

UNITED STATES GOVERNMENT

# Memorandum

NASA Manned Spacecraft Center

TO : See list attached

DATE: October 29, 1969

69-PA-T-138A

FROM : PA/Chief, Apollo Data Priority Coordination

SUBJECT: Automatic CSM Rendezvous

Partly because of Mike Collin's post-flight criticisms and partly because we don't have anything else to do anymore, some of us MSC and MIT guys had a little meeting the other day to discuss implementation of a quasi-automatic CSM rendezvous capability in the GNCS. Of course, it is impossible to provide a fully automatic rendezvous system in the CSM because of the manual optics which are required for rendezvous navigation. Our objective at this meeting was to review and endorse an MIT proposed design of a system that comes as close to fully automatic as is reasonably possible. Based on the agreements reached at our meeting, MIT is going to develop an off-line COLOSSUS assembly and associated support documentation which we can try out on the CMS. Although MIT was noncommittal on schedule, the impression given was that it would be available around the first of the new year. If it turns out really great and doesn't shake up the program too much we will probably add it to a flight assembly and perhaps look at some of the other programs the same way, including those in the LM. At the least, it is a good source of experience for future projects.

To give you a little idea of what is being done, let me just list some of the operations which the computer will relieve the crew from doing.

- a. Automatic W-matrix initialization
- b. More judgment in the automatic data editing
- c. Automatic cycling from program to program
- d. Automatic loading of "Target  $\Delta V$ " to update the LM state vector when it has maneuvered
- e. Automatic DAP (RO3) initialization
- f. Automatic attitude maneuvers without crew authorization (but with displays to tell what it's trying to do)



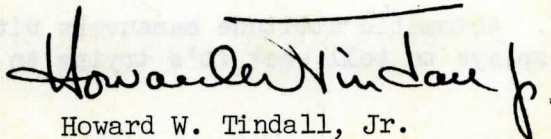


In addition to these specific items, there is also a general clean-up of the program such as eliminating the need for the crew to input standard parameters we are unlikely to ever change (such as elevation angle and terminal phase transfer angle) and a number of displays which the crew ordinarily has no interest in seeing. Altogether it is anticipated that the total number of DSKY key strokes would be reduced from the 850 or so required on Apollo 11 to under 300.

There is some question as to whether it would be necessary for a crew to learn how to operate the system in the old non-automatic mode. It appears there is a good chance that the automatic mode will be capable of handling not only a standard rendezvous, but also any of the abort situations that can be imagined as well. We will have to await completion of the program before we will know that. Provision is being made, of course, to interrupt the automatic mode to permit non-nominal things such as unscheduled platform alignments (P52) and up-links from the ground (P27) or anything else that might become necessary in real time. This is being done by providing standard reset points throughout the sequence, each identified and callable by a new program number. (MIT's current plan is to use the P8X's for this purpose.)

Two new programs or routines were strongly endorsed for addition into this system, if they aren't too difficult. The first is a new targeting (prethrust) program to permit onboard computation of the height adjustment maneuver used in a number of abort sequences. At present the crew is required to use a chart in conjunction with the CSI program (P32) to back-up the ground targeting, which is prime. Provision of this program would make the spacecraft independent of the ground for all abort rendezvous sequences currently planned. The other would provide automatic sequencing of the G&N for a command module SPS plane change, including IMU pulse torquing and spacecraft attitude control. At present this is a really messy procedure which the CMP would have to carry out by himself in a time critical period if that need ever occurred in flight. Incidentally, these capabilities would be good additions to the present system!

It was interesting to note the enthusiasm most of the people had for this undertaking. But, of course, I was careful to invite only those whom I thought would be friendly since we are not necessarily designing a flight system but rather a trial system based on a philosophy new to MSC operational people. It will be easier to deautomate it later if that's a good idea than to go the other way.

  
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