SECURITY MARKING

#369940

The classified or limited status of this report applies to each page, unless otherwise marked.
Separate page printouts MUST be marked accordingly.

CONTENTS

INTRODUCTION

1. PROJECT SUMMARY
   1.1 Development Plan
   1.2 Technical Feasibility
   1.3 Management Aspects
   1.4 Costs Summary
   1.5 Follow-on Reconnaissance Program

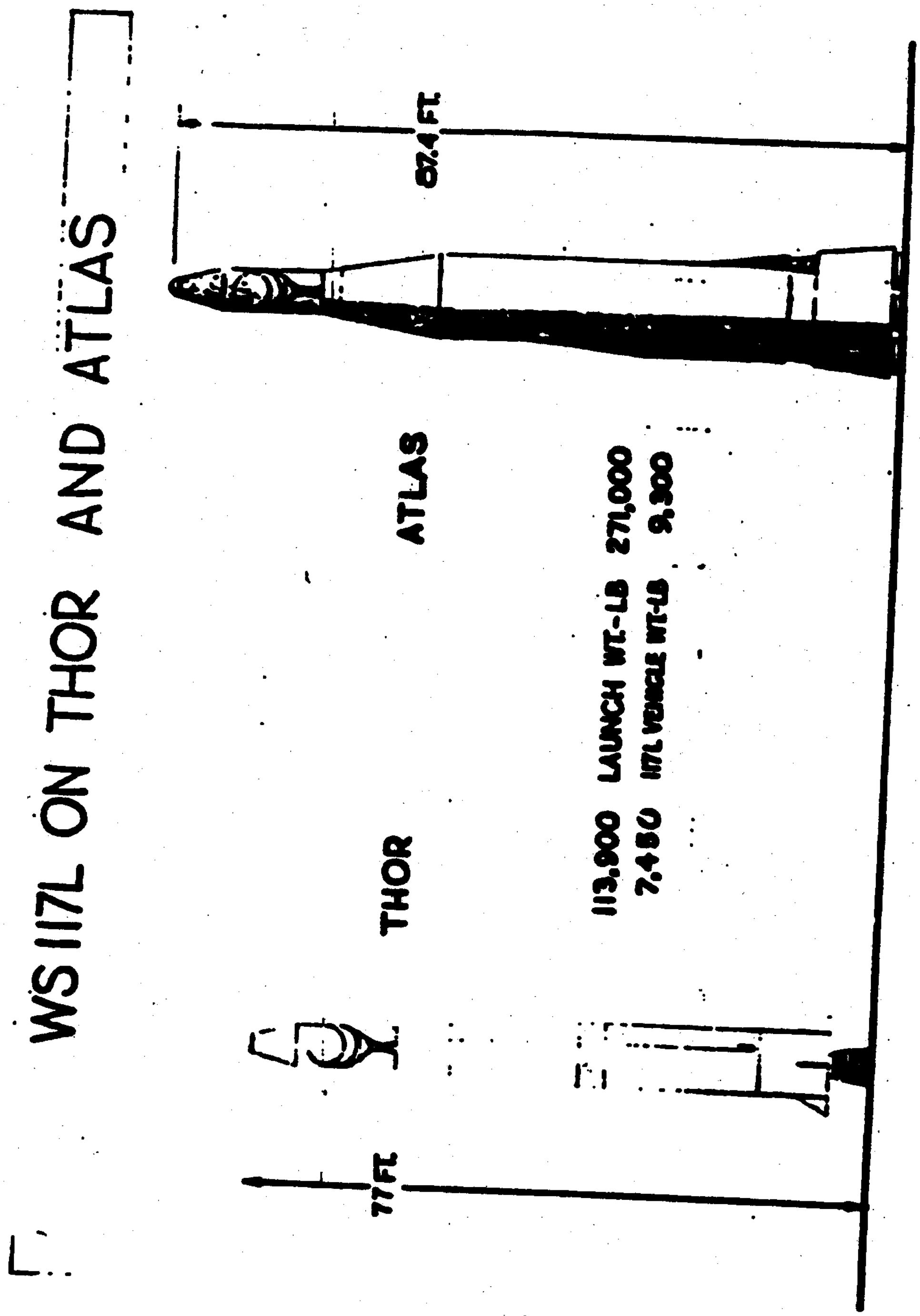
2. MANAGEMENT CONSIDERATIONS
   2.1 Lockheed's Corporate Position
   2.2 Contractor's Established Capabilities
   2.3 Expedited Methods for Accelerated Program Accomplishments
   2.4 Manpower and Skill Availibility
   2.5 Assumptions
   2.6 Program Plan

3. TECHNICAL DEVELOPMENT PLAN
   3.1 DD-613
   3.2 General Design Specifications
   3.3 WS-117L Accelerated Program Milestones

4. TECHNICAL ANALYSIS
   4.1 Performance of the WS-315A Series IV and WS-107, SM-65, Vehicle as Boosters for WS-117L
   4.2 Preliminary Design of the Vehicle
   4.3 Operations Analysis
   4.4 Camera Parameters
   4.5 Recoverable Reconnaissance Package Orbital Stabilization
   4.6 Recoverable Package Re-entry Requirements
   4.7 Guidance Selection
   4.8 Recovery Consideration

FAIRCHILD PANORAMIC CAMERA SYSTEM

[redacted]



Frontispiece

INTRODUCTION

The WS-117L program now under development has as its objective the provision of complete reconnaissance systems utilizing satellite borne sensing devices. The material here represents a development plan for accelerating this program, and has been prepared by the Lockheed Missile Systems Division in its role as the WS-117L Weapon System Contractor.

In the course of negotiations on 12 to 19 November 1957 for the WS-117L definitive contract, it was requested by AFBMD personnel that Lockheed consider modification of the program for a potential acceleration. Included was consideration of increasing the tempo of vehicle firings to assure greater probability of program success and to reduce the development time scale of a first Pioneer Visual flight capability by one year to March 1960. Subsequently it was requested that consideration be given to developing the Pioneer Ferret system to a time scale comparable to that of the Visual.

In view of recent emphasis on missile weapon systems, it appeared appropriate to the Contractor to consider the inclusion of two alternate approaches in the development program: (1) The use of an IRBM missile as a booster, and (2) The physical recovery of reconnaissance photographs from the orbiting vehicle. Both approaches have been a part of the Contractor's over-all program concept from its inception but had been shelved due to initial funding limitations. The combination of the two approaches will provide a system attaining very early reconnaissance capability. This is quite similar to a method proposed recently by the RAND Corporation using the Thor as a booster and a panoramic camera, in a spin-stabilized recoverable capsule, on orbit.

[redacted]

The overall-program presented here is essentially the same as that presented to AFBMD on 27 November and 5 December 1957, but incorporates the RAND concept for early Thor-boosted reconnaissance flights.

The Contractor believes strongly that should additional funds be available for enhancement of the U. S. military program, consideration should be given to augmentation of the present WS-117L program in the manner and amount shown in Figure 1. This would allow capitalization of the established broad WS-117L base toward expeditious accomplishment of its military objectives. Expanding the vehicle firing rate from four to 20 by Feb. 1960 will allow a more efficient utilization of the system, increase ultimate reliability, and bring about earlier reconnaissance capability.

