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MANNED ORBITING LABORATORY

PROGRAM DIRECTIVE

MOL PHASE I PROGRAM AUTHORIZATION

NO. 65-2

25 August 1965

HEADQUARTERS UNITED STATES AIR FORCE

WASHINGTON, D.C.

MOL PROGRAM OFFICE

HANDLE VIA BYEMAN
CONTROL SYSTEM

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TAB 14

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MOL PROGRAM OFFICE

DIRECTIVE 65-2

PROGRAM REQUIREMENT DOCUMENT

THIS DOCUMENT IS AN OFFICIAL RELEASE OF THE MOL PROGRAM OFFICE AND ITS REQUIREMENTS ARE DIRECTIVE ON ALL COGNIZANT ELEMENTS OF THE MOL PROGRAM

APPROVED ______________________

B. A. SCHRIEVER
General, USAF
Director, MOL

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I. PURPOSE

This directive provides authority to initiate the Contract Definition Phase for the Manned Orbiting Laboratory System (Program 632A) and to continue with Pre-MOL activities.

II. SCOPE

This directive is applicable to all aspects of the MOL Program conducted by elements or agencies of the U. S. Air Force. In combination with approved budget authorizations, this directive constitutes authority for program implementation and planning.

III. PROGRAM OBJECTIVES

The principal and initial objective of the MOL Program is the development and early demonstration of an operationally useful high resolution optical reconnaissance system capable of achieving [redacted] on the ground. In meeting this objective, provisions will be made for extending on-orbit lifetime, and for incorporating on a timely basis advanced optical sensors capable of affording resolutions on the ground [redacted] The camera-optical system will be designed to be operated and serviced by man or be adapted to automatic unmanned operation so as to approach as closely as possible the performance capability of the manned system.

The development and demonstration of other military mission applications of MOL such as COMINT, ELINT, and Ocean Surveillance are secondary objectives. However, provisions for the introduction of these missions, both in the form of supporting experiments and full-scale demonstrations, will be considered in vehicle design, but insuring that the principal objective is not compromised.

Accommodation of DOD and NASA scientific and technological experiments is a tertiary objective. Every effort will be made to develop and pursue an experiments program of significance and value to be conducted throughout the MOL Program, but without interference to principal military objectives. Although a broad spectrum of experimentation is encouraged, priority should be shown to those which support the investigation of the utility of military manned space flight.

IV. SYSTEM DESCRIPTION

A. General Requirements

The MOL System will have the capability to accomplish photographic reconnaissance missions in fulfilling the primary objective discussed in Section III. It will be designed to also accommodate, with minimum change, other mission objectives, such as COMINT, ELINT, Ocean Surveillance or other general experimentation. Reconnaissance payloads will be launched from WTR on high inclination orbits to achieve the optimum reconnaissance information of the Sino-Soviet Bloc. For photographic missions, the perigee of these orbits may be as low as 70-80 nautical miles and orbital plane inclinations allowing sun-synchronous precession in order to permit the highest possible ground resolution of the targets to be photographed.

The MOL System will be capable of performing missions of at least 30 days duration with a 2-man flight crew. Consideration will be given to extending the system operating capability to durations of 60 or 90 days using the same basic system elements. Although this latter requirement is not part of the basic MOL Development Program, this growth should be readily achievable in the future as the need arises. The initial MOL System capability will be based on integral launches of crew and laboratory. Rendezvous capability should not be precluded in growth considerations. System growth will also consider the possibility of accommodating larger optical systems which would be capable of producing a ground resolution [redacted] presently desired.

Since the MOL System will be a first attempt to operate with crew stay times in space which are considerably longer than previously accomplished, a concentrated biomedical simulation, training, and monitoring program should be planned for and maintained during the early phases of the flight program to provide the maximum assurance of crew safety and an indication of crew capability limits for future missions which may be of even more extended duration.

In the Contract Definition Phase and during subsequent design activities a detailed analysis shall be made of total system reliability, deliberately distinguishing between crew safety and mission success probability. As a design objective, the design philosophy in terms of redundant systems and back-up modes shall be such that no single failure shall cause an abort, and during an abort no single failure shall be fatal to either or both crew members. In addition, every effort will be made to maximize the probability of recovering the crew even if they are incapacitated.

