APOLLO 13
APOLLO AS-508/CSM-109/LM-7
FINAL FLIGHT PLAN
MARCH 16, 1970

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INTRODUCTION

This Flight Plan has been prepared by the Flight Planning Branch, Flight Crew Support Division, with technical support by TRW Systems.

This document schedules the AS-508/CSM-109/LM-7 operations and crew activities to fulfill, when possible, the test objectives defined in the Mission Requirements, H-2 Type Mission Lunar Landing, Revision B dated February 19, 1970.

The trajectory parameters used in this Flight Plan are for April 11, 1970 launch, with 72° launch azimuth and were supplied by Mission Planning and Analysis Division as defined by the Apollo Mission H-2 Spacecraft Operational Trajectory to be published.

The Apollo 13 Flight Plan is under the configuration control of the Crew Procedures Control Board (CPCB). All proposed changes to this document that fall in the following categories should be submitted to the CPCB via a Crew Procedures Change Request:

1. Items that impose additional crew training or impact crew procedures.

2. Items that impact the accomplishment of Mission Objectives.

3. Items that result in a significant RCS or EPS budget change.

4. Items that result in moving major activities to a different activity day in the Flight Plan.

5. Items that require a change to the flight data file.

The Chief, Flight Planning Branch (FCSD) will determine what proposed changes fall in the above categories.

Lt. Col. T. R. Lindsey will act as co-ordinator for all proposed changes to the Apollo 13 Flight Plan.

This Flight Plan is not to be reproduced without the written approval of the Chief, Flight Crew Support Division.

Any requests for additional copies or changes to the distribution lists of this document must be made in writing to Mr. W. J. North, Chief, Flight Crew Support Division, MSC, Houston, Texas.
ACKNOWLEDGEMENTS


Views of the earth shown in the Flight Plan were taken from the document, "Views from the CM and LM during the Flight of Apollo 13 (Mission H-2)."

The CSM and LM attitude information was taken from the document, "Operational Lunar Orbit Attitude Sequence for Apollo 13 (Mission H-2)" to be published.

Consumable analysis data was prepared by the Consumables Analysis Section of the Mission Planning and Analysis Division.
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ABBREVIATIONS (CONT'D)

GDC  Gyro Display Coupler
GDS  Goldstone, California
GET  Ground Elapsed Time
GETI Ground Elapsed Time of Ignition
GLY  Glycol
GMT  Greenwich Mean Time
G&N  Guidance and Navigation
GNCS Guidance Navigation Control System
GWM  Guam
GYM  Guaymas, Mexico

H2    Hydrogen
HA    Apogee Altitude
HAW   Hawaii
HBR   High Bit Rate (TLM)
HD    Highly Desirable or Heads Down
HFE   Heat Flow Experiment
HGA   High Gain Antenna
HI    High
H2O   Water
HP    Perigee Altitude
HSK   Honeysuckle (Canberra, Australia)
HTC   Hand Tool Carrier
HTR   Heater
HTV   USNS Huntsville
HU    Heads Up

ICDU  Inertial Coupling Data Unit
IGA   Inner Gimbal Angle
IGN   Ignition
IMU   Inertial Measurement Unit
IND   Indicator
INIT  Initialization
INT   Intervalometer
IP    Initial Point
ISA   Interim Stowage Assembly
IU    Instrumentation Unit
IVC   Intervehicular Communications
IVT   Intravehicular Transfer

JETT  Jettison

KM    Kilometer
kwh   Kilowatt Hour
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<td>Latitude</td>
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<td>LBS or lbs</td>
<td>Pounds</td>
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<td>LCG</td>
<td>Liquid Cooled Garment</td>
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<td>L/D</td>
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<td>USNS Watertown</td>
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<td>Time of Closest Approach (Symbol)</td>
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<td>Yaw</td>
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PHOTOGRAPHIC NOMENCLATURE

AAA/BBB/CCC/DDD - EEE, EEE, (GGG, HHH, III) JJJ

AAA - Location from which photography is to be accomplished

BBB - Camera

CCC - Lens

DDD - Film Type

EEE - Photography aids (i.e., brackets, intervalometer, mirror etc.)

GGG - Lens Aperture Setting

HHH - Shutter Speed

III - Focus distance in feet

JJJ - Number of frames for DC, LTC, EL & LEL cameras

  Frame Rate
  Magazine percent
  Time (minutes)
  Operating time (minutes) for TV

CODE EXAMPLE:
  CM4/DAC/18/CEX-BRKT,SPOT (S,250, ∞) 12 fps, .5 mag (4 min)

Meaning: Photos taken from CM right hand rendezvous
  window using the DAC with 18mm lens and
  SO368 film. The camera will be bracket
  mounted with the following camera settings:
  f-stop from spotmeter reading, shutter speed
  1/250 of a second, focus at infinity, 12 frames
  per second, .5 mag or 4 min to be used.
SYMBOL NOMENCLATURE

LANDING SITE
LUNAR TERMINATOR
SPACECRAFT SUNSET
MSFN LOS
START OF INDICATED REVOLUTION
DARKNESS
SPACECRAFT SUNRISE
LUNAR TERMINATOR
MSFN AOS
SCHEDULED TELEVISION
SUBSOLAR POINT
SECTION I - GENERAL
FLIGHT PLAN NOTES

A. Crew

1. Crew designations are as follows:

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<td>Love</td>
<td>Young</td>
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<td>Command Module Pilot (CMP)</td>
<td>Matting</td>
<td>Swigert</td>
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<tr>
<td>Lunar Module Pilot (LMP)</td>
<td>Haise</td>
<td>Duke</td>
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2. The nominal CM couch positions are:

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<th>Center</th>
<th>Right</th>
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<td>CDR</td>
<td>CMP</td>
<td>LMP</td>
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<tr>
<td>T&amp;D thru Entry</td>
<td>CMP</td>
<td>CDR</td>
<td>LMP</td>
</tr>
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</table>

3. The PGA's will be worn as follows:

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>PRESSURIZED HARD SUIT</th>
<th>SUITED (SOFT SUIT)</th>
<th>PARTIAL SUIT W/O HELMET &amp; GLOVES</th>
<th>SHIRT SLEEVES</th>
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<tbody>
<tr>
<td>LAUNCH</td>
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<tr>
<td>TLI THROUGH S-IVB</td>
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<tr>
<td>EVASIVE MNVR</td>
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<tr>
<td>TLC &amp; TEC</td>
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<tr>
<td>LM ACTIVATION</td>
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<td></td>
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</tr>
<tr>
<td>UNDOCKING</td>
<td></td>
<td></td>
<td></td>
<td>CDR &amp; LMP</td>
</tr>
<tr>
<td>SEPARATION</td>
<td></td>
<td></td>
<td></td>
<td>CDR &amp; LMP</td>
</tr>
<tr>
<td>PDI &amp; TD</td>
<td></td>
<td></td>
<td></td>
<td>CDR &amp; LMP</td>
</tr>
<tr>
<td>LUNAR STAY</td>
<td>Varies according to checklist for CDR &amp; LMP.</td>
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<td></td>
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<tr>
<td>EXCEPT EVA</td>
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<td></td>
<td></td>
<td>CMP W/BE IN SHIRT SLEEVES</td>
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<tr>
<td>SURFACE EVA</td>
<td>CDR &amp; LMP</td>
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<td>LIFTOFF</td>
<td></td>
<td>CDR &amp; LMP</td>
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<td>THRU DOCKING</td>
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<td>CMP</td>
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<td>POST JETTISON</td>
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<td>ALL</td>
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<td>THRU TEI ENTRY</td>
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<td>ALL</td>
</tr>
</tbody>
</table>

4. Crew status reports will be voiced to MCC-H before and after crew sleep periods. After waking the crew will report sleep obtained and radiation doses received during the last 24 hours and before going to sleep the crew will report medication used and any other pertinent information on activities performed.

5. Negative reporting will be used in reporting completion of each checklist.

6. All onboard gauge readings will be read directly from the gauges with no calibration bias applied.
B. CSM Systems

1. Communications
   (a) The preferred S-Band communication modes are:
       (1) Uplink Mode 6 (Voice, PRN, and Updata)
       (2) Downlink Mode 2 (Voice, PRN, TLM-HBR)
   (b) OMNI B and VHF LEFT will be selected for liftoff. OMNI D will be selected by the crew during boost if the launch azimuth is less than 96° or OMNI C if the launch azimuth is greater than 96°. OMNI D will normally be the best antenna during earth orbit.
   (c) VHF Duplex B will be used for launch, and Simplex A for earth orbit operations.
   (d) During TLC and TEC, OMNI antennas will normally be used. The CSM X-axis will be pitched up 90° (North) for TLC and pitched down 90° (South) for TEC with the Y-Z axis in the plane of the ecliptic. These attitudes permit high gain antenna coverage and simultaneous viewing of the earth and moon through side windows for TV coverage.
   (e) For nominal conditions, the CSM communications with the LM while the LM is on the lunar surface is VHF only.
   (f) Table 1-1 is a summary of the MSFN coverage available for the CSM.
   (g) Table 1-2 contains a summary of the scheduled TV transmissions.
   (h) During PTC the OMNI antennas will be switched via ground command. During periods of attitude control other than PTC the crew will manage antenna operations.

2. DSE
   (a) The DSE will be normally operated via ground command except for special cases where the operation is time limited. In these cases the crew may be asked to rewind the tape.
   (b) During the earth orbit phase, the CSM LBR data will be recorded when the CSM is not within MSFN coverage. The DSE will be dumped during the pass over the US and over CRO prior to TLI if possible.
   (c) During the lunar orbit phase, CSM HBR data is required for the first and last five minutes of all photographic strips. When the HGA is not available, this data will be recorded on the DSE.
(d) During lunar orbit phase, the CSM LBR data will be recorded when the CSM is not within MSFN coverage. The DSE will normally be dumped at AOS.

(e) CSM LBR data will be recorded during all P22 landmark tracking and dumped at completion of tracking.

(f) CSM HBR and voice will be recorded during all CSM engine burns.

(g) All Entry data will be recorded in HBR during the blackout.

3. Electrical Power
(a) The CSM will normally remain powered up throughout the mission.

(b) Table 1-3 lists the fuel cell purges and waste water dumps.

(c) Based on cryo purity and performance, the time between fuel cell O2 purges will be increased to coincide with water dump times. The O2 purge at 11 hours will allow a judgement to be made on the defined purge schedule.

(d) The cryogenic heaters will be in AUTO during the mission and the fans will be operated manually. The O2 & H2 fans will be cycled for one minute before and after each sleep cycle and before each SPS burn. The O2 & H2 fans will also be cycled prior to CSM-LM Ejection from the SIVB.

(e) Table 1-9 contains the battery charge schedule.

4. ECS and Water Management
(a) Potable water will be chlorinated once a day after the eat period prior to each sleep period.

(b) Waste Water dumps and fuel cell purge criteria:
1. During TLC and TEC water dumps and fuel cell purges will be scheduled after the sextant star check and prior to each midcourse maneuver.

2. Waste water dumps and fuel cell purges will not be scheduled during the following periods:
   a. Between MCC-3 and LOI plus two hours.
   b. Within three revolutions of undocking.
c. Between TEI and sextant star check prior to MCC-5.

d. Within one hour prior to optical navigation sightings.

e. Between MCC-6 and EI.

3. During lunar orbit, waste water dumps and fuel cell purges should be scheduled as close to the LOS midpoint as possible.

4. All waste water dumps will be manual.

(c) Only one CO2 absorber filter (LIOH canister) is changed at a time. Table 1-4 lists the LIOH canister change schedule. There are 20 filters onboard with 18 stowed at launch.

(d) At lift-off the cabin will contain 60% O2 and 40% N2. The CM will be purged after launch. The purge is terminated prior to LM pressurization after TLI. After the LM is configured for ejection, it will be isolated and the CM will be purged for eight more hours.

5. Guidance and Navigation

(a) REFSMMAT Definitions

1. The "Launch Pad" REFSMMAT will be used for launch, TLI and TD&E. This REFSMMAT places the IMU X-axis along the launch azimuth at the pad and the Z-axis along the negative radius vector. The FDAI, at launch, will display roll 162° (launch azimuth +90°), pitch 90° and yaw 0°.

2. The "PTC" REFSMMAT will be used for all midcourse maneuvers (except MCC-7) and other operations during TLC and TEC. This REFSMMAT places the IMU X-axis in the ecliptic plane and perpendicular to the earth-moon line projection in the ecliptic plane at the average time of transearth injection for the monthly launch window and azimuth range. The Z-axis is then perpendicular to the ecliptic and directed south. At the beginning of the PTC Mode, during TLC, the spacecraft will maneuver to an FDAI display of roll X, pitch 90° and yaw 0°. During TEC the pitch attitude will be 270°.

3. The "Landing Site" REFSMMAT will be used for LOI, DOI, PDI, landing and CSM lunar orbit activities up to the first plane change. This REFSMMAT places the CSM IMU X-axis along the positive lunar radius vector at the
landing site at the predicted landing time and the Z-axis in the direction of flight parallel to the CSM orbital plane. At nominal touchdown the LM FDAl will display roll 0°, pitch 0° and yaw 0°.

4. A "Preferred" REFSMMAT will be used by the CSM for all lunar orbit plane changes and TEI. The CSM IMU X-axis will normally be aligned with the spacecraft X-body axis at the vehicle attitude for ignition with the thrust directed through the center of gravity. In the case of large plane change maneuvers, the IMU X-axis may be aligned 45° from the spacecraft body axis at ignition attitude. The Z-axis will be in the plane formed by the X-axis and position vector and directed up away from the moon for plane changes and towards the moon for TEI. Nominally, at burn ignition, the FDAl will display roll 0°, pitch 0° and yaw 0°. TEI will be heads down with an FDAl roll of 180°.

5. The "Lift Off" REFSMMAT will be used for all lunar activities between plane change 1 and 2 including rendezvous and docking. This REFSMMAT places the CSM IMU X-axis along the positive lunar radius vector at the landing site at predicted lift-off time, with the Z-axis parallel to the CSM orbital plane. At nominal lift-off time the LM FDAl will display roll 0°, pitch 0° and yaw 0° with slight differences reflecting actual touchdown yaw and slop tilt angles.

6. A "Photography" REFSMMAT will be used for the "Bootstrap" phase between plane change 2 and TEI. This REFSMMAT is a pseudo landing site REFSMMAT in that it is referenced to the time of crossing the longitude of the landing site on revolution 41. The FDAl will display roll 0°, pitch 0°, and yaw 0°, with the X-axis pitched up 20° from the local horizontal and the Z-axis in the direction of flight parallel to the CSM orbital plane.

7. The "Entry" REFSMMAT aligns the IMU X-axis in the local horizontal plane in the direction of flight at entry interface. The entry REFSMMAT is used for MCC-7 and all remaining activities. The Z-axis is down along the negative radius at entry interface. At entry interface; with wings level, local horizontal, heat shield forward, lift up, heads down, the FDAl will display roll 0°, pitch 180°, and yaw 0°.

(b) The CSM external lighting will be operated during the rendezvous from lift-off to docking. The running lights only will be on from CSM/LM separation to PDI.
(c) After each landmark tracking period, the CSM will hold on N89 for 30 seconds so that these values are displayed on TLM for data retrieval.

(d) The time tags on maneuvers in Section 3 indicate the completion time of the maneuvers unless otherwise stated. All maneuver angles are the FDAl angles after the completed maneuver. 'By' precedes the time tag when the completion time is critical, otherwise the time is in parentheses.

(e) CSM/LM and CSM attitude maneuvers will normally be at the rate of 0.2°/sec (0.5°/sec after rendezvous and docking) unless other rates are required.

(f) Undocking will be done radially, CSM below, using the soft-undocking procedure. The probe will be extended its full length with the LM held on by the capture latches. When the rates are nulled, the CSM will then release the LM. The separation maneuver will then be performed immediately.

6. Propulsion Systems
   (a) In order to conserve SM RCS the SPS engine will be used to "back-up" all LM rendezvous burns except CDH. The nominal CDH burn magnitude is zero and it is backed up by the SM RCS. The SPS gimbal motors will not be turned on during the normal maneuver preparation, except for CSI.

   (b) The SPS will always be started using a single bank; however, the other bank will be opened 2 to 5 seconds after ignition for burns longer than 6 seconds. Bank A will be used for the first engine ignition.

   (c) Table 1-5 lists the CSM propulsion burns.

C. LM Systems
1. Communications
   (a) The preferred S-Band communications are:
      (1) Uplink Mode 7 (Voice, Updata)
      (2) Downlink Mode 1 (Voice, TLM-HBR)

   (b) The LM voice recorder (DSEA) will be used to record LM voice. Table 1-8 is a schedule of LM voice recorder usage.

   (c) Figure 1-1 shows the communications mode for the first part of the EVA (CDR EVA only) and the one man contingency EVA. Figure 1-2 shows the nominal two-man EVA comm configuration.

2. ECS
   (a) The LM will contain ambient air at lift-off. During launch the pressure will bleed to zero. CSM 02 will be used to pressurize the LM after T&D.
After T&D, the LM will be isolated and allowed to bleed down via leakage. For each entry into the LM before undocking the CSM 02 will be used to equalize LM pressure. After each LM egress, the LM will be isolated and allowed to leak down. This procedure insures a pure oxygen environment in the LM at the first EVA.

(b) There are a total of six LM repressurizations, three docked and three on the lunar surface.

3. Guidance Systems
   (a) The LGC and CMC will use the same landing site and lift-off REFSMMPATS.

   (b) The AGS will be placed in standby after the "GO" is given for lunar stay.

   (c) The RR and IMU will be powered down and the LGC placed in standby after TD plus two hours until lift-off preparation.

   (d) The rendezvous radar will be pointed away from the sun and will be turned off when no functional use is required to prevent overheating of the antenna. The LM tracking light will be turned off during the rendezvous while the LM is in sunlight.

4. Propulsion Systems
   (a) The APS/RCS interconnect will be used during the lunar lift-off and ascent only.

   (b) Table 1-6 lists the LM propulsion burns.

D. Procedures

1. CSM
   Crew procedures called out in the flight plan may be found in the following documents:
   (a) Apollo Operations Handbook - CSM 109 (AOH), Volume 2
   (b) Crew Checklists
   (c) CSM Rendezvous Procedures
   (d) Photographic Operations Plan
   (e) Lunar Landmark Tracking Attitude Studies
   (f) Lunar Orbit Attitude Sequence for Mission H

2. LM
   Crew procedures called out in the flight plan may be found in the following documents:
   (a) Apollo Operations Handbook LM-7 Volume 2
(b) Crew Checklists  
(c) LM Rendezvous Procedures  
(d) LM Descent/Ascent Procedures  
(e) Photographic and T.V. Procedures  
(f) Orbital EVA Procedures  
(g) Lunar Surface Procedures

E. Medical Data During Sleep Periods

1. During translunar and transearth coast phases, and in lunar orbit when all three crewmembers are in the CSM, an EKG and ZPN will be transmitted continuously from at least one crewman.

2. During lunar orbit, when the CMP is the sole occupant of the CSM, the CMP's EKG and ZPG will be transmitted to MCC.

3. While on the lunar surface, an EKG and ZPN will be transmitted continuously from at least one crewman.

F. Miscellaneous

1. Table 1-7 contains a summary of the expected block data update times.

2. Table 1-10 is the Landmark Tracking Table.

3. Table 1-11 is the Mission Activity Summary.
LUNAR EXPLORATION COMMUNICATIONS
BOTH CREWMEN EVA

FIGURE 1-2
## TABLE 1-1
S/C COVERAGE BY MSFN STATIONS USING 85-FT/210-FT DISH/ANTENNA

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<th>GOLDSTONE (GDS)</th>
<th>PARKS</th>
<th>HONEYSUCKLE (HSK)</th>
<th>MADRID (MAD)</th>
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**NOTE:** AOS AND LOS TIMES SHOWN ASSUME TRACKING TO 0° ELEVATION.
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* Recorded only
**Approval pending for satellite time
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<td>PC-2</td>
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NOTE: HA&HP ARE HEIGHTS ABOVE MEAN LUNAR RADIUS (938.49 nm.)
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NOTE: HA & HP ARE HEIGHTS ABOVE MEAN LANDING SITE RADIUS
### TABLE 1-7

**APOLLO 13 RTE BLOCK DATA SCHEDULE**

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**Notes:**

1. The TLI + 90 min abort is to the AOL all other block data maneuvers are to the MPL line [Nominal TEI (TEI 46) is to EOM $\phi$, $\lambda$].
2. Lift-off + 15h abort assumes no MCC-1.
3. Lift-off + 35h abort assumes MCC-2.
4. Pass flyby early if pericycthon is not clear of moon.
5. Pericycthon + 2 hours fast return to MPL assumes MCC-4.
6. TEI-1 assumes LOI.
7. TEI-4 assumes LOI and no DOI.
8. TEI-5 assumes DOI.
9. TEI-35 assumes circularization and PC-1, and CSM SEP.
11. All TEI's are i=40° ascending.
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<th>OPERATE TIME x (%) DUTY CYCLE = TAPE TIME USED</th>
<th>TOTAL TAPE TIME USED</th>
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<td>ICS/PTT</td>
<td>00:13 x 100% = 00:13</td>
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**BOOTSTRAP PHOTO TARGETS**

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*Difference between landmark radius vector and mean lunar radius
Mean Lunar Radius = 1736.685 km
or 938.4935 nm
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*Alternates*
SECTION 2 - MISSION OBJECTIVES
SECTION 2
MISSION OBJECTIVES

This section contains an activity summary, reflecting the objectives for Apollo 13 as described in "Mission Requirements H-2 Type Mission". Table 2-1 provides a functional breakdown of the objectives and indicates the page in the timeline where the activity occurs. The alphanumerical listing presented in Table 2-1 is not intended to represent a priority or a sequential listing.

