8 JUL 1970

BYE-107750-70
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MEMORANDUM FOR: Director, National Reconnaissance Office

SUBJECT : Request for Approval to Initiate the System Definition Phase of the Electro Optical Imaging Program

REFERENCES : A. BYE-8098-70, dated 26 February 1970
B. BYE-12762-70, dated 6 April 1970
C. BYE-6395-70, dated 16 April 1970

1. On 26 February, I submitted to you a status report on the Electro Optical Imaging Program (Reference A). This status report concluded that all of the technology programs underway in support of the EOI system had exceeded the goal set for that time period. In particular, the critical technology concerned with the development of the Solid State Arrays had demonstrated satisfactory performance, not only in chip level photoelectric testing, but in breadboard level actual image testing. Subsequent to this status report you approved an additional [redacted] along with authority to initiate a series of system design studies for both the Imaging Satellite and the Processing Facility (Reference B). At that time you also stated your intention to review the status of the program in July 1970 and in consultation with ExCom decide whether or not to proceed with the System Definition Phase of the EOI Program.

2. I can now report to you that progress in the EOI Program has been satisfactory in all areas. This memorandum together with its attachments summarizes briefly the overall program status with particular emphasis on progress since February and recommends that you approve the initiation of System Definition on 1 August 1970. I am proposing three alternative approaches to the System Definition Phase of the program. The first of these

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alternatives maintains a broader competitive environment for a somewhat longer period of time at the penalty of increased FY 71 costs. The second alternative maintains an adequate competition during the entire System Definition Phase, but reduces the number of competing contractors earlier in that phase at some cost savings. The third maintains the broader competitive environment with lower FY 71 costs at the penalty of delaying system acquisition start by four months. Recognizing the potentially difficult budgetary problems you are facing in FY 72, I am also suggesting alternative approaches to the first year of the acquisition phase of the program.

Program Status

In March 1970 a number of parametric System Design Studies were initiated both for the Imaging Satellite system segment and for the Processing Facility system segment. Four contractors were funded in the Imaging Satellite area and three in the Processing Facility area. Final oral reports from all contractors were received during the last two weeks of June. The results of these studies have been most gratifying. In every case the contractors exerted a maximum effort on these studies, both in terms of key personnel and in terms of corporate assets. The results of the system studies are discussed in Attachment 1.

The contractors were tasked to explore a range of potential performance requirements with the objective of determining the sensitivity of system design, program risk, and program cost to these performance characteristics. Based on these parametric studies the contractors were required to identify a limited number of point designs and explore these designs in depth. In the Imaging Satellite area there were no dramatic divergences among the four contractors in their approaches to the engineering problems. In no case did any contractor identify a critical technology problem which had previously gone unrecognized. In all cases the range of point design selected resulted in a factor of two in program costs from the lowest performance, least expensive configuration to the highest performance, most expensive configuration.

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The Processing Facility study contractors were also tasked to approach the design of the image reconstruction equipment parametrically and perform point design studies both for a real time system and for a system which records the image data and later reconstructs at lower rates. In all cases reasonable designs were identified. The cost of the essential data processing and image reconstruction equipment is less than was originally estimated. The cost of the overall Processing Facility is strongly influenced by requirements in support of the exploitation process over and above on line image reconstruction that this facility be required to meet.

Based on the result of these initial systems studies work packages for the Phase I System Definition activities have been prepared. These work packages are now in draft form and can be ready for release to contractors by 1 August 1970.

Development activities on both the Westinghouse and TRW Solid State Arrays has progressed rapidly. Both contractors have met their June schedules for delivering second generation array breadboards. In both cases these breadboards are multichipped and are mechanically aligned to flight specifications. TRW has delivered a twelve chip module assembled from twelve Integrated Chip Assemblies designed to flight configuration. The Westinghouse breadboard has been delivered to [redacted] where it is currently being used for the [redacted] test program. The TRW array is to be delivered to the RCA Image Processing Lab for imaging tests.

Both contractors have continued to fabricate detector chips and accumulate performance data on these chips. The original program plan called for the delivery of test data on 200 "good" chips by mid-June. Although some test data has been delivered, both contractors are running four to six weeks behind this initial schedule. Attachment two summarizes performance data for both contractors. The initial data from TRW indicates noise performance approximately a factor of two worse than the January data package and better response uniformity than in January. The

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initial Westinghouse data flow shows noise performance a factor of two better than that of January and the same excellent uniformity.

Work is also progressing at both contractors on preliminary designs of flight configurations for both the arrays and associated data processors. Interface meetings have been held between both array contractors and the optical system contractor. In addition, development work has been started on other micro-electronic circuits which will be needed for the data processing system.

Particularly notable progress has been made with the Image Chain Simulation experiments. This program was initiated in order to obtain actual imagery which would be characteristics of various potential EOI system designs (Attachment 3). A complete range of images have now been generated covering image quality characterized by ground sample dimensions of [redacted] up to 24 inches. These experiments confirm that the original design point at a signal to noise ratio greater than five was a sound selection. More important, however, the recent studies confirm the earlier analytical predictions that the Solid State Array detectors have imaging characteristics appreciably better than the imaging characteristics of silver halide film. These test results along with other experimental work indicate that the earlier assumption that a 12 inch ground sample (GSD) would yield image quality equivalent to the earlier initial Gambit system are extremely conservative. Current indications are that an EOI system designed to give 12 inch GSD at a signal to noise ratio of five will yield imagery of interpretability comparable to that of the Gambit-3 system.

