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19 Jun 68

COVERING BRIEF

Dr. Flax:

Reference is made to my May 23 memo to you recommending we not bend the program over "immediately" to accommodate $500 million in FY 69, and which you subsequently forwarded to Dr. Brown (Tab A).

On May 29, Dr. Brown called me to verify that we could wait a few weeks before bending the program over. During the course of our conversation, he indicated that he had talked with Dr. Foster and that FY 69 funding might be as much as $525-530 million, but more likely at or close to the $500 million level.

Shortly after the discussion with Dr. Brown, Mr. Palley brought around a proposed Foster-Nitze memo, which inclosed a chart of MOL funding options and ramifications (John Kirk showed you an earlier version of this), and recommended a funding level of "no less than $500 million" for MOL in FY 69. Mr. Palley requested that I secure Dr. Brown's comments and/or concurrence on this paper (Tab B).

Sometime during the same day (May 29) Dr. Brown wrote a note to Dr. Foster and you indicating he had agreed to postpone actions to reduce MOL FY 69 expenditures until about June 15th (Tab C).

Later during the day, I sent the proposed Foster-Nitze memo to Dr. Brown, along with a covering memo from me recommending that he suggest to Dr. Foster that the memo to Mr. Nitze propose a $500-530 million level for MOL in FY 69, with the final level to be established by mid-June. I indicated to Dr. Brown that I wanted to discuss in more depth with you the possibilities of a manned-only Block I MOL Program because it had some appeal schedule and financial-wise (Tab D).

On May 31, Dr. Brown sent the proposed Foster-Nitze memo back to Dr. Foster, suggesting that he recommend a

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$500-530 million level for MOL in FY 69, with the exact number to be determined by mid-June (see HB-penciled notes on covering brief and proposed memo in Tab B). Mr. Kirk and Mr. Palley subsequently had the proposed memo retyped to reflect Dr. Brown's recommendation and apparently will submit it in that form to Dr. Foster.

On the opposite page (Tab E) is a memo to you recommending that the MOL scope be changed from a manned/unmanned program to a six launch manned-only program (present manned/automatic baseline configuration without change), to be funded at a level of $530 million in FY 69, with the first all-up manned launch in November 1971 and subsequent launches on five month centers, at a total cost of $2.7 billion. It discusses the major factors which appear to be relevant to the issue, and obviously has more detail and information than you need. It was intentionally prepared in that manner, however, so that it could be used as a talking paper with Dr. Brown and/or Dr. Foster if you so desire.

JAMES T. STEWART
Major General, USAF
Vice Director, MOL Program

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JUN 1 1968

MEMORANDUM FOR DR. FLAX

SUBJECT: (SECRET-BYEMAN) Deferral of Development of the Unmanned MOL System

At the $500-520 million level in FY 69, it does not appear possible to avoid slippage of the first all-up manned launch in the present MOL Program from August 1971 until sometime in 1972, plus an increase in Phase II costs to more than $3 billion. In my opinion, this will result in the program position being even more precarious than it is already.

In order to minimize slippage beyond August 1971, keep any future single-year fund requirement below $600 million, and hold Phase II total costs comfortably below $3 billion, I recommend that serious consideration now be given to deferring the development of the unmanned MOL system until a Block II buy. In view of the budget limitations and technical uncertainties in at least two areas essential to successful operation of the unmanned system, such a scope reduction in the present program appears reasonable and justifiable.

More specifically, it is proposed that a six launch MOL Program be established (two unmanned, non-payload qualification launches; plus four manned, all-up 30 day reconnaissance missions). The present baseline manned configuration would be developed without change to permit verification of the feasibility of unmanned "automatic" operations and convertibility to an unmanned system if that should become a necessary or desirable future option. At a $525-530 million level of funding in FY 69, the first all-up manned launch should be possible in November 1971, and with subsequent launches on approximately five-month centers, the total Phase II cost would be at least $100 million less than the present program.

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The following sections deal briefly with what appear to be the pertinent factors associated with a change in scope from a seven launch manned/unmanned MOL Program to a six launch manned-only program.

