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MANNED ORBITING LABORATORY
PROGRAM PLAN

VOLUME 1 of 2

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VOLUME 1

TABLE OF CONTENTS

DORIAN

Page Number

Page Number

Page Number

PREFACE

In a June 29, 1965 memorandum to the Secretary of Defense, the Secretary of the Air Force proposed a redefined Manned Orbiting Laboratory (MOL) Program aimed principally at achieving very high resolution photography of significant targets. Specifically, in that memorandum, the SAF requested early approval to enter into a MOL Program Contract Definition Phase. Approval was subsequently given, and publicly announced by the President in August 1965 with no reference, however, to a reconnaissance mission objective.

This Program Plan presents a description of the MOL Program which has evolved from the Contract Definition Phase and engineering development activities to date. Volume I describes the overall MOL Program in terms of development objectives, operational concepts, fund requirements, schedules, facilities, training, etc. Volume II presents, in considerably more detail, technical descriptions, schedules, and fund requirements of the major system segments.

Program Objectives

The principal objective of the MOL Program is the development and early demonstration of an operationally useful, high resolution, optical reconnaissance system capable of achieving [redacted] ground resolution photography. The MOL Development Program will yield both manned and unmanned versions of this reconnaissance system. These are hereafter referred to as the manned/automatic and automatic versions respectively. The manned/automatic system will provide the crew the option of operating in manual, automatic, or combined manual/automatic modes.

The development and demonstration of other military applications of MOL such as SIGINT is a secondary objective. Provisions for the introduction of such capabilities, both in the form of supporting experiments and full-scale demonstrations, will be given appropriate consideration in the design of the basic system, but will not be allowed to compromise the primary objective.

Accommodation of other DOD and NASA scientific and technological experiments is a tertiary objective. Experimental programs of significance and value will be pursued throughout the MOL Program on a non-interference basis with the principal military objectives. Priority will be given to those experiments which support the investigation of the utility of military manned space flight.

Presently, virtually the entire capacity of the MOL vehicle is utilized for the accomplishment of the primary objective and no secondary or tertiary experiments are planned in the basic development program. Studies in the area of secondary experiments are being undertaken for possible inclusion in future flights and, in addition, discussions are being held with NASA regarding the use of MOL for scientific experimentation.

The MOL Program, however, plans to take maximum advantage of a possible early 1969 flight of NASA's Apollo Orbital Workshop to gain additional preliminary knowledge on man-system integration for the MOL Laboratory Module. As part of a series of DOD experiments in this portion of the Apollo Applications Program, it is planned to establish crew mobility and restraint methods for the MOL free volume in the pressurized Lab Module, to evaluate the design of the MOL sleep station, to demonstrate the zero-G self-donning capability of the MOL space suit, and possibly to investigate on-orbit maintenance procedures (probably using a molecular sieve unit from the MOL life support system).

Prior Activities

Approximately $108 million was released during the contract definition period which extended from Presidential announcement in August 1965, to September 1, 1966, after which funds began to be obligated to protect program schedules and objectives. These latter funds were applied for engineering definition of the major system segments and in the case of Eastman Kodak and the T-IIIM, for hardware development, procurement of long lead items, and construction of industrial facilities associated with the acquisition of the DORIAN payload. Also, a completely successful Gemini B heat shield flight test was conducted on 3 November 1966, using a refurbished Gemini spacecraft. The purpose of the test was to obtain early engineering data on the ability of a heat shield with an integral hatch to withstand the reentry environment. The test was conducted on the Eastern Test Range using Titan IIIC R&D vehicle #9. Also included in the flight, as a secondary objective, was a simulated MOL laboratory test structure.

A number of important technical decisions in program content and concept occurred during the Phase I Definition. The program, as envisaged in June 1965, consisted of nine launches (two unmanned and seven manned) from the Western Test Range. The two unmanned development launches were scheduled as an early test of system hardware, exclusive of optical sensor equipment (the critical pacing item in the original schedule that projected a first manned flight in late 1968). The original planning was structured to provide a semi-operational capability at the earliest possible date, and would have required the initiation of Phase II engineering development at the beginning of calendar year 1966. Based on this planning data, the total cost of the development program was then estimated at $1.5 billion.

During the detailed appraisal of optical payload development lead times in the Contract Definition Phase, plus the development of integrated test and checkout schedules in 1966/67, it became apparent that time-extension revisions in the overall program schedule were necessary. The first manned flight, which now includes a fully qualified DORIAN payload, presently is scheduled for December 1970

Current Program Status

To accomplish the primary MOL objective, a development program of seven launches currently is approved. The first manned reconnaissance system flight (MOL Flt 3) in December 1970 will be preceded by two unmanned flights in April and June 1970 for the purposes of qualifying the Gemini B spacecraft, the Titan IIIM man-rated booster, and the Orbiting Vehicle structure. The final two of the planned five reconnaissance payload flights, scheduled for October 1971 and January 1972, will operate in the fully automatic (unmanned) mode. This schedule provides operationally useful information at the earliest practical date in consideration of system and sensor development, and resources availability, and should provide an increasing quality and quantity of mission data as the flight test program matures.

The configuration selected for the MOL system to accomplish an early manned demonstration of high resolution optics utilizes existing flight and ground system hardware and capabilities from DOD and NASA inventories to the maximum extent possible. An optimized selection has been made after thorough examination, during the Definition Phase, of the many alternatives and trade-offs of subsystem and components developed and tested in other manned and unmanned space systems. Extended life capability will be achieved through minimum modification of existing systems by means of redundancy, spares, or modest product improvement, with a minimum of new subsystems or components developed. The Air Force, throughout the Definition Phase, insisted that the contractors be continually conscious of cost effectiveness in their design definition. No contingency funds have been included in the program to allow for uncertainties which normally are encountered in a development program. However, program cost estimates are based primarily on negotiated contract costs and contractor proposals for the schedule described in Section I. Deferred and change item cost estimates, where negotiations have not yet been completed, are based on comprehensive anaylses made with the contractors on the basis of detailed specifications furnished by the Air Force.

Total Program Cost Estimate

Program definition resulted not only in a better understanding of, and confidence in the technical and schedule baselines but also established a much higher degree of accuracy in total program cost estimates. The Engineering Development Program as now defined and recommended is estimated at $2.35 billion, as detailed in Section I.

The increase in the engineering development cost estimate, over that submitted to the Secretary of Defense in June 1965, is due primarily to detailed program definition, some increase in program scope, and a longer period than originally allocated for development and test.

In addition to schedule adjustments required to accommodate increased development and test time, guidance received during the definition period from the Panel on Reconnaissance of the President's Science Advisory Committee (PSAC) resulted in certain changes to the initial MOL configuration. Specifically, the requirement that the reconnaissance system provide the option to be operated in either a manned/automatic or an automatic (unmanned) mode was incorporated into the basic MOL system specification. Contractors' roles and responsibilities include this dual mode as an integral part of the development program. The program is currently planned so that the final two of the seven scheduled launches will be flown in the automatic mode. All launches will use the seven-segment 120-inch diameter solid rocket motor Titan III with certain improvements to the airframe and liquid rocket engine to meet the MOL payload requirements. The inclusion of General Electric as a major participating associate contractor is another change which was either unforeseen or not fully understood at the initiation of program definition.

Such changes, together with the actual negotiated contract costs, cost of living increases, and more realistic estimating of program deferrals have all contributed to the program cost increase.

The capability to have intermediate delivery of reconnaissance data was initially included in the baseline program. This was to be accomplished by a Wideband Data Readout System and/or a Data Return

Vehicle (ballistic reentry capsule) that would permit mid-flight return of approximately 60 pounds of film. These capabilities have been deferred both because of an apparent lack of interest on the part of potential users and in order to reduce early year funding requirements; however, the laboratory will include space, weight and power provisions sufficient to accommodate these capabilities should the decision be made at a later date to proceed with their development and test.

Summary

The MOL Program, as defined in this plan, will provide: first, a semi-operational intelligence collection capability which will photograph significant targets at [redacted] resolution; second, knowledge of man's essential and/or worthwhile contributions to very high resolution reconnaissance photography from space; third, the technology, fundamental subsystem hardware, and system designs for a satellite reconnaissance system which could achieve resolutions [redacted] and fourth, an orbital facility to determine the utility of man in space for military purposes, and to develop and test out other potential military mission applications as they become apparent.

The technical feasibility of the MOL system has been affirmed by studies and test demonstrations. Areas of apparent technical concern have been analyzed in depth, and appropriate early attention is being focused on them. The current baseline schedule represents a balanced orderly progression of development toward the earliest possible useful military space capability consistent with anticipated fund availability.

There is confidence, therefore, in the MOL Program Office that the MOL system will meet or better its performance goals in the time frame estimated and within the overall cost projection.

Stewart
for
JAMES FERGUSON
General, USAF
Director, MOL Program

Glossary of Frequently-Used Abbreviations

ACTS - Attitude Control & Translation Subsystem (Laboratory Vehicle).

ADS - Advanced Data System.

AMD - Aerospace Medical Division, Air Force Systems Command.

ASTEG - All Systems Test Equipment Group. Douglas nomenclature for automated checkout equipment.

ATP - Authority to Proceed. Baseline date for initiation of Phase II; Sept 1, 1966.

ATS - Acquisition and Tracking Subsystem.

CDR - Critical Design Review.

CITE - Computer Integrated Test Equipment. G.E. nomenclature for automated checkout equipment.

COA - Camera-Optical Assembly. Camera and lens barrel with optical elements, less tracking mirror.

DRC - Data Recovery Capsule. Film container in Gemini.

DRV - Data Recovery Vehicle. Ejectable film return reentry vehicle.

EC/LS - Environmental Control/Life Support Subsystem (Laboratory Vehicle).

EDCTU - Electronic Development Compatibility Test Unit. Douglas electrical/electronic Lab Vehicle mock-up.

FACI - First Article Configuration Inspection.

GBPS - Gemini B Procedures Simulator.

GBQ - Gemini B Qualification Vehicle. First flight article.

IMU - Inertial Measuring Unit.

LCC - Launch Control Center, Vandenberg Air Force Base, California.

LM - Laboratory Module. See Figure a.

LMQTV - Laboratory Module Qualification Test Vehicle.

LV - Laboratory Vehicle. See Figure a.

MCC - Mission Control Center, Sunnyvale, California.

MDAU - Mission Data Adapter Unit. Electronic interface between Mission Payload and LV Data Management Subsystem.

MGC - Missile Guidance Computer (Titan IIIM).

MM - Mission Module. See Figure a.

MMAS - Mission Module Aft Section. See Figure a.

MMFS - Mission Module Forward Section. See Figure a.

MPSS - Mission Payload System Segment.

OAMS - Orbit Attitude & Maneuvering System (Gemini).

OTEF - Operational Test and Evaluation Facility.

OV - Orbiting Vehicle. See Figure a.

PCM - Pulse Code Modulation.

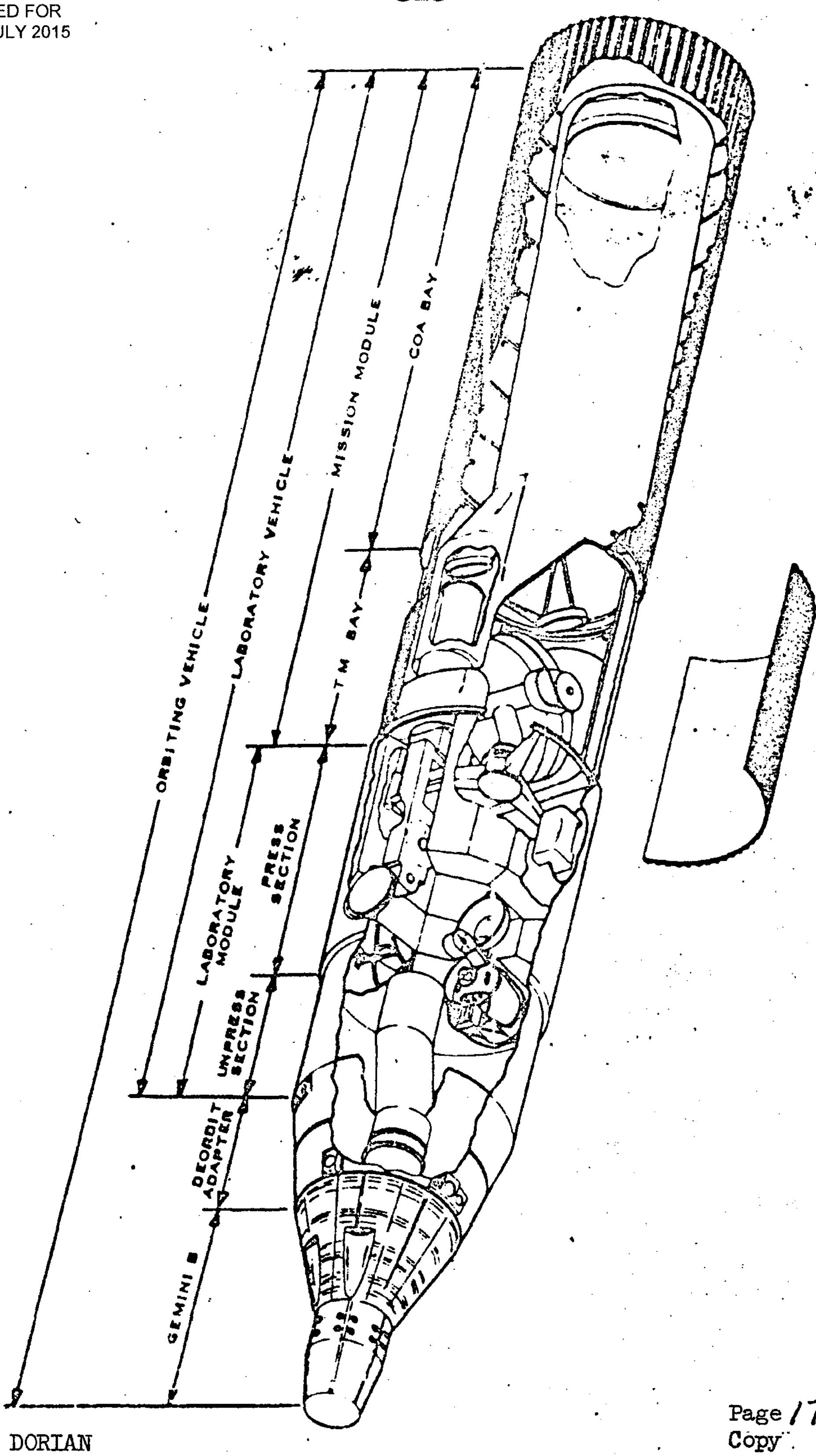
PDR - Preliminary Design Review.

PSA - Pressure Suit Assembly.

PSIA - Production Systems Integration Area. Douglas nomenclature for assembly area in Huntington Beach facility.

RTS - Remote Tracking Station.

SCF	-	Satellite Control Facility.
SGLS	-	Space - Ground Link Subsystem.
SM	-	Support Module. Replaces Gemini B in unmanned MOL configuration.
STC	-	Satellite Test Center, Sunnyvale, California.
TM	-	Tracking Mirror.
TVC	-	Thrust Vector Control (Titan IIIM).
VAFB	-	Vandenberg Air Force Base.



ORBITING VEHICLE
Figure a.

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Page 17 of pages
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SECTION I - SYSTEM DEVELOPMENT/OPERATING CONCEPTS

Part 1 - System Description

A. Program Objective

The objective of the high resolution MOL photographic reconnaissance system is to acquire photographs of significant targets of denied areas in both manned and automatic modes, with at least [redacted] ground resolution in the manned mode, and as close to [redacted] as possible in the automatic mode.

B. Development Flight Test Objectives

The objectives of the flight program, listed in general order of priority, are:

1. To demonstrate in semi-operational use the ability of the MOL high resolution photographic reconnaissance system to acquire photographs of significant targets in both manned and automatic modes, achieving the highest possible ground resolution in all modes and operating conditions.

2. To acquire quantitative data which will permit assessment of the nature and value of the significant contributions of man in increasing the quantity and quality of photography obtained.

3. To demonstrate a 30-day capability to perform the mission cited in 1, above.

4. To obtain data which will permit valid assessment of the military worth of other possible manned or unmanned missions in space, e.g., [redacted] crisis surveillance, etc.

5. To obtain quantitative data concerning optical technology and design for advanced systems which could provide photography with ground resolution [redacted].

6. To conduct experiments which will contribute to the improvement of military space technology and to collect bioastronautic data for longer duration missions.

7. To obtain quantitative data which measures the effectiveness of manned versus automatic modes of operation in the achievement of basic and secondary objectives.

C. Operating Concept

The photographic system will be launched from the WTR into a nominal orbit of 80 NM perigee (at 55 degrees N. Latitude) and 180 NM apogee, with an orbital inclination of 90 degrees, to permit maximum target coverage under appropriate solar illumination conditions.

The MOL System will be capable of performing high resolution optical reconnaissance missions of at least 30 days duration in either a manned mode with a 2-man flight crew, or up to 42 days in an unmanned mode. Provisions will be made in the design to allow the option of increasing the unmanned mode operating time to 60 days. As a design objective, the philosophy in terms of redundant systems and back-up modes shall be that no single failure shall cause a mission abort, or if an abort occurs, 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 will be made of existing man-rated subsystems, components and facilities. Extended life capability will be pursued through minimum modification of existing systems by means of redundancy, spares, maintainability or product improvement. Only if these approaches are unsatisfactory will new subsystems or components be developed. Adequate mission program schedule assurance will be provided by back-up systems which could be introduced as primary systems later in the program to aid in any second generation growth.