[redacted]

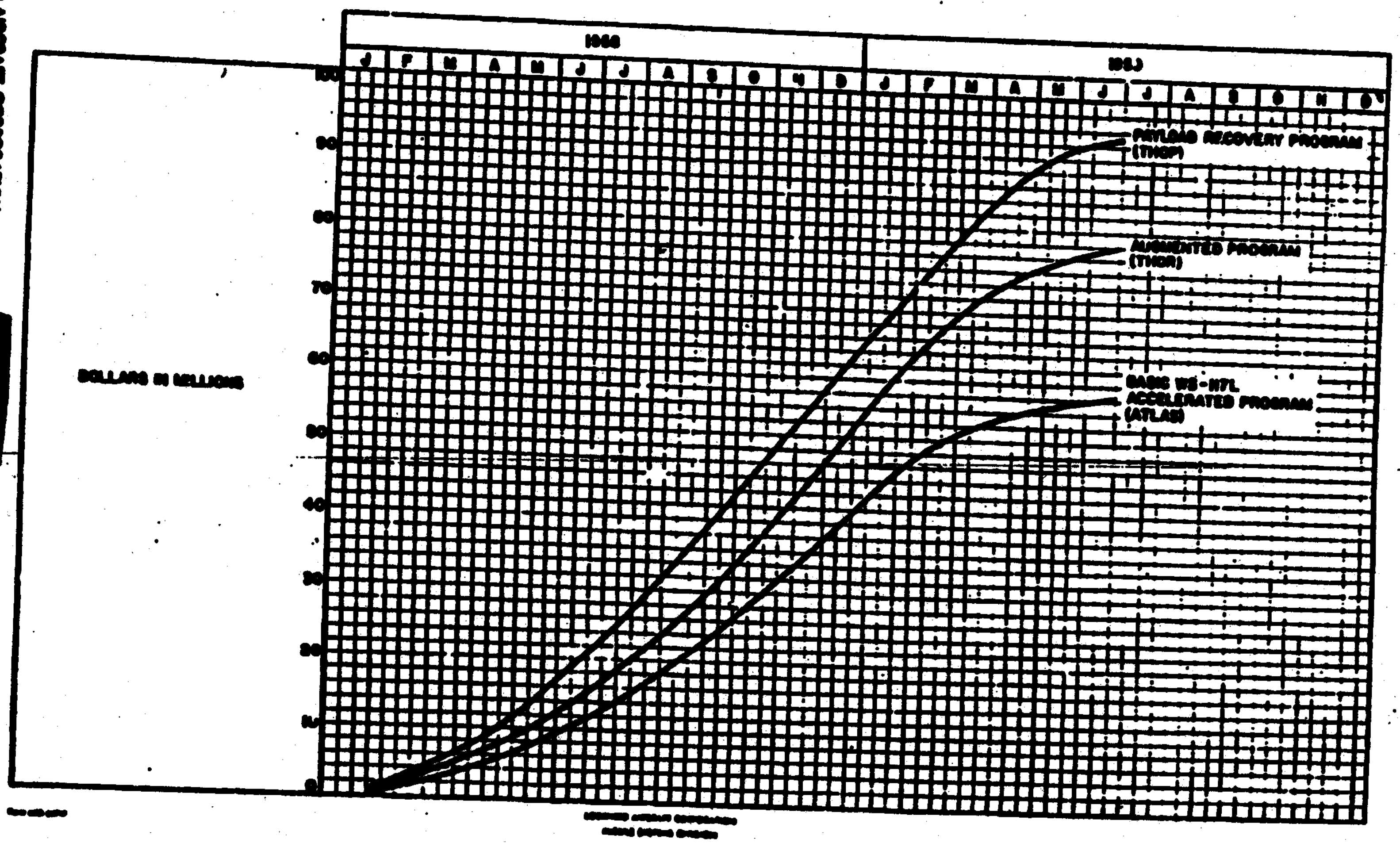


Fig. 1 WS-117L Program Cumulative Funding Requirements

[redacted]

ACCELERATION OF WS-117L PROGRAM

The acceleration of developmental effort leading to earlier WS-117L operational availability embraces the following significant additions to the program:

Advance the first firing from June 1959 to October 1958.

Advance the first Pioneer Visual, high latitude firing from March 1961 to March 1960.

[redacted]

Advance the move to IOC from March 1961 to March 1960.

Accelerate program via use of Thor IRBM as earliest available booster.

Initiate RAND-type visual-recce/physical-recovery program to advance availability of reconnaissance information with:

1 st flight January 1959

6 th flight (prototype) July 1959

Introduce use of UDMH fuel as product improvement to Hustler engine program. (Increasing Isp from 263 to 277).

Flight test (in period 1 January 1958-1 July 1959) eleven WS-117L vehicles instead of one.

Manufacture (in period 1 January 1958-1 July 1959) twenty-one WS-117L vehicles instead of original four.

SECTION I

PROGRAM SUMMARY

1.1 Development Plan

1.1.1 System Considerations

As a result of its previous WS-117L activities under the direction of AFBMD, the Lockheed Missile Systems Division is thoroughly familiar with the Air Force's requirement for developing earth satellites having the capability to perform reconnaissance of very strategic military significance. Primary categories of reconnaissance are visual, ferret and infrared-with priorities for operational requirement in that order. Long term efforts are aimed toward establishment of an Advance Reconnaissance System to become operational in the 1960-65 time period. However, efforts will also be undertaken to provide a limited reconnaissance capability as soon as possible.

The Air Force and LMSD have recently negotiated a program of effort toward these ends. The Development Plan herein presents ways and means to accelerate the existing program through increased effort and materiel-augmentation with the eventual result of earlier operational capability and increased overall effectiveness.

The program is planned to proceed from the simple to the more complex, with each point of capability embodying the best compromise between scientific state-of-the-art and early availability of Reconnaissance Weapon Systems for military use. To enhance this effort, the basic program would be supplemented by the development of an alternative Photographic Payload which can be physically recovered from a vehicle on orbit. In this case, the WS-117L vehicle would be boosted to orbit by a Thor Booster and would carry a recoverable visual payload similar to that described in recent Rand Corporation literature.

LMSD's overall activities are organized in the following phases:

1.1.1.2 Program I.

The objective of this program is the achievement of orbital capability on an accelerated time scale. The program calls for the design and development of a basic WS-117L vehicle utilizing a liquid-fueled orbit-boost engine and providing capability for carriage of various payloads. Vehicle design is based on a gross weight, with fuel and payload of 9300 pounds that allows the off-loading of fuel or payload for satisfaction of special flight objectives. Final Program I flight for demonstration of orbit capability is established for February 1960. The achievement of a reliable capability on an accelerated time scale requires the initiation of orbit flights by October 1958. The first four of these flights will utilize the Thor IRBM because of their early availability. The succeeding ten flights will be boosted by the Atlas ICBM in accordance with existing plans. All flights will be orbit-tries. Concurrently with the achievement of an orbital capability, a considerable effort will be spent during Program I in obtaining initial orbital testing of visual, ferret and infra-red reconnaissance payload components, partial subsystems and later, complete subsystems. These tests will provide the extremely important developmental phase of orbital environmental test conditions and will contribute to the acceleration of an early reconnaissance capability in later programs.