This conclusion is particularly significant in light of the results of the Imaging Satellite system design studies. These studies have shown that feasible system designs exist using Solid State Arrays and [redacted] optical systems which will yield [redacted] GSD. Thus, it is possible to contemplate EOI system design which provides image quality better than that of the current Gambit-3 system and therefore, when operational could replace this sytem. Alternatively, the performance requirements

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for the EOI system could be relaxed to 18 inch (or even perhaps 24 inch) GSD and still meet many of the USIB requirements for a readout system at significantly reduced costs.

Work on the optical element fabrication program has progressed unexpectedly well during the past three months. At the time of this writing the first lightweight secondary mirror (aspheric element approximately has been finished to flight specifications (less than 1/50 wave rms surface error). This milestone has been met several months ahead of the anticipated schedule. The first lightweight primary mirror was delivered to in March. Initial figuring of the piece has progressed well and is currently within one wavelength peak to valley error of the desired figure. The lightweight piece reached this stage of processing in approximately one month which is an improvement of almost two months for similar progress with the solid piece. has also delivered an optical design package to serve as input to the Phase I System Definition studies.

Table 1 shows a summary of FY 70 funding by project. Work in all areas has progressed, with only minor deviations, at the pace initially anticipated. Work in the optics, and other subsystem development programs is described in Attachment 5.

The interface between the Electro-Optical Imaging program and the Air Force Data Relay Satellite program managed by SAMSO has been progressing satisfactorily. The Data Relay Satellite program plan is now completely coordinated and synchronized with the overall Electro-Optical Imaging program plan. The Air Force funded advanced development programs are all funded and well along. SAMSO has completed a source selection with the objective of initiating two parallel Data Relay Satellite system level design studies. SAMSO is prepared to proceed with these studies but at this writing funding has not been released to SAMSO for this purpose.

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Program Options

The program plan outlined in Reference A provided for a System Definition Phase of approximately one year duration followed by an acquisition phase of approximately three years duration. The March ExCom decision which deferred the System Definition Phase but provided for FY 70 funding of Systems Design Studies resulted in slipping the System Definition Phase start to 1 August 1970. The current schedule, contingent upon ExCom approval to initiate System Definition on 1 August, is summarized in Table 2.

During the month of June, a complete review of the overall program status has been conducted and final oral reports from all of the system studies have been received. Based on these activities three alternative program plan options for FY 71 have been formulated.

Option 1 is similar to that submitted in the Office of Special Projects FY 71 Budgetary Requirements (Reference C). This option is summarized in Table 3. The majority of the funding required under Option 1 is allocated to continued funding of the subsystems advanced development activities. The System Definition portion of the program is divided into two phases for both the Imaging Satellite and the Processing Facility. During Phase 1, four Imaging Satellite contractors and three Processing Facility Contractors will be funded for competitive design studies. These seven contractors are the same ones that have been funded for the systems design studies just completed. In December 1970, two Imaging Satellite contractors and two Processing Facility contractors would be selected to proceed into Phase II System Definition. The objective of this phase would be to proceed with detailed design of a selected systems configuration and with the development of detailed costs and schedule proposals. These proposals are to be completed by the end of June 1971 and evaluated during July and August. Based on this evaluation, a contractor team could be selected and acquisition phase of the program initiated on 1 September 1971.

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Option 2 for FY 71 was constructed with the objective of reducing program costs for that fiscal year to a minimum. This is achieved primarily by reducing the number of systems level contractors competitive for the program from a total of seven down to four. Under Option 2 an RFP for the Imaging Satellite System Definition Phase and a second RFP for the Processing Facility System Definition Phase would be issued to these seven contractors on 1 August. Responses would be required by 14 September and a three week proposal evaluation phase would be conducted. By 6 October, two Imaging Satellite contractors and two Processing Facility contractors would be selected and a nine month System Definition Phase would be initiated. This phase, as under Option 1, would be completed by June 1971 with the delivery of two detailed cost/schedule proposals for the Imaging Satellite and similarly two proposals for the Processing Facility. Again as under Option 1, System Acquisition Phase could be started on 1 September 1971. In a further effort to reduce FY 71 costs, Option 2 also deletes NRO funding of communications technology and the flight computer. Although there is some increase in program risk both in the communications technology areas and in the flight computer area, Option 2 is acceptable and stands a good chance of meeting all program objectives. With the deletion of the communications technology, the Imaging Satellite is entirely depended upon the SAMSO funded RF component technology. The deletion of flight computer development at this time represents some increased program risk. This risk would have to be periodically reassessed during the course of the System Definition Phase and appropriate reprogramming actions initiated if that risk is judged to be too high.