D. System Description

The major elements comprising the MOL System include the

Gemini B

Support Module (replaces Gemini B in unmanned mode)

Laboratory Module

Mission Module

Flight Crew and Crew Equipment

Launch Vehicle

Test Operations

Facilities

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

The Gemini B is derived from the basic NASA Gemini spacecraft. It will provide crew support, protection and transportation for two crewmen during ascent and re-entry, and will be capable of supporting two crewmen, and being otherwise autonomous for a sufficient time after separation from the orbiting laboratory, to achieve a controlled re-entry and water landing at the pre-designated landing area. The Gemini B will be capable of returning the crew, film, and experimental data to earth when desired.

The Laboratory Module will provide crew and mission support during the entire orbital flight phase. It will carry all the necessary subsystems for the safe and efficient autonomous operation of the Orbiting Vehicle. It will provide support for quiescent storage of the Gemini B, and supply functions such as power and command and control to the Mission Payload System Segment.

The Mission Payload System Segment (MPSS) is composed of a Photographic System and the subsystems necessary for its control and dynamics. The subsystems are located in the Laboratory Module or the Mission Module depending on the specific function involved.

The General Electric Company is responsible for the overall integration of the MPSS and the control hardware for the interface between the Douglas Laboratory Module System Segment, and the Eastman Kodak main optical system and camara (Photographic System).

The Photographic System for the initial MOL development program will be a [redacted] focal length camera-optical system having a 70-inch aperture and capable of providing a ground resolution of at least [redacted] from an altitude of 80 nautical miles.

The camera-optical system will have the capability of being manually operated by man, but will also be designed so as to function in an automatic mode. Automatic systems for navigation, camera pointing, tracking and focusing, cross format image motion compensation and on-orbit optical alignment will be developed to realize the fullest potential of the optics during unmanned automatic operations and to enhance performance during manned operations. Provision for manual supervision and override will be incorporated in the automatic mode of the manned/automatic configuration.

A capability to accommodate a Wideband Data Readout System and a Data Return Vehicle will be preserved by including the necessary space, weight, power, and environmental control requirements in the basic spacecraft design.

The flight crew will be highly proficient in all activities related to the 30-day MOL flight profile. During the 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.

The basic MOL Launch Vehicle will be a Titan III capable of inserting a total orbiting vehicle weight of at least 31,325 pounds into an elliptical orbit with an 80 NM perigee (at 55 degrees N. Latitude) and 180 NM apogee, at a 90 degree inclination launch from the Western Test Range.

Mission control will be exercised through the Satellite Test Center (STC) of the Satellite Control Facility (SCF). MOL on-orbit support will be achieved with SCF tracking stations, augmented as required.

The recovery forces will be comprised of sea, land, and air units and specialist teams in such quantities and at such locations as are necessary. It is anticipated that these forces will be provided from existing Government resources for the most part.

E. System Growth Studies

In system growth studies, a modest and continuing effort will be made to define sensor systems which use advanced techniques such as lightweight mirror technology, new materials, advanced optical designs, and optical mirror figure control on orbit. These studies will be directed principally to technology, techniques and systems compatible with basic MOL hardware. The potential for extending the normal system operating capability to durations of 60 days or more using the same basic system elements will be explored. Although a 60-day lifetime capability requirement is not currently part of the Phase II MOL development program, such growth is expected to be readily achievable in the future if the need arises. Although the initial MOL System capability in the manned configuration will be based on integral launches of the entire on-orbit spacecraft, the application of rendezvous techniques will not be precluded in growth considerations.

Systems growth studies will be accomplished subject to the availability of funds only after baseline requirements have been satisfied.

Part 2 - MOL Contractor Responsibilities and Factory-To-Pad Operation

A. Basic MOL Contractor Structure

The MOL system will be designed and produced by five major associate contractors whose responsibilities are as follows:

1. Douglas Aircraft Company* - Laboratory Vehicle and Support Module Design and Fabrication and Orbiting Vehicle System Integration.

2. General Electric Company - Mission Payload System Segment Integration and Selected Subsystem Hardware Developments.

3. Eastman Kodak Company - Photographic System.

4. McDonnell Company* - Gemini B.

5. Martin Marietta Corporation and Associates - Titan IIIM Launch Vehicle, and Launch Pad Operations.

Additional support tasks and lesser subsystems are handled by Government groups or support contractors. The specific tasks of the associate contractors, particularly in areas of close interrelationship with their associates, are discussed in some detail below.

B. Contractors' Roles and Responsibilities for Mission Hardware

1. Specific Responsibilities

Responsibilities for the Mission Payload System Segment have been established as follows:

a. GE will provide the on-orbit design requirements for the Mission Module structure. DAC will be responsible for preparation

* The Douglas and McDonnell Companies have been merged into the McDonnell Douglas Corporation.

and release of fabrication drawings and construction of the Mission Module structure in two separable sections, Forward and Aft.

b. The structure for the Camera-Optical Assembly (COA) will be separate from the Mission Module structure and will be contracted for, and installed by EKC in the Mission Module Aft Section. GE is responsible for the dynamic performance and analysis of the Mission Payload System Segment.

c. The support structure for the tracking mirror drive will be furnished and installed by GE in the Mission Module Forward Section.

d. GE will furnish and install the tracking mirror drive. This includes the gimbals, bearings and servo drive motors. GE will also furnish and install the necessary tracking mirror control hardware and software, with the exception of the airborne computer which will be furnished by DAC. GE will integrate the Image Velocity Sensor and provide and integrate the tracking mirror control hardware which includes those instruments required for accurate positioning information such as the star tracker subsystem, drag accelerometer, rate gyro package, and the instrumentation to measure angular displacement between the lens barrel and the structure for the tracking mirror drive. GE will also provide the reconnaissance system control consoles.

e. The Acquisition and Tracking System (ATS) including the control hardware and airborne computer software will be furnished by GE.

f. EKC will provide the mounts and locks for the main lens barrel and Ross corrector barrel. The connection between the Ross corrector barrel and the Laboratory Module pressure bulkhead will be provided by DAC.

g. EKC will provide the necessary insulation, heaters and control devices to maintain the main lens barrel and Ross corrector barrel within the required temperature range.

h. GE will provide all necessary insulation, heaters and control devices in the Mission Module Forward Section to maintain the tracking mirror within the required temperature range. Environmental control doors and the servo mechanisms required for control of thermal flux on the tracking mirror during photographic periods will be furnished by GE.

i. DAC will provide the basic DC electrical power source and GE will be responsible for receiving, controlling and distributing the electrical power for the Mission Payload System Segment.

2. <u>Ground Flow Philosophy</u>

Ground flow processing of system hardware and software is based on a factory-to-pad concept which provides a coordinated assembly, test, and handling plan for delivering flight-ready hardware. The key features of the factory-to-pad concept are as follows:

a. Balanced and integrated testing at GE/EKC/DAC/VAFB.

b. Direct comparison of Mission Profile Test results at GE/EKC/DAC/VAFB.

c. Use of command and telemetry link during acceptance and pre-launch tests.

d. Identical AGE design for factory and field checkout tests.

e. Minimized handling and transfer.

f. Malfunction isolation to the component level.

g. Component replacement capability on the pad.

3. Vehicle Processing Requirements and Integration

The preparation of the MOL system for launch involves the assembly and test of a number of MOL system segments. To enhance the probability of a successful mission operation, comprehensive testing will be conducted on the ground. The test program includes the participation of all pre-launch, launch and orbiting systems, and support elements.

The Mission Payload System Segment flight vehicle hardware provided by GE is assembled (including installation of components in the Mission Module Forward Section) and tested at the contractor's plant. Then the Payload Consoles go to DAC for assembly into the Laboratory Module. The Mission Module Forward Section is shipped to EKC, combined with the Aft Section and tested. The Mission Module is then mated with the Laboratory Module at DAC, Huntington Beach. Upon completion of integration and acceptance tests at DAC, the Laboratory Vehicle is shipped to VAFB. Here it is mated with the Titan III and

Gemini B, pre-launch tested and launched. Baseline equipment flows have been established for both the manned and the unmanned modes. These systems flow plans are described below.

4. Manned System Flow Plan (Mission Payload)

The manned system flow consists of the following individual elements:

a. GE AVE assembly and test at GE/Valley Forge.

b. Payload (less Mission Payload Consoles) integration at EKC.

c. Mission Payload Consoles/Laboratory Module integration at DAC, followed by Laboratory Module/Mission Module integration.

d. Pad cycle at VAFB.

A simplified block diagram of the complete manned mission payload system ground flow showing the major functions at GE/Valley Forge, EKC, DAC, and VAFB is shown in Figure I-1.

5. System Flow at General Electric

System flow at GE starts with final assembly and terminates with the shipment of the Mission Module Foreward Section to EKC. The operations to be performed at GE are shown in Figure I-2.

At Valley Forge, GE will install the tracking mirror support structure and drive, the control devices and other AVE (star tracker, etc.) in the Mission Module Forward Section structure received from DAC. Electrical compatibility of the Mission Payload Consoles and the Forward Section will be verified, and assembly completed by adding the inertial/thermal tracking mirror simulator.

Performance tests are then conducted employing Computer Integrated Test Equipment (CITE) AGE and an electrical simulator for the Mission Module Aft Section. These tests encompass GE AVE located in the Laboratory Module (Mission Console Bays 2 and 8, including the DAC-supplied computer) and in the Mission Module Forward Section. Ambient-environment testing will be conducted first, progressing in complexity and incorporating one new element at a time until a mission profile test demonstrating full capability is run. This mission profile test establishes a baseline, and is repeated during subsequent testing at GE, and at EKC, DAC, and VAFB.

Subsequent test phases at GE include vibration, mode verification, thermal/vacuum, and the final performance demonstration for buyoff. Mission Payload Consoles are used to exercise the Mission Module Forward Section AVE for all of these test phases.

After completion of the GE, Valley Forge, tests, the Mission Payload Consoles are shipped to DAC for installation in the Laboratory Module. After the tracking mirror simulator is removed, the Mission Module Forward Section is shipped to EKC for further processing

6. System Flow at Eastman Kodak Company

The system flow at EKC is shown in Figure I-3. EKC assembles the lens barrel (main and Ross corrector) and the thermal control system for both barrels, and installs them in the DAC supplied Mission Module Aft Section. They then perform a mode survey, and ambient and thermal optical tests using a substitute Mission Module Forward Section where required.

In parallel with the Aft Section testing, EKC receives the Mission Module Forward Section from GE and installs the tracking mirror. After testing the installed tracking mirror for flatness, EKC assembles the Forward Section to the Aft Section and conducts ambient performance, acoustic, dynamic, optical baseline, thermal optical, and operational dynamics tests. Between and after the environmental tests, baseline performance is re-verified. GE supports these tests by operating the Mission Module Forward Section AVE (with required AGE support), as necessary, to determine how much the Mission Module Forward Section elements contribute to photographic image smear.

The assembled Mission Module is then shipped by air to DAC for further processing.

7. Equipment Flow at DAC

Figure I-4 shows the DAC portion of the manned system flow. The Mission Payload consoles are received at DAC before the Mission Module, and are installed in the Laboratory Module (LM) by DAC personnel with GE assistance. After this installation, assembly of the LM is completed, and the LM system checkout is conducted including a thermal vacuum test.

When the Mission Module is received from EKC, it is inspected for shipping damage and weight, and c.g. measurements are performed.

The Laboratory Module and Mission Module are mechanically and electrically mated. The Laboratory Vehicle system testing is performed and electromagnetic compatibility is verified. A low-level vibration acceptance test is conducted. With completion of the manned Laboratory Vehicle testing phase at DAC, the Laboratory Vehicle mission profile is repeated for Air Force acceptance. Throughout all testing at DAC, the Mission Payload System Segment test results will be compared with previous results for performance trends.

After Air Force acceptance, the assembled Laboratory Vehicle is prepared for over-the-road shipment to VAFB.

8. Description of Flow at VAFB

Figure I-5 defines the equipment and event flow at VAFB with the tasks to be performed up to launch. Prior to receipt of the Laboratory Vehicle, a complete pad/AGE checkout will be made. The Laboratory Vehicle is received at the pad and inspected for possible transport damage. The Laboratory Vehicle is then mated to the Titan IIIM and the Gemini B spacecraft. Subsystems are checked, a mission profile test and launch dress rehearsal are conducted, launch readiness preparations are performed, and the launch countdown is conducted.

9. Automatic (Unmanned) System Flow Plan

In the unmanned configuration, the Gemini B is replaced with a Support Module (SM) containing Data Recovery Vehicles. The Laboratory Module/Mission Module will be equipped only for automatic operation in this configuration.

Roles and responsibilities for the Support Module have been assigned as follows:

a. DAC

1. Design and systems integration
2. External fairing
3. Fairing doors and separation subsystem
4. DRV/film transport support structure
5. Thermal control
6. Electrical power and signal distribution
7. Instrumentation of DAC-supplied equipment
8. Integration of all SM instrumentation into LV system
9. Tankage for expendables
10. AGE associated with DAC equipment

b. EKC

1. Film transport subsystem
2. Film takeup cassettes in the DRV's
3. Film cutter and sealer mechanism
4. Film takeup command/power sequence unit
5. Instrumentation of EKC-supplied equipment
6. Alignment and test of the film transport system
7. Mechanical AGE for EKC equipment

c. GE

1. Data Recovery Vehicles (DRV's)
2. DRV separation command/power sequence unit
3. Integration of command/power sequence units with electrical AGE

4. AGE associated with GE equipment

5. DRV separation and launch mechanism

6. Film cutter sealer mechanism's in the DRV

7. Instrumentation for GE-supplied equipment

LABORATORY VEHICLE GROUND FLOW (Including MPSS)