Details of the implemented test requirements are adequately covered in the Mission Requirements Document, the Lunar Surface Operation Plan and the Photographic and TV Operations Plan.
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<td>ALSEP-2</td>
<td>Deploy the Heat Flow Experiment (S-037)</td>
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<td>Deploy the Charged Particle Lunar Environment Experiment (S-038)</td>
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<td>Deploy the Cold Cathode Gauge Experiment (S-058)</td>
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<td>Deploy the Lunar Dust Detector Experiment (M-515)</td>
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<td>Lunar Field Geology</td>
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<td>Collect lunar surface drill stem samples.</td>
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<td>S-059-2</td>
<td>Obtain three core tube samples of lunar material</td>
<td>EVA-2</td>
<td>3-99</td>
</tr>
<tr>
<td>S-059-3</td>
<td>Collect a lunar environment sample of lunar surface material.</td>
<td>EVA-2</td>
<td>3-99</td>
</tr>
<tr>
<td>S-059-4</td>
<td>Collect a gas analysis sample of lunar surface material.</td>
<td>EVA-2</td>
<td>3-99</td>
</tr>
<tr>
<td>S-059-5</td>
<td>Collect a sample of lunar surface material for study of residual magnetism.</td>
<td>EVA-1</td>
<td>3-99</td>
</tr>
<tr>
<td>S-059-6</td>
<td>Examine, describe, photograph and collect lunar geologic samples for return to earth.</td>
<td>EVA-2</td>
<td>3-98-101</td>
</tr>
<tr>
<td>S-059-7</td>
<td>Study and describe field relationships (such as shape, size, range, patterns of alignment or distribution) of all accessible types of lunar topographic features.</td>
<td>EVA-2</td>
<td>3-98-101</td>
</tr>
<tr>
<td>S-080</td>
<td>Solar Wind Composition</td>
<td>EVA-1/2</td>
<td>3-85/101</td>
</tr>
<tr>
<td>S-080-1</td>
<td>Conduct the Solar Wind Composition Experiment (S-080).</td>
<td>EVA-2</td>
<td>3-98-101</td>
</tr>
<tr>
<td>S-184</td>
<td>Lunar Surface Closeup Photography</td>
<td>EVA-2</td>
<td>3-98-101</td>
</tr>
<tr>
<td>B</td>
<td>Television Coverage</td>
<td>EVA-1/2</td>
<td>3-82/97</td>
</tr>
<tr>
<td>B-1</td>
<td>Provide TV camera coverage of an astronaut descending to the lunar surface.</td>
<td>EVA-1/2</td>
<td>3-82/98</td>
</tr>
<tr>
<td>B-2</td>
<td>Provide TV camera coverage of an external view of the landed LM.</td>
<td>EVA-1/2</td>
<td>3-82/98</td>
</tr>
<tr>
<td>B-3</td>
<td>Provide TV camera coverage of the lunar surface in the general vicinity of the LM.</td>
<td>EVA-1/2</td>
<td>3-82/98</td>
</tr>
<tr>
<td>B-4</td>
<td>Provide TV camera panoramic coverage of distant terrain features.</td>
<td>EVA-1</td>
<td>3-83</td>
</tr>
<tr>
<td>B-5</td>
<td>Provide TV camera coverage of an astronaut during lunar surface activities.</td>
<td>EVA-1/2</td>
<td>3-82/98</td>
</tr>
<tr>
<td>NUMBER</td>
<td>OBJECTIVE</td>
<td>ACTIVITY</td>
<td>PAGE NO.</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------------------------------------------------</td>
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<tr>
<td>C</td>
<td>Contingency Sample Collection</td>
<td></td>
<td></td>
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<tr>
<td>C-1</td>
<td>Provide a contingency sample for postflight scientific investigations.</td>
<td>EVA-1</td>
<td>3-82</td>
</tr>
<tr>
<td>D</td>
<td>Selected Sample Collection</td>
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</tr>
<tr>
<td>D-1</td>
<td>Collect rock samples and fine grained fragmental material.</td>
<td>EVA-1</td>
<td>3-85</td>
</tr>
<tr>
<td>D-2</td>
<td>Collect one large rock.</td>
<td>EVA-1</td>
<td>3-85</td>
</tr>
<tr>
<td>E</td>
<td>Evaluation of Landing Accuracy Techniques</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-1</td>
<td>Obtain data to allow a determination of the ability to land within one</td>
<td>TOUCHDOWN</td>
<td>3-77</td>
</tr>
<tr>
<td></td>
<td>kilometer of a preselected lunar feature.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Photographs of Candidate Exploration Sites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-1</td>
<td>Obtain photographs of a selected lunar site from low altitude.</td>
<td>REV-4</td>
<td>3-62</td>
</tr>
<tr>
<td>F-2</td>
<td>Obtain stereoscopic and sequence photographs of selected lunar sites.</td>
<td>CSM SOLO</td>
<td>3-96</td>
</tr>
<tr>
<td>F-3</td>
<td>Obtain high resolution photographs of selected lunar sites.</td>
<td>BOOTSTRAP</td>
<td>3-122</td>
</tr>
<tr>
<td>G</td>
<td>EVA Communications System Performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G-1</td>
<td>Determine the effects upon communication of obstructing lunar surface</td>
<td>EVA-2</td>
<td>3-99</td>
</tr>
<tr>
<td></td>
<td>features between EVC-1 and the LM.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Lunar Soil Mechanics</td>
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<td></td>
</tr>
<tr>
<td>H-1</td>
<td>Obtain data on lunar soil mechanical behavior.</td>
<td>EVA-2</td>
<td>3-99</td>
</tr>
<tr>
<td>H-2</td>
<td>Obtain data on lunar surface characteristics relative to the mobility</td>
<td>EVA-1/2</td>
<td>3-82/97</td>
</tr>
<tr>
<td></td>
<td>of men and roving vehicles.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H-3</td>
<td>Obtain data on the lunar sub-surface characteristics relative to</td>
<td>EVA-2</td>
<td>3-99</td>
</tr>
<tr>
<td></td>
<td>construction either on or within the lunar surface.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NUMBER</td>
<td>OBJECTIVE</td>
<td>ACTIVITY</td>
<td>PAGE NO.</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>----------</td>
<td>----------------</td>
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<tr>
<td>I-1</td>
<td>Dim Light Photography</td>
<td>CSM SOLO</td>
<td>3-81/88</td>
</tr>
<tr>
<td>I-2</td>
<td>Obtain photographs of the solar corona using the moon as an occulting disc.</td>
<td>CSM SOLO</td>
<td>3-101/102</td>
</tr>
<tr>
<td>I-3</td>
<td>Obtain photographs of the zodiacal light using the moon's horizon as an occulting edge.</td>
<td>CSM SOLO</td>
<td>3-103</td>
</tr>
<tr>
<td>I-4</td>
<td>Obtain photographs indicating the presence and seriousness of the contamination cloud surrounding the spacecraft.</td>
<td>BOOTSTRAP</td>
<td>3-125</td>
</tr>
<tr>
<td>I-5</td>
<td>Obtain photographs of the ice particles resulting from a water dump.</td>
<td>TEC</td>
<td>3-143</td>
</tr>
<tr>
<td>I-6</td>
<td>Obtain photographs of the lunar limb brightening just after lunar sunset.</td>
<td>CSM SOLO</td>
<td>3-88</td>
</tr>
</tbody>
</table>

| J-1    | Selenodetic Reference Point Update | PRE DOI | 3-58        |
| J-2    | Obtain lunar landmark tracking data to permit an update of the selenodetic coordinates of selected lunar reference points. | CSM SOLO | 3-79/83/85/103/104 |

| K-1    | CSM Orbital Science Photography | CSM SOLO | 3-81/98/99   |
| K-2    | Obtain photographs from the CSM using the Lunar Topographic camera with the 80 mm lens from terminator to terminator and of lunar surface areas of prime scientific interest. | BOOTSTRAP | 3-124-126   |
| K-3    | Obtain photographs from the CSM using the Hasselblad reseau camera with the 250 mm lens of lunar surface areas of prime scientific interest. | CSM SOLO | 3-96/97       |
| K-4    | Obtain photographs from the CSM using the Hasselblad camera with the 250 mm lens of lunar surface areas of prime scientific interest. | BOOTSTRAP | 3-122        |
| K-5    | Obtain photographs from the CSM using the 16 mm sequence camera and the T-1 (f.95) lens in earthshine of specific segments of the lunar surface. | CSM SOLO | 3-79 through 104 |

| L-1    | Transearth Lunar Photography | TEC | 3-134-135/143 |
SECTION 3 - DETAILED TIMELINE
## FLIGHT PLAN

<table>
<thead>
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<th>EVENT</th>
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<tr>
<td>-00:09</td>
<td>LCC: REPORT IGNITION</td>
<td>CREW POSITIONS @ L/O</td>
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<tr>
<td>00:00</td>
<td>LCC: CDR: REPORT LIFT-OFF</td>
<td>CDR - LH COUCH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CMP - CENTER COUCH</td>
</tr>
<tr>
<td>00:02</td>
<td>CDR: REPORT YAW MNVR</td>
<td>LMP - RH COUCH</td>
</tr>
<tr>
<td>00:13</td>
<td>CDR: REPORT ROLL AND PITCH PROGRAM</td>
<td></td>
</tr>
<tr>
<td>00:31</td>
<td>CDR: REPORT ROLL COMPLETE</td>
<td>LIFT-OFF 1313 CST</td>
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<tr>
<td>00:42</td>
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<td>APRIL 11, 1970, 72° L.A.</td>
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<tr>
<td>00:50</td>
<td>LMP: REPORT CABIN PRESS DECREASING</td>
<td>TARGETED FOR FRA MAURÔ</td>
</tr>
<tr>
<td>01:25</td>
<td>MAX Q</td>
<td>ALTITUDE 14,000 ft</td>
</tr>
<tr>
<td>01:58</td>
<td>MCC: REPORT MARK MODE IC</td>
<td>ALTITUDE 100,000 ft</td>
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<tr>
<td>02:00</td>
<td>MCC: CDR: REPORT GO/NO-GO FOR STAGING</td>
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<tr>
<td></td>
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<td>EDS AUTO-OFF</td>
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<td>CDR: REPORT INBOARD ENGINE CUTOFF</td>
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<td>CDR: REPORT STAGING</td>
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<td>02:46</td>
<td>CDR: REPORT S-II IGNITION</td>
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<td>03:15</td>
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<td>MCC: REPORT MODE II</td>
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<td></td>
<td>CDR: REPORT S/C GO/NO-GO</td>
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**MISSION:** APOLLO 13  
**EDITION:** FINAL (APRIL)  
**DATE:** MARCH 16, 1970  
**PAGE:** 3-1
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<td>MCC: REPORT TRAJECTORY GO/NO-GO</td>
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<td>MCC: REPORT S-IVB TO COI CAPABILITY</td>
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<td>MCC: REPORT PREDICTED SECO</td>
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<td>11:00</td>
<td>CDR: REPORT S/C GO/NO-GO</td>
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<tr>
<td>11:46</td>
<td>CDR: REPORT SECO TB5 = 0 S-IVB MAINTAINS COMMANDED CUTOFF INERTIAL ATTITUDE</td>
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<tr>
<td></td>
<td>SECO MCC: REPORT ORBITAL GO/NO GO INSERTION</td>
</tr>
<tr>
<td>+10 SEC</td>
<td>S-IVB MANEUVERS TO LH AND INITIATES ORB RATE (HEADS DOWN)</td>
</tr>
<tr>
<td>+20 SEC</td>
<td>S-IVB INITIATES CONTINUOUS LH2 VENTING (TERMINATES AT TB6 + 42.2 SEC)</td>
</tr>
<tr>
<td></td>
<td>V66-TRANSFER CSM STATE VECTOR TO LM SLOT</td>
</tr>
<tr>
<td></td>
<td>V45-RESET LUNAR SURFACE FLAG</td>
</tr>
<tr>
<td>12:46</td>
<td>BDA LOS INSERTION AND SYSTEMS CHECKS</td>
</tr>
<tr>
<td>16:00</td>
<td>VAN LOS</td>
</tr>
<tr>
<td>16:34</td>
<td>CYI AOS</td>
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<tr>
<td>19:05</td>
<td>MCC UPDATE: Z TORQUING ANGLE SYSTEM MONITORING &amp; CHECKING POST INSERTION ECS CONFIGURATION</td>
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<tr>
<td>22:59</td>
<td>EARTH UMBRA</td>
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<tr>
<td>23:40</td>
<td>CYI LOS</td>
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<td>P52 IMU REALIGN</td>
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<td>OPTION 3-REFSSMAT (LAUNCH ORIENT)</td>
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<tr>
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<td>GDC ALIGN</td>
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<td>CONFIGURE CAMERA FOR T&amp;D AND S-IVB PHOTO</td>
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<tr>
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<td>CM2/DAC/18/CEX-BRKT, MIR (f8,250,7) 12 fps MAG A</td>
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<td>CM/EL/80/CEX-SPOT (f8,250,focus) 10 MAG L</td>
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<td>52:17</td>
<td>CRO AOS</td>
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<td>DUMP DSE</td>
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<td>REPORT GYRO TORQUING ANGLES</td>
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<td>58:07</td>
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<td>LMP HOLDS CAMERA</td>
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<td>Y _ _ : _ _ _ _</td>
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<td></td>
<td>Z _ _ _ _</td>
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<td>GET: _ _ _ _ : _ _ : _ _</td>
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<td>MISSION</td>
<td>APOLLO 13</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

LIFT-OFF  APRIL 11, 1970

LAUNCH OPERATIONS CHECKLIST

NOTES
LIFT-OFF CREW POSITIONS
LEFT COUCH - CDR
CENTER COUCH - CMP
RIGHT COUCH - LMP

AT SECO+20 SEC, S-IVB
MNVRS TO LH AND
INITIATES ORB RATE
(HEADS DOWN)

UPDATE TO CSM
Z TORQUING ANGLE

00:00
MCC-H
1313 CST

00:10
MSFN

00:20
CYI

00:30
P52 - IMU REALIGN
OPTION 3 - REFSMMAT
(LAUNCH ORIENT)
GDC ALIGN

00:40
SET UP CAMERA EQUIPMENT

00:50
REPORT GYRO TORQUING ANGLES

01:00
DUMP DSE

P52 IMU REALIGN
N71:      ___________
N05:      ___________
N93:      
X          ___________
Y          ___________
Z          ___________
GET        ___________

MISSION  EDITION      DATE            TIME         DAY/REV    PAGE
APOLLO 13  FINAL (APRIL) MARCH 16, 1970  00:00 - 01:00  1/E.0.      3-1
FLIGHT PLAN

MCC-H 1413 CST

01:00

? H K S

:10

:20

01:30

SCS ATT REF COMPARISON CK
EXTEND DOCKING PROBE

01:40

DUMP DSE

UPLINK TO CM
CSM S.V. & V66
UPDATE TO CSM

TLI PAD
TLI +90 MIN
ABORT PAD
P37 (L/0+8) PAD

GO/NO-GO FOR PYRO ARM

01:50

GO/NO-GO FOR PYRO ARM (CUE MSFN)
LOGIC ON

TLI PREPARATION CHECKLIST
GDC ALIGN
PYRO ARM

:40

02:00

NOTES

AS A GENERAL RULE, EXCEPT DURING TEC,
UPLINK THE STATE VECTOR TO THE CSM SLOT AND TRANSFER IT VIA V66 TO THE LM SLOT IN ORDER TO HAVE REDUNDANT STATE VECTORS ONBOARD

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
--------|---------|------|------|---------|------
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 01:00 - 02:00 | 1/E.O. | 3-2

FLIGHT PLANNING BRANCH

MSC Form 29 (May 69)
FLIGHT PLAN

TL1
BURN TABLE

<table>
<thead>
<tr>
<th>P OR Y RATES</th>
<th>ATT DEVIATION</th>
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<th>RESIDUALS</th>
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<tr>
<td>10°/SEC SHUTDOWN</td>
<td>+45° SHUTDOWN</td>
<td>BT + 6 SEC &amp; $V_i = PAD VALUE$</td>
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TABLE 3-1
3-2A
FLIGHT PLAN

GO/NO-GO FOR TLI
TB-6 (02:25:49.65)
P47 - THRUST MONITOR

TLI

TIG: 02:35:27.65
BT: 5 MIN 55.7 SEC

POO - CMC IDLING
V66 - TRANS CSM SV TO LM SLOT
TLI BURN STATUS REPORT
CDR - TRANS TO CENTER COUCH, CMP - LEFT COUCH
LMP - RIGHT COUCH
WASTE STOWAGE VENT - CLOSED
DIRECT O2 VLV-OPEN, UNTIL CABIN IS 5.7 PSI, THEN CLOSE
GDC ALIGN
SIVB MNVRS TO SEP ATT (2:56:25)

AT SECO: S-IVB INERTIAL
AT SECO+2 MIN 31 SEC:
S-IVB TO LOCAL HORIZONTAL ORB RATE,
HEADS DOWN

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
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<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>02:00 - 03:00</td>
<td>1/TLC</td>
<td>3-3</td>
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</table>
FLIGHT PLAN

ACTIVATE AND LOAD DAP N46 (11103, 01111)
LOAD DOCKING GIMBAL ANGLES
CSM SEP PREPARATION

(CSM/SIVB SEP GET: 03:06)

CSM MNVR TO DOCK ATT (03:10)
HGA TRACK - REACQ
HGA BEAM - WIDE DAP 11102
TV (GDS) 03:15 TO 04:23 CM4/TV - P EAK, BRKT (f 22)
VISUALLY INSPECT AND PHOTOGRAPH SIVB AND LM

(DOCK GET: 03:16)

BEGIN CSM/LM CABIN PRESSURE EQUALIZATION
CDR: CONFIGURE FOR LM EJECTION
TUNNEL PRESSURE INTEGRITY CHECK
REMOVE AND TEMPORARILY STOW TUNNEL HATCH
CHECK DOCKING LATCHES
VENT DOCKING PROBE
LM UBILICAL CONNECTION
REINSTALL TUNNEL HATCH
LM TUNNEL VLV - LM/CM AP
LEAVE TUNNEL EQUALIZATION VALVE CLOSED
CYCLE O_2 & H_2 FANS
S-IVB NON PROPULSIVE VENT START (GET: 03:41)
GO/NO-GO PYRO ARM (CUE MSFN)
LOGIC ON
LOAD DAP N46 (21101, 11111)
PYRO ARM
P47 - THRUST MONITOR
PHOTOGRAPH LM EJECTION
S-IVB VENT COMPLETE (GET: 03:56)

(CSM/LM EJECTION)

T&D MNVR
+X FOR 3 SEC (ΔV ~ 0.5 FPS),
AFTER 15 SEC PITCH UP AT 2.0°/SEC. V49 AUTO MNVR
TO DOCKING ATT. NULL
TRANSLATION AND RATES,
+X FOR 4 SEC (ΔV ~ 0.7 FPS)

CAMERA SETTINGS FOR
TRANPOSITION/DOCKING:
CM2/DAC/18/CSEX-BRKT,
MIR(f8,250,7)12 fps,
0.7 MAG (5 MIN) MAG A
CM/EL/80 CSEX - SPOT
(f8,250,FOCUS)10, MAG L

CAMERA SETTINGS FOR
LM EJECTION:
CM 2/DAC/18/CSEX - BRKT,
MIR (f8,250,7) 6 fps,
0.3 MAG (5 MIN) MAG A

SPRING ACTUATOR
ΔV ~ 0.8 FPS. 5 SEC
AFTER EJECTION THERE
IS A 4 JET RCS -X
TRANSLATION FOR 3 SEC
(ΔV ~ 0.4 FPS). TOTAL
ΔV ~ 1.2 FPS.

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
----- | ----- | ----- | ----- | ----- | -----
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 03:00 - 04:00 | 1/TLC | 3-4
FOV 10°
GET 04:12
CSM/SIVB RANGE 803 FT

FOV 1°
GET 04:34
CSM/SIVB RANGE 12,227 FT
**FLIGHT PLAN**

**NOTES**

THE S-IVB 80° YAW MNVR IS PLANNED FOR LM EJECTION +3 MIN. THE MNVR WILL NOT BE STARTED UN- TIL CREW REPORTS GOOD EJECTION. THE S-IVB EVASIVE MNVR WILL NOT BE STARTED UNTIL THE CREW HAS THE S-IVB IN SIGHT.

NOTE: DURING T/LC HGA IS REQUIRED ONLY FOR TD&E, TV TRANSMISSIONS AND MCC'S. THE ANTENNA WILL BE STOWED AT OTHER TIMES.

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
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<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>04:00 - 05:00</td>
<td>1/TLC</td>
<td>3-5</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

PREPARE FOR LAUNCH VEHICLE SYSTEMS PERFORMANCE DEBRIEFING AT 25 HRS.
SEE QUESTIONS ON PAGE 3-21

1813 CST
05:00

MCC-H

NOTES

UPLINK TO CSM
DESIRED ORIENTATION (PTC)
ZERO TRUNION BIAS

05:30

P52 - IMU REALIGN
OPTION 1 - PREFERRED
(PTC ORIENT)
GYRO TORQUE

REPORT GYRO TORQUING ANGLES

GDC ALIGN

STARS ___ , ___
SA ___ , ___
TA ___ , ___

06:00

VHF A SIMPLEX - OFF
VERIFY WASTE STOWAGE VENT VALVE - VENT

P52 IMU REALIGN
N71: ___ . ___
N05: ___ . ___
N93: ___ . ___
X ___ . ___
Y ___ . ___
Z ___ . ___
GET ___ : ___ : ___

UPDATE TO CSM
P37 PAD (L/O+15)

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
---|---|---|---|---|---
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 05:00 - 06:00 | 1/TLC | 3-6

P 37 PAD ASSUMES NO MCC-1
FLIGHT PLAN

MNVR TO OPTICS CALIBRATION ATT
LOAD DAP, N46 (21101, 11111)
P23 - CISLUNAR NAVIGATION
OPTICS CALIBRATION STAR 4 0
P00
V49 - MNVR TO SIGHTING ATT
STAR/EARTH HORIZON
P23 - CISLUNAR NAVIGATION
LOAD W MATRIX \( R1 + 8 0 0 0 0 (R2 + 0 0 0 7 0) \)

1. STAR 33 EFH (R3 00120) ANTARES
2. STAR 221 ENH (R3 00110) DELTA CAPRICORNI
N88: \((R1 +39954)(R2 -26599)(R3 -14003)\)
3. STAR 76 EFH (R3 00120) THETA SCORPII
N88: \((R1 -03957)(R2 -36365)(R3 -34088)\)
4. STAR 40 ENH (R3 00110) ALTAIR
5. STAR 42 ENH (R3 00110) PEACOCK

02 FUEL CELL PURGE }
WASTE WATER DUMP IF NO MCC-1

S-IVB APS MCC-1
GET: 06:00
\( \Delta V \sim 3 \text{ FPS} \)
3 MARKS ON EACH STAR
INCORPORATE P23
MARK DATA AND
UPDATE ONBOARD
STATE VECTOR

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
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<tr>
<td>Apollo 13</td>
<td>FINAL (APRIL)</td>
<td>March 16, 1970</td>
<td>06:00 - 07:00</td>
<td>1/TLC</td>
<td>3-7</td>
</tr>
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</table>
**FLIGHT PLAN**

**MCC-H**

<table>
<thead>
<tr>
<th align="center">07:00</th>
<th align="center">MVR TO PTC ATTITUDE</th>
<th align="center">P 90</th>
</tr>
</thead>
<tbody>
<tr>
<td align="center">:10</td>
<td align="center">PREPARE FOR EARTH WEATHER</td>
<td align="center">Y 0</td>
</tr>
<tr>
<td align="center">:20</td>
<td align="center">PHOTOGRAPH CM /EL/250/CEX - RING</td>
<td align="center"></td>
</tr>
<tr>
<td align="center">:40</td>
<td align="center">(fTT,250, $\omega$) 10</td>
<td align="center"></td>
</tr>
<tr>
<td align="center">:50</td>
<td align="center"></td>
<td align="center"></td>
</tr>
<tr>
<td align="center">08:00</td>
<td align="center"></td>
<td align="center"></td>
</tr>
</tbody>
</table>

**UPDATE TO CSM QUADS TO DISABLE FOR PTC (LOWEST QUANTITY PRPLNT)**

**RECORD PHOTO TIMES ON CREW MARK.**

**NOTES**

- GO TO PTC ATTITUDE AND NULL RATES TO + 0.5° DB. DISABLE TWO ADJACENT QUADS.
- MONITOR FOR 20 MINUTES THEN SELECT + 30° DB AND 0.3°/SEC RATE, THEN DISABLE THE REMAINING QUADS AFTER SPIN UP.

