BELLCOMM, INC.
955 L'ENFANT PLAZA NORTH, S.W. WASHINGTON, D.C. 20024

SUBJECT: Trip Report: AAP Mission Requirements Panel Meeting, MSFC, September 13, 1968 - ~~Case 610~~

DATE: September 27, 1968

FROM: K. E. Martersteck

ABSTRACT

The tenth AAP Mission Requirements Panel Meeting was held at MSFC on September 13, 1968. Outstanding action items including possible extension of the IU lifetime, and status of the Mission Requirements Document and Baseline Reference Mission Document were reviewed.

However, most of the discussion centered about two principal topics: experiment compatability and payload performance improvement. The Centers have reevaluated the AAP-2 experiments and prepared a priority list along with pertinent data on weight, cost, development status, etc., for submission to Headquarters. A major unresolved issue is the amount of WACS propellant, if any, which can be allocated for experiment use.

In the performance area it was recommended that the AAP-2 orbit be lowered to 210 nm, that SPS suborbital ignition be approved for CM/SM flights and that the AAP-1 SM RCS be used to boost the OWS to its 210 nm orbit from 185 x 210 nm. These proposals would provide a positive payload margin on all flights with an allowance for growth included in the weight accounting.

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MEMORANDUM FOR FILE

The tenth meeting of the AAP Mission Requirements Panel (MRP), held at MSFC on September 13, was attended by D. A. De Graaf, D. A. Mills and the author. An agenda is attached.

Agenda items which provoked significant discussion are summarized below:

10.1.1 The investigation of schemes for extending the IU lifetime is a lingering MRP action. MSFC has had IBM and Douglas study the IU and APS respectively to determine the impact of lifetime extension. The contractor reports are in now but mission changes, in particular the inclusion of unmanned rendezvous on AAP-4, obviate the need for IU lifetime extension. However, a question was raised as to whether the C-band beacon will still be needed after OWS insertion for radar tracking or whether skin tracking will provide sufficiently accurate orbit determination (at the fifth MRP meeting, a recommendation was approved to provide ground-controlled ON-OFF capability on the beacon). MSC will determine whether this requirement still exists.

10.1.2 The Mission Requirements Document for AAP-1/AAP-2 has been issued. The AAP-3A and AAP-3/AAP-4 documents are being held pending possible changes in the missions during the forthcoming weights meeting.

10.1.3 A Preliminary Baseline Reference Mission Document has been published. A steering committee co-chaired by E. Whitacre, MSC/KM, and J. Cremin, MSFC/R-AERO, has been formed to administer the updating of the document and generation of the Baseline Reference Mission.

10.1.6 J. Waite presented the results of a joint MSFC/MSC effort to reevaluate the AAP-2 experiments based on criteria such as the contribution of each experiment toward meeting mission objectives, necessity of flying the experiment on a manned flight, importance of experiment in satisfying overall AAP objectives, etc. Experiments were listed on a priority basis along with pertinent data such as weight, cost, development status, etc. The earth resources experiments were included in the list but the panel was

unable to agree on a recommendation about these experiments. It was decided to present Headquarters with the pros and cons of flying them and let the program managers decide which experiments should be flown.

A particularly burning question relating to the issue of the experiments is whether there will be any WACS propellant available for manual pointing of the cluster. If conservative values for atmospheric density and system dispersions are used, only 12000 lb-sec impulse would be available for experiments if the missions were initiated at 210 nm. However, if nominal values are assumed for these parameters, about 42000 lb-sec impulse would be available for experiment pointing.

10.1.8 & 10.1.9 These action items on MSC and KSC respectively relate to launch operations considerations. It was announced that the rendezvous implications will be set forth in an MSC memo by the Rendezvous Analysis Branch of MPAD and discussed at the next FOP meeting. Problems faced on the KSC side concern plans for pad turn around, the definition of "on-time" launch, and criteria for hold and recycle. A. R. Raffaelli, KSC/AA-SVO, said they "think differently" if launch time must be within 30 sec instead of within 10-20 min. Thus, launch planning for the LM/ATM may be significantly different from all the rest. These items remain open.

10.2 & 10.3 Most of the rest of the meeting was devoted to a discussion of these weight and performance issues, particularly the latter. As a result of considering the present weight status plus anticipated changes and a growth allowance of 3000 lbs for AAP-2, 2500 lbs for AAP-4 and 1000 lbs for the CM/SM flights, the projected vehicle margins were shown to be:

AAP-1	AAP-2	AAP-3A	AAP-3	AAP-4
+860 lbs	-2725 lbs	-873 lbs	-453 lbs	+1129 lbs

A number of proposals were made to improve this performance margin situation. First it was proposed that the AAP-2 orbit be lowered from 220 to 210 nm. Principally this would increase the AAP-2 payload by 800 lbs and, due to the recently deferred flight schedule, sufficient orbit lifetime would still be assured. As planned at the last Weights Meeting, a J-2 engine would be specially selected and calibrated for AAP-2, thus adding 500 lbs more payload capability.

