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PROGRAM [REDACTED] ASSIGNED

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REPORT ON AGENA D
CONTRACT STATUS

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FOREWORD

In conformance with directives received from Hq USAF and in recognition of the urgency attached to the satisfactory accomplishment of the Accelerated Agena D Program, certain extra-ordinary and unusual technical and contractual relationships were established with the Lockheed Missiles and Space Company, Sunnyvale, California. It is the purpose of this paper to record these relationships, to analyze the effectiveness of this unique management approach in light of the results obtained to date, and to present summary conclusions in response to Hq USAF message AFSSV-EQ 85147 dated 4 May 62.


HENRY B. KUCHEMAN, JR.
Colonel, USAF
Program Director

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INTRODUCTION

Early in 1961, increased activity and mounting costs of space programs forced recognition by AFSSD of the necessity for reducing cost and increasing flexibility through standardization of the Agena stage. In order to establish the technical feasibility of this approach, on 30 June 61, the Agena Standardization Study was authorized. The results of this study were favorable and after approval by Hq USAF and DOD, on 25 August 61, the U. S. Air Force awarded Contract AF 04(695)-21 to the Lockheed Missiles and Space Company for the design, development and production of twelve Agena D satellite vehicles, which were to be standard in nature and capable of being used with a minimum degree of change in various satellite programs. First launch was scheduled for January 1963.

On 17 October 61 the Honorable Dr. Joseph V. Charyk, Under Secretary of the Air Force, appointed a special committee chaired by Mr. Clarence L. Johnson to investigate ways and means of providing a more reliable Agena on an accelerated schedule. This committee reviewed the approach proposed under the standard Agena concept and the capacity of the Lockheed Missiles and Space Company for accelerating the approved schedule. It was the conclusion of the committee that a more reliable standard Agena could be produced to support a 28 June 62 first launch provided extraordinary and unusual technical and contractual relationships were established

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and rigorously adhered to by both the Contractor and the Government. The management principles proposed by the Johnson Committee were reviewed by Hq USAF and approved as the basis for program management. In general, these ground rules apply a streamlined AF/Contractor management concept and include a DX priority, reduction in formal procedures, exclusion area in which to perform the work, and extraordinary program management channels. To insure compliance by both parties, these 'ground rules' were actually made a preamble to the contractual work statement for the accelerated Agena D program. For a more detailed description and procedures, refer to Part II of the Abbreviated Program Plan, Program 662A (648B) dated 22 December 61.

The prime objectives of the accelerated Agena D program are:

1. To produce a more reliable standardized basic vehicle capable of performing essential ascent and/or orbital functions derived from common mission requirements of the following programs: 622A, 201, 698AL, 102, 239A, 621A, 698AM, 698AA, Advent, Rebound and Ego in accord with the accelerated schedule and within the allocated budget.
- b. To provide a fixed-price procurement source for Agena D vehicles with a production capacity of five vehicles per month.

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I. CONTRACTS

A. Background. In compliance with guidance received from Hq USAF (Reference Hq USAF messages (1) AFSDG-F 82350 dated 30 Nov 61, (2) AFSPM 80799 dated 22 Nov 61, and (3) AFSSC-EQ 90915 dated 5 Jan 62, see Annex A for copies) two separate contracts have been established to accomplish the stated objectives of the accelerated Agena D program. The basic development/engineering contract (AF 04(695)-21) provides the necessary engineering capability and industrial base for the design, development, fabrication, assembly, qualification and test of twelve prototype Agena D flight vehicles with initial delivery to support a June 1962 first launch. This contract also provides as a primary objective, creation of the 'Procurement Package' to permit a fixed price procurement and the creation of a capability for production at the rate of five Agena D vehicles per month. The follow-on production contract (AF 04(695)-68) has been established to support an initial delivery of 39 Agena D vehicles with an initial production rate established as four vehicles per month.