Maximum use should be made of existing man-rated subsystems, components and facilities. Extended life capability should be achieved through minimum modification of existing systems by means of redundancy, spares, and maintainability or product improvement. Only after these avenues have been explored in this order, should new subsystems or components be proposed for development. Adequate mission program schedule assurance shall be provided by back-up systems which might be introduced as primary systems later in the program to aid in the projected second generation growth.

B. System Performance Requirements

The MOL System is defined as the totality of all hardware, software and personnel necessary to accomplish the MOL objectives, from launch through recovery. The major segments comprising the MOL System include the:

Gemini B

Laboratory Module

Mission Module

Payload

Flight Crew and Crew Equipment

Launch Vehicle

Test Operations

Facilities

Each of these major segments consists of a number of subsystems, including the necessary AGE and support personnel. The Gemini B, Laboratory Module, Mission Module, and the Payload form the Orbiting Vehicle which is launched as an integral unit and is to function in orbit for at least 30 days.

The Gemini B will be derived from the basic Gemini spacecraft through minimum modification and maximum utilization of man-rated Gemini subsystems. The Gemini B will provide crew support, protection and transportation during ascent and reentry. It will allow for safe and efficient crew passage to and from the laboratory module during orbital flight. In addition to the normal pre-launch, launch, initial laboratory manning, on-orbit checkout and pre-separation time periods, the Gemini B will be capable of supporting two crewmen, and being otherwise autonomous for a sufficient time in orbit after separation from the orbiting laboratory to achieve a controlled reentry and water landing at a pre-designated and prepared landing area. In addition to the crew, it will be capable of returning to earth substantial useful data as may be defined by mission requirements.

The Laboratory Module will provide crew and mission support during the entire orbital flight phase. In addition to providing adequate pressurized volume for a two-man crew and certain equipment accommodation, it will carry all the necessary subsystems for a safe and efficient autonomous operation of the Orbiting Vehicle, such as power, propulsion, life support, environmental control, communications, stabilization, navigation, and control fluids. It will be equipped with a wide bandwidth communications system capable of rapid relaying of selected payload output and telemetry data. It will provide support for the quiescent storage of the Gemini B and supply certain functions, such as power and environmental control, to the Mission Module. Every effort should be made to keep the Laboratory Module as standard as possible, regardless of varying mission or experimental demands being placed upon the Mission Module.

The Mission Module will furnish the support of the mission payload. In the case of the optical reconnaissance sensor, it provides the structure, environmental control, and drive mechanisms. It houses the optical elements, cameras, film drives and other photographic support equipment. Astronaut access to the Mission Module for the purpose of optics alignment, film retrieval, maintenance and possibly direct viewing will be provided. If a continuous capability for direct viewing cannot be easily provided, a high quality TV link between the primary optics image plane and the Laboratory Module may be utilized. Controls and displays relating to the operation of the primary optics, as well as the pointing and tracking scopes will be located in the Laboratory Module although they are to be considered part of the Mission Module System. The majority of the data output from the sensor system will be transported to earth by means of reentry capsules or the returning Gemini spacecraft.

The primary mission payload for the initial MOL development program will be a camera-optical system with a telescope of at least 60-inch aperture capable of providing a mission average ground resolution [redacted] from an altitude of 70-80 nautical miles. During Contract Definition Phase two methods of providing pointing and tracking shall be considered:

a. Using a suitably sized flat tracking mirror;

b. Driving the entire telescope.

Prior to the completion of CDP a pointing and tracking method shall be selected and the final recommended program plan based on this selection.

The camera-optical system will have the capability of being operated by man. It will be designed in such a way as to also make it possible to operate unmanned by being supported by the best possible automatic systems for navigation, camera pointing, focusing and image control. When in the unmanned mode, necessary optical alignment will be achieved by providing a capability for adjusting alignment remotely or automatically while in orbit rather than by strengthening the structure over that required for manned operation. Manual override and supervision capability will be incorporated in the automatic mode.

