38	CC	Roger. Copy 39.3 and 1.3.
05 03 37 56	CC	Aquarius, Houston. Over.
05 03 38 01	CMP	Go ahead, Vance.
05 03 38 03	CC	Jack, looks like the LM suit release valve has been bumped to AUTO again; request it - -
05 03 38 12	CMP	Okay.
05 03 38 13	CC	- - closed. Over.
05 03 38 44	CMP	In work.
05 03 38 45	CC	Okay.
05 03 39 27	CMP	How's that right there?
05 03 39 32	CC	Okay. They say it looks good.
05 03 39 34	CMP	Okay.
05 03 43 43	CC	Aquarius, Houston.
05 03 43 49	CMP	Go ahead.
05 03 43 50	CC	Okay, Jack. We need another one of those voltage amps readouts and then maybe we will get off of your back for a little while.
05 03 43 57	CMP	Oh, don't worry about it. I'd like to have you talk with us. Volts and amps coming up.
05 03 44 02	CC	Okay.
05 03 45 29	CMP	Okay, Vance. Volts 39.4, amps 1.25.
05 03 45 38	CC	Okay. EECOM's got it duly recorded.
05 03 45 45	CMP	Is John Aaron on?
05 03 45 53	CC	No. Gee, I don't know what shift he is on. But he comes in later, I guess.

05 03 46 13	CMP	Actually, all the shifts are morning shifts to us.
05 03 46 19	CC	Say that one again - -
05 03 46 21	CMP	The Sun is always shining - All of the shifts are morning shifts to us, because the Sun is always shining.
05 03 46 28	CC	That was a short night.
05 03 46 39	CMP	Just for curiosity's sake, are we still holding entry angle at 6.25?
05 03 46 59	CC	Okay. Jack, right now we're told that it's closer to 6, and - But they would like to track it some more. Looks like your next midcourse will be in the order of 2 to 3 foot per second.
05 03 47 16	CMP	Okay.
05 03 54 03	CMP	I just got a good view of the Southern Cross, Alpha and Beta Centauri, and Atria.
05 03 56 40	CMP	Houston, 13.
05 03 56 45	CC	Go ahead, Jack.
05 03 56 49	CMP	Okay. We're still in good shape as far as water goes in the LM?
05 03 56 56	CC	Okay. We copy.
05 03 57 11	CMP	The reason I ask is I'm assuming that we are, and I have no idea each time I pressurize the surge tank to get water out of the command module, how much I drop that surge tank and if we are in good shape as far as water goes in the LM, we'd like to fill a couple of drink bags to get some water for drinking purposes.
05 03 57 37	CC	Okay. Have you run out of CM drinking water yet, Jack?
05 03 57 42	CMP	Oh, no, we've got plenty of drinking water. I think the - I don't have any idea what the surge tank pressure is.

05 03 57 57	CC	Okay. It's 750 - -
05 03 57 58	CMP	- - and I don't have any - -
05 03 57 59	CC	It's 750, Jack.
05 03 58 02	CMP	Okay. 750.
05 03 58 33	CC	Aquarius, Houston.
05 03 58 38	CMP	Go ahead, Vance.
05 03 58 40	CC	Okay. Stand by 1, Jack, and we'll give you an indication of how that water situation on the LM is - which is your question. Right?
05 03 58 51	CMP	Okay. But I guess what I was really asking is, if you'd have any violent objections if we filled two drink bags from LM water rather than repressurizing the surge tank.
05 03 59 03	CC	Okay. Stand by on that.
05 03 59 04	CMP	Also, Jim is asleep up there and we didn't want to bother him, either.
05 03 59 10	CC	Okay. We understand.
05 03 59 18	CC	And, Jack, we'll be changing stations in 1 minute; so, we may have a temporary dropout in COMM.
05 03 59 26	CMP	Okay.
05 04 02 09	CC	Aquarius, Houston.
05 04 02 18	CMP	Okay, Vance. Go ahead. Loud and clear.
05 04 02 20	CC	Okay, Jack. We're going to bargain with you on this one. Instead of two, would - wish that you would just get just one bag full. That shouldn't do any harm; however - -
05 04 02 32	CMP	Okay.
05 04 02 33	CC	- - we are not all that fat on water that we want to do any drinking out of the LM as a regular thing after this one bag. So would you let us know when you get the water out and give us a mark on it so we can watch the TM. Over.

05 04 05 53	CMP	Okay. Fred-o is about to withdraw the water now.
05 04 06 01	CMP	Okay, Vance. We've withdrawn - oh, about 8 ounces of water.
05 04 06 09	CC	Okay, Jack. How's it taste?
05 04 06 18	CMP	It's - good. It's not quite as gaseous as that in the command module.
05 04 17 16	CC	Apollo 13, Houston - or rather, Aquarius, Houston. Over.
05 04 17 23	CMP	Go ahead.
05 04 17 25	CC	Hey, Jack, we need another reading. Volts and amps.
05 04 17 29	CMP	Okay. They're coming up.
05 04 20 10	CMP	Vance, you won't believe this, but Fred-o says it's 39.4 and 1.245.
05 04 20 19	CC	Okay. Our EECOM is recording those numbers. Charlie Dumas, this time.
05 04 20 27	CMP	Oh.
05 04 20 36	CC	Not changing very fast, is it?
05 04 20 42	CMP	How far out are we?
05 04 20 55	CC	Okay. 953 and 6068 on velocity, per FIDO.
05 04 21 02	CMP	Okay.
05 04 21 03	CC	Bill Stoval.
05 04 21 04	CMP	Thank you.
05 04 38 32	CDR	Houston, Aquarius. Over
05 04 38 38	CC	Go ahead, Aquarius.
05 04 38 42	CDR	Are the flowers in bloom in Houston?
05 04 38 45	CC	No, not yet. Still must be winter.
05 04 38 52	CDR	Suspicions confirmed.

05 04 38 57	CC	Yes, I doubt if they will be blooming even Saturday, when you return.
05 04 39 05	CDR	I concur.
05 04 39 07	CC	Hey, Jim, we have some photo information to pass up to you. Discussed this briefly with Fred earlier. It's instructions or suggestions for which photos - which cameras and lenses to use during your service module photography. Over.
05 04 39 31	CDR	Okay. Stand by 1.
05 04 39 33	CC	Okay.
05 04 39 57	CDR	Go ahead.
05 04 39 59	CC	Okay. We have three cameras here, two of them to be used for picture taking from the LM, one to be used from the number 5 window of the CSM. First, I'll hit the LM cameras. And this camera that I mention now has first priority. It's considered the one to give you the best results. That's the 70-millimeter DC Reseau camera, Hasselblad, that is, with the 80-millimeter lens, from box A-13. Suggest fresh magazine of 3400 black-and-white film.
05 04 41 02	CDR	Okay.
05 04 41 06	CC	Okay. Suggest either magazine R or magazine S from A-13. Transfer all of this to the LM and recommend the following settings: LM/DC/80/BW 3400 (f:5.6 at a 250th).
05 04 42 00	CC	And that's all for that one.
05 04 42 04	CDR	Okay, Vance. Let me see if I have it here. For the LM, want to use the 70-millimeter DC Hasselblad 80-millimeter lens in A-13, using 3400 black-and-white film MAGs R or S. Prepare to take camera to the LM, and the setting would be the LM/DC/80/BW 3400 (f:5.6) at a 250th.
05 04 42 28	CC	That's correct. Okay. Next: the next camera - Stand by 1. I've got noise here. Okay. The next LM - The next camera for the LM will be the 16-millimeter, and these photos are considered to be priority 3. Okay. One, get the 16-millimeter DAC and powerpack from A-8. Get

the 10-millimeter lens, and remove it - remove the 10-millimeter lens, and take the 18-millimeter lens from B-3 and attach it to the camera. And attach the power cable transfer to the LM, set frame rate at 12 frames per second, and the same data line that I gave you before reads this way this time. LM/DAC/18/CEX, battery (f:8 and 1/250th). Okay. Now looking at these two cameras in the LM, it's recommended that you use the 16-millimeter for the first 2-1/2 minutes and then switch to the 70-millimeter. That's partly because the frame's been - or the - They've been optimized for closer and longer range. Okay. Read back, please.

05 04 44 59 CDR Okay, Vance. Essentially, what you wanted to use as far as the movie camera in the LM goes, is our lunar sequence camera which is attached to the powerpack. We use the 18-millimeter lens, set it at 12 frames per second ... f:8 at 250th of a second.

05 04 45 22 CC Roger. f:8 at 250th.

05 04 45 30 CDR Right; f:8 at 250th.

05 04 45 35 CC Okay. Would you believe that we have a correction now to the last camera I gave you? Correct that 18-millimeter lens to 75-millimeter lens.

05 04 45 52 CDR Okay. The 18-millimeter to the 75-millimeter lens. Okay.

05 04 45 57 CC Right. Okay. Next for the command module pictures, it may be a little hard to see the service module from the command module, but if you can see it, it will be through window 5, people down here think. Recommend for that the CM 70-millimeter. These photos have priority 2. So this is 70-millimeter EL, with - which has the 80-millimeter attached, and this is all in B-3. Take off the 80-millimeter lens and attach the 250-millimeter lens. And the 250-millimeter lens can be found in U-4. Use CEX film from A-13. Ring sight from A-7, and these pictures will be f:8 at a 250th. And I think probably by now you probably all have - already have these cameras configured, and this may be redundant information, but here it is anyway. Over.

05 04 47 26	CDR	Okay, Vance. You're right. We do have cameras almost configured like you said. For the command module, you think that the EL with the 250 lens, CEX film, f:8 at a 250th is the best bet, and you're saying now that where you think you'll see it is out window 5? Is that it?
05 04 47 48	CC	That's right, Jim.
05 04 47 52	CDR	Okay. My procedure, now, after service module JETT is going to be to pitch up, in order to try to get the service module into the - to get the center window in view of the service module, which we are going to have somebody there - to photograph. Why do you think window 5 will be it?
05 04 48 35	CC	Okay. Stand by on that one. This is a question of geometry, and I'll get right back.

END OF TAPE

05 04 58 10	CC	Aquarius, Houston. Over.
05 04 58 14	CDR	Go ahead, Houston.
05 04 58 16	CC	Jim, regarding window 5, I have a drawing here; and, when you're docked, you have approximately a 60-degree angle between the Z-axes of the two spacecraft. It appears that peering out window 5, you would be looking at the rendezvous radar on top of the LM which would, if you pitched, more or less give you a view of the service module. That is, if you pitched, so - from - and I think that this has been run by quite a few folks here; so, offhand, I can't see where any other window would be as good or perhaps even possible.
05 04 59 12	CDR	Okay. I understand. Yes, you're right. When we look out window 5, we can see rendezvous radar, and we'll try - We'll try window 5.
05 04 59 21	CC	Roger. It presumes, though, that there has to be a pitch to be able to see it. You guys sound a lot more rested today.
05 04 59 33	CDR	Well, I just went back and sacked out for an hour or so and didn't get back up.
05 04 59 40	CC	Very good.
05 05 00 51	CC	And, Jim, Houston. We really are going to get those checklists up to you.
05 05 00 57	CDR	Okay.
05 05 15 07	CC	Aquarius, Houston. Over.
05 05 16 27	CC	Aquarius, Houston. Over.
05 05 16 32	CDR	Go ahead, Houston.
05 05 16 33	CC	Jim, it's time for readings on the battery charging again. Request the BAT A voltage and the charger amps. Over.
05 05 16 43	CDR	Okay. Stand by, Vance.
05 05 19 07	CDR	Houston, Aquarius.

05 05 19 09	CC	Go ahead, Jim.
05 05 19 12	CDR	Okay. We have no more water in the potable tank. We tried to get some more out a few minutes ago, and there isn't any.
05 05 19 21	CC	Okay. Understand you ran out of water in the CM potable tank.
05 05 19 27	CDR	Affirmative.
05 05 25 17	CC	Aquarius, Houston. Over.
05 05 25 50	CC	Aquarius, Houston. Over.
05 05 25 54	CDR	Go ahead, Houston.
05 05 25 56	CC	Jim, we - you were able to get those voltage - BAT A voltage and current readings?
05 05 26 02	CDR	Oh, yes. Fred's - Fred's up there now.
05 05 26 05	CC	Okay. And we're ready to read you the first checklist installment. This will - What we're going to readup is going to be a LM time line, a CSM time line, and checklist changes to conform with these. And right now I have the first installment of the CSM time line ready to read up. Over.
05 05 26 37	CDR	Okay, Jack. I'm going to get - Vance, I'm going to get Jack on the line for that; and so stand by.
05 05 26 43	CC	Okay. And he'll need a lot of paper.
05 05 26 50	CDR	Okay. Volts are 39.5; amps, 1.24. Stand by.
05 05 27 01	CC	Okay. We got it.
05 05 27 28	CC	Aquarius, Houston.
05 05 27 50	CMP	Okay, Vance. I'm on and ready to copy.
05 05 27 54	CC	Okay, Jack. Wait 1. We want to get one into the hands of FLIGHT and EECOM, and it'll take about a minute or 2. Sorry to wake you up for this, but take about a minute, and then we'll read it up to you.

05 05 30 07	CC	Aquarius, Houston.
05 05 30 12	CMP	Okay, Vance. Go ahead.
05 05 30 14	CC	Okay, Jack. Do you have any of that CM water - bagged water, left? Over.
05 05 30 22	CMP	Negative. I went up and tried to repressurize the surge tank and get another shot of water, and was able to repressurize the surge tank okay, but there was no water that came out of the water tank.
05 05 30 36	CC	Yes. We understand that there isn't any more in the potable tank, but we understood that you had put some water from that tank into bags, and I wondered if any of the bags were left.
05 05 30 48	CMP	Negative.
05 05 30 50	CC	Okay.
05 05 33 42	CC	Okay, Jack. Ready to copy?
05 05 33 49	CMP	Okay, Vance. Ready to copy.
05 05 33 51	CC	Okay. Start at EI minus 6-1/2 hours. You're going to re - get LM pads and CSM pads, and I don't know if you want to copy them or not. This is something I can just read off to you. Over. Without you copying unless you especially want it.
05 05 34 17	CMP	Okay.
05 05 34 19	CC	Okay. LM pad, SM jettison - -
05 05 34 25	CMP	Okay. Go ahead; read which ones we're going to get.
05 05 34 28	CC	Okay. I'll read them fast first here so you get a general idea. LM pad, service module JETT attitude, Moon viewing attitude, Sun viewing attitude, and LM JETT attitude. The CM pads are coarse aline angles for LM attitudes during Moon and Sun sightings, coarse aline angles for entry REFSMMAT, and CMC angles on entry REFSMMAT for LM JETT. Moon viewing, and entry. Okay. That - That's general pad information. If you want, I'll read it slowly so you can copy it all down; otherwise, I'll go ahead.

05 05 35 30	CMP	I got - I was trying to copy it as you were reading it, Vance. The LM pads are service module jettison attitude, Moon viewing attitude, Sun viewing attitude, and LM jettison attitude. Is that correct?
05 05 35 44	CC	That's correct. Okay. I'll read the CM pads now, slowly. Coarse aline angles for LM attitudes during Moon and Sun sightings.
05 05 36 21	CC	Okay. The next coarse aline angles for entry REFSMMAT. Okay. The next, CMC angles on entry REFSMMAT for (1) LM JETT, (2) Moon viewing, (3) entry. Okay. I'll stand by until you read that back.
05 05 37 37	CMP	Okay. The CSM pads will be coarse aline angles for LM attitudes during Moon and Sun sightings. Coarse aline angles for entry REFSMMAT. CMC - CMC angles on entry REFSMMAT for (1) LM jettison, (2) Moon viewing, (3) entry.
05 05 38 07	CC	Okay. That's correct.
05 05 38 43	CC	Okay, Jack. Going to hold up 1. All the hordes of people that devised this procedure are going to be coming into the room in a minute, and they'd like to hold up until everybody can listen in.
05 05 39 24	CC	Get that, Jack?
05 05 39 50	CMP	Okay, Vance. We're ready to go.
05 05 39 54	CC	Okay. We lost you there briefly while you were in an attitude where we couldn't receive you. Jack, we'd like to hold off for about 5 minutes. We have some more people coming in to listen to this, and it took a lot of people to devise this procedure, and a few people have been testing it out, so we'd like to have them all on hand while we give you the rest.
05 05 40 21	CMP	Okay.
05 05 40 28	F	How's the temperature up there, Jack? You guys chopping wood to keep warm?
05 05 40 34	CMP	Deke, it's about 51, I think, or 50 in the LM, and it's about - I don't know - 45 or little bit less in the command module.

05 05 40 49	F	Oh, it's a nice fall day, huh?
05 05 40 54	CMP	Yes, I tell you, we don't have to worry about chilldown.
05 05 43 30	CMP	Okay, Vance. While we're waiting, do you have there also what I can expect ground to uplink me?
05 05 43 44	CC	We'll have that, Jack, but - Stand by for that.
05 05 43 52	CMP	Okay.
05 05 44 08	CC	Jack, probably - probably the thing to do is to give you all of the checklist, and it will include things like this. Then we'll have a big question and answer session afterwards, if that's okay by you.
05 05 44 24	CMP	Okay. That sounds good.
05 05 46 52	CMP	Okay, Vance. While we're waiting, just for your information, the command module has been stowed per your checklist with the exception of the two Hasselblad cameras.
05 05 47 11	F	Roger. Got that, Jack.
05 05 47 22	CMP	And the LM is pretty well stowed with the exception when we have yet to bring in the probe and the drogue.
05 05 47 31	F	Roger. Got that.
05 05 47 55	F	Relative to your water situation, Jack, we're going to have a pretty good hack on the LM here in the next few hours, and we anticipate letting you fill your own tanks before we transfer over, so you should be in reasonably good shape there.
05 05 48 12	CMP	Okay. We have a number of juice bags all cut and ready to go, and we tried to get the water out of the command module about 20 minutes ago and found out that the command module's potable tank was empty. So we have no bags made up now, so we're dependent on LM water, PLSS water.
05 05 48 39	F	Roger. If you feel like trying the PLSS, that's all excess, and you might want to try that at any time. I'm sure it'll taste like PLSS but you might as well try it.

05 05 48 57	CMP	Okay.
05 05 50 28	CMP	Okay, Deke. All the windows in the command module are heavily coated with water right now. So I don't know what kind of pictures we'll get out of them, but I'm going to try and clean them off and do the best I can with the 250-millimeter lens on the Hasselblad.
05 05 50 47	F	Roger. That's why we have the top priority stuff in the LM. We figure you've got a much better chance of getting it through there.
05 05 50 55	CMP	Okay.
05 05 53 24	CC	Aquarius, Houston.
05 05 53 29	CMP	Are you ready to send it up, Vance?
05 05 53 31	CC	Jack, before we start reading the procedure, we'd like - We find that BAT A is topped off and in great shape. Like to switch over and top off BAT B some more. Give it 2 more hours of charging. Have about a seven- or eight-step procedure here to give you, if you want to copy that. We're switching before we start recording the entry procedures.
05 05 53 58	CMP	Okay. Stand by and let me get out my other checklist.
05 05 54 14	CMP	Okay, Vance. Ready to copy.
05 05 54 19	CC	Okay. Panel 3: switch BATTERY CHARGE to OFF. Panel 5; MAIN BUS TIE BAT A/C to BAT A/C; CB BATTERY CHARGER, BAT A CHARGE to open; CB BATTERY CHARGER, BAT B CHARGE, close. Next, panel 250; CB BAT B POWER ENTRY/POSTLANDING to close. Panel 5; MAIN BUS TIE, BAT B/C, off. Panel 3; BATTERY CHARGE to B. Advise; well, stand by. Jack, advise that we have a backout procedure for this, but we'll read that up to you later, in about 2 hours. And, also, that this procedure is a DELTA to your - the first battery charging procedure that we gave you. In other words, it's a DELTA from where you are right now.

05 05 57 10	CMP	Okay. This is the procedure for charging BAT Baker. Panel 3; BAT CHARGE, OFF; panel 5; MAIN BUS TIE, BAT A/C to A/C; CB BAT CHARGER, BAT A CHARGE, open; CB BAT CHARGER, BAT B CHARGE, close. Panel 250; CB BAT B POWER ENTRY and POSTLANDING, close. Panel 5; MAIN BUS TIE, BAT B/C, to OFF; Panel 3; BAT CHARGE to B. This is a DELTA for the first battery charging procedure; you'll give me the backout procedure in a couple hours.
05 05 57 47	CC	That's affirm.
05 05 57 51	CMP	Okay. I'll put it in work right now, then come back and stand by to copy the rest of - well, I - not the rest - everything.
05 05 58 01	CC	Everything is right.
05 05 58 13	CC	You'd never believe how much this procedure's been massaged in the last day.
05 06 02 41	CMP	Okay, Vance. I put BAT Baker on charge; I don't think it quite had stabilized. It was reading 1.1 amps, 39.6 volts when I left up there.
05 06 03 02	CC	Okay. We got that.
05 06 03 07	CMP	Okay. I guess now is as good a time to start as any.
05 06 03 21	CC	Just a second, Jack.
05 06 04 45	CC	Aquarius, Houston.
05 06 04 50	CMP	Okay, Vance. You're kind of weak, but readable.
05 06 04 54	CC	Jack, we're going to need readings on the BAT volt and charger amps about every 10 or 15 minutes for a while, so is there somebody else that can be reading them out while you're copying? Over.
05 06 05 10	CMP	Yes. Jim will take a run up there. Fred-o is sleeping right now. We're trying to get some sleep here, and Jim'll run up and take a look at voltage and current whenever you call.
05 06 05 22	CC	Okay.

05 06 06 34	CDR	Houston, Aquarius.
05 06 06 37	CC	Go ahead, Aquarius.
05 06 06 40	CDR	Vance, we've got to realize that we've got to establish a work-rest cycle up here, so we just can't wait around here to just read procedures all the time up to the burn. We've got to get them up here, look at them, and then we've got to get the people to sleep. So take that into consideration when you get ready to send up the pads.
05 06 07 01	CC	I know, Jim. We're very conscious of that. We - we should be ready to go in about 5 minutes. That's all I can say. Stand by.
05 06 07 16	CDR	Okay.
05 06 11 48	CC	Aquarius, Houston.
05 06 11 53	CMP	Okay, Vance. We're ready to go.
05 06 11 56	CC	Okay. We need a - Sorry (laughter). We need a readout. Volts and amps.
05 06 12 05	CMP	Okay. In work.
05 06 12 10	CC	And, might as well bring the COMM up to a higher fidelity for this long period of checklist reading. That requires, panel 16: CB PRIMARY S-BAND POWER AMP, closed.
05 06 12 37	CMP	Okay, PRIMARY S-BAND POWER AMP closed now. How do you read?
05 06 12 40	CC	Okay. And next step, panel 12: S-BAND FUNCTION to VOICE and RANGING FUNCTION to RANGING.
05 06 13 25	CMP	Okay, Vance. The S-BAND FUNCTION is at VOICE and the RANGING switch was at RANGING.
05 06 13 32	CC	Okay. That makes it so we can hear you better, Jack.
05 06 13 41	CMP	Okay. Can we - Since the first part of it, you're just going to read and I'm going to copy and we're going to have a question and answer period later, can we get started?

05 06 13 52	CC	Okay. Procedure's coming back in again. Multi-copies for distribution. And Ken's back. He's a local expert on this now, so we'll turn you over to him and he'll read it off.
05 06 14 07	CMP	Okay. Stand by. I'll give you volts and amps. Okay. The voltage is 39.1; amps, 1.75.
05 06 14 20	CC	Okay.
05 06 14 43	CC	Hello, Aquarius; Houston. How do you read?
05 06 14 48	CMP	Okay. Very good, Ken.
05 06 14 50	CC	Okay. Let me take it from the top here. Just - there might be some overlap, but to make sure we're all on the same signal. We're starting off with a set of time line procedures that are going to give us - end up with the normal entry checklist. There will be some checklist changes into the book, but the bulk of what I have for you is the time line stuff. And it starts at 6 hours and 30 minutes prior to EI and assumes that we're getting LM power to MAIN B in the command module. I think you already have the numbers for the LM pads and the command module pads; I mean the types of pads we'll be giving you. And if you have a question on what they'll be doing or what they're for, I can go over those now or when we get through.
05 06 15 42	CMP	Okay. Yes, I'll make a little note there, and we'll discuss it when we get everything copied, huh?
05 06 15 50	CC	All right. And the first item, then, after you get ready to start this checklist, is to install lithium hydroxide canisters and to stow ORDEAL. On panel 8, we want to turn the FLOODLIGHTS to FIXED.
05 06 16 08	CMP	Okay. Wait a minute. You're going too fast, here.
05 06 16 11	CC	Okay. I'll tell you. I'll go line at a time and wait for your verification before I go on to the next one. I have panel 8, FLOODLIGHTS, FIXED.

05 06 16 38	CC	Okay. Install LiOH canisters, stow ORDEAL, FLOODLIGHTS, FIXED.
05 06 16 42	CC	Okay. That's the panel 8 floodlights. Now we're going to take panel 5 and put the FLOODLIGHT rheostat to FLOOD and the LEB, that's panel 100, FLOODLIGHTS are also going to FIXED. And the purpose of this is to balance up buses A and B.
05 06 17 05	CMP	Okay. Panel 5; FLOODLIGHTS; you want the rheostat on. Panel 100, FLOODLIGHTS; you want FIXED.
05 06 17 14	CC	That's affirmative. Okay. On panel 8: circuit breakers EMS, MAIN A and MAIN B, that's two, open.
05 06 17 47	CMP	Okay. Panel 8: EMS MAIN A and MAIN B, open.
05 06 17 51	CC	Okay. On panel 250: circuit breaker BATTERY A POWER ENTRY and POSTLANDING, closed.
05 06 18 14	CMP	Okay. Panel 250: CB BAT A POWER ENTRY and POSTLANDING, closed.
05 06 18 20	CC	Okay. The same for circuit breaker BATTERY B POWER ENTRY and POSTLANDING.
05 06 18 39	CMP	Okay. BATTERY B POWER ENTRY and POSTLANDING, closed.
05 06 18 42	CC	Okay. And add BATTERY C POWER ENTRY and POST-LANDING.
05 06 19 00	CMP	BATTERY C POWER ENTRY and POSTLANDING, closed.
05 06 19 03	CC	Okay. That's correct. On panel 5: circuit breaker BAT CHARGE, BATTERY A CHARGE, closed.
05 06 19 27	CMP	Okay. Panel 5: CB BAT CHARGE, BAT A, close.
05 06 19 32	CC	Okay. And the same for circuit breaker for BATTERY CHARGE, BAT B/CHARGE, closed.
05 06 19 52	CMP	Okay, BAT CHARGER, BAT B, closed.
05 06 19 56	CC	All right. Like to take MAIN BUS TIES, two of them, on and up. That's probably a verify.
05 06 20 16	CMP	MAIN BUS TIES A/C and B/C, on, verify.

05 06 20 21	CC	That's correct. Circuit breaker BATTERY RELAY BUS, BATTERY A and B, closed.
05 06 20 43	CMP	Okay. CB BAT RELAY BUS, BAT A, and BAT RELAY BUS, BAT B, closed.
05 06 20 49	CC	That's affirmative. Circuit breaker EPS SENSOR SIGNAL, MAIN A and MAIN B, closed.
05 06 21 13	CMP	EPS SENSOR SIGNAL, MAIN A and MAIN B, closed.
05 06 21 18	CC	Okay. On panel 275: circuit breaker MAIN A, BATTERY C, closed.
05 06 21 37	CMP	Okay, Ken. Wait on that one here. I'm just about to lose you here. Just - I've got to change OMNIs.
05 06 21 42	CC	Okay.
05 06 21 47	CMP	Okay. Could you give me that one again, please.
05 06 21 50	CC	All right. On panel 275: circuit breaker MAIN A, BATTERY C, closed.
05 06 22 05	CMP	Okay. MAIN A, BAT B, closed on 275.
05 06 22 09	CC	That's MAIN A, BATTERY C, Charlie.
05 06 22 15	CMP	MAIN A, BAT C, Charlie.
05 06 22 20	CC	That's affirm. No - Negative on battery Bravo.
05 06 22 27	CMP	Okay. Negative on battery Bravo. That's MAIN A, BAT Charlie, closed.
05 06 22 32	CC	Okay. Good. On panel 276: circuit breaker INSTRUMENTATION POWER CONTROL, 3 and 4, open.
05 06 22 49	CMP	Would you say that one again, Ken?
05 06 22 51	CC	All right. On panel 276: circuit breaker INSTRUMENTATION POWER CONTROL, 3 and 4, open.
05 06 23 17	CMP	Okay. Panel 276: CB INSTRUMENTATION POWER CONTROL, 3 and 4, open.
05 06 23 24	CC	That's affirmative. Okay. Panel 5: circuit breaker CENTRAL INSTRUMENTATION POWER, MAIN B, closed.

05 06 23 51	CMP	Okay. On panel 5: ...
05 06 23 59	CC	Okay. I'm sorry, Jack. Would you read that again, please?
05 06 24 03	CMP	Okay. On panel 5: CB CENTRAL INSTRUMENTATION POWER, MAIN B, closed.
05 06 24 10	CC	Okay. That's correct. PRIMARY EVAPORATE WATER CONTROL valve to AUTO.
05 06 24 24	CMP	This is on 382?
05 06 24 27	CC	That's affirmative.
05 06 24 28	CMP	Wha - Wha -
05 06 24 30	CC	Okay, Jack. We want to put the PRIMARY and the SECONDARY EVAPORATED WATER CONTROL valves to AUTO.
05 06 24 37	CMP	Okay.
05 06 24 52	CC	And, Jack, can you give us a readout on BAT B and the charger current?
05 06 25 14	CMP	Okay, Ken. That was the PRIMARY and SECONDARY H_2O CONTROL valves to AUTO on 382.
05 06 25 20	CC	That's affirmative, and did you copy about the readout on the battery and charger?
05 06 25 25	CMP	Yes. Jim's on his way up.
05 06 25 27	CC	Okay. Thank you. All right, the next little step after your water control valves is to perform the CSM RCS preheat. We'll do that on page E/1-5, steps 35 and 37.
05 06 25 53	CMP	Okay, Ken. We're having a problem with the COMM. You read now?
05 06 25 57	CC	Yes, sir. Loud and clear.
05 06 26 04	CMP	Okay. It's perform CM - CSM RCS preheat, and could you say again all after?
05 06 26 11	CC	Okay. I'm referring to the entry checklist, page E/1-5, steps 35 and 37.