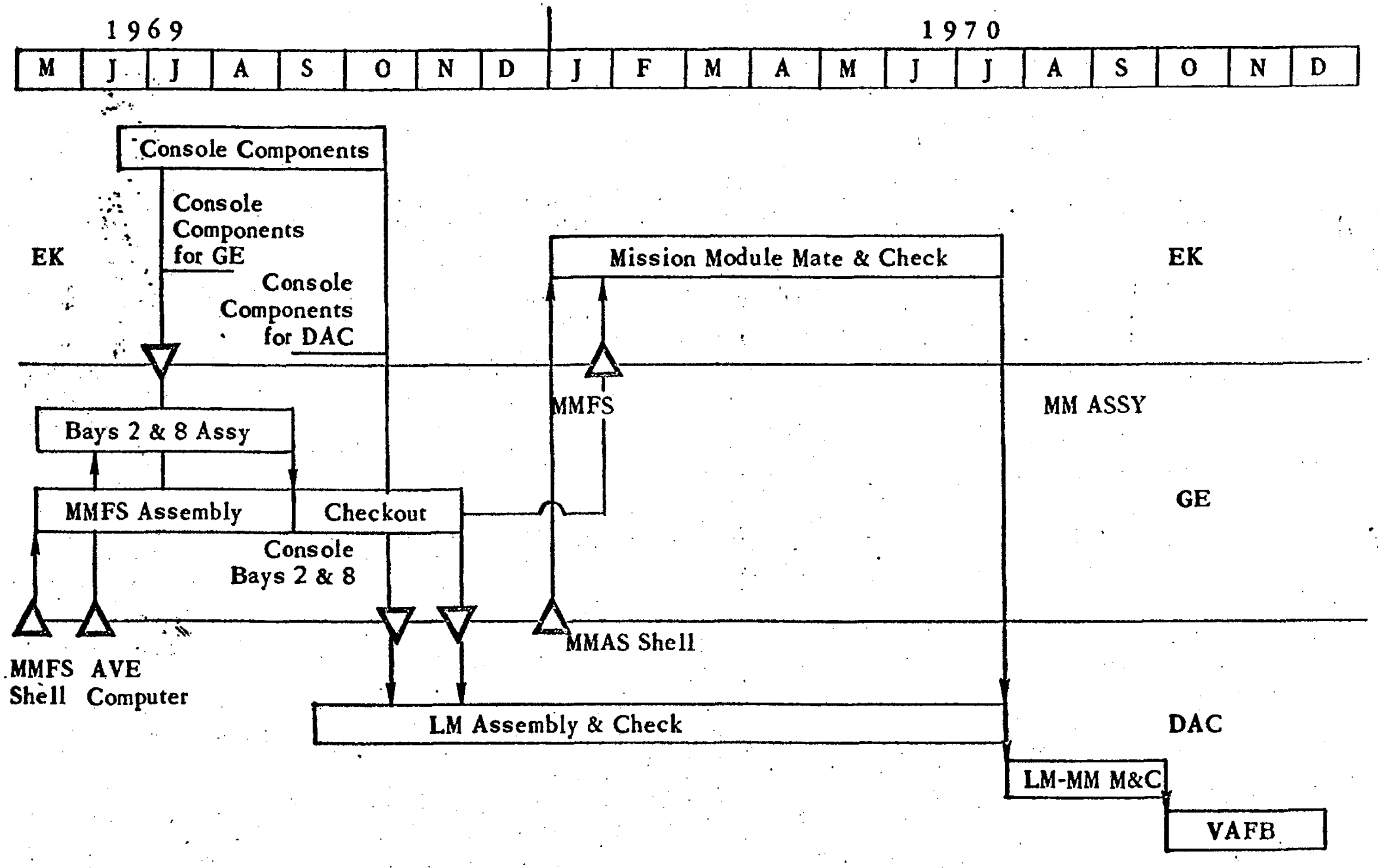

Figure I-1

MANNED/AUTOMATIC GROUND FLOW (MPSS) AT GE

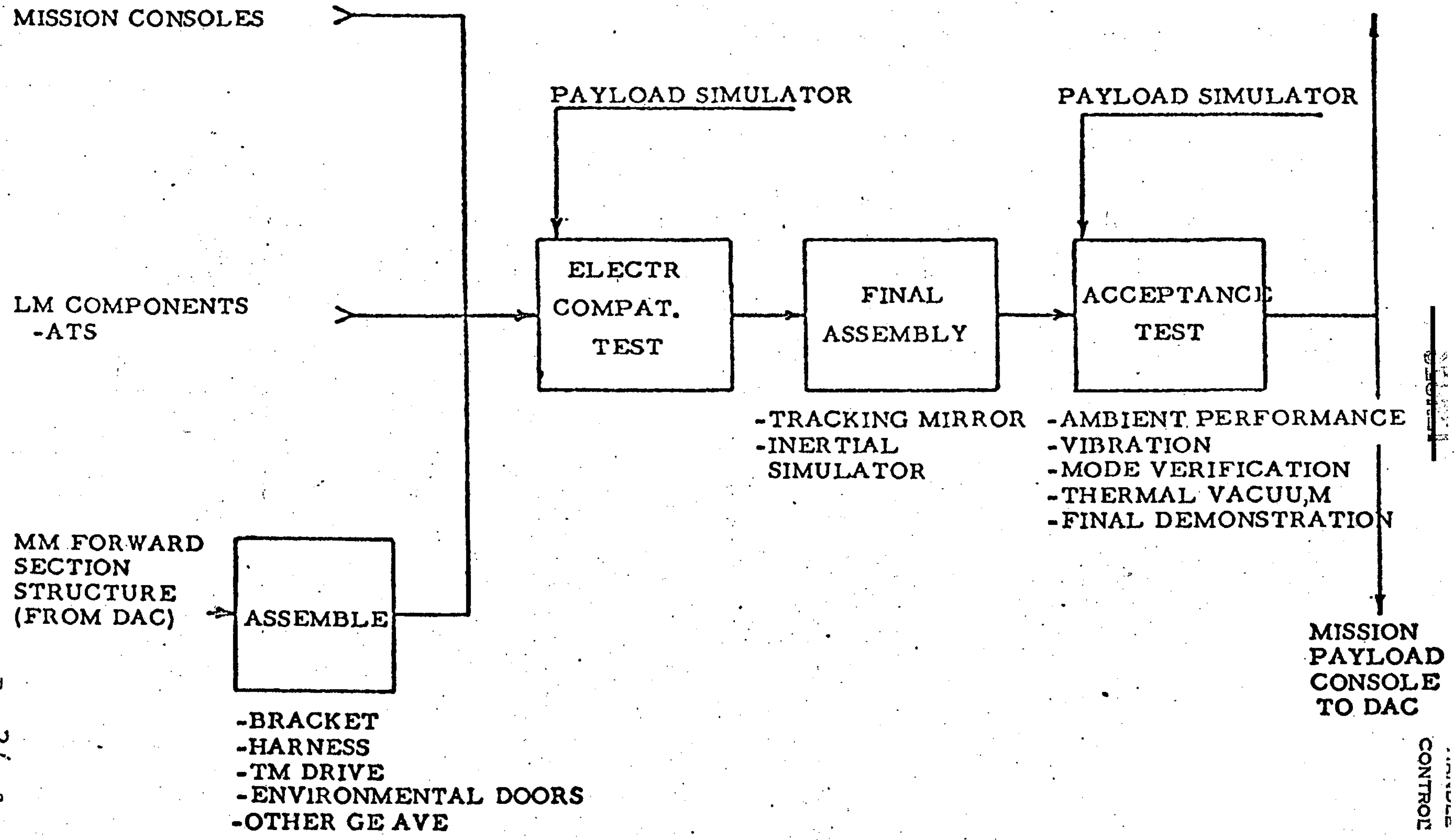

Figure I-2

MANNED/AUTOMATIC GROUND FLOW MPSS AT EKC

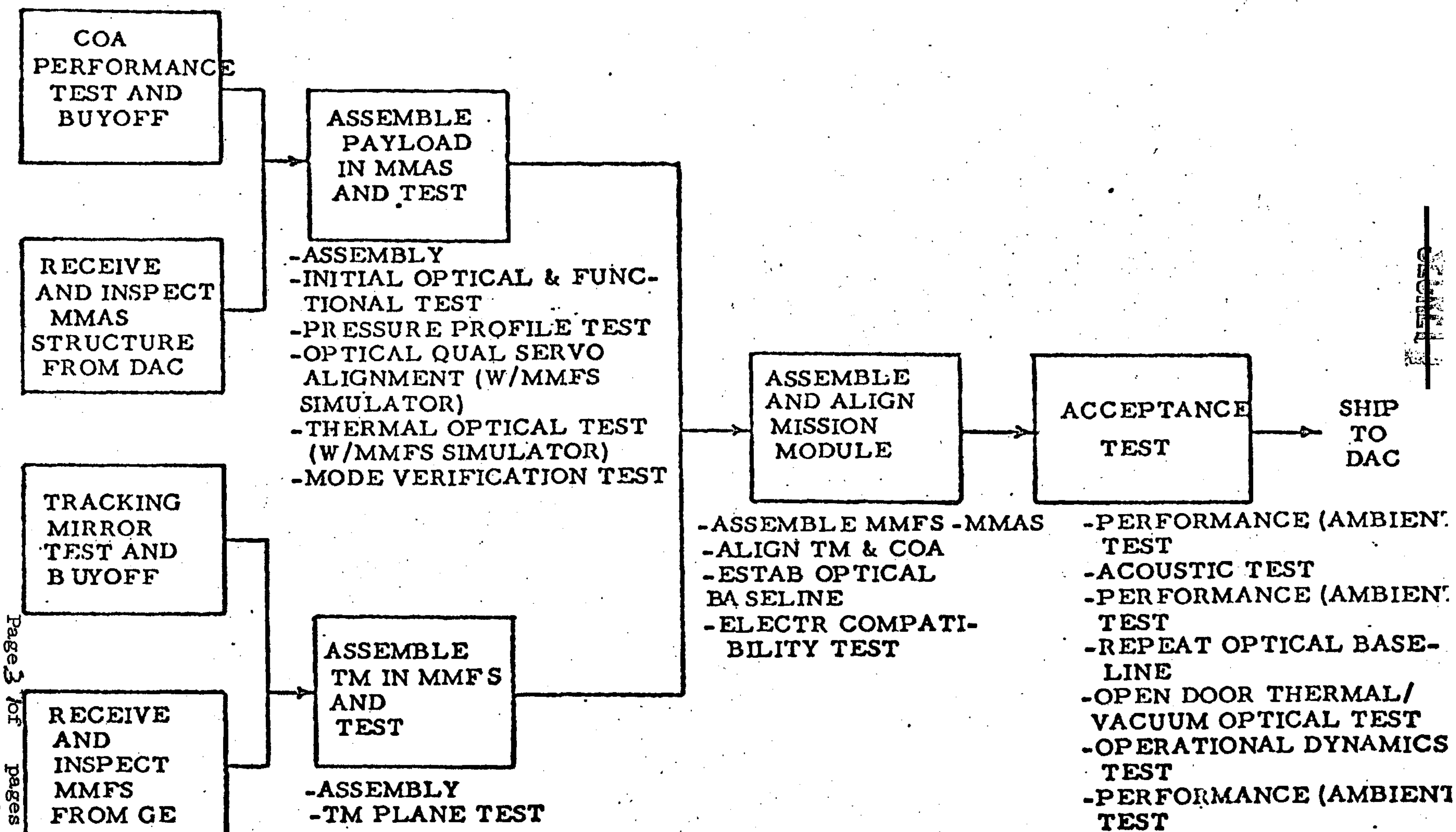

Figure 1-3

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MANNED/AUTOMATIC GROUND FLOW (Laboratory Vehicle, Incl MPSS) AT DAC

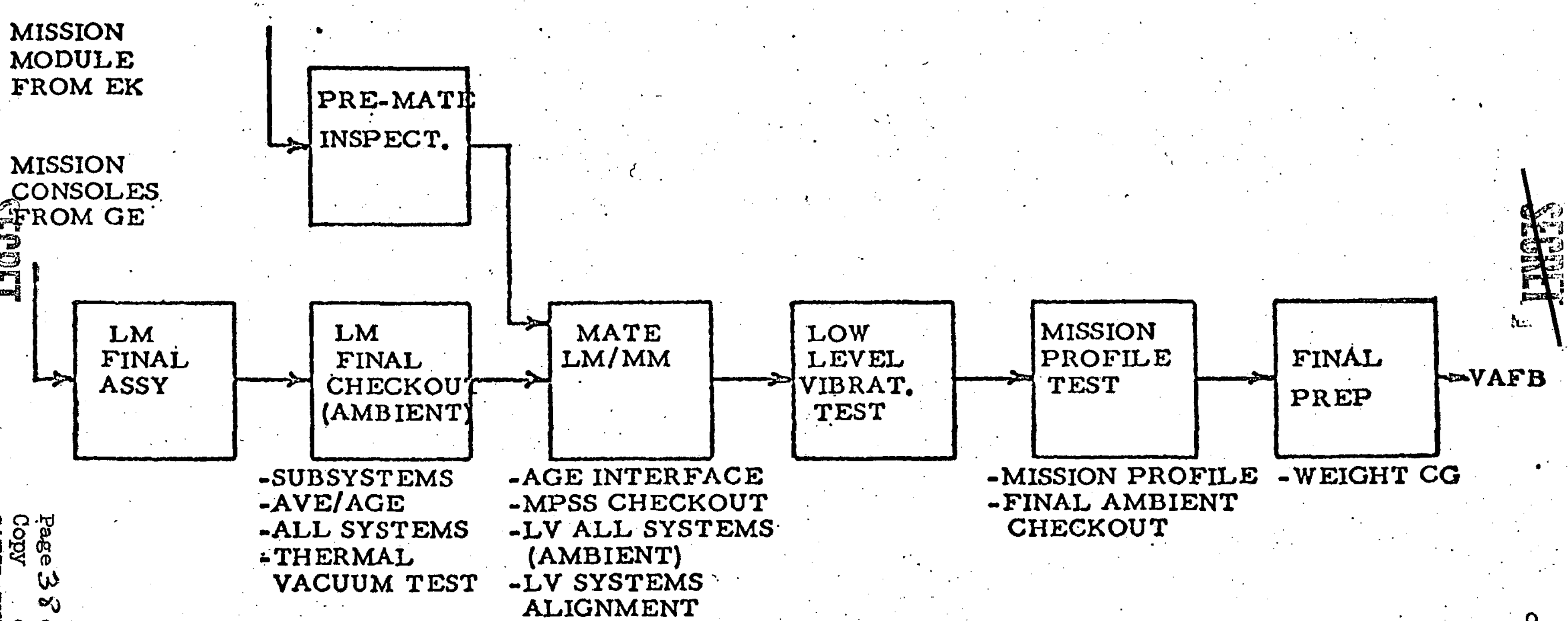

Figure 1-4

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MANNED/AUTOMATIC SYSTEM GROUND FLOW (FLIGHT VEHICLE) AT VAFB

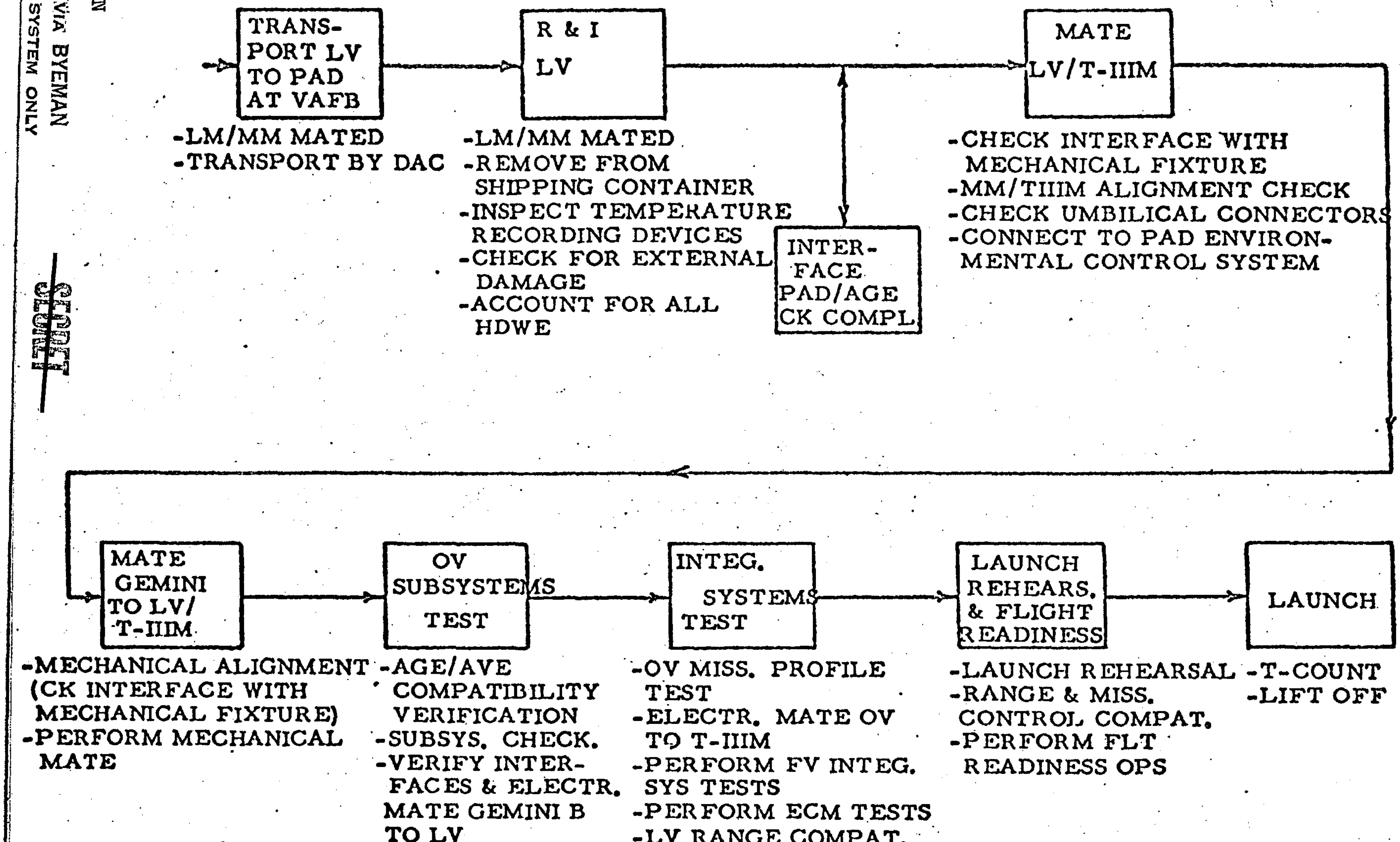


Figure I-5

Part 3 - Master Planning Schedule

Figure I-6 presents, in summary form, the major program milestones. These are presented in greater detail in each Part 3 Section of Volume 2.

MASTER PLANNING SCHEDULE

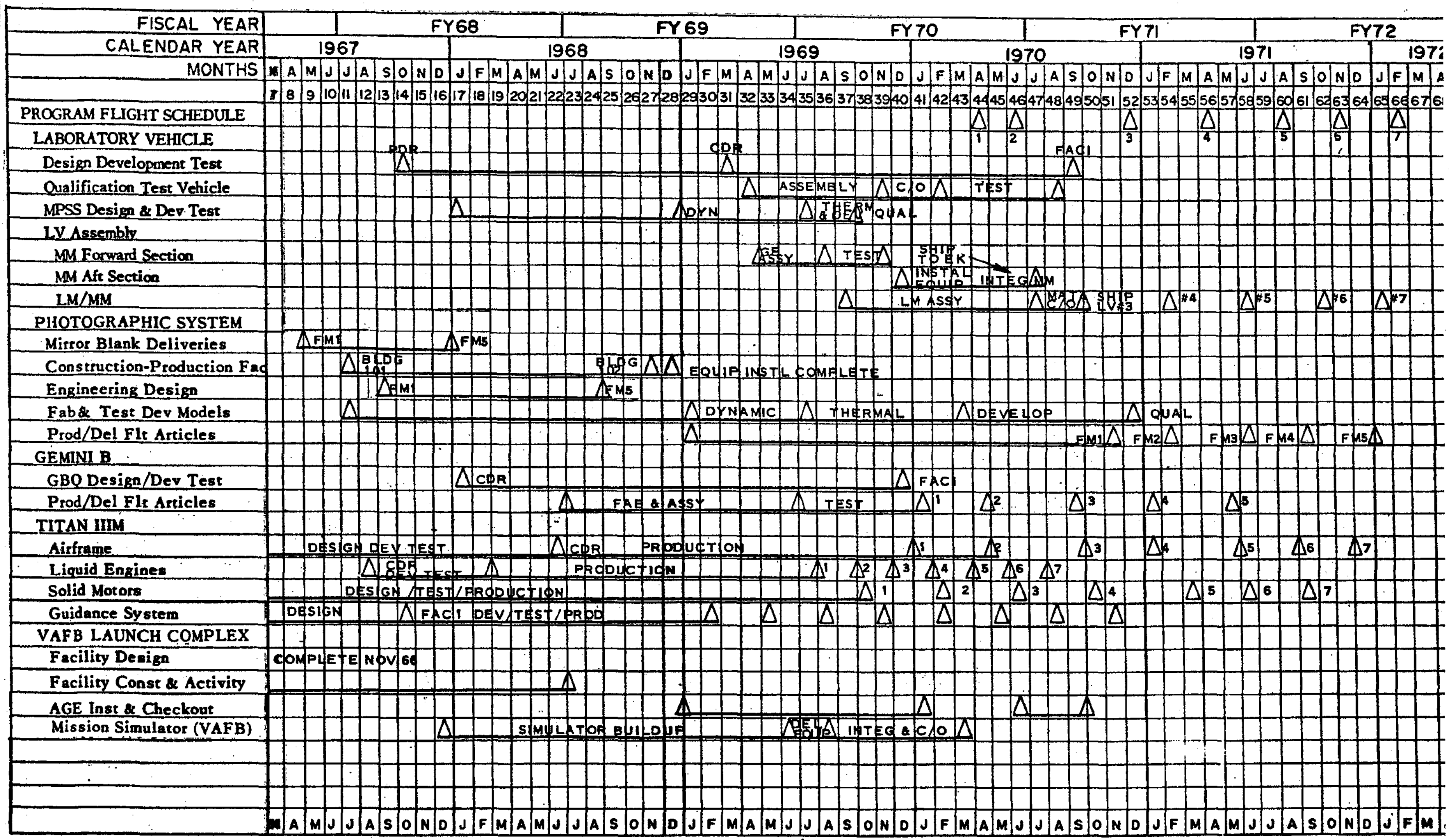


Figure I-6

Part 4 - Funding Requirements

Figure I-7 presents a recapitulation, by fiscal year, of the total programs financial needs. These are supported by the individual segment detail contained in Volume 1, Sections II, III and VII, and all of the Sections of Volume 2.