B. Development/Engineering Contract

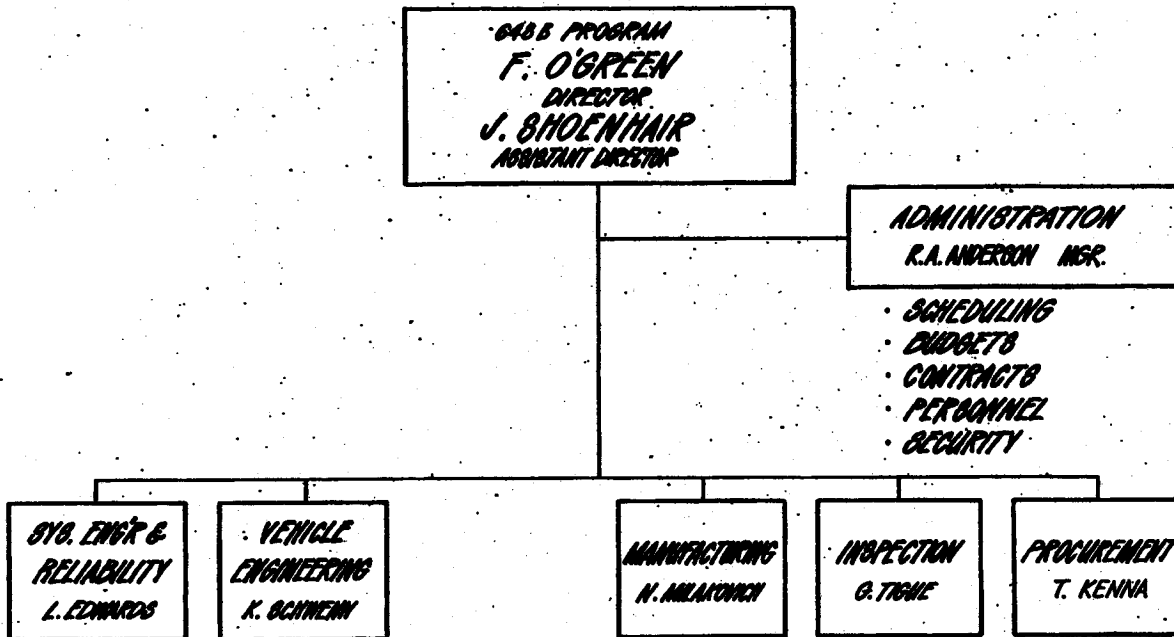
1. General. The Development/Engineering Contract (AF 04(695)-21) was written originally to support the standard Agena program authorized on 25 August 61. In order to accomplish the objectives of the acceleration, however, the management approach to this contract was completely reoriented on 7 November 61. In essence, the Lockheed Missiles and Space Company in response to Air Force guidance completely reoriented

[REDACTED]

the organization responsible for management of the vehicle design, fabrication, assembly and test which was in being to support the production of the Agena B. From the outset, it was recognized that it would be necessary to assign one individual across-the-board responsibility for all phases of the Agena D program. Accordingly, LMSC proposed the creation of what might be considered a company within a company, establishing the Agena D program office having responsibilities delineated on the following chart (Figure 1), and reporting directly to the Vice President and General Manager, Space Systems. This organizational approach was dramatic and effective. As much as any other single factor, it has been responsible for the quick response time which has been demonstrated in the performance of LMSC to date. The basic R&D contract was definitized in such a manner that it encompassed all of the requirements for the complete redesign and qualification of the Agena D vehicle. It authorizes the fabrication and use of development tools such as the Propulsion Test Vehicle which was utilized to proof test the orifice pressurization system and the dual start capability of the rocket engine, the Structural Test Vehicles which were utilized to concurrently qualify the forward equipment rack and aft structure, and the Thermal Test Vehicle which was used to verify environmental acceptability of the design. Additionally, a Functional Test Mockup and necessary wood mockups were furnished. In addition, twelve prototype flight articles will be produced, qualified, and checked out under this contract, and provision has been made for the production of a Development Test Vehicle. The DTV will serve now and in the future as a means of installing, qualifying, and where

[REDACTED]

LMSC ORGANIZATION PROGRAM 648 B



FIG#1

necessary, hot firing, program peculiar and component improvement modifications in support of all programs utilizing the Agena D stage. In addition to the above, it is a requirement of the -21 contract that a manufacturing production capability be established which will permit production of Agena D vehicles at the rate of five vehicles per month on a fixed price contract.

