

BELLCOMM, INC.

SUBJECT: Review of the Lightning Strike
Incident at Launch Complex 37 on
July 27, 1967, and Comparison to
a Gemini Lightning Strike - Case 320

DATE: December 11, 1967

FROM: J. A. Llewellyn

ABSTRACT

The Launch Complex 37 lightning strike of July 27, 1967, was reviewed and compared to a similar incident on the Gemini Program.

Available data indicate little likelihood of damaging currents having been present in SA-204 Launch Vehicle or the ground equipment during the July 27th incident. Based on the results of subsystem and system testing after the strike, anticipated results of future testing, the six months elapsed time between the strike and launch, and the fact that much of the critical airborne electrical/electronic equipment has been removed since the strike for other reasons, no new actions are considered necessary at this time.

In the Gemini case, significant failures occurred in both airborne and ground circuits. Due to the resultant semiconductor uncertainty, and the relatively short time prior to planned launch, all critical airborne components containing semiconductors were replaced, and a sophisticated data comparison task was implemented.

(NASA-CR-92819) REVIEW OF THE LIGHTNING
STRIKE INCIDENT AT LAUNCH COMPLEX 37 ON JULY
27, 1967, AND COMPARISON TO A GEMINI
LIGHTNING STRIKE (Bellcomm, Inc.) 6 p

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MEMORANDUM FOR FILE

INTRODUCTION

At the request of Mr. W. C. Schneider, Apollo Mission Director, a brief review of the lightning strike incident which occurred at Launch Complex 37 on July 27, 1967, was conducted. The incident was compared to a similar incident which occurred on the Gemini Program.

LAUNCH COMPLEX 37 STRIKE

SA-204 was erected at Launch Complex 37 and undergoing integrated system testing when the strike occurred at approximately 2:30 P.M. LM-1 had not yet been stacked; there was, however, a protective hat above the IU. An eyewitness inside the IU reported a flash in the IU near the forward end of the S-IVB Stage. Other reporting established that lightning did indeed strike the top of the service structure near the stiff leg derrick; lightning instrumentation recorded 50,000 amperes. No service structure damage was found during later inspections. However, a burned spot was found on the derrick, and an anemometer located in the area had been knocked off its mount, probably by the strike. (1)

At this point in time it is somewhat controversial as to whether or not lightning really got inside the silo. Feelings are that the reported flash observation inside the silo could have been a reflection. Inspectors who conducted thorough visual inspections of the area - as well as the remainder of the launch vehicle - were unable to uncover any evidence of an actual strike. One element of spacecraft GSE, the C14-240 ACE (Acceptance Checkout Equipment) unit, was found later to be inoperative. It was thought that this failure - a total of seven circuit boards were inoperative - was caused by the strike; however, this apparently was never confirmed.

Subsequent to the incident a number of special system reverification tests were conducted, none of which showed any launch vehicle or ground equipment performance deterioration. A number of all-systems tests have been and will be conducted prior to launch; these are:

1. Sequence Malfunction Test (completed)
2. Plugs-In Overall Test (completed)
3. Plugs-Out Overall Test (completed)
4. Launch Vehicle - MCC - Houston
Interface Test (completed)
5. Flight Readiness Test
6. Countdown Demonstration Test.

The tests which have been conducted have given no evidence of system performance deterioration due to lightning.

GEMINI STRIKE

Gemini Launch Vehicle number 2 experienced a similar incident while at Cape Kennedy. In that case, however, a fairly large number of electrical ground support equipment components failed, as well as 8 airborne pressure transducers. All other airborne and ground equipment was tested and found to be functioning. However, since large currents were known to have been present in the airborne and ground circuits (from component failure data), and because of the unknown state of the semiconductor devices, and the rather limited time between incident and scheduled launch (4 - 6 weeks), essentially all of the flight critical airborne packages containing semiconductors were replaced. A complete subsystem and system re-evaluation with sophisticated data comparison (to pre-incident data) was conducted prior to continuing into the normal all-systems test. There were no component failures - either airborne or ground equipment - experienced after the initial components which were thought to have been failed by the lightning strike were removed. In other words, the fear that current/voltage overstressing of semiconductor devices, in equipment which was not replaced, would cause failures later, never materialized.⁽²⁾

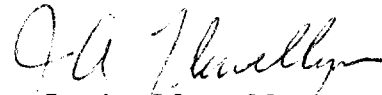
CONCLUSIONS

It is felt that additional post-lightning incident measures are not required on Apollo 5 or Launch Complex 37 equipment at this time due to the following considerations:

1. There is no direct evidence that abnormal currents were present in airborne circuits.
2. A good percentage of the IU electrical/electronic equipment has been removed, inspected, tested, and reinstalled or replaced, for other reasons. Examples are: Digital Computer, Digital Adapter, Control Signal Processor, Rate Gyros, Control Accelerometers and Signal Conditioners, Flight Control Computer, and the Platform Electronic Assembly.

3. A significant amount of both subsystem and system testing has been and will be accomplished prior to launch, which should expose failed or degraded components.
4. Approximately six months will have elapsed between strike and launch. This time, and the normal stressing due to repeated on-off cycling should be ample to "bring out" latent failure conditions.

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REFERENCES

1. Memorandum to Mr. F. Dhom from Mr. K. W. Colley, Subject: Lightning Strike at VLF-37, dated November 1, 1967
2. GLV-2 Reverification Plan, The Martin - Marietta Corp., dated September 10, 1964

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