05 06 26 43	CMP	Okay. Perform CSM RCS preheat per entry check-list, page 1-5, steps 35 and 37.
05 06 26 43	CC	That's affirmative. Now back to panel 5: circuit breaker CAUTION AND WARNING, MAIN B, closed.
05 06 26 59	CMP	CB CAUTION AND WARNING, MAIN B, closed.
05 06 27 02	CC	That's affirm. On panel 2: CAUTION AND WARNING POWER to 1.
05 06 27 15	CMP	Panel 2: CAUTION AND WARNING POWER to 1.
05 06 27 20	CC	That was POWER to number 1, Jack.
05 06 27 26	CMP	CAUTION AND WARNING POWER to 1.
05 06 27 29	CC	Okay. On panel 5: circuit breaker EPS SENSOR UNIT, DC BUS A and B, closed.

END OF TAPE

05 06 27 50	CMP	Okay, Ken. The COMM from you is awful weak - awful weak, I - I can't - it's CB EPS SENSOR UNIT. Say again, after that.
05 06 27 59	CC	All right, Jack. That's CB EPS SENSOR UNIT, DC, that's Delta Charlie, BUS A and B, closed.
05 06 28 16	CMP	Okay. CB EPS SENSOR UNIT, DC BUS A and B, close. And I'll give you the volts and amps.
05 06 28 27	CC	Okay, that's correct. Go ahead.
05 06 28 29	CMP	Okay. Volts are 39.1; amps, 1.5.
05 06 28 45	CC	Okay. On panel 3: MAIN BUS A and B, go to RESET and leave it in the center.
05 06 29 06	CMP	Okay, panel 3 - Stand by; got to change OMNI's.
05 06 29 19	CMP	Okay. MAIN BUS A and B, RESET, then center.
05 06 29 27	CC	That's affirmative. Okay, now we're at EI minus 5 plus 05. And, as far as you're concerned, Jack, the command module is using this for information only. This will be the LM doing an Earth-terminator AGS alinement; and at the time of 5 plus 05 is the time they'll be going ahead and releasing their ball. And this will be covered in the LM checklist; it'll be uplinked after this one. At EI minus 5, we perform midcourse number 7. Over.
05 06 30 16	CMP	Okay. At EI minus 05:05, the LM is making an Earth-terminator aline; and at EI minus 05:00, we perform MCC-7.
05 06 30 27	CC	That's correct. At the completion of midcourse 7, the LM will maneuver to a separation attitude. And this attitude will be sent up on one of the pads that you're going to get before all the sequence starts. And it'll be flown to the LM ball angles on that pad.
05 06 30 47	CMP	Okay. Understand.
05 06 30 50	CC	All right. At EI minus 4 plus 40, we want to perform page 1-6, step 39 of the entry checklist.

05 06 31 07	CMP	Ken, I - I didn't get it. We had to change OMNI's again. Could you say it - the EI minus 4 dash - or 04:40, we do something.
05 06 31 15	CC	Okay. And at that time, you'll want to perform step 39 of page E/1-6. Over.
05 06 31 31	CMP	Okay. Perform step 39 of entry checklist page E/1-6.
05 06 31 39	CC	That's correct. Okay. The next is the command module RCS activation, and that's step 4-1 of page E/1-6.
05 06 32 13	CMP	Okay. The next is perform CSM - or CM RCS activation for step 4-1 of page E — E/1-6.
05 06 32 28	CC	That's correct.
05 06 32 41	CC	All right, Jack. The next is at EI minus 4 plus 30. We want to verify that the LM is configured for command module RCS hotfire.
05 06 33 08	CMP	Okay. Verify LM configure for RCS hotfire at EI minus 04:30.
05 06 33 16	CC	That's correct. Now to panel 5: circuit breaker G&N IMU HEATER, MAIN B, closed.
05 06 33 41	CMP	Okay. Panel 5: CB G&N IMU HEATER, MAIN A and MAIN B, closed.
05 06 33 49	CC	That's negative, Jack. That's MAIN B only.
05 06 33 59	CMP	Okay. MAIN B only.
05 06 34 02	CC	I'm sorry; I lost you that time. Say it again.
05 06 34 08	CMP	Okay. Let's repeat it. Stand by. Cut out. We've really got a strange attitude, so this is why we are having the COMM problem. Panel 5: CB G&N IMU HEATER, MAIN B, closed.
05 06 34 24	CC	That's affirmative. On panel 1: ROTATION CONTROL POWER, NORMAL. That's two of them, to AC/DC.
05 06 34 42	CMP	Okay, panel 1: RHC, NORMAL, two to AC/DC, two controllers.
05 06 34 48	CC	That's correct. On panel 7: SCS, LOGIC POWER 2/3, ON.

05 06 35 03	CMP	SCS, LOGIC POWER 2/3, ON, panel 7.
05 06 35 09	CC	That's affirm. Back to panel 2: RCS COMMAND, ON.
05 06 35 20	CMP	Panel 2: RCS COMMAND, ON.
05 06 35 25	CC	That's correct. Now the command module RCS check per step 4 of page E/2-1.
05 06 35 44	CMP	Okay. Perform the command module RCS check per step 4, page 2-1.
05 06 35 49	CC	That's correct. Okay, at this point, we want to lock the rotation hand controllers.
05 06 36 09	CMP	Okay. After that, lock both rotation hand controllers.
05 06 36 14	CC	That's affirm. On panel 8: SEQUENTIAL, PYRO ARM, two to ARM.
05 06 36 37	CMP	Okay. Panel 8: set FYRO ARM, two, to ARM. Do I get a MSFN GO for that?
05 06 36 43	CC	That's negative, Jack. We haven't powered up any of the downlink at this time. You'll be doing this and the command module RCS pressurization both by yourself.
05 06 36 57	CMP	Okay.
05 06 37 00	CC	Okay. Now, the next event is going to be the separation of the service module, and these are some LM steps, but so that you will know what is going on, I'll read them to you. The LM will do a LM plus-X of one-half foot per second. Then you'll be hitting the CM SM SEP on and up, on their command. As soon as we are free of the service module, the LM will do another LM minus-X for 0.5 feet per second. This is called the push-pull maneuver. I think it was described this afternoon.
05 06 37 46	CMP	Yes, Ken. It was, I heard about it.
05 06 37 49	CC	Okay. I just wanted you to know that's the sequence you're in. Okay. At the completion of that, we go back to panel 8, and it's SEQUENTIAL, PYRO ARM, both of them, to SAFE.
05 06 38 16	CMP	Okay. Panel 8: SEQ PYRO ARM, two, to SAFE.

05 06 38 28	CC	Okay. And following this, we take SEQUENTIAL, LOGIC, two, to OFF.
05 06 38 43	CMP	Okay. LOGIC, two, to OFF.
05 06 38 48	CC	I'm sorry, Jack. I'll have to ask you to repeat that.
05 06 38 58	CMP	Okay. Panel 8: SEQ LOGIC, two, to OFF. Are they ON now, Ken? I don't remember turning them - I guess that's part of one of the other sequences, huh? That we turned them ON?
05 06 39 08	CC	That's affirm. The reason we're turning the logic off, Jack, is a power savings. So we'll be turning them off, and I'll ge getting them back on when we go to get off of the LM; and then turn them back off, then we'll be turning them on prior to entry. Just so you know what's coming.
05 06 39 25	CMP	Okay, real fine.
05 06 39 28	CC	Okay. Then following this, the LM will pitch up to acquire the Moon - Excuse me, they're going to pitch up and acquire the service module and photograph, and they'll be using the ACA for rotations from now on. And you may see the LM out of window number 5 at the same time they pitch up to acquire it.
05 06 40 02	CMP	Okay. The LM pitches up, acquires the service module and photographs it, and I should expect to find - might possibly see the service module out of window 5.
05 06 40 12	CC	That's affirmative. Okay, now we're down to EI minus 3 hours, or the next time-event, and the LM starts a maneuver to what we call the Moon-view attitude. This maneuver is designed to place the command module optics pointing with zero zero at the Moon, and it will be flown to on the LM ball angle.
05 06 40 57	CMP	Okay, the LM maneuvers to the Moon-viewing attitude which would place the Moon in the center of the command module optics with them at zero zero.
05 06 41 08	CC	That's affirmative. Okay, now we're going to panel 5, and it's circuit breaker G&N, COMPUTER, MAIN B, closed.
05 06 41 21	CMP	Okay. Panel 5: CB G&N, COMPUTER, MAIN B, closed.

05 06 41 35	CC	That's affirmative. Now you're going to come up with a 37 ENTER 06 ENTER most likely on the computer. And what we want to do is to put the computer to standby; if you come up with a 37 06, you'll have to do an ENTER in order to get the code 62. If it's got 62 on it, you can do a PROCEED until the DSKY blanks. You might remember that the AC is still off at this time so you won't be getting the STANDBY status light, and your cue that the computer is indeed in standby is when the DSKY goes blank.
05 06 42 16	CMP	Okay. You're saying that I will probably get a PROGRAM 06 with a VERB 37 ENTER flashing.
05 06 42 27	CC	I expect that you - -
05 06 42 28	CMP	ENTER 06.
05 06 42 29	CC	I expect you are - -
05 06 42 30	CMP	Say again, Ken.
05 06 42 32	CC	Yes. We think that you're going to come up with a 37 06 already on the DSKY. If you do, do an ENTER and that should take you to the code 00062, which is the request for standby. And when you get that, hit PROCEED until the DSKY blanks. If you come up with something else, that's where we want to end up anyhow. With either, when you get the code 62 when it comes up, just do a PROCEED on it.
05 06 43 05	CMP	Okay. Is there anything else I could get?
05 06 43 12	CC	I don't believe so, Jack. That's one that when you get to that step, if you do get something else, we will be standing by to see that you see. The whole scheme is to go to standby.
05 06 43 23	CMP	Will you be getting it on downlink?
05 06 43 25	CC	No, sir. We don't have that powered up yet.
05 06 43 29	CMP	Okay. I'll yell to Jim, and Jim will give you a call.
05 06 43 33	CC	Okay. The basic thing, Jack, is just to get the computer in standby to save power.
05 06 43 40	CMP	Okay.

05 06 43 41	CC	And we need another battery B readout.
05 06 43 56	CMP	Okay. He is on his way. Go ahead.
05 06 43 58	CC	Okay. Now, we're at EI minus 2 plus 30; we're going to panel 5: circuit breaker ESSENTIAL INSTRUMENTATION, MAIN A, closed.
05 06 44 20	CMP	Okay, CB ESSENTIAL INSTRUMENTATION, MAIN A, closed.
05 06 44 25	CC	That's correct. Now circuit breaker G&N, IMU HEATER, MAIN A, closed.
05 06 44 42	CMP	CB G&N, IMU HEATER, MAIN A, closed.
05 06 44 47	CC	That's correct. CB LM POWER-1 and -2, open.
05 06 45 01	CMP	CB LM POWER-1 and -2, open.
05 06 45 05	CC	That's correct. CB G&N, COMPUTER, MAIN A, closed.
05 06 45 22	CMP	CB G&N, COMPUTER, MAIN A, closed.
05 06 45 26	CC	Okay, Jack. And that's correct. I got it out of sequence. Would you put that COMPUTER, MAIN A, ahead of LM POWER?
05 06 45 51	CMP	Okay, Ken. That's CB G&N, COMPUTER, MAIN A, closed, goes before CB LM POWER-1 and -2, open.
05 06 45 59	CC	That's correct. Jack, what we're doing is we've had the LM powering MAIN B, and we've had all these particular loads on it, and we're getting ready to secure LM power so we wanted to make sure that essential things like the computer, the platform, and all have dioded power supplies before we remove the LM power.
05 06 46 19	CMP	Okay. Sounds good. Volts, 39.1; amps, 1.3.
05 06 46 28	CC	Okay. Thank you. All right, now panel 275: circuit breaker MAIN B, BATTERY BUS B, closed.
05 06 46 48	CMP	Panel 275: CB MAIN B, BAT BUS B, closed.
05 06 46 53	CC	That's correct. Circuit breaker INVERTER POWER 1, 2, and 3, closed.
05 06 47 08	CMP	CB INVERTER POWER 1, 2, and 3, closed.

05 06 47 13	CC	That's correct. On panel 5: circuit breaker BATTERY RELAY BUS, BATTERY A and B, closed.
05 06 47 33	CMP	CB BAT RELAY BUS, BAT A and B, closed.
05 06 47 38	CC	That's correct. Circuit breaker INVERTER CONTROL 1, 2, and 3, closed.
05 06 47 54	CMP	CB INVERTER CONTROL 1, 2, and 3, closed.
05 06 48 00	CC	That's correct. On panel 3: AC INVERTER 1, MAIN A.
05 06 48 13	CMP	Okay. Panel 3: AC INVERTER 1 to MAIN A.
05 06 48 19	CC	That's correct. Now, AC INVERTER 1, AC BUS 1, ON.
05 06 48 38	CMP	Okay. AC INVERTER 1 to AC BUS 1 to ON.
05 06 48 45	CC	That's correct. And we're going to also put AC INVERTER 1, AC BUS 2, ON.
05 06 49 04	CMP	Okay. AC INVERTER 1 to AC BUS 2, ON.
05 06 49 09	CC	That's correct. Back to panel 5. Circuit breaker EPS SENSOR SIGNAL, AC 1 and 2, closed.
05 06 49 27	CMP	Stand by, Ken. I'm going to switch OMNIs here. You got cut out.
05 06 49 30	CC	Roger.
05 06 49 37	CMP	Okay. Could you repeat that, please?
05 06 49 38	CC	Okay. On panel 5: circuit breakers EPS SENSOR SIGNAL, AC 1 and 2, closed.
05 06 49 56	CMP	Okay. CB EPS SENSOR SIGNAL, AC 1 and AC 2, closed.
05 06 50 04	CC	That's correct. Circuit breaker EPS SENSOR UNIT, AC 1 and 2, closed.
05 06 50 21	CMP	Okay. CBS - CB EPS SENSOR UNIT, AC 1 and AC 2, closed.
05 06 50 29	CC	That's correct. And circuit breaker CAUTION/ WARNING, MAIN A, closed.
05 06 50 41	CMP	CB CAUTION/WARNING, MAIN A, closed.

05 06 50 45	CC	That's correct. On panel 3: AC INVERTER, AC BUS 1 and 2, RESET and back to the center.
05 06 51 09	CMP	AC INVERTER, BUS 1 and 2, RESET then center.
05 06 51 15	CC	That's correct. On panel 225: circuit breaker FLIGHT BUS, MAIN A and MAIN B, closed.
05 06 51 35	CMP	Okay, panel - Okay, CB FLIGHT BUS, MAIN A and MAIN B, closed.
05 06 51 47	CC	That's correct. CB CTE, MAIN A and MAIN B, closed.
05 06 52 05	CMP	CB CTE, MAIN A and MAIN B, closed.
05 06 52 10	CC	That's correct. On panel 4: TELCOM, GROUP 1, AC1.
05 06 52 23	CMP	TELCOM, GROUP 1, to AC1.
05 06 52 27	CC	And TELCOM, GROUP 2, to AC2.
05 06 52 38	CMP	TELCOM, GROUP 2, to AC2.
05 06 52 41	CC	That's correct. On panel 3: S-BAND NORMAL, TRANSPONDER, to PRIMARY.
05 06 52 56	CMP	S-BAND NORMAL, TRANSPONDER, to PRIMARY.
05 06 53 00	CC	That's correct. We want to take POWER, SCE, to NORMAL.
05 06 53 12	CMP	POWER, SCE, to NORMAL.
05 06 53 14	CC	All right, and POWER, PMP, to NORMAL.
05 06 53 24	CMP	POWER, PMP, to NORMAL.
05 06 53 27	CC	That's correct, and UP TELEMETRY, COMMAND RESET to RESET and then NORMAL.
05 06 53 47	CMP	UP TELEMETRY, COMMAND RESET to RESET, then NORMAL.
05 06 53 51	CC	Okay. On panel 2: UP TELEMETRY, CMC, to ACCEPT.
05 06 54 05	CMP	UP TELEMETRY, CMC to ACCEPT.

05 06 54 09	CC	On panel 275: circuit breaker FLIGHT/POST-LANDING, MAIN A and MAIN B, closed.
05 06 54 26	CMP	A panel 275: CB FLIGHT/POSTLANDING, MAIN A and MAIN B, close.
05 06 54 33	CC	That's correct. And configure for COMM on panels 6, 9, and 10.
05 06 54 51	CMP	Okay.
05 06 55 04	CMP	Okay, are you with me?
05 06 55 06	CC	All right. I assume you got that. Panel 5: circuit breaker IMU, MAIN A and MAIN B, closed.
05 06 55 23	CMP	CB IMU, MAIN A and MAIN B, close.
05 06 55 28	CC	That's correct. Circuit breaker OPTICS, MAIN A and MAIN B, closed.
05 06 55 41	CMP	Okay. CB OPTICS, MAIN A and MAIN B, close.
05 06 55 46	CC	That's correct. CB G&N, POWER, AC1 and AC2, closed.
05 06 56 01	CMP	CB G&N, POWER, AC1 and AC2, close.
05 06 56 06	CC	That's correct, and the G&N POWER switch to AC2.
05 06 56 18	CMP	Okay, G&N POWER switch to AC2.
05 06 56 22	CC	That's correct. Now we want to perform the CMC powerup per the CSM G&C checklist, G 2-2.
05 06 56 44	CMP	Perform CMC powerup per the G&C checklist, page 2-2.
05 06 56 50	CC	That's correct. Perform the EMS check, step 32 of the entry book, page 1-4.
05 06 57 16	CMP	Okay. Perform the EMS check per step 32 per the entry checklist, page 1-4.
05 06 57 26	CC	That's correct. Okay, now the ground is going to give you a P27 update, at EI minus 2 plus 15. That's a - that's a time that you need to be configured to accept up telemetry. And what they're going to give you on a P27 update will by a clock increment, a state vector; they'll

give you a VERB 66; they'll give you two REFSMMATs, there'll be an actual and a preferred; and the entry target load. Now, if you'd like to copy those, I can take it a little slower.

05 06 58 13 CMP No, I've got them. They are going to give me a clock DELTA, state vector, VERB 66, two REFSMMATs, and an entry target load.

05 06 58 20 CC That's correct. Okay, and then we'll do - -

05 06 58 24 CMP There isn't much else they could give me, is there, Ken?

05 06 58 28 CC No, not very much. How about IMU powerup according to the G&C checklist, G/2-1.

05 06 58 50 CMP Okay. Perform IMU powerup per G&C checklist, page 2-1.

05 06 58 58 CC That's correct. And while you are there, you can do the optics powerup on G/2-3.

05 06 59 21 CMP Perform the optics powerup per page 2-3.

05 06 59 25 CC That's correct; and on panel 229: circuit breaker TIMERS, MAIN A, closed.

05 06 59 46 CMP Okay. Panel 229: CB TIMER, MAIN A, closed.

05 06 59 52 CC That's correct. And the next thing you will do will be to set the mission timer and what we've done is to only turn on the mission timer on the MDC. And you'll probably have to wait here until they get through with the uplink so you can have the computer.

05 07 00 10 CMP Okay. Set it from the CMC, huh?

05 07 00 13 CC That's affirm. Okay. Now, we are getting ready to start the alinement sequence, and are you familiar with the general sequence of events we're going to use, Jack?

05 07 00 29 CMP How do you mean? We are going to make an alinement on the Moon and on the Sun; other than that - I didn't get any - I wasn't on the headset when the general information was passed up, so if there was any more than that, I didn't get it.

05 07 00 45 CC Okay. Basically, that is correct. Let me just run through it hand-waving-type for a minute, and then I'll read you the steps. I think it will make more sense. The scheme is that the LM can fly to a set of ball angles that will point your optics at the Moon. Now, at any time, in any attitude that we happen to be at, if you can look in the telescope and recognize star patterns sufficient that you believe you can make an alinement all on your own, that's the place we'd like to break off and let you go ahead and take over with your own alinement. However, we are giving you a procedure which will give you things we know you can see in the telescope without worrying about any reflections or anything of that nature, and it's not intended that this procedure has to be followed past the point where you know you've got good definition of star patterns in your telescope. If you need to go on, we'll maneuver, take a look at the Moon, we'll take a mark there, and then we'll maneuver with the LM/FDAI angles again and take a look at the Sun, and get yourself another mark on the Sun and that will complete the alinement. Now, the alinement scheme is that we are going to give you a set of angles that you can coarse aline the ball through when the LM is pointing you at the Moon. Now, this set of angles will agree with the REFSMMAT that you have in as a nominal REFSMMAT in you CMC. You can coarse aline to that, set a drift flag and REFSMMAT flag, and you'll have a good platform and we'll be within a couple of degrees of a good alinement. And, if we have to, we could break off at this point and go ahead with an entry; however, in an attempt to get a good platform, we are going to have you then do a P52 option 1, and what you are going to find in the option 1 slots in the entry REFSMMAT. You'll come up with the NOUN 22 values, and we intend to go ahead and coarse aline the ball to the entry REFSMMAT attitude, and then we'll go ahead and take marks through a normal P52 sequence. So that's the general scheme that we are going to use. If you think you have a handle on that, I will go ahead and read you the steps.

05 07 03 11	CMP	Okay. Well, let me ask a question. The LM maneuvers to a set of Moon-viewing angles. Okay, at this time, I am going to do a P52, is that right? With the planet option?
05 07 03 29	CC	The first thing we are going to do is to coarse aline the platform and get it inertial, based on the REFSMMAT that you have in the present slot inside the CMC. We'll then go - and do a P52, option 4 - Correction, option 1.
05 07 03 48	CMP	Okay - That's after the LM gets established at the attitude. Jim says I'm here at the Moon-viewing attitude, I do a VERB 41 NOUN 20 to the set of angles that you're going to give me in the pad.
05 07 04 00	CC	That's affirmative - -
05 07 04 01	CMP	And then I enter the P52.
05 07 04 03	CC	That's correct.
05 07 04 04	CMP	Okay. Then I enter the P52 and that's an option 3, right?
05 07 04 11	CC	The P52 will be done as an option 1. The only reason you have the other REFSMMAT inside the computer is that in order to set the REFSMMAT flag, you need some relative orientation.
05 07 04 22	CMP	Okay. I see. I do a P52 option 1, and when do I set the REFSMMAT flag and the drift flag?
05 07 04 33	CC	That will be before entering P52. I am going to give you this procedure in detail.
05 07 04 38	CMP	Okay. All right. Let's go at it. Maybe it'll all fall out and I won't have any questions. Go ahead.
05 07 04 45	CC	Okay. I'm ready to start reading again. We start with a VERB 41 NOUN 20.
05 07 05 08	CMP	Okay. When the LM is in the Moon-viewing attitude, I do a VERB 41 NOUN 20, ENTER.
05 07 05 14	CC	That's right. And you'll put in the attitudes that you'll get from one of the pads, and this will be for the coarse aline angles when the LM

is at the Moon-viewing attitude. Then when they're all squared away, I tell you they have the right attitude; we then pick up again with a VERB 40 NOUN 20, ENTER.

05 07 05 45 CMP Okay. VERB 40 NOUN 20, ENTER when Moon is - the LM is satisfied that they're at the Moon-viewing attitude.

05 07 05 53 CC That's correct. Now we're going to set the REFSMMAT and drift flags according to the G&C checklist, page G/7-1, steps 3 and 4.

05 07 06 15 CMP Okay. Set the REFSMMAT flag for G&C 7-1, steps 3 and 4.

05 07 06 20 CC That's correct. Now VERB 37, ENTER; 52, ENTER; option 1.

05 07 06 33 CMP VERB 37, ENTER; 52, ENTER; option 1.

05 07 06 36 CC That's correct. And we'll do the coarse aline.

05 07 06 49 CMP Okay. Perform the coarse aline function.

05 07 06 53 CC Okay. Now when it gets back to the mark routines, we want to take a mark on the Moon.

05 07 07 06 CMP Okay. Mark on the Moon with the crosshairs in the center. Is that right?

05 07 07 10 CC That's affirmative. Okay. When that's complete, the LM will maneuver to the Sun-viewing angle for attitude. And when they get there, you take a mark on the Sun using the Sun filter and the telescope; and, again, we're marking on the center.

05 07 07 39 CMP Okay. Now, let me ask you a question. Is the first mark on the Moon made with the - are all these made with the telescope and not the sextant?

05 07 07 49 CC If - I'm not sure right offhand what the angular size of the Moon is, Jack. If you can get it in the sextant, that's the best thing to do, but you may have to go into the telescope in order to define the center. Either one's acceptable.

05 07 08 04	CMP	Okay. If I can define the center through the sextant, do it that way. And if I can't, use the telescope.
05 07 08 10	CC	That's affirmed. We know you're going to use the telescope on the Sun.
05 07 08 23	CC	Okay. You ready to press on?
05 07 08 29	CMP	I'm ready.
05 07 08 30	CC	Okay. Just reminded we owe somebody a BAT B voltage.
05 07 08 37	CMP	Okay, another volts and amps coming up.
05 07 08 40	CC	All right. Thank you. And this left us in P52 with two marks, and we'll go ahead and torque the NOUN 93s.
05 07 09 03	CMP	Okay. ... torque the NOUN 93s, after the two marks.
05 07 09 08	CC	Okay. So that gives us a good platform. Now the LM will maneuver to the jettison attitude, and the only thing of significance here is that you want to watch to make sure that the path they choose to go to the jettison attitude avoids gimbal lock on your own platform.
05 07 09 38	CMP	Okay. The LM maneuvers to the jettison attitude and I just monitor the maneuver and yell at Jim if he gets near a gimbal lock.
05 07 09 46	CC	That's affirmed. Okay, and then the LM will go to a MAX deadband attitude hold in the jettison attitude.
05 07 10 04	CMP	Okay. The LM goes to MAX deadband attitude hold.
05 07 10 09	CC	Okay. Now we're ready to go back to work. The next thing we'll do is to continue to powerup procedures. Do you have any further questions on that alinement, Jack?
05 07 10 18	CMP	No. No. I think - I think it's all self-explanatory now.
05 07 10 23	CC	Okay. The one thing that everybody would like for you to understand is we certainly don't

		insist on using the Moon and the Earth; if you find you have good stars, why use them. However, this alinement is more than adequate to give us a good guided entry.
05 07 10 40	CMP	Okay. If I get a set of good stars, do I start right out to a basic P51 and a P52 option 1?
05 07 10 50	CC	That's affirmative.
05 07 10 53	CMP	Okay.
05 07 10 55	CC	Okay. Now, we're ready to go to work on panel 275. And it starts with a circuit breaker MAIN A - -
05 07 11 01	CMP	Wait - wait just a minute. Wait just a minute. I owe you some volts and amps.
05 07 11 06	CC	Okay. All right.
05 07 11 09	CMP	Okay. Volts are 39.4; amps, 1.25.
05 07 11 15	CC	Okay. I thought maybe your meter was stuck before.
05 07 11 20	CMP	No (laughter).
05 07 11 24	CC	All right. You ready to go back to 275? Have a circuit breaker MAIN A, BAT BUS A, closed.
05 07 11 42	CMP	CB MAIN A, BAT BUS A, closed.
05 07 11 45	CC	That's correct. And circuit breaker MAIN B, BAT C, closed.
05 07 11 57	CMP	CB MAIN Baker, BAT Charlie, closed.
05 07 12 00	CC	Okay. That's correct. Now we're up to EI minus 1 plus 30. And at this time, we're going to proceed with the closeout and hatch installation.
05 07 12 30	CMP	Okay. Closeout and hatch installation at EI minus 01:30.
05 07 12 35	CC	That's right, Jack, and we're going to close the LM hatch, and we'll make the dump valve in the LM hatch closed.

05 07 12 51	CMP	Understand you're going to close the dump valve now on the LM hatch, right?
05 07 12 56	CC	That's correct.
05 07 12 57	CMP	Okay. This is a change from what we had understood previously.
05 07 13 01	CC	That's correct.
05 07 13 03	CMP	I'm - Personally, I'm happy to see it, but that's good.
05 07 13 06	CC	Okay. That's one vote on your side. Okay; and we're going to go ahead and do the - use the decal to perform the hatch installation, and we'll start on the hatch integrity check.
05 07 13 39	CMP	Okay. Per the decal, perform the hatch installation and start on the hatch integrity check.
05 07 13 49	CC	That's correct.
05 07 13 53	CMP	Okay, Ken. One thing I think that - I don't know whether anybody - the decal don't take into account the fact that we still have the umbilicals connected. At what point in time should they be removed?
05 07 14 10	CC	Okay, Jack. That doesn't matter. We're going to be separating the tunnel upstream of those umbilicals, and you can leave them right there.
05 07 14 24	CMP	Okay. Does it make any difference if we disengage - the LM - We have pulled the circuit breakers LM POWER-1 and -2, so if we choose to disconnect these umbilicals, there's no harm, right?
05 07 14 41	CC	That's right. No sweat. John Aaron's just saying that they may be hot. He's checking on it, so how about holding a decision on that and let me come back to you?
05 07 14 54	CMP	Okay.
05 07 14 59	CC	Okay. And let me tell you what we're going to do since we told you a different story this afternoon on this tunnel. We're actually going to vent the tunnel down so that we end up with about 1-1/2 to 2 psi absolute in the tunnel.

And this will give us a DELTA-P of 3. So we'll do our hatch integrity check at the same time we're venting the tunnel down.

05 07 15 24 CMP Okay. It sounds good.

05 07 15 26 CC Okay. Now let me give you some plumbing switches here. Let's take the SURGE TANK OXYGEN valve to ON.