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
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</thead>
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<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>07:00 - 08:00</td>
<td>1/TLC</td>
<td>3-8</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

DEACTIVATE PRIMARY EVAPORATOR
GLY EVAP H2O FLOW - OFF (CTR)
GLY EVAP STM PRESS AUTO - MAN
GLY EVAP STM PRESS INCR - INCR FOR 1 MIN

SELECT NORMAL LUNAR COMM EXCEPT:
S-BD AUX TAPE - OFF
TAPE RCDR FWD - OFF

GET 8 HRS F.O.V. 11°

LiOH CANISTER CHANGE
(3 INTO A, STOW 1 IN B5)

S-IVB MCC-2 APPROX
09:00 GET, ΔV IS NOMINALLY ZERO

<table>
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<tr>
<th>MISSION</th>
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<th>DAY/REV</th>
<th>PAGE</th>
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</thead>
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<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>08:00 - 09:00</td>
<td>1/TLC</td>
<td>3-9</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

GET 10 HRS  F.O.V. 10°

EARTH WEATHER PHOTOGRAPHY

PTC P 90, Y 0

MISSION | EDITION     | DATE           | TIME        | DAY/REV | PAGE
---------|--------------|----------------|-------------|---------|-----
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 09:00 - 10:00 | 1/TLC   | 3-10
FLIGHT PLAN

EMS ACCEL NULL BIAS TEST (REPORT)

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
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</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>10:00 - 11:00</td>
<td>1/TLC</td>
<td>3-11</td>
</tr>
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</table>
# FLIGHT PLAN

## MCC-1 BURN TABLE

<table>
<thead>
<tr>
<th>P OR Y RATES</th>
<th>ATT DEVIATION</th>
<th>SHUTDOWN TIME</th>
<th>RESIDUALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10°/SEC TAKEOVER</td>
<td>±10° TAKEOVER</td>
<td>BT + 1 SEC</td>
<td>IF &lt; 2FPS, TRIM X AXIS TO 0.2 FPS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IF &gt; 2FPS, NO TRIM</td>
</tr>
</tbody>
</table>

**TABLE 3-2**

3-11A
FLIGHT PLAN

11:00
P30 - EXTERNAL ΔV

11:10
V49 - MNVR TO BURN ATT
P40/41 - SPS/RCS THRUST
SXT STAR CHECK
O₂ FUEL CELL PURGE IF NOT PERFORMED
WASTE WATER DUMP AT 06:55

11:30
GDC ALIGN

11:40
MCC-1
V66 - TRANSFER CSM SV TO LM SLOT
MCC-1 BURN STATUS REPORT

REPORT: LM/CM ΔP
WASTE STOWAGE VENT VLV - CLOSE (Δ8HRS FROM VENT)
VENT BATTs UNTIL SYSTEM TEST METER (4A) = 0

12:00

NOTES

BURN STATUS REPORT

ΔTIG
BT

V_gx

TRIM

R
P
Y
V_gx
V_gy
V_gz

ΔV_c

FUEL *

OX *

UNBAL

ITEMS TO BE REPORTED TO MSFN
MCC-1 WILL BE DELAYED TO MCC-2 IF PROPELLANT COST IS NOT PROHIBITIVE

<table>
<thead>
<tr>
<th>MISSION</th>
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<th>DAY/REV</th>
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<td>11:00 - 12:00</td>
<td>1/TLC</td>
<td>3-12</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

UPDATE TO CSM QUADS TO DISABLE FOR PTC (LOWEST QUANTITY PRPLNT)

0113 CST

12:00

MNCR TO PTC ATT P 90 Y 0

START PTC

MSF

EAT PERIOD

PTC P 90, Y 0

PRESLEEP CHECKLIST

ONBOARD READOUT
BAT C
PYRO BAT A
PYRO BAT B
RCS A
B
C
D
DC IND SEL - MNA OR B

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
--- | --- | --- | --- | --- | ---
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 12:00 - 13:00 | 1/TLC | 3-13
FLIGHT PLAN

MCC-H 0213 CST

13:00 ~

:20 ~

:40 ~

14:00 ~

MSFN ~

:20 ~

:40 ~

15:00 ~

NOTES
DURING REST PERIOD
TWO CREWMEN IN
REST STATIONS AND
ONE IN COUCH

PTC
P 90, Y 0

REST PERIOD
(10 HOURS)

MISSION | EDITION        | DATE          | TIME       | DAY/REV | PAGE
---------|----------------|---------------|------------|---------|-----
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 13:00 - 15:00 | 1/TLC   | 3-14
FLIGHT PLAN

MCC-H 0413 CST

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<th>TIME</th>
<th>DAY/REV</th>
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<td>MARCH 16, 1970</td>
<td>15:00 - 17:00</td>
<td>1/TLC</td>
<td>3-15</td>
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<td>MISSION</td>
<td>EDITION</td>
<td>DATE</td>
<td>TIME</td>
<td>DAY/REV</td>
<td>PAGE</td>
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<td>17:00 - 19:00</td>
<td>1/TLC</td>
<td>3-16</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

POSTSLEEP CHECKLIST
LIOH CANISTER CHANGE
(4 INTO B, STOW 2 IN B5)
BATTERY CHARGE, BATTERY A

REPORT LM/CM AP

NOTES

CSM CONSUMABLES UPDATE
GET: ______:_____
RCS TOTAL ______
QUAD A ______ B ______
C ______ D ______
H_2 TOTAL ______
O_2 TOTAL ______

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
---------|---------|------|------|---------|-----
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 23:00 - 24:00 | 2/TLC | 3-19
FLIGHT PLAN

LAUNCH VEHICLE SYSTEMS PERFORMANCE DEBRIEFING

1. Were there any significant changes in noise level between stages of powered flight?
2. Were there any significant changes in noise/vibration level during a single stage of powered flight?
3. Were there any unexpected acceleration transients experienced at initiation of IGN, SII CECO, MAX Q or M/R shift for both SII and S-IVB?
4. After SC separation, describe the conditions of the IU thermal shroud. Was there any looseness?
5. How was ground/SC comm at ignition/liftoff time region relative to vibration and acoustic environments?
6. Describe any visible venting or suspected leak after separation.
7. When, and at what distance, was the S-IVB seen for the last time?
8. Are there any comments relative to S-IVB/IU TLI guidance cutoff conditions (predicted vs actual SC display)?

MISSION EDITION DATE TIME DAY/REV PAGE
APOLLO 13 FINAL (APRIL) MARCH 16, 1970 25:00 - 26:00 2/TLC 3-21
THIS PAGE INTENTIONALLY LEFT BLANK
**FLIGHT PLAN**

**MCC-2 BURN TABLE**

<table>
<thead>
<tr>
<th>P OR Y RATES</th>
<th>ATT DEVIATION</th>
<th>SHUTDOWN TIME</th>
<th>RESIDUALS</th>
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</thead>
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<tr>
<td>10°/SEC TAKEOVER</td>
<td>+10° TAKEOVER</td>
<td>BT + 1 SEC</td>
<td>IF &lt; 2FPS, TRIM X AXIS TO 0.2FPS IF &gt; 2FPS, NO TRIM</td>
</tr>
</tbody>
</table>

**TABLE 3-3**

3-23 A
FLIGHT PLAN

1913 CST

30:00

P40 - SPS THRUST
SXT STAR CHECK

:10

TV (GDS) 30:15 TO 30:45
CM4/TV-AVG (f5.6)

:20

H₂ & O₂ FUEL CELL PURGE
WASTE WATER DUMP
H₂ PURGE LINE HEATERS - OFF

30:30

GDC ALIGN

:40

MCC-2

V66 - TRANSFER CSM SV TO LM SLOT
MCC-2 BURN STATUS REPORT

:50

31:00

NOTES

BURN STATUS REPORT

NOTE: MCC-2 WILL
BE ACCOMPLISHED
ON BANK A ONLY

TIG: 30:40:49
BT: 2.2 SEC
ΔVR: 15.1 FPS
ULLAGE: - NONE
ORBIT: N/A

*ITEMS TO BE
REPORTED TO MSFN

ATTITUDE FOR MCC-2
BURN IS CONSTRAINED
IN ROLL FOR HGA
ACQUISITION FOR TV
AND BY SXT STAR CHECK

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
---|---|---|---|---|---
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 30:00 - 31:00 | 2/TLC | 3-24
FLIGHT PLAN

MNVR TO OPTICS CALIBRATION
R 147
P 340
Y 0

OPTICS CALIBRATION
STAR 4

V49 - MNVR TO SIGHTING
R 136
P 307
Y 0

LOAD W MATRIX
(R1 + 4 5 0 0 0)
(R2 + 0 0 0 0 6)

1. STAR 37 EFH (R3 00120) NUNKI

2. STAR 221 ENH (R3 00110) DELTA CAPRICORN
N88: (R1 +39954)(R2 -26599)(R3 -14003)

3. STAR 42 EFH (R3 00120) PEACOCK

4. STAR 45 ENH (R3 00110) FOMALHAUT

5. STAR 77 EFH (R3 00120) KAUS AUST
N88: (R1 +03986)(R2 -41062)(R3 -28249)

NOTES
3 MARKS EACH STAR
INCORPORATE P23
MARK DATA AND
UPDATE ONBOARD
STATE VECTOR

GET 30 HRS   F.O.V. 4°

MISSION  EDITION  DATE  TIME  DAY/REV  PAGE
APOLLO 13 FINAL (APRIL) MARCH 16, 1970 31:00 - 32:00 2/TLC 3-25
**FLIGHT PLAN**

2113 CST

32:00

- MANEUVER TO PTC ATTITUDE $P_{90}$
- START PTC
- S-BAND ANT - OMNI B ON MCC CUE
- SECURE HGA
- HGA TRACK - MAN
- HGA PITCH $-52^\circ$
- HGA YAW $270^\circ$
- CHECK BAT VENT (TEST METER 4A)

33:00

---

<table>
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<tr>
<th>MISSION</th>
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<th>DAY/REV</th>
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<td>MARCH 16, 1970</td>
<td>32:00 - 33:00</td>
<td>2/TLC</td>
<td>3-26</td>
</tr>
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</table>
LOI MINUS 5 HR FLYBY IS A CIRCUMLUNAR TRAJECTORY TO THE PRI MPL AND WITH A PERILUNE BETWEEN 60 AND 1500 NM.

**FLIGHT PLAN**

**UPDATE TO CSM LOI MINUS 5 HR FLYBY**

<table>
<thead>
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<th>MISSION</th>
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<th>TIME</th>
<th>DAY/REV</th>
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<td>33:00 - 35:00</td>
<td>2/TLC</td>
<td>3-27</td>
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</table>
FLIGHT PLAN

L1OH CANISTER CHANGE
(5 INTO A, STOW 3 IN B5)

REPORT LM/CM ΔP

EAT PERIOD

PRESLEEP CHECKLIST

UPLINK TO CSM
CSM S.V. & V66

MCC-H 0013 CST

35:00

36:00

37:00

NOTES

ONBOARD READOUT
BAT C
PYRO BAT A
PYRO BAT B
RCS A
B
C
D

DC IND SEL - MNA OR B

<table>
<thead>
<tr>
<th>MISSION</th>
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<th>TIME</th>
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<td>35:00 - 37:00</td>
<td>2/TLC</td>
<td>3-28</td>
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</table>
FLIGHT PLAN

REST PERIOD (10 HOURS)

NOTES
DURING REST PERIOD
TWO CREWMEN IN
REST STATIONS AND
ONE IN COUCH

PTC
P 90 Y 0

<table>
<thead>
<tr>
<th>MISSION</th>
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<th>TIME</th>
<th>DAY/REV</th>
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<td>37:00 - 39:00</td>
<td>2/TLC</td>
<td>3-29</td>
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**FLIGHT PLAN**

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<td>MARCH 16, 1970</td>
<td>41:00 - 43:00</td>
<td>2/TLC</td>
<td>3-31</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

POST SLEEP CHECKLIST

EAT PERIOD

L\text{OH} CANISTER CHANGE
(6 INTO B, STOW 4 IN B5)

REPORT LM/CM \Delta P

CSM CONSUMABLES UPDATE
GET: ___ : ___
RCS TOTAL ________
QUAD A ___ B ___
C ___ D ___
H\text{2} TOTAL ________
O\text{2} TOTAL ________

NOTES

PTC
P 90 Y 0

<table>
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<th>TIME</th>
<th>DAY/REV</th>
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<td>47:00 - 49:00</td>
<td>3/TLC</td>
<td>3-34</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

P52 - IMU REALIGN
OPTION 3 - REFSMMAT
(PTC ORIENT)

REPORT GYRO TORQUING ANGLES

GET 50 HRS F.O.V. 3°

NOTES

P52 IMU REALIGN
N71: __ __ __
N05: __ __ __
N93:
X __ __ __
Y __ __ __
Z __ __ __
GET __ __ __ __

PTC
P 90 Y 0

MISSION | EDITION | DATE         | TIME        | DAY/REV | PAGE
----------|----------|--------------|-------------|---------|-------
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 49:00 - 51:00 | 3/TLC   | 3-35
FLIGHT PLAN

UPLINK TO CSM
CSM S.V. & V66
MCC-3 TGT LOAD
UPDATE TO CSM
GO/NO-GO MCC-3
MCC-3 MNVR PAD

P52 - IMU REALIGN
OPTION 3 - REFSSMAT
(PTC ORIENT)

CONTINUE PTC IF MCC-3 IS NOT PERFORMED
REPORT GYRO TORQUING ANGLES

P30 - EXTERNAL ΔV

FUEL CELL PURGE AND
WASTE WATER DUMP
SCHEDULED AT 55:08
WILL BE DELAYED
TO 57:50 IF MCC-3
IS NOT PERFORMED.

<table>
<thead>
<tr>
<th>MISSION</th>
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<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>53:00 - 55:00</td>
<td>3/TLC</td>
<td>3-37</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

V49 - MNVR TO BURN ATT
P40/P41 - SPS/RCS THRUST
SXT STAR CHECK
O2 FUEL CELL PURGE
WASTE WATER DUMP

GDC ALIGN

MCC-3
V66 - TRANSFER CSM SV TO LM SLOT
MCC-3 BURN STATUS REPORT

BATTERY CHARGE, BATTERY B

START PTC

LM TUNL VENT VALVE - LM/CM ΔP
IF LM/CM ΔP <1.7 psid - VENT
UNTIL ΔP>1.7

TIG: 55:24:53
BT: NOM. ZERO
ΔVR: NOM. ZERO
ULLAGE: NONE
ORBIT: N/A

MCC-3 WILL BE DELAYED TO MCC-4
IF PROPellant COST IS NOT PROHIBITIVE

*ITEMS TO BE REPORTED TO MSFN

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>55:00 - 56:00</td>
<td>3/TLC</td>
<td>3-38</td>
</tr>
</tbody>
</table>
### FLIGHT PLAN

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>56:00 - 57:00</td>
<td>3/TLC</td>
<td>3-39</td>
</tr>
</tbody>
</table>

**Notes**
- Lunar photography at crew option
- CM /EL/80 or 250/BW-RING (f5.6, 250, ∞) 10
- MAG P
- CM /EL/80 or 250/CEX-RING (f5.6, 250, ∞) 10
- MAG L
FLIGHT PLAN

UPLINK TO CSM
ΔH (IF REQUIRED)

2213 CST

57:00

PRESSURIZE CSM TO 5.7 PSIA
PRESSURIZE LM

:10

T EPHEM: V05N01 1706E
COPY IN LM ACTIVATION CHECKLIST (ACT 33)

:20

CLEAR TUNNEL OF
CM HATCH
INSPECT TUNNEL &
DOCKING LATCHES
REMOVE PROBE & DROGUE

57:30

:40

TV (GDS) 58:00 TO 58:30
CM_/TV-AVG (f5.6)

:50

LOAD DAP, N46 (21111, 11111)

58:00

STOP PTC ROLL AT ___,   HGA P ___ Y ___

NOTES
ΔH DETERMINED
FROM STAR/Earth
HORIZON SIGHTINGS
WILL BE UPLINKED
IF IT DIFFERS FROM
ΔH IN E-MEMORY
BY MORE THAN 5.0 KM

PTC
P 90, Y 0

O₂ FUEL CELL PURGE
&WASTE WATER DUMP
@ 57:50 IF NOT
PERFORMED AT 55:08

---

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
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</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>57:00 - 58:00</td>
<td>3/TLC</td>
<td>3-40</td>
</tr>
</tbody>
</table>
**CSM**

- CMP
- MNVR TO PTC ATTITUDE
- START PTC
- S-BAND ANT-OMNI B
- (ON MCC CUE)
- SECURE HGA

**FLIGHT PLAN**

- 0013 CST

**LM**

- 59:00
- CDR
- LM
- FAMILIARIZATION

**MCC-H**

- UPDATE TO CSM QUADS TO DISABLE FOR PTC (LOWEST QUANTITY PRPLNT)

**PTC**

- P 90 Y 0

**MSFN**

- 59:30

**IVT TO CSM**

- 59:00
- CLOSE LM HATCH

**FLIGHT PLAN**

- 59:40

**CMP:**

- INSTALL PROBE AND DROGUE
- INSTALL CM HATCH
- LM TUNNEL VENT VALVE - LM/CM ΔP

---

**MISSION** | **EDITION** | **DATE** | **TIME** | **DAY/REV** | **PAGE**
---|---|---|---|---|---
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 59:00 - 60:00 | 3/TLC | 3-42
REST PERIOD (9 HOURS)

MISSION | EDITION          | DATE       | TIME          | DAY/REV | PAGE  
---------|------------------|------------|---------------|---------|------- 
APOLLO 13 | FINAL (APRIL)    | MARCH 16, 1970 | 67:00 - 69:00 | 3/TLC  | 3-47  

MCC-H 0813 CST
FLIGHT PLAN

MCC-H 1013 CST

69:00

:20

:40

70:00

:20

:40

71:00

REST PERIOD (9 HOURS)

POST SLEEP CHECKLIST

EAT PERIOD

LiOH CANISTER CHANGE (8 INTO B, STOW 6 IN B6)

NOTES

IF MCC4 IS NOT PERFORMED, CREW AWAKE TIME IS 73 HRS.

PTC P 90, Y 0

CSM CONSUMABLES UPDATE
GET: __ __ __ __
RCS TOTAL __________
QUAD A __ __ B __
C __ __ D __
H2 TOTAL __________
O2 TOTAL __________

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>69:00 - 71:00</td>
<td>3-4/TLC</td>
<td>3-48</td>
</tr>
</tbody>
</table>
**FLIGHT PLAN**

- **MCC-H**
  - 1213 CST
  - UPLINK TO CSM
  - CSM S.V. & V66
  - MCC-4 TGT LOAD

- **UPDATE TO CSM**
  - MCC-4 MNVR PAD
  - CONSUMABLES
  - FLIGHT PLAN
  - PERICYNTHION +2HR
  - ABORT PAD

- **NOTES**
  - PERICYNTHION +2 HR
  - ABORT PAD TARGETED
  - FOR A FAST RETURN TO MPL.

- **P52 IMU REALIGN**
  - N71: ___
  - N05: ___
  - N93:
    - X: ___
    - Y: ___
    - Z: ___
  - GET: ___

- **REPORT**
  - GYRO TORQUING ANGLES

- **STOP PTC AT**
  - BURN ROLL ATT

- **P30 EXT. ΔV**

- **LOAD DAP, N46 (20101,01111)**

- **V49 MNVR TO BURN ATT**

---

**MISSION** | **EDITION** | **DATE** | **TIME** | **DAY/REV** | **PAGE**
--- | --- | --- | --- | --- | ---
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 71:00 - 72:00 | 4/TLC | 3-49
FLIGHT PLAN

**MCC-4 BURN CHART**

<table>
<thead>
<tr>
<th>P OR Y RATES</th>
<th>ATT DEVIATION</th>
<th>SHUTDOWN TIME</th>
<th>RESIDUALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10°/SEC TAKEOVER</td>
<td>±10° TAKEOVER</td>
<td>BT + 1 SEC</td>
<td>TRIM X AXIS ONLY TO 1.0 FPS</td>
</tr>
</tbody>
</table>

**TABLE 3-5**

3-49A
FLIGHT PLAN

P40/41 - SPS/RCS THRUST
SXT STAR CHECK

GDC ALIGN
V66-TRANSFER CSM SV TO LM SLOT
MCC 4 BURN STATUS REPORT
REPORT LM/CM ΔP
LOAD DAP, N46 (20111, 01111)
BATTERY CHARGE, BATTERY A

MCC-4

NOTES

BURN STATUS REPORT

ΔTIG
BT
Vgx
TRIM
R
P
Y
Vgx
Vgy
Vgz
ΔVc
FUEL
OX
UNBAL

TIG: 72:24:53
BT: NOM ZERO
ΔVR: NOM. ZERO
ULLAGE: N/A
ORBIT: N/A

*ITEMS TO BE REPORTED TO MSFN

MCC-H

1313 CST

72:00

:10

:20

:40

:50

73:00

LOI - 5 HRS

72:30

MCC-4

MISSION | EDITION | DATE        | TIME        | DAY/REV | PAGE
---------|----------|-------------|------------|---------|------
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 72:00 - 73:00 | 4/TLC | 3-50
**FLIGHT PLAN**

PRE LOI SEC GLY LOOP CHECK
ECS IND SW - SEC
SEC GLY TO RAD VLV - NORM
SEC COOL LOOP PUMP - AC1
GLY DISCHARGE SEC PRESS-39-51 PSIA
ACCUM SEC QTY IND-30-55%
SEC EVAP TEMP OUT - DECREASE
(VERIFY FLOW)
SEC COOL LOOP PUMP - OFF (CTR)
SEC GLY TO RAD VLV - BYPASS
ECS IND SW - PRIMARY

PRESSURIZE CSM TO 5.4 PSI

---

**NOTES**

IF NO MCC-4, CREW WILL BE AWAKENED AT 73:00. THE CREW WILL PICK UP THE P52 AND BAT CHARGE NOMINALY SCHEDULED AT 71:20 AND 72:37 RESPECTIVELY AND PROCEED WITH SCHEDULED ACTIVITIES AT 73:00.

---

**MISSION** | **EDITION** | **DATE** | **TIME** | **DAY/REV** | **PAGE**
--- | --- | --- | --- | --- | ---
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 73:00 - 74:00 | 4/TLC | 3-51
FLIGHT PLAN

PRESSURIZE LM
(IN CASE OF LOI ABORT)
LM TUNNEL VENT VALVE-CM/LM AP

CHECK MISSION TIMER AGAINST CMC CLOCK

MNVR TO MOON VIEW ATT (74:25)
(HATCH WINDOW)

R 0 HGA
P 073 P -69
Y 0 Y 0

UPLINK TO CSM
CSM S.V. & V66
(PRELIMINARY)
LOI TGT LOAD
(PRELIMINARY)
DESIRED ORIENTATION
(LDNG SITE)

UPDATE TO CSM
LOI MNVR PAD
(PRELIMINARY)
TEI 1 & 4 PAD

P52 IMU REALIGN
OPTION 1 - PREFERRED
(LDG SITE ORIENT)
GYRO TORQUE

REPORT GYRO TORQUING ANGLES

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>74:00 - 75:00</td>
<td>2/TLC</td>
<td>3-52</td>
</tr>
</tbody>
</table>
### FLIGHT PLAN

**MCC-H**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Coordinates</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>75:00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75:10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75:20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75:30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75:40</td>
<td>MNVR TO BURN ATT</td>
<td>R 180</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>HGA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>P 272</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>P -88</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Y 357</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Y 172</td>
<td></td>
</tr>
<tr>
<td>76:00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES**

- LUNAR PHOTOGRAPHY AT CREW OPTION
  - CM-/EL/80 or 250/BW-RING(f5.6,250,∞)10 MAG P
  - CM-/EL/80 or 250/CEX-RING(f5.6,250,∞)10 MAG L

---

**MISSION** | **EDITION** | **DATE** | **TIME** | **DAY/REV** | **PAGE**
-------------|-------------|----------|-----------|-------------|--------
APOLLO 13    | FINAL (APRIL) | MARCH 16, 1970 | 75:00 - 76:00 | 4/TLC | 3-53
FLIGHT PLAN

PRE LOI SYSTEMS CHECKS:
C&W CHECK
CM RCS CHECK
SM RCS CHECK
SPS PERIODIC MONITOR
ECS PERIODIC MONITOR
EMS ΔV AND ACCEL NULL BIAS TEST (REPORT)
VERIFY PUGS - INCREASE

P30-EXT ΔV
P40-SPS THRUST
LOAD DAP N46 (20101) (01111)
ROLL TO BURN ATT (76:40)
OMNI D

SXT STAR CHECK

SUBEARTH POINT
REV 1
3.215W
0.868N
CSM GNC GO CRITERIA

SPS
- FU/OX TANK (W/O LEAK) - FU/OX
- GN₂ TANK (W/O LEAK) - 1 OF 2 (CANT CONFIRM)
- BALL VALVE BANK - BOTH
- FEEDLINE TEMP >40° F
- FU/OX ΔP<20 PSI
- PC>70 PSI
- ullage capability - 1 OF 2
- HE TANK (W/O LEAK)

SM RCS
- HE TANK (W/O LEAK) - ALL
- NO LEAK BELOW ISO VLV - ALL
- PKG TEMP > 55° - ALL
- THRUSTERS - 3 OF 4 P & Y, 6 OF 8 R

CM RCS
- HE TANK (W/O LEAK) - BOTH
- MANIFOLD (W/O LEAK) - BOTH
- NOT ARMED

SYSTEMS MANAGEMENT
- START BURN ON BANK B
- OPEN BANK A TIG + 2-5 SECONDS

LOI INHIBIT CRITERIA

- FULL CRITICAL SYSTEMS REDUNDANCY
- ADEQUATE CONSUMABLES FOR MIN LO OPS, CAPABILITY TO SUSTAIN TANK LOSS AND RETURN TO EARTH WITH AVG POWER LEVEL OF 40 AMPS
- SPS PRPLNT RESERVE FOR TEI AND TEC MCC'S
- RCS PRPLNT RESERVE FOR TEI AND TEC MCC CONTROL, PTC, AND MIN LUNAR ORBIT OPERATIONS
- DPS LOI IF REQUIRED TO ACCOMPLISH A LUNAR ORBIT OPERATION

CSM GNC GO CRITERIA

GNCS/SCS
- 3 - AXIS AUTO ATTITUDE CONTROL
- 3 - AXIS RATE DAMPING
- 3 - AXIS DIRECT RCS
- BMAGS P, Y -- 1 OF 2
- BMAGS R -- 1 OF 2
- FDAI -- 1 OF 2
- CMC, ISS, OSS, OPTICS DAC
- TVC SERVO LOOP -- BOTH
- DSKY -- 1 OF 2
## FLIGHT PLAN

### LOI BURN TABLE

<table>
<thead>
<tr>
<th>P OR Y RATES</th>
<th>ATT DEVIATION</th>
<th>SHUTDOWN TIME</th>
<th>RESIDUALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10°/SEC TAKEOVER</td>
<td>+10° TAKEOVER</td>
<td>BT + 10 SEC</td>
<td>DO NOT TRIM</td>
</tr>
</tbody>
</table>

### TABLE 3-6
LOI ABORT TABLE

<table>
<thead>
<tr>
<th>MODE I (DPS ONLY)</th>
<th>MODE II (DPS ONLY)</th>
<th>MODE III (DPS ONLY)</th>
<th>(DPS ONLY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1 MIN 45 SEC</td>
<td>1 MIN 45 SEC TO</td>
<td>2 MIN 50 SEC TO</td>
<td>3 MIN 50 SEC</td>
</tr>
<tr>
<td>(\Delta V_m) 0-750 (TIGHT)</td>
<td>2 MIN 50 SEC</td>
<td>3 MIN 50 SEC</td>
<td>5 MIN 57 SEC (CUTOFF)</td>
</tr>
<tr>
<td>LOI + 2 HR.</td>
<td>(\Delta V_m) 750-1245 (LOOSE)</td>
<td>(\Delta V_m) 1245-1700 (LOOSE)</td>
<td>(\Delta V_m) 1700-2815 (TIGHT)</td>
</tr>
<tr>
<td>MCC-H TARGET OR CREW CHART (NO COMM)</td>
<td>DPS \textsubscript{1} @ LOI + 2 HR</td>
<td>DPS \textsubscript{2} @ LOI + 1 REV</td>
<td>DPS @ LOI + 1 REV</td>
</tr>
</tbody>
</table>

TIGHT SPS LIMITS

FUEL - OXID DELTA P GREATER THAN 20 PSI CONFIRMED BY LOW PC
PROP TANK PRESS LESS THAN 160 PSI CONFIRMED BY LOW PC
PC LESS THAN 80 PSI OR DECAYS 10 PSI DURING THE BURN
ANY BALL VALVE FAILS TO OPERATE, OR CLOSES PREMATURELY, AND THE OTHER BANK GN2 TANK PRESSURE HAS DECAYED TO 1500 PSI (SHUT DOWN DECAYING BANK FIRST, IF STILL BURNING, CONTINUE)

NOTE: IF THE FIRST BANK SELECTED FAILS TO OPERATE UNDER G & N CONTROL, ATTEMPT TO START THAT BANK UNDER SCS CONTROL. IF THE BANK STARTS UNDER SCS CONTROL, CONTINUE THE BURN AND EVALUATE G & N STEERING. IF THE BANK FAILS TO START UNDER SCS CONTROL, INHIBIT LOI.