FUNDING REQUIREMENTS (IN MILLIONS)

MOL ENGINEERING DEVELOPMENT

September 1, 1966 - June 30, 1972

	67	68	69	70	71	72	TOTAL
LM Basic	106.2	170.6	231.7	173.5	63.6	8.6	754.2
Deferrals	.8	4.1	11.1	33.9	36.5	24.6	111.0
Changes	.2	.3	3.1	15.0	8.8	.1	27.5
	107.2	175.0	245.9	222.4	108.9	33.3	892.7
MM Basic	29.6	54.5	61.2	35.2	4.0	.6	185.1
Deferrals	2.6	13.0	35.1	38.9	24.1	11.3	125.0
Changes	1.1	2.5	4.7	5.2	1.0	-0-	14.5
	33.3	70.0	101.0	79.3	29.1	11.9	324.6
Photo Sys Basic	51.0	93.3	65.3	24.0	7.9	4.2	245.7
Deferrals	.4	10.5	14.8	20.5	5.6	-0-	51.8
Changes	1.3	6.2	34.6	14.9	6.5	-0-	63.5
Special Dorian Effort	5.8	4.6	5.0	5.1	5.0	5.0	30.5
	58.5	114.6	119.7	64.5	25.0	9.2	391.5
GB Basic	35.5	43.7	67.7	37.9	12.5	1.0	198.3
Deferrals	.1	5.1	12.2	14.9	8.5	3.2	44.0
Changes	.7	5.2	2.4	1.4	.5	-0-	10.2
	36.3	54.0	82.3	54.2	21.5	4.2	252.5
TIIIM Basic	43.0	39.4	97.7	93.4	56.4	18.0	347.9
Deferrals	.2	4.6	7.0	.7	-0-	-0-	12.5
	43.2	44.0	104.7	94.1	56.4	18.0	360.4
Crew Eq	.5	3.8	3.1	2.9	2.0	.4	12.7
Test Ops	1.4	1.8	8.5	7.8	8.2	4.6	32.3
Aerospace	6.5	13.8	14.7	15.5	15.5	12.4	78.4
SIVB Exper.	.6	2.4	-0-	-0-	-0-	-0-	3.0
Laboratory Misc.	1.0	.6	.1	.1	.1	-0-	1.9
	10.0	22.4	26.4	26.3	25.8	17.4	128.3
TOTAL	288.5	480.0	680.0	540.8	266.7	94.0	2350.0
Prior Yr Carry Over	(60.1)						(60.1)
RDT&E NOA Reqm't	228.4	480.0	680.0	540.8	266.7	94.0	2289.9
MCP	5.6	1.0					6.6
	234.0	481.0	680.0	540.8	266.7	94.0	2296.5

FIGURE I-7

SECTION II - MISSION OPERATIONS

Part 1 - Operating Description

A. General

Other sections of this document define the roles and responsibilities of the major associate contractors, system ground flow philosophy, the support facilities, crew training, and flight vehicle processing requirements. This section deals with the principal government activities involved in the pre-launch, launch, ascent, on-orbit, and reentry and recovery phases for the demonstration of the attainment of an effective combination of man and machine for collection of useful overhead reconnaissance of denied areas.

B. Roles and Responsibilities of Government Groups Supporting MOL Operations

No single activity can provide all of the support necessary to accomplish the general flight objectives of the MOL Program. The principal groups involved in the sequence of major events which occur in the MOL operations from receipt of flight hardware at Vandenberg AFB through recovery of the flight crew, mission data, and the Gemini B spacecraft are listed below:

1. Satellite Operations Center. The SOC, located in Washington, D.C., provides an interface between the intelligence community with their requirements and the MOL/DORIAN System. The target deck and priorities

are generated by the SOC and sent to the Mission Control Center for processing and ultimate commanding of the MOL systems. This target list is fed into the computer programs and the optimum strategy is computed for target selection. The targeting events thus generated are fed to command generation software programs which provide the necessary commands and data to be sent to the MOL, including non-mission events such as station contacts, orbit adjusts, and specialized secondary flight objectives. The computer on board MOL has the complete target list which was available before flight. Specifically, the SOC will perform the following functions:

a. Select the launch date from within any limits of flexibility established by Director, MOL.

b. Select orbit parameters from within an available envelope established by Director, MOL.

c. Target selection software will be developed in coordination with the SOC. All targets, priorities, weightings, and target selection criteria will be provided by the SOC to MOL for use in the target selection software.

d. Approve the primary and secondary reconnaissance targets.

e. Provide retargeting priorities during on-orbit operations on the basis of prior mission accomplishments.

f. Provide such other operational guidance and support, as may be necessary during pre-mission, on-going, and post-mission phases.

2. Air Force Satellite Control Facility. Elements of the SCF are involved not only in the on-orbit support but provide support during simulations, on-pad compatibility checks, pre-launch activity, and powered flight.

a. The Satellite Test Center (STC) provides the focal point for both the distribution of commands and data to the remote tracking stations as well as the reception and processing of data received by the remote tracking stations. Their services include semi-automatic data distribution, computing facilities, orbit determination and ephemeris update, and allocation of network resources.

b. The Mission Control Center at the STC will develop mission profiles for the MOL Program as a function of requests from the SOC as well as integrating special payload operations, Laboratory Module operations, and secondary flight objectives. In the normal mode of operation, the ground software will generate identification of primary and alternate targets to be taken, and this information will be sent to the on board computer. The MOL computer knowing the current MOL ephemeris and the geographic position of the target can compute and generate all necessary pointing and tracking information. Provision is also allowed for supplementing the pre-stored target list by transmitting new targets to MOL with their geographic locations and special targeting requirements.

c. Remote Tracking Stations (RTS) provide SGLS support and data handling with the STC. They receive command loads from the STC and upon acquisition of the Orbiting Vehicle will transmit these command loads to the MOL.

3. 6595th Aerospace Test Wing will be the on-site integrator for launch operations which includes assuring that the launch complex is fully operational, crew is fully trained, check out test procedures are adequate, schedules and mission directives are prepared, and working groups and working relationships are established.

4. Western Test Range (WTR) will provide prelaunch support by making normal range checks and R.F. transmission relays from the launch complex to the Vandenberg Tracking Station of the SCF. During powered flight, the support will include range safety, ground precision tracking, and TIIIM telemetry coverage.

5. Pacific Missile Range (PMR) will provide backup TIIIM coverage, prime telemetry and UHF voice coverage during Stage 0 plume attenuation period.

6. 1st Strategic Aerospace Division will supply standard base support services, real property and real property installed equipment management.

7. NRD/NASA will provide insertion ship support and selected stations for C-band tracking and UHF voice support in Gemini B contingency operations.

8. Department of Defense Manager for Manned Space Flight Support Operations (DDMS) will provide and control through all flight phases, the resources necessary to support MOL recovery operations.

9. MOL Systems Office will provide total MOL operations integration and flight crew training, which is described in Volume 1, Section VII.

C. MOL Peculiar Support Tasks

The government groups listed above (with the exception of the MOL Systems Office) have missions and responsibilities in support of other space programs in addition to MOL and are supported financially through their own program elements. However, some of the support they provide will be peculiar to MOL operations; consequently they expect to be reimbursed for these peculiar services. The remainder of this section is devoted to a description of this MOL peculiar support. Implementation schedules are shown in Part 2 and costs in Part 3.

1. Flight Operations and Support. Flight Operations and Support is concerned principally with Mission Control and the interface with the NRO Satellite Operations Center (SOC). It includes all equipments, communications, computer programs, personnel, techniques, and

procedures necessary to accomplish MOL Mission Control from start to countdown to mission completion including Laboratory Vehicle disposal, all data retrieval, and crew recovery when applicable. This segment also includes provisions for integration, simulation, training and overall system exercising.

a. The Mission Planning and Evaluation (MP&E) software which will be developed by the Deputy Director, MOL, will provide the primary interface with the SOC. Using the target data supplied by the SOC, this software will provide for the selection of targets to be imaged by the DORIAN system and from frame titling data for correlation of the photographs. The dynamic capabilities of the DORIAN optical systems and man-in-the-loop require a new generation of software for this purpose.

Contractor proposals have been received and evaluated for the development of the MP&E software. It is planned to initiate this contract during June 1967. A development phase of about 25 months will include program design, development and coding. Following the development phase, a nine-month integration and checkout phase will be conducted to assure program capability with all other MOL software and with the Mission Simulator in the OTEF at VAFB. A subsequent nine-month period has been scheduled to accomplish total software validation, crew procedures checkout, and mission readiness assurance. The operational interfaces with the SOC will be validated during this period.

UPDATE

b. Satellite Test Center Computer Programs. The MOL Program will utilize the capabilities of the SCF's Advanced Data System (ADS) which is scheduled to be in operation during the period of MOL flights. However, a variety of MOL Program peculiar software routines will be developed to support various MOL operational phases, and these routines will be included in the ADS. During powered flight and on-orbit phases, the ADS software provides control of the tracking telemetry and command functions of the STC. Verification of this software support will be accomplished using the Mission Simulator in the OTEF at VAFB. During the ADS contract period, interface requirements will be provided to assure that the software format is compatible with the MOL Program peculiar routines in the CDC 3800 computers.

c. Satellite Control Facility Augmentation. Augmentation of the SCF with additional equipment and MOL Program peculiar equipment is divided into two areas: Remote Tracking Station equipment and STC equipment.

(1) Remote Tracking Station Equipment. The primary voice circuit between the Remote Tracking Station (RTS) and the Orbiting Vehicle will use the SGLS but the SGLS baseband assembly unit at each RTS must be modified to provide the capability for secure digital voice transmission. In addition, an additional recorder will be provided at each RTS for recording of the MOL stored voice. This additional recorder will permit dedicated post-pass voice playback without preventing the RTS supporting another satellite during the playback time.

Three RTS (Thule, Kodiak, and Guam) must have clear voice capability to support ascent and early orbit voice requirements. It will be necessary to modify existing antennas at these stations to achieve this capability.

(2) STC Equipment. The support of MOL by the STC requires more equipment than that provided for a normal STC user. These increased requirements will be met by obtaining additional standard consoles and other modules being developed under the SCF's ADS contract. MOL Program costs included the procurement, installation and checkout of nine controller positions and supporting display equipment.

2. Test Support. The Test Support tasks listed below are MOL peculiar requirements to augment the National Range Division launch range and tracking ship support.

a. Range Toxic Dispersion Studies. Unknown toxic dispersion characteristics of the South Vandenberg and Sudden Ranch terrain will be analyzed to insure that optimum conditions for operational launches of a Titan IIIM are fully known. Empirical data will be gathered for the Sudden Ranch area Weather Information Network and Display System expansion by burning Minuteman solid material in the vicinity of the proposed MOL pad and taking quantitative samples at multiple selected sites on South Vandenberg, Sudden Ranch and adjacent property.

b. Range Reliability Studies. Studies of the Western Test Range capabilities necessary to support manned launches will be accomplished. These studies will define any equipment capability or reliability improvements which may have to be accomplished in FY 68, FY 69 and FY 70.

c. Space Ground Link Subsystem (SGLS) Receiver (Pacific Missile Range, San Nicolas Island). The SGLS provides telemetry receiving equipment at San Nicolas Island for the MOL SGLS downlink. San Nicolas Island will acquire the flight vehicle on a 60-foot antenna at not later than 80 seconds into flight. It will be the sole downlink terminal for some duration before Stage Zero separation and again for some duration before the Insertion Ship has acquired the MOL target.

d. AGM-19, T-2 Class Ship Software. This will provide the computer programming needed to employ the instrumentation of the AGM-19 class ships for MOL insertion support.

e. Countdown Status System. This will provide for the integration of MOL operations into the VAFB countdown status system. The displayed information consists of operation and program number, countdown time and status. Countdown information will be provided to selected range instrumentation sites and control facilities at VAFB, synchronized to range user operations.

f. Back-up Ship Mods. Include the additional "MOL peculiar" modifications (SGLS capability, communications, etc.) to the AGM-1 (Range Tracker) required to upgrade the ship for minimum insertion support after the fourth launch.

3. Recovery. The Recovery System includes the forces deployed and support provided for both planned and contingency landing areas. The MOL recovery system will make maximum use of those NASA equipments, techniques, and procedures developed for Gemini/Apollo recovery support which are appropriate for MOL. The recovery force will be comprised of sea, land, and air units, and associated specialist teams as necessary to meet the recovery requirements. Special high-density air, land, and sea recovery forces will be provided in the immediate area of the launch pad to insure recovery of the crew in case of land and water impacts. Rescue will be accomplished by ships stationed downrange and aircraft staged from Easter Island in the event of an abort from powered flight. Planned recoveries from orbit will be accomplished in areas designated in the Atlantic and Pacific Oceans. The forces will be stationed worldwide for contingency operations.

a. DOD Manager for Manned Spaee Flight Operations (DDMS). Recovery forces (ships and aircraft) will be required in support of MOL development flights for retrieval of the Gemini B spacecraft.

b. Handling AGE. Recovery AGE such as flotation collars, boilerplate spacecraft, transport dollies, hooks, etc., must be collected, refurbished, and maintained through the years associated with the MOL Program, starting in FY 68.

c. Testing, Training and Training Aids. Tests will be conducted at Patrick and Vandenberg Air Force Bases to establish launch area recovery baselines. This includes surf tests for specialized rescue (astronaut, data and spacecraft); dummies that will be air-dropped for rescue rehearsals both on land and water; parachutes in the event these are not available in sufficient number from supply sources; special harnesses that may be necessary for rescue and recovery and special equipment that may be necessary for mountain and crevice rescue; and recovery operations.

d. Launch Area Recovery Equipment (WTR). The Launch Area Recovery concept involves an expansion of existing WTR capabilities. Problems associated with flight crew recovery in the launch areas, both land and surf, are currently being investigated. The rough terrain surrounding the launch site, the surf breaking over the coastal rocks, and beachless, uneven coastline pose special problems to which no precedent or techniques are relatable from the NASA Eastern Test Range (ETR) manned launches. The terrain features may require special equipment and/or modifications to rescue boats and helicopters.

e. Ascent and Re-Entry, Acent and Re-Entry software is required to merge the varying logic of the Gemini B and T-IIIM systems, WTR tracking data, etc., into the SCF computer system. For example, for the powered flight phase, three PCM and one single side band (record only) data links will be received and processed by WTR and SCF ground stations. WTR will also provide metric tracking data from approximately five different sites. The metric tracking data will be transmitted to the STC in real time over the existing microwave line from the Vandenberg Tracking Station. A second microwave line will be acquired to carry MOL telemetry which has been received at Vandenberg Tracking Station to the STC as back-up to the WTR data. At the STC, the Advanced Data System (ADS) will merge tracking data along with MOL guidance systems data. The combined output will then be transferred to an on-line CDC 3800 computer for real time ascent trajectory and abort mode computation. Subsequently display on program peculiar plot boards and data consoles will be accomplished via the ADS. A similar set of circumstances of collecting data from a number of different sources for computation and display apply to the re-entry phase.

D. Mission Enhancement Support

Additional effort is desirable to extend and maximize the present DORIAN capability in accordance with accepted mission objectives. This effort consists of the tasks presented below. Funds not yet included in baseline approved funding are required for these tasks in the approximate amounts shown in Part 3 if they are to be accomplished. Approximately one half of the funds shown for FY 68 and FY 69 would be spent on aircraft simulation studies (see 3 below).