05 07 15 45 CMP SURGE TANK O_2 to ON.

05 07 15 48 CC All right. Take the MAIN REGs, two, OPEN.

05 07 15 59 CMP MAIN REGs, two, to OPEN.

05 07 16 02 CC Okay. And the WATER AND GLYCOL TANK PRESSURE, the PRESSURE valve and the RELIEF valve to BOTH.

05 07 16 20 CMP Okay, WATER AND GLYCOL TANKS PRESSURE and RELIEF valve to BOTH.

05 07 16 26 CC That's correct. And EMERGENCY CABIN PRESSURE valve to BOTH.

05 07 16 40 CMP EMERGENCY CABIN PRESSURE to BOTH.

05 07 16 43 CC That's correct; and the SUIT DEMAND REGs to BOTH.

05 07 16 55 CMP SUIT DEMAND REGs to BOTH.

05 07 16 58 CC That's correct. Okay, now we're going to panel 5: circuit breaker ECS TRANSDUCERs, PRESSURE GROUP 1 and 2, MAIN A and MAIN B. That's four circuit breakers, closed.

05 07 17 26 CMP ECS TRANSDUCERs, GROUP 1 and 2, MAIN A and MAIN B, four, to close.

05 07 17 32 CC That's correct. Okay, now. Circuit breaker ECS TRANSDUCER, TEMPERATURE, MAIN A and MAIN B, that's two of them, closed.

05 07 17 51 CMP CB ECS TRANSDUCER, TEMPERATURE, MAIN A and MAIN B, closed.

05 07 17 57 CC That's correct. On panel 4: PRIMARY ECS GLYCOL PUMPS, one, to AC 1.

05 07 18 13 CMP Primary ECS GLYCOL PUMPS to 1, AC1.

05 07 18 17	CC	That's correct. Okay, then we'll finish going back to the tunnel vent, and verify the LM/CM DELTA-P and make sure it's been holding pressure. And we'll come back again and rehash all of the hatch integrity check and tunnel vent procedures with you. The next thing I want to read off is the EI minus 1 plus 20. We'll go to panel 7: BMAG number 1 POWER to WARM UP.
05 07 19 11	CMP	BMAG number 1 POWER to WARM UP.
05 07 19 15	CC	That's correct. Then at EI minus 1 plus 10, we'll perform SCS powerup per checklist, page G/2-4.
05 07 19 35	CMP	Okay. Perform SCS powerup per G&C checklist, page 2-4.
05 07 19 42	CC	That's correct. Okay, on panel 4: SUIT COMPRESSOR NUMBER 2 to AC1.
05 07 19 58	CMP	SUIT COMPRESSOR 2 to AC1.
05 07 20 01	CC	That's correct. SPACECRAFT CONTROL to SCS.
05 07 20 20	CMP	SPACECRAFT CONTROL to SCS.
05 07 20 23	CC	Okay. And your MANUAL ATTITUDE switches, as you desire. We're coming up on jettison of the LM, so that's just like separation.
05 07 20 42	CMP	Okay.
05 07 20 44	CC	Okay. And we'll do a GDC aline.
05 07 21 01	CMP	Okay. Perform a GDC aline.
05 07 21 03	CC	Okay. On panel 8: ROTATION CONTROL POWER, DIRECT, 1 and 2, MAIN A/MAIN B.
05 07 21 29	CMP	Okay. These are circuit breakers, ROTATION CONTROL POWER, DIRECT, 1 and 2, MAIN A and MAIN B, closed.
05 07 21 42	CC	Okay, Jack. I was thinking switch. Let me verify that's a circuit breaker, too. I think we have to get both of them.
05 07 21 52	CMP	Okay, there's those four circuit breakers over there, Ken. When you said panel 8, that's what I thought you were talking about. I don't think the circuit breakers are out right now,

		but why don't we just put - verify the circuit breakers and put the switches to MAIN A/MAIN B.
05 07 22 17	CC	Okay, that's correct, Jack. Okay, at EI minus 1 hour, we're going to be doing the LM jettison; so just prior to that, we want to do a P47.
05 07 22 47	CMP	Okay, say at about 1 minute prior to LM jettison, huh?
05 07 22 55	CC	Yes, just something that's comfortable for you.
05 07 23 07	CMP	Okay.
05 07 23 08	CC	All right, after we've done that, we want to get panel 8, SEQUENTIAL, PYRO ARM, two of them, ON.
05 07 23 25	CMP	Okay. I get a GO from MSFN for this?
05 07 23 32	CC	Okay, John says we can watch it.
05 07 23 43	CMP	Okay.
05 07 23 44	CC	All right; the next thing is CSM/LM FINAL SEP, two of them, ON, up.
05 07 23 59	CMP	CSM/LM FINAL SEP, two, ON.
05 07 24 02	CC	That's correct. Now we're going back to panel 8, and it's SEQUENTIAL, PYRO ARM, two of them, to SAFE.
05 07 24 28	CMP	Okay. SEQ PYRO ARM, two, to SAFE.
05 07 24 31	CC	That's correct, and go back to POO.
05 07 24 42	CMP	Okay. Go to POO.
05 07 24 44	CC	All right. And now it's time to configure for single ring.
05 07 25 00	CMP	Okay. Configure for single ring RCS.
05 07 25 03	CC	That's right, and since you're still an hour from EI, I guess it wouldn't hurt to use MINIMUM IMPULSE or something like that rather than the DAP, at least not until you get closer down. We'll have the DAP loads for you later.
05 07 25 25	CMP	... - -

05 07 25 26	CC	Okay. And as soon as you've gotten yourself all set up with a good control mode, you want to maneuver to the entry attitude.
05 07 25 45	CMP	Maneuver to entry attitude per the pad.
05 07 25 47	CC	That's correct. And we show EI minus 55, which really means when you get to the entry attitude, we have a sextant star check for you. And that will be on the pad.
05 07 26 11	CMP	Okay. Perform a sextant star check.
05 07 26 14	CC	Okay. And I want to remind you to park the optics at 90 degrees of shaft.
05 07 26 20	CMP	Okay. Say again why, Ken. I didn't understand that.
05 07 26 31	CC	Okay, this is just a precaution, Jack. If we park the optics with a 90-degree shaft angle, that will line up the slit's so it gives you the best airflow over that part of the heat shield and avoids a hot spot. If you don't remember it, I don't think it makes much difference. It's just good procedure.
05 07 26 52	CMP	Okay.
05 07 26 55	CC	Okay. And after you've got it parked wherever you want it, well, turn the OPTICS POWER OFF and stow the optics.
05 07 27 14	CMP	Okay. OPTICS POWER, OFF; stow the optics.
05 07 27 17	CC	Okay, that's good. Okay. The next thing we'll do is to initialize the EMS and that's on entry checklist page 2-1, step number 2.
05 07 27 40	CMP	Okay, perform EMS initialization per entry checklist page 2-1, step 2.
05 07 27 46	CC	Okay, that's correct. Now we're coming up on EI minus 45 minutes, and we'll give you an entry pad and a final state vector.
05 07 28 12	CMP	Okay, at minus 45, entry pad and final state vector from MSFN.
05 07 28 17	CC	Okay. Now we're going to perform what we call the Moon check. Rather than go into detail, if

		you already know what we're doing, just say so; otherwise, I'll describe the use of the Moon-attitude set.
05 07 28 38	CMP	Maybe you better describe it.
05 07 28 41	CC	Okay, Jack. You remember everybody in the past has commented on seeing Moonset just a couple minutes prior to EI, and your horizon will probably be dark at the time that you get there; you're having an early morning entry; and coming in from the west, you'll still be looking at a dark horizon. So, just as a backup technique, just like you would track the horizon, we're going to give you an attitude which will be on the pad so that you can look directly at the Moon. This is an inertial attitude; it won't be changing, and you'll put the 36-degree window line on the Moon, and then just sit there and watch it. And just prior to EI, the Earth will come up and occult it, and you will then have a good horizon check. And I have some times, and I'll give you that later. And if you just look at this thing now, at that point you can set the GDC or whatever you desire. And you will have a known attitude reference. It's just like a horizon check.
05 07 29 47	CMP	Okay, I maneuver to the Moon check attitude; at which time I put the 36 window line on the Moon, and just prior to EI, the Earth will occult the Moon.
05 07 30 03	CC	That's correct. And that corresponds to the same inertial attitude that you'd have on the back of your entry card where it shows the horizon attitude several minutes prior to EI; it's the same thing.
05 07 30 21	CMP	Yes, that's that one at 17 minutes prior. Okay.
05 07 30 24	CC	Okay, and we're just getting it in a little closer. Okay, the next item on the check - checklist here is an EI minus 40; we're going to panel 7, and it's BMAG NUMBER 2 POWER to WARM UP.
05 07 30 49	CMP	Okay, panel 7: BMAG NUMBER 2 POWER to WARM UP.
05 07 30 52	CC	That's correct. Now, I'd like to verify the SURGE TANK and REPRESS PACKAGES are ON.

05 07 31 13	CMP	Verify SURGE TANK and REPRESS PACKAGE are ON.
05 07 31 16	CC	That's correct. On panel 5: circuit breaker ENVIRONMENTAL - CONTROL SYSTEM; WASTE WATER/ URINE DUMP HEATER, two of them, closed.
05 07 31 44	CMP	Panel 5: CB ECS, WASTE H_2O/URINE DUMP HEATERS, two, to close.
05 07 31 51	CC	That's correct. SUIT COMPRESSOR number 2 to OFF.
05 07 32 07	CMP	SUIT COMPRESSOR 2 to OFF.
05 07 32 09	CC	That's right, Jack, and what this - what we're planning to do in order to conserve power is we're going to run the suit compressor from an hour to this point at minus 40. And we'll be watching the PCO_2; if that thing's working, we'll turn it off at the earliest time that we have a good cabin, and then we'll just leave it off. And in the event that the PCO_2 gage isn't working properly or something like that, well, we'll just go ahead and run it for this time frame.
05 07 32 40	CMP	Okay, that sounds good.
05 07 32 43	CC	All right. Now we're at EI minus 30. SEQUENTIAL, LOGIC, that's two of them, to ON, up.
05 07 32 57	CMP	EI minus 30; SEQ, LOGIC, two, ON.
05 07 33 01	CC	Okay, in panel 7: the BMAG number 2 POWER to ON.
05 07 33 13	CMP	Okay, we - you only gave that 10 minutes for the warmup, huh?
05 07 33 18	CC	That's okay.
05 07 33 20	CMP	Okay.
05 07 33 22	CC	All right, and FDAI POWER to BOTH.
05 07 33 33	CMP	FDAI POWER to BOTH.
05 07 33 36	CC	Okay. And we want to activate the primary evaporator.
05 07 33 54	CMP	Okay, activate the primary evaporator. All this time, Ken, what've we been getting our cooling? Right now, I think we have the radiators at PULL TO BYPASS.

05 07 34 03	CC	That's correct. We started out that way, and we turned the glycol pumps on, and we're just circulating it internally. And we're counting on the command module being a heat sink; it's pretty cold soaked, and it looks like this is good enough. You got some relatively low heat loads - -
05 07 34 20	CMP	Okay.
05 07 34 21	CC	- - and we'll keep watching the temps, and if we need it, why we'll start the evaporator early.
05 07 34 27	CMP	Okay, that sounds good.
05 07 34 29	CC	Do you believe it's cold up there?
05 07 34 33	CMP	Yes, and we used to call the command module the bedroom and it's now the refrigerator.
05 07 34 38	CC	Okay, just don't call it the reefer. Okay. At about EI minus 19, we get back into the standard entry checklist on page 2-2, where it starts with P61.
05 07 35 04	CMP	Okay, at EI minus 19, we get back into the entry checklist at page 2-2, where we start entering P61.
05 07 35 14	CC	Okay, Jack. Now that's the - those are the time-line notes I had for you. I hate to tell you this, but I also have a couple of corrections to make to the entry checklist. They aren't corrections, they just are pieces of the entry checklist which will correspond to what I've written - already read to you. And I'm ready to to on that whenever you are. And Vance tells me you can get into the descent water for drinking now.
05 07 35 42	CMP	We can get into the descent water for drinking, huh?
05 07 35 45	CC	Yes.
05 07 35 47	CMP	Sounds good.
05 07 35 48	CC	Hey, go to it.
05 07 35 54	CMP	Jim would like to know whether the descent water will be good until LM jettison?

05 07 36 19	CC	Okay, Jack. Looks like we're going to go on the ascent tanks at 128:30. And it looks like - -
05 07 36 29	CMP	Okay, understand. We are going - -
05 07 36 30	CC	- - you have plenty of water. I'm sorry we cut each other out; say again.
05 07 36 34	CMP	Okay, yes. I was going to say, understand we're going to go on the ascent tanks at 128:30.
05 07 36 40	CC	That's right; based on the current rate, that's what they predict and you can go ahead and drink the water. No sweat.
05 07 36 48	CMP	Okay, real fine. And I've got the entry checklist out and I'm ready to copy; just give me the page.
05 07 36 54	CC	Okay. Jack, you're starting to sound like an LMP.
05 07 37 04	CMP	I think I'm probably the only CMP that's ever witnessed an - a LM burn from inside the LM in - in space flight.
05 07 37 14	CC	(Laughter) I hope it stays that way. Okay, Jack, we're starting on page 1-1.
05 07 37 21	CMP	Go ahead.
05 07 37 23	CC	Okay, down in the middle of the page on line 9, we're just going to strike out the "Activate VHF for COMM checks," and line 10, "Verify the DSE." We're going to leave the DSE OFF, and that's to save power, as is the VHF activation.
05 07 37 42	CMP	Okay.
05 07 37 45	CC	Okay, on page 1-2. At minus 2 hours, there's a title "Logic sequence" check; and we're deleting that entire sequence; that's included in what I read up to you.
05 07 38 03	CMP	Okay, delete the logic sequence check at minus 2 hours there.
05 07 38 09	CC	That's correct. And delete lines 23, 24, and 25. That means a maneuver to SUPERCIRC entry attitude. Everything below that is deleted.

05 07 38 33	CC	Okay. Delete lines 23 through 28.
05 07 38 38	CC	That's correct. You got ahead of me. All right, on line 29 on page 1-3, we're going to put in a time of minus 00:55. That's the time we gave you for the boresight check.
05 07 38 55	CMP	Okay - -
05 07 38 56	CC	That's your sextant check, really.
05 07 39 05	CMP	Got that.
05 07 39 06	CC	Okay, on the top of page 1-4; where it said "1 hour and 15 minutes" next to line 32, we're going to change that to "Minus 2 hours and 30 minutes."
05 07 39 22	CMP	Okay, minus 02:30 opposite item 32.
05 07 39 25	CC	Okay, down at the bottom of the EMS entry check right there where we are, the bottom line now reads, "EMS MODE to STANDBY." Well, just above that - like to remind you to put a remark, "Do not initialize the range to go." This is because you're going to come into the EMS entry check, you're going to run through all these things; then we're going to remove power from the EMS. And just didn't want you to get ahead of yourself and initialize the entry parameters, because you'll lose them when we power up.
05 07 39 59	CMP	Okay.
05 07 40 00	CC	And, after we go EMS MODE to STANDBY, like for you to add "Circuit breaker EMS, two, to open."
05 07 40 19	CMP	Okay, "CB EMS, two, to open."
05 07 40 21	CC	That's correct. And we want to delete this "Set up camera" that's listed on the bottom of the page. We're deleting that for power reasons. That's line 33 Alfa.
05 07 40 34	CMP	Okay, we're way ahead of you. We already got it stowed.
05 07 40 39	CC	Okay. On the top of the next page where it says "Secondary water EVAP," just keep in mind we don't plan to use the secondary evaporators unless the primary fails. On line 35 on page 1-5,

next to "Command module RCS preheat," the time is now "Minus 06:30."

05 07 41 14	CMP	Okay, "minus 06:30," and the voltage reading 3.9 still is good, right?
05 07 41 21	CC	Okay, very good. Under "Final stowage," the first thing that's listed on line 36, page 1-5, is "Optics." And if you want to get started on your stowage, we'd like to leave the optics out, because we'll have the star check coming up quite a bit after this. The rest of that stuff can be taken care of at your convenience.
05 07 41 47	CMP	Okay.
05 07 41 48	CC	All right, still on page 1-5, line 37; the time is now "Minus 06:10."
05 07 42 03	CMP	Got that.
05 07 42 05	CC	Okay, and this is one time it looks like we might actually do the preheat, so that's the reason we want to make sure that we know that not more than 20 minutes of time on the preheat. We may not be able to watch it at that time because you aren't powered up.
05 07 42 34	CMP	Okay. Either 20 minutes or until 3.9 volts DC.
05 07 42 38	CC	That's correct, Jack. And now let's go to page 1-6. And about one-third of the way down, it shows "Panel 275 CB MAIN A, BAT C, closed," we want to strike off that line, the next two lines, and we're going to strike out "MAIN A, BAT C, closed; MAIN B, BAT C, closed; and DC INDICATOR, MAIN B."
05 07 43 11	CMP	Okay. After that step on panel 275, strike out "CB MAIN A, BAT C; CB MAIN B, BAT C; and DC INDICATORS to MAIN B."
05 07 43 22	CC	That's correct. Now under panel 8, it tells you to "Close all circuit breakers EXCEPT," and I have four additions. The first one is CB SERVICE MODULE RCS HEATERS, QUAD Charlie, MAIN B, open.
05 07 43 50	CMP	SERVICE MODULE RCS HEATERS, QUAD Charlie, MAIN Baker, open.

05 07 43 55	CC	Okay. And the same thing for SERVICE MODULE RCS HEATERS, QUAD Delta, MAIN A, open.
05 07 44 11	CMP	SERVICE MODULE RCS HEATERS, QUAD Delta, MAIN A, open.
05 07 44 15	CC	That's correct. And Circuit breaker EMS, that's two of them, open.
05 07 44 34	CMP	CB EMS, two, to open.
05 07 44 36	CC	All right. And the last is the circuit breakers for SPS GAGING, four of them, open.
05 07 44 54	CMP	SPS GAGING, four to open.
05 07 44 58	CC	Okay. And how about our readout on the battery and that charger?
05 07 45 05	CMP	Okay, BAT's at volts and amps.
05 07 45 09	CC	That's affirmed. And let's go back to page 1-6, line 41. Let's put in a time "Minus 04:40."
05 07 45 20	CMP	Minus 04:40.
05 07 45 22	CC	That's correct. On page 2-1, line number 2, put in a time of "Minus 55 minutes."
05 07 45 44	CMP	Okay, minus 55 minutes.
05 07 45 47	CC	Okay. And the first thing you want to do under "EMS initialization," is circuit breakers EMS, that's two of them, to close.
05 07 46 01	CMP	Okay. CB EMS, two, to close.
05 07 46 04	CC	That's correct. All right. Line 4 or step 4, where it shows "CM RCS check." That occurs at minus 04:30.
05 07 46 17	CMP	Okay. Minus 04:30.
05 07 46 20	CC	All right. Under "CM RCS checks," the fourth line down says "MANUAL ATTITUDE, three, to MINIMUM IMPULSE." We'll have to use "ACCEL COMMAND" and the reason for that, Jack, is we don't have the SPS powered up so there's no minimum impulse generator.

05 07 46 39	CMP	Okay. MANUAL ATTITUDE, three, to ACCEL COMMAND.
05 07 46 42	CC	That's correct. And on the same page 2-1, strike out the last three lines, starting with "RCS transfer to service module."
05 07 46 57	CMP	Right. The last three lines are scratched out. We ain't got one of those things.
05 07 47 02	CC	That's correct. Okay, let's flip to page 2-2 and strike out the first two lines.
05 07 47 11	CMP	Okay. Now wait a second. I need to give you volts and amps, Ken.
05 07 47 14	CC	All right. Go ahead.
05 07 47 19	CMP	Okay. It's 39.6, 1.12.
05 07 47 25	CC	Sounds like you're getting there. Okay. I believe we scratched out the first two lines on 2-2. Now, we're - right below that, it says "Separation checklist." So we're going to just delete that whole thing; it's included in the notes I gave you.
05 07 47 50	CMP	Okay. It's included in the notations.
05 07 47 55	CC	All right. Line number 7. It says "Maneuver to horizon check attitude." We're going to call this the "Moon-check attitude" and this is the one we discussed, Jack. The angle of 265 is not correct. I'll have one of those for you first thing in the morning.
05 07 48 15	CMP	Okay.
05 07 48 16	CC	Okay. And at the bottom of the page, step number 1. That will be at EI minus 19 minutes, and we're off and running through a normal sequence of events.
05 07 48 32	CMP	Okay. That sounds good. Ken, I guess if you've read this thing - Is it a comfortable time line? Any areas where you had problems with?
05 07 48 42	CC	Jack, it is very comfortable. We've run it several times now and, in fact, it's being run right now, again. And we've run it both here at Houston and at the Cape. The only place where you might find that you need to stay ahead of

things is during the platform-alinement period, when you're getting ready to close out the LM and then once you get into the command module and jettison the LM, why you're back on a very comfortable time. And, of course, we'll be watching and anything we can do, like keeping track of time for you, we'll remind you of that as we go along.

05 07 49 16 CMP Hey, that would be good - that would be good, Ken.

05 07 49 22 CC Okay. Let me emphasize, Jack, that 2-1/2 hours is the earliest time we can start in on that powerup stuff. Everything else you can do the way you normally would, where you get as far ahead of the game as you can. But the 2-1/2-hour time is based on saving command module consumables. And if you do that, why we're fat; we've got plenty of time to give you some fans on the water even. So that's the one point you don't want to start early on. I do have a couple of more lines to run through on the entry checklist and two pages in the G&C. And I think that will clean us up.

05 07 50 14 CMP Okay, Ken. And G&C checklist now?

05 07 50 17 CC Let me finish a couple more things in the entry book. You still got that?

05 07 50 23 CMP Yes. Go ahead.

05 07 50 24 CC Okay. On - These are just cleanup items, Jack. On page 2-3, it lists how you separate, from the CM/SM SEP and all that, so, obviously, if we're on step 5 at 43 minutes down - that's all deleted. And that gets deleted all the way over onto page 2-4, up to the line where it says "15 minutes." And at that point, we pick back up and everything. From 15 minutes down is valid.

05 07 51 07 CMP Okay. Delete item 5 down to the point where it says "Minus 15 minutes."

05 07 51 14 CC That's correct, Jack. Okay, on page 2-5. The top line where we had "Horizon check," that's now the "Moonset check" and the time is approximately 57:37. And that's minus 02:23. And that angle that's listed in the book there - 177 - that's really a horizon time at 2 minutes; we'll

have you - can look that up on the back of your entry cue card, and I'll look that number up again for you tonight.

05 07 52 00 CMP Okay.

05 07 52 01 CC Okay. Another thing is to remember when we begin blackout, which is around 05g, and you can write this in your checklist wherever it's convenient; once we've lost COMM, we're going to go ahead and power down the SCE POWER OFF and the PMP POWER OFF. And we just want to do that after you lose COMM, which comes up around EI. Any time after that, go ahead and secure the PMP and the SCE power.

05 07 52 42 CMP Okay. When COMM is lost, SCE POWER OFF, PMP POWER OFF.

05 07 52 47 CC That's correct, Jack, and that completes the entry checklist. Let's look at the G&C book.

05 07 53 06 CMP Okay. Ready to copy.

05 07 53 08 CC Okay. Let's go to page 2-1.

05 07 53 25 CMP Okay. Go ahead.

05 07 53 27 CC Okay, Jack. The second line under "IMU powerup" says "FDAI POWER to BOTH," and we're going to make that a "1." The reason we're doing that is, again, to conserve power. There's no reason to drive the second FDAI before we get that information to put on it.

05 07 53 48 CMP Okay. "FDAI POWER to 1."

05 07 53 53 CC All right. That's correct. On page 2-2.

05 07 54 06 CMP Go ahead.

05 07 54 07 CC Okay. Under CMC powerup, line - or step 2 says "Flashing 3700, ENTER." The time we're going to use this, Jack, is going to be when you've just brought the computer up and it has a state vector in it that's way back many, many hours ago. So we want to do a VERB 96, ENTER to stop the integration to keep it from just sitting there ambling along. And when the ground gives you a new state vector, why then we can go through POO and we'll be back in business.

05 07 54 43	CMP	Okay. You want me to go to VERB 37, ENTER; 00, ENTER; and then do a VERB 96?
05 07 54 55	CC	When you come up, I guess you're going to - once you get the CMC powered up, you're probably going to be going - you're going to come up in a flashing 37, and if you'll just do a VERB 96, ENTER right there, that will take care of it.
05 07 55 08	CMP	Okay.
05 07 55 09	CC	All right. And the last one I have for you is on page 2-4.
05 07 55 23	CMP	Okay. Go ahead.
05 07 55 24	CC	Okay. Under the SCS powerup, the first line says "AUTO RCS SELECT, 16, to OFF." Okay. You can just delete that part. On the fifth line, it says "Circuit breaker SCS LOGIC POWER," that's really "LOGIC BUS, four of them, to closed." The DELTA-V CG is not important since we are not burning the engine. The "SIGNAL CONDITIONER/ DRIVER BIAS POWER" lists "Two to AC 1." We are going to make that just one of them; make it "SIGNAL CONDITION/DRIVER BIAS POWER, one, to AC 1." The "BMAG POWER," which is the third line from the bottom, says "BMAG POWER, two, ON;" we are going to make that just one. We'll bring up number 1, and we'll make "FDAI POWER, number 1" and the last line "AUTO RCS SELECT, 16, enable," you can strike that off and replace it with "BMAG MODE, three of them, to RATE 1." You want to try reading that back?
05 07 56 58	CMP	Okay. Delete "AUTO RCS SELECT, 16, OFF." Change "CB LOGIC POWER" to "LOGIC THRUST POWER - CBS CS LOGIC THRUST, four, to closed." Delete "DELTA-V CG," coming down here "SIGNAL CONDITIONER/DRIVER BIAS POWER, one, AC 1; BMAG POWER, 1, to ON," and it's the number 1 BMAG. "FDAI POWER to 1; BMAG MODE, three, to RATE 1," deleting the "AUTO RCS SELECT, 16, to enable."
05 07 57 34	CC	That's correct. You've got them all, Jack. Very good. Thank you.
05 07 57 40	CMP	Thank you. This does it, huh?

05 07 57 43	CC	Yes, sir. Let's see - just a second - let me check on this hatch and integrity check; maybe I can tell you something about that. And I do have an answer to your LM power question about the umbilicals. The umbilicals will be unpowered according to the LM procedures, so if you'd like to disconnect them, you can.
05 07 58 04	CMP	Okay. I think we will.
05 07 58 06	CC	All right, sir. Okay, Jack, and they'd like us to stand by just a second.
05 07 58 19	CC	Jack, would you get the BATTERY CHARGER, OFF, please. And we'll send you - -
05 07 58 24	CMP	Okay.
05 07 58 25	CC	- - the rest of that procedure later.
05 07 58 26	CMP	You mean there's more? Okay, in work. BATTERY CHARGER is going OFF.
05 07 58 33	CC	Right.
05 07 58 34	CMP	Okay, Vance. Okay - I don't think you've given me the backout procedure, have you, for the battery chargers?
05 07 58 43	CC	That's negative. Wait. All we want to do, Jack, is say BATTERY CHARGE OFF at the moment. We'll complete that procedure as soon as you are through with Ken completely.
05 07 59 01	CMP	Okay, Vance. The BATTERY CHARGER's OFF, and I'm ready to continue with Ken.
05 07 59 06	CC	Okay, Jack. And we'll get the backout to you after that.
05 07 59 13	CC	Okay, Jack. It looks like we've closed up the loose ends here. Amazingly enough, out of all that stuff, it looks like we only generated one question on the floor, and we'll research that one. We'll even let you guess what it might have been. If you have any questions, after you mull it over, why, we're always available. Just ask us what you're thinking about.
05 08 00 40	CMP	Okay. That's what we're going to do. We're going to wait until the LM people get theirs,

and then we're going to discuss it and coordinate things here, and make sure that - that we don't have any interface problems. And, if we have any more questions, we'll be coming back at you.

05 08 00 55	CC	Okay. We did run the thing integrated, so we think we've got all the little surprises ironed out for you.
05 08 01 04	CMP	I hope so because tomorrow is examination time.
05 08 01 08	CC	Roger.
05 08 01 09	CDR	Ken, this is Jim.
05 08 01 11	CC	Yes, sir.
05 08 01 12	CDR	Appreciate the work you've done, and Jack says that it's going to be hard to beat his record about saving SM RCS fuel all the way there and back.
05 08 01 22	CC	I can't do much about that.
05 08 01 25	CC	Some people will do anything to set a record.
05 08 01 32	CC	Hey, Jim, you even did good on service module fuel this time.

END OF TAPE

05 08 01 40	CMP	Yes. We're coming back with a full load almost of both RCS and SPS, that's - That's pretty much of a record.
05 08 01 56	CMP	Okay. Did you want to put Fred-o on, or somebody to copy the LM - the LM side of the house?
05 08 02 08	CC	Hey, Jack. Don't wake him up yet. Stand by 1.
05 08 02 13	CMP	He's - He's awake.
05 08 02 30	CC	Hey, Jack. We'll give you this battery charging backout procedure, and then Deke says you ought to get some sleep. You're going to need it tomorrow.
05 08 02 44	CMP	Okay. I'm ready to copy the backout procedure.
05 08 02 47	CC	Okay. Panel 3: BATTERY CHARGE, OFF - you've already done that, Jack - next AC INVERTER, INVERTER 2 OFF: Panel 5: MAIN BUS TIE BAT B/C to BAT B/C. Huh? Yes, it's up - the up position. Panel 250: circuit breaker, BAT A POWER ENTRY/POSTLANDING to open; circuit breaker, BAT B POWER ENTRY/POSTLANDING, open. Panel 5: CB BATTERY CHARGER BAT B CHARGE, open. Okay. I'll let you read that back, Jack.
05 08 04 09	CMP	Okay. BAT CHARGE, OFF; AC INVERTER 2 to OFF; MAIN BUS TIE, BAT B/C to on, up. Panel 250: CB BAT A, POWER ENTRY AND POSTLANDING, open; CB, BAT B, POWER ENTRY and POSTLANDING, open. Panel 5: CB BAT CHARGER, BAT B CHARGED, open.
05 08 04 32	CC	Okay. That's correct. Now, that gets you back to the place where you can back out of the - the big battery charging procedure, which you have. And I - I think you have the backout procedure for that, but I'd like to check with you.
05 08 05 00	CMP	Okay. Stand by here.
05 08 05 12	CC	Okay, Jack. Do you have that backout procedure in your hand there?
05 08 05 20	CMP	Yes, I do, Vance.
05 08 05 22	CC	Okay. Just to verify. It starts out panel 3, BATTERY CHARGE switch, OFF; AC INVERTER 2, OFF; panel 5, MAIN BUS TIE, BAT A/C, on, up, et cetera.