2. The Procurement Package. In order that the follow-on production contract might be carried out satisfactorily, it has long been recognized by the Agena D Program Office that a clear definitive statement and understanding of what is to be procured under the production contract and the method of operation must be definitely established. With this objective in mind, it has been a primary goal of the Development/Engineering contract to provide the 'procurement package' for the follow-on production contract. This 'procurement package' consists essentially of the Detail Model Specification, Vehicle Acceptance Test Specification, and Engineering Drawings to define the item under procurement, Hard Tooling, and a new LMSC facility (Building 152) to manufacture the vehicle, and Configuration Control to insure recurring quality. To provide better definition, a brief description of these elements of the 'procurement package' follows:

a. Detail Model Specification. This specification will describe the physical and functional design of the systems and the vehicle, and will give estimated performance capability of the vehicle. All

assemblies and components to the level of the Agena D Master Breakdown in the Advance Vehicle Description, LMSC AO81462, will be identified by their part numbers and by their specification numbers. Also included will be the identification of acceptance test specifications for components to the level of the Agena D Master Breakdown. The Detail Model Specification will specify quality control provisions and will reference the Vehicle Acceptance Test Specification, Item 2 of the 'procurement package'. Appendices will list the optional equipment, MIL-S-8169C, 'Specification, Detail, Guided Missile, Preparation of,' will be used as a guide in the preparation of this document.

b. Vehicle Acceptance Test Specification. This specification prescribes tests to be performed on each vehicle. The tests specified will be those performed on the vehicle in the Agena D systems checkout complex. The tests will validate the vehicles as a unit, and will be used as the basis for acceptance or rejection of the vehicle.

c. Engineering Drawings. The engineering drawings will consist of new Agena D drawings, Agena B drawings which are applicable to Agena D, and subcontractor drawings.

d. Hard Tooling. During the course of the development contract, it was mutually agreed that the tooling which would be ultimately utilized in connection with the production contract would be evolved and employed for the fabrication of the later models of the prototype vehicle. In this manner, it would be possible to transition rapidly into a fixed price

production, assuring maintenance of original quality and configuration without the necessity of additional production engineering. In large measure, this action has been accomplished.

e. Building 152. LMSC has under construction at the present time, a structure known as Building 152, financed with corporate funds approximating \$6,000,000. It has been planned that this facility will be outfitted as the future industrial facility for the Agena D vehicle. Air Force funds in the amount of [REDACTED] have been made available through the Agena D development (-21) contract for the necessary machine tools and equipment to suitably outfit this "Agena factory". Through the creation of this facility, it will be possible for the first time to set up an efficient production line for an orbital stage segregated from other programs and activities at LMSC, Sunnyvale. Cost accounting and price determination will be measurably simplified and this alone should facilitate the fixed price contract price redetermination. Through the combination of segregation of facility and cost accounting, it will be possible from the corporate point of view and that of the Air Force to evolve a more efficient operation and produce the Agena D vehicle at significant savings in unit cost.

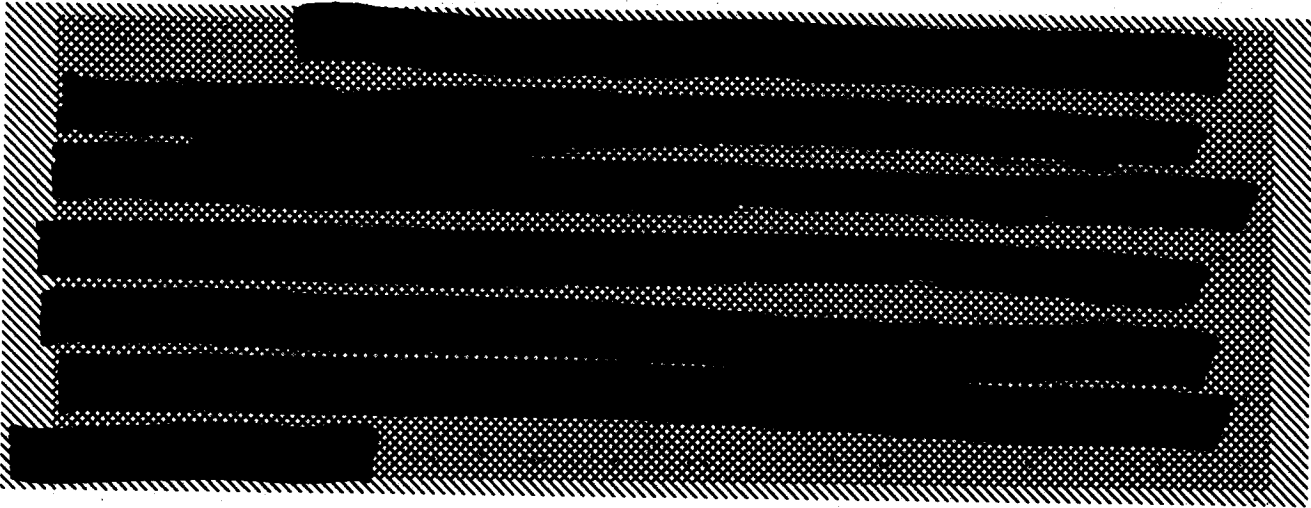
3. Incentive Features of the Contract.