[redacted]

[redacted]

2. Astronomical Observation. The MOL photographic system will also provide a capability for astronomical observations, particularly planetary. A vehicle roll capability and an infinite optical focus platen position is required. Time exposures up to 17 minutes (per orbital period) can be provided by use of the tracking mirror and up to 45 minutes (one-half the orbital period) by maintaining constant pitch attitude with respect to inertial space (disable pitch-rate program). Fine grain film may be used in conjunction with the long exposures and should produce resolutions better ~~ing~~ THAN those pre~~viously~~ attained from the ground by a factor of two. Resolution obtainable on the surface of Mars during the 1971 opposition is estimated at 25 nautical miles.

Steps are being taken to incorporate into the MOL vehicle (without equipment modification) and mission planning the capability for photography of Mercury, Venus, and Mars. Planning on further capability involving equipment modification will depend upon analysis and approval of cost and technical impacts of such modification.

3. Visual Observation Simulations. The value and limitations of telescopically aided observations of the earth from a satellite cannot

be determined precisely until actual missions are conducted. Many variables are known that affect the ultimate capability of man to detect and recognize earth objects from orbit. It is likely that additional variables still undefined also exist and similarly affect this capability. The number and range of these variables cause ground simulations to become unrealistic and the result inconclusive. Aircraft simulations to determine man's visual observation capability can eliminate the artificial provisioning of important variables such as scene brightness, object-to-background contrast and sun-scene vehicle geometry, as well as the physical characteristics of the observed objects (size, shape, color, pattern, etc.). Some variables in aircraft simulation are partially real, such as atmospheric visibility and relative motion, while others must be wholly simulated as on the ground.

As an expansion of the detection and recognition visual capability, another function of man in the MOL system can be measured much more accurately with aircraft simulations than on the ground. This is the ability of man to apply a priori knowledge and judgment in real-time manner to the selection of one of several potential targets depending on its intelligence value and/or its accessibility. Weather avoidance in the selection of targets using actual weather phenomena can be realistically demonstrated and evaluated. Also, the ability of man to determine target activity, pin-point objects of interest in a general area, and obtain intelligence from non-programmed observations can be credibly tested.

To date, only limited experimentation or simulation of this nature has been conducted. Expanded effort is planned to generate this information as quickly and cheaply as possible using simulations that closely approximate real MOL operating conditions.

4. Generalized Target Model. A continuing need exists for the generation and maintenance of a realistic engineering target model sufficiently general to fully exploit the man-machine flexibility of the MOL system in its primary mission of satellite reconnaissance. This model will be used to refine the system design parameters, analyze mission operations, and formulate mission operational procedures. The model will include targets representative of the needs of the national intelligence community which may be satisfied by MOL photography or visual observation. Present target models are designed for and/or limited by the capabilities of current reconnaissance systems. The generalized target model may ultimately be expanded to include requirements for SIGINT, radar surveillance and other appropriate missions.

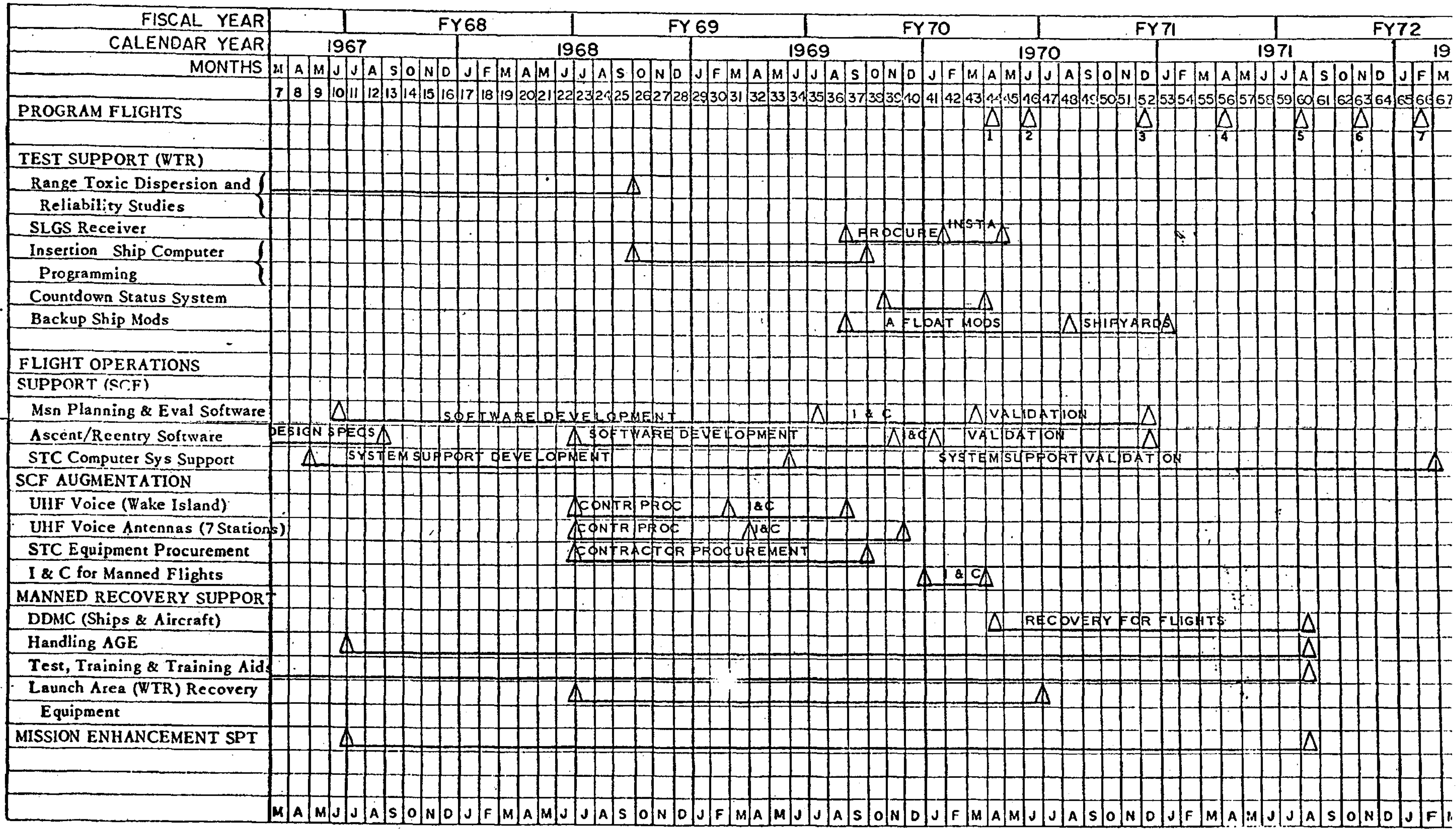
5. Stereo Photography. Since the MOL system is capable of multiple photographic frames of any one target, investigation will be undertaken to determine the optimum number, aspect angle, and range of acceptable stereo convergence angles for maximum intelligence value. It appears that these stereo qualities will vary with the type of target

being observed (unusual shapes), as well as the sun-scene-vehicle geometry during photography. Thus, a complete parametric study considering all variables is planned. These efforts will be accomplished in close coordination with appropriate elements of the NRO and the national intelligence community.

Part 2 - Schedule

Figure II-1 shows the milestones for the major program test support and operations activities required to provide the ground environment for MOL flight tests.

TEST OPERATIONS SUPPORT



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DORIAN

Figure II-1

Part 3 - Funding Requirements

Figure II-2 provides detail of the FY fund requirements for the test support and operations required additions, modifications and services.

DORIAN

TEST/OPERATIONS FUNDING REQUIREMENTS
(MILLIONS)

	FY 67	FY 68	FY 69	FY 70	FY 71	FY 72	TOTAL
Flight Operations Support							
Mission Software	.030	.600	1.400	1.000	1.5	1.100	5.630
STC Computer Program		.500	1.550	1.025	.805	.470	4.350
Satellite Control Facility Augmentation			1.995	.369			2.364
Subtotal	.030	1.100	4.945	2.394	2.305	1.570	12.344
Test Support							
Range Toxic Dispersion Studies	.330	.320					.650
Range Reliability Studies	.150	.150					.300
SGLS Receiver (PMR-SNI)				.245			.245
AGM-19 Class Ship Software			.300				.300
Countdown Status System				.033			.033
Back-up Ship Mods				1.045			1.045
Subtotal	.480	.470	.300	1.323			2.573
Recovery							
Handling, AGE		.150	.050	.250	.050	.020	.520
Testing, Training	.050	.050	.050	.100	.050	.050	.350
DDMS	.040			.806	5.796	2.898	9.540
WTR			.100				.100
Subtotals (Recovery)	.090	.200	.200	1.156	5.896	2.898	10.510
Ascent/Re-Entry Software	.828		3.000	3.000			6.828
							17.338
TOTAL	1.428	1.770	8.445	7.873	8.201	4.538	32.255
* Mission Enhancement Support		1.000	1.000	1.000	.500	-0-	3.500

*Mission Enhancement Support funds are included for information and planning only. Baseline approved funding does not inlude this line item.

FIGURE II-2

SECTION III - FACILITIES

Part 1 - General Description

A. General

The facilities described in this Section encompass those Government-owned or managed MOL-peculiar ground facilities necessary to support MOL operations from receipt of the MOL system segments at Vandenberg Air Force Base (VAFB), through launch of the MOL, and recovery of the Gemini B. The facilities required at VAFB for support of the program include a Space Launch Complex Number 6 (SLC #6) and MOL Support Facilities located on the Sudden Ranch and on VAFB proper. In addition, to reduce access time and size of recovery forces, an aircraft staging area will be needed for use in recovery operations in case of abort during powered flight.

The facilities used for receipt and inspection of launch vehicle flight hardware, hardware storage, flight vehicle build-up and launch, and control of countdown operations are not charged to the MOL Program element, but are included for information purposes and because their timely completion is vital to the consummation of the MOL Program. Funds for the Launch Complex facilities were authorized and appropriated in the FY 1966 and 1967 Military Construction Program.

The FY 1967 military construction budget provided funds for MOL support facilities at VAFB for accommodating activities not provided for in the Launch Complex. These activities are:

1. Training, evaluation, housing, and conditioning of the flight crew.

2. Receipt, inspection, storage, and processing of elements of the orbiting vehicle. (Final assembly and checkout will be accomplished on the launch pad).

3. Support of contractor personnel.

The MOL Launch Complex, located on the western portion of the Sudden Ranch area of VAFB, California, [It] will contain one launch stand and those facilities required to receive, assemble, checkout, monitor and launch the MOL Launch Vehicle. Major items of construction will be the Launch Pad, Umbilical Tower, Mobile Services Tower, AGE Building, propellant loading and storage systems, Launch Control Center, railroad siding, supporting utilities, security fencing, roads, Segment Ready Storage Building, Segment Receipt Inspection Building, Ready Building, Protective Clothing Building, and Complex Service Building.

MOL support facilities include Support Buildings, the Operational Training and Evaluation Facility, the Operational Readiness Unit, and the Engineering and Operations Building.

B. Launch Complex (SLC-6)

The original concept was to provide an Initial Launch Capability (ILC) which could at some future date be expanded into full Integrate-Transfer-Launch (ITL) capability which would support a family of Titan III-booster military payloads. However, at the present time there is no space program other than MOL planning to use the ILC.

The launch rate for MOL for planning purposes has been specified at a maximum of six per year. Therefore, no requirement can be foreseen which would cause a need to convert to the ITL concept. Nevertheless, the MOL Program does provide for capability improvements. Studies of improving cost effectiveness and providing for growth in the MOL Program point to the possible need for increased payload capability in both weight and diameter. Therefore, the original ILC is being developed with the following considerations:

1. Accommodate the 7-segment, 120-inch SRM and 10-foot core with the inherent capability of economic growth to a 3-segment, 156-inch SRM with 16-foot diameter core.

2. The concept of on-pad build-up will be retained with no requirement to maintain the option of proceeding to an ITL capability unless that option can be provided at essentially no cost.

3. The Launch Control Center and other support facilities will be sized to permit the support of a second launch pad using the on-pad build-up concept.

4. The design will not preclude the use of SLC-6 by any member of the current Titan III family.

C. Operational Training and Evaluation Facility

This will be a one-story structure of approximately 53,000 square feet housing a MOL mission simulator which is required for flight crew preparation, ground controller preparation, validation of ground and airborne software, development of contingency procedures, and validation of mission and specific flight planning. Other functions associated with this facility include:

1. Storage, inspection, and maintenance of training and orbital flight crew equipment.

2. Collection of physiological data which will be compared with in-flight crew status for purposes of mission management.

3. Pre-and post-flight crew examinations, minor diagnostic and treatment capability.

4. Final integrated astronaut/key personnel training.

D. Operational Readiness Unit

This is a one-story facility of approximately 8,900 square feet which will be used for pre-flight living and physical conditioning area for eight astronauts and key personnel. This facility will provide for the following:

1. Medical supervision to insure proper preparation and dietary management for personnel.

2. Pre-adaptation of the flight crew to unusual work/rest cycles as indicated by mission requirements.

3. Medical surveillance to prevent significant exposure to communicable diseases in order to avoid, where possible, mission degradation due to illness.

4. Sleeping quarters, dining room, and kitchen for crew and key personnel.

5. Physical conditioning area for the flight crew.

E. Support Buildings

This category includes a variety of existing buildings to be reassigned to the MOL Program to support McDonnell, Douglas, Eastman Kodak, General Electric and Martin-Marietta.

1. Engineering and Operations Building

This will be a two-story structure of approximately 80,000 square feet to provide technical support space for MOL contractor, sub-contractor, and Air Force personnel.

2. Staging Base for Powered Flight Abort Recovery Aircraft

An analysis of the rescue and recovery problems associated with an abort from powered flight clearly identified the need for a downrange aircraft staging base. The staging base will operationally support approximately eight aircraft and about 100 personnel, periodically, during mission periods. The results of studies show that Easter Island is the most suitable location for such a staging base. MOL requirements will be provided by augmenting facilities to be provided by the [redacted]. FY 1968 Military Construction Program Funds have been requested to provide runway paving, taxiway and parking area increase, fuel storage increase, and personnel facilities such as housing, messing, medical facilities, etc. FY 1968 funds are required to take advantage of the cost savings resulting from coupling the MOL augmentation construction with basic [redacted] construction programs.

F. Operating Concept

The live solid rocket motor components of the Titan IIIM will be transported to the Segment Ready Storage Building at VAFB by rail cars for storage prior to transportation to the Segment Receipt Inspection Building. A railroad will connect these two buildings and the launch pad. The solid rocket motors (Stage Zero) will be the first components assembled on the launch stand. Following this, the core segment of the Titan III will be assembled between the solids. The core segment (Stages 1 and 2) will arrive at VAFB by C-133B aircraft and will be processed through the Missile Assembly Building #5 before going to the launch pad.

The previously integrated Laboratory Module and Mission Module will be transported directly to the pad by road vehicle from the Douglas Huntington Beach plant for mechanical mate to the T-IIIM. Transportation of the Gemini B from the contractor's plant to VAFB will be by air. It will go to a Support Building for inspection of shipping damage and for installation of pyrotechnics, recovery parachute, flight seats, and retro rockets. The Gemini B will then be delivered to the launch stand and mechanically mated to the Lab Vehicle. Doors to the environmental shelter in the Mobile Service Tower will be closed and the subsystem and system tests will be started. Technical support space for MOL contractor/subcontractor/Air Force personnel will be provided in the Engineering and Operations Building.

Part 2 - Schedule

Figure III-1 summarizes the major facilities construction schedule. Because of AGE (LV and MPSS) delivery times at VAFB, activation times (between Flights 2 and 3) are critical in the overall schedule.