LOOSE SPS LIMITS

PC LESS THAN 70 PSI CONFIRMED BY OTHER CUES
PROP TANK PRESS LESS THAN 115 PSI CONFIRMED BY LOW PC

PHYSIOLOGICAL INDICATIONS OF ERRATIC ENGINE PERFORMANCE (VIBRATION, POPPING, ETC.)
FLIGHT PLAN

VERIFY DSE MOTION AT LOS

GDC ALIGN

NOTE: LOI will be started on BANK B. BANK A will be turned on 2 to 5 sec after ignition

TIG: 77:24:53
BT: 5 MIN 56.5 SEC
AVR: 2015.3
ULLAGE: NONE
ORBIT: 168.3 x 57.0

V66 TRANSFER CSM SV TO LM SLOT

MNVR TO COMM ATT (77:45)

R  0 HGA
P 160 P -24
Y 0 Y 180

LOI BURN STATUS REPORT

DUMP DSE

NOTES

BURN STATUS REPORT

| XX | XX | • | • |
| XX | • | • |

TRIM

R
P
Y
V<sub>x</sub>
V<sub>y</sub>
V<sub>z</sub>
ΔV<sub>c</sub>

FUEL

OX

UNBAL

* ITEMS TO BE REPORTED TO MSFN
** REPORT IF OFF MORE THAN ONE SECOND
*** REPORT IF >0.2 FPS
S-IVB LUNAR IMPACT (GET 77:49) LAT 2.6°S, LONG 27.7°W

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>77:00 - 78:00</td>
<td>4/1</td>
<td>3-55</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

MNVR TO LUNAR SURFACE
OBSERVATION ATT (78:00)
GO ORB RATE
V64 ACQUIRE MSFN

UPDATE TO CSM
LDMK TRK PAD REV 2

1913 CST
78:00

NOTES
A HEAVY LINE
UNDER A PITCH
ATTITUDE (P 215/___)
INDICATES AN
ORDEAL (L/H)
ANGLE.

MAP UPDATE REV 2
LOS : ______:____:____:____
180° : ______:____:____:____
AOS : ______:____:____:____

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
--- | --- | --- | --- | --- | ---
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 78:00 - 79:00 | 4/1 | 3-56
FLIGHT PLAN

H₂ PURGE LINE HTRS-ON
VERIFY DSE MOTION AT LOS

CONFIGURE FOR NORMAL LUNAR COMM
S-BD AUX TAPE - DN VOICE BU
TAPE RCDR FWD - FWD

H₂ & O₂ FUEL CELL PURGE
WASTE WATER DUMP
H₂ PURGE LINE HTRS - OFF

MISSION | EDITION       | DATE            | TIME        | DAY/REV | PAGE  
--------|----------------|-----------------|-------------|---------|-------
APOLLO 13| FINAL (APRIL)  | MARCH 16, 1970  | 79:00 - 80:00 | 4/2     | 3-57  

FLIGHT PLAN

MNVR TO LDMK TRK ATT (80:22)
GO ORB RATE

CM/DAC/SXT/CEx - (FIXED, 125, FIXED) 1 fps
MAG C % FILM

TRACK LDMK PICKERING B
80 SEC BETWEEN MARKS
5 MARKS
DO NOT PRO ON FINAL N89

START DAC @ T2-1 MIN
STOP DAC AFTER MARK 1
LDMK IS AT 23°
SUN ANGLE
START DAC AFTER MARK 4
STOP DAC AFTER MARK 5

MNVR TO BURN ATT R 180 HGA
EXCEPT FOR ROLL P 283 P -83
BY 80:45 Y 0 Y 2

LOAD DAP FOR TWO JET ULLAGE
(20111) (11111)
CMP - PRE DOI SYSTEMS CHECKS
C&W CHECK
CM RCS CHECK
SPS PERIODIC MONITOR CHECK
ECS PERIODIC MONITOR CHECK

EMS ΔV AND ACCEL NULL BIAS TEST (REPORT)

NOTES

MAP UPDATE REV 3
LOS
180°
AOS

P52 IMU REALIGN
N71:
N05:
N93:
X
Y
Z
GET

TEI 5 PAD
ASSUMES NOMINAL
DOI ACCOMPLISHED

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>80:00 - 81:00</td>
<td>4/2</td>
<td>3-58</td>
</tr>
</tbody>
</table>
**FLIGHT PLAN**

DOI

BURN TABLE

<table>
<thead>
<tr>
<th>P or Y Rates</th>
<th>Att Deviations</th>
<th>Shutdown Time</th>
<th>Residuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>10°/SEC Takeover</td>
<td>± 10° Takeover</td>
<td>BT + 1 SEC</td>
<td>TRIM X TO WITHIN 1 FPS DO NOT TRIM Y &amp; Z</td>
</tr>
</tbody>
</table>

**TABLE 3-8**
3-58A
FLIGHT PLAN

P52 IMU REALIGN
OPTION 3 REFSSMAT
(LDG SITE ORIENT)

DRIFT CHECK
REPORT GYRO TORQUING ANGLES
P30 EXT ΔV
P40 SPS THRUST
MNVR TO BURN ATT (81:15)
SXT STAR CHECK

VERIFY DSE MOTION AT LOS

MNVR TO BAILOUT BURN ATT (82:00)

GDC ALIGN

V66 TRANSFER CSM SV TO LM SLOT

NOTES

BURN STATUS REPORT

TIMESTAMP

R 0 OMNI C
P 283
Y 0

ΔTIG **
BT **
V gx

TRIM
R
P
V y***
V y***
V y***
V y***
ΔV c *

FUEL *
OX *
UNBAL

*ITEMS TO BE REPORTED TO MSFN
**REPORT IF OFF MORE THAN 1 SEC
***REPORT IF >0.2 FPS

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
---------|---------|------|------|---------|--------
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 81:00 - 82:00 | 4/3 | 3-59
CSM CMP

0113 CST

84:00

CDR

AID CMP OR LMP AS REQUIRED

84:10

LM

TRANSFER TO LM PWR COMM IN ACT

84:20

LMP

TOPO PHOTO PAD (CENSORINUS)
TEI 11 PAD
TRAJECTORY STATUS

84:30

MCC-H

DUMP DSE
UPDATE TO CSM

85:00

CSM S.V. & V66

CSM PWR TO LM-OFF
(AT LMP REQUEST)

85:10

PHOTO CENSORINUS

85:20

VHF SIMPLEX VOICE CHECK WITH LM

85:30

STOW TOPO CAMERA
MNVR TO REST ATT (85:00)

85:40

R 94, P 289, Y 0
HGA: P -4 , Y 281

CSM POWER TO LM-ON
(AT LMP REQUEST)
LOAD DAP R1(20101)

85:50

R2(11111)
V79: 10° DB
ZERO RATE

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 84:00 - 85:00 | 4/4 | 3-62
FLIGHT PLAN

LMP: IVT TO CSM
CLOSE LM HATCH

CMP: VERIFY DSE MOTION AT LOS
INSTALL DROGUE & PROBE
INSTALL CM HATCH
TUNNEL VENT VALVE - LM PRESS
LIOH CANISTER CHANGE: 9 INTO A, STOW 7 IN B6

EAT PERIOD

ONBOARD READOUT
BAT C
PYRO BAT A
PYRO BAT B
RCS A
B
C
D
DC IND SEL - MNA OR B

NOTES
MAP UPDATE REV 10
LOS :
180° :
AOS :

MISSON | EDITION | DATE          | TIME       | DAY/REV | PAGE
--------|----------|---------------|------------|---------|-----
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 85:00 - 86:00 | 4/4-5 | 3-63
**LUNAR ORBIT REST PERIOD ATTITUDE**

![Diagram of spacecraft with annotations]

- $\theta_s = 150^\circ$
- $\phi_s = 262^\circ$
- DB $\pm 10^\circ$

---

LOCAL HORIZONTAL

60°

EARTH

SUN

**FIGURE 3-2**

3-63A

- $\theta_s$ The smallest angle between the spacecraft X body axis and the sun line of sight.
- $\phi_s$ The angle which is measured from the minus Z spacecraft body axis positively about the X body axis to the sun line of sight vector projection in the Y - Z axis plane.
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<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>86:00 - 88:00</td>
<td>4/5-6</td>
<td>3-64</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

- REST PERIOD (8.5 HOURS)
- SET UP TV (95:50)
- EAT PERIOD
- REST ATT

NOTES
WAKE CREW AT 94:00
IF TWEAK BURN REQ.
AT 94:40

<table>
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<th>MISSION</th>
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<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>94:00 - 95:00</td>
<td>5/9-10</td>
<td>3-68</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

1213 CST

95:00

:10

:20

95:30

HGA P 4

Y 277

LMP DON LCG & PGA

W/O HELMET & GLOVES

POSTSLEEP CHECKLIST

EAT PERIOD

CDR DON LCG & PGA

W/O HELMET & GLOVES

REST ATT

CM5/TV-AVG (f22)

TV (MAD) 95:50-96:05

NOTES

CSM CONSUMABLES UPDATE
GET: ___ ___:

RCS TOTAL ________

QUAD A ___ B ___

C ___ D ___

H2 TOTAL ________

O2 TOTAL ________

DUMP DSE

UPDATE TO CSM

TRAJECTORY STATUS

CONSUMABLES

FLIGHT PLAN

TEI 35 PAD

REFSMAT

ZERO ZERO TIME

UPLINK TO CSM

CSM S.V. & V66

DESIRED ORIENT

(LDG SITE)

THE FRA MAURO

LANDING SITE WILL BE

VISIBLE OUT WINDOW 5

AT APPROXIMATELY 7°

SUN ELEVATION

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
---|---|---|---|---|---
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 95:00 - 96:00 | 5/10 | 3-69
22 deg pitch down from local horizontal orbital rate throughout tracking

CSM LANDMARK TRACKING PROFILE

MARK 1 = T2 + 40 sec
MARK 2 = T2 + 1 min 5 sec
MARK 3 = T2 + 1 min 30 sec
MARK 4 = T2 + 1 min 55 sec
MARK 5 = T2 + 2 min 20 sec

HORIZON

T1 GET AT 0° ELEVATION
T2 GET AT 35° ELEVATION

P22 LDMK TRACKING

T1
T2
R°°
N or S NM SA TA

LAT -04.043
LONG/2 -07.799
ALT -000.18

LAT
LONG/2
ALT

13-2
13-3

ΔT1 = 300 sec
ΔT2 = 40 sec
ΔT3 = 25 sec
ΔT4 = 25 sec
ΔT5 = 25 sec
ΔT6 = 25 sec
ΔT7 = 340 sec

AOS TO LOS - 146 sec
AOS TO FINAL MARK - 140 sec

CENTER OF MOON

FIGURE 3-4
3-74A
FLIGHT PLAN

CSM

ORBITAL SCIENCE
PHOTO TGT 14
DAP LOAD (10101)(11111)
MNVR TO TRK ATT (105:18)
R 0, P 306, Y 0
OMNI D

CM-/DAC/SXT

P22 ORBITAL NAV
GO ORB RATE (105:22)
P 338/306

START DAC @ T2 - 1 MIN

TRACK LDMK THEON SR.B
25 SEC BETWEEN MARKS
5 MARKS
DO NOT PRO ON FINAL N89

STOP DAC AFTER MARK 5
REMOVE DAC FROM SXT

TRACK LDMK 13-1
25 SEC BETWEEN MARKS
5 MARKS
DO NOT PRO ON FINAL N89

RNDZ XPND-OFF
INSTALL WINDOW SHADAS
CM4/EL (S/C CONTAM)

DOFF PGA

STOP ORB RATE (105:59)
P 192

LM

CDR

LMP

EAT PERIOD

RR-ON
P22 LUNAR SURFACE NAV

TERMINATE P22 LUNAR SURFACE NAVIGATION
DESIGNATE THEN PWR DOWN RR
E MEMORY DUMP

POWER DOWN IMU, LGC TO STANDBY
CREW STATUS REPORT (DOSIOMETER, MEDICATION)

MCC-H

UPDATE TO CSM
P22 TRK PADS REV 15
CONTAM PHOTO PAD
UPLINK TO CSM
CSM S.V.

UPDATE TO LM
LM CONSUMABLES
P22 ACQ TIME 28° EL
MSFN
RECORD PCM LBR ON
DSE DURING P22'S

UPDATE TO LM
DAP LOAD
LIFT OFF TIME FOR
REV 16 THRU 19

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
--------|---------|------|------|---------|-----
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 105:00 - 106:00 | 5/15 | 3-79
SOLAR CORONA PHOTOGRAPHY

FIGURE 3-5
3-80A
FLIGHT PLAN

MAP UPDATE REV 17
LOS : __ __ __ __ __
180° : __ __ __ __ __
AOS : __ __ __ __ __

SOLAR CORONA PHOTO PAD
T-START : __ __ __ __ __
START RECORDER at SUNSET(-) 5 MIN

TOPO PHOTO PAD (LM)
R __ P __ Y __
T START : __ __ __ __ __
T STOP : __ __ __ __ __
RNG ________ NM.

EARTHSHINE PHOTO PAD
T-START : __ __ __ __
START RECORDER AT SUNSET

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<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td></td>
<td></td>
<td>3-80B</td>
</tr>
</tbody>
</table>
**FLIGHT PLAN**

**CSM**

**CMP**

P22 ORBITAL NAV
GO ORB RATE (109:03)
P 338/353
START DAC @ T2 - 1 MIN
TRACK LDMK TARUNTUS O
25 SEC BETWEEN MARKS
5 MARKS
DO NOT PRO ON FINAL N89
STOP DAC AFTER MARK 5
LOAD DAP (10102)(11111)
START DAC @ T2-1 MIN
TRACK LDMK 130
25 SEC BETWEEN MARKS
5 MARKS
DO NOT PRO ON FINAL N89
STOP DAC AFTER MARK 5
& REMOVE DAC FROM SXT
MNVR TO LM TRK ATT
R O P 0 / 296 , Y 0
GO ORB RATE (109:29)
TRACK LM
25 SEC BETWEEN MARKS
5 MARKS
DO NOT PRO ON FINAL N89
MNVR TO EARTHSHINE ATT
R O P 270/157 , Y 0
HGA P -43 , Y 180
GO ORB RATE (109:45)
CM4/DAC(EARTHSHINE)
EARTHSHINE PHOTOS & VISUAL TGT 17

**CDR**

FLAG DEPLOY
WALK TO SEQ BAY (CW)
+Y STRUT PHOTOS & LM INSPECT
LOCATE TV FOR SEQ BAY
ALSEP PREP
OPEN SEQ BAY DOORS
OFFLOAD PKG 1
RTG FUEL SUPPORT
CLOSE SEQ BAY & CONNECT PKGS
TV & PHOTO PAN
POSITION TV TO COVER
TRaverse & CHECK
TRaverse > 300 FT WITH
ALSEP DEPLOY
LOCATE PKG 2 10FT WEST
EMPLACE PKG 2
DEPLOY RTG CABLE & CONNECT
to CENTRAL STATION
ALIGN PKG 1
AID LMP WITH HFE REMOVAL
DEPLOY PSE STOOL & REMOVE
SUBPALLET
DEPLOY PSE
DEPLOY CCGE

**LM**

TV RELOCATION
WALK TO SEQ BAY (CCW)
-Y STRUT PHOTOS & LM INSPECT
ALSEP PREP
OFFLOAD PKG 2, DEPLOY HTC
OFFLOAD ALS&D PLACE ON PAD
DEPLOY FUEL CASK
EXTRACT FUEL ELEMENT
FUEL RTG
TAKE HTC & ALS&D TO MESA
REMOVE CSC & PLACE DOWN
SUN NW
UNLOAD SRC 1 CONTENTS
INTO HTC
ALSEP DEPLOY
PLACE ALS&D ON HTC
AID CDR WITH HOOKUP
DUMP DSE
REMOVE HFE & LOCATE
DEPLOY HFE CABLES & LOCATE
HOLES
ASSEMBLE ALS&D

**LMP**

ALSEP DEPLOY
ALSEP PREP
OFFLOAD PKG 2, DEPLOY HTC
OFFLOAD ALS&D PLACE ON PAD
DEPLOY FUEL CASK
EXTRACT FUEL ELEMENT
FUEL RTG
TAKE HTC & ALS&D TO MESA
REMOVE CSC & PLACE DOWN
SUN NW
UNLOAD SRC 1 CONTENTS
INTO HTC
ALSEP DEPLOY
PLACE ALS&D ON HTC
AID CDR WITH HOOKUP
DUMP DSE
REMOVE HFE & LOCATE
DEPLOY HFE CABLES & LOCATE
HOLES
ASSEMBLE ALS&D

**MCC-H**

1:00
MSFN
RECORD PCM LBR ON
DSE DURING P22’S
1:10
ALSEP PREP
OFFLOAD PKG 2, DEPLOY HTC
OFFLOAD ALS&D PLACE ON PAD
DEPLOY FUEL CASK
EXTRACT FUEL ELEMENT
FUEL RTG
TAKE HTC & ALS&D TO MESA
REMOVE CSC & PLACE DOWN
SUN NW
UNLOAD SRC 1 CONTENTS
INTO HTC
ALSEP DEPLOY
PLACE ALS&D ON HTC
AID CDR WITH HOOKUP
DUMP DSE
REMOVE HFE & LOCATE
DEPLOY HFE CABLES & LOCATE
HOLES
ASSEMBLE ALS&D

**MISSION**

APOLLO 13

**EDITION**

FINAL (APRIL)

**DATE**

MARCH 16, 1970

**TIME**

109:00 - 110:00

**DAY/REV**

5/17

**PAGE**

3-83
### FLIGHT PLAN

**CSM**

- CMP
- P22 ORBITAL NAV

**LM**

- CDR
  - ASSIST LMP WITH CORE STEM REMOVAL
  - CLEAN UP DEBRIS
  - CHECK EMU
  - RETURN TRAVERSE
  - COLLECT SELECTED SAMPLES
  - PHOTO SAMPLE AREA
- LMP
  - REMOVE CORE STEMS
  - CAP AND STOW CORE STEMS
  - CLEANUP DEBRIS
  - CHECK EMU
  - RETURN TRAVERSE
  - COLLECT SELECTED SAMPLES

**MCC-H**

- 3:00 MSFN
  - RECORD PCM LBR ON DSE DURING P22'S EMU CONSUMABLES
  - GO/NO-GO FOR EVA
  - 3:10 EXTENSION
- 3:20
  - SRC 1 PACKING
  - PLACE HTC AT MESA
  - STOW CDR TOTE BAG, CAMERA & LENS IN ETB
  - UNLOAD SRC 2 & PUT ON +Y PAD
  - PLACE S-BAND COVER OVER SRC 2
  - UNSTOW & DEPLOY SWC
  - CLEAN EMU & CHECK ETB PACK
- 3:30
  - MNVR PAD (PLANE CHANGE)
  - DUMP DSE UPLINK TO CSM
  - CSM S.V.
  - PLANE CHANGE TGT LOAD
  - DESIRED ORIENT (PLANE CHANGE)
- 4:00
  - EVA TERMINATION
  - INGRESS, CHECK LM & EMU
  - STOW DAC & MOUNT LEC
  - ASSIST CDR - TRANSFER HAND LEC TO CDR
  - REPRESS CABIN

---

**MISSION**

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<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>111:00 - 112:00</td>
<td>5/18</td>
<td>3-85</td>
</tr>
</tbody>
</table>
CSM
CMP
P30 EXT AV
V49-MNVR TO BURN ATT
R0, P0, Y0
VERIFY DSE MOTION @ LOS
SEXTANT STAR CHECK

0513 CST
112:00

0:10

0:20

0:30

112:30

POST EVA SYSTEMS CONFIGURATION
CONFIGURE VALVES AND CIRCUIT BREAKERS, TV-OFF
DOFF HELMETS & GLOVES
DISCONNECT OPS 02 & PLSS H2O HOSES & CONNECT LM 02 &
H2O HOSES, LCG PUMP CB-CLOSE
SWITCH TO LM COMM SYSTEM, B1O MED-LEFT

PLSS 02 RECHARGE
CONNECT LMP'S PLSS TO LM 02 SUPPLY & FILL (2 MIN)
CONNECT CDR'S PLSS TO LM 02 SUPPLY & FILL (2 MIN)

PLSS/OPS DOFFING
REMOVE RCU'S, DOFF PLSS/OPS
REPLACE CDR'S PLSS BATT & LIOH CARTRIDGE
REMOVE OPS & STOW ON ENG COVER
STOW PLSS (RECHARGE STATION)
REPLACE LMP'S PLSS BATT & LIOH CARTRIDGE
REMOVE OPS & STOW PLSS (FLOOR)
CHECK OPS PRESSURE (BOTH)
STOW LMP OPS ON FLOOR