## COST-SCHEDULE CONSIDERATIONS

The present program schedules the first manned launch in August 1971 and the final unmanned launch in Jan/Feb 1973. The cost estimates associated with this program are as follows:

(Millions)

| FY68 & Prior | FY69 | FY70 | FY71 | FY72 | FY73 | Total |
|---|---|---|---|---|---|---|
| $722.3 | 600 | 600 | 485 | 350 | 83 | $2840 |

A reduction of $50 million in the present program in FY 69 would result in a 3-4 month slip in the first manned launch date and an increase in total cost of approximately $100 million. A reduction of $100 million in FY 69 would result in a 6-7 month slip in the first manned launch date and an increase in total cost of at least $200 million.

In the present program, the two unmanned launches are estimated to cost somewhere between $300 and $400 million (nonrecurring plus recurring costs -- it is difficult to identify all of the subtle nonrecurring efforts). Of that total, some $25 million in nonrecurring costs will occur in FY 69 and approximately $50 million (both nonrecurring and recurring costs) in FY 70.

To be conservative in estimating the cost of a six launch manned-only program, subtract the lesser figure quoted above for the two unmanned systems in the present program ($300 million) from the total cost. Add $100 million for a fourth manned system. Assuming a $525-530 million funding level in FY 69, the first manned launch would be scheduled in November 1971, and the fourth in March 1973 (one month later

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than the second unmanned launch in the present program). Additionally, about $75 million more should be added to cover an overall cost increase in the program (resulting mostly from slipping the first manned launch). The total estimated cost for a six launch manned-only program would then be as follows:

(Millions)

| FY68 & Prior | FY69 | FY70 | FY71 | FY72 | FY73 | Total |
|---|---|---|---|---|---|---|
| $722 | 530 | 575 | 450 | 305 | 128 | $2,710 |

TECHNICAL CONSIDERATIONS

None of the Gemini, spacecraft or booster subsystems or components for either the manned or unmanned systems appear to be critical technical items. Progress in all of these areas seems to be regulated only by dollar availability.

In the camera subsystem, most components and areas appear to be making satisfactory progress, for example:

1. The early engineering models and brassboards of the Itek camera-back (manned version with secondary platen) have demonstrated the feasibility of all components, and the first engineering model should be delivered to EK on or very near schedule late this year.

2. The engineering models of the test chambers in Rochester have verified that EK will be able to measure flats and aspheres to the required accuracies.

3. The most recent Gambit-Cubed mirrors appear to be about [redacted] and are still improving, giving confidence in the future ability of EK to produce [redacted] mirrors for MOL.

4. It appears that the latest Gambit-Cubed will have an Optical Quality Factor [redacted] percent, and the

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[redacted] percent range in the near future, giving confidence that MOL will meet its [redacted] percent OQF specification on the first production articles.

5. The ULE flat at EK has passed all tests to date and gives every indication that this mirror material will be available for the first all-up mission, thus greatly reducing potential thermal problems.

6. General Electric has demonstrated the adequacy of the bearings and torque motor drive for control of the tracking mirror (indications are that these will perform better than specification).

7. Simulations and zero-G tests have verified astronaut capabilities to point and track, load and process film, transfer film, etc. The visual-optics bench model at EK is performing better than specifications.

Two areas in the camera system, however, have not yet made satisfactory or reassuring progress; these pertain to pointing and tracking with the large flat. A brief discussion of these two areas follow (also attached is a paper which elaborates on them).

A total allowable pointing error of 2,000 feet has been established for the unmanned system. Total pointing error can be considered as including three general error sources (vehicle attitude/alignment error; ephemeris prediction error; and geodetic error). We have just completed a fairly detailed evaluation of the pointing error situation, with conclusions as follows:

1. Attitude/Alignment Error: The allowable pointing error in this general area is 5.9 arc minutes (about 800 feet on the ground from 80 miles). This appears reasonable, achievable, and not worth the cost of attempting to significantly improve it.

2. Ephemeris Prediction Error: Today, the STC can predict ephemeris in-track position two orbits ahead with

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4,000 to 8,000 feet accuracy. In-track prediction error is only about 600 feet and not bothersome. Via SGLS, a new atmosphere model, a new math approach to ephemeris prediction, and a low-G accelerometer in the MOL vehicle, it is hoped to improve in-track prediction accuracy to about 1800 feet. However, the ability to do this will not be verified before mid- to late 1970.