1.1.1.3 <u>Program II</u>.

The objective of this program is the achievement of pioneer visual reconnaissance capability which includes mapping physiographic features at a ground resolution at one hundred feet and a locational accuracy of one mile. Objectives of such reconnaissance are airfields, industry complexes and sea coast installations detectable at this scale. While Program II is not covered in detail in this Development Plan, it should be noted that the first Pioneer Visual Reconnaissance flight will be launched from I.O.C. in March 1960 as specifically directed by AFBMD.

<u>Program II-A</u>. The objective of this program is the early achievement of a Visual Reconnaissance capability through utilization of other techniques and sources than those incorporated in existing

basic WS-117L Weapon System Program. This is done via utilization of panoramic camera techniques currently available from aerial reconnaissance state-of-the-art. A requisite part of this program is the utilization of recovery of the Visual Payload from the orbiting vehicle by utilizing techniques described by the Rand Corporation. In this program, basic WS-117L vehicles, each loaded to approximately 7200 pounds, would be boosted by a Thor IRBMs to orbit about 135 statute miles above the earth. Following acquisition of reconnaissance data, and at an appropriate point in its orbit, a command signal would initiate recovery of the Payload through utilization of retroactive rockets. The descending capsule would be recovered from a pre-selected point in the Pacific Ocean, North of Hawaii. Data thus collected would have approximately the same characteristics of resolution as that prescribed for Program II above. It envisioned that the objectives of this program could be satisfied by six firings the first of which would be performed in January 1959 and the last in July 1959.

1.1.1.4 [redacted]

1.1.1.5 Advanced Development Programs

Later development programs will be carried out in order to provide an advanced reconnaissance capability. Program IV, the Advanced Visual Program, will provide greatly increased ground resolution (20 ft.) with a locational accuracy of one half mile. The system

[redacted]

may incorporate features to allow the programming of the camera to point to areas of specific interest. [redacted]

Programs VI and VIII represent the development of continuous satellite surveillance systems utilizing advanced visual [redacted] systems.

1.1.1.6 Program VII

The Infrared Surveillance Program has as an ultimate objective, a system of satellites on orbit, placing unfriendly territory under continuous and complete surveillance. Initially the early system will be capable of detecting ICBM launchings and transmitting an immediate warning of an imminent attack.

1.1.2 <u>Subsystem Considerations</u>

1.1.2.1 <u>Airframe Subsystem</u>

The airframe Subsystem consists of the structure, propulsion tankage, outer skin, installation supports and certain mechanical and electrical equipments. The major portion of the development effort on this subsystem will be conducted at LMSD including design, fabrication, assembly, and ground support equipment development. LMSD will rely heavily upon outside purchase for small components.

1.1.2.2 <u>Propulsion Subsystem</u>

The Propulsion Subsystem consists of the main orbital thrust rocket engine with the associate propellant feed system and control mechanisms, the thrust producting system for vehicle attitude and roll control, the auxiliary rockets for ullage control together with all necessary ground based support equipment used for the testing, calibrating, checkout and servicing of the subsystem. All research, development and fabrication of the orbital thrust rocket engine will be performed by Bell Aircraft Corporation. LMSD will perform the over-all subsystem development activities.

1.1.2.3 Auxiliary Power Subsystem

The APU Subsystem consists of the electrical power system for the complete satellite system together with the necessary ground support equipment. The subsystem design and development is being conducted by LMSD with appropriate subcontracting for specific battery and other subsystem developments.

1.1.2.4 Guidance and Control Subsystem

The Guidance and Control Subsystem consists of equipments required to fulfill functions associated with the initial boost, coast, orbiatl boost, reorientation, and orbital stabilization. LMSD is directing the over-all development of the necessary equipments required. Major components such as the inertial reference package and the horizon scanner will be developed by appropriate subcontractors. Both component and complete subsystem tests will be conducted by LMSD.

1.1.2.5 Visual Reconnaissance Subsystem

The Visual Reconnaissance Subsystem consists of the satellite-borne equipment required to collect, process, and store visual pictures and later to convert these pictures into video form for transmission to the ground with equipment which is a part of the Ground-Space Communications Subsystem. This subsystem also includes the necessary ground data-processing equipment. LMSD is planning and directing the development program with the major hardware development and fabrication of subsystem equipment being subcontracted to Eastman Kodak Company.

1.1.2.6 Electronic Reconnaissance Subsystem

[redacted]

1.1.2.7 Infrared Surveillance Subsystem

The Infrared Surveillance Subsystem consists of equipments for collecting infrared data from enemy ICBM's, and high-altitude jet aircraft and transmitting this data back to appropriate ground stations in order to provide warning of impending attack and surveillance of air traffic patterns. The over-all subsystem program is being directed by LMSD. Major subcontracts are underway for various phases of study and design work on components and subsystem equipment.

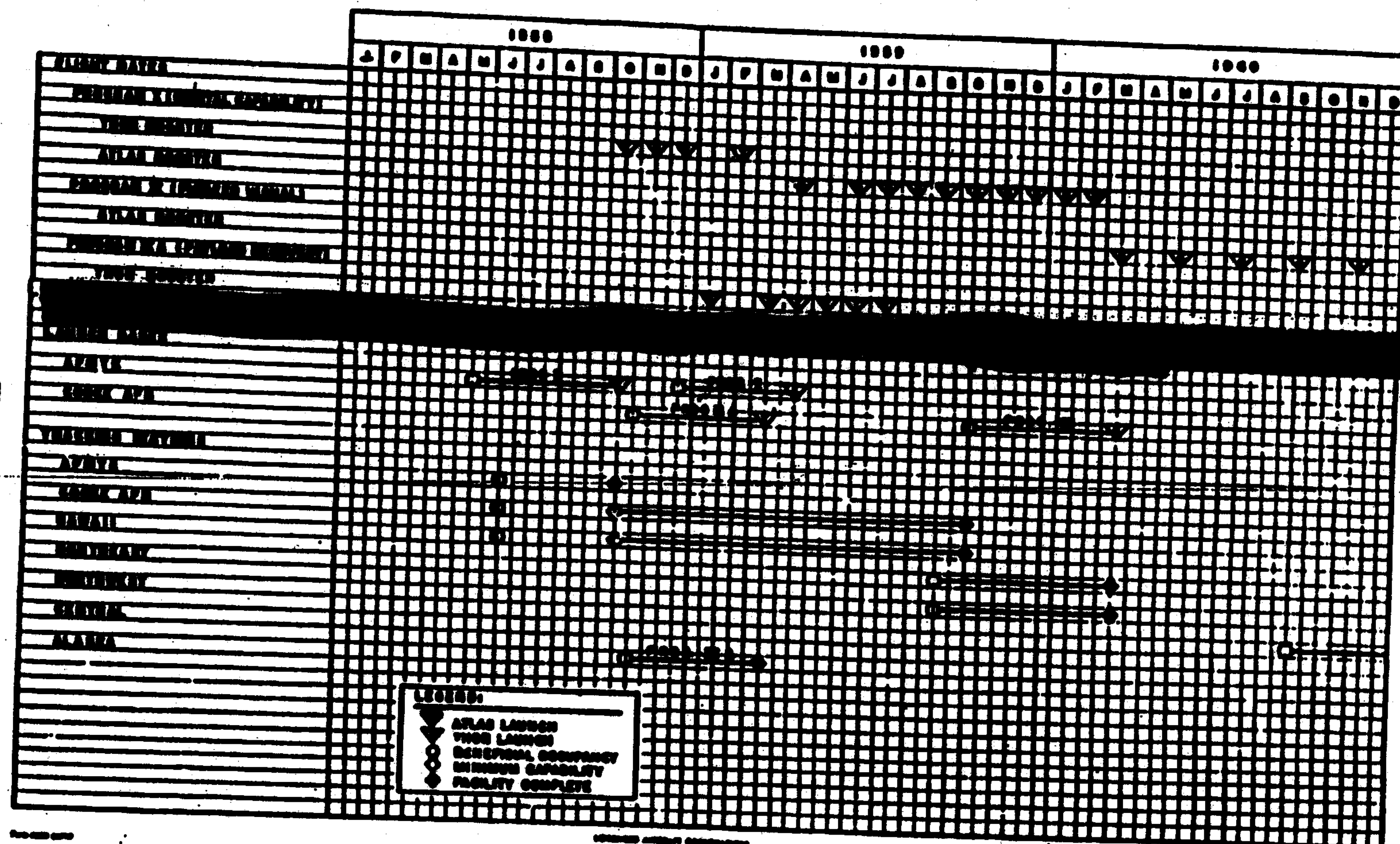
1.1.2.8 Ground-Space Communications Subsystem