05 08 05 40	CMP	Roger. Continues CB BAT A, POWER ENTRY/ POSTLANDING, open; INVERTER POWER 2, MAIN B, open; and then you reverse the steps that you had for entering the procedure.
05 08 05 54	CC	Yes, that's fine. Okay. And we have one other comment regarding the systems checklist, and stand by 1, and that'll - that'll wrap it up for us. Oh, a new item came in, Jack. We need to switch to ascent water, and I have a three-step procedure for you, if you're ready to copy.
05 08 06 27	CMP	Okay. Jim will copy that.
05 08 06 32	CC	Okay. DESCENT WATER valve, CLOSE. ASCENT WATER valve to CLOSE, and WATER TANK SELECT valve to ASCENT.
05 08 07 24	CDR	Okay, Vance. DESCENT WATER valve, closed; ASCENT WATER valve, closed; and WATER SELECT TANK to ASCENT. Is that correct?
05 08 07 34	CC	WATER TANK SELECT valve, ASCENT. That's correct, Jim.
05 08 07 45	CDR	And we'll proceed with that right now, and how about still drinking descent water?
05 08 08 12	CC	Jim, we understand that you should be able to continue drinking it.
05 08 08 24	CDR	Okay. We switched to ascent water, but we'll probably have to have the descent water valve back open up again to drink water.
05 08 08 34	CC	That's affirm. That's the one thing you'll have to do is, whenever you want to drink out of the descent tank, is open the descent valve - the DESCENT WATER valve momentarily.
05 08 08 49	CDR	Okay. And we are now on ascent water.
05 08 08 53	CC	Okay; okay. And I need Jack back again, please.
05 08 09 02	CMP	Okay, Vance. I'm here, and you have something in the systems checklist.
05 08 09 06	CC	That's right. Refer to S/2-6. This - Really what we're talking about, Jack, is the hatch integrity check decal. And I think it'll be easiest, if you'll open to S/2-6 and I explain it to you.

05 08 09 41	CMP	Okay, Vance. I'm ready to copy.
05 08 09 44	CC	Okay. This will - This just involves changes. Look down to the third line where it says "TUNNEL VENT valve, TUNNEL VENT for 30 seconds;" cross out "30 seconds" and cross out the two lines below that. In other words, "LM CSM DELTA-P. Check DELTA-P and recycle to TUNNEL VENT."
05 08 10 24	CMP	Okay. You want me to delete "For 30 seconds."
05 08 10 34	CC	That's affirm. And the two lines below "30 seconds." And actually the part of the fourth line there, which is "8-1/2 minutes."
05 08 10 50	CMP	Stand by. Can you read okay?
05 08 10 53	CC	Yes. I hear you now.
05 08 10 55	CMP	Okay. Delete the two lines below that, or the two-and-a-half lines below that, also.
05 08 11 02	CC	That's affirm. And now, we have an addition to put in place of what we deleted. Stand by 1; the COMM's bad. How do you read?
05 08 11 14	CMP	Roger. Loud and clear.
05 08 11 16	CC	Okay. We want you to vent - tunnel vent until, and add the following, "Until LM/CM DELTA-P is equal to 3.0 psid."
05 08 11 42	CMP	Okay. "Until LM/CM DELTA-P equals 3.0."
05 08 11 47	CC	Okay. And that means that you'll have a pressure of 1.5 to 2 in the tunnel, absolute. That's - -
05 08 11 57	CMP	Okay.
05 08 11 58	CC	That's a note.
05 08 12 01	F	Jack, that's what we want to end up with ultimately is 1-1/2 to 2 there in that tunnel and depending on the gage reading, but that should be about 3.
05 08 12 10	CMP	Okay, Deke.
05 08 12 12	CC	Okay, then, Jack. Continuing on, everything's okay until you get down to - on the next page, you get through "Verify O_2 FLOW INDICATOR no increase." We would like to delete everything below

that, until the last step, which is TUNNEL LIGHTS, OFF. So starting with "Before undocking only," delete all lines through "TUNNEL VENT VALVE to TUNNEL VENT."

05 08 12 50 CMP Okay. Delete the section that says "Before undocking only" down to where it says "TUNNEL VENT VALVE to TUNNEL VENT."

05 08 12 57 CC Yes, through that.

05 08 13 00 CMP Well, through that. Leave "TUNNEL LIGHTS OFF" is the only step remaining.

05 08 13 04 CC Roger. And just - That's a verify.

05 08 13 14 CMP Okay. Got that.

05 08 13 15 CC Okay. Really what this does for you, then, is it gives you a pressure - a tunnel pressure integrity - or a hatch pressure integary - integrity check with a DELTA-P of 3 psi between the tunnel and the cabin. And then you never go on to the steps of venting that on out. You just leave it in there for the time that you separate from the LM. And that gives you a shotgun DELTA-V effect.

05 08 13 52 CMP Okay. Copy that.

05 08 13 54 CC Okay. I think that's all, but we're polling the house here to see if there's another comment for you. Stand by.

05 08 15 19 CC Aquarius, Houston.

05 08 15 23 CMP Go ahead, Vance.

05 08 15 24 CC Jack, that's it. Unless you have any more questions, why, everyone is hoping you'll hit the sack and get some rest.

05 08 15 34 CMP Okay. You want that battery backout procedure now to take that - to complete the remaining steps?

05 08 15 50 CC That's affirm, Jack. We request that you go ahead and finish out the backout completely until you get to square 1. Over.

05 08 16 04 CMP Okay.

05 08 16 24	CDR	Houston, Aquarius.
05 08 16 26	CC	Go ahead, Jim.
05 08 16 29	CDR	Do you have any more updates for us?
05 08 16 32	CC	We've still got a LM update, but we strongly recommend that you and Jack work as hard as you can sleeping for about the next 5 hours. Fred can handle it.
05 08 16 42	CDR	Okay. That's what we'll do. We'll put Fred on watch here, and Jack and I will take it easy, and if Fred copies the LM update, well, then we'll all start from fresh in the morning.
05 08 16 56	CC	You bet.
05 08 23 44	CC	Aquarius, Houston. Over.
05 08 23 48	LMP	All right, go ahead, Vance.
05 08 23 50	CC	Okay, Fred. Two - three things. First thing is we need a docking angle check as soon as you can conveniently get it. Second point, you're free to drink all the descent stage water you want, if that wasn't clear before. And the third point, if you have a piece of paper, stand by to get writer's cramps. We have something to give you here.
05 08 24 21	LMP	Okay. You want the - again a look at the docking tunnel index?
05 08 24 27	CC	Why don't you go ahead and look at that - -
05 08 24 28	LMP	... - -
05 08 24 31	CC	Look at that first, yes.
05 08 24 34	LMP	Okay.
05 08 25 46	LMP	Okay. Jim says the docking tunnel index is a plus 2.1 degrees.
05 08 25 52	CC	Okay. Plus 2.1 degrees, docking tunnel index.
05 08 25 58	LMP	Okay. He corrects himself. He says make that sign a minus. Minus 2.1 degrees.
05 08 26 04	CC	Okay. We just changed, plus to minus.

05 08 26 09	LMP	Okay. And your second item was, we can drink all of that descent water that's left - looks like about 5 percent, and I'll get a book here and be ready to start writing.
05 08 26 23	CC	Okay. Get - This won't be as long as - as the one T. K. read up, but you'll need several pages, probably.
05 08 26 35	LMP	Okay. I've got lots of pages here of Ken's photo log set to go.
05 08 26 41	CC	Okay, Fred-o. Okay. This is "Entry, LM PREP." Starts EI minus 6 hours. At that time, you power up the AGS. I think I'll give you a line at a time and, when I hear you say okay on that, I'll to to the next. That sound reasonable?
05 08 27 11	LMP	Okay. I'll go hot mike briefly.
05 08 27 16	CC	Okay. BAT 5 -
05 08 27 25	LMP	Hey, how do you read now?
05 08 27 27	CC	Okay. I read you okay, Fred. Okay. Battery 5 - -
05 08 27 33	LMP	Okay ...
05 08 27 37	CC	Battery 5 NORMAL FEED ON is the first step.
05 08 27 50	LMP	Okay, Vance. That - Go ahead.
05 08 27 53	CC	Okay. Use modified LM DPS/RCS 30-minute activation checklist.
05 08 28 22	LMP	Okay.
05 08 28 25	CC	EI minus 5 hours. Midcourse-7, if required. Next: LM preentry procedure. And, Fred, the time on LM preentry procedure is just - -
05 08 28 49	LMP	Okay. Go ahead.
05 08 28 50	CC	Okay. The time on the LM preentry procedure is just as soon as you finish midcourse-7, or 5 hours -
05 08 29 08	LMP	All right, go ahead, Vance.
05 08 29 09	CC	Okay.

05 08 29 10	LMP	Okay. I've got this TEI minus 5 hours, MCC-7 if required, and now you're going to start me a new procedure called LM preentry procedure. Go ahead.
05 08 29 19	CC	Roger. Maneuver to SM SEP attitude. Configure for CSM hotfire.
05 08 29 44	LMP	Okay.
05 08 29 46	CC	Under that, DEADBAND, MAX; and ATTITUDE CONTROL, three, to PULSE.
05 08 30 04	LMP	Okay.
05 08 30 05	CC	Perform CSM hotfire. Maneuver back to SM SEP attitude.
05 08 30 22	LMP	Okay.
05 08 30 25	CC	And under that, ATTITUDE CONTROL, PITCH and ROLL, PULSE; YAW, MODE CONTROL.
05 08 30 51	CC	Okay. Next, EI minus 4 hours, 30 minutes. Configure for CM/SM SEP.
05 08 31 02	LMP	Okay. Hold on a minute.
05 08 31 03	CC	Okay.
05 08 31 04	LMP	That was EI - EI minus 4-1/2?
05 08 31 07	CC	That's correct.
05 08 31 26	LMP	Okay. That's EI minus 4-1/2 hours, configure for SM SEP.
05 08 31 30	CC	That's affirm, and under that, BALANCE COUPLE, ON.
05 08 31 42	LMP	Okay.
05 08 31 44	CC	AGS 404, plus 0; 405, plus 0; 406, plus 0; and 470, read out.
05 08 32 11	LMP	Okay. Got it.
05 08 32 14	CC	Translate plus-X at 0.5 feet per second.
05 08 32 30	LMP	Okay.
05 08 32 32	CC	Then CM/SM SEP. After SEP, null 470 - -

05 08 32 42	LMP	Okay. Stand by 1.
05 08 32 43	CC	Okay.
05 08 33 00	LMP	Okay. Go ahead.
05 08 33 02	CC	After SEP, null 470 to 0.
05 08 33 25	LMP	Okay.
05 08 33 27	CC	ATTITUDE CONTROL, three of them, to PULSE.
05 08 33 43	LMP	Okay.
05 08 33 44	CC	Pitch to acquire service module for photos.
05 08 34 07	LMP	Okay.
05 08 34 09	CC	Okay. Note: use ACA for control.
05 08 34 30	LMP	Okay. We can use the ACA now for control.
05 08 34 37	CC	Roger. EI minus 3 hours, maneuver and ATT HOLD for Moon view, attitude - -
05 08 34 59	LMP	Wait a minute. Was that maneuver in ATT HOLD for Moon view. Is that right?
05 08 35 04	CC	For - That's affirm. - For Moon view attitude until CM platform release.
05 08 35 43	LMP	Okay. It says maneuver in ATT HOLD for Moon view attitude until CM platform release.
05 08 35 49	CC	That's affirm. Better worded, it would have been maneuver and hold in attitude for Moon view, et cetera.
05 08 36 00	LMP	Okay. That's mainly for Jack to be able to get it in the optics, you mean.
05 08 36 08	CC	Yes, that's correct. Okay, Fred - -
05 08 36 11	LMP	Okay.
05 08 36 12	CC	Could you give us a readback on everything up to this point?
05 08 36 20	LMP	Okay. I'll go back to NORMAL VOICE. It might - Or is this pretty clear?

05 08 36 34	CC	It's clear.
05 08 36 40	LMP	Okay. The master title, "Entry, LM PREP, EI Minus 6 hours." First, BAT 5 NORMAL FEED, ON; second, use modified LM DPS/RCS 30-minute activation checklist. Next, is at TEI minus 5 hours, MCC-7, if required. Now, we have a LM preentry procedure. First, we maneuver to service module SEP attitude. Second, configure for CSM hotfire. Under that, DEADBAND MAX, and ATTITUDE CONTROL, three, to PULSE. Thirdly, perform CSM hotfire. Fourth, we - The LM maneuvers back to SM SEP attitude, with ATTITUDE CONTROLs, PITCH and ROLL to PULSE, ATTITUDE CONTROL, YAW, to MODE CONTROL. Now, you got that so far, Vance?
05 08 37 56	CC	That's correct so far, Fred-o.
05 08 37 59	LMP	Okay. At EI minus 4-1/2 hours, configure for SM SEP. First, BALANCE COUPLE, ON. Secondly, zero the counters in AGS; 404, 405, 406, plus 0; read out 470. Thirdly, translate plus-X to 0.5 foot per second. Fourth, CM/SM SEP. Fifth, after SEP, null 470 to 0. Sixth, ATTITUDE CONTROL, three, to PULSE. Seventh, pitch to acquire service module for photos. And a note, use the ACA for control. Last, we had - you gave me was TEI minus 3 hours. Maneuver in ATT HOLD for Moon view until the CM platform release.
05 08 39 19	CC	Okay, Fred. Only - Only a minor point that we just picked up. At the very top, EI minus 6 hours, the title is "power up," above BAT 5 NORMAL FEED, ON.
05 08 39 41	LMP	Okay. The title above BAT 5 NORMAL FEED, ON, is "power up."
05 08 39 46	CC	Okay. And on the last, it was maneuver and ATT HOLD for Moon view attitude until CM platform release. I think that's what you read. Okay. Ready to go on? EI minus - Are you there?
05 08 40 04	LMP	Okay. Next is - Okay. Next is TEI minus what, Vance?
05 08 40 08	CC	It's - It's EI minus 2-1/2 hours, Fred.
05 08 40 17	LMP	Okay. EI minus 2-1/2.
05 08 40 20	CC	Okay. The title, "Power removal from CM LM umbilical."

05 08 40 53	LMP	Okay. "Power removal from CM LM umbilical."
05 08 41 00	CC	That's correct. Next, assumes - This assumes all descent batteries on line.
05 08 41 14	LMP	Okay. I'll put that as a note.
05 08 41 31	CC	And ASCENT BATTERIES 5 and 6 on NORMAL FEED.
05 08 41 52	LMP	Okay. This assumes all descent BATs on line, and ASCENT BATs 5 and 6 on NORMAL FEED. Go ahead.
05 08 41 57	CC	Roger. Next, CSM CB LM POWER 1, MAIN B to open.
05 08 42 27	LMP	Okay. CSM, CB LM POWER 1, MAIN B, open.
05 08 42 30	CC	Next. CB, LM POWER 2, MAIN B, open.
05 08 42 42	LMP	Okay. CSM, CB LM POWER 2, MAIN B, open.
05 08 42 47	CC	CB EPS SENSOR SIGNAL, MAIN B to open.
05 08 43 10	LMP	Okay. CB EPS SENSOR SIGNAL, MAIN B, open.
05 08 43 14	CC	Okay. Next, the LM. CB, EPS panels 11 and 16, CROSS TIE BALANCE LOADS to close.
05 08 43 55	LMP	Okay. On the LM side now. CB EPS 11, panels 11 and 16, CROSS TIE BAL LOADS, close.
05 08 44 04	CC	That's correct. Next, CB EPS panel 16, BAT FEED TIE, two of them, open.
05 08 44 40	LMP	Okay. LM, CB EPS, panel 16, BAT FEED TIE, two, open.
05 08 44 50	CC	Okay. CB EPS 16, ASCENT ECA CONTROL to close.
05 08 45 12	LMP	Okay. CB EPS panel 16, ASCENT ECA CONTROL, close.
05 08 45 18	CC	Correct. BATTERY 1, HI VOLT - HIGH VOLTAGE to OFF/RESET.
05 08 45 40	LMP	Okay. BATTERY 1, HI VOLT, OFF/RESET.
05 08 45 42	CC	BATTERY 5, OFF/RESET.
05 08 45 55	LMP	Okay. BATTERY 5, HI VOLT - or, it should be BATTERY 5 NORMAL FEED to OFF/RESET.

05 08 46 04	CC	Roger. And - Stand by.
05 08 46 13	LMP	Or did you mean battery 2?
05 08 46 17	CDR	Yes. I think that's what he meant.
05 08 46 22	CC	Okay. We mean BATTERY 5 to OFF/RESET.
05 08 46 30	LMP	Okay.
05 08 46 33	CC	That's a NORMAL FEED.
05 08 46 34	LMP	BATTERY 5, NORMAL FEED - NORMAL FEED, OFF/RESET. Got you.
05 08 46 39	CC	Okay. BAT 2, LOW VOLTAGE, OFF/RESET then ON.
05 08 47 05	LMP	Okay. BATTERY 2, LOW VOLT, OFF/RESET, then ON.
05 08 47 11	CC	Next. BAT 2, HI VOLT, OFF/RESET, then ON.
05 08 47 59	LMP	Okay. You still there, Vance?
05 08 48 01	CC	Roger. I didn't catch your readback, Fred.
05 08 48 05	LMP	Oh, okay. The last item was item 9, and that was BAT 2, LOW VOLT, OFF/RESET, then ON.
05 08 48 12	CC	Roger. After that, I gave another one. BAT 2, HI VOLT, OFF/RESET, then ON.
05 08 48 39	LMP	Okay. BAT 2, HI VOLT, OFF/RESET, then ON.
05 08 48 42	CC	Correct. BAT 1, HI VOLT, ON.
05 08 48 55	LMP	Okay. BAT 1, HI VOLT, ON.
05 08 49 00	CC	BAT 5, NORMAL FEED, ON.
05 08 49 15	LMP	Okay. BAT 5, NORMAL FEED, ON.
05 08 49 20	CC	CB, EPS, 16, BAT FEED TIE, two of them, closed.
05 08 49 45	LMP	Okay. CB, EPS, 16, BAT FEED TIE, two, closed.
05 08 49 49	CC	Roger. Next. The LMP should transfer to the CM.
05 08 50 12	LMP	Okay. I'll underline that one. LMP transfer to CM.
05 08 50 17	CC	Don't let them forget you.

05 08 50 29	CC	Okay. And just before LMP transfer to CM, we'd like to have you add another step, Fred. That is - -
05 08 50 40	LMP	Go ahead.
05 08 50 41	CC	That is, CB, EPS, ASCENT ECA CONTROL, open.
05 08 51 08	LMP	Okay. You want CB - CB, EPS, that's on 16, I assume, ASCENT ECA CONTROL, open.
05 08 51 19	CC	Affirm. Okay. This is EI minus 1 hour 45 minutes, next.
05 08 51 44	LMP	Okay. Go ahead.
05 08 51 47	CC	Okay. Maneuver to CM LM JETT attitude.
05 08 52 01	CC	And you'll have a pad for that attitude.
05 08 52 12	LMP	Okay. Maneuver to CM IM JETT attitude.
05 08 52 16	CC	That's affirm. Matter of fact, Jack has a listing of your pads there, Fred-o, so you can review them after this is over.
05 08 52 25	LMP	Okay.
05 08 52 30	CC	EI minus 1 hour 35 minutes. Configure - -
05 08 52 40	LMP	- - EI minus 1 hour 30.
05 08 52 42	CC	That's correct. Configure for jettison.
05 08 52 58	LMP	Okay.
05 08 52 59	CC	Under that, verify CM free.
05 08 53 12	LMP	Verify CM free.
05 08 53 16	CC	Okay. Next, the COMM configuration. S-BAND, PM, PRIM.
05 08 53 33	LMP	Hold on. Say again now.
05 08 53 35	CC	Okay. Next, COMM configuration.
05 08 53 40	LMP	This is for the command module?
05 08 53 42	CC	Negative. The step above for CM free was command module, but the COMM is for LM again.

05 08 53 55	LMP	Okay. Go ahead.
05 08 54 01	CC	Okay. S-BAND, PM, PRIMARY, PRIMARY again, OFF, PCM, RANGE, OFF, and HI.
05 08 54 49	LMP	Okay. Our S-BAND CONFIG is: PM, PRIM, PRIM, OFF, PCM, RANGE, OFF, HI.
05 08 54 55	CC	That's correct. Stand by 1.
05 08 55 24	LMP	Do you have any druthers about which OMNI?
05 08 55 26	CC	Yes. Select best OMNI.
05 08 55 30	LMP	Select - Did you say AFT, or best?
05 08 55 33	CC	Best. Best in the west.
05 08 55 38	LMP	Okay. I was wondering if that's still going to be best after it leaves - But, okay. Select best OMNI at the time.
05 08 55 43	CC	That's affirm. Okay. We've covered COMM, Fred. Next, ECS.
05 08 56 01	LMP	Okay. Go ahead.
05 08 56 04	CC	Okay. Under ECS, FORWARD DUMP valve, close.
05 08 56 21	LMP	Okay. FORWARD DUMP valve, close.
05 08 56 24	CC	SUIT CIRCUIT RELIEF, AUTO.
05 08 56 46	LMP	SUIT CIRCUIT RELIEF to AUTO.
05 08 56 49	CC	CABIN GAS RETURN, EGRESS.
05 08 57 18	LMP	CABIN GAS RETURN, EGRESS.
05 08 57 20	CC	SUIT GAS DIVERTER, EGRESS.
05 08 57 32	LMP	GAS DIVERTER, EGRESS.
05 08 57 35	CC	SUIT ISOLATION valves, two of them, DISCONNECT.
05 08 57 51	LMP	Okay. ISO valves, two, to SUIT DISCONNECT.
05 08 57 55	CC	Roger. PRESSURE REGs A and B, close.
05 08 58 13	LMP	REGs A and B to close.

05 08 58 17	CC	CABIN REPRESS valve, close.
05 08 58 31	LMP	REPRESS VALVE, close.
05 08 58 35	CC	SUIT FAN, OFF.
05 08 58 41	LMP	How many more steps, Vance?
05 08 58 43	CC	Two after this, Fred-o.
05 08 58 47	LMP	Okay. Stand by.
05 08 58 52	CC	Maybe you need a scroll, yet.
05 08 58 56	LMP	Yes.
05 08 58 58	CDR	I want to ask him why all these steps just to get rid of a LM that's going to burn up in a half hour. Seems ridiculous. God damn it. Too many guys - -
05 08 59 08	LMP	SUIT FAN, OFF.
05 08 59 10	CDR	- - got in the act.
05 08 59 15	CC	Okay. The last one was SUIT FAN, OFF. Hey, Jim, Deke said he thought you were asleep.
05 08 59 38	CDR	Okay. All these steps woke me up.
05 08 59 46	CC	Okay. We'll try to be quieter. Except I don't know how. Okay, Fred-o - -
05 08 59 55	CDR	I got my audio breaker on.
05 08 59 57	CC	Did you get SUIT FAN, OFF?
05 09 00 01	LMP	Yes. SUIT FAN, OFF.
05 09 00 05	CC	Okay. Circuit breakers, panel - circuit breaker panel 16 rather. ECS, CABIN REPRESS to open.
05 09 00 37	LMP	Okay. CB panel 16, ECS, CABIN REPRESS, open.
05 09 00 42	CC	Roger. OVERHEAD DUMP VALVE, closed. Maybe Jim has a point there, though.
05 09 00 56	LMP	Yes. OVERHEAD DUMP VALVE close, and it is already.
05 09 01 02	CC	Right. Okay. That's all for the ECS. Next, ATTITUDE CONTROL, three, to MODE CONTROL.

05 09 01 23	LMP	Okay. Stand by 1.
05 09 01 31	CC	Oh, stand by 1, Fred. We'd like to - change the position of that ATTITUDE CONTROL, three, MODE CONTROL to be just under CM free. That's a more convenient time.
05 09 01 51	LMP	Yes, I agree. Okay. Under, it'll be my item B, after verify CM free, it's ATT CONTROL, three, to MODE CONTROL.
05 09 02 04	CC	And, along with that, DEADBAND, MAX.
05 09 02 11	LMP	Okay. Three to MODE CONTROL, comma, DEADBAND to MAX.
05 09 02 18	CC	Next verify - -
05 09 02 20	LMP	If I don't sound too clear, it's because I'm holding a flashlight between my teeth.
05 09 02 29	CC	Roger.
05 09 02 33	LMP	Okay.
05 09 02 35	CC	Okay. Now - -
05 09 02 36	LMP	Okay. I think I'm - I'm up with you. Go ahead, Vance.
05 09 02 39	CC	Okay. Now again down at the bottom beneath ECS, verify transfer list.
05 09 03 02	LMP	Okay. Verify transfer list.
05 09 03 06	CC	IVT to CM, and close hatch.
05 09 03 12	LMP	What was that - What was the first part of that?
05 09 03 15	CC	Transfer yourself to the CM. Or rather, IVT, that's the commander to the CM, and close hatch.
05 09 03 25	LMP	Okay.
05 09 03 46	LMP	Actually, it's commander transfer to CM and you mean close hatches. Plural, right?
05 09 03 53	CC	That's correct. Yes.
05 09 03 56	LMP	Okay.

05 09 04 01	CC	Okay. That's all for the time line, Fred. Now the contingency checklist, if it's handy.
05 09 04 12	LMP	Okay. Which page?
05 09 04 15	CC	Turn to 30-minute activation on page 24.
05 09 04 25	LMP	Okay. I'm there.
05 09 04 28	CC	Okay. Now, at this point, you have this section marked up already, so what I give you now represents additional DELTAs to your previously marked up checklist.
05 09 04 43	LMP	Okay. That's all right. I've got a different color pen, so it'll show up nicely. Go ahead.
05 09 04 47	CC	Okay. Okay. Go down to item 4.
05 09 04 54	LMP	Roger.
05 09 04 56	CC	Verify AGS STATUS switch, OFF. That's an addition.
05 09 05 09	LMP	Do you mean, under IVT to the LM, number 4, RCS SYSTEM A/B-2, QUADs 4, AUTO? That 4?
05 09 05 21	CC	That's affirm. Yes. It's the - the only 4 on that page 24 and it's a - presently has after it RCS SYSTEM A/B-2, QUADs, 4, to AUTO. Under that put - -
05 09 05 34	LMP	Roger.
05 09 05 36	CC	- - put verify AGS STATUS switch to OFF.
05 09 05 45	LMP	Okay. Verify AGS STATUS switch OFF.
05 09 05 49	CC	Okay. At the bottom of the page - Okay. You already have that. MODE CONTROL, both, OFF.
05 09 06 05	CC	Okay. Next, page 26, circuit breakers.
05 09 06 13	LMP	Okay. Go ahead.
05 09 06 16	CC	Okay. First row is okay as is. Second row, under FLIGHT DISPLAYS, GASTA should be closed.
05 09 06 33	LMP	Okay.
05 09 06 34	CC	Under AC BUS A, close GASTA.

05 09 06 43	LMP	Okay. GASTA FLIGHT DISPLAYS and AC BUS A will be closed.
05 09 06 47	CC	Roger. That's all on the second line. Now the third line, under STABILITY and CONTROL, ATCA (PGNS) to closed.
05 09 07 03	LMP	Okay. ATCA (PGNS) to close.
05 09 07 05	CC	That's all on that line. Fourth line, near the right side, LGC STANDBY to close. And - -
05 09 07 21	LMP	Wait a minute. You mean LGC/DSKY.
05 09 07 25	CC	LGC/DSKY. I'm sorry.
05 09 07 29	LMP	Okay.
05 09 07 30	CC	And IMU OPERATE, close.
05 09 07 35	LMP	Okay. IMU OPERATE, close.
05 09 07 49	LMP	Okay, Vance. IMU OPERATE, close.
05 09 07 52	CC	That's correct. Okay. Fourth row is okay as is. Now we would like to add - add in a late arrival to row two. Under - -
05 09 08 09	LMP	Go ahead.
05 09 08 10	CC	Under FLIGHT DISPLAYS, MISSION TIMER, closed.
05 09 08 19	LMP	Okay. FLIGHT DISPLAYS, MISSION TIMER, closed. We can look at the ghosties right to the end.
05 09 08 26	CC	Yes, that's right. Okay. That's all for that page, Fred. That should add up to six circuit breakers all closed, on that page.
05 09 08 39	CDR	Vance, Jim.
05 09 08 41	CC	Go ahead, Jim.
05 09 08 43	CDR	Have we looked seriously now at just the essential things required to make a safe LM jettison? We're not - I don't think we have the time to really do any engineering data that people might want to look at as this thing goes into the atmosphere.
05 09 09 06	CC	Well, Jim. I - I think that that was what everybody aimed for, and people down here feel that it's the essentials, that it's what you need.