3. Geodetic Error: Target geodetic positioning errors today range from a few hundred feet in Western Russia to as much as several thousand feet in Central China. In some target categories, locations are known more accurately. For example, of approximately 2100 SAC missile targets, about 35 percent have geodetic errors estimated at less than 450 feet, about the same percentage have geodetic errors between 450 and 750 feet, with most of the remainder 1000 feet or less. However, great attention has been focused on these targets, and their locations are known more accurately than the majority of the Sino-Soviet Bloc photographic targets. About 500 feet geodetic positioning accuracy (750 feet as an upper limit) is needed for MOL. Progress is being made in this area, but it is slow.

With regard to tracking, the Image Velocity Sensor is absolutely essential to the unmanned MOL (and also highly desirable for the manned system to fully exploit man's capabilities and measure his potential in space). [redacted] Early tests of the three IVS approaches under development indicate that all sense input velocities correctly only for certain scenes, all have center of power (rather than the specified center of format) tracking characteristics; all are very sensitive to scene detail and light levels; and all apparently will have problems coping with clouds. This is a very high risk area, and it will be another year or more before we really know whether or not one of these devices may be suitable for unmanned use.

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On the other hand, simulations have verified the ability of the astronauts to manually point and track well within the desired limits.

A conclusion which could be drawn, then, is that the feasibility of all critical technical areas for the manned MOL has been established, but not for the unmanned system. Answers to the pointing and tracking questions probably will not be available for 1-2½ years.

WHY MANNED RATHER THAN UNMANNED?

The reasons set forth in the past for developing and flying the manned MOL photographic reconnaissance system first (e.g., assurance of meeting resolution goal at the earliest reasonable date; acquisition of a worthwhile intelligence product at the outset; earlier maturing of the unmanned system; increased quantity and value of photography in the manned system through cloud avoidance techniques and/or the selection of targets with a momentary increase in value; the accomplishment of certain tasks such as alternate films, [redacted] visual reconnaissance, selective readout, if desired, etc., not now practical or reasonable for inclusion in the unmanned system; etc.) are all still valid.

However, some of the above-noted advantages of developing the manned system and flying it first can diminish or vanish altogether if the first manned launch is delayed too far into the future. For example, if the known and potential technical risks now associated with the unmanned system were ignored, it would be possible to develop and launch an unmanned system by mid-1971 (either MOL hardware or a spacecraft from another program) for considerably less than $500 million in FY 69. In such a hypothetical program, several launches would be possible before the first launch in the present program if the latter is delayed considerably. I would not recommend such a program, however, believing that if the manned system were canceled, we should enter into a period of analysis and evaluation (proceeding only with the camera) prior to embarking on any unmanned-only program.

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The manned MOL system, on the other hand, in addition to offering an operational test bed for other possible manned military space missions or experiments (sea surveillance, radar reconnaissance, etc.), also will provide the necessary means for even better photographic resolutions in the future using the present basic camera system. We have been informally investigating this possibility for the past several weeks, and the results are sufficiently promising to warrant some contractor-funded study efforts in FY 69. Modest future resolution improvements [redacted] should be expected as a matter of growth through improved Optical Quality Factor, more precise control and drive of the tracking mirror, faster film, etc. The use of an eliptical tracking mirror (for fuller aperture) also appears feasible and would further improve resolution.

An even more significant improvement in resolution appears feasible through an increase in focal length, a different Ross corrector lens arrangement, and a relocation of the platen. The trade-off here, of course, is the willingness to accept an even smaller field of view (perhaps, only 3-4,000 feet diameter on the ground) than the present system; this would make the pointing problem almost prohibitively difficult in an unmanned system. It appears, that such a system could be incorporated in the present manned MOL system, in addition to the basic camera, with some rearrangement of the pressurized compartment, and with either the normal or reduced field of view selectable in flight.

From all the above, the present MOL camera system (flown no lower than 70 miles) probably could be "grown" by the mid 1970's in the manned system from the present [redacted] to approximately a [redacted] resolution system. Further by adding a 3-4 foot "wafer" to the present forward unpressurized compartment and increasing expendables in the present space-craft, plus utilizing the large-diameter core TITAN IIIM (or some other booster if available), lifetime of the manned system could be increased to 50-60 days for modest cost.