The Ground-Space Communications Subsystem consists of equipments to perform the following functions: Acquisition and Tracking; Telemetry; Reconnaissance Data Link; Vehicle Antenna Systems; Ground Station Communications; Computers, Timers, and Command System. LMSD will direct the over-all design, development and test of these equipments. The Philco Corporation as the major subcontractor will have the responsibility for the development of the integrated subsystem together with specific developments as required.

1.1.2.9 System Management

The acceleration of this program will require the application of unusual measures in many cases to assure that an effective Weapon System is developed in the short time available. In the area of testing and operations, extensive captive testing of both subsystems and completely assembled flight systems will be necessary. Since it might not be possible to system-test each vehicle prior to flight, the test of one (1) complete vehicle out of selected production runs will satisfy necessarily reduced test requirements. In the manufacturing area, it will be necessary to stream-line procedures for drawing release, specification compliance, pilot line production, material procurement and other associated problems. Plans are now being laid to bring about these desirable end results. The acquisition and training of manpower presents a particularly imposing problem because of the unusual skills required and the heavy security requirements imposed. The immediate implementation of a program for acquisition of new personnel must be undertaken. Ground Support equipment for this program, as well as associated facilities, will be developed under an integrating plan by LMSD, although, extensive outside purchase of equipment is contemplated. Both the acceleration of the program and its enhancement of reliability will be accomplished by strong augmentation of testing for checkout and like equipments.

[redacted]



Summary Schedule - WS-117L Accelerated Program

[redacted]

1.2 Technical Feasibility

Technical feasibility analyses performed in conjunction with the program acceleration comprise two parts: the use of the Thor missile as a satellite booster and the use of physical recovery for early photographic reconnaissance data (essentially the system proposed in RAND Report No. RM 2012).

It is planned to use the Thor booster in two ways: to augment the flight proving program of the WS-117L vehicle (Program I) and to place the RAND-type recoverable camera capsule on orbit. It was found that the Thor booster will place the present WS-117L vehicle on a 300 statute mile orbit allowing approximately 100 pounds for instrumentation when fired from AFMTC. The concept of using relatively simpler IRBM class missiles to supplement ICBM class boosters in the flight-proving program is not a new one. The contractor presented this in the First Quarterly Pied Piper Report of October 1955.

In considering the best way of placing the Rand type payload on orbit, it was found that the WS-117L vehicle was equal in performance to the method assumed by Rand (Thor plus Vanguard second and a small third stage. In fact, the WS-117L vehicle in combination with the Thor is the optimum vehicle that can be added to the Thor to provide a two stage satellite. The reason for this is because of the high performance inherent in the WS-117L application and because the WS-117L vehicle is restricted in size for the Atlas application due to load carrying limitations of the latter's balloon-type construction. Figure 1-1 illustrates this point.

Figure 1-2 presents performance envelopes of two and three-stage satellites using the Thor missile as the first stage. It is assumed that the stage (stages) placed on the Thor represent the best presently available liquid rocket performance and structural design efficiency.

Figure 1-2 shows the relative performance of the Vanguard second-stage and the WS-117L vehicle when placed on the Thor. Here it

