~~CONFIDENTIAL~~

[redacted]

[redacted]/Lt Col Worthington/R&D-4113/ZR

FEB 14 1962

Discoverer 37 Investigation

[redacted]

1400008515

AFSC (SCGN)
Andrews AFB
Washington 25, DC

1. Discoverer 37 experienced a normal Thor boost phase but failed to achieve orbit because of an open circuit in the 400 cycle, phase A circuit to the IRP which in turn resulted in loss of attitude control during Agena engine burn.

2. Telemetry records show that between .010 and .018 seconds after the separation squibs fired the signal strength for both telemetry links dropped out. The acquisition transmitter signal strength also dropped out between .012 and .024 seconds after squibs fired. After approximately .1 second link 1 and acquisition transmitter signals recovered but link 2 signal was not recovered. The recovered link 1 data showed a loss of link 2, 200VDC plate voltage supply, and an open fuse in the IRP phase A, 400 cycle circuit. Link 1 data also indicated that the 2KC and 400 cycle inverters were recovering from an abnormal condition and recovery to normal limits was recorded within .4 seconds after telemetry signal recovery. Separation was verified within normal limits and all subsequent events were recorded as normal. By Agena engine start, however, the loss of phase A, 400 cycle power to the attitude gyros had rendered any attitude control impossible and the engine burned for only 9.46 seconds before it was shut down from fuel starvation caused by pump cavitation.

3. Upon isolation of the time within which the difficulty developed a thorough investigation was initiated concerning test and installation procedures, quality assurance and pre-launch systems tests to identify any possible weakness or situation which might contribute to an understanding or explanation of the difficulty experienced. No procedure deviations or discrepancies which could be related to this problem were found.

4. Concurrent with this effort a design review committee initiated malfunction studies and testing. The tests were conducted both on FTV 1123 and in the laboratories at Sunnyvale. Of all the many possible malfunctions duplicated during this investigation only a short between a 28VDC supply and a 400 cycle, phase A supply resulted in opening the fuses in the phase A circuit to the IRP, as experienced on Discoverer 37.

[redacted]

Declassified and Released by the NRO
In Accordance with E. O. 12958
on NOV 26 1997

~~CONFIDENTIAL~~

It is emphasized here; however, that to logically define the Discoverer 37 experience an almost simultaneous loss of 2KC power to the link 2 telemetry would also have to be explained and both these failures related to a single cause occurring almost simultaneous with firing of the separation squibs. A detailed review and analysis of all circuits for points where wiring errors might explain the problem resulted in the determination that one such error could not, in all probability, result in the condition experienced. A review of the test procedures prior to launch ended with the conclusion that wiring errors of the nature necessary to cause the malfunction would not escape discovery during these checks.

5. Intense investigation and analysis eliminated all other logical failure modes with the exception of the following possibility:

a. Physical damage to a wire harness containing 400 cycle, 2KC, and 28V power which passes directly under one of the separation pin puller assemblies.

Since the malfunctions were experienced practically coincident with separation squib functioning, it is conceivable that damage to this cable could result from abnormally large particle penetration. Damage to the wire harness could result in a short between the phase A, 400 cycle circuit and any one of several 28VDC circuits in this harness. Such damage could also account for an open 2KC circuit to the link 2 telemetry.

6. A serious malfunction in the pin puller is not predictable based on design, development, qualification and quality assurance records, However, it is conceivable that random degrees of damage to adjacent wire bundles could be experienced from flying particles of eroded metal or foreign material packed in the squib or inadvertantly left in the pin puller assembly.

7. It is believed that the effort to define the Discoverer 37 malfunction has been thoroughly pursued and that all logical failure modes which might explain the problem encountered have been eliminated as likely possibilities through careful analysis and test, with the exception of possible damage to the wire harness as mentioned above. No other single failure mode possibility has been revealed which ties the two AC power losses experienced to the time of occurance.

8. Based on the efforts outlined above to define the difficulties experienced on Discoverer 37 the following changes have been made effective for Discoverer 38, Project [redacted] Vehicle 2301, and all subsequent vehicles:

a. Elimination of fuses in primary vehicle circuits to further insure against abnormal transients disabling a circuit.

[redacted]

b. Protect all wires which pass near pin pullers with fiber glass tape and metal shields to protect them from hot gas and flying particle damage.

9. Based on the efforts and the corrective action outlined herein it is planned to launch Vehicle 2301 and Discoverer 38 as presently scheduled.

10. Continuing detailed investigation and testing to further define the malfunctions associated with this as well as other Discoverer operations which have not been conclusively defined is being emphasized by the Contractor under the direction of this office. A small, highly experienced analytical group is presently being formed to spend full time in this area. This group will provide a continuing review and analysis effort into all past and future difficulties in an effort to bring to light subtle details that may be overlooked otherwise. Such a group will materially aid in establishing the continuity necessary for more effective orbit malfunction analysis and serve as the key focal point in the investigation and analysis of future problem areas.

FOR THE COMMANDER

SIGNED

C.L. BATTLE
Colonel, USAF
Director
DISCOVERER Satellite System