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STATEMENT OF WORK

EOI SYSTEM DEFINITION PHASE I

PRIME SYSTEM CONTRACTORS

1.0 INTRODUCTION

System studies and technology programs performed to date have provided the data required to proceed into the System Definition Phase for an operational EOI System. System Definition will be accomplished in two phases. Phase I will cover a period of approximately four months and encompasses the development of preliminary EOI System and segment designs to a level of definition adequate to permit selection of an EOI System and program approach. The segment design will enable definition of subsystem design requirements adequate for initiating subsequent detailed design. Phase II will cover a period of about nine months resulting in detailed designs and program scheduling developed in sufficient depth to initiate hardware acquisition.

Phase I tasks will be performed by four candidate prime system contractors. The preparation of a preliminary plan for the Phase II effort is included in these tasks. The Phase II plan along with the other Phase I study results will be evaluated by

the Program Office to select two contractors for Phase II contract awards. Following the Phase II system definition effort, a single prime system contractor will be chosen for the EOI System acquisition.

Data that has been developed in the various sponsored technology programs will be made available to all contractors in order to permit a consistent basis for performing the System Definition studies. Additional data is expected from technology programs conducted concurrently with System Definition. The Program Office will make available to all contractors any significant results of potential impact on the studies. Interface meetings and data exchanges between System Definition and technology development contractors are to be subject to the guidelines specified in Attachment 10.

1.1 Purpose

The purpose of the effort specified by this statement of work is to:

- o Conduct comprehensive preliminary design studies necessary to allow the selection of an EOI System configuration.
- o Develop system designs adequate to enable

the initiation of detailed design of segment subsystems.

o Provide the basis for selecting two candidate prime system contractors to conduct Phase II System Definition.

1.2 Scope

Work performed by the contractor in compliance with this statement of work shall be based on the tasks defined in Section 2.0, and the requirements, guidelines and data provided in the attachments. It is intended that the contractor shall perform these tasks in sufficient depth to define and substantiate the following for both a system Configuration A (Par. 2.1) and a system Configuration B (Par. 2.2):

(1) A recommended overall EOI System configuration.

(2) A recommended Imaging Satellite preliminary design.

(3) A recommended Receiving Facility - Operations Facility preliminary design.

(4) A recommended Relay Satellite segment and interface requirements specification.

(5) Comparative cost data.

(6) Development and operational program schedule/plans.

(7) The estimated performance of the end-to-end system.

All documentation shall be prepared in a concise manner, and be adequate to permit an evaluation of the contractor's approaches for selection of two contractors for Phase II System Definition contract award. The documentation shall be submitted in accordance with the format and schedule specified in Section 3.0.

Specifically excluded from the effort defined by this statement of work are the development of detailed management plans, testing plans, manufacturing plans, quality assurance plans, etc., other than those aspects related to or supporting the necessary cost trade studies.

2.0 TASK DESCRIPTIONS

2.1 Task I: System Configuration A Study

2.1.1 System Configuration Study

The contractor shall develop a recommended EOI System configuration that satisfies the system functional requirements defined in Attachment 1. It is intended that this subtask concentrate primarily on the major system

segment trades. The system configurations should include the basic system segments identified in Attachment 2, and conform to the baseline system characteristics provided in Attachment 6 and the programmatic guidelines provided in Attachment 7. However, the contractor is encouraged to utilize originality in developing the best overall approach to the system configuration. The contractor may deviate from the above attachments only if such a variance is substantiated.

The contractor shall identify alternative approaches to the overall configuration of system segments that can satisfy the system functional requirements. System level trade studies shall be performed only to a level of detail necessary to define the segment characteristics and to conduct comparative evaluations of the candidate system configurations. Trade studies performed shall consider cost, technical risk and performance as a function of at least the following:

(1) The orbital characteristics of the imaging satellites.

(2) On-orbit functions versus ground-based functions.

(3) I/S functions versus R/S functions.

(4) R/F functions versus O/F or P/F functions.

(5) Deployment plans for achieving total system capability.

(6) Replacement plans for both I/S and R/S.

(7) Operational timelines.

The contractor shall conduct such evaluations as required to define and validate a recommended system configuration. These evaluations shall be based on criteria developed by the contractor to rank the alternative configurations. Appropriate factors for at least the cost, technical and schedule risk, reliability, and performance aspects of each configuration shall be included.

The contractor shall prepare a System Configuration Study Report documenting the recommended system configuration and the trades performed in arriving at the selections. The recommended configuration should be completely defined, including a comprehensive definition of the characteristics of each system segment, a recommended deployment scheme, and the schedule/cost data of 2.1.4. Descriptions of the alternative configurations considered should clearly identify the differences in characteristics among the system segments. The report should also include

trade study results and other supporting data in a concise form to allow Program Office evaluation of the alternative configurations considered.