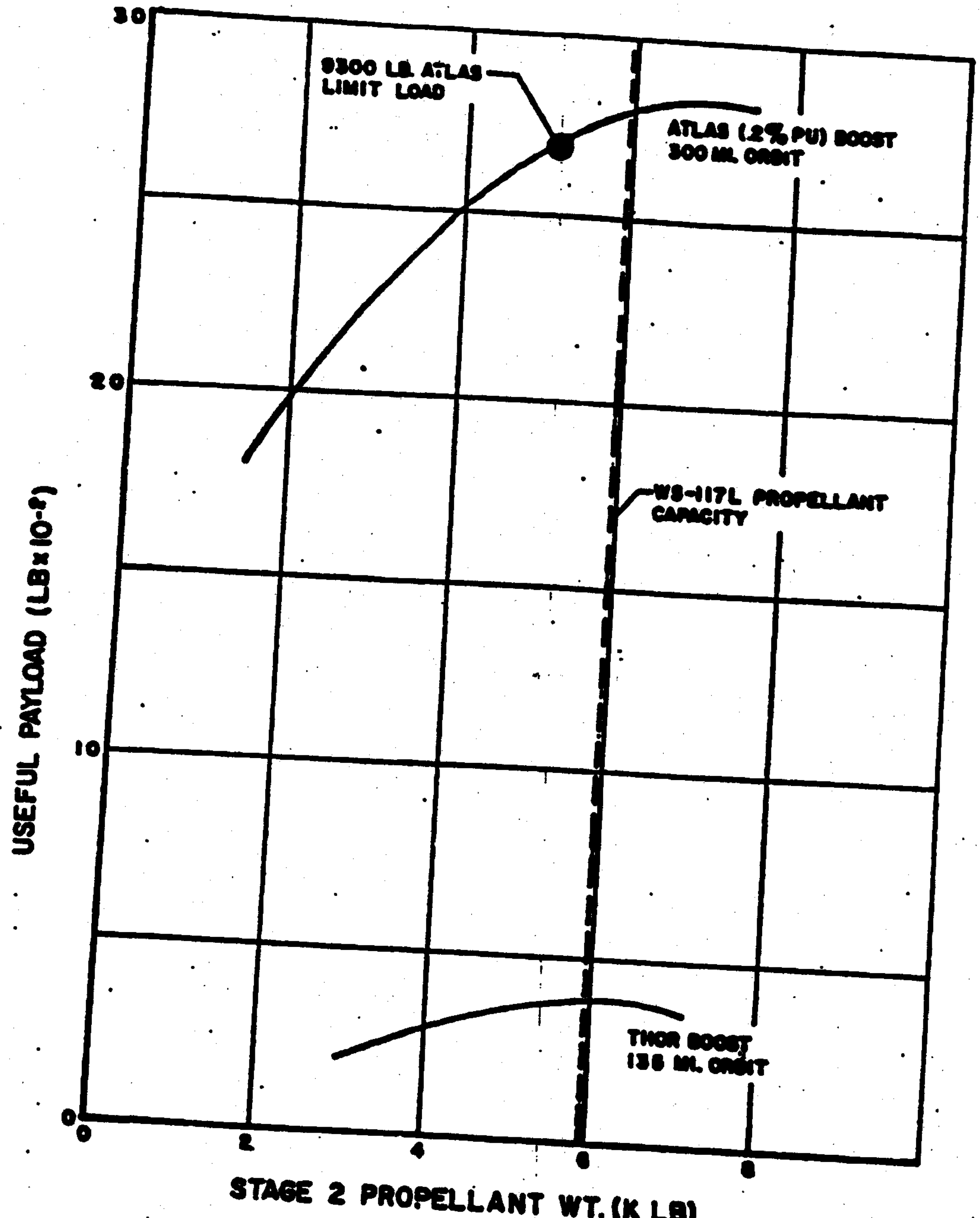


Fig. 1-1 Useful Payload vs Propellant wt. WS-117L Vehicle - Polar Orbit

USEFUL SATELLITE PAYLOAD VS WT OF STAGE (STAGES) ON THOR

POLAR 135 S.MILE ORBITS

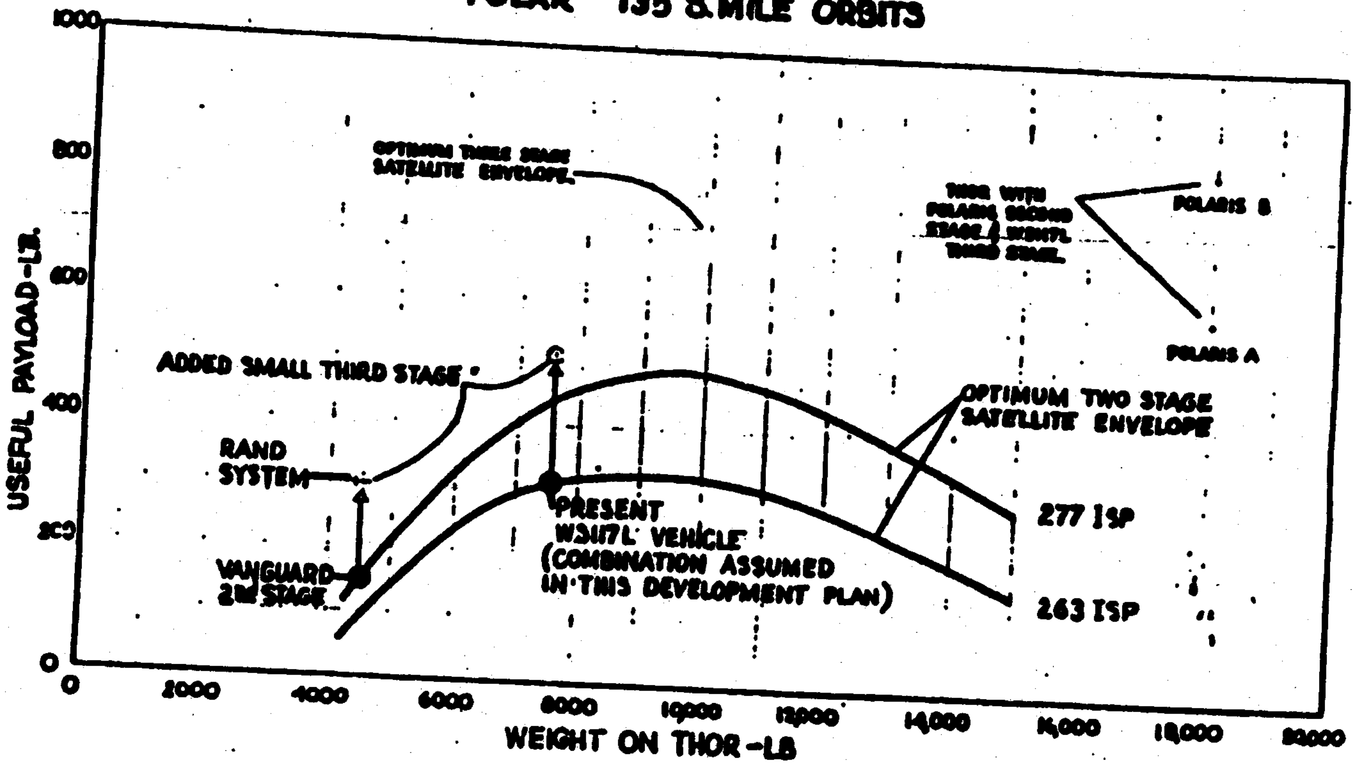


Fig. 1-2

is indicated that the WS-117L has a higher payload capability than the Vanguard because the WS-117L is the proper size despite the higher specific impulse of the Vanguard engine*.

In order to launch a satellite, the last stage must operate at orbit altitude. This means that a two-stage satellite must be launched on a less than favorable flight path from a performance point of view. If a small third stage is added it allows the second stage to be operated at lower altitudes and at a higher trajectory efficiency. Thus, although this small third stage does not contribute significantly toward the total impulse, it does allow considerably greater payloads. This point is illustrated in Figure 1-2.

RAND has assumed such a scheme in order to get enough payload capability to place their reconnaissance capsule on a useful orbit using the Vanguard second stage. Use of the small third stage versus a two-stage satellite is disadvantageous for reliability reasons and also because the last stage is not fired until the vehicle has coasted to apogee, which in the case of a three-stage vehicle is several thousand miles down range. For example, the RAND-assumed vehicle does not go on orbit until it is nearly in the Antarctic region. This introduces considerable difficulty in monitoring any functions while establishing the orbit. Furthermore, unless a guidance system is included in the last stage, great uncertainty is introduced in the type of orbit that is established.

On the other hand, the WS-117L vehicle will go on orbit within 900 miles of the launch point and this is considered to be quite significant for both guidance and instrumentation.

In the Teller Committee report, it was stated that the "WS-117L vehicle on a Thor would yield 200 to 400 pounds on orbit as proposed by Lockheed." Indeed, the material presented by Lockheed was based on the conditions that the payload would be placed accurately in an orbit with the latter useful for reconnaissance purposes (i.e., polar). The Contractor's

*The Vanguard engine does not have a pump and relies on tank pressures of 300 psi. At sizes commensurate with the WS-117L application, unfavorable Vanguard tank weights would offset the specific impulse advantage and would yield comparable performance only to the WS-117L engine.

performance figures were based on detailed designs, on rigorously optimized trajectories utilizing the 1103A computer, and on a large amount of system design data of satellite-type vehicles as a result of the WS-117L program over the last three years.