Both in the case of Option 1 and Option 2 there are two alternative FY 72 program options. The funding requirements for these two options are also found in Tables 3 and 5 respectively. FY 72 Option A contemplates proceeding with a high performance Electro-Optical Imaging System with a ground sample dimension in the [redacted] range. The Imaging Satellite system studies have shown this to be a feasible design objective, but at high program development costs than the lower performance options. However, Option A would lead to the development of an Imaging Satellite with sufficiently high performance to replace Gambit-3 program.

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FY 72 Option B postulates the development of a lower performance Imaging Satellite with a ground sample dimension in the range of 16-18 inches. This system would lead to image quality somewhat better than the original Gambit system but probably not of sufficient quality to justify the termination of the Gambit-3 program. Option B leads to reduced overall program cost and in particular leads to significant reductions in FY 72 budget requirements. However, since this lower performance Imaging Satellite would probably lead to a further development program to achieve high imaging performance, eventually the total program costs of Option B have been estimated appreciably higher than those of Option A.

Option 3 is similar to Option 1 in total content but results in a four month delay in the start of Systems Acquisition. Table 6 gives schedule details for Option 3. System Definition starts in August 1970 under this plan but completion of Phase II does not occur until November 1971. The extension of the System Definition phases results in lower FY 71 and FY 72 system funding requirements. Table 7 presents Option 3 funding estimates. The technology development programs are also streched out under this option so that the same program content planned in Option 1 is achieved but completion of the work is four months later. Corresponding funding levels are detailed in Table 7. The technical risk involved in this plan is similar to that of Option 2. Deletion of the R/F component technology work makes the I/S dependent upon the SAMSO R/F work and deletion of the computer development represents some increased program risk. The risk would have to be periodically reassessed during the course of System Definition and appropriate reprogramming actions initiated if necessary.

In the case of Option 1 or Option 2 FY 72 cost reductions could also be achieved by extending the System Acquisition Phase schedule. This can be most efficiently accomplished by completing contractor selection in July and August 1971 and then initiating a six month preliminary design phase at limited funding. This phase could then be followed by a full System Acquisition go-ahead in March 1972. This approach to the System Acquisition would probably extend the schedule by four to six months at a small overall increase in program costs. However, there would be a resulting reduction in FY 72 funding requirements and also probably some reduction in total program risk.

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A discussion of the Program Plan is presented in Attachment 4.

Summary

In summary, there appears to be no engineering feasibility questions unresolved at this time. In addition, a successful and extremely valuable round of systems design studies have been completed laying excellent ground work for a System Definition Phase. There are funding alternatives for both FY 71 and FY 72. However, it is strongly recommended that a System Definition Phase be initiated in August 1970. The requisite contractor teams have been assembled and have demonstrated their understanding of the total problem. In addition, the advanced development programs have proceeded to a point where meaningful systems design can be accomplished. Further delays at this time would yield diminishing returns and would delay the eventual acquisition of an Electro Optical Imaging system capability.

CARL E. DUCKETT
Deputy Director
for
Science and Technology

ELECTRO-OPTICAL IMAGING PROGRAM
FY 70 APPROVALS
($ THOUSANDS)

A. IMAGING SATELLITE

1. System Design Studies
2. Transducer
3. Image Processing Laboratory
4. Digital Tape Recorder
5. RF Components
6. [redacted]

B. PROCESSING FACILITY

1. System Design Studies
2. Image Processing

C. OPTICS

1. [redacted]
2. [redacted]
3. Optical System Studies - [redacted]

[redacted]