In the area of growth systems studies a continuing effort shall be exerted to define sensor systems which use advanced techniques such as light weight mirror technology, new materials, Cassegrainian design, and figure control. These studies should be constrained to be primarily compatible with the basic integral launch MOL concept and secondarily with a rendezvous concept. Experimental programs will be initiated to provide early information on the precise alignment of the optical elements while on-orbit and on the figure control of very light weight mirrors.

Component technology will be encouraged and sponsored in support of payloads which can accomplish the COMINT, ELINT, and Ocean Surveillance missions. Systems and subsystem designs studies will be sponsored to achieve some basis for early decisions on an optimized design for accomplishing these missions either in conjunction with the primary optical sensor system or in separate MOL flights.

The two astronauts comprising the Flight Crew must be highly proficient in all activities related to successful conduct of the entire 30-day MOL flight profile. This means that during pre-flight training, in addition to developing spacecraft control skills, particular emphasis will be placed on achievement of a high state of crew proficiency in operating the primary MOL mission payload and analyzing results.

The basic Launch Vehicle to be utilized for MOL will be a Titan IIIC uprated so that it is capable of inserting a total orbiting vehicle weight of at least 27,900 pounds into a 80 n.m. altitude, circular orbit, with an 80-degree inclination from WTR. Certain early pre-MOL test flights of MOL hardware may utilize the unmodified Titan IIIC with 5-segment solid rocket motors from ETR. The Titan IIIC shall be suitably modified to provide the maximum of crew safety while also enhancing mission success. In the process of uprating the Titan III capability careful consideration shall be given to potential growth requirements of future advanced manned space flight systems.

Mission Control will be achieved through the Satellite Test Center of the Satellite Control Facility. The STC can provide adequate and relatively inexpensive support to the MOL Program by assignment of programmed displays to a MOL Mission Control Center. Once the laboratory has been activated, the MOL on-orbit support shall be achieved with SCF tracking stations, augmented as required.

Launch of the two Pre-MOL unmanned flights are planned from the Cape Kennedy AFS Integrate-Transfer-Launch (ITL) complex. The basic MOL development launches will be conducted from the ILC to be constructed at WTR. The ILC shall be designed:

a. For subsequent expansion to ITL.

b. For initial on-pad assembly and checkout of vehicle and payloads.

c. Initial launch stand to be configured for uprated Titan IIIC with MOL Orbiting Vehicle.

The recovery force will be comprised of sea, land, and air units and specialist teams in such quantities and at such locations in the recovery area or appropriate bases as is necessary to effect retrieval of the spacecraft and crew from a water landing. Such resources will be provided from existing Government sources, wherever possible and practicable.

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The military program in MOL will require that data, command and voice services, and working area be secure to prevent compris- omising ing classified information. Channel capacity and reliability to support wide bandwidth data transmission to selected stations in CONUS, as well as flight crew-to-MCC voice, station control voice, telemetry data, command control, and tracking data transmission at all stations in the network will be provided.

V. SCHEDULES

A. MOL Contract Definition Phase will be initiated immediately upon receipt of budget authorization. For purpose of initial program scheduling, it is intended that Phase I will require approximately six months and will be followed shortly thereafter with Phase II development approval.

B. Program schedules will be oriented towards achieving first manned flight no later than 33-36 months from Phase II Go-Ahead with subsequent manned flights scheduled on four-month centers through completion of the five manned flights presently planned for the basic development program. Launch of the first manned flight late in CY 1968 is desired.

C. The first manned flight will be preceeded by an uprated Titan IIIC qualification flight from the MOL ILC at WTR. This booster development flight should preceed the first manned flight by 6 to 9 months.

D. The first MOL development flight which is to be unmanned but to include those subsystems necessary to qualify and demonstrate the integrity of the integrated basic vehicle will be scheduled approximately three to six months prior to the first manned flight.

E. Follow-on flights to the basic development flights at a launch rate of six flights per year are to be scheduled for planning purposes.

F. In addition to the above, Pre-MOL Program Planning will continue for an unmanned Heat Shield Qualification (HSQ) flight in late CY 1966 from ETR using a Titan IIIC R&D launch vehicle. A second flight with unmanned experimental payloads aimed primarily at military application will be tentatively planned for mid to late 1967.

