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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

APOLLO 6 MISSION

3-DAY REPORT

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MANNED SPACECRAFT CENTER
HOUSTON, TEXAS
April 1968

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April 8, 1968

Prepared by: Apollo 6 Mission Evaluation Team

Approved by: George M. Low
George M. Low
Manager
Apollo Spacecraft Program

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The evaluation in this report is based on preliminary data, and the values are subject to change. All times are referenced to range zero, the integral second before lift-off. Range zero was 12:00:01 G.m.t.

MISSION SUMMARY

The Apollo 6 mission was accomplished on April 4, 1968. This was the second Apollo mission utilizing a Saturn V launch vehicle (AS 502), a lunar module test article (LTA-2R), and a command and service module (CSM 020).

Lift-off occurred at 12:00:01.5 G.m.t. from launch complex 39A, Cape Kennedy, Florida. At approximately 00:01:28, PCM data from the spacecraft became noisy and were unusable until approximately 00:08:25. The launch escape tower was jettisoned as planned at 32 seconds after S-II stage ignition. Engines 2 and 3 of the S-II stage cut off at about 00:07:32, resulting in a delay of about 1 minute in S-II stage cutoff. The S-IVB stage inserted the spacecraft into an earth parking orbit with an apogee of 196 nautical miles and a perigee of 96 nautical miles. After two revolutions in the parking orbit, an attempt to fire the S-IVB stage for the translunar injection was unsuccessful. A ground command was then sent to the command and service module to implement a planned alternate mission. The command and service module was separated from the S-IVB stage at 03:14:28.8.

The alternate mission selected consisted of firing the service propulsion engine under guidance computer control to the onboard programmed apogee condition of 12 000 nautical miles. A 445-second engine firing, the longest performed inflight to date, was required to reach the targeted conditions.

Following the service propulsion engine firing, the command and service module was aligned to a pre-set cold-soak attitude, with the command module facing away from the sun. This attitude was maintained throughout the coast ellipse phase of approximately 6 hours to achieve the minimum temperature of the ablator prior to entry.

The planned second firing of the alternate mission was inhibited because the large amount of fuel used during the first propulsion engine firing resulted in residual propellants for only about 23 seconds of additional firing time. This meant that only about 20 percent or 800 ft/sec of the desired 4000 ft/sec could be realized; therefore, the decision was made to not perform the second service propulsion engine firing.

An additional data point for the total spectrum of Apollo entry effects was obtained by the entry velocity achieved (32 800 ft/sec) which was between that of spacecraft 011 (28 512 ft/sec) and spacecraft 017 (36 537 ft/sec).

The spacecraft landed within 50 miles of the onboard targeted landing point. The spacecraft was recovered by the USNS Okinawa and found to be in good condition, including the unified crew hatch. Charring of the command module thermal protection appeared similar to that on the Apollo 4 spacecraft.

Several significant system anomalies in the command and service module were noted, but none seriously affected the mission operations. Based on the available preliminary data, the overall performance of the spacecraft systems was excellent.

Guidance and control systems.- Performance of the guidance and navigation system, the stabilization and control system, and the mission control programmer was nominal throughout the mission. The state vectors computed by the spacecraft guidance computer agreed closely with those computed by the S-IVB guidance computer and from ground tracking data throughout the ascent and earth orbital phases. Gimbal angles from the inertial measurement unit agreed closely with those obtained from the S-IVB guidance system. Transients at spacecraft/S-IVB stage separation were normal, with no evidence of recontact. Start transients during the service propulsion engine firing were commensurate with the engine gimbal trim errors. All attitude-change maneuvers were nominal, and a cold-soak attitude was maintained throughout the coast ellipse phase.

A rather large roll divergence was noted between the Euler angles obtained from the inertial measurement unit and those computed in the attitude reference system of the stabilization and control system. The divergence is attributed to allowable drift in the stabilization and control system and is within specification limits when transferred to equivalent body axes.

Although no entry data are available at this time, indications are that the systems performed properly. All sequencing provided by the computer and mission control programmer appear correct.

Several ground updates were rejected by the onboard computer with the accompanying alarm indicating failure of the word validity check. The cause of the rejects is unknown; however, no computer restarts were experienced.

Service module reaction control system.- All measured parameters were normal during prelaunch and countdown with no evidence of helium leakage or heater malfunction. Engine duty cycles and source pressure decays indicated normal engine performance during the separation maneuvers and the orientation maneuver for the service propulsion engine firing.

The injector and quad temperature during boost were as expected. The quad temperature during the first two orbits indicated normal thermal control system performance for all quads. The thermal control performance during the cold-soak was as predicted. Quad C became the coldest, indicating that the quad was being shaded from the sun. The quad B temperatures indicated partial shading. Quad A and quad D cycled between normal heater control limits.