05 09 09 19	CDR	Well, we'll do everything you think is essential, but I just don't want to be throwing switches at the last minute. What we're really thinking about, getting that command module in good shape.
05 09 09 35	CC	Hey, Jim. This is Tom. The only reason we're bringing up the PGNS is to have another reference system just to control the LM when you jettison the thing. Over.
05 09 09 45	CDR	Okay. Okay, Tom. It's - I thought the - an AGS ATT HOLD would have been sufficient for this, when we first thought about this.
05 09 09 53	CC	Yes. I agree. But we decided just in case we have any glitch with the AGS, we want to make sure we get that LM off in a good shape. And I agree with you on keeping out all the garbage on it.
05 09 10 03	CDR	Okay, Tom.
05 09 10 05	F	Hey, would you like to have - -
05 09 10 06	CDR	Good night.
05 09 10 07	CC	Would you like to have us play you some guitar music to put you to sleep?
05 09 10 10	CDR	(Laughter) Oh, you know how to get to a guy.
05 09 10 14	CC	We'll even have a 12-string guitar for you, Jimbo.
05 09 10 20	CDR	Okay.
05 09 10 23	CC	Okay, Fred. Page 28.
05 09 10 28	LMP	Okay. I'm looking at panel 16 now.
05 09 10 32	CC	No - No changes to panel - -
05 09 10 33	LMP	...
05 09 10 34	CC	No changes to panel 16.
05 09 10 38	LMP	Okay. I'm on 28 now.
05 09 10 41	CC	Right. Okay. At the top of the page, under step 4, just above "VHF/S-band activation," put in, "Delete POWER AMP and LGC." These are caution lights.

05 09 11 07	LMP	Okay. You mean delete PREAMP.
05 09 11 10	CC	I'm sorry. PREAMP and LGC.
05 09 11 18	LMP	Okay.
05 09 11 21	CC	Okay. Under "VHF/S-band activation and checkout," step 2, we have changes to the COMM as follows.
05 09 11 34	LMP	Go ahead.
05 09 11 40	CC	Okay. Scratch - Scratch out the DOWN and DOWN VOICE. That leaves - That'll give you VOICE.
05 09 11 50	LMP	Okay. That's the way we had it last time.
05 09 11 54	CC	Okay. And, we'd like to insert RANGING.
05 09 12 01	LMP	Okay. Instead of OFF/RESET put RANGING.
05 09 12 04	CC	That's correct.
05 09 12 15	LMP	Okay.
05 09 12 17	CC	Okay. Under "PGNS turn-on," add in steps 1 and 2 again, which are NO ATTITUDE light off, VERB 96 ENTER, and set EVENT TIMER.
05 09 12 35	LMP	Okay. Steps 1 and 2 back in.
05 09 12 38	CC	That's affirm. And underneath "Set EVENT TIMER," add the following: VERB 25 NOUN 07, ENTER; 1257, ENTER.
05 09 13 04	LMP	Okay. Go ahead, Vance.
05 09 13 06	CC	Okay. If you got the 1257, ENTER, then 252, ENTER and ENTER.
05 09 13 18	LMP	Okay. After event, set EVENT TIMER, it's VERB 25 NOUN 07, ENTER; 1257, ENTER; 252 ENTER; ENTER.
05 09 13 28	CC	Roger. And this activates your upfiring jets.
05 09 13 35	LMP	Say the last again, Vance.
05 09 13 36	CC	Roger. What this does, Fred, is activate upfiring jets.
05 09 13 41	LMP	Oh, okay.

05 09 13 43	CC	They're all - actually, all vertical jets.
05 09 14 00	LMP	Okay. I got it.
05 09 14 01	CC	Okay. Next, same page, under "DAP set gimbal drive," go to step 2. Okay. Add in after NOUN 46, 32021.
05 09 14 31	LMP	Okay. 32021.
05 09 14 35	CC	Okay. Proceeding on down below the NOUN 47, to the PROCEED, insert VERB 34, ENTER, after the PROCEED. And that would come before the NOUN 48.
05 09 14 59	LMP	Okay. To PRO and then do a VERB 34.
05 09 15 13	CC	Roger. Okay. We have some noise here, Fred. Stand by a minute.
05 09 15 29	LMP	I switched OMNIs. How's that?
05 09 15 31	CC	Hey, that helped. Okay. No changes now on 29, 30, and 31. Next page is 32.
05 09 15 45	LMP	Okay. I'm on 32.
05 09 15 48	CC	Okay. At the very first step above "GUIDANCE CONTROL, AGS," put in VERB 76, ENTER.
05 09 16 02	LMP	Okay. VERB 76, ENTER.
05 09 16 05	CC	Okay. Below "GUIDANCE CONTROL, AGS," the third step should be changed to be MODE CONTROL, both, to ATT HOLD.
05 09 16 18	LMP	Okay. You want MODE CONTROL, both, to ATT HOLD.
05 09 16 21	CC	That's affirm.
05 09 16 31	LMP	Okay.
05 09 16 32	CC	Okay. At minus 6 - 6 hours - or 6 minutes rather, under MODE CONTROL, PGNS, ATT HOLD, which was scratched out, insert VERB 41 NOUN 20, ENTER, and three more ENTERs. So - So it's as shown in your procedure there.
05 09 17 13	LMP	Yes.
05 09 17 14	CC	Okay - -

05 09 17 15	LMP	Coarse aline 000.
05 09 17 17	CC	Below that, put in DEDA, 400 plus 5.
05 09 17 35	LMP	Okay. DEDA, 400 plus 5.
05 09 17 38	CC	Okay. Okay. We want back in again the next step which is "At burn attitude: VERB 40 NOUN 20, ENTER."
05 09 17 56	LMP	Okay.
05 09 18 08	CC	Okay. Proceeding on down, delete "At burn attitude" and the step above it, which is 400 plus 5.
05 09 18 24	LMP	400 plus 5 and the "at burn attitude."
05 09 18 28	CC	Correct.
05 09 18 39	CC	Okay. That's all for page 32, Fred. Next, page 33.
05 09 18 46	LMP	Go ahead.
05 09 18 49	CC	Okay. Under 4 minutes, minus 4 minutes, add back in MODE CONTROL, both, to ATT HOLD.
05 09 19 10	LMP	Okay. MODE CONTROL, both, to ATT HOLD.
05 09 19 15	CC	Okay. Two steps below that, add back in TTCA COMMANDER THROTTLE MIN DPS, and add in DPS.
05 09 19 36	LMP	Wait a minute.
05 09 19 39	CC	Stand by 1.
05 09 19 41	LMP	TTC - Yes. Seems like you should be in JETS, since this is going to be - is this going to be RCS or a DPS burn?
05 09 19 49	CC	Okay. This will be JETS for RCS and THROTTLE for DPS.
05 09 20 00	LMP	What I don't understand is, what is this MCC likely to be? I thought it was going to be an RCS.
05 09 20 05	CC	Well, we - We expect that, but we're remaining flexible.
05 09 20 11	LMP	(Laughter) Okay. Okay. I'll put in TTCA THROTTLE MIN for DPS, JETS for RCS.

05 09 20 18	CC	That's correct. Okay. That's all on page 33. Go to page 34.
05 09 20 36	LMP	Okay; 34.
05 09 20 39	CC	Okay. Beneath everything on that page, add in the following. Return to "Entry, - LM PREP" check - return to "Entry, LM PREP" checklist - -
05 09 21 00	LMP	Hold on, Vance; I don't understand. We want to delete everything on page 34?
05 09 21 07	CC	No, that's not correct, Fred. What we want to do is leave everything the way it is on 34, and add this one comment I'm giving you at the - at the bottom of it.
05 09 21 17	LMP	Oh, okay. Okay. I misunderstood. Okay. Go ahead with your added comment.
05 09 21 22	CC	Return to "Entry LM PREP checklist."
05 09 21 35	CC	Add "EI" - -
05 09 21 36	LMP	... turn to - return to "Entry, LM checklist?"
05 09 21 43	CC	That's affirm. At EI minus 5 hours.
05 09 21 48	LMP	Okay. At EI minus 5 hours. Let me take a look and see how that flows, now.
05 09 22 00	CC	Okay. And also you have a - -
05 09 22 02	LMP	Okay. That would be the LM - the LM preentry procedure. Yes. Okay.
05 09 22 08	CC	That's correct, and, also on that page, you - from our last correct - or addition exercise, you have a section called "Reestablish PTC." We'd like to scratch all of that, of course.
05 09 22 22	LMP	Roger.
05 09 22 46	CC	Okay, Fred. That's all except for one comment that we have, and - Just a second.
05 09 25 09	CC	Stand by 1. Fred, we're polling the room for comments here, any last minute thoughts from people. We'll be right back with you.

05 09 28 18	LMP	Okay.
05 09 28 11	CC	Aquarius, Houston.
05 09 28 17	LMP	Okay. Go ahead.
05 09 28 19	CC	Okay, Fred. Just two changes, comments to what we just gave you. The first is near the front at EI - in the section under "EI minus 2-1/2 hours," power removal from CM LM umbilical." We'll let you turn to that.
05 09 28 44	LMP	Okay, I'm there at "EI minus 2-1/2 hours, power removal CM LM umbilical."
05 09 28 49	CC	Okay. Under LM, we have a step, BAT 2, LOW VOLTAGE, OFF/RESET, then ON. Next we have a step BAT 2, HI VOLTAGE. OFF/RESET, then ON. We request that you wait in between these two steps for us to give you a GO. In other words, we'd like to look and see that all the relays closed and all that sort of thing before you throw BAT 2, HI VOLTAGE, to OFF/RESET, and ON.
05 09 29 33	LMP	Okay. After BAT 2, LOW VOLTAGE, OFF/RESET, I'll - then ON, I'll wait for a MSFN GO before proceeding.
05 09 29 42	CC	Right-o. Okay. Next, at - Under the section of "EI minus 1 hour and 45 minutes" - No, change that. Correction, "EI minus 1 hour, 35 minutes," refer to the ECS section, and we have a change.
05 09 30 13	LMP	All right. Go ahead, Vance.
05 09 30 17	CC	Okay, Jim's right. We should cross out all this stuff with a couple of exceptions. FORWARD DUMP valve, closed, the first step, should remain. All other steps should be scratched, except for the last one, which is OVERHEAD DUMP valve, closed. That leaves two steps.
05 09 30 45	LMP	Okay. Under ECS, we delete all except the first step, FORWARD DUMP valve, close, and step 10, which is OVERHEAD DUMP valve, closed, and leave in verify transfer list.
05 09 31 06	CC	That's affirm. Leave in what follows, which is verify transfer list and IVT and all that.
05 09 31 28	CC	IVT, of course, meaning CDR transferring to the CM.

05 09 31 38	LMP	We wouldn't forget it.
05 09 31 43	CC	Okay, Fred-o. That's - That's the changes. Not quite as extensive as the CSM had, but still pretty long. Any comments or questions to the house here?
05 09 32 02	LMP	No, it looks pretty good to me, Vance.
05 09 32 06	CC	Okay. Very good. Only other comment, aside from the checklist, we've been watching your descent stage water, and it looks - or your ascent stage water, and it looks real good.
05 09 32 22	LMP	Okay.
05 09 32 42	CC	Okay, Fred. We're going to try to refrain from calling you from now on, so that you can maybe get a couple of winks. We're getting a status around the room first, to see if anybody has any comments for you and, after that, we'll try to leave you alone for awhile.
05 09 33 06	LMP	Thank you.

END OF TAPE

05 09 37 36	CC	Aquarius, Houston.
05 09 38 00	CC	Aquarius, Houston.
05 09 38 25	CC	Hey, Fred-o. Are you there?
05 09 38 29	LMP	All right, go ahead.
05 09 38 30	CC	Okay. We polled the room. We don't have much for you. Only comments as follows: your consumables are looking good; your entry gamma right now is minus 6.01. We're expecting a midcourse of 2.81 foot per second which should be about 21 seconds of RCS.
05 09 38 56	LMP	Okay. It sounds good.
05 09 38 58	CC	Okay, Fred. See you in the morning.
05 09 39 01	LMP	Roger.
05 09 40 14	CC	Aquarius, Houston. Request you open the POWER AMPLIFIER circuit breaker and DOWN VOICE BACKUP, please.
05 09 40 30	LMP	Complete.
05 09 40 32	CC	Roger.

END OF TAPE

05 12 28 45	CC	Fred, are you sleeping?
05 12 28 54	LMP	Go ahead.
05 12 28 59	CC	Fred, in a couple of minutes we're going to hand over the Honeysuckle, so there'll be - Our uplink will be terminated. We'll contact you when we get it back.
05 12 29 15	LMP	Okay.
05 12 29 35	CC	After that, I've got a couple minutes of work for you.
05 12 29 45	LMP	All right. Go ahead.
05 12 29 51	CC	Let's wait until after the handover.
05 12 30 21	LMP	Are you there, Jack?
05 12 30 23	CC	Yes, I'm hearing you loud and clear. How me, Fred?
05 12 30 28	LMP	...
05 12 30 30	CC	Okay. We want to get some ranging data on you for about 15 minutes. So close the POWER AMPLIFIER circuit breaker and go to NORMAL VOICE, please.
05 12 30 40	LMP	Okay.
05 12 31 02	LMP	Okay. You ought to have it now, Jack.
05 12 31 09	CC	Okay. You're coming through good now, Fred. I've got three DELTAs to the checklist. They're minor changes. I'd like to pass them along now. One of them is to the CSM checklist. So if you'll pick that up, I'll give it to you.
05 12 31 25	LMP	Okay. Which one?
05 12 31 29	CC	Okay. Stand by 1.
05 12 31 33	LMP	Is it the one Jack wrote them all in? The big long readout? He also wrote something in the G&N book.
05 12 31 41	CC	It's in the big, long one he wrote out at about EI minus 02:30. EMS entry check.

05 12 31 51	LMP	Okay. He's coming back down with it.
05 12 32 37	CC	Meanwhile, Fred, I've got two for you on the LM PREP checklist.
05 12 32 44	LMP	Okay. Jack's here now. I'll hand it to him.
05 12 33 28	CMP	Okay, Houston; Aquarius.
05 12 33 32	CC	Hello, Aquarius. I've got a couple of changes for you on your CSM checklist.
05 12 33 44	CMP	Okay. Stand by 1.
05 12 33 56	CMP	Okay. Go ahead.
05 12 34 00	CC	Okay, Jack. The time line between EI minus 02:30 and 1 hour is real crowded, so you're really going to have to hustle, and we've decided to delete the EMS entry check at minus 02:30. That'll give you a little more time in there. What we've decided to do with it is wait until after EI minus 1, just before you initialize the EMS. If you have time, and only if you have time, do the EMS entry check. Otherwise, forget it and go right on into EMS initialization. You understand?
05 12 34 49	CMP	Okay. You're going to delete between 2 hours and 30 minutes and 02:15 there, and you're going to add it, if there is time, only if there is time, at EI minus 1 hour where the EMS initialization occurs.
05 12 35 11	CC	That's right. You got it correctly. Okay, Jack. One other item. Just before EI minus 2 hours and 15 minutes, we need an E-memory dump VERB 74 ENTER. Over.
05 12 35 40	CMP	Okay. Stand by 1, would you, please?
05 12 36 24	CMP	Okay. Right before 2 hours and 15 minutes, I assume that's before MSFN gives their P27 update, I do a VERB 74. Right?
05 12 36 34	CC	That's affirmative, Jack.
05 12 36 54	CC	How much sleep did you get, Jack?
05 12 37 01	CMP	Oh, I guess - Stand by. I guess maybe 2 or 3 hours. It was awful cold, and it wasn't very good sleep.

05 12 37 15	CC	Roger. You plan to try to get any more?
05 12 37 20	CMP	What GET do you have?
05 12 37 24	CC	We got 132:37.
05 12 37 40	CMP	Well, if I - If I get everything done, I'll try, but I tell you, it's almost impossible to sleep. All of us have that same problem. It's just too cold to sleep.
05 12 38 07	CC	Roger. The way we're looking at it, looks like you ought to have a couple 3 hours here before you have to really get with it.
05 12 38 19	CMP	We'll - we'll take it easy, but I - and we'll try to sleep, but it's just awful cold.
05 12 38 33	CC	Present data indicates that your entry angle is minus 6.03 degrees. Your DELTA-V at the midcourse is going to 2.8 feet a second.
05 12 38 45	CMP	Okay. Copy.
05 12 38 54	CDR	Jack, this is Jim. I understand this is going to be an RCS burn.
05 12 39 01	CC	That's affirmative, Jim. It's going to be an RCS burn.
05 12 39 05	CDR	Okay.
05 12 39 10	CC	And we need the SUIT CIRCUIT RELIEF valve back to AUTO. Correction, back to CLOSE.
05 12 39 24	CMP	Hey, Jack, that's in work. And one thing, comparing Jim's checklist with my own, I find one difference there at EI minus 02:30. His checklist has me changing a - opening a EPS SENSOR SIGNAL circuit breaker right prior to turning off LM power. Is - I'd like to find out which checklist is correct.

END OF TAPE

05 12 41 05	CC	Hey, Jack. The LM checklist is just for information to Jim. It's just to tell him that - that you're changing back to command module power. Your checklist is correct. Over.
05 12 41 20	CMP	Okay. And when do you figure that you'll be sending up the pads that you have?
05 12 44 02	CC	Aquarius, all of your pads will be coming up in about 3-1/2 hours, at EI minus 06:30. And one thing we want to remind you of, when you remove power from the command module LM umbilical, is to be sure that you open the LM POWER MAIN B circuit breakers, both of them, before you start throwing switches and circuit breakers in the LM. Do it as we've outlined it in the procedure, in that order. Over.
05 12 44 33	LMP	Okay. That's the way we planned on it. We'll let Jack do his three and then he'll tell us when we're GO from there. What pages are those changes on?
05 12 44 48	CC	Okay, Fred. The one I've got for you is at the end of power removal from the command module LM umbilical. And just for your information, after you go through that entire procedure and about the time you're ready to transfer to the command module, at that time, power will be removed from the umbilical, and it's okay to disconnect it. That is, after you've thrown the switches in the LM. Is that clear?
05 12 45 21	LMP	Roger. That's where I've got a remark here to check with you to see if it's all right to proceed.
05 12 45 28	CC	Roger. And that would be just after, on panel 16, you opening ASCENT ECA CONTROL breakers.
05 12 45 42	LMP	Which step number is that?
05 12 46 03	LMP	The confusing thing is, Jack, where they told me to wait for MSFN GC before proceeding was that BAT 2 LOW VOLTS OFF/RESET, then ON.
05 12 46 12	CC	Okay. That's still affirmative. We'll give you a go after waiting 5 seconds, and then down from there just a few steps, after you have opened

		the ASCENT ECA CONTROL breakers on panel 16, at that point, the umbilical is not powered, and it's okay to disconnect them should you care to do so.
05 12 46 35	LMP	Okay. After the last step then, I'm free to disconnect.
05 12 46 39	CC	Right. And one other change we have is, shortly after that, where we're configuring for jettison, we have closed both the FORWARD DUMP valve and the OVERHEAD DUMP valve. And we don't want to get in a locked up position like that, so one way to get around it is to - After we close the FORWARD DUMP valve, turn the DESCENT OXYGEN valve off. Over.
05 12 47 17	LMP	Okay. After the FORWARD DUMP valve, add a step in that says the DESCENT OX valve, off.
05 12 47 31	CC	Okay, Fred. That concludes the DELTAs. And perhaps you heard that our GAMMAs are still minus 6.03 and our DELTA-V will be a 2.8-foot-per-second RCS burn.
05 12 47 46	LMP	Roger.
05 12 48 23	CC	Fred-o, we've got one more change we'd like to give you to clarify a question that Jack asked earlier. At EI minus 02:30 - -
05 12 48 35	LMP	Okay. Hold on a minute, Jack. I meant to call Jack back down. I'm not familiar with the previous discussion.
05 12 48 42	CC	Negative. This is on your checklist.
05 12 48 47	LMP	Okay. Go ahead.
05 12 48 49	CC	At E mi - EI minus 02:30, during power removal from the umbilical, first thing we do is two steps with the CSM. We open the MAIN B, the LM POWER to MAIN B circuit breakers, and then there's a third step which says "Circuit breaker EPS SENSOR SIGNAL, MAIN B, open." Just delete that step. Over.
05 12 49 18	LMP	Okay. Delete the third step.
05 12 50 38	CC	And, Aquarius, for your information, as far as our water supply is concerned, including our

		plans for powerup, we have an additional 18 hours of water remaining from this point.
05 12 51 01	IMP	Okay. Eighteen hours of water remaining from this point, Jack.
05 12 51 26	CDR	Hello, Houston; Aquarius.
05 12 51 29	CC	Hello, Aquarius. Go ahead.
05 12 51 32	CDR	Okay, Jack. This is Jim. I just want to make sure that you're filtering the changes to the checklist that come up to make sure that they're absolutely essential. When we learn our procedures, we can only do it one time, and we can't make changes at the last minute. We'd like to do the best, the safest way possible, but unless the changes are really essential, don't bother sending them up.
05 12 51 57	CC	Roger. We won't. The chairman of the CPCB is still active, and one thing we're trying to do is to save you all the time we can between EI minus 02:30 and 1 hour.
05 12 52 10	CDR	That's affirm. That's a real important time.
05 12 52 14	F	Yes. For your information, Jim, I don't know whether you heard that originally, but that time from 2-1/2 to 1 in there has been run about three times, and it's pretty tight, so we've tried to weed out what we could, which isn't much, but I think the other message you might impress on Jack when you get around to alining that platform, don't try to get it down too neat. It doesn't have to be all that good. Just do a nice quick and dirty one, and that's going to be good enough anyway.
05 12 52 43	CDR	I concur. I think for reentry we don't have to have a real accurate platform, but I haven't told Jack that.
05 12 52 50	F	Roger. Hey, Jim, while you're up and things are nice and quiet, let me give you a couple of other things to think about. One specifically. I know none of you are sleeping worth a damn because it's so cold, and you might want to dig out the medical kit there around 01:35 or in that ballpark, and pull out a couple of Dexedrines apiece and try one about then, and another around 01:39 to 01:40.

05 12 53 15	CDR	Well, I hadn't brought that up. We might - We might consider it.
05 12 53 17	F	Okay.
05 12 53 39	F	Wish we could figure a way to get a hot cup of coffee up to you. It'd probably taste pretty good about now, wouldn't it?
05 12 53 46	CDR	Yes, it sure would. You don't realize how cold this thing becomes when it's in a PTC mode that's slowing down, and I just clocked the cycles on my ... And it's about 11 to 12 minutes now, and the Sun is directly overhead, so it's shining on the engine bell of the service module and not getting down to the spacecraft at all.
05 12 54 16	F	Hang in there. It won't be long now.
05 12 54 19	CDR	Yes. That's right. As a matter of fact, doing this alinement on the Earth this time will be like making a landing with a fogged-up windshield.
05 13 21 53	CC	Aquarius, Houston.
05 13 22 06	CDR	Go ahead, Houston.
05 13 22 08	CC	Okay, Skipper. We figured out a way for you to keep warm. We decided to start powering you up now, and what we want you to do - what we want you to do is take your entry LM PREP checklist and start at the top where it says "BAT 5 NORMAL FEED on," and then jump over as it says to your 30-minute activation, and do all of the 30-minute activation up to, but not including, the burn. You copy?
05 13 22 52	CDR	Okay. If I understand you correctly, then that gives me leeway to maneuver when we get up to activation complete, and we can be in position for the burn, but we will not burn. We don't have a pad anyway.
05 13 23 15	CC	That's affirm, Jim. You could maneuver to burn attitude, or you could maneuver to an attitude which should put the Sun in the windows to warm the place up.
05 13 23 23	CDR	Sounds good, and you're sure we have plenty of electrical power to do this?

05 13 23 29	CC	That's affirmative. We've got plenty of power to do it. I can get you a number, though.
05 13 23 37	F	Jim, you've got about 100-percent margins on everything from here on in.
05 13 23 45	CDR	That sounds encouraging.
05 13 23 46	F	Roger. That's in the LM. We're not talking about the CSM right now.
05 13 23 52	CDR	I understand.
05 13 30 36	LMP	Houston, Aquarius.
05 13 30 39	CC	Go ahead, Aquarius.
05 13 30 43	LMP	Okay. Question. This short turnon step 3 on page 24 has us only turning on the RCS SYSTEM A/B, two quads, and the breakers are still out on panel 11. Did you want those in, too, or are we just going to use one set of heaters?
05 13 31 02	CC	Stand by.
05 13 31 32	CC	Aquarius, Houston. Go as the checklist recommends for now. When you get into the circuit breaker panel configuration, you're going to get the number 1 set of heaters on anyway.
05 13 31 44	LMP	Okay.
05 13 34 14	LMP	Okay, Houston. We'd like to get a hack to set our mission timer here, Jack.
05 13 34 21	CC	Okay, Fred-o. Set it at 133:35 straight up. You've got about 30 seconds to set it.
05 13 34 49	LMP	Okay. Standing by.
05 13 34 52	CC	Okay. I'll give you the 2-second delay in there. Stand by to start.
05 13 34 59	CC	START.
05 13 35 03	LMP	Okay. We've got it.
05 13 35 05	CC	Okay. I'm counting 133:35:10.
05 13 35 11	LMP	Right on.

05 13 35 41	CC	Aquarius, Houston. One other way to warm things up in a hurry in there is when you get your AC on to turn on the window heaters.
05 13 35 58	LMP	Okay. I guess the only question I have is what it's liable to do to us with the - looks like almost a frost on it now.
05 13 36 25	LMP	Understand this, Jack. I'd like to let it maybe warm up just a little bit more before hitting it with the heat load.
05 13 36 33	CC	Not a bad idea.
05 13 38 26	LMP	And, as you can see, Houston, at turnon we got our old friend downlink 2 back.
05 13 38 37	CC	Roger. We're seeing it, Fred.
05 13 41 08	CC	Aquarius, Houston. It looks like you're proceeding toward the gimbal lock there. We'd like you to check that, please.
05 13 41 20	CDR	Roger. Not much we can do about it. We can't use the thrusters, Houston.
05 13 41 32	CC	Okay. Forget it now; we'll get it later.
05 13 44 44	LMP	And, Houston, Aquarius. I guess the next thing for the PGNS will be a coarse aline 000, but I guess we ought to hold up now until we get enough time on the RCS thrusters.
05 13 44 56	CC	Roger. We're looking at them. We'll give you the GO on them. Okay, Aquarius. Your quads are 120 to 133 now, so you're cleared for - Cleared for thrusters.
05 13 47 48	CC	Aquarius, Houston.
05 13 47 52	CDR	Go ahead.
05 13 47 53	CC	Roger. Did you get my GO for RCS?
05 13 47 56	CDR	That's affirm. We're GO. What we're doing now, Jack, is letting the spacecraft drift in this mode to pick up the Earth again.
05 13 48 00	CC	Okay.
05 13 48 07	CDR	I don't want to just go blasting around the sky and get high rates, because I don't have anything

		to null the rates on until the Earth comes back up again. And - Once I get the Earth in sight, we have no strain on nulling rates. That part of the Earth, that is.
05 13 53 50	CDR	It's going to be interesting today, Jack. The Earth's a lot bigger; the crescent is a lot more pronounced than it was yesterday.
05 13 54 04	CC	Well, you're going in the right direction.
05 13 54 10	CDR	That's right.
05 13 55 27	LMP	And, Jack, I guess we haven't changed our angle much with respect to the Sun 93 million miles away, so it ought to be in about the same place in the AOT, isn't that Charlie?
05 13 55 50	CC	Hold 1 on that, Fred. I'll get an answer for you.
05 13 55 54	LMP	Okay.
05 13 57 20	CC	Aquarius, your ASA is warmed up now. You can activate the AGS.
05 13 57 26	LMP	Okay.
05 14 00 46	CC	Aquarius, Houston. When you look out a detent 2 in the proper burn attitude, what you ought to see is the Sun at 12 o'clock, about halfway between the top of the AOT and the center of the pipper. And you ought to see the Earth - -
05 14 01 03	LMP	Okay.
05 14 01 04	CC	- - at 6 o'clock.
05 14 01 07	LMP	Okay.
05 14 01 41	CDR	And, it's getting a little warmer in here now. Thank you.
05 14 01 58	CC	Duck blinds are always warmer, Jim, when the birds are flying.
05 14 02 06	CDR	Right.
05 14 02 47	CDR	Jack, I've gotten so used to flying attitude with the TTCA, I won't be able to do it normally.

05 14 02 56	CC	Say again, Jim.
05 14 02 59	CDR	I said I've gotten so used to flying attitude with the translational control, I won't be able to do with the ACA.
05 14 06 06	CC	Aquarius, we see your glycol temperature getting up there. If you want to make it a little warmer, or you can try putting your SUIT TEMP valve to HIGH, if you haven't already got it there.
05 14 06 25	LMP	Okay.
05 14 10 45	CC	Aquarius, something we're thinking about right now is, if we can do it without using a lot of RCS, it would be to our advantage timewise to try to get an alinement.
05 14 11 00	CDR	Okay. You mean a P52?
05 14 11 05	CC	We're - -
05 14 11 06	CDR	I'll ... around.
05 14 11 07	CC	A combination of 51 and 52.
05 14 11 15	CDR	I'll see what we can do, Jack.
05 14 11 18	CC	Okay. And we'd planned to use the Moon and the Sun for that.

END OF TAPE

05 14 14 46	CC	Aquarius, Houston. On panel 16, we'd like for you to close the CROSS TIE BAL LOADS breaker, please.
05 14 14 57	CMP	Okay. It's closed.
05 14 15 04	CC	And it looks like we could support a - an alinement in a few minutes, if you'd be willing to go ahead with that.
05 14 15 13	CDR	Jack, it sounds good. I think from our position here, we know where the Sun and Moon are and it's strictly going to be a pitch maneuver. But I think we can save some gas. I'll see what we can do.
05 14 15 24	CC	Roger.
05 14 22 58	CDR	Houston, Aquarius.
05 14 23 00	CC	Go ahead, Aquarius.
05 14 23 02	CDR	We're all set to go. Are you going to ship us up a REFSMMAT?
05 14 23 06	CC	Yes, we are. Stand by 1.
05 14 23 09	CDR	Okay.
05 14 23 25	CDR	The Sun feels wonderful. It's shining in the rendezvous window.
05 14 23 32	CC	And, Aquarius, before we can ship you a load, we'll have to have, on panel 11, under COMM, the UPDATA LINK circuit breaker closed.
05 14 23 54	CDR	It's closed.
05 14 24 00	CC	Roger. It'll be a few - -
05 14 24 01	CDR	... closed ... -
05 14 24 02	CC	Okay. And it'll be a few minutes yet, Jim. We're still cranking it up.
05 14 24 10	LMP	Okay. Stay with it, Jack, and I'll go back to data.
05 14 24 15	CC	Roger.