MOL FACILITIES

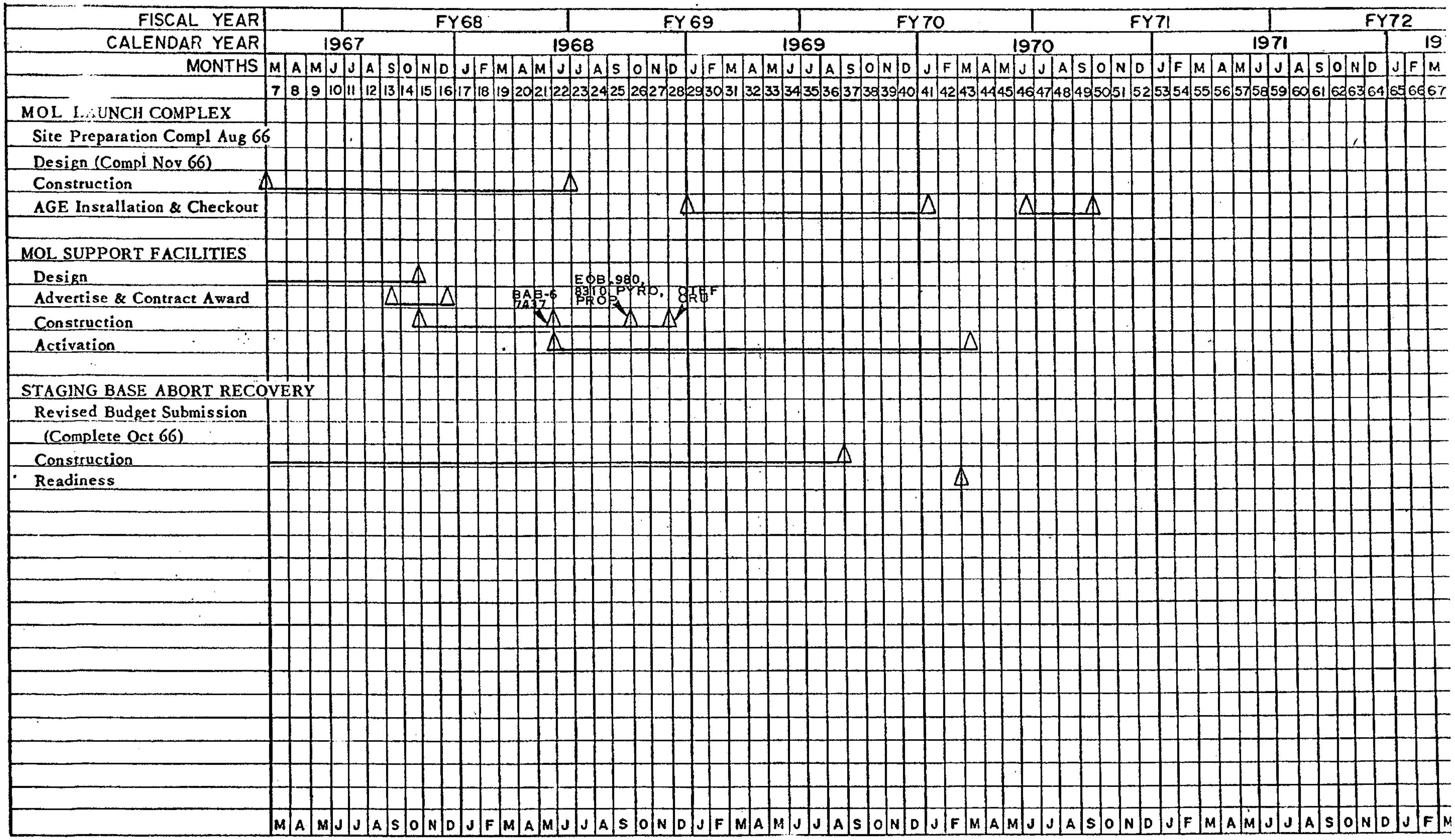


Figure III-1

Part 3 - Funding Requirements

Due to refinements and revisions in test philosophies and concepts (factory to pad, etc.), and the availability of existing VAFB facilities, numerous changes have been made which reduce the original estimate of $8.740M for the MOL support facilities. The current cost estimates for these facilities are shown in Figure III-2 and include costs for construction of new and/or modifications to existing facilities as appropriate. These estimates do not include costs for installation and checkout of AGE or other specialized technical equipment (these costs are covered by each program segment providing its own peculiar AGE).

FUNDING SUMMARY (IN MILLIONS)

	FY 67	FY 68	TOTAL
MOL Support Facilities			
Booster Assembly Building	.141		
Missile Assembly Building	.500		
Operational Readiness Unit	.243		
Operation Training & Evaluation Facility	2.109		
Engineering and Operations Building	2.030		
Abort Recovery Staging Base		1.000	
Storage Buildings	.572		
	5.595	1.000	6.595

Figure III-2

SECTION IV - PROGRAM MANAGEMENT

Part 1 - Government

A. Introduction

There have been three phases of Air Force management of the MOL Program beginning with an interim organization established in January 1965 for the initial study phase, and for which executive management was assigned to the Under Secretary of the Air Force. This was modified in August 1965 for the contract definition phase with the establishment of the MOL Program and Systems Offices and specific program responsibilities assigned to the Director, MOL, and the Director, Special Projects (SAFSP). MOL management is now entering its final phase for the engineering development portion of the program. This section describes the AF management arrangement which is effective July 1, 1967.

B. References

1. Memorandum for Deputy Secretary of Defense from Under Secretary of the Air Force, subject: "MOL Management", dated January 14, 1965.

2. Memorandum for Secretary of Defense from Secretary of the Air Force, subject: "MOL Management", dated August 24, 1965.

3. MOL Program Office Program Directive 65-1, Subject: "Management of the MOL Program", dated August 25, 1965.

4. MOL Program Office Program Directive 65-2, subject: "MOL Phase I Program Authority Action", dated August 25, 1966.

5. DNRO/Director, MOL Agreement, "MOL Black Financial Procedures", dated November 4, 1965.

6. Memorandum for CSAF and other addressees from Secretary of the Air Force, subject: "Delegation of Authority", dated November 9, 1965.

7. Memorandum from Assistant Secretary of the Air Force (R&D) to Vice Chief of Staff, subject: "MOL Financial Procedures," dated January 19, 1966.

8. Secretary of the Air Force Order No. 100.1, subject: "Functions of Under, Assistant, and Deputy Under Secretaries of the Air Force", dated September 1, 1966.

9. Secretary of the Air Force Order No. 117.4, subject: "Director of the MOL Program", dated September 1, 1966.

10. Memorandum for Director, MOL, from Assistant Secretary of the Air Force (R&D), subject: "Authorization to Proceed with the Engineering Development Phase of the MOL Program", dated January 13, 1967.

11. Memorandum For Director, MOL and Director, SAFSP from Assistant Secretary of the Air Force, subject: "Manned Orbiting Laboratory Program Management", dated June 1967.

C. Objectives

The objectives of the MOL management organization (Figure IV-1), and organizational responsibilities are to provide a streamlined management structure which will permit the most efficient employment of resources, and a single line of authority for management and control of the total program effort. The following considerations were fundamental in establishing the management philosophy:

1. Responsive, streamlined, integrated vertical management for all aspects of the program.

2. Highly qualified and experienced program management personnel.

3. Security control compatible with established policies for overhead satellite reconnaissance and with program objectives.

4. Three discrete management levels within the Air Force:

a. Program policy, guidance and approval.

b. Program direction.

c. Program implementation.

The responsibilities and relationships for each of these levels are described in paragraph D.

D. <u>Management Responsibilities</u>

1. Program Policy, Guidance and Approval

a. SAF/DNRO

The Secretary of the Air Force/Director, National Reconnaissance Office are responsible for executive management of the MOL Program. SAF will be responsible for all Air Force decisions and directions pertaining to the MOL program, and is the final reviewing and committing authority for the Department of the Air Force on this program. He is supported by the MOL Policy Committee which provides such advice and assistance as is required, and by the DNRO in those areas which interface with the National Reconnaissance Program. MOL activities are conducted using both "black" and "white" funding, procurement and security procedures. All activities which deal with the reconnaissance aspects of the program are handled in the BYEMAN control system under the special code work DORIAN. The DNRO is responsible for all National Reconnaissance Program aspects of the MOL Program. The SAF/DNRO assign management responsibility and delegate commensurate authority to the Director, MOL.

b. DNRO

The DNRO provides the Director, MOL with the guidance, task assignments, and requirements pertinent to the MOL reconnaissance payload development and technical objectives, overall program security, and MOL operations as a part of the National Reconnaissance Program.

In principle, MOL reconnaissance operations will be conducted in the same manner as current operating projects in the National Reconnaissance Program. Field command and control of MOL on-orbit operations will be exercised by the Deputy Director, MOL, from the Satellite Test Center, using resources of the Satellite Control Facility, under the reconnaissance mission control of the DNRO through the NRO Satellite Operations Center.

The DNRO also chairs the MOL Program Review Council (Ref Part 1-B-11). The Council functions include assistance, support and advice to SAFRD/DNRO on matters requiring their personal attention, action, or decision, and identification of items requiring attention of the MOL Policy Committee.

2. Program Direction

a. Director, MOL

The Director, MOL reports directly to SAF/DNRO. The Director, MOL is responsible to establish, manage and conduct, in accordance with DNRO guidelines, task assignments and requirements for all aspects of the approved MOL program as assigned by the SAF and by the overall provisions of this management plan. He is the principal operating agent for the direction of the MOL program. Operating activities include overall system performance, integration, testing, coordinating and planning; advanced studies, research, development, test and improvement of performance and effectiveness of manned military satellite vehicles; utilization of Air Force personnel and resources, in addition to any other resources assigned. He and his Washington office are located in the Pentagon near the offices of SAF. His office handles the Hq USAF and other Washington area Air Force staffing of the program including liaison with other Government agencies. His office provides complete and timely program status information available in comprehensive form for OSAF and OSD review. He is responsible for keeping selected senior members of the Air Staff personally informed concerning the MOL program. Major Air Staff offices and Commands (such as DCS/R&D, SAFOI, SAC, etc.) may provide a well-qualified officer for full-time duty as part of the office of the Director, MOL. Such officers will expedite functional support which the Director, MOL may determine necessary for the MOL Program, and will assist in keeping their parent offices or Commands informed.

The Vice Director, MOL, is also a General officer and is the principal assistant and advisor to the Director, MOL, coordinating the activities of all offices under the supervision and command of the Director, MOL. He acts with full authority of the Director, MOL, except in those responsibilities specifically reserved to the Director, MOL by the directives of higher authority. All action taken by him has the same force and effect as though taken by Director, MOL.

The AFSC Deputy Chief of Staff for Procurement and Production has been designated as Assistant Director, MOL (Procurement) and is responsible for all MOL Program contracting. To discharge this responsibility, the Secretary of the Air Force has delegated him special contract change and waiver authority for those covert contracts which are necessary to protect the security of the MOL reconnaissance mission, the association of the MOL Program with the NRP, and the relationship between the MOL Program and System Offices, and the National Reconnaissance Office.

3. Program Implementation

The Director, MOL has established a strong Systems Office, under the Deputy Director, MOL, located at SSD, El Segundo, California. The Systems Office is supported by the Aerospace Corporation to perform general systems engineering and technical direction for the MOL Program. Their functions and responsibilities are described in paragraph E.

The Deputy Director, MOL, a general Officer, is responsible for implementing all program direction by the Director, MOL for design, development, test and evaluation. He is also responsible for overall mission operations, including man's safety during all phases of manned flight, proper and safe functioning of the flight vehicle, planning for and exercise of on-orbit control of the vehicle and reconnaissance payload in response to intelligence collection tasks established by the DNRO or his designee. SAFSP and SAMSO offices provide the required functional assistance to the Deputy Director, MOL to fulfill his overall responsibilities.

The Deputy Director, MOL implements established NRO and AF security procedures for activities under his control.

The Deputy Director, MOL is responsible for overall top-level systems integration and general system engineering and technical direction. The overall system consists of all hardware, software, and personnel elements required for launch through recovery, including that software which is directly involved with selecting camera programs and orbit profiles in response to intelligence collection requirements. He is responsible for the development, acquisition and integration of the Gemini B, the Laboratory Module, and the Mission Module. The Deputy Director, MOL is also responsible for all technical liaison at field level with other military services and NASA.

The Deputy Director, MOL has a MOL Systems Office under his direct control and supervision. This office is manned and organized to perform functions peculiar to the MOL program, and provides guidance to supporting agencies in accordance with policies and procedures established by the Director, MOL for the conduct of this program. Office and agencies participating in major elements of the MOL program may furnish well-qualified personnel for full-time duty as part of the program office to provide the Deputy Director, MOL the resources necessary for the most efficient and effective conduct of the MOL program.

From funds provided through the Director, MOL, and in his capacity as Deputy Commander, SAMSO, for MOL, he obtains the following hardware and services from the normal SAMSO offices established to handle these areas: all launch and booster vehicles, selected AGE, selected equipment and services, launch pads and facilities. For range and tracking station equipments and services funded by other program elements the Deputy Director, MOL is responsible for insuring that his requirements are furnished on a timely basis to the proper offices and the Director, MOL.

All SAMSO offices provide functional support as requested by the Deputy Commander, SAMSO, for MOL, but, except for such requested support, are not involved in the MOL program management.

4. Director, SAFSP

The Director, SAFSP, provides his reconnaissance satellite experience directly to the MOL Program by virtue of his membership on the MOL Program Review Council. Additional responsibilities of the Director, SAFSP, to the DNRO with regard to the MOL Program include:

a. The management of certain sensor or sensor-related technology contracts intended in whole or in part for later inclusion in the approved MOL Program.

b. Joint coordination of MOL and Special Projects activities at Vandenberg AFB and involving the Satellite Control Facility.

c. Surveillance of critical optical contractor resources which must be applied to both MOL and other elements of the NRP.

d. The provision of BYEMAN-secure communications support to the MOL Systems Office.

e. The provision of BYEMAN-security support to the Deputy Director, MOL, in the form of processing personnel background investigations for the MOL Program, the establishment of the BYEMAN clearability of both military and industrial persons, and general advice and guidance related to the security inspection of facilities, security plan preparation, etc.

5. Commander, AFSC

The Commander, AFSC, who is also the Director, MOL, is directly responsible to SAF for insuring that AFSC provides, on a continuing basis, the facility, equipment, personnel, etc., resources necessary to properly support the MOL Program. In the event that MOL requirements exceed AFSC capabilities, the matter shall be referred directly to SAF or the DNRO, as appropriate.

E. GSE/TD Role of Aerospace Corporation

The Aerospace Corporation supports the MOL Program in the major area of General Systems Engineering and Technical Direction (GSE/TD). Aerospace participation in the MOL Program is established and organized to accomplish specific technical and scientific tasks as requested by the Deputy Director, MOL.

Aerospace assists the Deputy Director, MOL in activities which include design reviews, flight test qualification, overall System Specification and technical review of contractor data.

Aerospace activity will assist in performing technical assessment and in-house analysis to arrive at a quantitative basis for design verification. In particular, they will continue to assess design modifications and the weight, power and resolution criticality of the MOL Program vehicles. The timeliness of the activity is most important to minimize the technical risk in the development tests which follow immediately thereafter. They will also assist in the evaluation of development test plans, procedures, instrumentation, and methods for data analysis.

The necessary level of effort will be maintained throughout the Engineering Development Phase to support the MOL Systems Office in the preparation and conduct of Technical Direction and Interface Meetings. The necessary contractor coordination, meeting preparations, and follow-up with associated Aerospace in-house studies, will require continuous effort in this area.

a. Aerospace Corporation MTS Requirements

	FY67	FY68	FY69	FY70	FY71	FY72
MOL Program Support*						
GSE/TD-DORIAN Effort	49	50	50	50	50	40
GSE/TD-Other	187	226	243	260	260	200
TOTAL	236	276	293	310	310	240

Change DORIAN break-out

b. Aerospace Corporation Funding Requirements

	FY67	FY68	FY69	FY70	FY71	FY72	TOTAL
MOL Program Support*							
GSE/TD-DORIAN Effort	2.2	2.5	2.5	2.5	2.5	2.0	14.2
GSE/TD-Other	4.3	11.3	12.2	13.0	13.0	10.4	64.2
TOTAL	6.5	13.8	14.7	15.5	15.5	12.4	78.4

* GSE/TD effort in support of T-IIIM is provided in the funding for that system segment.

MOL Management

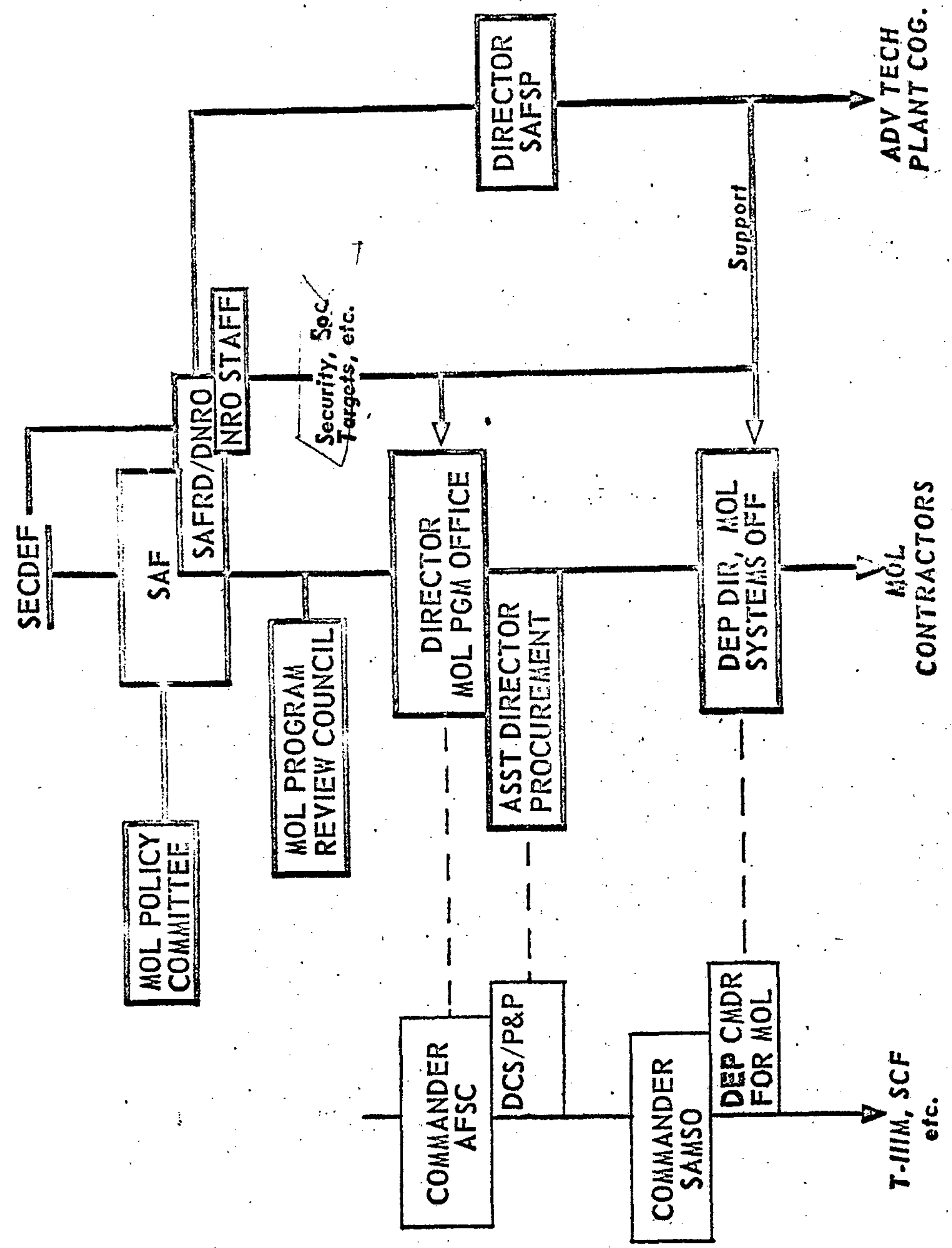


Figure IV-1

SECTION V - ADVANCED STUDIES AND TECHNOLOGY

Part 1. Scope

A. Objectives

This Section describes advanced studies and technology which, while not included in the basic MOL system, are prerequisite to any exploitation of the initial baseline capability and the achievement of advanced MOL capabilities.