Table I

ELECTRO-OPTICAL IMAGING PROGRAM

PROGRAM PLAN

OPTION I

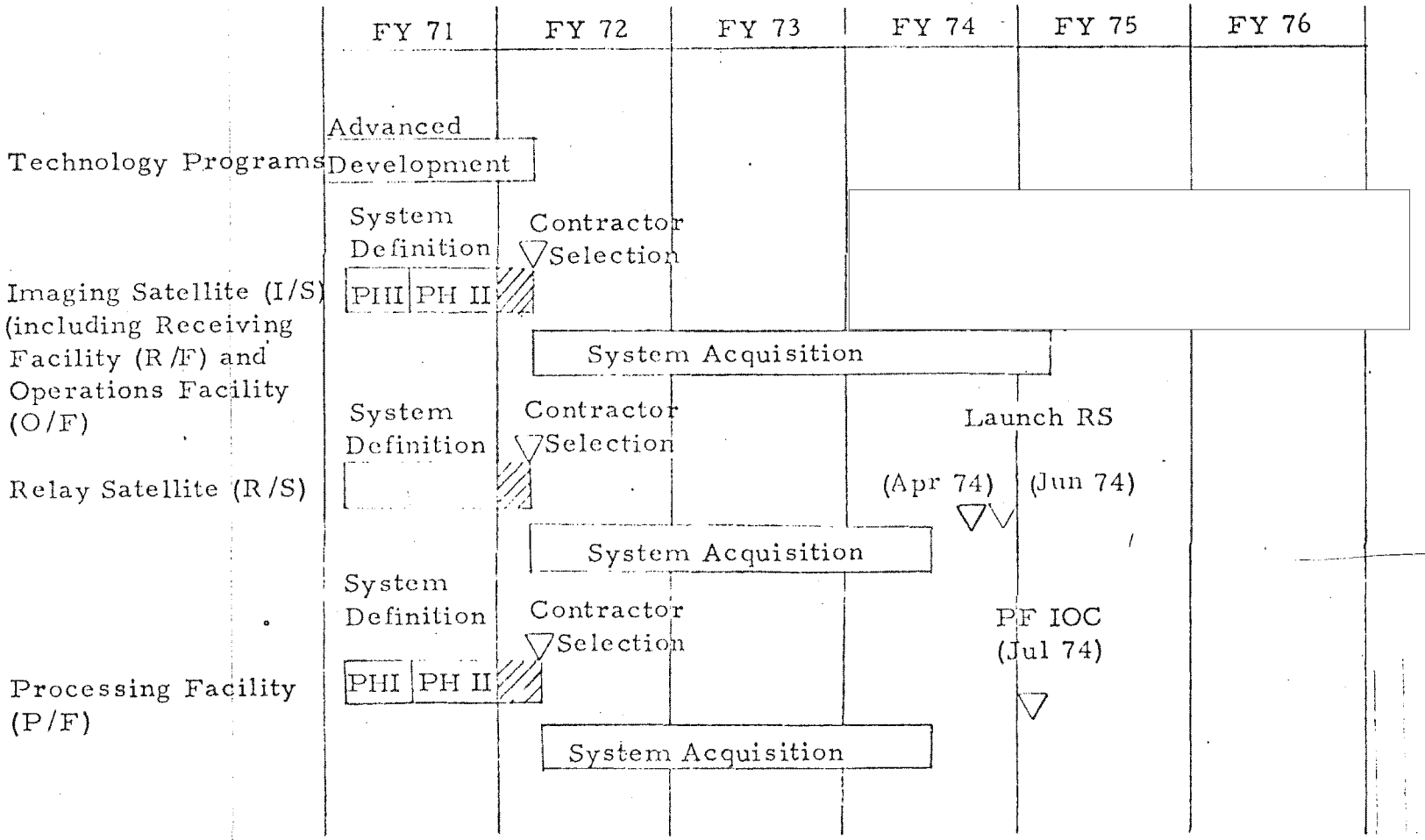

Table 2

SUMMARY - FY 71 FINANCIAL PROGRAM AND FY 72 BUDGET RECOMMENDATIONS
($ THOUSANDS)

	OPTION 1 FY 71	"A" FY 72 (6")	"B" FY 72 (18")
A. IMAGING SATELLITE			
1. System Design and Definition			
2. Solid State Transducers			
3. Optics			
4. Digital Tape Recorder			
5. Communication Technology			
6. [redacted]			
7. Flight Computer			
8. System Acquisition			
B. PROCESSING FACILITY			
1. System Design and Definition			
2. System Acquisition			
C. IMAGE CHAIN PERFORMANCE DEFINITION			
1. Image Chain Analysis			
2. Image Processing Lab			
D. TECHNICAL CONSULTANT			
E. LAUNCH VEHICLES			
1. Boosters			
2. LVI			

Table 3

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ELECTRO-OPTICAL IMAGING PROGRAM