G. A Program Planning Schedule of the above events is shown in Table 1.

VI. FUNDING

A. Approved DOD FY FS&FP funding levels for the MOL Program Element, exclusive of payload costs , are shown in Table 2 by FY and major appropriation.

B. Program requirements for FY 66 and subsequent years will be scoped to the approved FY funding levels. More definitive

F. Initial funds in the amount of $4.2 million have been authorized by the Director, NRO for Definition Phase activities in support of primary and secondary MOL mission objectives as defined in Section III. Obligation authority to cover these activities will be issued by the NRO Comptroller directly to SAF-SP.

PLANNING SCHEDULE

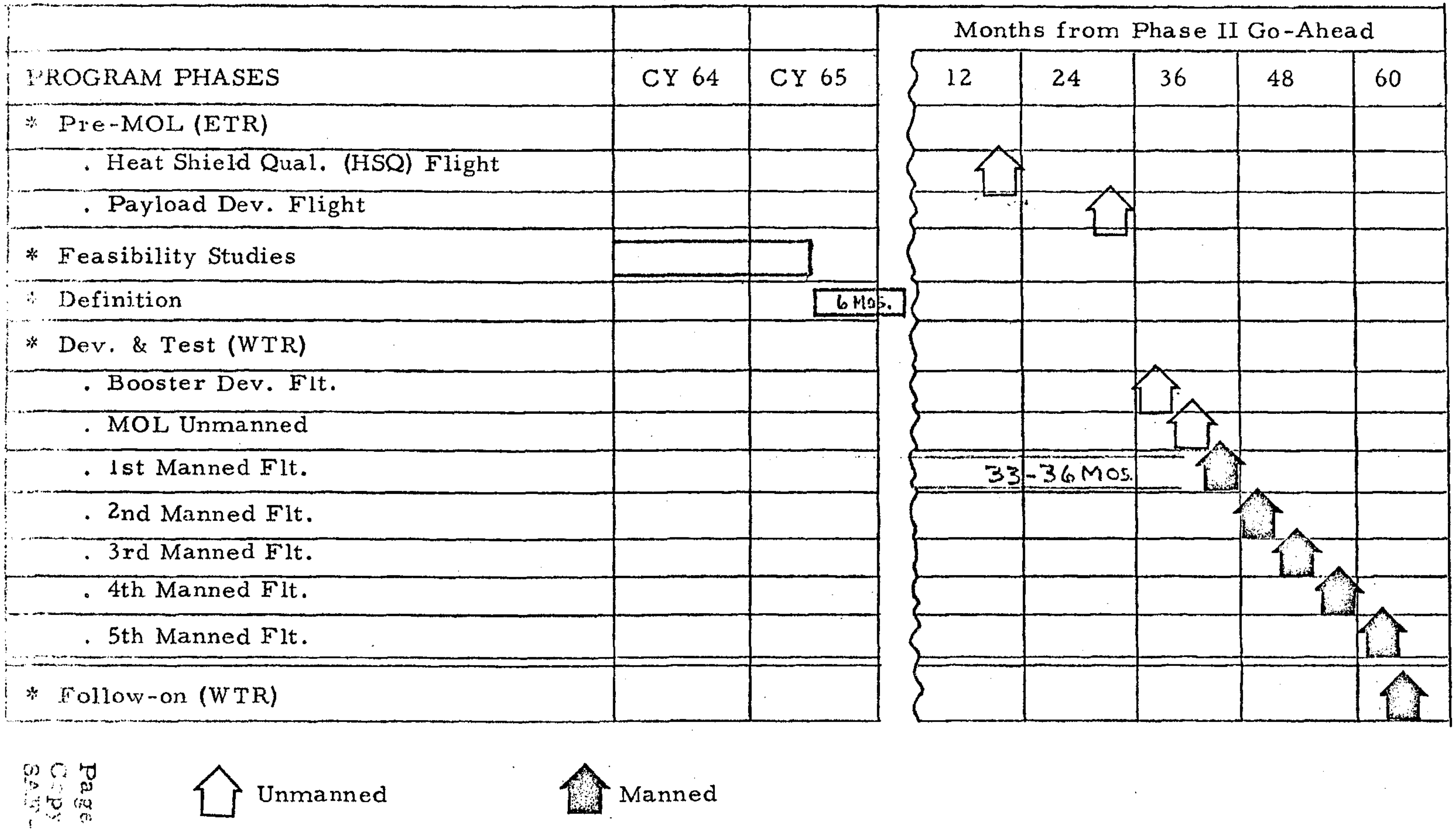

TABLE 1

FY FS&FP FUNDING SUMMARY

(Dollars in Millions)

	FY 64	FY 65	FY 66	FY 67	FY 68	FY 69	FY 70	TOTAL
X 600	10.0	36.5	150.0	324.4	360.0	274.0	53.0	1207.9
X 300				6.1				6.1
TOTAL								1214.0

Table 2

VII. PHASE I TASK SUMMARY

In accordance with this directive, the MOL Systems Office will:

A. Prepare and forward to SAF-SL for review and approval, prior to contract, the System Performance/Design Requirements General Specification for the MOL System.

B. Prepare and forward to SAF-SL for review and approval, prior to contract, Phase I Work Statements for the Laboratory Module, Mission Module, and the Optical Sensor package.

C. Provide SAF-SL with information copies of MOL Phase I Contract Work Statements and significant change notices for Titan IIIC, Gemini B, and Mission Control Equipment.

D. Identify and provide SAF-SL no later than 15 September, 1965, listing of major control milestone events to be accomplished during Phase I.

E. Prepare and submit for approval no later than 1 October, 1965 a plan for a second Pre-MOL flight with unmanned experimental payloads aimed primarily at supporting the primary and secondary MOL mission objectives as defined in Section III.

F. Prepare and submit by 1 January 1966 recommendation on method for camera pointing and optical system design accompanied with proper trade-off analysis and study.

G. Prepare and submit no later than completion of Phase I, and sooner if possible, a comparative analysis of optical systems operated and serviced by man as distinguished from automatic operation with manual override capability and supervision. This comparative analysis will be measured against performance, program risk, costs and schedules.