LiOH CANISTER CHANGE
11 INTO A, STOW 9 IN A3

HGA P-44, Y 270

113:00

0:50

DUMP DSE
MSFN
RECORD TOTE BAG #1
WEIGHT

POST EVA CABIN CONFIGURATION
STOW SRC IN LOWER & CDR OPS IN TOP OPS COMPARTMENT
REPORT TOTE BAG #1 WEIGHT

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
---|---|---|---|---|---
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 112:00 - 113:00 | 5/18-19 | 3-86
FLIGHT PLAN

CSM PLANE CHANGE #1
BURN TABLE

<table>
<thead>
<tr>
<th>P OR Y RATES</th>
<th>ATT DEVIATION</th>
<th>SHUTDOWN TIME</th>
<th>RESIDUALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10°/SEC TAKEOVER</td>
<td>+10° TAKEOVER</td>
<td>BT + 1 SEC</td>
<td>NO TRIM</td>
</tr>
</tbody>
</table>

TABLE 3-9
3-86A
GO/NO-GO FOR PC 1

P40 - SPS THRUSTING

GDC ALIGN TO IMU
SPS PLANE CHANGE #1
TGT: 113:42:03
BT: 10.0 SEC
ΔVR: 183.6 FPS
ULLAGE: 2 JETS, 15 SEC
ORBIT: 59.9x53.8
LOAD DAP (10112)(11111)
MNVR TO P52 ATT(113:56)
R 0, P 045, Y 0
OMNI B

P52 - IMU REALIGN

<table>
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<td>MARCH 16, 1970</td>
<td>113:00 - 114:00</td>
<td>5/19</td>
<td>3-87</td>
</tr>
</tbody>
</table>
P52 IMU REALIGN

N71: __ __ __
N05: __ __ __
N93:
  X __ __ __
  Y __ __ __
  Z __ __ __
GET __ __ __

SOLAR CORONA PHOTO PAD(SR)
T-START: __ __ __
  START RECORDER at
  SUNRISE(-) 7MIN

MAP UPDATE REV 20
LOS: __ __ __
180°: __ __ __
AOS: __ __ __
FLIGHT PLAN

CSM

CMP

1103 CST
118:00

:20
REV 22

:40

LM

CDR

119:00

REST PERIOD
(9 1/2 HOURS)

MSFN

MCC-H

LMP

120:00

REST PERIOD
(10 HOURS)

DUMP DSE

REST PERIOD
(9 1/2 HOURS)

MISSION | EDITION   | DATE           | TIME            | DAY/REV | PAGE
--------|------------|----------------|-----------------|---------|-----
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 118:00 - 120:00 | 5/21-22 | 3-91
REST PERIOD (10 HOURS)

124:00

REST PERIOD
(9 1/2 HOURS)

S-BD PWR AMPL-PRIM, VOICE-VOICE
CHANGE LM LiOH CARTRIDGE
CONFIGURE HAMMOCKS FOR JETTISON, LGC PUMP CB-CLOSE
LGC TO OPERATE TO UPDATE LGC CLOCK
THEN BACK TO STANDBY

STAY/NO STAY FOR EVA PREP
CREW STATUS REPORT (SLEEP, DOSIMETER)

EAT PERIOD

125:00

UPDATE TO LM
LM CONSUMABLES
LIFTOFF TIME FOR REV 25 THRU 29
STAY/NO STAY
DUMP DSE

**MISSION** | **EDITION** | **DATE** | **TIME** | **DAY/REV** | **PAGE**
--- | --- | --- | --- | --- | ---
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 124:00 - 125:00 | 5-6/24 - 25 | 3-94
CSM

CMP

VISUAL TGT 9

ORBITAL SCIENCE & VERTICAL STEREO STRIP

CM/EL (FRA MAURO)

FRA MAURO ZERO PHASE PHOTOS AND OBSERVATIONS

CM/EL (ORBITAL SCIENCE)

V64 ACQ MSFN PHOTO TGT 56

DAC & DC-OFF TS - 1 MIN

BATTERY CHARGE BATT A

VERIFY DSE MOTION @ LOS

INSTALL TOPO CAMERA IN HATCH WINDOW

LM

CDR

PLSS COMM CHECK
AUDI O SWITCHES CHECK, ACTIVATE PLSS COMM SYSTEMS&C/O BI MED-OFF
(TV CB - CLOSE THEN OPEN)

LMP

FINAL SYSTEMS Prep
CONNECT OPS O₂ HOSES
DON HELMETS
CONNECT PLSS H₂O HOSES
LCG PUMP CB-OPEN

DON GLOVES
VERIFY ITEMS PREPARED FOR JETTISON
VERIFY EVA CB CONFIGURATION

PRESSURE INTEGRITY CHECK
PLSS O₂ ON

CABIN DEPRESS
DEPRESS CABIN TO 3.5 PSIA
FWD DUMP VALVE - OPEN

FINAL PREP FOR EGRESS
PLSS H₂O ON, FINAL SYSTEMS CHECK, TURN TV ON
VERIFY CB CONFIGURATION, JETTISON BAG & LHSSC

CDR EGRESS & TRANSFER
DEPLOY LEC & DESCEND TO SURFACE

ASSIST CDR

MCC-H

HOVER

- :40

- :30

- :20

UPDATE TO CSM TOPO PHOTO PADS
REV 27

- :10

START EVA
0:00

0:10

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
---------|---------|------|------|---------|-----
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 127:00 - 128:00 | 6/26 | 3-97
FLIGHT PLAN

TOPO PHOTO PAD TGT 6
R ___ P ___ Y ___
T START: ___ : ___ : ___
T STOP : ___ : ___ : ___
RNG ________

TOPO PHOTO PAD TGT 9
R ___ P ___ Y ___
T START: ___ : ___ : ___
T STOP : ___ : ___ : ___
RNG ________

TOPO PHOTO PAD CENSORINUS
R ___ P ___ Y ___
T START: ___ : ___ : ___
T STOP : ___ : ___ : ___
RNG ________

TOPO PHOTO PAD TGT 29
R ___ P ___ Y ___
T START: ___ : ___ : ___
T STOP : ___ : ___ : ___
RNG ________

TOPO PHOTO PAD TGT 34
R ___ P ___ Y ___
T START: ___ : ___ : ___
T STOP : ___ : ___ : ___
RNG ________

TOPO PHOTO PAD TGT 42
R ___ P ___ Y ___
T START: ___ : ___ : ___
T STOP : ___ : ___ : ___
RNG ________

TOPO PHOTO PAD TGT 46/54
R ___ P ___ Y ___
T START: ___ : ___ : ___
T STOP : ___ : ___ : ___
RNG ________

MAP UPDATE REV 27
LOS : ___ : ___ : ___
180° : ___ : ___ : ___
AOS : ___ : ___ : ___

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
---------|---------|------|------|---------|------
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 |   |   | 3-97A
FLIGHT PLAN

CSM

CMP

MNVR TO TOPO TGT 6
ATT (128:20)
R 349, P 269, Y 353

LOAD DAP (10102)(11111)

TOPO PHOTOGRAPHY
PCM-HBR
TOPO TGT 6
TOPO TGT 9
PCM-LBR
OMNI D

ACQ MSFN HGA P-21, Y 177

NOTE: A MNVR IS REQUIRED
FOR EACH TGT TO ORIENT
THE CAMERA'S IMAGE MOTION
COMPENSATION ALONG THE
S/C'S VELOCITY VECTOR.
THE ATTITUDES AND CAMERA
START AND STOP TIMES WILL
BE ON THE TOPO PAD FOR
EACH TARGET.

TOPO STRIP, CENSORINUS

CDR

TRANSFER ETB TO SURFACE

RETREIVE SRC 2 & OPEN

ALHT CARRIER LOAD UP
OFFLOAD SRC 2 CONTENTS
LOAD GEOLOGY EQUIP & TOOLS
ON HTC

PUT TOTE BAG ON LMP
COLLECT CONTAMINATED SAMPLE UNDER LM
PHOTO COLOR CHART

LM

LMP

ASSIST CDR

LMP EGRESS
CLOSE HATCH & DESCEND TO SURFACE

ALHT CARRIER LOAD UP
CSC PHOTOS IN LM VICINITY
STOW TOOLS ON HTC

COLLECT SIEVE SAMPLE

POSITION TV FOR GEOLOGY TRAVERSE

FIELD GEOLOGY TRAVERSE
OUTBOUND
TAKE DOCUMENTED SAMPLES & CSC PHOTOS THROUGHOUT TRAVERSE

NOTE: SEE LUNAR SURFACE CHECKLIST FOR DETAILS OF ACTIVITIES DURING TRAVERSE.

1:00
1:10

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
--------|----------|------|-------|---------|------
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 128:00 - 129:00 | 6/26 - 27 | 3-98
ZODIACAL LIGHT PHOTOGRAPHY

Fig. 3-8
3-100 A
FLIGHT PLAN

P22 LDMK TRACKING (1/250)

T1
T2
R
N or S
LAT
LONG/2
ALT

MOLTKE

P22 LDMK TRACKING (1/60)

T1
T2
R
N or S
LAT
LONG/2
ALT

13-1

N89

13-2

13-3

LAT
LONG/2
ALT

MAP UPDATE REV 30

LOS : __ : __ : __ : __ : __
180° : __ : __ : __ : __ : __
AOS : __ : __ : __ : __ : __

MISSION | EDITION        | DATE       | TIME | DAY/REV | PAGE
---------|-----------------|------------|------|---------|-----
APOLLO 13 | FINAL (APRIL)   | MARCH 16, 1970 |     |         | 3-103A
FLIGHT PLAN

CSM

CMP

SPS CHECKLIST

backup CSI
confirm LM CSI
P20-mvnr to track att
P33 - target cdh
SXT & VHF tracking

OMNI D

CONFIRM LM PC
P33 - target CDH
SXT & VHF tracking
V64-acquire MSFN

FINAL CDH COMP
P41-RCS THRUSTING
RCS CHECKLIST

CDR

P41-RCS THRUSTING

null residuals
P33 - target CDH
RNDZ radar tracking

LM

LOAD AGS CSI EXT ΔV

TIG: 138:06:01
ΔT: 44.4 SEC
ΔVR: 49.6 FT/SEC
ULLAGE: none
ORBIT: 44.9 x 43.4

LMP

EXT LTG - OFF

[IF PLANE CHANGE NOT REQ, CONTINUE TRACKING FOR CDH]

P30-TARGET PLANE CHANGE
CSI BURN STATUS REPORT
P41-RCS THRUSTING

RCS PLANE CHANGE

STEERABLE P -12, Y 15
PCM-HI, BIOMED-RT
LOAD AGS PC EXT ΔV

V47 - INITIALIZE AGS
CHECK RCS, EPS, ECS

FINAL CDH COMPUTATION
[IF CDH NOT REQUIRED, TERMINATE P33]

P41 - RCS THRUSTING

LOAD AGS CDH EXT ΔV

MCC-H

0713 CST

07:13 CST

138:00

REV 32

138:30

139:00

138:30

139:00
CSM
MCC-1 BACKUP
CONFIRM LM MCC-1
P35-TARGET MCC-2
SXT & VHF TRACKING

FINAL MCC-2 COMP
P41-RCS THRUSTING
MCC-2 BACKUP
CONFIRM LM MCC-2
PREDOCK CHECKLIST
P47-THRUST MONITOR
ROLL 180° FOR HI GAIN
HGA P -50, Y 358
TV (MAD) 140:23-140:35
START DAC

PITCH 360° FOR LM PHOTOS
GO/NO-GO FOR PYRO ARM
(CUE MSFN), LOGIC-ON
ROLL RT 120° TO DOCK ATT:
R 300, P 332, Y 0
OMNI-D
PYRO ARM

CSM ACTIVE DOCKING
ROLL LEFT 120° TO R 180
HGA: P -45, Y 356
SC CONT-SCS
N46 (61112, 11111)
FLIGHT PLAN

CDR
NULL RESIDUALS
P35-TARGET MCC-2
RNDZ RADAR TRACKING

FINAL MCC-2 COMPUTATION
P41-RCS THRUSTING

LM
LOAD AGS MCC-2 EXT ∆V

MCC-1
TIG: 140:00:41
∆Vr: NOMINALLY ZERO

MCC-2
NULL RESIDUALS
V48-LOAD DAP, N46-11002
P47-THRUST MONITOR
V63-RR SELF TEST

RR-OFF
OMNI-AFT
BIOMED-RIGHT

SET UP CAMERAS FOR CSM
PHOTOS & DOCKING
LM3/DC
LM3/DAC
EXTERIOR LTG-OFF
PHOTOGRAPH CSM

OMNI-FWD

Docking
STEERABLE
P 32, Y -32
LMP ASSIST CDR WITH
DECONTAMINATION AND
TRANSFER:

MODE CONTROL-OFF
N46-12021

CONFIGURE ECS FOR
DECONTAMINATION

MISSION  EDITION  DATE          TIME         DAY/REV  PAGE
APOLLO 13 FINAL (APRIL) MARCH 16, 1970  140:00 - 141:00  6/33  3-110
FLIGHT PLAN

CSM

10:13 CST
141:00

- Verify CRYO 02 Press
- Repress PKG VLV-OFF
- Pressurize CABIN to 5.5 PSIA
- Adjust O2 Flow < 0.5 LB/HR
- Adjust O2 Flow to 0.6 LB/HR
- Pressurize TUNNEL to 3 PSID
- Verify ΔP Stable for 3 Minutes
- Verify LM FWD DUMP VALVE-AUTO

- Equalize TUNNEL PRESSURE
- LiOH CANISTER CHANGE
  12 INTO B, STOW 10 IN A3
- STOW OPTICS
- REMOVE HATCH AND STOW
- VERIFY DOCKING LATCHES (>3)
- REMOVE PROBE AND DROGUE
- STOW TV CAMERA
- PASS TO CDR AT HIS REQUEST:
  PROBE
  DROGUE
  HELMET/GLOVE BAGS
  DECONTAMINATION BAGS (A8 & U1)

- RECEIVE TRANSFER ITEMS FROM THE
  LM AND STOW AS FOLLOWS:
  A1
  UPPER EQUIPMENT BAY
  B5, B6
  A7/A11
  R13
  R13
  A8

- B1 (IN B1 BAG)

---

LM

141:30

- DOFF GLOVES
- CONFIGURE HOSES AND BRUSH
  FOR VACUUMING
- UNSTOW & VACUUM CSRC & CSC CASSETTE
- UNSTOW, VACUUM & RESTOW SRC'S
- UNSTOW, VACUUM & SET ASIDE:
  LUNAR SURFACE HASSELBLAD
  TOTE BAG
  ISA

- DOFF HELMETS, VACUUM & SET ASIDE
  VACUUM PGA'S

141:40

- DISCONNECT & STOW VACUUM
  BRUSH & HOSES
- VERIFY TUNNEL PRESSURIZED
- OPEN HATCH
- RECEIVE PROBE FROM CMP & STOW
- RECEIVE DROGUE FROM CMP & STOW
  OVER PROBE
- RECEIVE BAGS FROM CSM

142:00

- BAG TRANSFER ITEMS
- TRANSFER TO CMP FOR STOWAGE:
  1 ISA IN BAG
  2 HELMETS IN BAGS (GLOVES INSIDE)
  2 SRC'S IN BAGS
  1 TOTE BAG IN BAG
  2 HASSELBLAD MAG BAGS (5 MAGS)
  1 16MM MAG BAG (6 MAGS), DSEA, PPK'S
  1 SURFACE HASSELBLAD IN BAG
  1 CLOSEUP CAMERA CASSETTE IN BAG
  1 CSRC IN BAG
  1 SURFACE 16MM MAG BAG (2 MAGS)
FLIGHT PLAN

CSM

N46 (61102, 11111)
P30-TARGET SEPARATION
SC CONT-CMC, MODE-AUTO
V49-MNVR TO LM JETT ATT (142:15)
  R 285, P 356, Y 346
  HGA  P -9, Y 25
BIOMED-OFF
STOW SUITS IN L-SHAPED BAG
TRANSFER JETTISON ITEMS TO LM
  WARNING
  NO URINE/FECES
  ALL OPENED FOOD MUST BE TREATED AND STORED IN BETA BAG
UNSTOW AND INSTALL HATCH
DIRECT 02 OFF
PERFORM HATCH INTEGRITY CHECK, DEPRESS TUNNEL FOR JETTISON BY 142:40
GO/NO-GO FOR PYRO ARM (CUE MSFN), LOGIC-ON

LM

DISABLE AUDIO COMM
DISCONNECT LM HOSES & STOW
DOFF SUITS
LM JETT ATTITUDE:
  R __, P __, Y __
CDR IVT TO CSM WITH SUITS
LMP: CONFIGURE S-BD, VERIFY COMM
STEERABLE: P __, Y
INITIALIZE AGS, ALIGN TO PGNCS
P30-TARGET PGNCS
TARGET AGS ΔV
CONFIGURE LM FOR JETTISON
CLOSE HATCH, IVT TO CSM

NOTE: GO/NO-GO FOR PYRO ARM

---

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
---|---|---|---|---|---
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 142:00 - 143:00 | 6/34 | 3-112
DAC ON
P47-THRUST MONITOR
LM JETTISON 143:04
P41-RCS THRUSTING
MNVR TO SEP ATT, (143:08) R 180, P 341.6, Y 0
V64-ACQUIRE MSFN

CSM SEPARATION 143:09
GO ORB RATE (143:10) P 087/342
PREPARE DAC FOR LM DEORBIT BURN PHOTOGRAPHY
CM/DAC/SXT/CEX (FIXED,250,FIXED) 12 FPS, 0.5 MAG, 4 MIN
PRESLEEP CHECKLIST
S/C CLEANUP
CMP DOFF PGA
CONFIGURE FOR BI-STATIC RADAR TEST
VERIFY VHF AM B - DUPLEX
VHF RANGING-RANGING
VHF ANTENNA-LEFT
VHF AM SQUELCH A-MAX
VHF AM T/R OFF
(3 AUDIO PANELS)
THIS VHF CONFIGURATION WILL BE MAINTAINED UNTIL 166:10

VERIFY DSE MOTION @ LOS

EAT PERIOD

MAP UPDATE REV 35
LOS : _ _ _ _ _ _ _ _
180° : _ _ _ _ _ _ _ _
AOS : _ _ _ _ _ _ _ _

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
--- | --- | --- | --- | --- | ---
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 143:00 - 144:00 | 6/34-35 | 3-113
FLIGHT PLAN

UPDATE TO CSM
TEI 40 PAD
LM DEORBIT TIG

UPDATE TO CSM
LM IMPACT TIME

1313 CST
144:00

:10

:20

OMNI D
P20 - RENDEZVOUS NAVIGATION
AUTO MNVR TO TRACK ATTITUDE

OMNI C
TRACK LM THROUGH SCANNING TELESCOPE
PHOTOGRAPH BURN WITH DAC ON SEXTANT
P76-LM TARGET ΔV
V93-INITIALIZE W-MATRIX
TRACK LM

MNVR TO TOPO PHOTO ATTITUDE (144:50)
R 005, P 122, Y 008
HGA P -74, Y 144

UNSTOW AND INSTALL TOPO CAMERA ON HATCH WINDOW FOR LM IMPACT SITE PHOTOGRAPHY MAG V
SET: SHUTTER 1/50 SEC
RANGE 92.0
INTERVAL 8.4

LM DEORBIT BURN
TIG: 144:32:20
BT: 75.2 SEC
ΔV: 185.5 FT/SEC

NOTES
TEI 40 PAD ASSUMES NO PLANE CHANGE 2
FLIGHT PLAN

TOPO PHOTOS OF LM IMPACT SITE (POST IMPACT)
MNVR TO REST ATT (145:15)
LOAD DAP N46
STOW TOPO CAMERA

(10111,11111)
V21N01
3255E, 1616E

REST PERIOD
(7.75 HOURS)

DUMP DSE

NOTES
LM LUNAR IMPACT
GET: 145:00:17.9
LAT: 3°S
LONG: 19.65° W

NOTE: IF ALSEP 13 IS INOPERABLE THE LM WILL BE IMPACTED NEAR ALSEP 12.
LAT 3.32°S
LONG 23.38°W

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</table>
FLIGHT PLAN

MCC-H

2013 CST

151:00

152:00

153:00

REST PERIOD (7.75 HOURS)

REST ATT

DUMP DSE

REV 39

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FLIGHT PLAN

UPLINK TO CSM
CSM S.V. & V66
PLANE CHANGE TGT LOAD
DESIRED ORIENT
(PLANE CHANGE)

UPDATE TO CSM
MVNR PAD
(PLANE CHANGE)
CONSUMABLES
FLIGHT PLAN
TEI 42 PAD

POSTSLEEP CHECKLIST

MNVR TO P52 ATT
(153:15)
R 098, P 274, Y 315
HGA P -20, Y 253

P52 IMU REALIGN
OPTION 3 - REFSMMAT
(LIFT OFF ORIENT)

P52 IMU REALIGN
OPTION 1 - PREFERRED
(PLANE CHANGE ORIENT)
GYRO TORQUE

P30 - EXT ΔV
V49 MNVR TO BURN ATT
(153:50)
P40 SPS THRUST
SXT STAR CK

CSM CONSUMABLES UPDATE
GET: _____ : _____
RCS TOTAL _______
QUAD A _____ B _____
C _____ D _____
H2 TOTAL _______
O2 TOTAL _______

VERIFY DSE MOTION AT LOS
STARS ______
SA ______
TA ______

P52 IMU REALIGN
N71: _____ _____
N05: ________
N93:
X ______
Y ______
Z ______
GET ______

TEI 42 ASSUMES
PLANE CHANGE 2

MAP UPDATE REV 40
LOS: _____ _____
180°: _____ _____
AOS: _____ _____

P52 IMU REALIGN
N71: _____ _____
N05: ________
N93:
X ______
Y ______
Z ______
GET ______

MISSION  EDITION  DATE  TIME  DAY/REV  PAGE
APOLLO 13  FINAL (APRIL)  MARCH 16, 1970  153:00 - 154:00  7/39-40  3-119
## CSM Plane Change #2

**Burn Table**

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<th>P or Y Rates</th>
<th>Att Deviation</th>
<th>Shutdown Time</th>
<th>Residuals</th>
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<td>10°/sec Takeover</td>
<td>+10° Takeover</td>
<td>BT + 1 sec</td>
<td>NO TRIM</td>
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**Table 3-10**

3-119A
**FLIGHT PLAN**

GDC ALIGN

HGA P 6, Y 264

PLANE CHANGE NO 2
V66-TRANSFER S.V. TO LM SLOT

LOAD DAP N46 (10112, 11111)

L10H CANISTER CHANGE
13 INTO A, STOW 11 IN A3
REPORT GYRO TORQUING ANGLES (P52 AT 153:30)
START EAT PERIOD

BATTERY CHARGE, BATTERY B

MAP UPDATE REV 41
LOS : ___ ___ ___ ___
180° : ___ ___ ___ ___
AOS : ___ ___ ___ ___

MNVR TO P52 ATT (155:00) R 180
P 180
Y 040

**NOTES**

VERT STEREO PHOTO REV 41
T START: ___ ___ ___ ___
T STOP: ___ ___ ___ ___

**BURN STATUS REPORT**

```
ΔTIG
BT
VGx
TRIM
RP
VGY
Vgz
ΔVC
FUEL
OX
UNBAL
```

**MISSION** | **EDITION** | **DATE** | **TIME** | **DAY/REV** | **PAGE**
---|---|---|---|---|---
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 154:00 - 155:00 | 7/40 | 3-120
FLIGHT PLAN

P52 IMU REALIGN
OPTION 1 - PREFERRED
(PHOTO ORIENT)
GYRO TORQUE

REPORT GYRO TORQUING ANGLES
VERIFY DSE MOTION AT LOS

GDC ALIGN

WASTE WATER DUMP
02 FUEL CELL PURGE

CONFIGURE CAMERAS FOR VERTICAL STRIP PHOTOGRAPHY
CM4/DC/80/BW-BRKT,IVL (f2.8,250,∞), 180 MAG S
START FRAME NO.
CM/DAC/SXT/CEX (fixed,60,fixed) 1 FPS, MAG H
% FILM REMAINING
ZERO OPTICS & MANUALLY SET SA = 0°, TA = 45°
LOAD DAP N46 (10102, 11111)
MNVR TO PHOTO ATT BY
GO ORB RATE BY 155:50