05 14 25 09	LMP	I got BAT in about 33-1/3 percent on that uplink. Too fast alarm.
05 14 25 13	CC	Say again on that, Fred.
05 14 25 20	LMP	I just got another uplink too fast when I took the DATA switch back off - It's happening, I guess, about a third of the time.
05 14 25 25	CC	Roger.
05 14 28 11	CC	Aquarius, Houston. We're ready with your load if you'll give us DATA please.
05 14 28 16	CDR	Going to DATA. You got it.
05 14 34 42	CC	Aquarius, Houston. After the uplink, you'll have to set the drift and the REFSMMAT flag as on page 8 of the contingency book, steps 5 and 6.
05 14 34 55	CDR	Page 8, steps 5 and 6. Roger.
05 14 37 21	LMP	Okay. Are you done with the computer now, Jack?
05 14 37 24	CC	Negative. We'll give you the word.
05 14 37 27	F	Roger. Aquarius, we're through with it, it's your computer.
05 14 37 32	CDR	Thank you.
05 14 39 32	CC	And, Aquarius, Houston; take option 1 on a P52 when you get to it. And I've got some ball angles for a Sun and Moon.
05 14 39 46	LMP	Okay. We want an option 1 and you've got some ball angles for Sun and Moon. And right now, Jim has the Sun pretty well squared away right in the middle of AOT.
05 14 43 19	LMP	And have you got some plan in vectors for us, Jack?
05 14 43 37	CC	Okay, Fred-o. For the Sun, I've got 246; for the Moon I've got 250.
05 14 43 55	LMP	Are you talking about ball theta angles?
05 14 43 59	CC	Negative. I was - I was reporting the code for NOUN 70.

05 14 44 07	F	They're in the computer, Fred.
05 14 44 10	LMP	Oh, okay.
05 14 49 06	CDR	Okay, Houston. We have the Sun marks and I'll start up at pitch now to go over and pick up the Moon.
05 14 49 14	CC	Roger.
05 14 53 22	CDR	Houston, Aquarius.
05 14 53 24	CC	Go ahead.
05 14 53 27	CDR	Just as a note of interest, in this dock configurations for P52s, the command module docking probe is right down the middle of - the docking light, rather, is right down the middle of the detent. And when the Sun flashes on, it really makes it difficult.
05 14 53 48	CC	Roger.
05 15 02 10	CDR	Just like the simulator.
05 15 02 15	CC	Yes. It was good training.
05 15 02 35	CDR	Well, Jack, that's what it says the torquing angles are.
05 15 02 39	CC	We haven't got them yet.
05 15 02 51	CC	Aquarius, hold on to torquing angles, please.
05 15 02 55	CDR	We're doing that.
05 15 03 18	CC	Jim, the reason for the delay is that we're not seeing the data yet. We're having to check a point here; and as soon as they come up, we'll let you know what to do with them.
05 15 03 30	CDR	Okay. We had a large NOUN 105 of - what - 112, and our torquing angles, Jack, are minus 01713, minus 03278, minus 01395.
05 15 03 53	CC	Roger. Minus 01713, and we see them now.
05 15 04 17	CC	Aquarius, torque them.
05 15 04 20	CDR	Okay.

05 15 04 28	CDR	At 35:04:25.
05 15 06 10	CC	Aquarius, do you have a star close by there you could check?
05 15 06 18	CDR	I'll look around, Jack. I was just trying to get a check on the Moon, again, to see if those angles were indeed true, and we got the Moon back again and centered.
05 15 06 27	CC	Roger.
05 15 10 09	CDR	Okay, Jack. What you're reading now the angles? We had the Moon centered, and it's pretty close to what we have on the 8 ball, I guess. Close enough for any entry that we'd like to do.
05 15 10 20	CC	Roger. And I'm told that Denubla - Denebola and Regulus are nearby if you wanted to make a star check.
05 15 10 35	CDR	Okay. I'm going to start pitching around again, and I'll see if I can pick them up. I have Orion out here to my left a little bit, but it's pretty close to the - oh, here. I've got Sirius. That's a nice one. How about that?
05 15 10 55	CC	Sounds good here.
05 15 14 44	CC	Aquarius, is Jack sitting on the rumble seat there?
05 15 14 48	LMP	He was. He just headed upstairs to take another look around.
05 15 14 53	CC	Okay. I got a minor addition to the entry checklist for him. This time it's in the - -
05 15 14 58	LMP	Okay. Stand - -
05 15 15 00	CC	- - entry book.
05 15 15 02	LMP	Okay. Stand by 1. He has that in his pocket.
05 15 15 54	CDR	What I'm doing, Jack, is just - I'm pitching over now. I'm going to pick up another star. Sirius was just too far off. I thought I was going to use too much gas getting there.
05 15 16 05	CC	Roger.

05 15 16 08	CDR	By the time I get alined in the - in the AOT - be nice if we didn't have Odyssey attached, we could just AUTO - AUTO maneuver over to these things.
05 15 16 28	CC	Looks to us like you've got her alined, Jim, so I wouldn't worry about it too much.
05 15 16 33	CDR	Yes. I'm pretty confident that the platform's fairly descent.
05 15 17 38	CC	Aquarius, Houston. We need an E MOD VERB 74, when you've got a chance, please.
05 15 17 43	CDR	Okay. Coming to you.
05 15 22 35	CC	Okay, Jack. On your entry checklist, on page 2-5. Down there on step 9, where it says 152 degrees pitch at .05g, adjacent to that, so that Recovery can see you better on the way down, we want you to turn your S-BAND, POWER AMPLIFIER to HIGH. Over.
05 15 23 25	CMP	Okay. Turn S-BAND, POWER AMP to HIGH at .05g time.
05 15 23 37	CC	That's affirmative.
05 15 23 49	CMP	Okay. Is that it?
05 15 23 52	CC	That's it, Jack.
05 15 32 42	CC	Aquarius, Houston. We're considering doing the midcourse with PGNS, unless you'd rather do it in AGS.
05 15 32 52	CDR	No. PGNS is fine with me. I just aline myself up with the old ball again. So I've got you foresighted again, but any way you want to do it.
05 15 33 02	CC	Like you say, you might as well go first class.
05 15 33 07	CDR	I guess you're right.
05 15 33 14	LMP	Now wait a minute, Jack.
05 15 33 22	CC	I just lost a lot of friends there.
05 15 35 20	LMP	And, Jack, you can tell Owen Morris that the RCS SYSTEM A/B 2 QUAD 1 breaker is still nicely in.

05 15 35 52	CC	Roger. We'll pass the word.
05 15 38 21	CC	Aquarius, Houston. We think we've figured out a way to save you some time at a very critical - very full schedule. And that's by doing a docked coarse aline, since we got the LM up now. That would save you a maneuver or two.
05 15 39 38	CDR	Houston, Aquarius. It seemed to me a docked coarse aline might be quicker for - for Jack.
05 15 39 45	CC	Yes. We think it would be, and it'd save quite a bit of time at a place where you're going to be pretty busy. Also save you some petrol.
05 15 39 56	CMP	Affirm.
05 15 40 13	CC	Okay, Jim. We're looking at doing this in the service module SEP attitude, and the optics will be pointed away from the Sun. So it should be a good attitude for a P52.
05 15 40 34	CDR	Okay. So, we'll be going to the service module SEP attitude, at which time we'll do a docked coarse aline, and -
05 15 40 54	CDR	Then you want - You want Jack then to do a P52?
05 15 41 20	CC	The way we'll do that in our time line Jim, is to go ahead and do the service module JETT and then we'll just stay in that attitude and when it comes time in our time line as we've outlined, to bring the platform up, we'll proceed with the P52 - coarse aline, and then the P52.
05 15 41 40	CDR	Okay. Are we going to use the same techniques that we normally do for LM activation? In other words, I try to maintain an attitude, and give him some angles and then - Are you going to give him the angles? Then he does the 52.
05 15 41 57	CC	Basically, it's the same procedure just reversed, Jim.
05 15 42 01	CDR	Okay.
05 15 42 02	CC	Another nice thing about this, is it's one we've done before.
05 15 42 40	CC	And, Aquarius. One thing, however, that we do not plan to do is to proceed with the command module powerup prematurely.

05 15 42 51	CMP	Roger.
05 15 42 57	CDR	Understand.
05 15 45 27	CMP	Okay, Houston. This is Jack.
05 15 45 32	CC	Go ahead, Jack.

END OF TAPE

05 15 45 33	CMP	Okay. I just wanted to talk over with you, it looks like we've had some changes in the flight plan here, due to Jim's P52. Do you have - Can you talk over with me what your plans are?
05 15 45 50	CC	Roger, Jack. Since we've got the PGNS up, we plan to use that information to give the CMC a dock coarse alone, and then we're in the service module jettison attitude, we'll wait until it comes time to power up the CMC, and we'll get the CMC a dock coarse aline, and we'll pick some good stars to give you a fine aline with, and it looks like we can pick some stars that are looking away from the Sun in which you can find in that service module jettison attitude; so, we'll save you quite a bit of gas, and save you some time in a very busy time.
05 15 46 36	CMP	Hey, that sounds good. Really fine.
05 15 46 40	CC	Keeping warm?
05 15 46 43	CMP	Hey, it's warmed up here now. It's almost comfortable.
05 15 46 52	CDR	I'm looking out the window now, Jack, and that Earth is whistling in like a high-speed freight train.
05 15 47 13	CC	We're clocking you at 48 000 miles and coming in at about 9000.
05 15 47 21	CDR	I don't think there's many LMs that have seen it like this. I'm still looking for Fra Mauro and Cone Crater.
05 15 47 38	CC	You're going the wrong way, son.
05 15 48 29	CMP	Okay, Jack. It looks - Just looking over what I may expect here, it looks like I'm just going to get three angles to do a VERB 41 NOUN 20, right?
05 15 48 45	CC	That's what it looks like from here, Jack. It's pretty much the opposite of the LM activation procedure where we do the dock coarse aline.
05 15 49 05	CMP	Yes, except in a way we did a lot of VERB 06 NOUN 20, ENTERS, simultaneously, and then you all shipped him up post-torque values. You're not going to do anything like that are you?

05 15 49 20	CC	Say again, please, Jack.
05 15 49 23	CC	Okay. During the activation part, we do a lot of VERB 06 NOUN 20, ENTERS simultaneously, reading you out the difference in the angles, and then MSFN furnishes the post-torquing angles, in order to get the platform fine alined. Do you plan something like that or just three coarse aline angles.
05 15 49 53	CC	Jack, we're going to give you three coarse aline angles, and then you can go right to your check-list as we're giving it, and start in with the VERB 40 NOUN 20.
05 15 50 07	CMP	Okay. Real fine.
05 15 52 45	LMP	And, Jack, how do you read?
05 15 52 48	CC	Fine - square.
05 15 52 54	LMP	I was around shooting pictures of all the debris inside here, before we left, and I inadvertently changed the settings on the DC command module Reseau camera that we need for the service module pictures. I wonder if FAO can dig them out again - what we need, f-stop and speed.
05 15 53 18	CC	Okay, Fred. Stand by.
05 15 54 55	CC	Fred, in regards to the camera settings, for black-and-white 3400 film, the settings were f:5.6 at 1/250th. Over.
05 15 55 09	LMP	Okay. I'd guessed right after all, but thank you.
05 16 04 59	CC	Aquarius, Houston. Over.
05 16 05 03	CDR	Go ahead, Houston.
05 16 05 04	CC	Okay, Jim. I got MCC-7 pad when you're ready to copy. Over.
05 16 05 09	CDR	Okay. Stand by.
05 16 05 35	LMP	Okay. We're in luck, I got one pad left.
05 16 05 38	CC	Okay. We'll take care not to change this one. Ready to go?

05 16 05 45	LMP	Go ahead, Joe.
05 16 05 46	CC	MCC-7: 137:39:48.39, minus 0003.1, plus all zeros, plus 00001, N/A, plus 0020.5, 0003.1, 0:23, 008, 359; the rest is N/A. Remarks: plus-X, four jets, RCS; and your weights for the DAP load: LM weight, 25181; CSM weight, 62468. Over.
05 16 07 02	LMP	Okay, Joe. MCC-7: 137:39:48.39, minus 0003.1, plus all balls, plus 0000.1, N/A, plus 0020.5, plus 0003.1, 0:23, 008, 359; the rest of pad N/A. Remarks: plus-X, four jets, RCS, ullage; the LM weight, 25181; CSM weight, 62468. Over.
05 16 07 51	CC	Okay. Readback correct.
05 16 08 22	CC	And, Aquarius; Houston. I have a service module SEP pad if you want to copy that, now. Over.
05 16 08 32	LMP	Say again, Joe.
05 16 08 34	CC	Roger, Fred. I have a service module SEP pad with the attitudes. You don't need a pad sheet for it; just any old blank sheet will do.
05 16 08 49	LMP	Okay. I was going to say I don't - We don't hardly carry a service module SEP pad.
05 16 08 56	CC	Yes, we'll have to change that.
05 16 09 02	LMP	Okay. I'm using a P27 here. Go ahead.
05 16 09 06	CC	Okay. The pad reads as follows and then I'll repeat the angles for you so you can copy them. The following MCC-7, maneuver the LM to the following FDAI attitudes: roll, 000; pitch, 91.3; yaw, 000. Now do you want those attitudes repeated, Fred?
05 16 09 40	LMP	Okay. Following MCC-7 we're to maneuver to the following attitudes: roll, 000; pitch, 091.3; yaw, 000.
05 16 09 54	CC	Okay. That's correct. And the last part of the pad is at GET 138:10:00, which is EI minus 4.5 hours, execute a push of 0.5 feet per second, four jet, plus-X; perform SM SEP; then execute pull, 0.5 feet per second, four jet, minus-X. Over.
05 16 10 45	CDR	Houston, Aquarius. Jack's entering the command module, now.

05 16 10 48	CC	Okay, Jim.
05 16 11 14	LMP	Okay. That last Joe was execute at the GET at 138:10:00 which is EI minus 4-1/2 hours; execute a push of 0.5 feet per second, four-jet ullage; then execute SM SEP followed by a pull of 0.5 feet per second, with respect to a nomenclature on the TTCA; I think we really need an up of 0.5 and then a down of 0.5.
05 16 11 47	CC	That's correct, Fred.
05 16 12 02	CC	Okay, Aquarius. The last pad I had for you right now is the LM jettison pad. Similar to the - Stand by 1, Aquarius.
05 16 12 22	CC	Okay, Aquarius; Houston. Request POO and DATA for a data load. Over.
05 16 12 28	LMP	You got it.
05 16 12 30	CC	Okay. And I was about to say the LM jettison pad is similar to the SM SEP pad, Fred, when you're ready to copy.
05 16 12 42	LMP	Just about the same number of lines?
05 16 12 44	CC	Yes.
05 16 13 09	LMP	Okay. Go ahead, Joe.
05 16 13 11	CC	Okay, Fred. Prior to 141:40:00, which is EI minus 1 hour, maneuver the LM to the following FDAI angles: roll, 130; pitch, 125; yaw, 012.4. The corresponding CSM gimbal angles will be roll, 291; pitch, 196; yaw, 045, and that's the pad. Over. And the computer is yours, Aquarius.
05 16 14 14	CDR	Thank you.
05 16 14 23	LMP	Okay. A LM SEP pad prior to 141:40:00, EI minus 1 hour, maneuver to following attitudes: roll, 130; pitch, 125; yaw, 012.4. The corresponding CSM gimbal angles are roll, 291; pitch, 196; yaw, 045.
05 16 14 49	CC	Readback correct.
05 16 15 57	CC	Aquarius, Houston.

05 16 16 01	LMP	Go ahead, Joe.
05 16 16 02	CC	Okay. We're so efficient down here that we got an entry pad ready, Fred. Do you want to copy that for Jack? Over.
05 16 16 10	LMP	Stand by. I'll have to try to borrow his book from him.
05 16 16 14	CC	Roger.
05 16 16 17	CDR	Can we hold off on that a little bit, Joe?
05 16 16 19	CC	Oh, absolutely, Jim. We're well ahead. I just wanted to let you know that we had it.
05 16 16 25	CDR	Okay. I hope that when you send up all those uplinks to Jack that you could get them up to him quickly.
05 16 16 33	CC	We're shooting for less than 5 minutes.
05 16 16 38	CDR	Sounds good.
05 16 16 43	LMP	And are you still using the computer?
05 16 16 46	CC	That's a negative, Fred. The computer is yours.
05 16 16 58	CC	And, Fred, the computer has your target load in.
05 16 17 04	LMP	Okay.
05 16 18 56	CDR	Houston, Aquarius.
05 16 18 59	CC	Go ahead, Aquarius.
05 16 19 01	CDR	Okay. I just want to clarify one thing on the LM SEP pad. It appears to me that in my configuration, I could probably use a VERB 49 loading in 622, yaw, pitch, and roll, in that order; and then being able to fly out at 5018 in roll, pitch, and yaw. Is that correct?
05 16 19 24	CC	Stand by; I'll verify it, Jim.
05 16 19 29	CMP	Okay, Joe. And while you're doing that I've got a question about the command module checklist.
05 16 19 32	CC	Okay, Jack. Go ahead with your question.
05 16 19 37	CMP	Okay. Either I copied the circuit breaker wrong, or - I can't read it. Comes down just about the -

		oh, about the 20th one down, after panel 276, where it says CB INSTRUMENTATION POWER CONTROL 3 and 4, open. The next circuit breaker on panel 5 - I - Would you give that to me again?
05 16 20 03	CC	Roger. That's CB ESSENTIAL INSTRUMENTATION POWER, MAIN B. Over. And it's, closed.
05 16 20 16	CMP	Okay. I just can't, right - I just can't read my writing, ESSENTIAL INSTRUMENTATION POWER MAIN B, closed.
05 16 20 20	CC	That's affirmative.
05 16 21 39	CC	Aquarius, Houston.
05 16 21 45	LMP	Go ahead, Joe.
05 16 21 46	CC	Roger. The word we have is that you can't make a VERB 49 maneuver to the LM jettison attitude because those are FDAI angles we gave you; they don't correspond to the gimbal angles for the load; it'll have to be a manual maneuver. Over.
05 16 22 05	LMP	Okay.
05 16 22 06	CC	And mind out for gimbal lock.
05 16 22 12	LMP	We will.
05 16 42 01	CC	Aquarius, Houston.
05 16 42 05	CDR	Go ahead, Houston.
05 16 42 07	CC	Roger. We're looking at LM current, to see if Jack has started his preheat, and we haven't seen it yet. Is he doing okay down there?
05 16 42 24	CDR	Houston, Jack said he's already started it, and he said that in 1 more minute, he'll be up to 20 minutes.
05 16 42 31	CC	Oh. Roger that.
05 16 42 42	CC	Jim, Houston. Have him let us know what his test meter reads when he's done.
05 16 42 51	CDR	He says that he had a battery A voltage drop of 2 volts, and he'll try to look at the test meter for you right now.

05 16 42 55	CC	Okay.
05 16 42 58	CDR	He's been looking at them, but they haven't been coming up, so far.
05 16 43 02	CC	We copy.
05 16 43 23	CDR	Do you see a current now, Houston?
05 16 43 28	CC	Stand by 1 on that, Jim. That's affirmative, Jim; it looks like we are seeing one now.
05 16 43 43	CDR	Okay. And thanks for keeping us on it.
05 16 43 51	CC	Okay.
05 16 46 43	CC	Aquarius, Houston.
05 16 46 46	CDR	Go ahead.
05 16 46 47	CC	Roger. Reminder P41 for the RCS burn.
05 16 46 54	CDR	Thanks for keeping us honest.
05 16 46 57	CC	We got to protect our jobs, Jim.
05 16 47 09	CDR	We've been DPS-ing so long here.
05 16 47 12	CC	Yes.
05 16 54 30	CDR	Okay, Houston. I finished up the maneuvers, the AUTO maneuver in 41; but my roll and yaw needles seem to be offset. Pitch is okay.
05 16 54 41	CC	Okay, Jim. We copy. Stand by. Aquarius, Houston. We recommend PGNS MODE CONTROL to ATT HOLD. Save a little gas and stand by on the error needles.
05 16 55 01	CDR	Okay.
05 17 04 39	LMP	Houston, Aquarius.
05 17 04 53	CC	Aquarius, Houston. Did you call?
05 17 04 57	LMP	Roger, Joe. Figured, if we're going to do this burn in PGNS now, I ought to give you an update on the contingency book pages 32, 33, and 34, because the last time we went through this portion, we were burning it in AGS.

05 17 05 22	CC	Okay, Fred. Stand by. We've been talking about possibly having you do it in AGS. We recommend at this time that you do an AGS to PGNS aline, the 400 plus 3 procedure only. Over.
05 17 05 44	LMP	Okay.
05 17 06 19	CC	And, Aquarius, Houston.
05 17 06 23	CDR	Go ahead, Houston.
05 17 06 24	CC	Roger. We recommend that you perform this burn in AGS, as you did the last midcourse maneuver; we think it will save gas. Over.
05 17 06 36	CDR	Okay. Joe, do you want me to line up the same way we did the last one, too?
05 17 06 42	CC	Stand by on that.
05 17 06 57	LMP	And, Joe, Jack just handed me some injector temperatures, if you want to read these on ... so I can plug them in.
05 17 07 05	CC	Roger. Go ahead with those.
05 17 07 07	LMP	Okay. 5 Charlie, 4.0; 5 Dogs, 3.7; 6 Able, 3.5; 6 Bravo, 4.1; 6 Charlie, 4.2; 6 Delta, 3.8.
05 17 07 21	CC	Okay. Copy those, Fred.
05 17 09 09	CC	Aquarius, Houston.
05 17 09 11	CDR	Go ahead, Houston.
05 17 09 13	CC	Okay, Jim. Our recommendation on this burn is that you maneuver to the burn attitude, in PGNS MIN IMPULSE, then do a body-axis aline, 400 plus 5, followed by 400 plus 0, and then do the burn in AGS. Over.
05 17 09 34	CDR	Okay. Now we're spinning it with the PGNS, what you gave us for a PGNS attitude. Is this the wrong one? Do you want me to just to aline up the Earth as I did before in the last midcourse?
05 17 09 46	CC	No. We don't want you to do that. Read me your FDAI angles, and let's compare them with what we have down here.

05 17 09 55	CDR	Okay. You're looking at them in the DSKY. I've got roll of 8.47; pitch of about 0.51; and yaw looking at about 3.750.
05 17 10 18	CC	Okay, Jim. Those are very close - I guess all you need to do is trim them up a bit.
05 17 10 26	CDR	I plan to do a final trim - AUTO trim, and then a four-jet translation.
05 17 10 40	CC	Okay, Jim. For fuel conservation, we'd prefer you to trim it up MIN IMPULSE, and there's really very little trim required; and then go ahead and do it AGS. We're on the expected fuel usage, but we're just being old ladies about it.
05 17 10 58	CDR	Okay. Understand. My only question, Joe, is the fact that both the roll and the yaw needles did not go to null when I did an AUTO maneuver. I'd tried to go manually to the attitude; and then went to AUTO, but the roll and the yaw do not come in at all.
05 17 11 14	CC	Roger. I haven't got an answer on that yet, but your attitude looks very close.
05 17 11 20	CDR	Okay. I can take it on ...
05 17 12 45	CDR	And, Houston, Aquarius. I'm not sure that if I follow and null the needles, that will be the proper attitude.
05 17 13 02	CC	Okay. Stand by 1, Jim. We're talking about it. It's going to be very close; in any event, close enough.
05 17 13 10	CDR	Okay.
05 17 13 16	CC	And, Jim, just for your information, I have the entry pad. I have the landing area weather summary, which you probably don't even have to copy, but which I'll read up to you when you're ready; and some stars for Jack that I'm holding for him for later on.
05 17 13 31	CDR	Okay.
05 17 13 42	LMP	And, Joe, Jack says all the injector temperatures, he just checked them again, and they're all over 3.9 - -

05 17 13 50	CC	That they're all over 3.9 now. Thanks a lot.
05 17 13 58	CC	You can tell him that it's looking good to us. They were even happy with the previous ones.
05 17 14 05	LMP	Okay.
05 17 15 02	CDR	And, my only question, Houston, is do you want me to null the PGNS needle manually?
05 17 15 08	CC	Okay. Stand by 1 more minute, Jim.
05 17 16 47	LMP	Houston, Aquarius.
05 17 16 49	CC	Go ahead, Aquarius.
05 17 16 51	LMP	Yes. I guess the basic question is comparing the balls here and out the window it doesn't look too unreasonable, and I guess Jim says the COAS is yawed and roll slightly off from what he might eyeball; but yet, the FDAI air needles for PGNS are showing a full scale left in roll and full scale left in yaw. ...
05 17 17 17	CC	Okay. Go ahead.
05 17 17 23	LMP	Yes. It appears if we track those we, obviously, aren't going to be on the attitude that we burned the last midcourse.
05 17 17 30	CC	Okay. Well, this attitude we passed you is not quite alined to the terminator, and stand by on this.
05 17 17 39	CC	It should be off about 8 degrees, FLIGHT.

END OF TAPE

05 17 20 34	CDR	How you doing there, Houston?
05 17 20 37	CC	Oh, we're getting there, Jim. We're - we're all agreed that you're almost, but not quite, in the proper attitude, and we're just trying to get you one firm recommendation on how to proceed from here.
05 17 20 48	CDR	Okay. I have nulled the null - roll needle and the pitch needle now and I'm yawed - rolled left now. I'm rolled left about 9 degrees.
05 17 20 59	CC	Okay. Understand the needles are nulled.
05 17 21 03	CDR	The yaw isn't, but the pitch and roll are.
05 17 21 07	CC	Roger that.
05 17 23 50	CC	Aquarius, Houston.
05 17 23 52	CDR	Go ahead.
05 17 23 53	CC	Okay. Here's the big story. Your attitude really looks quite good except in roll, and we'd like you to do the following. In MIN impulse PGNS, we'd like you to trim to zero pitch, which is about where you are now; to 008 degrees in roll, which is about 16 degrees from your present roll attitude; and to zero degrees in yaw, which is about where you are now. Then we'd like you to do the body-axis aline 400 plus 5, 400 plus 0. PITCH and ROLL to PULSE, select AGS, do the burn in AGS. How does that sound? Over.
05 17 24 33	CDR	Okay. I'm rolled the wrong way; that is what you're saying, right?
05 17 24 37	CC	That's right.
05 17 24 49	CDR	And you know I can't roll in minimum impulse. I've got to use TTCAs.
05 17 24 56	CC	That's right, Jim. Sorry.
05 17 26 26	CDR	And you don't want me to automatically trim 5018, I take it.

05 17 26 42	CC	That's affirm, Jim. Don't trim 5018.
05 17 26 46	CDR	Okay.
05 17 26 53	CC	We just want you to cycle on through P41 to get the average g and burn it out.
05 17 27 00	CDR	Okay.
05 17 27 51	CC	Aquarius, Houston.
05 17 27 53	CDR	Go ahead.
05 17 27 54	CC	Just for your information, we see 3.0 in register 1. We read you up 3.1 on the pad. The actual DELTA-V was 3.05, and they warned me that it might come out 3.0.
05 17 28 11	CDR	Okay. That's a little burn.
05 17 28 13	CC	Right.
05 17 29 36	CC	Aquarius, Houston. Your attitude looks real good. We will give you a mark at 10 minutes to the burn, which is in 28 seconds.
05 17 29 46	CDR	Okay. We'll burn it in AGS and use the AGS ball.
05 17 29 54	CC	Right. I was looking at the wrong clock, and we're a little under 10 minutes now. I'll give you a mark at 9 minutes. Okay?
05 17 30 05	CDR	That's fine.
05 17 30 36	CC	Aquarius, Houston. We have 10 seconds until 9 minutes to the burn. 3, 2, 1 -
05 17 30 49	CC	MARK.
05 17 30 50	CC	Nine minutes.
05 17 30 53	CDR	Very well. That agrees with our event timer.
05 17 30 56	CC	Okay.
05 17 36 57	CDR	Okay, Houston. About 3 minutes to go, and we're all squared away.
05 17 37 14	CC	And, Aquarius; Houston. Roger that. And we're standing by for your body-axis aline and your zeroing 404, 405, 406, going to 470.

05 17 37 27	LMP	Okay. You'd asked - you'd asked me before, Joe, to go 400 plus 3, which I did. I assume you've changed the script again.
05 17 38 08	CC	Okay, Fred. We did tell you to do that awhile ago, and it doesn't matter; you're looking good.
05 17 38 15	LMP	Okay.
05 17 39 50	LMP	Yes. It looks like we had a minus 0.2 bias at 470. We're burning.
05 17 39 54	CC	Copy that, Fred.
05 17 40 24	CC	Good show, Aquarius.
05 17 40 29	CDR	We're tweaking now, Joe.
05 17 40 31	CC	Roger. Aquarius, Houston. You're good right where you are.
05 17 40 40	CDR	Okay. That's it.
05 17 40 49	LMP	Okay. If you're happy, can we maneuver to service module SEP attitude now?
05 17 40 57	CC	That's affirmative, Aquarius.
05 17 41 19	CDR	And I'm pitching up to the proper attitude.
05 17 41 23	CC	Okay. We're looking at it.
05 17 41 26	CDR	And it's again necessary to use the TTCA to pitch.
05 17 41 30	CC	Okay. Affirmative.
05 17 43 55	CC	Aquarius, Houston.
05 17 43 58	CDR	Go ahead, Houston.
05 17 43 59	CC	Okay. Recommend you terminate P41.
05 17 44 08	CDR	Okay.
05 17 47 38	F	Hey, Jim, have you broken into the medical kit per my recommendation a few hours ago?
05 17 47 46	CDR	Yes. Everything is taken care of Deke.
05 17 47 49	F	Okay, fine. You might hit it again in about 2 hours.