a. In conformance with DOD policy, it was established from the outset of the Agena D program, that the research and development phase was to be contracted as a Cost Plus Incentive Fee contract. The guidance

received from Hq USAF is shown in outline form on Figure 2 which follows on the succeeding page.

b. The features of the negotiated incentive formula for computation of fee are shown in Figure 3 which follows. Briefly, the fee provisions are:

1. Division of Fee: Equal weight will be given to cost, schedule, and performance (1/3) each.



A like procedure applies to underruns. If the final cost is 5% less than the target price, the Contractor's fee is increased by \$31,712, if 10% less, the fee will be increased by \$63,428, etc.

3. Schedule: As to vehicle delivery, the Contractor will receive 9% or [redacted] based upon a target cost of [redacted] if all vehicles are delivered to contract delivery schedule. To permit correction of all reported discrepancies resulting from Air Force Acceptance inspections and to permit delivery of a 'clean' article, the delivery formula provides a two-week grace period without penalty; if

USAF FEE GUIDANCE

● TARGETS

- ▲ REALISTIC
- ▲ PLATEAU MAY BE USED

● PROFIT RANGE

- ▲ EQUAL EXTENT UP AND DOWN
- ▲ FULL STATUTORY LIMIT
- ▲ USE LATEST NEGOTIATED FEE AS TARGET

10

● PERFORMANCE

- ▲ SPECIFY ESSENTIAL PERFORMANCE
- ▲ IF POSSIBLE, USE FINAL OR LAUNCH RESULTS

● MEASUREMENT

- ▲ LIMIT TO A FEW KEY MEANINGFUL POINTS
- ▲ WHERE TANGIBLE MEASUREMENTS ARE NOT AVAILABLE, AF JUDGEMENT WILL APPLY
- ▲ EQUAL WEIGHT TO COST, DELIVERY, PERFORMANCE