PROGRAM PLAN

OPTION 2

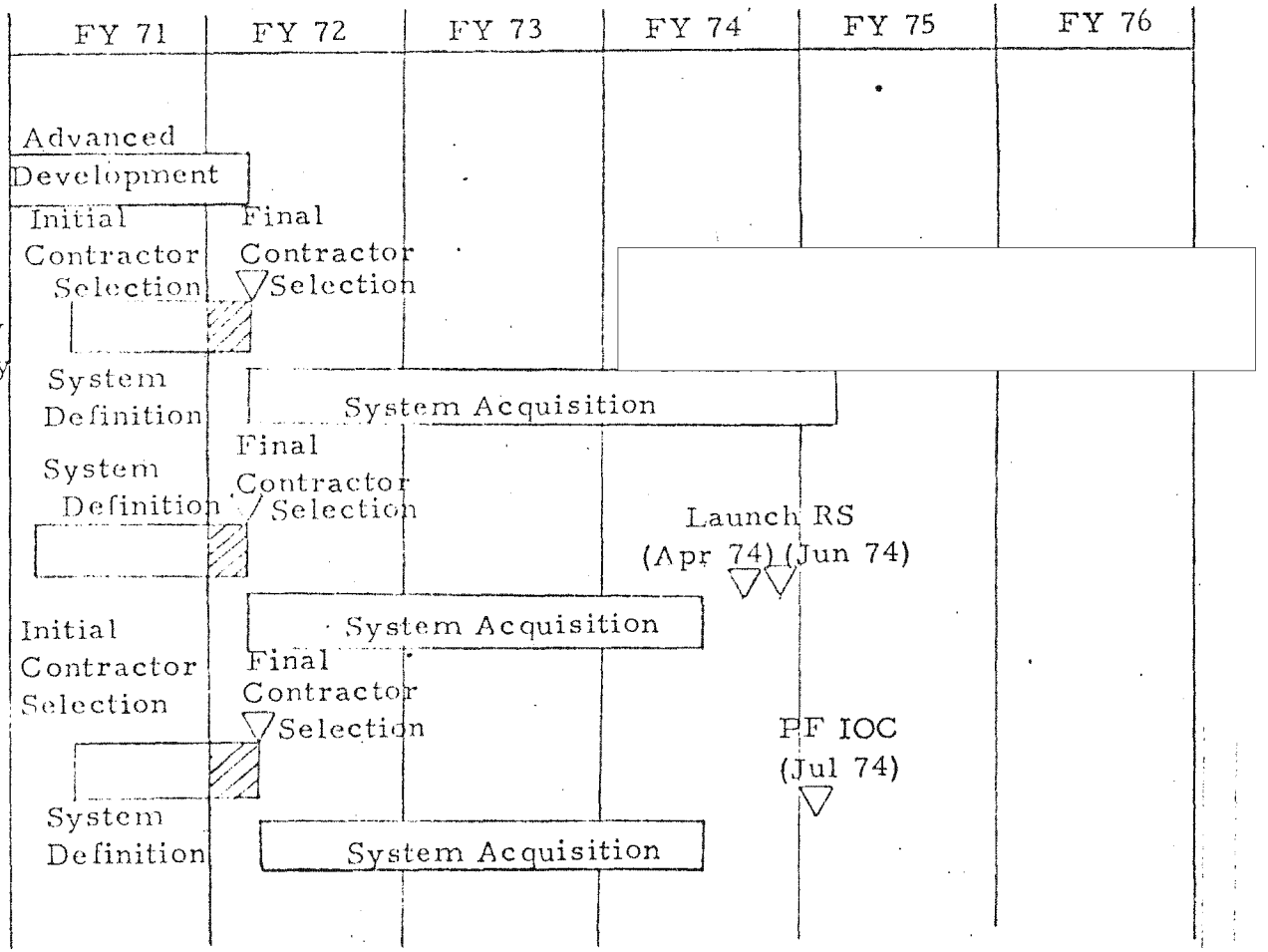

Table 4

ELECTRO-OPTI L IMAGING PROGRAM
SUMMARY - FY 71 FINANCIAL PROGRAM AND FY 72 BUDGET RECOMMENDATIONS
($ THOUSANDS)

	OPTION 2 FY 71	"A" FY 72 (6")	"B" FY 72 (18")
A. IMAGING SATELLITE			
1. System Design and Definition			
2. Solid State Transducers			
3. Optics			
4. Digital Tape Recorder			
5. Communication Technology			
6.			
7. Flight Computer			
8. System Acquisition			
B. PROCESSING FACILITY			
1. System Design and Definition			
2. System Acquisition			
C. IMAGE CHAIN PERFORMANCE DEFINITION			
1. Image Chain Analysis			
2. Image Processing Lab			
D. TECHNICAL CONSULTANT			
E. LAUNCH VEHICLES			
1. Boosters			
2. LVI			