05 17 47 55	CDR	Okay.
05 17 50 37	CC	Aquarius, Houston. AFT OMNI.
05 17 50 41	CDR	I beat you to it, Houston.
05 17 50 43	CC	Yes. I thought you did, but I thought I'd say it anyway.
05 17 55 52	CC	Okay, Aquarius; Houston. That attitude looks pretty good. How's Jack getting along?
05 17 55 58	CDR	He's getting along, all set to go. And I'm going to go into PGNS ATT HOLD.
05 17 56 02	CC	Roger.
05 17 57 06	CC	Aquarius, Houston.
05 17 57 10	CDR	Go ahead.
05 17 57 11	CC	Roger. Again for fuel-consumption reasons, we'd like you to go back to the AGS mode you were in rather than PGNS ATT HOLD. Over.
05 17 57 20	CDR	Okay. I'm in PGNS MINIMUM IMPULSE right now while we're firing. And I'll go back to the AGS mode.
05 17 57 31	CC	Okay, Jim. PGNS MIN IMPULSE is okay; AGS is okay too. It's your choice.
05 17 57 37	CDR	Soon as we get rid of the service module, Joe, I think I'll be able to maneuver a lot better.
05 17 57 42	CC	Sure thing.
05 17 57 48	CDR	Okay, Jack just reported that all thrusters fired on both rings.
05 17 57 53	CC	Real fine. Real fine.
05 17 58 32	CDR	And SM JETT at 138:12.
05 17 58 43	CC	Roger. Understand; that's SM JETT, 138:12. It's not that time critical, Jim.
05 17 58 52	CDR	Can we do it at any time, Joe?

05 17 58 55	CC	I think so, but let me check. Aquarius, Houston. That's affirmative. You can jettison the service module when you are ready; no big rush, but any time.
05 17 59 14	CDR	Okay. Sounds good.
05 18 00 41	CC	Aquarius, Houston.
05 18 00 44	CDR	Go ahead.
05 18 00 45	CC	Roger. We recommend that you use the AGS for the separation maneuver, because we'd like to get the proper weight in for the DAP before we use the PGNS again.
05 18 00 59	CDR	Roger. We will. Stand by.
05 18 02 06	CDR	SM SEP.
05 18 02 09	CC	Copy that.
05 18 03 53	CDR	Do you see it, Jack?
05 18 04 26	CC	Okay, Aquarius; Houston. I recommend you terminate AVERAGE G. Over.
05 18 04 33	CDR	Okay, I've got her, Houston.
05 18 04 36	CC	Beautiful, beautiful. And for you information, Jim, you'll be coming up on an RCS caution light for helium. No sweat. Over.
05 18 04 46	CDR	And there's one whole side of that spacecraft missing.
05 18 04 50	CC	Is that right?
05 18 04 57	CDR	Right by the - Look out there, will you? Right by the high gain antenna, the whole panel is blown out, almost from the base to the engine.
05 18 05 09	CC	Copy that.
05 18 05 22	LMP	Yes, it looks like it got to the SPS bell, too, Houston.
05 18 05 28	CC	Think it zinged the SPS engine bell, huh?

05 18 05 31	LMP	That's the way it looks; unless that's just a dark brown streak. It's really a mess.
05 18 05 51	CC	Okay, Jim. We'd like you to get some pictures, but we want you to conserve RCS. Don't make unnecessary maneuvers.
05 18 06 08	CC	And, Jim; Houston. In particular, of course, we don't want any translation maneuvers.
05 18 06 16	CDR	Right on that. Joe, you realize that when I went up to the SM SEP attitude, I had to use TTCA to do it.
05 18 06 25	CC	That's affirm. We know that. That's okay.
05 18 06 50	CDR	All right. She's drifting right down in front of our windows now, Houston.
05 18 06 55	CC	Okay.
05 18 08 12	LMP	Okay, Joe, I'm now looking down the SPS bell, and it looks - looks okay on the inside; maybe it is just a streak.
05 18 08 19	CC	Okay. Copy that, Fred. Was the bell deformed on the outside or just nicked or what?
05 18 08 33	CDR	I think the explosion, from what I could see, Joe, had - had stained it. I don't know whether it did any actual deformation or not.
05 18 08 41	CC	Okay.
05 18 09 09	LMP	Man, that's unbelievable!
05 18 09 38	CDR	And, Joe, looks like a lot of - a lot of debris is just hanging out the side near the S-band antenna.
05 18 09 47	CC	Roger, Jim.
05 18 10 43	CC	Aquarius, Houston.
05 18 10 46	CDR	Go ahead.
05 18 10 47	CC	I know you're busy, but when Jack gets a chance, we'd like BAT C current and MAIN A voltage in the command module.

05 18 12 19	CDR	Houston, Aquarius.
05 18 12 21	CC	Go ahead, Aquarius.
05 18 12 23	CDR	Okay. I've pitched up to about 180 degrees now, and do you want me to go to the LM SEP attitude for his alinement?
05 18 12 30	CC	Stand by on that, Jim.
05 18 12 46	CC	Aquarius, Houston.
05 18 12 48	CDR	Go ahead.
05 18 12 49	CC	Roger. We want you to go to the service module SEP attitude.
05 18 12 54	CDR	Okay.
05 18 12 58	CC	And, Jim, when you have leisure to copy, I have your NOUN 46 and NOUN 47 DAP data load numbers.
05 18 13 08	CDR	Okay. Go ahead.
05 18 13 10	CC	Okay. NOUN 46, 31021; NOUN 47, plus 25248 and plus 09050. Over.
05 18 13 33	CDR	Roger; 31021, plus 25248, plus 09050.
05 18 13 40	CC	That's correct.
05 18 14 27	CDR	And now, Houston, do you still think that AGS is going to be less expensive than PGNS mode?
05 18 14 33	CC	That's affirmative, Jim.
05 18 14 36	CDR	Okay. I'm in AGS pulse right now. It's the ...
05 18 14 40	CC	Okay. We concur.
05 18 14 48	CDR	Going back to LM SEP attitude - or CSM SEP attitude.
05 18 14 53	CC	Roger that.
05 18 16 09	CC	Aquarius, Houston.
05 18 16 13	CDR	Stand by. Jack's on the line and he says that he can't get the computer to go into standby.

05 18 16 20	CC	Okay. Have him tell us what he's - what he looks at. And remind him that he won't see the light. He won't see the STANDBY light - -
05 18 16 31	CMP	Okay - -
05 18 16 32	CC	- - because it's not powered - -
05 18 16 33	CMP	- - Joe - -
05 18 16 34	CC	Go ahead, Jack.
05 18 16 35	CMP	Joe. Okay, I get a flashing 37, I am in PROGRAM 06. There is no STANDBY light, but when I ENTER, I don't get the three balls 62 displayed like I'm supposed to.
05 18 16 52	CC	Okay, Jack - -
05 18 16 53	CMP	And this - -
05 18 16 54	CC	Go ahead - -
05 18 16 55	CMP	- - and this occurs on both DSKYs.
05 18 16 58	CC	Okay. Understand. We're - we're thinking about it. Stand by 1.
05 18 17 09	CC	Okay, Jack; Houston. We'd like you to go VERB 37, ENTER; 06, ENTER again. Over.
05 18 17 17	CMP	Okay. In work.
05 18 17 19	CC	Okay.
05 18 18 54	CDR	Okay, Houston. I'm back in the service module SEP attitude.
05 18 19 00	CC	Okay. Copy that, Jim. Looks good. Do you know whether Jack got any pictures out of window 5? Was it still fogged up? Over.
05 18 19 09	CDR	I don't think so. I think he came right down here, because I think he saw it first in the - in the LM.
05 18 19 15	CC	Okay. Good deal. And whenever you get cleaned up, we got the entry pad and the landing area summary for you.
05 18 19 36	CMP	Okay, Vance. This is Jack.
05 18 19 39	CC	Go ahead.

05 18 19 41	CMP	Okay. Doing a VERB 37, ENTER; 06, ENTER does bring up the three balls 62 display, but I can't PROCEED on it on either DSKY and a VERB 33 doesn't work either.
05 18 19 55	CC	Okay.
05 18 19 56	CMP	It's still just a flashing 5025 with a code 00062.
05 18 20 03	CC	Okay. Copy that, Jack. Stand by 1.
05 18 20 39	CC	Jack, Houston. How long did you hold PROCEED before you quit on it?
05 18 20 49	CMP	Well, it was varying lengths. Is it suppose to be a long-time PROCEED?
05 18 20 56	CC	We think it may be, Jack. We think it may be 15 to 20 seconds, and our recommendation is that you PRO and hold it down for a good period of time, probably half a minute or more, and see if the DSKY blanks.
05 18 21 11	CMP	Okay. All right, I didn't hold it in that long. Maybe 2 or 3 seconds is the longest I held it.
05 18 21 15	CC	Okay.
05 18 21 54	CDR	Okay, Jack just came down the tunnel again and said the computer's okay.
05 18 21 57	CC	Okay. Good to hear it. And did you ever get that BAT C MAIN A reading for us?
05 18 22 05	CDR	I guess in the heat of the battle, I forgot to to give it to you, I guess. Stand by.
05 18 22 08	CC	Okay.
05 18 22 25	CDR	BAT C current was 2 amps and BAT A voltage, 30.2.
05 18 22 30	CC	Copy, 2 amps, 30.2. And that sounds good to us, Jim.
05 18 23 26	CC	Aquarius, Houston.
05 18 23 29	CDR	Go ahead.

05 18 23 30	CC	Okay. We'd like to have Jack verify that the PYROs in LOGIC are SAFE, and we'd like to remind him to do no further powerup of the CSM until EI minus 2 plus 30.
05 18 23 44	CDR	Roger. He reports that the PYROs are SAFE, and we're standing by for 02:30.
05 18 23 48	CC	Okay. Real good.
05 18 24 06	CDR	Well, I can't say that this week hasn't been filled with excitement.
05 18 24 12	CC	Well, James, if you can't take any better care of a spacecraft than that, we might not give you another one. Hey, Jim; Houston. You might ask Jack, while he's down there, to take a peek through the telescope and tell us whether he can see any stars. Over.
05 18 24 34	CDR	Okay.
05 18 26 20	CDR	Joe, Jack tells me that there's still a lot of particles floating around and he's - he can't pick out any constellation that he recognizes so far. But it might clear here in a little while.
05 18 26 30	CC	Okay, understand.
05 18 30 56	CC	Aquarius, Houston. Over.
05 18 30 59	CDR	Go ahead.
05 18 31 00	CC	Okay. EECOM is looking at that battery amperage that you gave us awhile ago. He'd like to see it about a half an amp to an amp lower. Like you to ask Jack to just check the circuit breakers and switches that he's pulled in so far and make sure he doesn't have any extra loads on MAIN A; specifically, the FLOODLIGHT configuration, and his CAUTION AND WARNING circuit breakers, and his ESSENTIAL INSTRUMENTATION POWER circuit breakers. Over.
05 18 31 35	CDR	Okay.
05 18 31 37	CC	Thanks.

05 18 34 39	CDR	Okay. Jack reported that he turned out all the floodlights.
05 18 34 45	CC	Okay. Okay, we copy that. Like to have him check the amperage on there; see what you have now, and give us a voltage reading, too.
05 18 35 05	CDR	Okay, will do.
05 18 35 33	CMP	Okay, Joe. This is Jack.
05 18 35 35	CC	Go ahead.
05 18 35 37	CMP	Okay. I've been not reading any voltage at all on BAT C, and the amperage looks like about 2 amps, but that could be kind of noise-level stuff. I've got all the floodlights off and I - Can you think of anything - I could power down to lower MAIN A.
05 18 35 53	CC	Okay. How about reading the voltage off of MAIN A?
05 18 35 57	CMP	Okay. Oh, this is Ken. Okay. Ken, it was 30.2.
05 18 36 03	CC	Okay. We're checking out the floodlights we gave you. Actually, Jack, you ought to be able to go ahead and use the lights we gave you. There's no reason to sit in the dark. They're supposed to be coming off of MAIN B, and we're checking that now.
05 18 36 19	CMP	Okay. It's not bad down there. We're in - got plenty of light. But should I be reading the voltage on BAT C?
05 18 36 39	CC	Jack, you should be reading BAT C voltage. That circuit breaker should be open.
05 18 36 46	CMP	Okay. Okay, can you think of anything else you want to get turned off to lighten load on MAIN A?
05 18 37 01	CC	Okay. We're perusing that subject right now, Jack. It's really not that big a thing, just something we wanted to dress up.
05 18 37 11	CMP	Okay.
05 18 37 57	CC	Okay, Aquarius; Houston.
05 18 38 00	CDR	Go ahead.

05 18 38 02	CC	Say, Jim, as something to try, you might have Jack turn off the RING 1's AUTO coils, which are probably on MAIN A. Have him turn those off and take a look at the readings.
05 18 38 13	CDR	Okay.
05 18 39 11	CDR	Okay. Jack has turned off RING 1 that was on MAIN A, and he's still reading 30.2 volts.
05 18 39 19	CC	Roger that, Jim. What's his amperage? Did he read that off?
05 18 39 29	CDR	I guess. He says it's down in the mud; it's less than 2 amps.
05 18 39 32	CC	Down in the mud. Okay, understand that. Request he turn them back on and - Okay, Jim, that's the AUTO coils back on RING 1, MAIN A, and when you get that done, I'd like you to copy the entry pad.
05 18 40 25	CDR	Okay, Joe. Standing by to copy the entry pad.
05 18 40 29	CC	Okay, here we come. Entry pad: Mid-Pacific, 000153; 000. The next two lines will be the GET of moonset and the Moon-check attitude; 142:38:17, 178; NOUN 61, minus 21.66, minus 165.37; 06.7; 36211, 6.51; 1168.9, 36292; 142:40:40; 00:28. The next four are N/A; D_0 is 4.00, 02:04; 00:17, 03:22, 08:14; 33, 353.1, 29.9. Boresight star is Sigma Libra, down 08.8, left 0.4; lift vector up. Comments: GDC for entry alinement, stars 31 and 23. The roll aline 041, pitch 245, yaw 024, use EMS nonexit pattern. Maintain Moon-check attitude until moonset; then go to entry attitude or track horizon with the 36-degree window mark. Last comment: constant g entry is roll right. Over.
05 18 43 46	CDR	Entry pad as follows: Mid-PAC, 000153, 000; 142:38:17, 178; minus 21.66, minus 165.37; 06.7; 36211, 6.51; 1168.9, 36292; 142:40:40; 00:28. Next four columns are N/A; D_0 is 4.00, 02:04; 00:17, 03:22 08:14; 33, 353.1, 29.9. Zebra Libra, or something like that, Beta Libra is down 08.8, left 0.4; lift vector up; GDC entry alined, stars 31, 33. Roll 041, pitch, 045, yaw 024. EMS nonexit pattern to be used;

maintain Moon-check attitude until moonset, and if all else is lost, the constant g entry is right - Roll is right.

05 18 45 08 CC Okay. Roger that, Jim. I want to verify a couple of things I'm not sure I heard you read back. The first one was Zebra Libra (laughter) that's Sigma Libra. The set stars 31 and 23. Did you get that? Over.

05 18 45 27 CDR Okay. No, I had 31 and 33, and I got Sigma Libra now, and it'll be 31 and 23 for the set stars.

05 18 45 34 CC Okay. And your GDC pitch aline, I wasn't sure whether that was - whether you read back 245 or 045. The correct number is 245. Over.

05 18 45 45 CDR Good show, because I have 045 down. 245.

05 18 45 48 CC Okay. And the Moon check here, unlike the horizon check, is on the 36-degree window mark all the way. Just wanted to repeat that.

05 18 46 08 CDR Moon check on 30-degree window mark.

05 18 46 11 CC That's 36-degree window mark, Jim.

05 18 46 14 CDR Three six. Roger.

05 18 46 16 CC Okay. Readback correct. And, Aquarius; Houston. If you want me to read you the landing area summary, I'll do that.

05 18 46 31 CDR Sounds good.

05 18 46 33 CC Okay. In the mid-Pacific landing area, the weather is good. The cloud cover is 2000, scattered; visibility, 10; winds 060 at 10; wave heights are 4 feet, and the altimeter 2986, if you care. Scattered showers less than 10 percent of the area. Recovery forces are as follows: the Iwo Jima will be at the touchdown point, the aircraft call sign will be Recovery 1, on station with swimmers on board. The - we have the constant g backup reentry area covered with the USS Hall, the Good Liberty Ship, and the other recovery aircraft whose call signs you may hear are Samoa Rescue C-130s.

05 18 47 31	CDR	Okay, fine. We have the two Jima as the prime recovery ship.
05 18 47 34	CC	That's correct.
05 18 47 37	CDR	Joe, Jack tells me he is still having trouble looking through the optics. I'm just going to pitch up a little bit more here to see if he can get into the dark spot.
05 18 47 46	CC	Okay, real fine. You might tell him when we get to that point, we have some - some stars with corresponding shaft and trunnion angles to pass to him as backups in case the computer doesn't happen to point him straight at one. And it's the Summer Triangle.
05 18 51 16	CDR	And are you tracking us, and do you have any results on that last midcourse?
05 18 51 21	CC	Stand by. It looks good. I'll try and get you numbers.

END OF TAPE

05 18 52 14	CDR	It feels nice to use the hand controller again.
05 18 52 19	CC	Go ahead, Aquarius.
05 18 52 22	CDR	I just said, Joe, it feels nice to use the hand controller again.
05 18 52 25	CC	Oh. Roger that. FIDO says he's got you nailed within a half a foot per second; the midcourse looked real good.
05 18 52 33	CDR	Okay.
05 18 52 35	CC	And I've got two things we'd like Jack to do in the command module to ease the load on MAIN A. One of them is to verify or turn the CM/RCS HEATER switch to OFF. We're done with that, and even though the circuit breakers are pulled, the switches might be drawing a little current. And the second one is, we'd like him to turn SCS LOGIC POWER 2/3 to OFF; we don't need it now. It's called up in the checklist at the appropriate time, and we'd like him to turn that off. Over.
05 18 53 20	CDR	Okay. I'll tell Jack to check that the CM/RCS HEATER switch is off, and, if not, we'll turn it off; and also to turn off the SCS LOGIC POWER 2/3 switch, OFF, since it comes up later in the checklist.
05 18 53 34	CC	That's correct.
05 18 54 14	CDR	Houston, Aquarius. We're recording MAIN A voltage up to 31.0.
05 18 54 19	CC	Roger. That's 31.0. We're smiling.
05 18 59 10	CDR	Houston, Aquarius.
05 18 59 11	CC	Go, Aquarius.
05 18 59 14	CDR	Okay. How about if I hold a pitch attitude of about 115 instead of about 91. I think Jack can use the optics a little bit better at that angle.
05 18 59 28	CC	Jim, that's perfectly okay with us, if it looks good for stars.

05 18 59 35	CDR	He just looked at them briefly; I'll go down and look at them a little bit better here.
05 18 59 41	CC	Okay. With the new attitude, our shaft and trunnion angles we were going to pass him don't mean anything, but it's more important to have a good star field.
05 19 09 45	CC	Aquarius, Houston.
05 19 09 48	CDR	Go ahead.
05 19 09 49	CC	Okay, Jim. We - We've been talking about your going to a different attitude than the pad attitude for better star field vision out the command module, and what we'd like to have you do is this. If you can predict now or sometime soon, what attitude it is that you would like to hold at that time, and go to that attitude now, we'd like to be able to compute the coarse aline gimbal angles for the CSM, and we can do that if you go to the selected attitude, hold it, call up a VERB 06 NOUN 20, and read us your LM gimbal angles, we can take those and compute CSM coarse aline gimbal angles on the assumption that, when we get back into the CSM coarse aline, you will return to that selected attitude. Does that sound okay? Over.
05 19 10 46	CDR	Yes. I'll try to hold the attitude we select directly, while you're giving us the coarse aline attitude. We're not too sure what - what's the best attitude. I'm going to ask Jack again if 115 is sufficient for him.
05 19 11 02	CC	Okay. You can take some time figuring out the best attitude, and then you won't have to hold it all the way from now until then, if you just get back to it.
05 19 12 58	CDR	Houston, Jack would like to know what constellations are in his sextant, or scanning telescope, field of view at an attitude of about 105 pitch, zero roll, zero yaw. Can you give that to us?
05 19 13 15	CC	Okay. We'll sure give it a go. As I said, we - We have some stars. They're not - They're not centered with the shaft and trunnion zero. Let us take a quick look at 105 pitch, shaft and trunnion zero, and see if we can get you an answer.

05 19 13 52	CC	Aquarius, Houston.
05 19 13 55	CDR	Go ahead.
05 19 13 56	CC	Roger. These - None of these stars will be exactly centered, but, at a pitch attitude of 115, we had computed that Vega, Altair, Rasalhague, and Deneb would all be in the telescope field of view, and the first three were also in view at the 91-degree pitch, so he should be able to see one or more of those four stars. Over.
05 19 14 30	CDR	Okay. Thank you, very much.
05 19 14 33	CC	Okay. And, Jim, I can give shaft and trunnions if - if he's interested.
05 19 14 42	CDR	Okay. Why don't you give us the shaft and trunnion for - say, Altair at 115, and I'll go up there, and I'll see if he can pick it up.
05 19 14 52	CC	Okay. Real fine. At 115 degrees of pitch, Altair, shaft 274, trunnion 22.2. Over.
05 19 15 08	CDR	Roger. Shaft is 274, trunnion 22.2.
05 19 15 11	CC	That's affirm.
05 19 15 44	CC	Aquarius, Houston.
05 19 15 47	CDR	Go ahead, Joe.
05 19 15 48	CC	Okay, Jim. In the LM, there we have - We show battery 3 only drawing about an amp, and we think it's probably time to get it off the line; battery 3 to OFF/RESET. Over.
05 19 16 10	CDR	Battery 3 is OFF/RESET.
05 19 16 12	CC	Okay.
05 19 16 19	CDR	Just how's our power consumption, Houston, just out of curiosity?
05 19 16 25	CC	I'll verify it, Jim. I'm sure it's okay.
05 19 16 47	CC	Okay, Aquarius; Houston. With the present amount of power you've got in the LM, which is over 500 amp-hours, and the rate you're using them, we figure you've got almost 12 hours of power left.

05 19 17 04	CDR	Twelve hours, huh? We could reenter with it.
05 19 17 06	CC	That's affirm.
05 19 17 15	CC	That's enough for two touch-and-goes and a full stop, Jim.
05 19 17 24	CDR	That's right, Joe; if you could dig a crater like Cone Crater, I could might hit it.
05 19 17 30	CC	(Laughter) Okay.
05 19 17 33	CDR	Jack reports that he thinks he can see Altair.
05 19 17 36	CC	Very good.
05 19 17 40	CDR	He says, he thinks he can see Altair.
05 19 17 44	CC	Okay. I'll take back the "very," but I'll leave the "good."
05 19 21 22	CDR	Houston, Aquarius.
05 19 21 25	CC	Aquarius, Houston. Go.
05 19 21 30	CDR	I ran back there to take a look and see what I could see in the - in the scanning telescope. It looks pretty grim back there right now. It might be that we have to go with the coarse aline, and maybe computation of some fine aline docking angles, if we have time.
05 19 21 46	CC	Okay. We'd like to do that, too. Wait a minute; stand by, Jim.
05 19 23 28	CC	Aquarius, Houston. How do you read?
05 19 23 31	CDR	I read you loud and clear.
05 19 23 32	CC	Okay. What we'd like to do, Jim, is - We'll go ahead and get the coarse aline to the gimbal angles that - that you're going to be holding for us; and we'll get the platform up, and then when you call P52 and you use PICAPAR, it probably won't be close enough to put the star in the sextant, but if you can see any kind of a bright star in the general vicinity, - and like general vicinity, I mean 2 to 3 degrees from the center of the telescope, so that you have some clue as to which way to go, then the identification problem shouldn't present much of a - of a

difficulty. And once you get the thing in the sextant, then you can go ahead and treat it like any other PICAPAR.

05 19 24 18 CDR That sounds great, Ken. One little problem: there's all sorts of bright objects floating around us, and also that just staring at part of Aquarius; it's just reflecting light like mad. We can give it a try. There's no problem there; if we can see it, we'll get it.

05 19 24 38 CC Okay. And in - in the event that that doesn't work, we're standing by with the original scheme, a set of LM FDAI angles to fly to that'll point the command module optics at the Moon and the Sun; so we can always go back to that.

05 19 24 53 CDR Okay.

05 19 25 10 CC And, Aquarius, Houston. We'd like you to verify the SUIT RELIEF valve to closed. Over.

05 19 25 18 CDR Stand by. It's closed.

05 19 25 25 CC Okay.

05 19 31 05 CDR Okay, Houston; Aquarius.

05 19 31 07 CC Aquarius, Houston. Go.

05 19 31 09 CDR We'll go with your original 91-degree angle, if you have the stars figured out, and the coarse aline angle for it.

05 19 31 18 CC Okay. Roger that, Jim. Then at - at your convenience here, we'd like you to go to that attitude, as close as you can get, and call up a NOUN 20 for us.

05 19 31 31 CDR Okay. In work now.

05 19 31 33 CC Okay.

05 19 34 58 CDR Houston, Aquarius.

05 19 35 02 CC Go ahead, Aquarius.

05 19 35 05 CDR Okay. I take it that, if - if Jack cannot see stars at this attitude after you give him the coarse aline angles, we're just not going to

read down to you our gimbal angles and have you figure out a target angle for Jack, but you want him to do sighting on the Moon and the Sun. Is that correct?

05 19 35 26	CC	That's roughly correct, Jim. Jack will coarse aline at that attitude. This is what we're having you maneuver to the - to that attitude for. We're going to compute coarse aline gimbal angles and pass them up to him, and the first thing he'll do when he gets there, per his checklist, is to coarse aline his platform. Then he'll go into the P52, and, if he can't see stars, we will quickly pass up to you the - your FDAI angles to put him in the Moon-view attitude, and he'll do his P52 on the Moon, and then have you maneuver on the Sun and complete the P52 of the Sun.
05 19 36 11	CDR	Okay. But I'm going to have to maneuver to the Moon to help him out.
05 19 36 15	CC	Oh. That's - That's affirmative. If he can't see stars at the - at the SEP attitude that - that you'll be holding, you'll have to maneuver to the Moon attitude and then to the Sun attitude for him.
05 19 37 26	CC	Aquarius, Houston.
05 19 37 29	CDR	Go ahead.
05 19 37 30	CC	Just like to mention that, even if, for some reason, we run out of time or something and don't complete the Moon-Sun P52, Jack will have a platform coarse aline to the entry REFSMMAT, which we feel will be plenty good enough.
05 19 37 46	CDR	Roger. That's my feelings, too.
05 19 37 48	CC	Okay.
05 19 50 45	CC	Aquarius, Houston.
05 19 50 49	CDR	Hello there, Houston.
05 19 50 50	CC	Hi! Jim, we - We've gone ahead and computed the CSM coarse aline gimbal angles based on your being at the service module SEP attitude at the time that Jack cranks up the computer and - and coarse alines the IMU. That is, we assume that

you're going to be at roll, 0; pitch, 091; yaw, 0; and, if you concur on that, I'd like to pass up the angles for - for Jack to have.

05 19 51 27	CDR	Okay. I'll be there to the best of my ability.
05 19 51 30	CC	Good show. You ready to copy?
05 19 51 38	CDR	Go ahead.
05 19 51 40	CC	Okay. CSM coarse aline angles: ROLL, plus 298.95; PITCH, plus 271.30; YAW, plus 000.20.
05 19 52 11	CDR	Okay. The command module angles will be: ROLL, 298.95; PITCH, 271.30; and YAW, 000.20.
05 19 52 21	CC	That's affirmative, and that's for his VERB 41 NOUN 20 when he gets there.
05 20 00 50	CC	Aquarius, Houston. Over.
05 20 00 53	CDR	Go ahead, Houston; Aquarius here.
05 20 00 55	CC	Okay, Jim. We're getting about 9 minutes from the commencement of command module powerup, and we wanted to just mention to you for Jack's benefit that, although the batteries are looking real good, in case they're cool and have a little difficulty hacking the load just at first, we'd like him to monitor main bus voltage to 24 volts or above during the powerup procedure and, if it falls below, we'll have a couple of circuit breakers for him that - that will solve the problem.
05 20 01 33	CDR	Okay. And I take it you're also monitoring main bus voltage.
05 20 01 38	CC	Negative. Not in the command module at this time, because we don't call up telemetry until a little bit later on.
05 20 01 44	CDR	Ah so. That's right; I forgot. Okay. I will tell him.
05 20 01 47	CC	Thank you.
05 20 09 48	CC	Aquarius, Houston.
05 20 09 51	CDR	Go ahead.

05 20 09 52	CC	Okay. You're GO to start powering up the command module.
05 20 09 56	CDR	Right-o. We're starting now.
05 20 09 58	CC	Okay.
05 20 10 32	LMP	Okay. We have LM power breakers.
05 20 11 20	LMP	Okay. Houston, you're looking at it.
05 20 11 24	CC	Okay. Roger. Stand by.
05 20 11 34	CC	Okay. Press on, Fred.
05 20 11 39	LMP	Okay.
05 20 12 10	LMP	Okay. That's - That's it, Joe.
05 20 12 17	CC	Okay. Real good.
05 20 16 23	CC	Aquarius, Houston.
05 20 16 26	CDR	Go ahead.
05 20 16 27	CC	Roger. We have command module AOS. Request OMNI Charlie in the CM. Over.
05 20 16 33	CDR	OMNI Charlie. Okay. Standby.
05 20 16 45	CDR	Coming up.
05 20 16 46	CC	Okay.
05 20 16 54	CDR	That was sent through a new onboard communication system known as yelling through the tunnel.
05 20 17 00	CC	(Laughter) The one MC.
05 20 17 08	CDR	I've got Fred up there with Jack now helping to power up the CM, and I'm staying down in good old Aquarius.
05 20 17 16	CC	Understand, Jim.
05 20 21 13	CC	Aquarius, Houston.
05 20 21 16	CDR	Go ahead.
05 20 21 17	CC	Just to inform you. We've got data from the - from Odyssey, and it looks good.

