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NASA - Manned Spacecraft Center
Houston, Texas
In reply refer to: SG (DWG:vb)
July 9, 1963

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MEMORANDUM for the Acting Manager, Apollo Spacecraft Project Office

Subject: Guidance Computer for Apollo

Recent studies by MSC, MIT, Bell Comm., and IBM have defined the relative characteristics of the present MIT-Raytheon Computer and the proposed IBM-TMR Computer being planned for Saturn V. The action being proposed by Headquarters now is to develop the TMR Computer so that it can be used for the Spacecraft also. In evaluating this action further, some additional information needs to be developed and some decisions or ground rules established. These are discussed as follows:

a. To what extent will Spacecraft modification be acceptable in accommodating the new computer at some future time? The proposed IBM Computer will not fit in the present space allocated in the Spacecraft. The MIT Computer fits, but must have more space for spares storage. This is much easier than locating another active black box. Do we want to re-design the Spacecraft now to make more room in one place?

b. In planning for a possible future change in Computers, will it be permissable to write all new programs, or should it be a ground rule that no program changes are required. The logical design of the IBM machine is different to the extent that complete re-programming would be required. To preserve MIT programming with TMR would require a complete, new Computer design.

c. In resolving MSC-MSFC interface problems, how different will the two versions of the TMR Computer be permitted to grow? The problems mentioned above can be solved by building two different TMR Computers, but this is not a "free backup" from a NASA standpoint. On the other hand, agreeing on instruction code, word length, interrupt sequence, etc., would be a monumental task and require a new Computer design. The effort so far with Bell Comm., is keeping our only Computer man away from the existing program almost completely. The degree to which the logic is identical also affects the degree to which programs can be identical. Can the mechanical packaging be different in the two applications, or must this be negotiated also?

d. What are the relative administrative, management and technical responsibilities of MSC and MSFC in this matter? Who pays for what? How do we decide?

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In thinking over how we might resolve these problems, I have formed the following opinions:

a. We should proceed with the effort to make the TMR compatible with the Spacecraft needs with the understanding that it should be possible to use TMR at some future date, but not necessarily convenient.

b. Plan no change to existing Spacecraft to accommodate the TMR Computer. The TMR Computer would be designed to fit in the existing hole plus a spill-over box that would be mounted in some other location with a minimum of re-design at the time the TMR was installed.

c. Plan to re-program when TMR is used in the Spacecraft. This is a big effort, but the only practical solution.

d. It should be a requirement that only one basic TMR Computer be developed. The basic Computer should fit the hole in the Command Module and this part should be common with Saturn. The "spill-over box" can be unique for the Spacecraft application, and other boxes can be added for the Saturn application. The LEM version should be derived from some simple (smaller) modification of the basic Computer.

With this set of rules, the major cost to MSC should consist of the re-programming effort. The TMR design effort could proceed almost independently. We wouldn't plan to do any more until we really got serious about changing over to TMR. If, however, we plan to do more than this, or deviate in some manner from these rules, the amount of coordination required between MSC and MSFC could increase rapidly and could keep an additional four or five people busy full time, quite easily. This doesn't sound like much of a problem, but the existing personnel problem is already grim. We should have one full-time man assigned to coordinate design data, in any event. If you have any firm opinions on direction in these matters, [illegible]d appreciate discussing the matter with you before the ne[illegible]

Original '
David W.

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Manager,
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