● OTHER CONTRACTS

- ▲ ASSURE NO PETRIMENTAL EFFECT ON OTHER PROGRAMS

● ACCT SYSTEM

- ▲ ASSURE SEGREGATION OF COSTS TO PERTINENT CONTRACTS
- ▲ SYSTEM SHOULD PROVIDE COST DATA USEFUL ON FOLLOW-ON

Fig. #2

GRAPHIC PRESENTATION OF FEE PROVISIONS

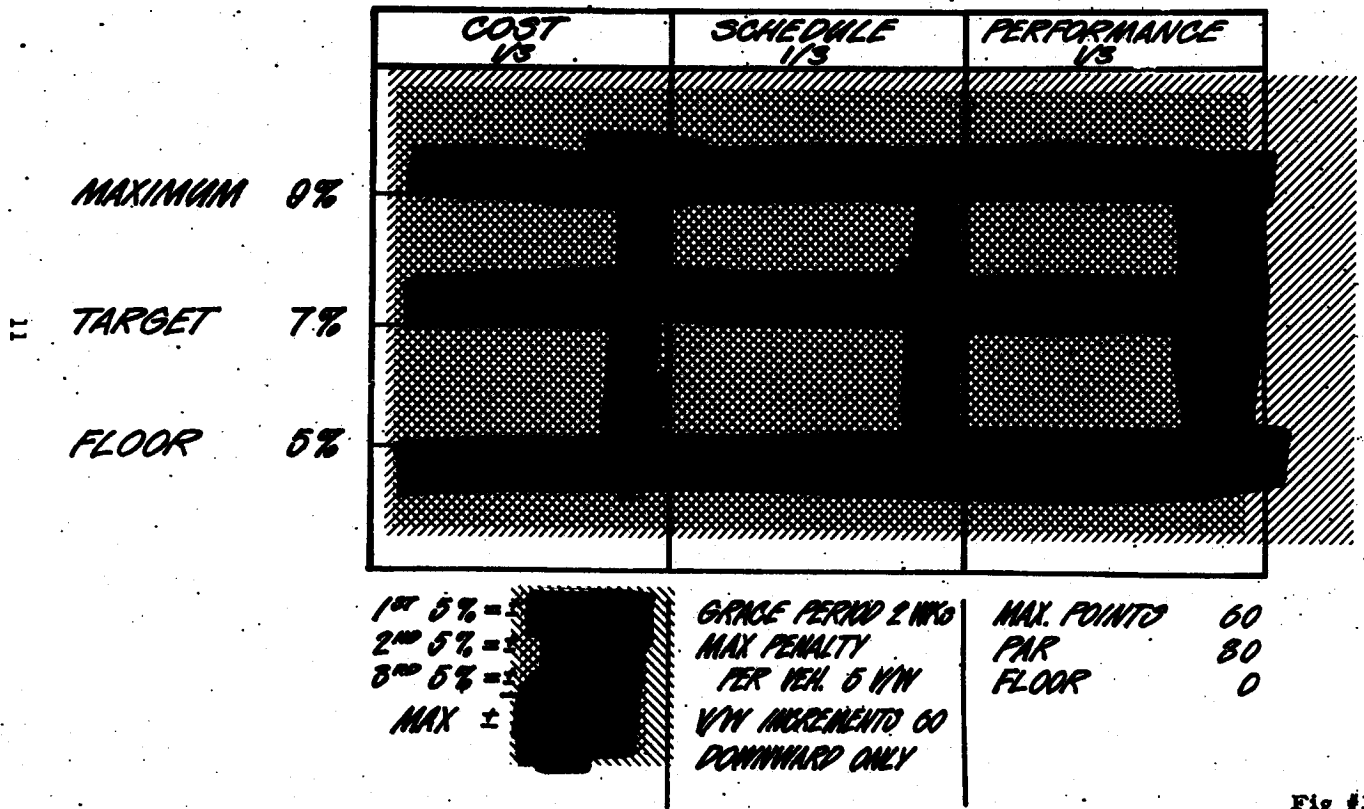


Fig #3

late more than two weeks, the fee is decreased by .0222% of target cost per week for five weeks to a maximum penalty of .111% of target cost per vehicle. If all twelve vehicles are seven weeks or more late, the fee would be reduced to 5% of target cost of [REDACTED]. A detailed procedure has been evolved to determine the actual date and time of 'final' acceptance and delivery for fee purposes.

4. Performance: One of the most significant and unique features of the negotiated incentive fee relates to the payment of the 1/3 fee based upon performance. The Contractor proposed and the Air Force accepted the principle that the Air Force would unilaterally rate the Contractor's performance. LMSC officials suggested a set of criteria as the basis for rating which were similar but not identical to those finally arrived at through negotiation. It is now agreed that the 1/3 fee based upon performance shall be by a point rating system. If the Contractor's performance is rated the maximum of 60 points, the fee for performance will be based upon 9% of target cost of [REDACTED]. A performance rating of 30 points gets the target fee of 7% of [REDACTED] a performance rating of 0 points gets the minimum rate of 5% or [REDACTED].

An Air Force board composed of representatives of the using programs and the Agena D Program Office will be appointed by the Commander, AFSSD, to rate the Contractor's performance within 30 days of the launch of the twelfth prototype vehicle. The board will use the following criteria: 30 points for (1) Reliability, (2) Program Adaptability, (3) Ease of Checkout; 30 points for (1) Weight of Vehicle, (2) Ascent Performance.

Additionally, it has been mutually agreed between the Contractor and the Agena D Program Office that should failure to qualify all components of the Agena D vehicle prior to flight of each of the prototype vehicles delay the flight of any vehicle, a suitable adjustment of the performance fee will be made. This will be the first time that the Agena vehicle will be contractually required to have all components qualified for flight prior to flight.