H. Prepare and submit for approval at the completion of Phase I a Proposed System Package Plan (PSPP) (or comparable final report) containing a complete technical, management, and cost proposal for Phase II development, and effort will be made to conform to the format and provisions detailed in AFSCM 375-4. In addition, the final report will include the information outlined in Attachment 1.

INFORMATION IN THE FINAL PHASE I REPORT

The MOL Systems Office shall submit a final Phase I Report containing a complete technical, management and cost proposal for the Phase II development. The report shall contain, but shall not be limited to, the following items:

1. A complete MOL System specification which technically defines the program requirement baseline and is organized in a form suitable for technical and contractual management of the acquisition program.

2. Phase II Work Statements for the Laboratory Module, Mission Module, and the Optical Sensor Package.

3. Summary of Associate Contractors' Operating Program Management Network for Phase II.

4. Detailed cost estimates for Phase II, which include cost estimates for the items of the work breakdown structure, as derived from PERT/Cost; together with planning estimates for the period beyond Phase II (investment and operating cost for five years, including production, operation, maintenance, etc.).

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5. A milestone schedule for Phase II consistent with the PERT/Cost network and validated by recycling the PERT planning process, together with planning schedules for the period beyond Phase II (investment and operation for five years, including production, training, maintenance, etc.).

6. Time-cost-performance trade-off decisions which have been made with respect to major alternatives, including subsystems and components, and back-up information showing the operational and cost effectiveness of these alternatives.

7. Foreseeable technical problems and proposed solutions including back-up efforts, if necessary.

8. Other problems that cannot be defined or resolved during CDP.

9. A completely integrated astronaut training plan, including content and schedule.

10. Requirements and delivery schedules for data and documentation.

11. Associate contractors' commitments for managing the project including:

a. Management-control and cost-control techniques, including reporting procedures.

b. Make-buy subcontracting procurement plan.

c. Facility requirements.

12. Contractors' proposals on the specific features on an incentive contract.

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