The Contractor has not been able to show on this same basis useful payloads of "400 to 800 pounds" for the Vanguard second and third stages as proposed by Douglas in the Teller report, or the large payload numbers presently being quoted by Ramo-Wooldridge. Part of this difference could be accounted for if the latter studies assume launching eastwardly from AFMTC. Under these circumstances the WS-117L vehicle would enjoy a similar increase in payload capability, but such an orbit is not useful for reconnaissance purposes. The remaining difference might be accounted for by more optimistic performance assumed for the Thor missile than is indicated by present WS-315A data available to Lockheed. Lockheed personnel have not been granted authorization by AFBMD to discuss in detail improved Thor performance with Douglas. If such improvements are in the offing it would be highly desirable to consider same in context with future applications of Thor to the WS-117L program.

The two-stage combination proposed by the Contractor is adequate to provide a useful reconnaissance mission in the time period prior to the WS-117L/Atlas reconnaissance systems. For this reason, the Contractor does not recommend for this early application the additional complexity of either a three-stage satellite or the development of higher performance propulsion systems. Higher performance systems will pay for themselves in the WS-117L program in the early Atlas boosted vehicles as well as in later applications of the Thor missile. For this reason, the Contractor is presently proposing to intensify the effort under the advanced WS-117L propulsion system that is already a part of the WS-117L development program. It is planned to sponsor development of a modified Hustler engine (providing 277 specific impulse) and the development of a high performance engine of 340 to 440 seconds specific impulse, using fluorine as the oxidizer. The utility of higher performance engines in the follow-on Thor reconnaissance systems is discussed later in this Summary Section.

The early Recoverable Reconnaissance System is based upon the concept of the physical recovery of high resolution photographs of enemy territory taken from a satellite orbit. Complete coverage of the USSR North of 45 degrees latitude is accomplished by a satellite orbiting at an altitude of 135 statute miles and scanning 45 degrees each side of vertical during a four-day period.

The method for the mechanization of this concept makes use of the dynamics of a rotating body to maintain proper orientation in inertial space as well as using the spin of the body to operate a transverse panoramic camera. This method results in a relatively lightweight reconnaissance package which is quite compatible with the performance of the Thor/117L System as previously discussed.

Figure 1-3 shows the general reconnaissance scheme and Figure 1-4 shows the sequence of events for a mission. It can be seen that immediately after establishment of orbit the vehicle and camera package are oriented for proper photography over the zone of interest. After attitude orientation the camera package is caused to spin at approximately 18 RPM and is then separated from the vehicle. This rotation is sufficient for stabilization purposes. At this rotation rate, camera operation on every third revolution over the zone of interest provides continuous coverage. Proper timing of the camera operation is obtained by combining joint operation of a timer and sun sensor.

After a sufficient number of passes have been made by a vehicle, the reentry and recovery phase of the mission is initiated as the package passes near the Zenith over a selected tracking station in Alaska. A signal is initiated which will cause a solid propellant rocket in the package to modify the orbit so that the package re-enters the earth's atmosphere. During passage through the atmosphere the vehicle slows to subsonic velocity. A heat shield on the forward end of the package, accomplished by use of a material ablation technique, will protect the reentry body and internal components from the intense heating

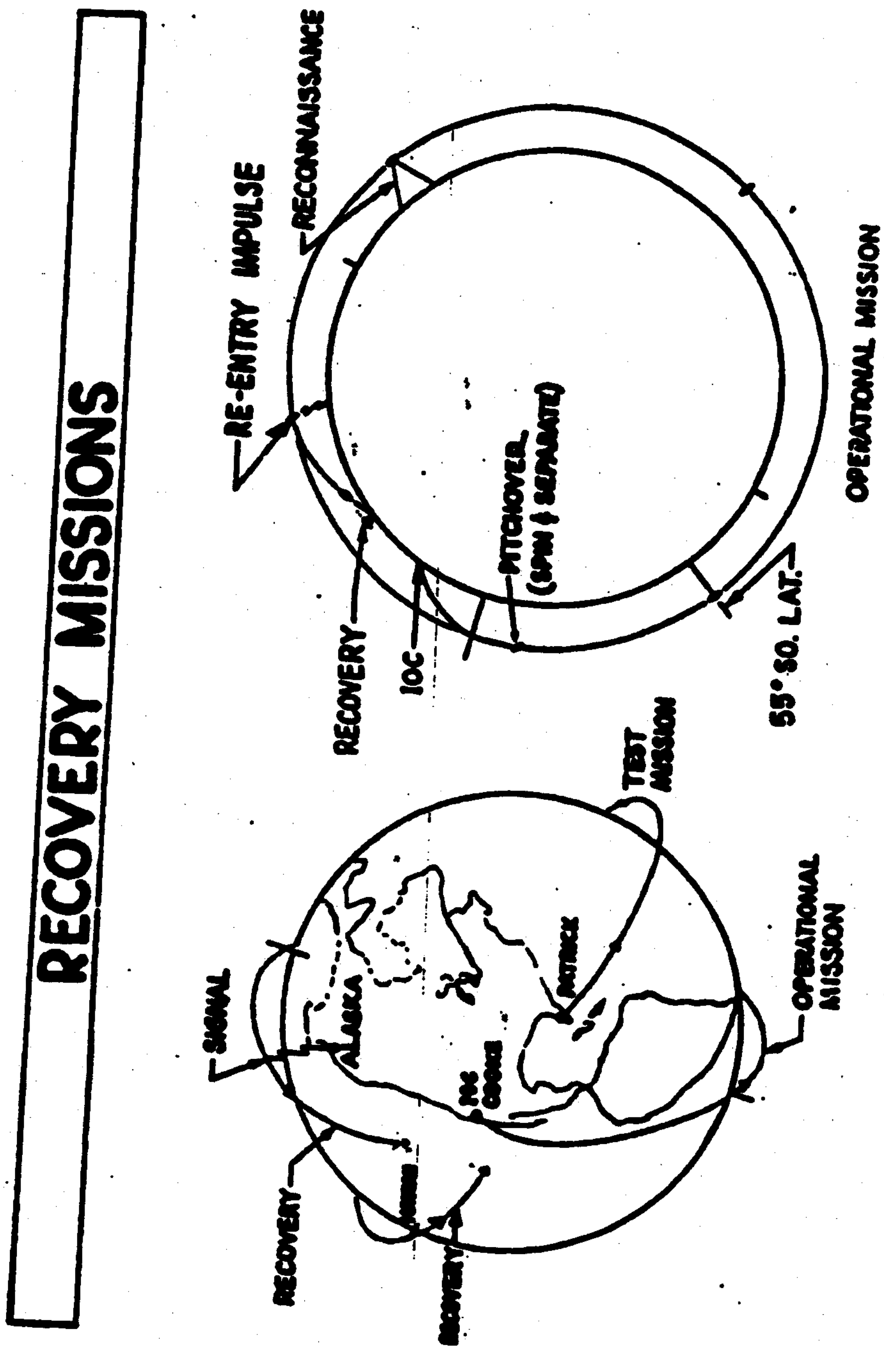

RECOVERY MISSIONS
RE-ENTRY IMPULSE
RECONNAISSANCE
OPERATIONAL MISSION
PITCHOVER (SPIN & SEPARATE)
RECOVERY
IOC
55° SO. LAT.
TEST MISSION
SIGNAL
ALASKA
PATRICK
OPERATIONAL MISSION
RECOVERY
RECOVERY