Table 5

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HANDLE VIA BYEMAN CONTROL

ELECTRO-OPTICAL IMAGING PROGRAM

PROGRAM PLAN

OPTION 3

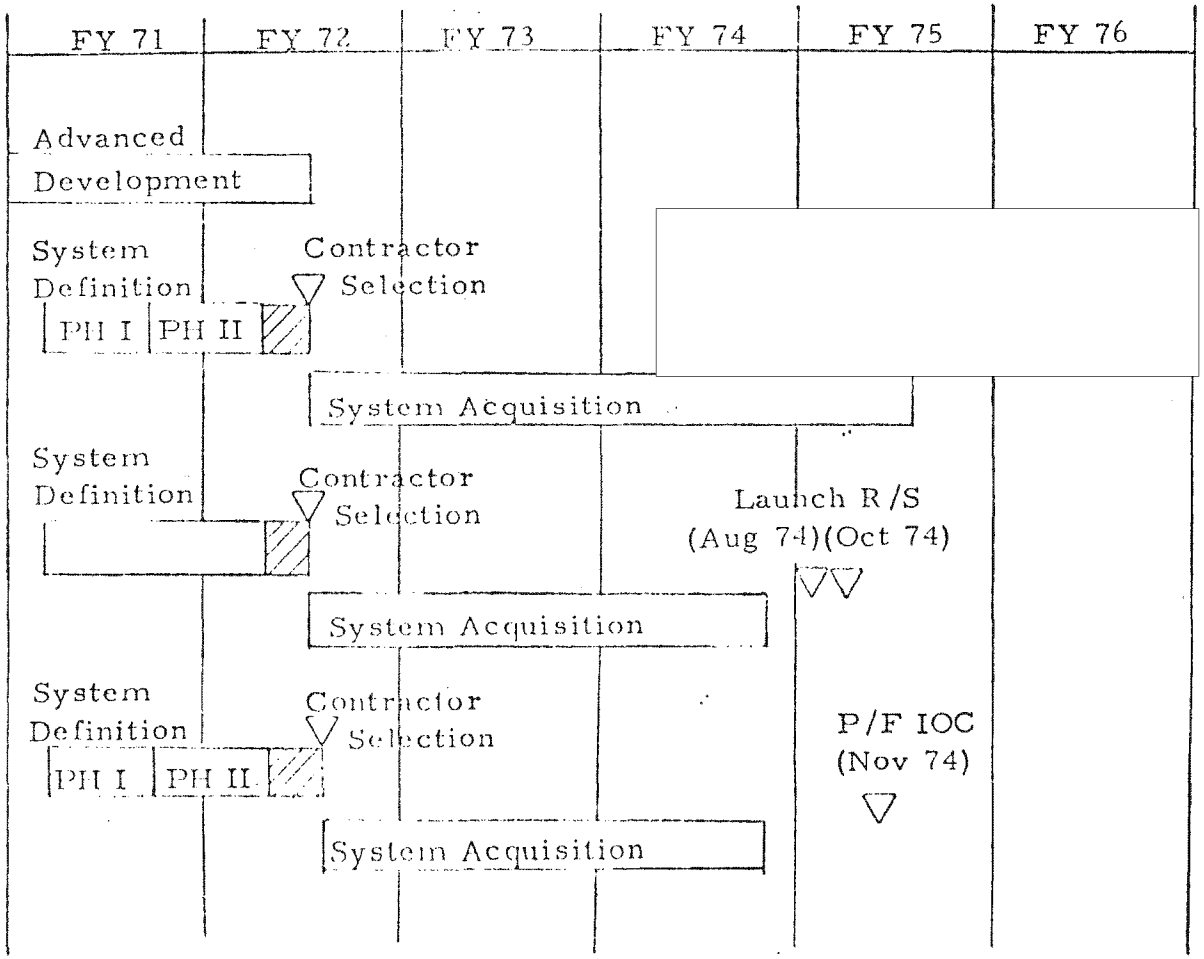

Table 6

ELECTRO-OPTICAL IMAGING PROGRAM
SUMMARY - FY 71 FINANCIAL PROGRAM
AND FY 72 BUDGET RECOMMENDATIONS
($ THOUSANDS)

	OPTION 3	FY 71	FY 72
A. IMAGING SATELLITE			
1. System Design and Definition			
2. Solid State Transducers			
3. Optics			
4. Digital Tape Recorder			
5. Communication Technology			
6.			
7. Flight Computer			
8. System Acquisition			
B. PROCESSING FACILITY			
1. System Design and Definition			
2. System Acquisition			
C. IMAGE CHAIN PERFORMANCE DEFINITION			
1. Image Chain Analysis			
2. Image Processing Lab			
D. TECHNICAL CONSULTANT			
E. LAUNCH VEHICLES			
1. Boosters			
2. LVI			

Table 7

Attachment Four
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PROGRAM PLAN

Introduction

The Electro-Optical Imaging Program objective is the development of a reconnaissance satellite system yielding a continuous and responsive flow of imagery data to the Intelligence Community. The system will provide a major new capability with applications over a broad range of strategic intelligence problems. The general system functional requirements have been developed by the Intelligence Community to define the EOI System configuration and operation to meet the intelligence needs most effectively.

The system concept involves three major elements: the Imaging Satellite, a network of Relay Satellites and CONUS ground facilities including a Receiving Facility and a Operations/Processing Facility. The Imaging Satellite will provide continuous on-orbit availability with a minimum life expectancy of one year. The Relay Satellites will provide continuous communications capability between the Imaging Satellite and ground facilities. The CONUS ground facilities will deliver near real time readout through the Processing Facility. A range of system configuration concepts has been developed during the system studies. These are being examined until all major subsystems have been evaluated in a total systems consideration.

The Relay Satellite network development is proceeding under the direction of the Space and Missile Systems Organization (SAMSO) supported with USAF funds. Close coordination is maintained with SAMSO to integrate the performance requirements for the Relay Satellites with the other elements of the EOI System.

Program Plan

The EOI program plan is proceeding in the following phases:

A. Advanced Development

B. System Definition

C. System Acquisition

D. Initial Operational Capability

The FY 70 Advanced Development phase has been successfully completed in both the key technology development areas and the system studies. The required progress has been made and scheduled milestones have been achieved. This phase has provided the data base on which the subsequent phases will rely.

Three options are presented for consideration in proceeding into System Definition. Schedules and cost estimates have been developed for all options. The options are described in the following actions.

Option 1

This option provides for initiation of System Definition Phase I in August 1970. Overall system level design study activities will be conducted during Phase I to develop a preferred overall configuration in preparation for the competitive System Definition Phase II beginning in January 1971. Four contractors will conduct the Phase I design studies for the Imaging Satellite, the Receiving Facility, the Operations Facility and the overall system integration for the complete EOI system. At the end of Phase I in December 1970, two contractors will be selected for the Imaging Satellite and two contractors for the Processing Facility for the System Definition Phase II competition. They will then work to the overall system configuration and design requirements chosen at the completion of Phase I. The design work accomplished by the contractors during Phase II will be in sufficient depth to present a detailed system design including subsystem interfaces by July 1971. The contractors' submissions at the completion of Phase II will include firm cost and schedule proposals as well as detailed management plans.

