

Massachusetts Institute of Technology
Instrumentation Laboratory

MEMORANDUM

TO: All Apollo Personnel
FROM: P. Felleman
DATE: 5 December 1969
SUBJECT: Highlights of the Apollo 12 Mission

Apollo 12 was launched November 14, 1969, at 11:22 EST. Approximately 30 to 40 minutes prior to launch, the CMC main panel DSKY flashed all 8's for a short time and then returned to its normal display. After consulting with MIT personnel at Cambridge and KSC, it was suspected that a contaminated relay was the cause of this phenomenon and I reassured J. McDivitt at KSC and SPAN personnel at MSC that other DSKY functions such as ability to input data would be unaffected by this type of failure. The decision was to launch with this anomaly.

At 36 seconds after liftoff, a spectacular electrical transient, believed caused by a static electricity discharge from the spacecraft to ground, caused a power failure of the fuel cells. The batteries picked up the load, but there was effect upon several systems. The CMC experienced 5 restarts and the X, and Y CDU's were affected. At 52 seconds after liftoff, a second static discharge was experienced which caused the X, Y and Z CDU's to be affected. The result was that the CMC sensed that the middle gimbal angle was larger than 85° and proceeded to coarse align the IMU. At this point, the IMU lost its inertial reference and was driven at $\sim 35^{\circ}$ /second in all three axes. The crew reported a tumbling platform and after consultation with MIT personnel in Cambridge the recommendation to the crew through the MIT SPAN representative was to power down the IMU for 3 minutes and then turn it back on. This procedure was followed immediately after insertion into orbit. A P51 followed by P52 was accomplished, several SPS tests were performed and a P52 realignment was accomplished on the second night pass. This second P52 indicated a good

platform and MIT felt that the GNC system was "go" for TLI.

The P23 trans-lunar sightings to determine the horizon locator indicated two widely differing locators (49km and 19km). It was decided (MIT and MPAD) to use the 19km altitude and recommend to the CMP which locator to mark on in the event of communications loss.

All scheduled flight plan events were nominal through LM activation, although an unscheduled entrance to the LM was made to determine that the heaters were on for the LM IMU and rendezvous radar. During LM activation, a V35 indicated a 212 alarm (PIPA fail) which is expected but not simulated on either CMS or LMS. This caused the crew some concern but the problem was resolved quickly.

The docked alignment technique used (recommended by R. White) proved to be extremely accurate and the subsequent P52 LM alignment was exceptionally good. Landing was very smooth with the RLS update of 4200 ft downrange and an instrument approach from approximately 30-40 feet altitude. All of the estimates of landing site position converged and the CMP was able to track the landed LM through the SXT on the next pass. During LM activation prior to ascent, a V35 seemed to affect the PIPA bias and as a result, the PGNCS insertion state vector differed from the AGS and Lear processor by about 6 fps. The MSFN state vector was sent up to the LM and PIPA bias compensation updated. Rendezvous and docking were nominal. The ascent burn resulted in about 32 fps overspeed due to the fact that the engine override enable switch was thrown late, not allowing the LGC to shut down the engine. A great deal of P22 activity followed, with all scheduled sightings accomplished.

On the trans-earth phase, many P23, cislunar navigation exercises were scheduled to test lighting constraints for this trajectory. All these were accomplished although a problem occurred during a zero optics which indicated a failed optics CDU. AGC support analyzed the problem as a software problem and recommended a recovery procedure. This worked and a procedural note to the crew avoided further trouble. During the mission it was noticed on several occasions that with optics power on and in the zero mode, the shaft angle would indicate 0.25 to 0.5 degrees. The crew was asked to examine the mechanical counter and confirmed that there was physical motion at the shaft. It is expected that post-flight analysis of the hardware will explain the phenomenon. There was no problem in using the optics since the zero switch was cycled prior to each use.

Entry and landing was nominal and the estimated miss was 1.5 miles.

I would like to commend all the MIT personnel who supported this mission at MSC, at KSC and in Cambridge. I received congratulations from the SPAN room personnel to all of you for your rapid and accurate response to those problems we had.