2.1.2 Imaging Satellite Design Study

The contractor shall perform studies to develop a recommended preliminary design of the Imaging Satellite based on the system configuration developed in 2.1.1. This design shall satisfy the appropriate functional requirements of Attachments 1 and 3, and the system operational concept of Attachment 2. The contractor may deviate from the requirements of these attachments only if such a variance is substantiated. The contractor shall also define a design approach for and the characteristics associated with each subsystem of the I/S.

Alternative I/S segment and subsystem design approaches shall be investigated and trade studies performed to include at least the cost, development program, performance, weight, expendable requirements, technical risk, reliability, critical design and developments, operational complexity and interaction with other segment/subsystem requirements. The contractor shall use the results of these trade studies

and other appropriate criteria in selecting the preferred I/S design and each I/S subsystem design approach.

The contractor shall prepare a preliminary layout of the preferred I/S design, including the positioning of the selected subsystems, their dimensions and interfaces. Analyses shall be performed and documented to verify that the I/S and its subsystems satisfy all applicable requirements. Estimates should be provided for the appropriate subsystem characterisitcs to validate the transducer, optical, thermal, structural, electrical, communication, attitude control and propulsion aspects of the designs. Specific attention shall be drawn to any critical design features and long-lead procurement or development items in the spacecraft or any subsystem.

The contractor shall define the Titan III-D launch vehicle requirements for the recommended I/S design. These studies shall include analysis of upper-stage requirements as appropriate in addition to the launch trajectory and environment. The preferred I/S configuration and subsystem design requirements shall be documented in the Design Studies Report and Preliminary Performance Requirement Specification.

2.1.3 Receiving Facility/Operations Facility Design Study

The contractor shall perform studies to develop a recommended preliminary design for the Receiving Facility (R/F) and Operations Facility (O/F) segments of the EOI System based on the system configuration developed in 2.1.1. These designs shall satisfy the appropriate functional requirements of Attachment 1 and 4, and the system operational concept of Attachment 2. The contractor may deviate from the requirements of these attachments only if such a variance is substantiated.

A design approach shall be defined for each of the respective subsystems of the R/F segment. Trade studies shall be performed as required to select and validate a design approach for each subsystem. These studies shall be performed in sufficient depth to select and justify a recommended approach to the R/F design. In particular, effects on R/F design of I/S and R/S data handling and communications link variants shall be evaluated. The reliability, security and privacy, technical risk, cost, and operational maintainability should be assessed for each approach. Consideration shall be given to all operational aspects of the mission.

A design approach shall be defined for the respective subsystems of the O/F. Trade studies shall be performed in sufficient depth to select and validate preferred subsystem design approaches. These studies shall be performed in sufficient depth to select and justify a recommended approach. The studies shall include evaluation of the effects on O/F design of availability, reliability, technical risk, cost, and operational maintainability.

The preferred R/F-O/F configuration and subsystem design requirements shall be documented in the Design Studies Report and Preliminary Performance Requirements Specification.

2.1.4 Schedule/Costs Study

The contractor shall prepare a development and operational program schedule for the recommended system Configuration A.

The contractor shall conduct a comprehensive cost study of the recommended program approach to include at least summary cost data at the system segment, (excluding the P/F segment), and subsystem levels. Summary cost

estimates should include recurring and non-recurring elements with hardware, software and manpower breakdowns. Cost accumulation results should be prepared according to Fiscal Year.

Results of this study shall be documented in the System Configuration Study Report, and shall incorporate summary data sheets to be provided by the Program Office.

2.2 Task II System Configuration B Study

2.2.1 System Configuration Study

The contractor shall develop a recommended EOI System configuration that satisfies the system functional requirements defined in Attachment 1. It is intended that this task concentrate primarily on major system segment trades. The system configuration should include the basic system segments identified in Attachment 2, and conform to the baseline system characteristics provided in Attachment 6, and the programmatic guidelines provided in Attachment 7. However, the contractor is encouraged to utilize originality in developing the best overall approach to the system configuration. The contractor may deviate from the above attachments only if such a variance is substantiated.

The contractor shall identify alternative approaches to the overall configuration of system segments that can satisfy the system functional requirements. System level trade studies shall be performed only to a level of detail necessary to define the segment characteristics and to conduct comparative evaluations of the candidate system configurations. Trade

studies performed shall consider cost, technical risk, and performance as a function of at least the following:

(1) The orbital placement of imaging satellites.