The evaluation of the proposals for System Acquisition will be conducted during the first quarter of FY 72 and selection

of the Imaging Satellite contractor will be accomplished by 1 September 1971 with selection of the Processing Facility contractor by 1 October 1971. A preliminary design review will be held with both contractors and SAMSO for the Relay Satellite within four to six months after contract award.

Development work in the key subsystem areas will continue from August 1970 through July 1971 in parallel with the System Definition phases until the initiation of System Acquisition in September 1971. At that time, the respective subsystem programs will be turned over to the Imaging Satellite contractor and the Processing Facility contractor.

The FY 71 Option 1 technology programs have been planned to bring the subsystem development work to the status appropriate to initiation of System Acquisition. The following paragraphs summarize the significant goals for the programs costed in Table 3.

Both solid state array contractors will be tasked to carry out engineering model designs of the transducer and data processor with emphasis on circuit and logic configurations to meet flight requirements. Analytical models will be refined and reliability assessments will be detailed for design feedback, structural, thermal and other environmental design requirements will be detailed and test plans will be prepared. Chip and module level fabrication will be continued to improve processes, to refine assembly and manufacturing test techniques, and to provide multiple units for a wide range of performance/environmental testing. Full rate data processor modules will also be evaluated. After selection of the preferred Imaging Satellite configuration in December 1970 the transducer program will include extensive interface design activities to determine requirements on the optical, power and communication subsystems.

[redacted] will continue the 15-month optical subsystem analysis, design and fabrication program initiated in September 1969 and will initiate additional tasks preparatory to System Acquisition in September 1971. In view of the excellent progress in all areas, the activities will be extended to utilize the analytical, design and fabrication task outputs of the past nine months for accomplishing an in-depth subsystem

design. The work will emphasize design and test of focus and alignment sensing and mechanization, thermal and structural models and subsystem performance evaluation. Analysis and design work will be carried out to define and detail interfaces with the Imaging Satellite, the transducer and other subsystems. An optical subsystem performance analysis will be carried out at during the first half of FY 71 and the fabrication program started in FY 70 will be completed. The performance analysis will detail the estimates for a primary delivered in July 1970 will be polished using conventional techniques initially and a computer controlled lap for the final figure.

Three contractors will each complete fabrication of by April 1971 as well as carry out design analyses and life tests of selected components including The will be tested at the during the last quarter of FY 71 to verify performance in a representative spacecraft structure on a Estimates of control law validity, control system response and spacecraft dynamics will be verified during the testing.

The communication technology development program will include work on the antenna, exciter/driver, filters and demodulators. The TWT breadboard data developed in FY 70 will be used to initiate the design and fabrication of a prototype tube with appropriate flight-type permanent magnet and high voltage power supply. Testing of the antenna will be completed and the breadboard antenna drive will be evaluated. Design and fabrication of a antenna, incorporating results of the FY 70 work, will be undertaken. A will be breadboarded and tested with the to provide data for subsequent flight design work. Design and breadboard work will be carried out on low-loss filters with good thermal stability and narrow bandwidths. The development plan for a high data rate demodulator includes circuit analysis, design and laboratory testing.

The rotary and longitudinal tape recorder preliminary designs developed during FY 70 will be breadboarded and

laboratory testing will be carried out during the last quarter of FY 71. The potential advantage of fewer channels for the rotary will be measured against the anticipated lower power requirements of the multi-track longitudinal design. Recorder designs for archival requirements will be evaluated and laboratory tests will be conducted to verify analyses. Various techniques for write-out devices will be examined, drawing on related recorder technologies, to identify areas for hardware implementation work.

A flight computer design and breadboard program will be initiated incorporating the necessary considerations of storage capacity, computational speed, flexibility, reliability and redundancy. The data base provided by previous studies and breadboard activities, as well as recent circuit and logic developments, will be utilized to provide the best approach for this satellite application.

The Image Chain Analysis (ICA) contract initiated in FY 70 will produce an initial model measured against simulations generated in the Image Processing Laboratory (IPL) during the first half of FY 71. This data will provide image quality measures for System Definition activities during the second half of FY 71. The model will be used during FY 71 to assess subsystem impacts on image quality and to generate system performance specifications.

In addition to supporting ICA activities by producing simulated imagery, the IPL will test next generation solid state array modules during FY 71. A range of test values, representative of Imaging Satellite conditions, will be covered and new software for transfer function compensation of the output will be evaluated. All aspects of the sensor/satellite operation will be evaluated except spectral effects of the scene. The spectral considerations will be assessed by flight tests as required to define response characteristics.

These technology programs will provide the analytical, design and test results needed for System Acquisition and will develop the subsystem areas to the required level for continuation as a subcontract to the appropriate system contractor.

The Initial Operational Capability (IOC) of the Operations Facility and Receiving Facility is scheduled for the fourth.

quarter of FY 74. IOC of the Processing Facility is planned for early FY 75 and the launch of the first Imaging Satellite for the second quarter of FY 75. This achieves a total EOI System IOC at the end of the first half of FY 75. The schedule for Option 1 is presented in Table 2 and financial program in Table 3. There are different estimates for the FY 72 Budgetary Requirements depending upon the Imaging Satellite and overall system configurations selected. In the event that a simple, minimum capability approach is selected, costs will be shown in Table 3, Column B. If the higher capability approach is chosen, the costs will be as listed in Table 3, Column A. These FY 72 estimates apply to Options 1, 2 and 3.