Fig. 1-3

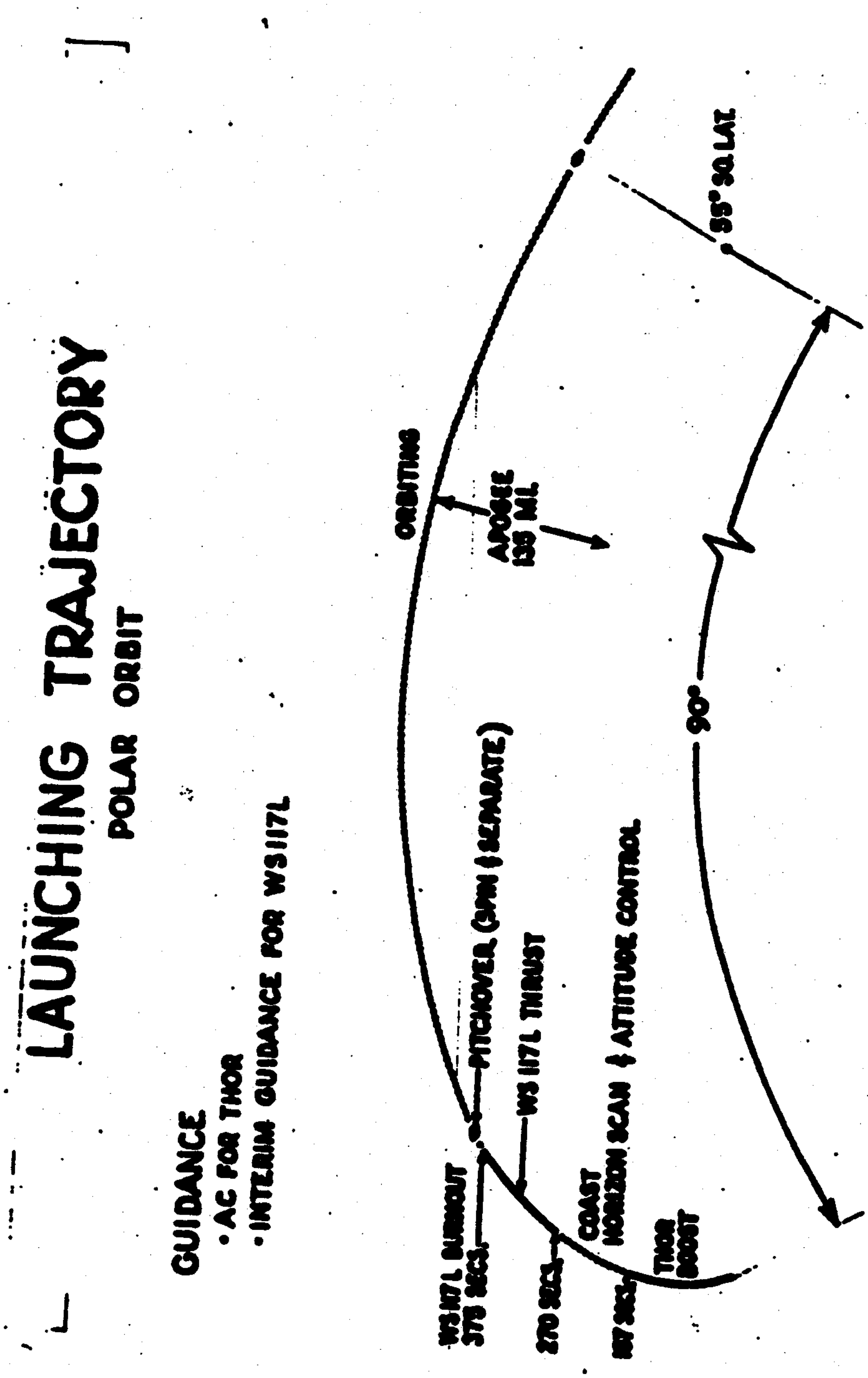

LAUNCHING TRAJECTORY
POLAR ORBIT
GUIDANCE
• AC FOR THOR
• INTERIM GUIDANCE FOR WS117L
ORBITING
APOGEE 135 MI.
WS 117 L BURNOUT 375 SECS.
PITCHOVER (SPIN & SEPARATE)
WS 117L THRUST
270 SECS.
COAST
HORIZON SCAN & ATTITUDE CONTROL
187 SECS.
THOR BOOST
90°
55° SO. LAT.

Fig. 1-4

encountered as the vehicle reenters the earth's atmosphere. The distance from initiation of the rocket to the impact in the ocean off the West Coast of the U. S. will be about 1500 miles. The CPE of the impact will be approximately 30 miles. Air and/or Naval surface craft will be utilized in recovery aided by radio beacon, SOFAR, and/or sea dye marker signals.

The Recoverable Reconnaissance System selected here is quite similar to the one proposed by RAND (RAND Report RM 2012), but differs in two ways.

First, since the entire WS-117L vehicle goes on orbit before ejection of the capsule, the latter is simply spun up and separated. Second, only the camera and film, and the recovery components are contained within the recovery body which reduces the mass reentering the atmosphere and also gives an improved stability through better center-of-gravity location. Analysis by the Contractor yielded over 100 pounds of ablation material needed for the RAND recovery weight (compared to 60 pounds computed by RAND). By reducing the weight of the system being recovered, retention of the 60 pound figure was allowed.

The panoramic camera system assumed by RAND is a variation of one developed by Fairchild Camera and Instrument Corporation for aircraft application. Fairchild has submitted a proposal to Lockheed for the camera portion of the pre-pioneer reconnaissance system and their material is included in this report.

1.3 Management Aspects

A complex undertaking such as the acceleration of the WS-117L negotiated program requires the contractor to make a careful survey of his capabilities and objectives before assumption of the many responsibilities of such a program. The Management of Lockheed fully appreciates the implications of this effort and is prepared to accept both the responsibility and challenge inherent in it.

In the past, Lockheed Aircraft Corporation has successfully undertaken design and production of many military and commercial aircraft, as well as several guided missile Weapon Systems. These undertakings have allowed the build-up of substantial resources, facilities, equipment, and skilled manpower. LMSD has accomplished a proportionate buildup in both its functional organizations and the WS-117L Project.

Using these people as a nucleus, LMSD will immediately implement additional and expedited efforts to assure that the accelerated program objectives are met. These include standardization of equipment designs, establishment of a close-knit, projectized team of managers, designers, fabrication specialists and test personnel---centrally located--- to assure concentration on problems peculiar to the WS-117L Program. It will also include simplification of drawing release procedures, specification compliance and acceptance procedures; as well as augmentation of test hardware equipment, necessary increase in facilities and maximum use of subcontractor capabilities.