SET UP EL CAMERA FOR HAND HELD
SCIENCE PHOTOGRAPHY MAG N
CM_/EL/250/CEX, (FP,250,∞) FLT PLAN

VO6N65 (DO NOT ENTER), PCM BIT RATE - HIGH
ENTER (VO6N65) & START DAC AT T-START
FLIGHT PLAN

START DC
RECORD START TIME __:___
V16N91E AT TERMINATOR (+) 2 MIN
PCM BIT RATE - LOW (156:04)
- DC f/4 (156:07)
- DAC 1/125 (156:09)
- DAC 1/250 (156:16)
- DC f/5.6 (156:19)
- PHOTO TGT 17, ON (f11,250,∞) 16 @ 10 SEC (180° + :28)
- START FRAME NO __
V64 ACQUIRE MSFN
- PHOTO TGT 27, ON (f11,250,∞) 21 @ 10 SEC (180° + :45)
- PHOTO TGT 30, ON (f11,250,∞) 46 @ 20 SEC (180° + :50)

STEREO STRIP PHOTOGRAPHY

- DC f/4 (156:41)
- DAC 1/125 (156:42)
- DC f/2.8 (156:46)
- DAC 1/60 (156:48)
- PHOTO TGT 69, ON (f5.6,250,∞) 25 @ 10 SEC (180° + 1:11)

V06N65 (DO NOT ENTER)
STOP DAC & ENTER (V06N65)
STOP DC
RECORD STOP TIME __:___:___

MAP UPDATE REV 42
LOS: __:___:___:___:
180°: __:___:___:___:
AOS: __:___:___:___:

TOPO PHOTO PAD REV 42 (#1)
R ____ P ____ Y ____
T START: __:___:___:___:
T STOP: __:___:___:___:
RNG: _______________

TOPO PHOTO PAD REV 42 (#2)
GET: __:___:___:___:
RANGE: ____________
GET: __:___:___:___:
RANGE: ____________
GET: __:___:___:___:
RANGE: ____________

STOP DC
RECORD STOP TIME __:___:___:___:

MISSION | EDITION       | DATE            | TIME             | DAY/REV | PAGE
---------|---------------|-----------------|------------------|---------|-----
APOLLO 13| FINAL (APRIL)| MARCH 16, 1970  | 156:00 - 157:00  | 7/41    | 3-122
FLIGHT PLAN

VERIFY DSE MOTION AT LOS

UNSTOW AND INSTALL TOPO CAMERA IN HATCH WINDOW FJR VERTICAL PHOTOGRAPHY MAG V FRAME NO. __

SET: SHUTTER 200 SEC
RANGE 91.8
INTERVAL 8.7

MNVR TO VERTICAL TOPO PHOTO ATT (157:55) R 0
P 213/277
Y U

GO ORB RATE

SET UP EL CAMERA FOR HAND HELD SCIENCE PHOTOGRAPHY CM_/EL/250/CEX,(FP,250,∞) FLT. PLAN MAG N START FRAME NO. __

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HIGH RESOLUTION PHOTOGRAPHY (VERTICAL)
(LUNAR TOPOGRAPHIC CAMERA)
REV 42

FIGURE 3-10
3-123 A
FLIGHT PLAN

UPDATE TO CSM
TOPO PHOTO PAD
(REV 43)
CONTAMINATION FIELD
PHOTO PAD
(REV 43)
TEI 44 PAD

RECORD PCM HBR
DATA FIRST 5 MIN
OF TOPO STRIP ON
DSE

START VERT TOPO STRIP PHOTOGRAPHY AT 40°E
(T-START)

- TOPO RNG (91.7)
- DESCARTES
- TOPO RNG (91.9)
- PHOTO TGT 32, S(f11,250,∞) 8 @ 20 SEC (180° + :52)
START FRAME NO.

TOPO 1/100(158:41) - PHOTO TGT's 38 & 40, S(f8,250,∞), 7 @ 20 SEC (180° + :59)
- DAVY RILLE
- TOPO RNG (92.2)
- TOPO 1/50(158:46) - PHOTO TGT 47, S (f5.6,250,∞) 3 @ 20 SEC (180° + 1:03)
V64 ACQUIRE MSFN
- PHOTO TGT 59, S(f5.6,250,∞) 4 @ 20 SEC (180° + 1:08)
- PHOTO TGT 63, S(f4,250,∞) 17 @ 20 SEC (180° + 1:10)

STOP VERT TOPO STRIP PHOTOGRAPHY AT TERMINATOR (T-STOP)

MAP UPDATE REV 43
LOS : ___________
180° : ___________
AOS : ___________

CONTAMINATION PHOTO PAD REV 43
T-START: ___________
START RECORDER AT
SUNRISE (-) 10 MIN.
SETUP CAMERA FOR CONTAMINATION/STAR FIELD PHOTOGRAPHY (BETELGEUSE)
CM4/EL/80/VHBY-BRKT, CONT (f2.8,1/4,∞)
MAG T START FRAME NO. 
INSTALL WINDOW SHADES
VERIFY DSE MOTION AT LOS

CONFIGURE TOPO CAMERA FOR 30° AFT LOOKING PHOTOGRAPHY SET: SHUTTER 200 SEC
MAG V START FRAME NO. INTERVAL 6.2
RANGE 94.1 NM

MNVR TO CONTAMINATION FIELD PHOTOGRAPHY ATT (159:30) R 343, P 086, Y 346
INHIBIT THRUSTERS A3, C4, B3, D4
ADVANCE FILM 5 FRAMES
159:40:16 CREW RECORDER - ON (SR - 10 MIN)
1 FRAME, EXP TIME 1/4 SEC (SR - 5 MIN)
CHANGE EXP TIME TO 1 SEC (2 CLOCKS)
1 FRAME, EXP TIME 1 SEC
CHANGE EXP TIME TO BULB
1 FRAME, EXP TIME 4 SEC
159:53:16 1 FRAME, EXP TIME 4 SEC (SR + 3 MIN
CHANGE EXP TO 1 SEC
1 FRAME, EXP TIME 1 SEC
CHANGE EXP TIME TO 1/4 SEC
1 FRAME, EXP TIME 1/4 SEC
CREW RECORDER - OFF, LIGHTS - UP STOP FRAME NO.
ADVANCE FILM 5 FRAMES
ENABLE THRUSTERS A3, C4, B3, D4
MNVR TO TOPO PHOTO ATT
GO ORB RATE (160:00)
HIGH RESOLUTION PHOTOGRAPHY (30 DEG OBLIQUE)
(LUNAR TOPOGRAPHIC CAMERA)

REV 43
SPACECRAFT
TRAVEL

T-START
30°
CAM LOS

40 SEC
LOCAL VERTICAL
30° E. LONGITUDE

DESCARTES

40 SEC
LOCAL VERTICAL

DAVY RILLE

15° W. LONGITUDE

CAM LOS

T-STOP

TERMINATOR
W

FIGURE 3-11
3-125 A
OMNI D

- VISUAL TGT 4, N (180° + :28)
  SET UP EL CAMERA FOR HAND HELD
  SCIENCE PHOTOGRAPHY
  CM/EL/250/CEX, (FP,250,∞) FLT PLAN
  START FRAME NO. _____
  MAG 0

START OBlique TOPO
PHOTO STRIP
AT 30°E (T-START) - PHOTO TGT 26,N,(f8,250,∞) 10 @ 20SEC (180° + :45)

30° AFT LOOKING OBlique
TOPO PHOTOGRAPHY
- TOPO RANGE (94.0) _____
- DESCARTES
- TOPO RANGE (94.2) _____
  V64 ACQUIRE MSFN

- DAVY RILLE

  - PHOTO TGT 48,N,(f5.6,250,∞) 3 @ 20 SEC (180° + 1:03)
  - PHOTO TGT 52,0N,(f5.6,250,∞) 3 @ 20 SEC (180° + 1:04)

STOP OBlique
TOPO PHOTO STRIP
AT 15°W (T-STOP)

- PHOTO TGT 66,5,(f4,250,∞) 3 @ 20 SEC (180° + 1:10)

START EAT PERIOD
FLIGHT PLAN

STOP ORB RATE
MNVR TO P52 ATT R 0
P 0
Y 0
OMNI D

P52 IMU REALIGN OPTION 3 - REF SMAT (PHOTO ORIENT)
VERIFY DSE MOTION AT LOS

GDC ALIGN

STOW TOPO CAMERA

SETUP DAC FOR LDMK TRACKING PHOTOS THRU SXT CM/DAC/SXT/CEX, (fixed, FP, fixed)
MAG C % FILM

MNVR TO LDMK TRACK ATT (161:45) R 0
GO ORB RATE P 338/061
Y 0

TRACK LDMK CP-1
25 SEC BETWEEN MARKS
5 MARKS
DO NOT PRO ON FINAL N89

START DAC @ T2 -1 MIN
LDMK IS AT 17°
SUN ANGLE
STOP DAC AFTER MARK 5

NOTES

P52 IMU REALIGN
N71: ___ ___ ___
N05: ___ ___ ___
N93: X ___ ___ ___
Y ___ ___ ___
Z ___ ___ ___
GET ___ ___ ___

MAP UPDATE REV 44
LOS : ___ ___ ___
180° : ___ ___ ___
AOS : ___ ___ ___
RECORD PCM LBR DATA DURING EACH LDMK TRK ON DSE

OMNI D

TRACK LDMK CP-2
25 SEC BETWEEN MARKS
5 MARKS
DO NOT PRO ON FINAL N89

START DAC @ T2 -1 MIN
LDMK IS AT 56°
SUN ANGLE
STOP DAC AFTER MARK 5

MAP UPDATE REV 45
LOS:
180°:
AOS:

TRACK LDMK DR-1
25 SEC BETWEEN MARKS
5 MARKS
DO NOT PRO ON FINAL N89

START DAC @ T2 -1 MIN
LDMK IS AT 49°
SUN ANGLE
STOP DAC AFTER MARK 5

TRACK LDMK CP-5
25 SEC BETWEEN MARKS
5 MARKS
DO NOT PRO ON FINAL N89

START DAC @ T2 -1 MIN
LDMK IS AT 12°
SUN ANGLE
STOP DAC AFTER MARK 5

MNVR TO P52 ATT (163:00)
% FILM (REMAINING)
R 180
HGA
P 223
P -24
Y 0
Y 193

UPDATE TO CSM
LDMK TRACK PADS
(REV 45)
UPLINK TO CSM
CSM S.V. & V66
DUMP DSE

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FLIGHT PLAN

0813 CST

163:00

P52 IMU REALIGN
OPTION 3 - REFSMMAT
(PHOTO ORIENT)

REPORT GYRO TORQUING ANGLES
VERIFY DSE MOTION AT LOS

GDC ALIGN

163:30

SET UP DAC FOR LDMK TRACKING PHOTOS THRU SXT
CM/DAC/SXT/CAX, (fixed,FP,fixed) 1 fps
MAG C % FILM __

MNVR TO LDMK TRK ATT (163:45) R 0 OMNI D
GO ORB RATE P 338/056 Y 0

164:00

TRACK LDMK CP-1
25 SEC BETWEEN MARKS
5 MARKS
DO NOT PRO ON FINAL N89

START DAC @ T2 -1 MIN
LDMK IS AT 16°
SUN ANGLE
STOP DAC AFTER MARK 5

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<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>163:00 - 164:00</td>
<td>7/44-45</td>
<td>3-129</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

1013 CST

165:00

VERIFY DSE MOTION AT LOS

P52 IMU REALIGN
OPTION 1 - PREFERRED
(TEI ORIENT)
GYRO TORQUE

GDC ALIGN

WIPE EXCESSIVE MOISTURE FROM
TUNNEL HATCH AREA

CONTAMINATION CONTROL (OPERATIONS CHECKLIST)

CM/TV-AVG (f22)
TV (MAD) 166:10 TO 166:50 (RECORD AT MAD)
MNVR TO TV ATT
GO ORB RATE BY 165:50
OMNI C

P52 IMU REALIGN
N71: __ __ __ __
N05: __ __ __ __
N93: __ __ __ __
X __ __ __ __
Y __ __ __ __
Z __ __ __ __
GET __ __ __ __

STARS __________
SA __________
TA __________

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
---|---|---|---|---|---
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 165:00 - 166:00 | 7/45-46 | 3-131
UPDATE TO CSM
TEI 46 MNVR PAD (NOMINAL)
TEI 47 MNVR PAD & AOS TIME

UPLINK TO CSM
CSM S.V. & V66
TEI 46 TARGET LOAD

1113 CST
166:00

REPORT GYRO TORQUING ANGLES

V64 ACQ MSFN (166:10)
HGA P -36, Y 345
DISCONTINUE BI-STATIC RADAR TEST
VHF RANGING-OFF
VHF AM B-OFF

PRE TEI SYSTEMS CHECKS
C&W CHECK
CM RCS MONITOR CHECK
SM RCS MONITOR CHECK
EPS MONITOR CHECK

LiOH CANISTER CHANGE
(14 INTO B, STOW 12 IN A3)

DUMP DSE
166:30

MNVR TO BURN ATT
EXCEPT FOR ROLL (166:55)
R 0 HGA
P 0 P -77
Y 0 Y 88

MAP UPDATE REV 47
LOS
180°
AOS WITH TEI
AOS WITHOUT TEI
## FLIGHT PLAN

### TEI BURN TABLE

<table>
<thead>
<tr>
<th>P OR Y RATES</th>
<th>ATT DEVIATION</th>
<th>SHUTDOWN TIME</th>
<th>RESIDUALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10°/SEC TAKEOVER</td>
<td>+10° TAKEOVER</td>
<td>FOR G&amp;N C/O &gt;3 SEC EARLY &amp; ΔVC &gt;=+50 FPS SWITCH TO SCS AUTO &amp; RESTART SPS</td>
<td>BT + 2 SEC &amp; ΔVC = -40 FPS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TRIM X AND Z AXIS TO 0.2 FPS</td>
</tr>
</tbody>
</table>

**TABLE 3-11**

3-132A
FLIGHT PLAN

1213 CST

ROLL TO BURN ATT R 180 OMNI C
(167:00) P 0
Y 0

VERIFY DSE MOTION AT LOS

SXT STAR CHECK

GDC ALIGN

TIG: 167:28:48
BT: 2MIN 15.0SEC
ΔVR: 3147.7 FPS
ULLAGE: 2JET, 17 SEC

V66 TRANSFER CSM SV TO LM SLOT
LOAD DAP, N46 (10111,11111)
UNSTOW EL AND PREPARE FOR LUNAR PHOTO
CM3/EL/80/BW-(f5.6,250,∞) MAG Q
CM3/DC/80/BW-(f5.6,250,∞) MAG R or S
MNVR TO PHOTOGRAPH LUNAR
SURFACE BY 167:42
(HATCH AT NADIR) R 140 HGA
P 227 P -11

TEI BURN STATUS REPORT Y 337 Y 305

CM/TV-PEAK (f22)
TV (MAD) 168:00 TO 168:25

NOTES

*ITEMS TO BE REPORTED TO MSFN
**REPORT IF OFF MORE THAN ONE SECOND
***REPORT IF 0.2 FPS

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
---|---|---|---|---|---
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 167:00 - 168:00 | 7/46-TEI | 3-133
FLIGHT PLAN

LUNAR PHOTOGRAPHY TEI + 32 MIN (168:01)
CM3/DC/80/BW-(f5.6, 250,∞) MAG R OR S
HAND HELD, OVERLAPPING,
4 FRAMES MINIMUM, PAN
OF VISIBLE DISC, RAPID
SEQUENCE

LUNAR PHOTOGRAPHY TEI + 42 MIN (168:11)
CM3/DC/80/BW-(f5.6, 250,∞) MAG R OR S
HAND HELD, TWO SINGLE FRAMES,
COVERS VISIBLE DISC

P52 - IMU ALIGN
OPTION 1 PREFERRED
(PTC ORIENT)
GYRO TORQUE
REPORT GYRO TORQUING ANGLES
CHANGE EL LENS TO 250
MNVR TO PHOTO ATT
LUNAR PHOTOGRAPHY TEI + 1 HR 10 MIN (168:39)
CM3/EL/250/BW-(f5.6, 250,∞) MAG Q
HAND HELD, OVERLAPPING,
4 FRAMES MINIMUM,
PAN OF VISIBLE DISC,
RAPID SEQUENCE

VISUAL ASSESSMENT OF
LUNAR TGT'S 7 AND 8

NOTE: IF NO FRAMES ARE AVAILABLE FOR THE DC (MAG R OR S), USE THE EL WITH MAG Q (B&W).

P52 IMU REALIGN
N71: — — — —
N05: — — — —
N93:
X — — — —
Y — — — —
Z — — — —
GET — — — — — — — —

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
---------|---------|------|------|---------|------
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 168:00 - 169:00 | 7/TEC | 3-134
FLIGHT PLAN

UPDATE TO CSM
TOPO PHOTO ATT
(IF REQ)

169:00
169:10
169:20
169:30
169:40
169:50
170:00

1413 CST

EAT PERIOD

MOUNT TOPO CAM ON HATCH WINDOW MAG V
DISABLE IMC
LOAD DAP, N46 (20101, 01111)

MNVR TO TOPO PHOTO ATT (169:25)

LUNAR PHOTOGRAPHY TEI + 2 HR
MAG V, START FRAME NO.
SINGLE FRAMES AT INTERVALS
OF 5 MINUTES FOR 20 MINUTES,
COVERING VISIBLE DISC

STOW TOPOカメラ

GET 169:30 F.O.V. 20°

SET: SHUTTER 1/100 SEC
RANGE DISABLED (99.9 CW)
INTERVAL SINGLE FRAME
RECORD GET: 1. __ __ __ __ __
2. __ __ __ __ __
3. __ __ __ __ __
4. __ __ __ __ __
5. __ __ __ __ __

MISSION  EDITION   DATE          TIME        DAY/REV   PAGE
APOLLO 13  FINAL (APRIL) MARCH 16, 1970  169:00 - 170:00  7/TEC  3-135
FLIGHT PLAN

MNVR TO OPTICS CALIBRATION ATT
R 235, P 287, Y 0
P23 - CISLUNAR NAVIGATION
OPTICS CALIBRATION
STAR 3 0
P00
V49 - MNVR TO SIGHTING ATT
R 212, P 299, Y 0
STAR/LUNAR HORIZON
P23 - CISLUNAR NAVIGATION
LOAD W MATRIX
(R1 + 4 5 0 0 0)(R2 + 0 0 0 0 0)

1. STAR 26 LFH (R3 00220) SPICA
2. STAR 37 LNH (R3 00210) NUNKI
3. STAR 33 LNH (R3 00210) ANTARES
4. STAR 34 LNH (R3 00210) ATRIA

MNVR TO PTC ATT
START PTC
S-BAND ANT - OMNI B ON MCC CUE
SECURE HGA
HGA TRACK - MAN
HGA PITCH -52°
HGA YAW 270°
PRESLEEP CHECKLIST

NOTES
The TEI CMC S.V. will be updated by onboard navigation (P-23's) during TEC. MCC's will be performed with a MSFN calculated S.V. replacing the CMC calculated S.V. which will be down-linked prior to the burns. After the MCC the previous CMC S.V. (corrected for the burn) will be uplinked to the LM slot and transferred to the CSM slot; thus preserving the original CMC S.V. and the W-Matrix. After the burn MCC-H will also uplink a current MSFN S.V. to the LM slot for reference purposes.

3 MARKS ON EACH STAR
INCORPORATE P23
MARK DATA AND
UPDATE ONBOARD
STATE VECTOR

ONBOARD READOUT
BAT C
PYRO BAT A
PYRO BAT B
RCS A
B
C
D
DC IND SEL - MNA OR B

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>170:00 - 171:00</td>
<td>8/TEC</td>
<td>3-136</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

173:00

174:00

175:00

REST PERIOD
(10 HOURS)

PTC
P 270, Y 0

MISSION | EDITION       | DATE           | TIME          | DAY/REV | PAGE
---------|---------------|----------------|---------------|---------|------
APOLLO 13| FINAL (APRIL)| MARCH 16, 1970 | 173:00 - 175:00 | 7/TEC   | 3-138
FLIGHT PLAN

REST PERIOD (10 HOURS)

MISSION | EDITION | DATE         | TIME     | DAY/REV | PAGE
---------|---------|--------------|----------|---------|-----
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 177:00 - 179:00 | 7/TEC | 3-140
FLIGHT PLAN

P52 - IMU REALIGN
OPTION 3 REFSDMAT
(PTC ORIENT)

REPORT GYRO TORQUING ANGLES

POST SLEEP CHECKLIST

LlOH CANISTER CHANGE
(15 INTO A, STOW 13 IN A4)

STOP PTC

H₂ PURGE LINE HEATERS-ON

SET UP DAC FOR WATER DUMP PHOTOGRAPHY (182:01)
CM1/DAC/18/VHBW-(f2.0, 125, 10)6 fps, 30 sec MAG G
P30 EXTERNAL ΔV % FILM ___

V49 - MNVR TO BURN ATT (181:50)

P40/41-SPS/RCS THRUST
SXT STAR CHECK
H₂ & O₂ FUEL CELL PURGE

NOTES

P52 IMU REALIGN
N71: __ __ __
N05: __ __ __
N93:
X __ __ __
Y __ __ __
Z __ __ __
GET __ __ __ __

CSM CONSUMABLES UPDATE
GET: __ __ __
RCS TOTAL __________
QUAD A ___ B ___
C ___ D ___
H₂ TOTAL __________
O₂ TOTAL __________

IF NO MCC-5, MNVR
TO TOPO ATTITUDE (182:50)
FOR DAC WATER
DUMP PHOTOGRAPHY
## MCC-5
**BURN TABLE**

<table>
<thead>
<tr>
<th>P OR Y RATES</th>
<th>ATT DEVIATION</th>
<th>SHUTDOWN TIME</th>
<th>RESIDUALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10°/SEC TAKEOVER</td>
<td>+10° TAKEOVER</td>
<td>BT + 1 SEC</td>
<td>TRIM X AXIS ONLY TO 0.2 FPS</td>
</tr>
</tbody>
</table>

**TABLE 3-12**
3-142A
**FLIGHT PLAN**

WASTE WATER DUMP
H₂ PURGE LINE HTRS - OFF

WATER DUMP PHOTOGRAPHY
HAND HELD, PHOTOGRAPH EXPANSION OF WATER DROPLET CLOUD
CM1/DAC/18/VHBBW-
(Φ2.0,125,10)
6 fps, 30 sec MAG G
CHANGE FOCUS TO ∞
AND EXP TIME TO
1/60, USE REMAINING FILM

GDC ALIGN

MCC-5 BURN STATUS REPORT
LOAD DAP N46 (20101,01111)

MNVR TO PHOTOGRAPH LUNAR SURFACE (182:50)
(HATCH AT NADIR)

UNSTOW TOPO CAMERA AND MOUNT ON HATCH WINDOW
DISABLE IMC

TOPO PHOTOGRAPHY MAG V
TWO SINGLE FRAMES COVERING VISIBLE DISC
START FRAME NO. ____

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>182:00 - 183:00</td>
<td>8/TEC</td>
<td>3-143</td>
</tr>
</tbody>
</table>

**NOTES**

BURN STATUS REPORT

<table>
<thead>
<tr>
<th>ΔTIG</th>
<th>BT</th>
<th>Vₓ</th>
<th>Vᵧ</th>
<th>Vₓ</th>
<th>ΔVᵧ</th>
<th>ΔVₓ</th>
<th>ULLAGE</th>
<th>ORBIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*ITEMS TO BE REPORTED TO MSFN

UPLINK TO CSM
CSM S.V. (CMC) V47E
CSM S.V. (MSFN) (NO V47)