Option 2

Option 2 planning provides for initiation of System Definition during FY 71, but the approach has been modified from that used in Option 1 to reduce program costs in FY 71. The principal changes consist of reducing the number of competitive system contractors earlier, reducing some development efforts and deleting one technology program. Although this approach is less desirable since early selections provide less data for consideration and since technical risk is undesirable progress during FY 70 has made the option practical.

The system contractors for both the Imaging Satellite and the Processing Facility made excellent progress during the system studies completed in FY 70. All seven contractors completed tasks involving examination of the overall system and interfaces, the parametric tradeoffs in system and subsystem designs, hardware implementation requirements, specific system segment designs and initial cost estimates.

Under Option 2, Requests for Proposal (RFP) for System Definition of the Imaging Satellite and for the Processing Facility will be sent to the respective contractors (four Imaging Satellites and three Processing Facilities) on 1 August 1970. Responses will be due 14 September 1970 and selection of two Imaging Satellite and two Processing Facility contractors completed by 6 October 1970.

A single phase System Definition will be initiated in October 1970. During the remaining three quarters of FY 71

detailed design studies will be carried out. The results of the FY 70 studies and the competitive proposals will be used to select the preferred overall system configuration and the region of system segment design investigations. The contractors will submit detailed cost, schedule and management proposals in July 1971 and final selection will be made as in Option 1 for System Acquisition in September 1971. The schedule for this option is described in Table 4 and the financial plan in Table 5. Selection down to two contractors in October 1970 does reduce the time and data available for making the decision but the penalty of the early selection is offset by lower FY 71 program costs as shown in Table 5.

Subsystem development work under this option will be similar to that for Option 1. In order to provide the required data base for initiation of System Acquisition in September 1971, the optics and transducer programs will be carried out to the same depth planned for Option 1. A review of the SAMSO communication technology programs indicates that their efforts are quite broad and deletion of that technology work results in minimal increase in program risk and does provide a reduction in program cost. Instead of pursuing two tape recorder alternatives a selection will be made in first quarter FY 71 and the preferred design only will be breadboarded resulting in cost saving shown in Table 5. Work on the flight computer will be deferred until the start of System Acquisition. These actions and their effect on the program will be reviewed periodically during System Definition and appropriate reprogramming requested if necessary. The key [redacted] work will proceed at the same level planned for Option 1 as will the Image Processing Lab and technical consultant efforts. The development work will be turned over to the Imaging Satellite and Processing Facility contractors in September/October 1971 as in Option 1.

Option 3

Option 3 is a plan which involves FY 71 costs lower than either Options 1 or 2. Both FY 71 and FY 72 funding requirements are shown in Table 7. Under Option 3, The System Definition Phase would begin in FY 71 as in Options 1 and 2; however, completion of this phase would not be

accomplished until FY 72 (Nov. 1971). The technology programs would also be extended to conform to initiation of System Acquisition in Jan. 1971. Table 6 presents the Option 3 schedule.

In Option 3, System Definition Phase I would begin on 1 September 1970 for four Imaging Satellite and three Processing Facility contractors. Phase I would continue until mid-January 1971. At that time the results of the system definition studies conducted by the contractors would be evaluated to select an overall baseline system configuration and to select two Imaging Satellite contractors and two Processing Facility contractors to participate in System Definition Phase II. The duration of Phase I would be increased from four and one-half months under Option 1 to five and one-half months under Option 3, however, the total effort remains the same and the total data available to make the selection is the same as Option 1. The six week period from mid-January through February 1971 provides for evaluation of the Phase I results.

Two contractors will be selected for the Imaging Satellite (I/S) System Definition Phase II and two contractors for the Processing Facility (P/F) System Definition Phase II. The competitive design phase will cover eight months from March 1971 to November 1971. This represents a four month delay in Phase II completion. The objectives and output of this phase are identical to the Phase II System Definition discussed under Option 1. The two I/S contractors and two P/F contractors will submit detailed designs and complete cost/schedule proposals including comprehensive management plans.

As in Option 1 a period of two months is devoted to detailed evaluation of the proposals leading to selection of one I/S contractor and one P/F contractor. System Aquisition for the I/S would be initiated 1 January 1972 and for the P/F, 1 February 1972. These milestones are four months later than the corresponding Option 1 milestones.

Under Option 3, the subsystem development work would be at a lower level during FY 71 but the total effort through December 1971 remains the same as Option 2. This plan provides minimum cost for both FY 71 and 72 at the

same technical risk discussed in Option 2 and with the penalty of a four months schedule extension. The schedule change delays the Initial Operational Capability (IOC) date for the overall system to the third quarter FY 1975. Continuous assessment of the impact of technical risks and schedule changes would be required late FY 71 early FY 72 to determine reprogramming actions which might be appropriate.