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SUNDISK Memo # 1-68

TO: Distribution  
FROM: G. M. Levine  
DATE: January 12, 1968  
SUBJECT: Incorrect Extrapolation of W Matrix

I have recently discovered four different SUNDISK errors, each of which causes the W matrix to be improperly extrapolated during rendezvous navigation. There exist "work around" procedures to avoid the error in all but one case. The errors and the error avoidance procedures are as follows:

1) P-00 Integration

During P-00 integration, the CSM state vector and the W matrix are first extrapolated, then the LM state vector is integrated. A program request during this process will be complied with at the conclusion of the integration of either state vector. Thus, the LM state vector can be left at a time earlier than the CSM state vector and the W matrix. If this situation occurs and the LM state vector is being updated, then the W matrix will be associated with the LM state vector and thus integrated over too long a time interval the next time navigation data is processed.

Avoidance Procedure

The astronaut must not perform DSKY activity during P-00 integration, a condition which is indicated by the green computer activity light.

2) Verbs 83 and 85

An astronaut request for a range, range rate, angle display (by means of verbs 83 and 85) while Average G is on, causes both state vectors to be extrapolated without the W matrix. The next time navigation data is processed, the W matrix will be associated with a state vector and will be integrated over too short a time interval. The error does not occur when these displays are requested if Average G is not on.

Avoidance Procedure

The astronaut must not request the displays if Average G is on until no further rendezvous navigation is to be performed, i. e. until terminal rendezvous (P-47).

3) Target  $\Delta V$ , R-32

If the LM state vector is being updated during a monitored LM-active rendezvous (as it should be), R-32 integrates the LM state vector to the LM maneuver time and then adds the velocity change. This procedure does not extrapolate the W matrix. The next time navigation data is processed, the W matrix will be associated with the LM state vector and extrapolated over too short a time interval.

Avoidance Procedure

The astronaut must perform either verb 83, verb 85, or P-00 immediately after R-32. The two state vectors and the W matrix will become correctly synchronized. Note that the required activity (verb 83, verb 85, or P-00) must be allowed to complete its computations. See item 1 above.

4) P-4X

To perform a maneuver during a CSM-active rendezvous, the CSM state vector is integrated from the last navigation sighting time without the W matrix. No state vector synchronization is performed after the maneuver. If the CSM state vector is being updated; then, the next time navigation data is processed, the W matrix is associated with the CSM state vector and extrapolated over too short a time interval. The error does not occur if the LM state vector is being updated since the W matrix will be associated with the LM state vector in that case.

Avoidance Procedure

The astronaut must select the LM state vector update mode for a CSM-active rendezvous. There is no method of avoiding the error if the CSM state vector is updated.



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