183:00

0313 CST
FLIGHT PLAN

MNVR TO OPTICS CALIBRATION  R 235
P23 - CISLUNAR NAVIGATION    P 287
OPTICS CALIBRATION           Y 0
STAR  3  0

P00
V49 - MNVR TO SIGHTING ATT   R 090
STAR/EARTH HORIZON           P 020
P23 - CISLUNAR NAVIGATION    Y 332

1. STAR 221 EFH (R3 00120) DELTA CAPRICORNI
   N88: (R1 +39954)(R2 -26599)(R3 -14003)

2. STAR 102 ENH (R3 00110) MIRACH
   N88: (R1 +38943)(R2 +11914)(R3 +29008)

3. STAR 45 EFH (R3 00120) FOMALHAUT

4. STAR 01 ENH (R3 00110) ALPHERATZ

5. STAR 126 ENH (R3 00110) GAMMA PEGASI

6. STAR 02 ENH (R3 00110) DIPHDA

7. STAR 44 EFH (R3 00120) ENIF

*ALTERNATE

3 MARKS ON EACH STAR

INCORPORATE P23
MARK DATA AND
UPDATE ONBOARD
STATE VECTOR

MISSION | EDITION       | DATE          | TIME       | DAY/REV | PAGE
---------|---------------|---------------|------------|---------|------
APOLLO 13 | FINAL (APRIL)| MARCH 16, 1970| 183:00 - 184:00 | 8/TEC  | 3-144
FLIGHT PLAN

0513 CST

UPDATE TO CSM QUADS TO DISABLE FOR PTC (LOWEST QUANTITY PRPLNT)

184:00

START PTC

184:20

MSFN

EAT PERIOD

184:30

PTC

P 270, Y 0

185:00

GET 185:00 F.O.V. 3°

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>184:00 - 185:00</td>
<td>8/TEC</td>
<td>3-145</td>
</tr>
</tbody>
</table>
**FLIGHT PLAN**

- **TIME:** 0713 CST
- **NOTES:**
  - STOP PTC AT ROLL 235

---

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>186:00 - 187:00</td>
<td>8/TEC</td>
<td>3-147</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

0813 CST

187:00

MNVR TO OPTICS CALIBRATION ATT
P23 - CISLUNAR NAVIGATION
OPTICS CALIBRATION
STAR 3 0

POO
V49 - MNVR TO SIGHTING ATT
STAR/LUNAR HORIZON
P23 - CISLUNAR NAVIGATION

1. STAR 33 LNH (R3 00210) ANTARES
2. STAR 26 LFH (R3 00220) SPICA
3. STAR 24 LFH (R3 00220) GieniaH
4. STAR 31 LFH (R3 00220) ARCTURUS
5. STAR 25 LNH (R3 00210) ACRUX
6. STAR 32 LFH (R3 00220) ALPHECCA
7. STAR 30 LNH (R3 00210) MENKENT

*ALTERNATES

NOTES

3 MARKS ON EACH STAR
INCORPORATE P23 MARK DATA AND
UPDATE ONBOARD STATE VECTOR

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>187:00 - 188:00</td>
<td>8/TEC</td>
<td>3-148</td>
</tr>
</tbody>
</table>
UPDATE TO CSM
QUADS TO DISABLE
FOR PTC (LOWEST
QUANTITY PRPLNT)

188:00
START PTC

188:10

188:20

188:30
M
S
F
N

188:40

188:50

189:00

PTC
P 270, Y 0

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>188:00 - 189:00</td>
<td>8/TEC</td>
<td>3-149</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

BATTERY CHARGE, BATTERY A

GET 190:00 F.O.V. 3°

A OF FERTILITY

SEA OF CRISIS

SEA OF SERENITY

OPPERGUS

ARCHIMEDES

PTC

P 270, Y 0

MISSION | EDITION       | DATE          | TIME           | DAY/REV | PAGE  
--------|---------------|---------------|----------------|---------|------- 
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 189:00 - 190:00 | 8/TEC   | 3-150
FLIGHT PLAN

191:00

MNVR TO OPTICS CALIBRATION ATT
P23 - CISLUNAR NAVIGATION
OPTICS CALIBRATION
STAR 4 4
P00
V49 - MNVR TO SIGHTING ATT
STAR/EARTH HORIZON
P23 - CISLUNAR NAVIGATION

1. STAR 221 EFH (R3 00120)
   N88: (R1 +39954)(R2 -26599)(R3 -14003)
   DELTA CAPRICORNI

2. STAR 102 ENH (R3 00110)
   N88: (R1 +38943)(R2 +11914)(R3 +29008)
   MIRACH

3. STAR 45 EFH (R3 00120)
   FOMALHAUT

4. STAR 02 ENH (R3 00110)
   DIPHDA

5. STAR 126 ENH (R3 00110)
   N88: (R1 +48229)(R2 +02461)(R3 +12955)
   GAMMA PEGASI

*6. STAR 44 EFH (R3 00120)
   ENIF

*7. STAR 01 ENH (R3 00110)
   ALPHERATZ

*ALTERNATES

192:00

NOTES

3 MARKS ON EACH STAR
INCORPORATE P23
MARK DATA AND
UPDATE ONBOARD
STATE VECTOR
FLIGHT PLAN

UPDATE TO CSM QUADS TO DISABLE FOR PTC (LOWEST QUANTITY PRPLNT)

START PTC
CONTAMINATION CONTROL (OPERATIONS CHECKLIST)

WIPE EXCESSIVE MOISTURE FROM TUNNEL HATCH AREA (IF REQUIRED)

LiOH CANISTER CHANGE (16 INTO B, STOW 14 IN A4)

PTC P 270, Y 0

MISSION | EDITION     | DATE            | TIME         | DAY/REV | PAGE
---------|--------------|-----------------|--------------|---------|------
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970  | 192:00 - 193:00 | 8/TEC   | 3-153
FLIGHT PLAN

MNVR TO OPTICS CALIBRATION ATT
P23 - CISLUNAR NAVIGATION
OPTICS CALIBRATION
STAR 3 0

POO
V49 - MNVR TO SIGHTING ATT
STAR/LUNAR HORIZON
P23 - CISLUNAR NAVIGATION

1. STAR 33 LNH (R3 00210) ANTARES
2. STAR 26 LFH (R3 00220) SPICA
3. STAR 24 LFH (R3 00220) GIENAH
4. STAR 31 LFH (R3 00220) ARCTURUS
5. STAR 25 LNH (R3 00210) ACRUX
6. STAR 32 LFH (R3 00220) ALPHECCA
7. STAR 30 LNH (R3 00210) MENKENT

*ALTERNATES

3 MARKS ON EACH STAR
INCORPORATE P23
MARK DATA AND
UPDATE ONBOARD
STATE VECTOR

MISSION | EDITION | DATE       | TIME      | DAY/REV | PAGE
---------|---------|------------|-----------|---------|-----
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 195:00 - 196:00 | 8/TEC | 3-156
FLIGHT PLAN

UPDATE TO CSM QUADS TO DISABLE FOR PTC (LOWEST QUANTITY PRLPLNT)

1713 CST
196:00

START PTC

EAT PERIOD

PRESLEEP CHECKLIST

NOTES

ONBOARD READOUT
BAT C
PYRO BAT A
PYRO BAT B
RCS A
B
C
D
DC IND SEL - MNA OR B

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
---------|---------|------|------|---------|------
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 196:00 - 197:00 | 8/TEC | 3-157
FLIGHT PLAN

MCC-H

199:00

REST PERIOD
(10 HOURS)

200:00

P 270, Y 0

201:00

NOTES

MISSION | EDITION       | DATE          | TIME            | DAY/REV | PAGE
--------|----------------|---------------|------------------|---------|------
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 199:00 - 201:00  | 8/TEC   | 3-159
FLIGHT PLAN

MCC-H

2213 CST

201:00

:20

:40

202:00

M S F N

REST PERIOD
(10 HOURS)

203:00

:20

:40

NOTES

PTC
P 270, Y 0

MISSION | EDITION       | DATE            | TIME           | DAY/REV | PAGE
------- |---------------|-----------------|----------------|--------|-----
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970  | 201:00 - 203:00| 8/TEC  | 3-160
0513 CST

576.0x756.0

MISSION EDITION
APOLLO 13
FINAL (APRIL)
MARCH 16, 1970
208:00 - 209:00

DAY/REV PAGE
08:00 - 09:00
9/TEC

FLIGHT PLAN

NOTES

3 MARKS ON EACH STAR
INCORPORATE P23 MARK DATA AND UPDATE ONBOARD STATE VECTOR

P23 - CISLUNAR NAVIGATION
OPTICS CALIBRATION STAR 4.4

POO - MnVR TO OPTICS CALIBRATION ATT
V-49 - MnVR TO SIGHTING ATT

1. STAR 221 EPH (R3 00120)
   N88: (R1 +39854)(R2 -26599)(R3 -14003)
   Fomalhaut

2. STAR 45 EPH (R3 00120)
   N88: (R1 +38403)(R2 +29008)
   Mirach

3. STAR 102 ENH (R3 00110)
   N88: (R1 +38403)(R2 +29008)
   Markaf

4. STAR 224 EPH (R3 00120)
   N88: (R1 +46814)(R2 -11832)(R3 +12977)
   Gamma Pegasi

5. STAR 126 ENH (R3 00110)
   N88: (R1 +48229)(R2 +02461)(R3 +12955)
   Enif

6. STAR 44 EPH (R3 00120)
   N88: (R1 +39854)(R2 -26599)(R3 -14003)
   Alpheratz

7. STAR 01 ENH (R3 00110)

*ALTERNATES

08:00
09:00
10:00
208:30
209:00

08:00
08:20
08:40
09:00
09:20
10:00

0513 CST

3-164
FLIGHT PLAN

UPDATE TO CSM QUADS TO DISABLE FOR PTC (LOWEST QUANTITY PPRLNT)

START PTC

BATTERY CHARGE, BATTERY B

GET 210:00 F.O.V. 3°

PTC

P 270, Y 0

MISSION | EDITION | DATE            | TIME           | DAY/REV | PAGE
--------|---------|-----------------|----------------|---------|-----
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 209:00 - 210:00 | 9/TEC   | 3-165
### MISSION
APOLLO 13

### EDITION
FINAL (APRIL)

### DATE
MARCH 16, 1970

### TIME
211:00 - 212:00

### DAY/REV
9/TEC

### PAGE
3-167

---

**FLIGHT PLAN**

211:00

STOP PTC AT ROLL 075

212:00
FLIGHT PLAN

MNVR TO OPTICS CALIBRATION ATTITUDE R 075
P23 - CISLUNAR NAVIGATION P 063
OPTICS CALIBRATION Y 0
STAR 4 4

P00
V49 - MNVR TO SIGHTING ATTITUDE R 090, P 105, Y 331
STAR/EARTH HORIZON
P23 - CISLUNAR NAVIGATION

1. STAR 221 EFH (R3 00120) DELTA CAPRICORN
   N88: (R1 +39954)(R2 -26599)(R3 -14003)

2. STAR 102 ENH (R3 00110) MIRACH
   N88: (R1 +38943)(R2 +11914)(R3 +29008)

3. STAR 45 EFH (R3 00120) FOMALHAUT

4. STAR 01 ENH (R3 00110) ALPHERATZ

5. STAR 224 EFH (R3 00120) MARKAF
   N88: (R1 +46814)(R2 -11832)(R3 +12977)

6. STAR 126 ENH (R3 00110) GAMMA PEGASI
   N88: (R1 +48229)(R2 +02461)(R3 +12955)

7. STAR 44 EFH (R3 00120) ENIF

*ALTERNATES

3 MARKS ON EACH STAR
INTEGRATE P23
MARK DATA AND
UPDATE ONBOARD
STATE VECTOR

MISSION | EDITION | DATE         | TIME         | DAY/REV | PAGE  
--------|---------|--------------|--------------|---------|-------
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 212:00 - 213:00 | 9/TEC | 3-168
FLIGHT PLAN

MCC-H 1313 CST

216:00

216:10

216:20

216:30

216:40

216:50

217:00

CONTAMINATION CONTROL (OPERATIONS CHECKLIST)

LiOH CANISTER CHANGE
(18 INTO B, STOW 16 IN A4)

STOP PTC AT ROLL 075

PTC
P 270, Y 0

MISSION | EDITION | DATE        | TIME       | DAY/REV | PAGE
--------|---------|-------------|------------|---------|-----
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 216:00 - 217:00 | 9/TEC | 3-172
FLIGHT PLAN

MNVR TO OPTICS CALIBRATION ATT       R 075
P23 - CISLUNAR NAVIGATION            P 063
OPTICS CALIBRATION                   Y 0
STAR 4 4

P00
V49 - MNVR TO SIGHTING ATT           R 090, P 126, Y 332
STAR/earth horizon
P23 - CISLUNAR NAVIGATION

1. STAR 221 EFH (R3 00120)          DELTA CAPRICORNI
N88: (R1 +39954)(R2 -26599)(R3 -14003)

2. STAR 45 EFH (R3 00120)           FOMALHAUT

3. STAR 102 ENH (R3 00110)          MIRACH
N88: (R1 +38943)(R2 +11914)(R3 +29008)

4. STAR 224 EFH (R3 00120)          MARKAF
N88: (R1 +46814)(R2 -11832)(R3 +12977)

5. STAR 44 EFH (R3 00120)           ENIF

*6. STAR 126 ENH (R3 00110)         GAMMA PEGASI
N88: (R1 +48229)(R2 +02461)(R3 +12955)

*ALTERNATE

3 MARKS ON EACH STAR
INTEGRATE P23
MARK DATA AND
UPDATE ONBOARD
STATE VECTOR

UPDATE TO CSM
MCC-6 PAD DATA
ENTRY PAD (ASSUMES MCC-6)

UPLINK TO CSM
CSM S.V. & V47E
MCC-6 TGT LOAD

MCC-H  1413 CST

MISSON | EDITION | DATE     | TIME      | DAY/REV | PAGE
--------|---------|----------|-----------|---------|------
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 217:00 - 218:00 | 9/TEC | 3-173
**FLIGHT PLAN**

**MCC-6**
**BURN TABLE**

<table>
<thead>
<tr>
<th>P OR Y RATES</th>
<th>ATT DEVIATION</th>
<th>SHUTDOWN TIME</th>
<th>RESIDUALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10°/SEC TAKEOVER</td>
<td>+10° TAKEOVER</td>
<td>BT + 1 SEC</td>
<td>TRIM X AXIS ONLY TO 0.2 FPS</td>
</tr>
</tbody>
</table>

**TABLE 3-13**
3-173A
FLIGHT PLAN

P52 IMU REALIGN
N71: __ __ __
N05: __ __ __ __
N93: __ __ __ __
X __ __ __ __
Y __ __ __ __
Z __ __ __ __
GET __ __ __ __

REPORT GYRO TORQUING ANGLES

P30 EXTERNAL ΔV
V49 - MNVR TO BURN ATT
P40/41 - SPS/RCS THRUST
SXT STAR CHECK
O2 FUEL CELL PURGE
WASTE WATER DUMP

P40/41 - SPS/RCS THRUST

GDC ALIGN

MCC-6

V66 - TRANSFER CSM SV TO LM SLOT

MCC-6 BURN STATUS REPORT

<table>
<thead>
<tr>
<th>ΔTIG</th>
<th>BT</th>
<th>V</th>
<th>Vx</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TRIM</th>
<th>R</th>
<th>P</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FUEL</th>
<th>OX</th>
<th>UNBAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*ITEMS TO BE REPORTED TO MSFN

MISSION | EDITION | DATE           | TIME         | DAY/REV | PAGE
---------|---------|----------------|--------------|---------|-------
APOLLO 13 | FINAL (APRIL) | MARCH 16, 1970 | 218:00 - 219:00 | 9/TEC | 3-174
FLIGHT PLAN

220:00

MNVR TO OPTICS CALIBRATION ATT R 075
P23 - CISLUNAR NAVIGATION P 063
OPTICS CALIBRATION Y 0
STAR 4 4

POO
V49 - MNVR TO SIGHTING ATT R 090, P 133, Y 333
STAR/Earth HORIZON
P23 - CISLUNAR NAVIGATION

1. STAR 221 EFH (R3 00120) DELTA CAPRICORNI
N88: (R1 +39954)(R2 -26599)(R3 -14003)

2. STAR 45 EFH (R3 00110) FOMALHAUT

3. STAR 102 ENH (R3 00110) MIRACH
N88: (R1 +38943)(R2 +11914)(R3 +29008)

4. STAR 126 ENH (R3 00110) GAMMA PEGASI
N88: (R1 +48229)(R2 +02461)(R3 +12955)

5. STAR 224 EFH (R3 00120) MARKAF
N88: (R1 +46814)(R2 -11832)(R3 +12977)

*6. STAR 44 EFH (R3 00120) ENIF
*ALTERNATE

MNVR TO TV ATT (220:55) R HGA
P P
Y Y

MCC-H
1713 CST

NOTES
3 MARKS ON EACH STAR
INTEGRATE P23 MARK DATA AND UPDATE ONBOARD STATE VECTOR

MISSION  EDITION  DATE  TIME  DAY/REV  PAGE
APOLLO 13  FINAL (APRIL)  MARCH 16, 1970  220:00 - 221:00  9/TEC  3-176
FLIGHT PLAN

REPORT CM RCS INJECTOR VALVE TEMPS (SYS TEST METER 5C, 5D, 6A, 6B, 6C, 6D)

TV (GDS) 221:45 TO 222:00
CM_TV-AVG (f22)
### Flight Plan

**Presleep Checklist Start PTC**

- **1913 CST**
- **222:00**
- **222:30**
- **223:00**

**Rest Period (9 hours)**

**222:30**

P 270, Y 0

---

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>222:00 - 223:00</td>
<td>9/TEC</td>
<td>3-178</td>
</tr>
</tbody>
</table>

---

### Notes

**Onboard Readout**

- BAT C
- PYRO BAT A
- PYRO BAT B
- RCS A
- B
- C
- D

DC IND SEL - MNA OR B
Flight Plan

Mission: Apollo 13
Edition: Final (April)
Date: March 16, 1970
Time: 227:00 - 229:00
Day/Rev: 9/TEC
Page: 3-181
FLIGHT PLAN

MISSION | EDITION | DATE       | TIME      | DAY/REV | PAGE  
---------|---------|------------|-----------|---------|------- 
APOLLO 13| FINAL (APRIL) | MARCH 16, 1970 | 229:00 - 231:00 | 9/TEC | 3-182
FLIGHT PLAN

MCC-H
UPDATE TO CSM
FLIGHT PLAN
CONSUMABLES

0413 CST
231:00

POST SLEEP CHECKLIST

:10

:20

231:30

EAT PERIOD

:40

+:50

LiOH CANISTER CHANGE
(19 INTO A, STOW 17 IN A6)

232:00

NOTES

CSM CONSUMABLES UPDATE
GET: ___ ___ ___
RCS TOTAL ________
QUAD A ___ B ___
___ C ___ D ___
H₂ TOTAL ________
O₂ TOTAL ________

PTC
P 270 Y 0

STOP PTC AT ROLL 075

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>231:00 - 232:00</td>
<td>10/TEC</td>
<td>3-183</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

MNV R TO OPTICS CALIBRATION ATT R 075
P23 - CISLUNAR NAVIGATION P 063
OPTICS CALIBRATION Y 0

PO0
V49 - MNVR TO SIGHTING ATT R 090, P 150, Y 342
STAR/ EARTH HORIZON
P23 - CISLUNAR NAVIGATION

1. STAR 227 ENH (R3 00110) BETA PERSEI
   N88: (R1 +26012)(R2 +27461)(R3 +32698)

2. STAR 44 EFH (R3 00120) ENIF

3. STAR 224 EFH (R3 00120) MARKAF
   N88: (R1 +46814)(R2 +11832)(R3 +12977)

4. VENUS ENH (R3 00110) VENUS

5. STAR 103 ENH (R3 00110) ALMACH
   N88: (R1 +31917)(R2 +18810)(R3 +33577)

*6. STAR 223 EFH (R3 00120) BETA PEGASI
   N88: (R1 +42788)(R2 -11002)(R3 +23411)
*ALTERNATE

NOTES

3 MARKS ON EACH STAR
INCORPORATE P23 MARK DATA AND UPDATE ONBOARD STATE VECTOR

MISSION | EDITION       | DATE         | TIME          | DAY/REV | PAGE
---------|---------------|--------------|---------------|---------|-------
APOLLO 13 | FINAL (APRIL)| MARCH 16, 1970 | 232:00 - 233:00 | 10/TEC  | 3-184
PTC, Y 0
P 270, Y 0

ENTRY CHECKLIST

GO/NO-GO FOR MCC-7 REPORT CM RCS INJECTOR VALVE TEMPS (SYS TEST METER 5C, D, 6A, B, C, D)

0713 CST
234:00
:10
:20
234:30
:40
:50
235:00

MCC-H

(EL-6 HRS)
GO/NO-GO

FLIGHT PLAN
VHF SIMPLEX A - ON

P52 - IMU REALIGN
OPTION 3 - REFCSMMAT
(PTC ORIENT)

REPORT GYRO TORQUING ANGLES

STOP PTC

MNVR TO OPTICS CALIBRATION ATT
P23 - CISMUNAR NAVIGATION
OPTICS CALIBRATION
STAR

MISSION | EDITION | DATE | TIME | DAY/REV | PAGE
---|---|---|---|---|---
APOLLO | FINAL (APRIL) | MARCH 16, 1970 | 235:00 - 236:00 | 10/TEC | 3-187
FLIGHT PLAN

P00
V49 - MNVR TO SIGHTING ATT
STAR/ EARTH HORIZON
P23 - CISLUNAR NAVIGATION
1. STAR 1 EFH (R3 00120)
   ALPHERATZ
2. STAR 10 ENH (R3 00110)
   MIRFAK
3. VENUS ENH (R3 00110)
   VENUS
*4. STAR 133 ENH (R3 00110)
   ZETA PERSEI
   N88: (R1 + 22481)(R2 + 36063)(R3 + 26344)
*5. STAR 223 EFH (R3 00120)
   BETA PEGASI
   N88: (R1 + 42788)(R2 - 11002)(R3 + 23411)

*ALTERNATES

P52 - IMU REALIGN
OPTION 1 - PREFERRED
(ENTRY ORIENT)
GYRO TORQUE

REPORT GYRO TORQUING ANGLES

ECS & EPS CK
SPS CHECK
CM RCS MON CK
SM RCS MON CK
C & W SYS CK

UPDATE TO CSM
MCC-7 MNVR PAD
ENTRY PAD
UPLINK TO CSM
CSM S.V. & V66
MCC-7 TGT LOAD
DESIRED ORIENT (ENT)
ENT LAT & LONG

(EI-4 HRS)
# FLIGHT PLAN

MCC-7
BURN TABLE

<table>
<thead>
<tr>
<th>P OR Y RATES</th>
<th>ATT DEVIATION</th>
<th>SHUTDOWN TIME</th>
<th>RESIDUALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10°/SEC TAKEOVER</td>
<td>+10° TAKEOVER</td>
<td>BT + 1 SEC</td>
<td>TRIM X AXIS ONLY TO 0.2 FPS</td>
</tr>
</tbody>
</table>

TABLE 3-14
3-188A
FLIGHT PLAN

P30 - EXTERNAL ΔV
V49 - MNVR TO BURN ATT
P40/41-SPS/RCS THRUST
SXT STAR CHECK

GDC ALIGN

TIG: 237:49:37.6
BT: NOM. ZERO
ΔVR: NOM. ZERO
ULLAGE: N/A
ORBIT: N/A

MCC-7 BURN STATUS REPORT
V66 - TRANS CSM SV TO LM SLOT

(MCC-H) 1013 CST

1013 CST
237:00
237:30
:20
:10

MCC-7

(BURN STATUS REPORT)

ΔTIG
BT
Vgx
TRIM
R
P
Vgy
Vgz
ΔVc
FUEL
OX
UNBAL

*(ITEMS TO BE REPORTED TO MSFN)

MISSION  EDITION  DATE          TIME          DAY/REV  PAGE
APOLLO 13  FINAL (APRIL) MARCH 16, 1970  237:00 - 238:00 10/TEC 3-189
FLIGHT PLAN