To undertake this complex operation, it is assumed that Lockheed will be given immediate contractual authorization to proceed and will be provided necessary hardware and services (i.e., Atlas vehicles) as required. It assumes availability of appropriate Air Force facilities and supporting services at such locations as AFMTC and the IOC. The expedited approval by the Air Force of such things as subcontracts for purchase of hardware, establishment of DX priority and the approval of necessary overtime on the program is a basic requisite.

As a major consideration, it is assumed that full cooperation will be given by the Air Force in obtaining for the Contractor industrial and test facilities, machinery and equipment as needed in support of the acceleration of the program.

1.3.1 Priority Items

1. The following items are those on which an immediate "go-ahead" or priority action is required in connection with the implementation of an accelerated WS-117L Program:

A. Subsystem A - Airframe

(1) Authority to obtain required data on the shape of the front end of the Thor in early January.

B. Subsystem B - Propulsion

(1) Adequate priority authorization to LMSD by approximately 15 January for the purchase of pressurization system components.

(2) Authority to approve Bell Aircraft's purchase orders for approximately $50,000 in engine materials and parts between 15 January and 1 February 1958.

(3) Authority to negotiate a subcontract with Bell Aircraft for engines, ground handling equipment, and support services in time for a "go-ahead" date of 1 February 1958.

(4) Require adequate priority to obtain solid ullage control rockets from Allegheny Ballistic within six months instead of presently scheduled delivery of 10 months.

C. Subsystem D - Guidance and Control

(1) Authority be granted by approximately 10 January 1958 to:

[redacted]

(a) Initiate a crash program on the horizon scanner

(b) Initiate a crash program on the proportional valve.

(c) Initiate a crash program on the inertial reference packages (or alternately, sufficient priority to be established to procure two Titan reference packages as GFE by 1 April, and one per month thereafter, until the inertial reference packages are available).

D. Subsystem C - Auxiliary Power

(1) Sufficient priority for Engineered Magnetics Company, manufacturers of 400-cycle inverters, to obtain delivery of a frequency standard crystal in 45 days, in lieu of present 90 day delivery schedule.

E. Subsystem F - Electronic Reconnaissance

[redacted]

F. Subsystem H - Ground-Space Communications

(1) Waiver of Military Specifications for drawings as well as JAN Specifications in connection with Philco-supplied equipment and services. Instead, specifications in accordance with good commercial practice should be authorized.

G. Ground Support Equipment

(1) Authority to proceed immediately from design to fabrication, without Air Force design approval, on servicing and handling equipment, and launch control and monitoring equipment.

H. Interim Tracking Stations (Cooke and Hawaii)

(1) TLM-18 concrete foundations are required by July 1958. The Air Force should either provide these or authority should be furnished for direct procurement by LMSD. It would be advantageous for the foundations and antenna installations to be contracted with the antenna subcontractor.

[redacted]

WS-117L PROGRAM ACCELERATION COST

1.4

A. FUNDING SCHEDL.

	Monthly Cost Expend.	Cum. Cost Expend.	Cum. CPFF Expend.	Cum. CPFF Expend. and Commitments
Jan. 58	[redacted]	$ 547,615	[redacted]	[redacted]
Feb.	[redacted]	2,486,390	[redacted]	[redacted]
March	[redacted]	5,237,977	[redacted]	[redacted]
April	[redacted]	8,932,827	[redacted]	[redacted]
May	[redacted]	13,323,807	[redacted]	[redacted]
June 58	[redacted]	17,995,725	[redacted]	[redacted]
July 58	[redacted]	22,933,390	[redacted]	[redacted]
Aug.	[redacted]	28,213,107	[redacted]	[redacted]
Sept.	[redacted]	34,153,150	[redacted]	[redacted]
Oct.	[redacted]	40,280,762	[redacted]	[redacted]
Nov.	[redacted]	46,359,216	[redacted]	[redacted]
Dec. 58	[redacted]	52,363,436	[redacted]	[redacted]
Jan. 59	[redacted]	58,319,742	[redacted]	[redacted]
Feb.	[redacted]	64,304,393	[redacted]	[redacted]
March	[redacted]	70,214,947	[redacted]	[redacted]
April	[redacted]	76,130,064	[redacted]	[redacted]
May	[redacted]	81,951,928	[redacted]	[redacted]
June 59	[redacted]	87,753,435	[redacted]	[redacted]

1.4

WS-117L PROGRAM ACCELERATION COST

B. Price Summary

	Hours	Amount	Amount
Direct Labor-Management	162,299	[redacted]	
-Research & Development	1,472,102		
-Hardware	2,031,433		
Total Direct Labor	3,665,834		
Development Overhead			
Contract & Administrative Expense			
Total Labor & Overhead			[redacted]
Material			
Direct Charges			
Total Material & Direct Charges			[redacted]
Subcontract			
Total Cost			
Fixed Fee			
Total CPFF			

1.4

WS-117L PROGRAM ACCELERATION COST

C. Summary by Subsystem

	Hours	Labor & Overhead*	Material	Subcontract	Total
Management	162,299	$ 1,454,783	$ ---	$ ---	$ 1,454,783
Systems	1,501,249	13,456,636	2,856,032	261,000	16,573,668
Subsystem A	713,076	6,391,745	715,082	---	7,106,827
Subsystem B	244,721	2,193,587	255,549	10,108,530	12,557,666
Subsystem C	57,076	511,608	139,204	2,037,630	2,688,442
Subsystem D	169,554	1,519,818	284,638	578,724	2,383,180
Subsystem E	17,417	156,119	4,912	10,224,552	10,385,583
Subsystem F	[redacted]				
Subsystem G	---	---	---	609,000	609,000
Subsystem H	778,589	6,978,997	1,140,110	16,555,645	24,674,752
Subtotal	[redacted]				

Direct Charges	
Total Cost	3,574,625
Fixed Fee	[redacted]
Total CPFF	6,637,758
	[redacted]

*At Project Average Rates

Subsystem A - Vehicle
Subsystem B - Propulsion
Subsystem C - Auxiliary Power
Subsystem D - Guidance & Controls
Subsystem E - Visual
Subsystem F - Ferret
Subsystem G - Infrared
Subsystem H - Ground-Space Comm.

[redacted]

1.4

WS-117L PROGRAM ACCELERATION COST

D. Summary by Element

	Hours	Labor & Overhead*	Material	Subcontract	Total
Management	162,299	$ 1,454,783	$ ---	$ ---	$ 1,454,783
Research & Development					
Design & Development	471,062	$ 4,222,418	$ 530,119	22,477,182	$27,229,719
Test & Operations	868,982	7,789,227	263,519	1,033,816	9,086,562
Ground Support Equip.	126,672	1,135,440	576,484	1,356,488	3,068,412
Human Engineering	5,384	48,256	---	---	48,256
Q.P.R.I	---	---	---	---	---
Total R&D	1,472,100	$13,195,341	$1,370,122	$24,867,486	$39,432,949
Hardware					
Tooling & Mockup	[redacted]				
Fab. Assem. & Instal.					
Ground Support Fabr.					
Mfg. Services					
Total Hardware					
Subtotal					
Direct Charges					
Total Cost					3,574,625
Fixed Fee					[redacted]
Total CPFF					[redacted]

*At Project Average Rates