05 20 21 22	CDR	Hey, great.
05 20 21 33	CDR	Houston, Aquarius. Odyssey is trying to call. Can you read them?
05 20 21 36	CC	Negative. Don't read Odyssey yet; has he got his intercom panel configured?
05 20 21 41	CDR	I'll doublecheck. They're hearing you.
05 20 21 49	CC	Okay. Good deal. I don't hear them, yet.
05 20 22 01	CDR	Are you ready for an E-MEMORY dump, VERB 74?
05 20 22 07	CC	Stand by for just 1 minute, Jim.
05 20 22 42	CDR	We've got a lot of things to do, Houston.
05 20 22 45	CC	I know it. Okay, Aquarius; Houston. Recommend in Odyssey that he switch the POWER AMPLIFIER to LOW. Over.
05 20 22 54	CDR	POWER AMPLIFIER to LOW.
05 20 23 02	CDR	It's been switched to LOW, Houston.
05 20 23 05	CC	Roger. Okay. Verify the POWER AMP talkback is gray, Jim.
05 20 23 13	CDR	Okay. That's verified.
05 20 23 24	CC	Okay.

END OF TAPE

05 20 24 13	CC	Aquarius, Houston.
05 20 24 15	CDR	Go ahead.
05 20 24 16	CC	We have high bit rate; we are standing by for the VERB 74 ENTER and the E-MOD dump.
05 20 24 22	CDR	Roger. Thank you.
05 20 24 25	CMP	Joe, how do you read?
05 20 24 26	CC	Okay. Read you, babe.
05 20 24 29	CMP	Okay. Loud and clear. VERB 74 coming down.
05 20 24 39	CC	Okay. Copy that, Jack.
05 20 24 43	CMP	And I'll be ready for your P27 update.
05 20 24 47	CC	Okay.
05 20 24 51	CMP	And I'm in ACCEPT.
05 20 24 54	CC	Okay. Understand you are in POO and ACCEPT. Verify OMNI Charlie.
05 20 25 04	CMP	Okay. Joe, we are OMNI Charlie. We have little bit better signal strength on another OMNI.
05 20 25 10	CC	Okay. Stand by.
05 20 25 23	CC	Okay, Odyssey; Houston. Select your own best OMNI and then repeat VERB 74 ENTER. Over.
05 20 26 50	CC	Okay, Odyssey; Houston. We are locked on solid high bit rate now; repeat the VERB 74 ENTER. Over. Delay that; hold the VERB 74 1 minute. Wait.
05 20 27 02	CMP	You're too late, Joe; it's coming down.
05 20 27 31	CC	Okay, Odyssey; Houston.
05 20 27 36	LMP	Go ahead.
05 20 27 37	CC	Okay. We are going to skip the E-MOD dump for right now and get the uplink in.
05 20 27 43	LMP	Okay. POO and ACCEPT.

05 20 27 44	CC	Okay. POO and ACCEPT. And, Jack, you can go ahead with the IMU and optics powerup. Over.
05 20 27 54	LMP	Roger. It's in work.
05 20 27 56	CC	Okay.
05 20 35 13	LMP	... unable to read any BAT B voltage. We do have current, though, on BAT B.
05 20 35 25	CC	Okay. Copy that, Fred.
05 20 35 28	LMP	Why don't you check?
05 20 35 38	CC	You're looking good on the ground, Odyssey.
05 20 35 41	LMP	Okay.
05 20 35 45	CC	And I think the reason you don't read voltage is it's a circuit breaker that we have called as being out.
05 20 35 53	LMP	All right.
05 20 36 56	CC	Odyssey, Houston. The uplink is going well. We have one more load to get in.
05 20 37 02	LMP	Okay. Real fine.
05 20 39 09	CMP	Is the computer mine now, Joe?
05 20 39 13	CC	Stand by 1 second.
05 20 40 02	CC	Okay, Jack. We'd like the VERB 74 ENTER, and it'll take less than a minute for E-MOD dump.
05 20 40 10	CMP	Coming down.
05 20 40 20	CC	And, Jack, Houston. It'll be 100 seconds on that.
05 20 40 26	CMP	Okay. Can I go to BLOCK on the UP TELEMETRY?
05 20 40 29	CC	Not just yet, Jack.
05 20 40 55	CC	Odyssey, Houston. You can go to UP TEL BLOCK. Over.
05 20 41 01	CMP	UP TEL BLOCK and the computer is mine.
05 20 41 03	CC	Not yet, Jack. We're still in the E-MOD dump. And, Aquarius, Houston.

05 20 41 14	CDR	Go ahead, Houston.
05 20 41 16	CC	Okay. We're coming up on time for the coarse aline, Jim, so you can hold your attitude real good.
05 20 41 23	CDR	Roger.
05 20 41 25	CC	And, Odyssey, Houston. The computer is yours. You can press on.
05 20 41 30	CMP	Okay.
05 20 43 13	CDR	Houston, Aquarius.
05 20 43 17	CC	Aquarius, Houston. Go ahead.
05 20 43 18	CDR	Roger. He just did the coarse aline. I'm going to the jettison attitude.
05 20 43 23	CC	Copy that.
05 20 43 37	CC	Aquarius, Houston. I copied that you - that he's completed the coarse aline; he's going into the P52 now? Is that right?
05 20 43 54	CDR	Let me check. I think he is.
05 20 43 56	CC	Okay. You're staying at your present attitude, aren't you?
05 20 44 03	CDR	Yes. We'll - I'll stay in the present attitude.
05 20 44 05	CC	Roger that.
05 20 44 26	CMP	Okay, Houston. I got a 220 alarm here. ...
05 20 44 34	CC	Roger that.
05 20 44 37	CMP	... ...
05 20 44 55	CC	Odyssey, Houston. Have you set the drift light and the REFSMMAT light? Over.
05 20 45 07	CC	Odyssey, Houston.
05 20 45 12	CMP	... flag.
05 20 45 15	CC	You were noisy; I didn't copy. Have you set the drift and REFSMMAT flag?

05 20 48 04	CMP	Okay, Joe. I don't have a star in the sextant. I'm going to hunt for it in a minute.
05 20 48 09	CC	Roger that, Jack.
05 20 49 23	CMP	Okay, Joe. Can you give me any stars that I might try here?
05 20 49 28	CC	That's affirmative. Vega and Altair should be good. Vega is 36, Altair is 40.
05 20 49 36	CMP	Okay. We'll give that a try.
05 20 49 38	CC	Okay. And you might look for them in the telescope if they're not in the sextant right off. They should be close to the crosshairs.
05 20 49 45	CMP	Okay. I got all that material that's venting from the bottom of the command module.
05 20 49 53	CC	Roger that.
05 20 52 07	CDR	I have an RCS light, Houston.
05 20 52 16	CC	Okay, Jim. That's the one we warned you about some time ago. Low helium; no sweat.
05 20 52 22	CDR	Oh, okay.
05 20 52 39	CMP	Okay, Houston. There's a star angle difference with stars 36 and 40.
05 20 52 46	CC	How about that, baby.
05 20 52 49	CMP	An odd maneuver, Houston.
05 20 52 52	CC	Roger that. Copy you're maneuvering to the LM JETT attitude. Is that right?
05 20 52 58	CMP	That's affirm - -
05 20 52 59	CDR	That's affirm.
05 20 53 00	CMP	I'm going to torque those gimbal angles.
05 20 53 05	CC	Torque them, babe, full stroke gimbal.
05 20 53 07	CMP	There it is. Okay. I'll do a star check.
05 20 53 10	CC	Okay.

05 20 53 27	CC	Okay, Odyssey. You're suddenly ahead of the time line.
05 20 53 53	CC	Odyssey, Houston. Request OMNI Bravo.
05 20 54 06	CMP	I am OMNI Bravo, Jim.
05 20 54 08	CC	Okay.
05 20 54 18	CMP	Okay, Houston. The sextant star check passes.
05 20 54 25	CC	Say again, Jack.
05 20 54 28	CMP	I did a star check, and it passes. It puts that star right in the telescope.
05 20 54 35	CC	Good enough. You can press on in the checklist, Jack.
05 20 54 56	CC	Find out LM gimbal lock, Jim.
05 20 54 59	CDR	It's the command module's gimbal lock I'm worried about.
05 20 55 03	CC	(Laughter) Okay.
05 20 55 28	CC	Aquarius, Houston.
05 20 55 30	CDR	Go ahead.
05 20 55 31	CC	Roger. If you concur, we would be inclined to recommend that you go to AGS for the maneuver because you'll have to be there later on anyway.
05 20 55 41	CDR	Okay.
05 20 55 43	CC	And AGS PULSE is the recommendation.
05 20 55 46	CDR	We're having trouble maneuvering, Joe, without getting it in gimbal lock.
05 20 55 50	CC	Okay. You can - -
05 20 55 51	CDR	You picked a lousy attitude, though, to separate.
05 20 55 55	CC	Well, we apologize. Just take your time. Jim, we've got time now.
05 20 56 01	CDR	Okay.

05 20 56 28	CDR	Houston, why can't I stay in PGNS ATT HOLD for the LM attitude hold?
05 20 56 38	CC	Stand by on that, Jim.
05 20 57 34	CC	Aquarius, Houston. Over.
05 20 57 36	CDR	Go ahead.
05 20 57 38	CC	Okay. Our recommendation is that you stay in AGS for the LM JETT simply because we've thought it through. We've got the right deadbands and all set up. Over.
05 20 57 49	CDR	Okay. It's a lot easier for me to maneuver in PGNS, Joe, than it is AGS.
05 20 57 56	CC	Yes. You can maneuver in PGNS, Jim. I'm sorry, I thought you were talking about the ATT HOLD and the LM JETT afterward. You can maneuver in PGNS if you want to.
05 20 58 22	CDR	I want to get way over here, Joe. To prevent him into gimbal lock, I have the yaw at about - I'd say about almost 50 degrees.
05 20 58 35	CC	Roger that. Just stay out of gimbal lock and that 45-degree isn't critical - the out of plane, that is.
05 20 59 05	CC	Odyssey, Houston. Request OMNI Charlie.
05 20 59 10	CMP	Okay. Going OMNI Charlie.
05 20 59 11	CC	Thank you.
05 20 59 12	CMP	There.
05 20 59 13	CC	Okay. Good.
05 21 00 20	CC	Roger. That's VERB 46. Roger. Aquarius, Houston.
05 21 00 31	CDR	Go ahead.
05 21 00 32	CC	Okay, Jim. The particular DAP configuration we have set up now is using more fuel than we'd like out of system B. We'd like you to reconfigure the DAP to 30021. Over.
05 21 00 57	CC	Thank you.

05 21 01 35	CC	Odyssey, Houston.
05 21 01 36	CMP	Go ahead.
05 21 01 39	CC	We'd like to have you turn the optics power off until you need them again, and we would like to have you check the RCS ring 1 and 2 temps for us. Over.
05 21 01 52	CMP	Optics power going off.
05 21 01 54	CC	Okay.
05 21 02 05	CMP	Okay, Joe. Our ring 1 is 50; ring 2 is plus 42.
05 21 02 09	CC	Ring 1 is 50; copy. What was the other?
05 21 02 13	CMP	42.
05 21 02 15	CC	Got it. Thank you.
05 21 02 22	CDR	Okay, Houston; Aquarius. I am at the LM SEP attitude and I'm planning on bailing out.
05 21 02 32	CC	Okay. I can't think of a better idea, Jim.
05 21 02 36	CDR	I'll go to AGS ATT HOLD, if you want me to.
05 21 02 40	CC	We recommend that, Jim.
05 21 02 54	CC	Okay, Aquarius; Houston. In AGS ATT HOLD, we recommend WIDE DEADBAND. Over.
05 21 03 01	CDR	I'm in the AGS DEADBAND.
05 21 03 04	CC	Roger.
05 21 03 35	CC	Aquarius, Houston. Don't forget the ...
05 21 03 53	LMP	You need to relay something downstairs, Jim?
05 21 04 00	CC	Odyssey, Houston.
05 21 04 03	CMP	Go ahead, Joe.
05 21 04 04	CC	Okay. Our troops would like to have you go to the SYSTEMS TEST METER and read out the injector temps on RCS for us.
05 21 04 12	CMP	Okay. Okay. In work.

05 21 04 49	CMP	Okay, Houston. Let me read out the injector temperatures for you.
05 21 04 53	CC	Go ahead.
05 21 04 57	CMP	5 Charlie, 4.2; 5 Dog, 4.6; 6 Alfa, 4.3; 6 Bravo, 4.3; 6 Charlie, 3.6; 6 Dog, 3.6.
05 21 05 19	CC	Okay. Copy that. No complaints.
05 21 05 32	CMP	Okay. We're ready to proceed with hatch closeup.
05 21 05 35	CC	Okay. Did Jim get the film out of Aquarius?
05 21 05 43	CMP	Yes. We - You mean the film we took this morning?
05 21 05 46	CC	That's affirm.
05 21 05 48	CMP	Yes. We've transferred that.
05 21 05 50	CC	Okay. Good deal. Jack, let me mention something about the hatch integrity check. You're going to vent the tunnel until you get a 3-psi DELTA-P. That should take 9 or 10 minutes, and it's our firm feeling that you don't have to wait another 10 minutes after that for a leak check. If it holds pressure for a minute or so or even gets down there, you know you've got a good hatch. Over.
05 21 06 16	CMP	Okay. Copy that.
05 21 06 18	CC	Okay.
05 21 12 42	CMP	Okay, Houston. We've got an O_2 FLOW HIGH.
05 21 12 47	CC	Okay, Jack, are you -
05 21 12 53	CMP	Well, we might be pressurizing a lot of the system that was not pressurized.
05 21 12 59	CC	Roger. I expect that's the case. Let us check it.
05 21 13 04	CMP	Okay. Take a good look at CABIN.
05 21 13 07	CC	Will do.
05 21 13 28	CC	Odyssey, Houston. Just verify your DIRECT O_2 is OFF. Over.
05 21 13 37	CMP	Yes, sir. That is verified.

05 21 13 38	CC	Okay, and - -
05 21 13 39	CDR	... It's dropping now, Joe.
05 21 13 43	CC	Roger. We think that you were just pressurizing the cabin up to that regulator's particular SPEC.
05 21 15 14	CC	Odyssey, Houston.
05 21 15 18	CMP/CDR	Go ahead.
05 21 15 19	CC	Okay. We're observing middle gimbal angle getting a little bit high. The LM appears to be deadbanding okay within its attitude, but just wanted you to know that we're keeping an eye on it and if it does get too high, we might want you to punch off early.
05 21 15 32	CMP	Okay.
05 21 15 36	CC	And verify that the hatch is secured and that you are venting the tunnel. Over.
05 21 15 42	CMP	That's verified. We have a DELTA-P of 2.8.
05 21 15 46	CC	Real good. Real good.
05 21 16 27	CMP	Okay, Joe. Since we're ahead of the time line, can I proceed on and kind of punch off early, or do you want me to punch off at exactly 1 hour?
05 21 16 35	CC	Jack, when you are comfortably ready to punch off, you can go ahead and do it.
05 21 17 49	CC	Odyssey, Houston. We just had a formal GO for LM JETT at your convenience. Over.
05 21 17 57	CMP	Okay. Thanks, Joe.
05 21 17 58	CC	Okay.
05 21 18 25	CC	Okay, Odyssey; Houston. We're ready for you to bring the BMAGs ON and WARM UP and all other things being equal, we'd like you to go through the LM JETT at - on the checklist you've got. And that is BMAGs 1 - -
05 21 18 38	CMP	Okay. Will do.
05 21 18 40	CC	- - 1. That's BMAG 1 now, as you know.

05 21 18 45	CMP	Yes, BMAG 1 is in WARM UP.
05 21 18 47	CC	Good deal.
05 21 20 17	CMP	Okay, Houston. Do you have a command module weight for me?
05 21 20 24	CC	Stand by 1, Jack.
05 21 20 43	CC	Odyssey, Houston.
05 21 20 47	CMP	Go ahead.
05 21 20 48	CC	Okay. I'm reminded that the entry DAP is all you've got. It'll initialize itself, and you won't have an - you won't have an RCS DAP, so you don't have to fool with it.
05 21 20 59	CMP	Okay.
05 21 22 12	CMP	Okay, Joe. I'm - Have you got your checklist out there on the SPS powerup?
05 21 22 17	CC	That's affirm.
05 21 22 19	CMP	Okay. I'm coming down here to a step that says FDAI POWER, off. Is that what you want right now, I guess, huh?
05 21 22 28	CC	Go ahead.
05 21 22 29	CC	Okay, Jack. That FDAI POWER, OFF, is to stop momentary gliches as you bring up the BMAG to put it on, and you turn right around and put the FDAI POWER right back on 1.
05 21 22 44	CMP	Okay. And I don't have the BMAG TEMP light out yet. Do you want me to go ahead and put the BMAG ON with the TEMP light still ON?
05 21 22 50	CC	That's affirm. We can go ahead and you'll have a good stable rate.
05 21 22 55	CMP	All right. Let's do it.
05 21 26 38	CMP	Okay, Houston. We'll punch off at 141 plus 30.
05 21 26 43	CC	Okay, Jack. We copy and we concur.
05 21 28 21	CMP	Okay, Houston. Do we have a GO for PYRO ARM?
05 21 28 34	CC	Odyssey, Houston. We can give you a GO if you'll put the LOGIC ON momentarily first.

05 21 28 41	CMP	Okay. The SECS LOGIC is on.
05 21 28 42	CC	Okay. Just copied that, and you are GO for PYRO ARM.
05 21 28 47	CMP	Real fine.
05 21 29 51	CMP	10 seconds.
05 21 29 56	CDR	Five. LM jettison.
05 21 30 05	CC	Okay, copy that. Farewell, Aquarius, and we thank you.
05 21 30 21	CC	Watch gimbal lock there, Jack.
05 21 30 24	CMP	Yes, we did.
05 21 31 52	CC	Odyssey, Houston. Request OMNI Bravo.
05 21 36 03	CC	Odyssey, Houston.
05 21 36 05	CMP	Go ahead.
05 21 36 06	CC	Okay, Jack. We'll have a pad for you in a few minutes. We're getting data now on the tracking, and although we suspect the changes from your preliminary pad will be very small, we recommend that you hold off on initializing the EMS until we get you the final pad. Over.
05 21 36 23	CMP	Okay. Will do.
05 21 36 25	CC	Roger.
05 21 37 20	CMP	Okay, Houston. The sextant star check passes.
05 21 37 23	CC	Houston, copy. Good show. That was some P52, Jack.
05 21 37 35	CMP	Yes. I was kind of lucky, I guess.
05 21 37 41	CC	Give you a big gold star for that.
05 21 37 44	CMP	Thank you.
05 21 38 15	CMP	Hey, Joe. We're standing by to copy your new pad.
05 21 38 18	CC	Okay, Jack. It'll be a few minutes yet. We want to get it right up to speed.

05 21 38 43	CMP	Okay. I can proceed with EMS check, can't I, Joe?
05 21 38 46	CC	That's affirmative, Jack. You can go ahead with that.
05 21 46 48	CC	Odyssey, Houston. Over.
05 21 46 51	CDR	Go ahead, Houston.
05 21 46 53	CC	Okay, Jim. Your CABIN is looking real good. We recommend you turn the SUIT COMPRESSOR to OFF now. Over.
05 21 47 00	CDR	Going OFF. Boy, it's nice and quiet in here.
05 21 47 09	CC	Okay, real good. Incidentally, your power is looking real good also, Jim.
05 21 47 16	CDR	Thank you.
05 21 48 12	CC	Odyssey, Houston. I have your final entry pad when you are ready.
05 21 48 22	CDR	Okay, Houston. Ready to copy.
05 21 48 23	CC	Okay. Mid-PAC, 000152, 000; 142:38:19, 178; and you recall that's GET moonset and Moon-check attitude. NOUN 61, minus 21.66, minus 165.37; 05.2; 3621.1, 6.20; 1119.7, 36291; 142:40:46; 00:30; the next four are N/A; D_0 is 4.00, 02:20; 00:19, 03:38, 07:59. The rest of the pad is N/A for this one. You are lift vector up at the very bottom. And the remarks all remain the same; if you want me to copy them, let me know; otherwise, you can read back. Over.
05 21 50 02	CDR	Okay. Entry pad as follows: Mid-PAC, 000152, 000; 142:38:19, 178; minus 21.66, minus 165.37; 05.2; 3621.1, 6.20; 1119.7, 36291; 142:40:46; 00:30; all the D_Ls are N/A. D_0 is 4.00, 02:20; 00:19, 03:38, 07:59. All the rest are N/A, except lift vector which is up; and I have the the ...
05 21 50 51	CC	Okay, Jim. That's a tiny hair shallower than we had you before, but it's based on solid tracking, and it still is lift vector up comfortably.

05 21 51 06	CDR	Roger. We never did bring that angle up, did we?
05 21 51 12	CC	No, actually, we didn't.

END OF TAPE

05 22 00 42	CC	Odyssey, Houston. Over.
05 22 00 44	CMP	Go ahead.
05 22 00 45	CC	Okay, Jack. We'd like POO and ACCEPT for your final state vector.
05 22 00 55	CDR	You've got it.
05 22 01 04	CC	And, Odyssey, Houston. We're also sending you a final PIPA bias update and clock increment. Over.
05 22 01 12	CDR	Okay. Fine; thank you. Joe. How does the LM look? Are you still tracking it?
05 22 01 17	CC	All I've heard was that it's - that the cabin was holding pressure. I haven't heard anything more. And, Odyssey, we're ready for you to warm up the BMAG number 2's at your discretion and we're curious whether the Moon check attitude is good. Over.
05 22 01 43	CMP	Yes, Joe, it's coming down. I got just about 45 degrees now and it's coming on down.
05 22 01 50	CC	Roger that.
05 22 06 12	CC	Odyssey, Houston. The computer is yours. Over.
05 22 06 15	CMP	Okay. Thanks, Joe.
05 22 07 06	CMP	Okay, Joe. The Moon is coming down to about 38 degrees. ... - -
05 22 07 10	CC	Okay, Jack. Sounds real good.
05 22 09 00	CC	Odyssey, Houston.
05 22 09 02	CDR	Go ahead.
05 22 09 03	CC	Okay. We'd like the S-BAND POWER AMPLIFIER to OFF, center, at this time, Jim.
05 22 09 11	CDR	OFF, center, is done.
05 22 09 14	CC	Okay. You're still looking real fat on power. We show you having over 30 amps on the water.

If you do get into a bind and don't come up - that's amp-hours - don't come up with Recovery, you can always power down and you can always put the pyro batteries on the line if you need them after you're down.

05 22 09 35	CDR	Okay.
05 22 17 54	CMP	Joe, are you planning to run this all the way down without the suit compressor?
05 22 18 00	CC	Say again, Jack.
05 22 18 02	CMP	Are you planning to turn on the suit compressor at all on the way down?
05 22 18 07	CC	That's a negative, Jack; I'll verify it, but I sure don't think so.
05 22 18 11	CMP	Okay. That's all right with us.
05 22 18 22	CC	Okay, Jack. This is Houston. We've got POWER, and you can cycle it for 10 minutes if you so desire, but we don't think you need to do it. Over.
05 22 18 31	CMP	Okay. We'll hold out.
05 22 18 33	CC	Okay. Real fine. How did the EMS check go, Jack?
05 22 18 36	CMP	EMS checked out okay - -
05 22 18 39	CC	Good deal.
05 22 18 40	CMP	- - been initialized and sitting on ENTRY.
05 22 18 42	CC	Roger.
05 22 20 21	CMP	Okay, Joe. Are you watching - you and FIDO taking a look at our NOUN 60 here?
05 22 20 26	CC	That's affirmative. Hold it just a second; we are looking at 6.13 and 4.80. I'll get a check on that.
05 22 20 37	CMP	Okay. That's not too many g's.
05 22 20 41	CC	Jack, FIDO says that's okay.
05 22 20 45	CMP	Okay.

05 22 21 21	CC	Jack, Houston. Your EDUN 63 looks good to us also.
05 22 21 25	CMP	Okay.
05 22 22 08	CMP	Joe, how far out do you show us now?
05 22 22 12	CC	Oh, on our plotboard up here, we can't hardly see how far out you are.
05 22 22 19	CMP	Okay.
05 22 22 28	CMP	I know all of us here want to thank all you guys down there for the very fine job you did.
05 22 22 36	CDR	That's affirm, Joe.
05 22 22 38	CC	I'll tell you - We all had a good time doing it.
05 22 22 56	CC	Okay, Odyssey; Houston. Just for your information, it looks as though battery C will deplete around main chute time; that's expected; you've got plenty of amp-hours in the other batteries.
05 22 24 34	CC	Odyssey, Houston. Over.
05 22 24 45	CC	Odyssey, Houston. Over.
05 22 25 04	CC	Odyssey, Houston. Over.
05 22 25 13	CC	Odyssey, Houston. Over.
05 22 25 16	CDR	Go ahead.
05 22 25 25	CC	Okay, I was just going to tell you about that handover we just had, but I was a little late on the - on the ball. Since we're fat on power and we'd kind of like to have S-band with you after blackout - we'd - We'd like you to delete the step on your entry checklist page 2-5, after "Begin blackout," it says "POWER PMP to OFF." We'd like you to leave it on if you think of it. Over.
05 22 25 41	CDR	Okay.
05 22 25 43	CC	Okay.
05 22 30 47	CC	Odyssey, Houston. Over.

05 22 30 49	CMP	Go ahead.
05 22 30 50	CC	Okay. At 10 minutes to 400 K, you're looking good; we're real happy with the trajectory, and a minute ago, we just lost contact with your friend Aquarius.
05 22 31 03	CMP	Okay. Where did she go?
05 22 31 07	CC	Oh, I don't know. She's up there somewhere.
05 22 31 13	CMP	She sure was a good ship.
05 22 31 16	CC	Hey, just as I said that, we got another burst of LM data, so I guess it's still ticking.
05 22 33 06	CC	Odyssey, Houston. Your DSKY is doing all the right things. The G&N is GO. Over.
05 22 33 11	CMP	Okay. Thank you.
05 22 33 18	CMP	You have a good bedside manner, Joe.
05 22 33 22	CC	Say again, Jack.
05 22 33 25	CMP	You have a good bedside manner.
05 22 33 31	CC	(Laughter) That's the nicest thing anybody's ever said! How about that?
05 22 33 43	CMP	Sure wish I could go to the FIDO party tonight.
05 22 33 47	CC	(Laughter) Yes, it's going to be a wild one.
05 22 34 04	CC	Somebody said, "We'll - We'll cover for you guys; and, if Jack's got any phone numbers he wants us to call, why, pass them down."
05 22 36 15	CC	Odyssey, Houston. Over.
05 22 36 17	CMP	Go ahead.
05 22 36 18	CC	Okay: We just had one last time around the room and everybody says you're looking great.
05 22 36 24	CMP	Thank you.
05 22 38 33	CC	Odyssey, Houston. Over.
05 22 38 35	CMP	Go ahead.

05 22 38 36	CC	Okay. LOS in about a minute or a minute and a half; in entry attitude, we'd like OMNI Charlie, and welcome home. Over.
05 22 38 45	CMP	Thank you.
05 22 46 03	CC	Odyssey, Houston standing by. Over.
05 22 46 08	CMP	Okay, Joe.
05 22 46 12	CC	Okay. We read you, Jack.
05 22 46 28	CC	We're looking at the weather on TV and it looks just as advertised; real good.
05 22 48 53	CC	Odyssey, Houston standing by for your NOUN 67 when you get it. Over.
05 22 49 17	CMP	We got two good drogues.
05 22 49 20	CC	Roger that.
05 22 49 21	CMP	... thousand.
05 22 50 06	CC	Odyssey, Houston. We show you on the mains. It really looks great.
05 22 50 15	CC	Got you on television, babe.
05 22 50 17	CMP	...
05 22 50 26	S-2	Iwo Jima Control, this is Swim 2. I have a visual bearing 182.
05 22 50 34	IWO	Iwo Jima; Roger.
05 22 50 39	R	Iwo Jima Control, this is ... Recovery. I have a visual bearing 190. Over.
05 22 50 44	IWO	Iwo Jima; Roger.
05 22 50 52	S-1	Iwo Jima, Swim 1 has a visual at 110. ...
05 22 50 57	IWO	Iwo Jima; Roger.
05 22 50 59	R	Apollo 13, Apollo 13, this is Recovery. Over.
05 22 51 18	R	Apollo 13, Apollo 13, this is Recovery. Over.
05 22 51 47	R	Apollo 13 - -

05 22 51 49	CMP	Go ahead. ~~Go ahead.~~
05 22 51 55	CMP	- - see you loud and clear going through 5000 - - See you loud and clear going through 5000.
05 22 51 59	R	Roger, Apollo 13. This is Recovery and your chutes look good.
05 22 52 11	R	Apollo 13, this is Recovery. We observed your RCS burn. Over.
05 22 53 38	R	This is Recovery. Apollo 13 is descending through 2000 feet.
05 22 53 42	IWO	Okay. Our altimeter concurs.
05 22 53 47	R	Iwo Jima; Roger. Out.
05 22 54 09	R	Apollo 13 and Recovery passing through 1000 feet.
05 22 54 14	IWO	Iwo Jima; Roger.
05 22 54 34	R	Through 500 feet.
05 22 54 38	S-1	Swim 1 on station.
05 22 54 40	S-2	- - 2 is on station.
05 22 54 44	P-1	Photo 1's on station. Photo 1 observes splashdown at this time.
05 22 54 48	IWO	1 ... pickup ...
05 22 54 49	S-1	Roger.
05 22 54 56	P-1	Photo-1. Splashdown at this time. The three chutes are displaced. They're in the water.
05 22 55 12	R-1	... Recovery, I have a clock - -

END OF TRANSCRIPTION