LOGIC SEQUENCE CHECK
GO/NO-GO FOR PYRO ARM SEQUENCE (CUE MSFN)
LOGIC - ON
MNVR TO ENTRY ATTITUDE
R  OMNI
P  VHF ANT
Y

BORESIGHT AND SXT STAR CHECK

MCC-H  1113 CST

(EI - 2 HRS)
GO/NO-GO
VHF A SIMPLEX
COMM CHECK

<table>
<thead>
<tr>
<th>MISSION</th>
<th>EDITION</th>
<th>DATE</th>
<th>TIME</th>
<th>DAY/REV</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOLLO 13</td>
<td>FINAL (APRIL)</td>
<td>MARCH 16, 1970</td>
<td>238:00 - 239:00</td>
<td>10/TEC</td>
<td>3-190</td>
</tr>
</tbody>
</table>
FLIGHT PLAN

P52 - IMU REALIGN
OPTION 3 - REFSLAMAT
(ENTRY ORIENT)

REPORT GYRO TORQUING ANGLES

GDC ALIGN

EMS ENTRY CHECK

PRIME & SEC WATER EVAP ACTIVATION
CM RCS PRE-HEAT (IF REQ'D)

FINAL STOWAGE
CONFIGURE CAMERA EQUIP FOR FIREBALL AND CHUTES PHOTOS
CM4/DAC/18/CIN - (f16,250,7) 12 FPS, (4 MIN) FIREBALL MAG K
- (f11,250,7) 12 FPS, (4 MIN) CHUTES

TERMINATE CM RCS PREHEAT

239:00
239:10
239:20
239:30
239:40
239:50
240:00

(EI - 1 HR)

MCC-H
1213 CST

MISSION  EDITION  DATE  TIME  DAY/REV  PAGE
APOLLO 13  FINAL (APRIL)  MARCH 16, 1970  239:00 - 240:00  10/TEC  3-191

P52 IMU REALIGN
N71: __ __ __
N05: __ __ __ __
N93:
X __ __ __ __
Y __ __ __ __
Z __ __ __ __
GET __ __ __ __

NOTES
**FLIGHT PLAN**

- **SYS TEST PANEL CONFIGURATION**
- **PYRO BATT CHECK**
- **FINAL GDC DRIFT CK (IF REQUIRED)**
  - **CM RCS ACTIVATION**
  - **GO/NO-GO FOR PYRO ARM (CUE MSFN)**
  - **LOGIC - ON**
  - **SET DET (UP, TO EI)**
  - **EMS INITIALIZATION**
  - **RSI ALIGN**
  - **CM RCS CK**
  - **SEPARATION CHECKLIST**
  - **MNVR TO HORIZON CHECK ATT**
  - **P61 - ENTRY PREP**
  - **P62 - CM/SM SEP & PRE-ENTRY MNVR**
  - **SECS PYRO ARM**
  - **CM/SM SEP GET - 240:34**
  - **MNVR TO ENTRY ATT**

**TRAJECTORY EVENTS**

- **16,000 FEET (GET 240:49:37.6)**
- **ENTER S BAND BLACKOUT**
- **0.05G**
- **KA - INITIATE CONSTANT DRAG**
- **RDOT = -700 FPS**
- **PEAK G (6.5)**
- **SUBCIRCULAR VELOCITY**
- **P64 TO P67**
- **EXIT S BAND BLACKOUT**
- **GUIDANCE TERMINATION**
- **DROGUE DEPLOYMENT**
- **MAIN DEPLOYMENT**
- **SPLASHDOWN**

**MISSILE**

- **MISSION**: APOLLO 13
- **EDITION**: FINAL (APRIL)
- **DATE**: MARCH 16, 1970
- **TIME**: 240:00 - 241:00
- **DAY/REV**: 10/TEC
- **PAGE**: 3-192
SECTION 4 - CONSUMABLES
SM RCS BUDGET

Ground Rules and Assumptions

1. Following transposition and docking, the S-IVB performs the evasive maneuver.

2. Two midcourse corrections (translunar) are executed as SPS burns with one MCC followed by an RCS trim.

3. One midcourse correction (transearth) is executed as an RCS burn of 5 fps.

4. Quad management is to be determined during the mission.

5. Redlines have been defined by the Flight Control Division as an aid in assuring that mission rules are not violated during the mission. They are subject to review during the mission as mission phases are completed and systems capabilities are evaluated. In the event the rescue redline is violated prior to rendezvous, lunar orbit photography activities can be curtailed to conserve propellant. The lunar orbit redline includes a nominal transearth coast phase (with all navigational sightings) plus a 3 sigma G&N TEI cutoff error MCC. If a rescue is required and the lunar orbit redline is violated prior to the nominal TEI, TEI can be performed early and navigational sighting activity curtailed during the transearth phase. The rescue redline is based on the minimized activity during the transearth phase.
### CM RCS PROPELLANT SUMMARY

<table>
<thead>
<tr>
<th>Item</th>
<th>Propellant required, lb</th>
<th>Propellant remaining, lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loaded</td>
<td>--</td>
<td>245.0</td>
</tr>
<tr>
<td>Trapped</td>
<td>36.4</td>
<td>208.6</td>
</tr>
<tr>
<td>Available for mission planning</td>
<td>--</td>
<td>208.6</td>
</tr>
<tr>
<td>Nominal usage</td>
<td>43.7</td>
<td>164.9</td>
</tr>
<tr>
<td>Nominal remaining</td>
<td>--</td>
<td>164.9</td>
</tr>
</tbody>
</table>

**TABLE 4-1**

4-2
## SM RCS PROPELLANT LOADING AND USAGE SUMMARY

<table>
<thead>
<tr>
<th>Item</th>
<th>Propellant required, lb</th>
<th>Propellant remaining, lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected</td>
<td></td>
<td>1342.4</td>
</tr>
<tr>
<td>Initial outage caused by loading mixture ratio</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>Total trapped</td>
<td>26.4</td>
<td></td>
</tr>
<tr>
<td>Gaging inaccuracy</td>
<td>80.4</td>
<td></td>
</tr>
<tr>
<td>Deliverable</td>
<td></td>
<td>1220.0</td>
</tr>
<tr>
<td><strong>Nominal usage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Translunar</td>
<td>189</td>
<td></td>
</tr>
<tr>
<td>Lunar orbit</td>
<td>499</td>
<td></td>
</tr>
<tr>
<td>Transearth</td>
<td>235</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>923</td>
<td></td>
</tr>
<tr>
<td>Nominal remaining usable propellant</td>
<td></td>
<td>297</td>
</tr>
</tbody>
</table>

**TABLE 4-2**

4-3
TABLE 4-5

SM RCS propellant profile - quad B.
SPS ANALYSIS

Ground Rules and Assumptions

There has recently been a significant change to the SPS budgeting philosophy, which is designed to show a more realistic nominal profile, and yet retain enough conservatism to allow for contingencies such as LM rescue or weather avoidance in the recovery area. This philosophy has been reviewed by FOD and ASPO.

The TLMC $\Delta V$ allocation has changed from 120 fps to $33 \pm 42$ fps. This is based on analyses performed by the Lunar Mission Analysis Branch, which indicate that $3\sigma$ usage on the translunar phase is 75 fps and the mean usage is 33 fps. Hence, the budget in the SPS table shows 33 fps allocated for all translunar midcourses (in addition to the nominal hybrid transfer maneuver). The $3\sigma$ variation of $\pm 42$ fps is included in the $3\sigma$ dispersions.

LOI, DOI, AND TEI also have $\Delta V$ dispersions of $\pm 20$, $\pm 20$, and $\pm 10$ fps, respectively, which have been included in the $3\sigma$ dispersions.

Allocations for contingency situations have changed to cover the largest worst case contingency, but not a combination of worst case events. Formerly, there was 1000 fps budgeted for contingencies, which was the RSS of 900 fps (LM rescue), 500 fps (weather avoidance), and 150 fps (SCS TEI). The updated philosophy is to budget for either 600 fps at the mission rendezvous phase or for 500 fps during TEC, whichever is worse. Analyses by the Orbital Mission Analysis Branch have indicated that 600 fps will cover all realistic LM rescue cases. This 600 fps will also cover either the weather avoidance or the SCS TEI, but it will not cover the combination of all three.

The 500 fps allocated for weather avoidance is assumed to be applied 24 hours before entry interface, and provides a landing point redesignation capability of 1000 miles.

The budget shown in the SPS table has the 500 fps as being the worst case contingency. For this budget, the mission performed with 600 fps LM rescue is not shown, since it was about 2800 lb better, based on the assumptions that LOPC-2 is deleted for a rescue situation, and that TEI $\Delta V$ reduces to 2711 fps after rescue to obtain the maximum transearth coast time within spacecraft system constraints.

The $3\sigma$ dispersions are the root-sum-square of the penalties imposed on the SPS margin by 3$\sigma$ dispersions in propellant loading, mixture ratio, engine Isp, maneuver $\Delta V$, spacecraft weights, and consumable weight losses. Engine Isp is 313.38 $\pm$ 1.593 seconds, and all spacecraft weights in the analysis are from Volume III of the Spacecraft Operational Data Book.

The SPS table shows the nominal mission reserves of 1893 lbs. For a $3\sigma$ low mission, this reduces to 1436 lbs. If the additional 500 fps contingency is included, total mission margin is 250 lbs or about 100 fps.
<table>
<thead>
<tr>
<th>Item</th>
<th>Propellant required, lb</th>
<th>Propellant remaining, lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loaded</td>
<td>-</td>
<td>40796.0</td>
</tr>
<tr>
<td>Trapped and unavailable</td>
<td>441.4</td>
<td>40354.6</td>
</tr>
<tr>
<td>Outage</td>
<td>59.8</td>
<td>40294.8</td>
</tr>
<tr>
<td>Unbalance meter</td>
<td>100.0</td>
<td>40194.8</td>
</tr>
<tr>
<td>Available for ΔV</td>
<td>-</td>
<td>40194.8</td>
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<td>Required for ΔV:</td>
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<td></td>
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<tr>
<td>TLMC (33 fps)</td>
<td>345.9</td>
<td>39848.9</td>
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<tr>
<td>Hybrid maneuver (15.1 fps)</td>
<td>159.0</td>
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<tr>
<td>LOI (2815.3 fps)</td>
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<tr>
<td>DOI (212.9 fps)</td>
<td>1535.5</td>
<td>14668.7</td>
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<tr>
<td>Circ (70.4 fps)</td>
<td>273.2</td>
<td>14395.5</td>
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<tr>
<td>LOPC-1 (183.6 fps)</td>
<td>678.6</td>
<td>13716.9</td>
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<tr>
<td>LOPC-2 (824.6 fps)</td>
<td>2864.9</td>
<td>10852.0</td>
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<tr>
<td>TEI (3147.7 fps)</td>
<td>8958.9</td>
<td>1893.1</td>
</tr>
<tr>
<td>Nominal remaining</td>
<td>-</td>
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<tr>
<td>3σ dispersions</td>
<td>456.9</td>
<td>1436.2</td>
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<tr>
<td>Margin above 3σ</td>
<td>-</td>
<td>1436.2</td>
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<tr>
<td>Contingency (500 fps)*</td>
<td>1186.2</td>
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<tr>
<td>Total propellant margin</td>
<td>-</td>
<td>250.0</td>
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</tbody>
</table>

* For weather avoidance at 24 hr prior to entry interface.
LM RCS BUDGET

Ground Rules and Assumptions

1. Data for the LM RCS engine performance and propellant requirements were obtained from the Spacecraft Operational Data Book and postflight analysis of Apollo 9, 10, 11 and 12.

2. All orientation maneuvers, unless stated otherwise, are assumed to be three axis.
LM RCS Propellant Loading and Usage Summary

<table>
<thead>
<tr>
<th></th>
<th>Propellant required, lb</th>
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<tr>
<td>Loaded</td>
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<td>633.0</td>
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<tr>
<td>Trapped</td>
<td>40.6</td>
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<td>Gaging inaccuracy and loading tolerance</td>
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<td>552.9</td>
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<td>Mixture ratio uncertainty</td>
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<td>Nominal usage through landing</td>
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<td>Nominal usage from landing to docking</td>
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<td>Nominal usage from docking to impact</td>
<td>110.9</td>
<td>120.3</td>
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</table>

TABLE 4-9
Mayfield/GPB/MPAD (for LM Systems)
Data source: Final flight plan for April 11 launch
Data confirmed
LM 9-1 - LM RCS propellant profile, (April 11 launch date)

Data applicable to April 11 launch window
2/24/70 Final

LM RCS propellant profile.

TABLE 4-10
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Descent Propulsion System Propellant Budget

The DPS propellant budget is presented in the DPS table and the assumptions used to prepare this budget are shown in the assumptions table. Propellant loading and trapped propellant data were taken from Volume III of the Spacecraft Operational Data Book. LM-7 data were used for engine performance and delta V requirements were coordinated with the Landing Analysis Branch.

Three sigma dispersions represent total propellant cost due to 3 sigma uncertainties in propellant loading, trapped Isp, delta V, separation weight, non-delta V consumables weight, and mixture ratio. There is a total propellant margin of 400 lbs.

The following philosophy changes have been included in the enclosed budget.

1. A flying time of 2 minutes below 500 feet will be called a nominal requirement.

2. The engine valve-pair malfunction has been deleted as a contingency since this malfunction was found not to cost propellant.

3. Redesignation and low-level sensor uncertainty have been removed as contingencies and considered as dispersions.

4. A contingency of 25 seconds has been included for possible early low-level light based on Apollo 11 and Apollo 12 experience.

5. An allowance of 20 seconds has been included as a contingency to insure that a mission will not be aborted.
ASSUMPTIONS FOR THE DPS ANALYSIS

1. Integrated average Isp = 302.87 ± 5.1 seconds
2. LM separation weight = 33872 lbs
3. Mixture ratio = 1.6000 ± .0225
4. Nominal delta V = 6891 ± 141 fps
5. Non-delta V consumables of 60.00 lbs from separation to PDI and 132.70 lbs from PDI to touchdown
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<thead>
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<th>Item</th>
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<td>Loaded</td>
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<td>18434.8</td>
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<td>180.0</td>
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<tr>
<td>Available for delta V</td>
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<td>18227.3</td>
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<tr>
<td>Nominal guidance required for delta V of 6891 fps *</td>
<td>17094.5</td>
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<td>Dispersions (-3 sigma)</td>
<td>335.3</td>
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<td>Contingencies</td>
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<td></td>
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<td>Low-level sensor allowance (25 sec)</td>
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<td>Abort reserve (20 sec)</td>
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<tr>
<td>Margin</td>
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<td>399.6</td>
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</table>

* Includes 2 minutes flying time from 500 feet (48 seconds above automatic landing).
Ascent Propulsion System Propellant Budget

The APS table presents the ascent propellant budget for Apollo 13. Propellant loading and trapped propellant data were taken from Volume III of the Spacecraft Operational Data Book. LM-7 data was used for engine performance and delta V requirements were coordinated with the landing Analysis Branch.

The budget shown in the table accounts for an engine valve-pair malfunction, a PGNCS to AGS switchover and a touchdown abort. There is a total propellant margin of 173 lbs.
ASSUMPTIONS FOR THE APS ANALYSIS

1. Isp = 309.37 ± 4.11 seconds
2. Mixture ratio = 1.609 ± .029
3. Nominal delta V = 6044.4 ± 30.7 fps
4. Ascent stage liftoff weight = 10679.7 lbs
## APS PROPELLANT SUMMARY

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<td>Outage</td>
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<td>Available for Delta V</td>
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<td>Nominal required for delta V of 6044.4 fps</td>
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<td>Dispersions (-3 sigma)</td>
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<td>257.1</td>
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<tr>
<td>Contingencies</td>
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<tr>
<td>Engine valve-pair malfunction</td>
<td>12.9</td>
<td>244.2</td>
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<tr>
<td>Delta MR = ± .0100 or -.0180</td>
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<tr>
<td>PGNS to AGS switchover (40 fps)</td>
<td>23.4</td>
<td>220.8</td>
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<tr>
<td>Half-degree out-of-plane (18 fps)</td>
<td>10.5</td>
<td>210.3</td>
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<td>Touchdown abort (delta wt = 99.6 lb, delta V = -15.2 fps)</td>
<td>37</td>
<td>173.3</td>
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<tr>
<td>Margin</td>
<td></td>
<td>173.3</td>
</tr>
</tbody>
</table>

TABLE 4-12
4-19
1. The system was assumed to operate with three fuel cells and two inverters.

2. Fuel cell purging is included in the EPS requirements.

3. Both H₂ and O₂ tanks are assumed to be fully loaded.

4. Three entry and postlanding batteries were considered available to supply the total spacecraft power required for entry, parachute descent, and postlanding time. Each battery was assumed to have a 40 A-h capacity until landing at which time the capacity was uprated to 45 A-h.

5. Two batteries were considered to be in parallel with the fuel cells during ascent and for each SPS maneuver.

6. No cryogenic venting was assumed in flight.

7. The EPS hydrogen consumption rate (lb/hr) = 0.00257 X I_{fc}.

8. The EPS oxygen consumption rate (lb/hr) = 7.936 X \dot{H}_2.

9. No reserves are considered in plotting the nominal profile and redlines.
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<th>$O_2$ (lb)</th>
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<td>Total loaded</td>
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<td>Less residual</td>
<td>2.32</td>
<td>13.00</td>
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<td>Less instrumentation error</td>
<td>1.50</td>
<td>17.50</td>
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<td><strong>Flight requirement</strong></td>
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<td>EPS (inc F/C purge)</td>
<td>44.18</td>
<td>345.35</td>
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<td>ECS (inc cabin purge)</td>
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<td>LM pressurizations</td>
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<td><strong>Total flight requirements</strong></td>
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<td><strong>Nominal reserves</strong></td>
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<td>EPS uncertainty (2.5%)</td>
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<td>ECS uncertainty (.08 lb/hr</td>
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<td><strong>Total Requirement</strong></td>
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<tr>
<td><strong>Operational Reserves</strong></td>
<td>5.82</td>
<td>107.82</td>
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</table>

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* Data supplied by KSC
Hydrogen remaining for mission for one tank

TABLE 4-15
LM EPS ASSUMPTIONS AND GROUND RULES

1. Energy available from the descent batteries is 1600 A-h and from the ascent batteries is 592 A-h.

2. Energy unusables due to lack of continuous Manned Space Flight Network (MSFN) coverage for the descent and ascent stages are 6 A-h and 3 A-h, respectively.

3. Energy unusables due to telemetry (TM) inaccuracies for the descent and ascent stages were 77 A-h and 12 A-h, respectively.

4. Electrical unusables due to energy dispersions for the descent and ascent stages were 22 A-h and 4 A-h, respectively. This dispersion is obtained by taking 2 percent of the energy used.

5. As per the flight plan, the Primary Guidance and Navigation Subsystem (PGNS) and Abort Guidance Subsystem (AGS) were left in the standby mode for the majority of the lunar stay.

6. The RCS heaters were assumed to have a 100 percent duty cycle for 15 minutes after initial activation and then dropping to a 7 percent duty cycle until undocking. From undocking until lunar touchdown plus 2 hours the heaters were assumed to cycle at 0 percent, but from touchdown plus 2 hours until lunar liftoff the duty cycle went up to 4.5 percent.

7. At the beginning of the analysis, it was assumed that a total of 10 A-h had been used from the descent batteries between 30 minutes before launch and the conclusion of transposition and docking (T and D).

8. The CDR and LMP forward window heaters were assumed not to be needed.

9. The cabin fan was assumed to be inoperative for the entire mission.

10. All flood lights were turned off at touchdown plus 2 hours and back on at power up.

11. No duty cycle was assigned to the portable utility lights.

12. The Liquid Cooled Garment (LCG) pump was cycled as dictated by the checklist.
<table>
<thead>
<tr>
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<th>Usable A-h Remaining</th>
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<tr>
<td>Initial capacity</td>
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<tr>
<td>Unusables(^1) due to lack of continuous systems data</td>
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<td>1594</td>
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<td>TM unusables(^1)</td>
<td>14</td>
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<td>Dispersion(^1)</td>
<td>6</td>
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<td>Actual requirement through touchdown</td>
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<td>Unusables(^2) due to lack of continuous systems data</td>
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<td>TM unusables(^2)</td>
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<td>Dispersion(^2)</td>
<td>16</td>
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<td>Actual requirement from touchdown to liftoff</td>
<td>812</td>
<td>379</td>
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<tr>
<td>Total mission requirement</td>
<td>1116</td>
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</tr>
<tr>
<td>Usable margin at liftoff</td>
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<td>379 (24%)</td>
</tr>
</tbody>
</table>

\(^1\) Unusables calculated from descent battery activation until lunar touchdown.

\(^2\) Unusables calculated from touchdown until lunar liftoff.
<table>
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<td>Unusables(^1) due to lack of continuous systems data</td>
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<td>TM unusables(^1)</td>
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<td>Dispersion(^1)</td>
<td>5</td>
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<td>Actual requirement through docking</td>
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<td>Unusables(^2) due to lack of continuous systems data</td>
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<td>TM unusables(^2)</td>
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<td>Dispersion(^2)</td>
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<td>Actual requirement from docking through crew transfer</td>
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<td>Actual requirement from crew transfer through lunar impact</td>
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<td>Total mission requirement</td>
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<td>Usable margin at impact</td>
<td>-</td>
<td>170 (29%)</td>
</tr>
</tbody>
</table>

\(^1\) Unusables calculated from ascent battery activation until docking.

\(^2\) Unusables calculated from docking until crew transfer.

TABLE 4-19
4-28
LM-7 descent stage amp hours remaining (April 11 launch date)

Data applicable to April 11 launch
3/6/70 Amendment 2

**Summary**

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<tr>
<th>Description</th>
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<td>Lack of MSFN unusables</td>
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<td>-77 A-h</td>
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<td>Dispersion</td>
<td>-22 A-h</td>
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<td>Mission requirements</td>
<td>-1116 A-h</td>
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<tr>
<td>Total usable margin</td>
<td>379 A-h (24 %)</td>
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</table>

**Ground elapsed time, hr**

**LM-7 descent stage amp hours remaining.**

**TABLE 4-20**
LM-7 ascent stage amp hours remaining. (April 11 launch date)

Data applicable to April 11 launch
3/6/70 Amendment 2

Table 4-21
LM ECS

The LM ECS consumable analysis was not available for the final flight plan. For further information contact the Consumables Analysis Section (CAS) of the Mission Planning and Analysis Division (MPAD).
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SECTION 5 - ABBREVIATED TIMELINE
**MISSION**  
APOLLO 13

**EDITION**  
FINAL (APRIL)

**DATE**  
MARCH 16, 1970

**TIME**  
72:00 - 96:00

**DAY/REV**  
4/1-9

**PAGE**  
5-4
SECTION 6 - ALTERNATE MISSION TIMELINES
ASSUMPTIONS

1. NOMINAL LOI AND DOI HAVE BEEN PERFORMED BY THE SPS TO PLACE THE CSM/LM IN A 60 X 8 N MI ORBIT.

2. SOMETIME DURING LM CHECKOUT, A FAILURE HAS BEEN DISCOVERED RESULTING IN A NO-GO SITUATION FOR LUNAR LANDING.

CONSTRAINTS

1. LM JETTISON AS EARLY AS POSSIBLE.

2. ADHERENCE TO THE NOMINAL FLIGHT PLAN AS MUCH AS POSSIBLE.

SEQUENCE OF EVENTS

**ALTERNATE MISSION 3 SUMMARY FLIGHT PLAN**

**APOLLO 13**

[CSM/LM LOW EARTH ORBIT]

---

### LM MANEUVER DATA

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### CSM MANEUVER DATA

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### Sequence of Events

1. **Launch**
2. **Abort**
3. **Entry**
4. **Landing**

---

**ASSUMPTIONS**

- The abort sequence has been reviewed by S.C.L.
- The abort sequence involves the following steps:
  1. The spacecraft is returned to a safe orbit.
  2. The crew is transferred to the LM.
  3. The LM is activated.

---

**CONCLUSIONS**

- The abort sequence is designed to be as safe as possible.
- The crew is trained to handle any unexpected events.

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**NOTES**

- The abort sequence is designed to be as safe as possible.
- The crew is trained to handle any unexpected events.

---

**REFERENCES**

- The abort sequence is designed to be as safe as possible.
- The crew is trained to handle any unexpected events.

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**Figure 6-3**

This figure shows the sequence of events for the abort sequence of the Apollo 13 mission.