4. Cost Management

a. LMSC Internal Budgets. The Air Force has established the incentive features of the contract in an effort to control cost, schedules and insure performance. The effectiveness of the incentive features of the contract pertaining to cost immediately became evident when the Contractor established his Program Cost Accounting System. In order to delegate and fix management responsibility and authority, each of the major department heads, i. e., Systems Engineering and Reliability, Vehicle Engineering, Manufacturing, Inspection, Procurement, and Administration have been given individual operating budgets and overtime allocation. These budgets are reviewed weekly by the LMSC and Air Force Program Directors and are tracked against individual organizational allocations and master program milestones that should permit the Contractor to stay within costs allocated to the program. Experience to date has indicated that this method of high lighting and controlling cost has permitted the Program Directors timely access to information which forewarns of potential overruns. This

information has permitted corrective action to be taken in sufficient time to keep expenditures within the budget. It is significant to note that at this point in the program, approximately 60% of the costs have been incurred and program costs are still tracking an expenditure curve which will result in the Contractor completing the contract at or slightly below the target cost established during the negotiation.

b. Agena D Accounting System. In early December 1961 it became necessary for the Agena D Program Office to cause the Contractor to establish a special accounting system for the Agena D program which would satisfy the Air Force Auditor General requirements for the CPFF contract. This has been accomplished to the satisfaction of the Auditor General and should permit the most accurate cost accumulation vs. vehicle production thus far achieved at LMSC Sunnyvale. The main problem with the pre-Agena D accounting system at LMSC, related to the pool charges which were utilized to fund common or centralized facilities and services. It had been the approved technique to prorate these costs among appropriate customer contracts. In large measure, this accounting system limitation has been overcome by the straight line organization created by LMSC for the Agena D program and the fact that the Program Director has been able to negotiate with the remainder of the Corporation for services provided outside his control. The cost accounting system which has been established was mutually evolved among the Contractor, AFPRO, local representatives of the Auditor General's Office, and the Program Office. The breakdown

of the accounting system is in sufficient detail such that the problem of cost analysis for the follow-on contract should be measurably reduced from that of previous development contracts negotiated with the Lockheed Missiles and Space Company.

c. Air Force Auditor General Representative. In order to insure compliance with the Contractor with the agreed procedures and the proper interpretation of the cost accounting system to support the CPIF contract, the Agena D Program Director requested and was assigned early in the program, a full time representative of the Air Force Auditor General's Office as a member of the Agena D staff. This individual has had access to all cost information as it is accrued and is in a position to keep the Auditor General, AFPR, and Program Director informed of the compliance of the Contractor and his current fiscal status at all times. In addition, at the request of the AFPRO, AGO, PCO, and Program Director, he has conducted special investigations and studies as required.

5. Program Control Techniques.

a. In order to avoid the necessity of special reports and briefings by the Contractor to the Air Force Program Office during the course of the accelerated program, the LMSC Program Director extended to the Air Force Program Director and his staff an invitation to attend the weekly internal Lockheed program management meetings. This has become the accepted management tool of both the LMSC and Air Force Program Directors for obtaining a weekly status report on all features of the program.

The 'pipeline meeting', as it is called, is held every Tuesday morning at 0800 hours and consists of a detailed discussion of the following:

1. Action items carried over from previous meetings.
2. Significant accomplishments since last meeting.
3. Problems which have arisen during the reporting period.
4. Items which must be accomplished to stay on schedule and within costs.
5. Review of technical status.
6. Review of subcontractor procurement status.
7. Review of logistic status.
8. Review of qualification program.
9. Financial and manpower status.

The attendees at this meeting consist of the members of the LMSC Program staff through management division level and such additional representation as may be required to adequately answer questions in connection with presentations which are to be given. The milestone technique of program control is utilized with every major segment of the program receiving as detailed review as is required. The presence of the Air Force Program Office at this internal LMSC management meeting has been a unique advantage for the Program staff for it has permitted the Air Force team to participate in the decision making process for all major issues that have arisen to date. Normally the Lockheed Program Director runs the meeting and gives the necessary administrative and technical direction to his staff in a manner that might be considered more appropriate if Air Force

representatives were not present. It is common practice for the LMSC staff and the Air Force program team to present technical and administrative issues and differences that require mutual decision for resolution. By this technique, it has been possible for the Air Force Program Director and the LMSC Program Director to resolve differences on the spot and thereby, expedite the program objectives.

6. Technical Management Interface

a. In establishing the accelerated 648B Program, two of the Johnson Committee ground rules had a marked effect on the internal LMSC exchange of technical information and the AF/LMSC technical working relationships. These were as follows:

1. "Engineering personnel shall be located in an enclosed area immediately adjacent to the tooling and manufacturing area."