The focus of advanced planning in the MOL program, as set forth in the August 1965 Memorandum for the President from the Secretary of Defense, is on the ultimate achievement of the best resolution permitted by atmospheric conditions. Subordinate to this primary goal, but still of fundamental concern, is the determination of the utility and feasibility of other applications of the MOL capability as an earth-orbital space vehicle.

Translating these broad goals into more specific terms, the objectives of the MOL Advanced Study and Technology effort are to:

1. Contribute to improvement or extension of the baseline capability in terms of application to any follow-on program.

2. Determine how the baseline capability can be increased to the limits of the natural environment, the state of technology, and operational practicality.

3. Devise and evaluate the feasibility and utility of new applications of MOL hardware developed in the baseline program.

4. The Advanced Study and Technology effort described below is aimed at the achievement of [redacted] resolution in the 1975 and subsequent time period. Other applications of MOL hardware are envisioned as being possible at any time after the baseline capability is demonstrated. In the discussion that follows, near-term specific projects and tasks are identified whereever possible, while activity further in the future is necessarily summarized in more general terms. The time-phasing of this advanced planning activity is depicted in Part 2, with commensurate funding estimates shown in Part 3.

B. Advanced Studies

The advanced study requirements are shown in detail for FY 1968 and 1969. Some will continue into FY 1970. Undoubtedly, additional study requirements will arise during the course of the basic MOL development program. Therefore, a planning funding level of effort is shown in Part 3 for all subsequent years.

1. Advanced Optical System Studies

Achievement of the ultimate goal of [redacted] resolution will require an optical system significantly larger than the present program. Tracking mirrors up to about [redacted] in diameter are feasible under existing technology. Larger size optics will probably require new construction methods primarily due to insufficient structural rigidity during test and handling in the earth gravitation environment. Ground resolution improves with increasing mirror diameters of up to about [redacted] where vehicle vibration, atmospheric turbulence, reduced field of view, weight, and other system factors assume much greater significance. The present state of technology, projected reasonably into the future, should permit the acquisition of optical systems capable of [redacted] photographic ground resolution.

Additional studies will be performed during FY 1968 and FY 1969 to determine the most promising optical system designs which have [redacted] ground resolution potential. As a part of these studies, particular consideration will be given to stabilization, pointing, and vehicle vibrations, and these will be iterated against a number of launch vehicle considerations. Weight reduction and elimination of the large tracking flat will also be investigated. Materials and mirror structure design considering casting and fabrication techniques will be investigated.

2. Advanced Vehicle Studies

Preliminary investigation of growth avenues for improved MOL systems has led to study objectives for both larger integral launch vehicles and rendezvous-resupply vehicles which utilize the basic MOL hardware. Specific growth objectives include improved system economics through longer duration, improved operational flexibility, and improved mission performance through additive and growth payloads.

The integral launch vehicle growth favors the Titan III "large diameter core" booster concept which would provide a substantial increase in payload capability over the T-IIIM. However, no R&D

effort is being expended on the concept at this time. The alternate approach is based on adaptation of the basic MOL hardware to a rendezvous-resupply system which would substantially increase on-orbit payload capability and provides the potential of continuous on-orbit operations for periods up to one year or more. Alternative or complementary payloads may also be accommodated due to relaxation of the basic payload weight limitation associated with integral launch.

An exploratory study contract to verify the rendezvous-resupply concept has been let with the Douglas Company and will be completed early in FY 1968. Refinements on this approach will be conducted in-house during FY 1968, as well as continued investigations of integral launch potential. In addition, more general investigations of immediate follow-on options to the basic MOL will be conducted to provide a spectrum of time, money and capability trade-offs, and the impact thereof for decision making. The results of this effort will be required for the FY 1970 budgetary planning cycle.

3. Vulnerability Studies

Essential to the proper design of a military operational system is the study of techniques for reducing its vulnerability to hostile attack, and other hazardous environments in space. General Electric has conducted an initial study to examine the automatic MOL configuration in a hostile space environment. This study included delineation of the spectrum of defense aids and operational strategies in relation to mission orbital parameters and potential threats.

A preliminary evaluation of the threat spectrum has been done "in-house", ranging from solar flares to direct nuclear attack, with varying degrees of probability. On the basis of these probabilities, determination of vulnerability study tasks will be made with respect to high-probability threats, and appropriate survival measures will be evaluated consistent with using crew tolerance levels as the key limit in a maximum permissible damage situation. Once a specification has been defined, MOL subsystems will be analyzed to determine whether the criteria can be met, and within what constraints and costs. Some contracted effort to analyze or test specific soft items will be considered once a general understanding of MOL vulnerability is understood with respect to an agreed upon specification.

4. SIGINT Studies

Effort is underway to investigate SIGINT systems which could be used in growth versions of the photographic version of MOL, or independently of the optical sensor, to perform more sophisticated SIGINT missions. These latter studies and simulations will be concerned first with determining those SIGINT missions which can be best or uniquely performed by man, and then with the hardware necessary to these missions. Additionally, such SIGINT configurations may include systems or subsystems which are initially checked out and adjusted by an operator and subsequently operate in an automatic mode.

Investigation of more sophisticated SIGINT missions will be in the form of system studies and simulations based on data obtained from aircraft test programs, on-going orbital collection programs and associate data processing and analysis which have been implemented. These studies will be concluded in the early part of FY 1968 at which time further efforts will be considered.

5. Mission Optimization Studies

Additional effort in the form of studies, analyses, and simulations is required to maximize the usefulness and extend the present DORIAN capability. This effort consists of the following tasks which will be conducted during FY 1968.

a. Color

The use of color in current reconnaissance systems has been limited, since the photographic users are not willing to sacrifice the inherent high resolution of black and white for the color advantages. With the MOL system, both color and black and white frames may be obtained of the same target in a stereo pair. Stereo viewing of this pair appears to provide the resolution of black and white while at the same time enhancing camouflage detection and other discrimination characteristics of color. The improvement afforded by this technique requires thorough investigation.

b. Image Enhancement

By combining several photographic frames of the same objective, each with particular areas of high quality, information content may be increased over a single frame. This technique will be analyzed as it applies to the MOL system.

c. Astronomical Observation

An astronomical observation capability will be included in the baseline system, on a no-modification basis, and that activity is now reflected in the operations section of this document. Further study of the DORIAN system in this regard will be addressed to the feasibility of enhancement of the capability by minimum modifications to the MOL DORIAN system. As a first step, investigation will be made of feasible changes to the camera back to determine if extended exposure times to obtain photography of the outer planets would provide a serious impact to the baseline camera design.

d. System Filtering and IR

Intelligence information concerning some targets may be best gained by use of special film emulsions such as IR or special spectrum filtering such as red and green bands only. A study to determine the applicability of the MOL system is extracting intelligence information from all types of target images is highly desirable.

C. Advanced Technology

Specific advanced technology requirements are shown for FY 1968 and FY 1969. Some effort will be continued through FY 1970. Further efforts in hardware beyond FY 1970 will depend on the results of the Advanced Study area.

Requirements now identified include Cer-Vit development and test, and an Electromagnetic Pointing System.

1. <u>Cer-Vit Development and Test</u>

Effort is now being expended by Owens-Illinois Glass Company toward the development and manufacture of Cer-Vit material for the MOL primary and tracking mirrors to replace fuzed silica. Cer-Vit has a very low coefficient of expansion which will eliminate many of the present thermal problems and permit substantial weight savings in thermal protective devices. Cer-Vit has equivalent polishability characteristics and rigidity per unit weight as compared to fuzed silica.

The development effort is directed towards the production and test of 72-inch diameter Cer-Vit blanks to determine if they can replace the fuzed silica mirror which is the primary material for the DORIAN optical system. The present facilities of Owens-Illinois have been expanded to produce the 72 inch blanks. An additional $2.0 million was applied for the design, casting and test of several blanks to determine if this material, with its superior properties over fuzed silica, can be adapted as the primary mirror material. Assuming success in fabrication and polishing, a decision could be made by the 3rd or 4th quarter of FY 1968 to replace fuzed silica with Cer-Vit.

Once an acceptable 72 inch blank is polished to proper specifications, the next step would be to contract for a number of production blanks.

2. <u>Electromagnetic Pointing System</u>

Studies have been completed to develop a small, light-weight, auxiliary sensor system to enhance the system effectiveness of the MOL primary optical sensor. This dual sensor operation would use an Electromagnetic Point System (EPS) capable of identifying and locating emitters with sufficient accuracy to assure they fall within the field-of-view of the High Resolution Optics. Additionally, the system could provide the ability to analyze specific high priority signals, [redacted]

The EPS which has been evaluated would consist of an interferometer type direction finder covering the frequency range of 150 - 10,000 Mega-Hertz. It would utilize information stored in the computer to compare signal parameters of intercept data with those of desired signals. Overall system weight, including antennas, would be approximately 500 pounds, peak power less than 250 watts, and total volume less than 5 cubic feet inboard. The antenna system would be fixed to the outer skin at the rear of the vehicle. It would be covered by a fairing during launch and automatically deployed on operational command.

Integration costs have been estimated for inclusion of this capability in a baseline vehicle; however, at this time, it appears to be a more desirable feature when considered for follow-on longer duration operations, particularly in the rendezvous-resupply concept. The schedule for an EPS in Figure V-1 is laid out against a potential follow-on MOL system target date. The time span back to a Phase I decision point is also indicated. Since the EPS study and experimentation has brought this technology to the Phase I decision point, no additional interim work is contemplated at this time.

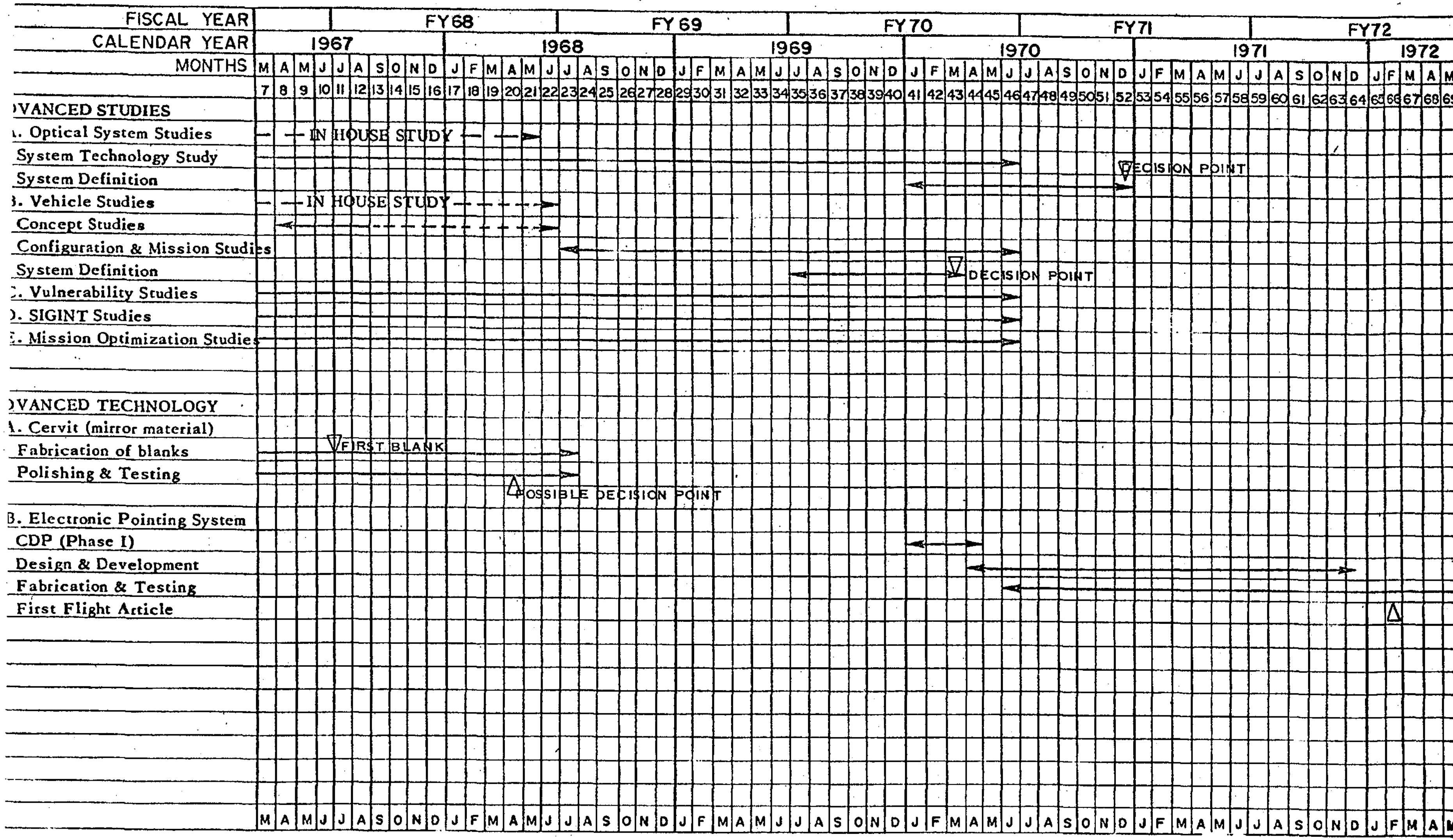
Part 2 - Schedule

Figure V-1 is a schedule of studies and advanced technology, arranged in manner which will be consistent with the current baseline schedule, and useful to follow-on MOL activities.

SECRET

ADVANCED STUDIES AND TECHNOLOGY

HANDLE VIA BYEMAN
CONTROL SYSTEM ONLY



Page 97 of pages
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Figure V-1

DORIAN

SECRET

HANDLE VIA BYEMAN
CONTROL SYSTEM ONLY

Part 3 - Funding Requirements

Figure V-2 contains the estimated FY funding requirements necessary to support the studies and technology described in Part 1 and the schedule contained in Part 2.

The funds for FY 1969 and beyond represent an added requirement to the basic program cost estimate of $2.35 billion.

ADVANCED STUDIES AND TECHNOLOGY FUNDING REQUIREMENTS
(IN MILLIONS)

Activity	Fiscal Year					
	68	69	70	71	72	Total
Advanced Studies						
Advanced Optical System Studies	-0-	1.0	1.5	2.0	-0-	4.5
Advanced Vehicle Studies	.5	1.5	3.0	1.0	-0-	6.0
Vulnerability Studies	.5	.2	-0-	-0-	-0-	.7
SIGINT Studies	-0-	.1	.2	.1	-0-	.4
Mission Optimization Studies	.1	.5	.1	.1	-0-	.8
Subtotal	1.1	3.3	4.8	3.2	-0-	12.4
Advanced Technology						
Cer-Vit Development and Test	-0-	1.0	3.0	1.5	-0-	5.5
Large Optical Systems Technology	-0-	1.8	5.0	5.0	2.0	13.8
Electromagnetic Pointing System	-0-	.1	1.0	.1	-0-	1.2
Information Management Concepts	-0-	.1	.5	.1	.1	.8
Subtotal	-0-	3.0	9.5	6.7	2.1	21.3
Grand Total	1.1	6.3	14.3	9.9	2.1	33.7

Figure V-2

DORIAN

VI - MANPOWER

This Section which will describe current and projected Government and contractor manpower requirements will be added in the near future.

SECTION VII - ASTRONAUT TRAINING

Part 1 - Flight Crew Training

A. Phase Description

The objective of the MOL Flight Crew Training Program is to provide flight certified space crews trained to accomplish the MOL mission. The objectives and the established Flight Crew Training Concept and Implementation Plan are included as part of a formal Flight Crew Training and Activities Plan.

Flight Crew training consists of the four basic phases described as follows:

1. Phase I - Indoctrination

An Indoctrination Phase is conducted at the MOL Systems Office as an introduction to the MOL Program and as a prerequisite to the Aerospace Research Pilot Course. Phase duration is two months. During this indoctrination, the crew member is given general knowledge on all aspects of MOL. This is accomplished through briefings at the MOL SPO and field trips to NASA and contractor facilities. Tentative duty assignments for the Engineering Development - Crew Integration Phase are made during this period.