A substantial gain of 1900 lbs in AAP-2 payload can be realized by what MSFC called an "Orbital Mechanics Scheme". The OWS would be inserted at perigee of a 185 x 191 nm orbit. Passivation would be done immediately, raising the apogee to 210 $\pm$10 nm. Following rendezvous by the AAP-1 CM/SM, the SM RCS

would be used to raise perigee to 210 nm and, if necessary, to raise apogee to 210 nm also. The 722 lbs of propellant necessary for these maneuvers would just fill the SM RCS tanks (and use up nearly all of the projected payload margin). Further gains in the AAP-2 margin could be made if the passivation could be delayed for half an orbit. However, MSFC is unwilling to make such a commitment until after the AS-205 flight results are analyzed. Also it was noted that a problem exists in the S-IVB propellant utilization system which may preclude normal closed-loop operation and cost a payload penalty of ∿1000 lbs.

Finally, suborbital ignition of the SPS was discussed by Morris Jenkins, MSC/KM, as the solution to improve the CM/SM margins on AAP-3A and AAP-3. This technique, also called 2-1/2 stages-to-orbit, would increase the allowable payload by around 2600 lbs by burning some 14,800 lbs of SPS propellant to produce the desired orbital insertion velocity. The S-IVB would carry a flight performance reserve to ensure a guidance cutoff at the specified suborbital conditions. An automatic separation sequence of 20 sec or less would ignite the SPS and MIT's cross-product steering would be used during the burn. Thus, there appears to be no impact whatever on the launch-vehicle guidance program and minimal programming effort for the CM computer. The major problem associated with this proposal is the possibility of an unavoidable land landing should the SPS engine fail during the 5-50 second period that the instantaneous impact point path crosses Africa. More southerly launch azimuths tend to alleviate this problem. Also, a few seconds of relief can be obtained by using the SM RCS.

In conjunction with the performance status, the question of flying the missions at 35° inclination was discussed. This would cost about 400 lbs of payload per flight. However, the orbits would provide overflight of the Southern USA including about 75% of all ground truth sites desired for early coverage in the Earth Resources Program. Cloud cover would probably reduce the number of useful passes, however. In addition, it was asserted that the ATM aperture doors must be closed whenever the vehicle is in the South Atlantic anomaly and in sunlight. If true, this may detract from the 35° case.

The Centers joint recommendations which will be presented to Mr. H. T. Luskin on September 26 are as follows:

Baseline:

- 210 nm orbit for AAP-2
- Engine selection and recalibration for AAP-2
- CSM boost of OWS
- Use suborbital SPS ignition on AAP-1, 3A, 3

Postpone baselining delayed passivation pending further flight experience on propellant seating problems.

Request a Headquarters decision whether the missions should be planned for flight at 35° inclination.

K. E. Martersteck

1025-KEM-dcs

Attachment

AGENDA
TENTH MEETING OF THE MISSION REQUIREMENTS PANEL
MSFC, BUILDING 4200, ROOM 513
SEPTEMBER 13, 1968, 8:30 A.M.

10.1 Review of action items.

10.1.1 Investigate extending lifetime of the IU by at least 3 hours or more (with adequate APS) for AAP-4. MRP AI 2.4.

10.1.2 Publish the Mission Requirements Document containing the mission requirements for AAP-1/2, AAP-3A, and AAP-3/4. MRP AI 6.2.

10.1.3 Publish the Baseline Reference Document for AAP-1/2, AAP-3A, and AAP-3/4. MRP AI 6.3.

10.1.4 Define the criteria for checkout of the MDA/AM/OWS prior to each CSM launch. MRP AI 7.3.

10.1.5 Prepare the Mission Requirements Panel Documentation Plan for the MRP Chairmen signatures including an agreement in regard to the documents described therein. MRP AI 8.1.

10.1.6 Establish the experiments compatibility for the AAP-1/2 mission and recommendations for the experiments (bio-med, earth resources, etc.) to be conducted on the AAP-1/2 mission. MRP AI 8.4.

10.1.7 Study and report the possible advantages and impact of altering the "core" program by the addition of a first flight of a Block II CSM that docks to the OWS. MRP AI 9.1.

10.1.8 Determine the minimum and maximum time between each AAP launch, i.e., AAP-1/2, AAP-2/3A, AAP-3A/3, AAP-3/4. MRP AI 9.2.

10.1.9 Determine the minimum and maximum (if any) times, that are feasible between each AAP launch, considering pad modification and turn around time, etc. MRP AI 9.3.

10.1.10 Prepare Experiments Operations Requirements Sections of MRD for AAP-3A and AAP-3/4. Experiments Subpanel AI 2.3.

10.2 Weight and Performance Status Report.

10.3 Payload Performance Improvement Report.

10.4 Orbital Lifetime Status Report.

10.5 Limitations of the Block II CSM for an AAP-1/2 OWS "Set-Up" Mission.

10.6 Review of appropriate WACS RIDS.

10.7 Review of appropriate CSM RIDS.

10.8 New Items.

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From: K. E. Martersteck

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