2. "Technical directive meetings involving large groups shall not be required. Air Force personnel shall work in close liaison with the LMSC Project Engineer so formal meetings are not required."

b. The LMSC Agent D engineering staff was selected from the existing, experienced LMSC engineering personnel. This staff was moved to an enclosed area which required a special pass to obtain access. These measures were taken to permit the proper concentration of effort and to eliminate interruption by non-Agent D personnel. A special liaison group was established to provide information to the various using programs.

c. It was realized that the normal Air Force technical direction and monitoring efforts would be ineffectual and time consuming

for such a rapidly moving program. The Johnson Committee rule, 2 above, was written to require a type of modified operation. A team of highly qualified Air Force officers from Air Force Space Systems Division were assigned the responsibility of directing this effort. This team spent a major portion of their time in residence at LMSC (approximately three days per week) and worked very closely with the LMSC engineering staff. Members of the team attended a large number of the technical and policy meetings, assisted in the discussions and in arriving at decisions. By being present during these formative discussions, there were minimum delays in obtaining Air Force approvals. Personal contact with all engineering personnel was fostered. The Air Force had complete access to LMSC internal correspondence, calculations and engineering data which was a substantial assistance in monitoring the development program.

d. Although the 648B Program personnel spent a major portion of their time at LMSC, the program team was normally split between their AFSSD and LMSC offices. To eliminate delays, a direct phone line was installed between the two offices. This provided a rapid means of communication and has proved very effective. Formal correspondence and paperwork has been kept to a minimum. Internal LMSC engineering reports, design reviews and analysis have been used throughout the program. Formal agreements have been recorded as memorandum of understanding or memorandum for the file.

7. Vehicle Acceptance Procedures.

a. The team concept of acceptance as used on Agena Bs has been instituted for the Agena Ds. It is planned that after the model specification,

test specification and test procedures have been approved and thoroughly tried out, the acceptance of vehicles will become the responsibility of the Air Force Plant Representative. In the interim, however, the Acceptance Team currently consists of three members of the AFSSD 648B Directorate, one of whom serves as Chairman, two members from the Air Force Plant Representatives Office (Quality Assurance), a member from the Air Force using program office, and a member from the LMSC using Program office.

b. Acceptability of the vehicle for delivery to the Government is determined by review of the test results during the assembly process at the rack and module level, and during final system test, and through physical inspection of the vehicle. A final integrated system test is made prior to acceptance of the vehicle. This test run simulates a representative ascent mission and exercises all equipment to be used in the vehicle. The data is then processed and made available for review of the Acceptance Team. An acceptance data table (Table 5) is completed for ease of review. Also the vehicle log is provided which gives a complete story of the vehicle from beginning of assembly until it is offered to the Air Force for acceptance. After completion of the system test and analysis of the data, the vehicle is thoroughly inspected by the LMSC inspection organization, which is followed by the LMSC engineering staff inspection. After working off all discrepancies, it is turned over to the Air Force for physical inspection. The engineering members of the Acceptance Team and the AFPR (QA) Inspectors then inspect the vehicle.

c. After physical inspection of the vehicle and review of the data, a formal acceptance meeting is held. At that time, an LMSC letter certifying the vehicle's acceptability to applicable design and specification is provided, signed by the LMSC Agena D Program Director. The meeting is held primarily to provide answers to the Air Force on any problems, omissions, discrepancies that have been uncovered. The acceptability of the vehicle to the terms of the contract is determined at this time. Should the vehicle be unacceptable, a detailed listing of discrepancies is formally provided to LMSC for necessary corrective action and subsequent reoffer of the vehicle. The contractual aspects of the incentive fee pertaining to schedules has been formally documented by memorandum between the LMSC Program Director and the Air Force Program Director.

8. Funding. Since the Agena D is a standard launch vehicle which will be utilized by a large number of space programs, originally it was proposed that the development cost, in toto, be funded by reimbursable funding techniques thereby passing along to the using programs, their pro-rated share of this cost. This approach to funding was disapproved by the Department of Defense and recent guidance received from Hq USAF indicates that appropriated funds totaling 39.9M will be used to finance the basic development/engineering (-21) contract. The fund requirement and method of financing is shown on the following table (Table 1).