## POLITICAL/PUBLIC CONSIDERATIONS

From the general Congressional and public view of MOL, a change in scope from a manned/unmanned to a manned-only

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program would not be apparent. The reduction from seven to six launches could be explained in terms of financial austerity, increased technical confidence, etc. If we can preclude slipping the first manned launch into CY 1972, we can also avoid the accusation that MOL has been slipped "another year" and is now "four years" behind the President's 1965 announcement of the first launch in late 1968. Further, it would be refreshing to advise Congress during the FY 70 budget hearings that, despite a modest slip in the first manned launch caused by FY 69 fund limitations, the total estimated cost is now lower than before.

For the Congressional Committees and individual Congressmen and Senators knowledgeable on all aspects of MOL, the full explanation of budget limitations, desire for minimum program slip and minimum total program cost increase, plus technical uncertainties still associated with the unmanned system, should provide an acceptable justification.

In the DoD, Mr. McNamara and Mr. Vance apparently were the primary unmanned system advocates. How the current incumbents feel is an unknown factor to me; however, at least some of the DDR&E Staff would support a change in scope to a manned-only program. Several points should be stressed, however, if a manned-only program is advocated. If a follow-on MOL Program to either the present or a manned-only program is approved, and no great gap in launch capability is desired, follow-on funding must be started in FY 71. Since the unmanned MOL system is already well-defined, it would be possible to start in FY 71 and produce the first Block II vehicle as either a manned or unmanned system. Further, the time interval of two years between now and when the Block II systems would have to be started would permit further analyses and verification of the feasibility and desirability of an unmanned MOL camera system (either in a MOL spacecraft or one from another program).

Outside the DoD, Dr. Hornig and Dr. Land's PSAC Panel appear to be the only reasonably strong advocates of the unmanned system (except Mr. Schultze, in 1965, for purely

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financial considerations). In advising them of a scope change to a manned-only program, the points should also be emphasized that the spacecraft would retain all of the features of the present configuration to demonstrate the feasibility of unmanned operations, would mature any unmanned system sooner, be relatively easy to convert to an unmanned spacecraft, etc.

DISCUSSION/RECOMMENDATION

Past circumstances and decisions have led to the current situation (e.g., hardware status, sizable contractor team and facility capability, future schedule, etc.) wherein the program apparently cannot be stretched-out further in any reasonably efficient manner. Additionally, another significant launch delay beyond the Fall of 1971 can strengthen the arguments of those who question the advisability of proceeding with the present program and may place it in even greater jeopardy than it is at present -- if that is possible. A change in scope to a six launch manned-only program would appear to decrease considerably the impact of a sizable reduction in the FY 69 appropriation.

A point not made before, and worth noting, pertains to the short time interval between the first possible unmanned launch in a stretched-out version of the present program and that possible in a Block II follow-on buy to a manned-only program. If the present program were funded at the $500 million level in FY 69, the first of the two unmanned launches would take place in about March 1973. In the manned-only program described earlier, if funded at the $525-530 million level in FY 69, the last manned launch would be made in about March 1973. If a Block II follow-on buy to this program were approved, a first unmanned launch, if desired, could be made in June or July 1973. A Block II buy to either a stretched-out version of the present program or a manned-only program would have to be funded starting in FY 71.

In my opinion, the Secretary of Defense could approve a change in scope to a manned-only MOL program, as described

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earlier herein, without abrogating the commitments Mr. McNamara made to the President in 1965 when he recommended approval of the program. Additionally, it should be noted that work on the unmanned MOL system could be reinitiated at any time in FY 69 or FY 70 with the impact being either additional funds needed in that Fiscal Year or a schedule adjustment to accommodate the unique unmanned efforts within whatever level of funding was available.

Although, it appears that the Secretary could approve such a change without outside coordination, he should so advise the President, National Space Council, Dr. Hornig, and the BoB at an early date thereafter.

I have briefly discussed this proposal with General Ferguson and he concurs in the basic recommendation.

In light of all of the preceding, I recommend that the Air Force advocate to OSD a change in the scope of the MOL Program to a six launch manned-only program, to fund it at a level of $530 million in FY 69, to schedule the first manned all-up launch in November 1971, and request approval by June 15 to proceed accordingly.

JAMES T. STEWART
Major General, USAF
Vice Director, MOL Program

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