2. Phase II - MOL ARPS (Aerospace Research Pilots School)

The MOL ARPS course is conducted at Edwards AFB, California, and consists of classroom, flying, and simulator training. Phase duration is five months. The objective of the course is to provide the crew member with technical courses related to MOL vehicle systems, operations procedures, and mission plans. Classroom instruction is provided in subjects as technical background to the MOL or as special courses uniquely MOL oriented. Subject material consists of higher mathematics, astronomy, structures, guidance and control, etc., plus MOL mission peculiar courses. Instructors are provided by ARPS, contractors, civilian agencies, and Aerospace Corporation. The simulator training is accomplished on the T-27 space flight simulator using MOL ascent, orbital, and re-entry parameters. (The T-27 space flight simulator, which was originally developed for the Dynasoar Program, has since been modified for Gemini B/MOL training.)

3. <u>Phase III - Engineering Development and Crew Integration</u>

The Engineering Development Crew Integration Phase involves active participation of the crew member in the design and development of hardware and the determination of operations procedures. This is a continuous training effort throughout the remaining period of time before assignment to a flight. Each crew member is assigned an area of responsibility which he operationally and technically monitors and to which he provides crew inputs. Government agency, contractor, and other supported training is also accomplished during this period. Contractor courses are provided on an as required basis. MOL Systems Office training includes background, environmental, and contingency training.

4. Phase IV - Pre-Flight Training

Upon assignment to a specific orbital flight, the primary and backup crews will commence 12 months training as prescribed by the formal Preflight Training Plan. The majority of Preflight Training will be conducted in the simulator at Vandenberg AFB, California. The total MOL Mission Simulator is composed of three sub-simulators, the Gemini B Procedures Simulator (GBPS), the Laboratory Module Simulation Equipment (LMSE), and the Mission Payload Simulation Equipment (MPSE). Each of these sub-simulators can be operated independently and concurrently or in integration with the others. Training consists of systems, part and whole mission simulations, and courses on systems, all aspects of operations, and mission plans.

The scheduling of these four phases of training for one group of trainees is illustrated in Figure VII-1.

In addition to the four training phases, proficiency flying and physical training are conducted throughout the life of the program.

B. General

Contractor training support is covered in separate contracts with associate contractors. Each Associate provides inputs to the Flight Crew Activities Plan on a semi-annual basis until the publication of the Flight Crew Training Plan by the Systems Office. Training requirement updates are required from the contractors prior to each manned launch. All training equipment used shall be supplied, modified, or refurbished by the contractors. This includes the government furnished equipment from NASA. There are eight major training hardware items. These are:

1. Laboratory Module Simulation Equipment

The Laboratory Module Simulation Equipment (LMSE) provides functional simulation of all subsystems characteristics that affect the operation of the Laboratory Module and the Crew Interface.

2. Mission Payload Simulation Equipment

The Mission Payload Simulation Equipment (MPSE) function is identical to the Lab Module Simulation Equipment.

3. Gemini B Procedures Simulator

The Gemini B Procedures Simulator (GBPS) will be used to train the Flight Crew and Ground Controllers in the Launch, Ascent, Early Orbit, and Re-entry portions of the Manned Orbiting Laboratory (MOL) flight profile. (These three simulators, operating simultaneously with the Mission Control Center and Satellite Control Facility, provide total mission simulation).

4. Zero "G" Trainer

Zero "G" trainer simulation may use a series of simulators, including the C-135 Flight using Keplarian trajectories, underwater, and air-bearing platforms.

5. Abort Trainer

The Abort Trainer provides a concentrated detection and crew action activity limited to abort.

6. Flotation-Egress Trainer

A mockup of the Gemini B provides experience for the crew in post-landing flotation and emergency escape in the event the spacecraft begins to leak.

7. Centrifuge Trainer

Provides experience for crew activities during powered flight.

8. Development Simulator No. 2

This is an early mission payload simulator that permits early examination of design and operation of the mission segment.

The general training support funding required is as follows:

	FY 67	FY 68	FY 69	FY 70	FY 71	FY 72	Total
(in millions)	$.150	$.280	$.525	$.525	$.350	$.350	$2.180

This funding includes special courses, planetarium training and reimbursable training at government facilities for water egress, launch abort, centrifuge, parachute and zero-g training.

FLIGHT CREW TRAINING SEQUENCE

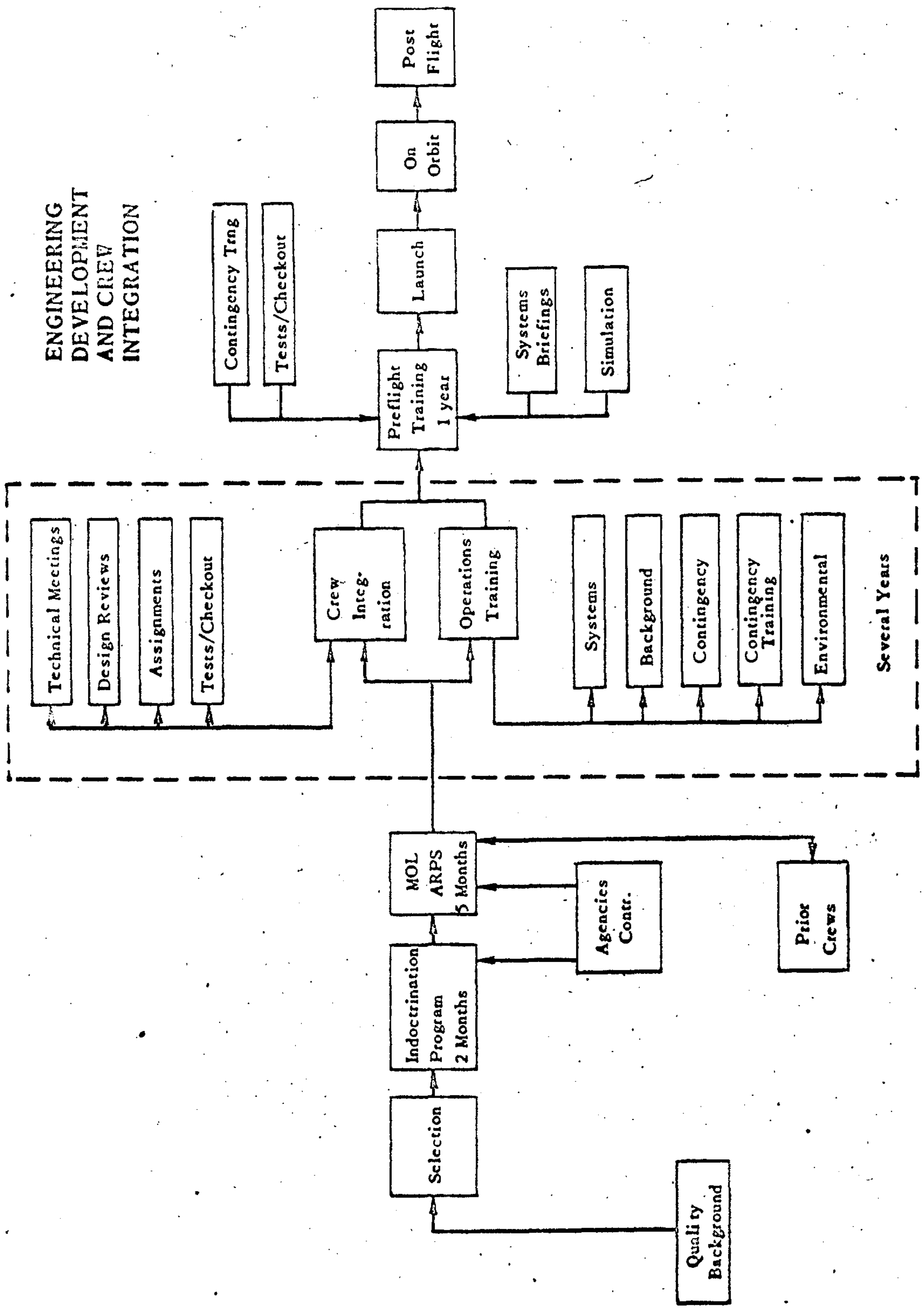

Figure VII-1

VIII - LOGISTIC SUPPORT

The Logistic Support Section will be included in this plan in the near future.

SECTION IX - SECURITY AND INFORMATION

Part 1. General

A. Purpose

This section describes the security control of MOL data and information for all classification levels through TOP SECRET/DORIAN.

B. References

1. Special Security Procedures for the Department of Defense, Manned Orbiting Laboratory (undated, TOP SECRET/DORIAN, BYE 36102-65).

> This document delineates the BYEMAN information from non-BYEMAN and unclassified elements of the program, i.e., it sets forth actual classification policy.

2. Security Policies and Procedures for the Department of Defense, Manned Orbiting Laboratory (February 19, 1965, CONFIDENTIAL).

3. Air Force Systems Command Security Classification Guide for Program 632A (April 1967),(UNCLASSIFIED).

> Reference B2 and B3 set forth security classification for the non-BYEMAN elements of the program; they were prepared in a manner to assist in providing a cover for the BYEMAN aspects of the Program. Care must be taken with these documents, not to confuse or consider the contents as applicable to the actual MOL BYEMAN mission elements.

4. MOL Program Office Directive 67-1, Policy Relating to MOL Astronauts (TOP SECRET/DORIAN, BYE 21277-66).

> This document outlines the security and information policy for MOL astronauts with emphasis on their selection, training and operational use.

5. MOL Program Information Plan (January 1965, CONFIDENTIAL).

The MOL Program Information Plan and Annexes contain basic information policy and assign responsibility for implementing action (CONFIDENTIAL).

Part 2. Security

A. Security Responsibility

1. The Director, MOL, is responsible to the DNRO for implementation of security within the MOL Program. The Assistant for Security, NRO Staff, functions as the principal advisor to DNRO and the Director, MOL, on all matters related to security of the MOL Program.

The Director, SAFSP, as the West Coast representative of the DNRO:

a. Processes background investigations for the MOL Program through established OSI channels.

b. Establishes clearbility of both military and industrial persons.

c. Provides BYEMAN-secure TWX service on a common-use basis.

d. Provides BYEMAN security assistance to the Deputy Director, MOL, in the form of advice, inspection of facilities, security plan preparation, etc.

2. Responsibility for enforcing security requirements follows the same staff channels as does management responsibility described in Section II, Part 1.

3. Within MOL contractor facilities, the Deputy Director, MOL, is responsible for the management of contracts, and is responsible for establishing and enforcing the security requirements of the contract.

B. Level of Information

The MOL Program is involved with handling and control of information protected under AFR 205-1 classified up through TOP SECRET, and Special Access Required data, controlled under provisions of AFR 205-23. The program also uses BYEMAN and other selected information controlled under policies contained in the security manuals in effect to control such information.

C. Security Controls of Work Areas

For effective program direction, both the MOL Program Office (SAFSL) and the MOL Systems Office (SAFSL-1) meet the physical security requirements for handling, storing, receiving and dispatching all levels of classified information associated with the MOL Program.

D. Special Clearance Actions

1. BYEMAN Projects Access for MOL Program

a. Access to BYEMAN projects is obtained after access clearability and Project need-to-know are substantiated. For the MOL Program Office, access clearability is vested in AFNIN and Project need-to-know, with the DNRO. For the MOL Systems Office, supporting military activities and its contractors, access clearability and need-to-know for BYEMAN information other than DORIAN is vested in SAFSP. Authority of the MOL Systems Office for establishing need-to-know for DORIAN is discussed below.

b. The Deputy Director, MOL, has authority to establish DORIAN need-to-know for:

(1) personnel assigned to the MOL Systems Office;

(2) SSD and Aerospace technical personnel and technical personnel of 6594th and 6595th Test Wings;

(3) Employees of

Douglas Missile and Space Division
Huntington Beach, California

(4) Eastman Kodak Company, Rochester, N. Y.;

(5) McDonnell Aircraft, St. Louis, Missouri;

(6) General Electric Company, MOL Department
Missile and Space Division
Valley Forge Missile Space Technology Center,
Philadelphia, Pennsylvania

c. All assignees (military and civilian) to the MOL Program Office and MOL Systems Office must meet eligibility requirements for BYEMAN security access approvals. When feasible, a pre-review of an individual's available investigation and/or personnel record is made in conjunction with the clearing authority prior to accepting an individual for assignment.

2. Sponsoring BYEMAN Clearances

The Director, Vice Director and Deputy Director of the MOL Program may sponsor military, civil service, and contractor personnel for access to BYEMAN project information when it is deemed that such access is required for participation in, or is of benefit to, the

MOL Program. The Deputy Director sponsorship will be limited to those personnel assigned to SSD and MOL Program contractors. Clearance requests will be processed through established BYEMAN channels.

3. Product Clearances

Access to product information is limited to incumbents in positions approved for access. An approved position is called a billet. All requests for product billets for the MOL Program are processed by SAFSL, prior to submission through established Air Force channels. Detailed justification will accompany each request. Clearances for personnel occupying approved billets are processed to SAFSL.

4. Special Access Required (SAR)

MOL Program Office (SAFSL) and the MOL Systems Office are approving authorities for access to SAR information as set forth in AFR 205-23 and the security classification guide for Program 632A.

E. Classification of Information

1. Classification Authority for the MOL Program rests with the Director, NRO and the MOL Program Director. All MOL information will be classified in accordance with the references cited in Part 1.

2. Classification Changes

Recommendations for changes in classification of information will be submitted to SAFSL for approval. Recommendations will include justification for the requested change.

DORIAN

3. New Classification

New or different types of information not previously considered for classification under policies pertaining to the MOL Program will be submitted to SAFSL for final determination of classification level. Such requests will include the information or type of information of concern, its relationship to the MOL Program and rationale for recommended classification.

F. Release of MOL Classified Information

MOL classified information will only be released to Government agencies, DOD activities and contractor facilities directly participating in, or contributing to, the MOL Program. Care will be taken to insure the recipient is appropriately cleared for the level of information released. Releases of MOL classified information to any source or for any purpose other than specified herein must be approved by SAFSL.

Part 3. Information

A. Objective and Policy Background

1. The objective of the MOL information policy is to provide for a carefully-planned program of public information which can be released as required. While no special effort is made to justify the MOL Program publicly, enough material is made available to respond to legitimate public interest and to cope with potential international repercussions.

2. All public information materials on MOL including releases, statements, artwork, photography and advertisements proposed by representatives of any Government department or agency or any MOL contractor are processed through established security and policy review channels for approval prior to release.

3. The effective implementation of the Manned Orbiting Laboratory (MOL) Information Plan requires the careful assessment of the public affairs implications of all program activity and the constant monitoring of day-to-day operations to insure compliance with, and consistency in, application of policy.

B. Responsibilities

1. The Assistant Secretary of Defense (Public Affairs) has made the Director of Information, Office of the Secretary of the Air Force, responsible for the implementation and overall monitorship of the MOL information plan.

2. SAF-OI has assigned an information officer to the MOL Program Office to serve as a single point of contact on MOL public affairs matters. This officer is assisted by SAF-OI divisions in the development, preparation and coordination of information materials, plans and policy guidance.

3. The MOL Program Office provides information on program plans and activities that have public affairs implications to SAF-OI so that appropriate information plans can be developed and coordinated with OASD(PA), and guidance issued to the field in advance. The office also assists in the review of proposed information materials relating to MOL primarily for security and accuracy.

4. The Air Force Systems Command is responsible for carrying out information actions for SAF-OI as directed in the MOL information plan and annexes. Since AFSC is responsible for providing on a continuing basis the facilities, resources and personnel necessary to support the MOL Program, the command also has the primary responsibility in implementing the information plan.

a. SSD as the lead AFSC division in supporting MOL will provide information support for the MOL Systems Office. In providing this support the SSD Office of Information will:

(1) Maintain cognizance of MOL Systems Office initiated program activities and assess them for public affairs implications.

DORIAN

Then alert SAF-OI, through AFSC, of those activities likely to require policy decisions concerning information handling.

(2) Maintain MOL pilot public affairs file to include current biographies and pictures; advise SAF-OI of any significant changes in pilot status such as promotion, or of any accomplishments such as special awards and decorations; refer any requests for MOL pilot participation in public affairs activities to SAF-OI.

(3) Provide information for and assistance in the preparation of annexes to the MOL Information Plan; provide information for and prepare or assist in the preparation of information materials in support of these annexes.

(4) Advise SAF-OI, through AFSC, of MOL Systems Office interface with other Government agencies and Air Force organizations and assess the public affairs implications of such joint activities.

(5) Advise SAF-OI, through AFSC, of potential community relations problems that might result from program activities--i.e., movement of personnel into Vandenberg AFB area.

(6) Advise MOL contractors of information policy and monitor their compliance with the policy.

(7) Process proposed contractor public information materials, coordinating with the MOL Systems Office and other SSD Program Offices as required, and then forward the materials with

recommendations through AFSC to SAF-OI for final review determination of releasability.

(8) Maintain collection of documentary photography--still and motion picture footage--on program activities as requested by SAFSL or the MOL Systems Office for possible use in briefings.

(9) Refer requests for information not covered in the attachments to the MOL information plan to SAF-OI, through AFSC, with recommended reply when possible.

(10) Coordinated all the above activities with the Deputy Director, MOL Program, and/or appropriate members of his staff.

5. The Deputy Director, MOL Program, provides information and assistance as necessary to the SSD Director of Information in accomplishing the tasks outlined above. This assistance includes reviewing proposed information materials, in support of the MOL plan and its annexes, primarily for security and accuracy. Final determination of releasability of information materials is made by SAF-OI in coordination with SAFSL and OASD(PA).