(2) The number and orbital placement of relay satellites, including polar, use of recorder for coverage gaps.

(3) On-orbit functions versus ground-based functions.

(4) I/S functions versus R/S functions.

(5) R/F functions versus O/F or P/F functions.

(6) Deployment plans for achieving total system capability.

(7) Replacement plans for both I/S and R/S.

(8) Operational timelines.

The contractor shall conduct such evaluations as required to define and validate a recommended system configuration. These evaluations shall be based on criteria developed by the contractor to rank the alternative configurations. Appropriate factors for at least the cost, technical and schedule risk, reliability, and performance aspects of each configuration shall be included.

The contractor shall prepare a System Configuration Study Report documenting the recommended system

configuration and the trades performed in arriving at the selections. The recommended configuration should be completely defined including a comprehensive definition of the characteristics of each system segment, a recommended deployment scheme, and schedule/cost data of 2.2.4. Descriptions of the alternative configurations considered should clearly identify the differences in characteristics among the system segments. The report should also include trade study results and other supporting data in a concise form to allow Program Office evaluation of the alternative configurations considered.

2.2.2 Imaging Satellite Design Study

The contractor shall perform studies to develop a recommended preliminary design of the Imaging Satellite based on the system configuration developed in 2.2.1. This design shall satisfy the appropriate functional requirements of Attachments 1 and 3, and the system operational concept of Attachment 2. The contractor may deviate from the requirements of these attachments only if such a variance is substantiated. The contractor shall define a design approach for and the characteristics associated with each

subsystem of the I/S.

Alternative I/S segment and subsystem design approaches shall be investigated and trade studies performed to include at least the cost, development program, performance, weight, expendable requirements, technical risk, reliability, critical design and developments, operational complexity and interaction with other segment/subsystem requirements. The contractor shall use the results of these trade studies and other appropriate criteria in selecting the preferred I/S design and each I/S subsystem design approach.

The contractor shall prepare a preliminary layout of the preferred I/S design, including the positioning of the selected subsystems, their dimensions and interfaces. Analyses shall be performed and documented to verify that all the I/S and its subsystems satisfy all applicable requirements. Estimates should be provided for the appropriate subsystem characteristics to validate the transducer, optical, thermal, structural, electrical, communication, attitude control and propulsion aspects of the designs. Specific attention shall be drawn to any critical design features and long-lead procurement or development items in the spacecraft

or any subsystem.

The contractor shall define the appropriate launch vehicle requirements for the recommended I/S design. These studies shall include analysis of upper-stage requirements as appropriate in addition to the launch trajectory and environment. The preferred I/S configuration and subsystem design requirements shall be documented in the Design Studies Report and Preliminary Performance Requirement Specification.

2.2.3 Receiving Facility/Operations Facility Design Study

The contractor shall perform studies to develop a recommended preliminary design for the Receiving Facility (R/F) and the Operations Facility (O/F) segments of the EOI System based on the system configuration developed in 2.2.1. These designs shall satisfy the appropriate functional requirements of Attachments 1 and 4, and the system operational concept of Attachment 2. The contractor may deviate from the requirements of these attachments only if such a variance is substantiated.

A design approach shall be defined for each of the

respective subsystems of the R/F segment. Trade studies shall be performed as required to select and validate a design approach for each subsystem. These studies shall be performed in sufficient depth to select and justify a recommended approach to the R/F design. In particular, effects on R/F design of I/S and R/S data handling and communications link variants shall be evaluated. The reliability, security and privacy, technical risk, cost and operational maintainability should be assessed for each approach. Consideration shall be given to all operational aspects of the mission.

A design approach shall be defined for the respective subsystems of the O/F. Trade studies shall be performed in sufficient depth to select and validate preferred subsystem design approaches. These studies shall be performed in sufficient depth to select and justify a recommended approach. The studies shall include evaluation of the effects on O/F design of availability, reliability, technical risk, cost and operational maintainability.

The preferred R/F-O/F configuration and subsystem design requirements shall be documented in the Design Studies Report and Preliminary Performance Requirements Specification.

2.2.4 Schedule/Costs Study

The contractor shall prepare a development and operational program schedule for the recommended system Configuration B.

The contractor shall conduct a comprehensive cost study of the recommended program approach to include at least summary cost data at the system, segment (excluding the P/F segment), and subsystem levels. Summary cost estimates should include recurring and non-recurring elements with hardware, software and manpower breakdowns. Cost accumulation results should be prepared by Fiscal Year.

Results of this study shall be documented in the System Configuration Study Report, and shall incorporate summary data sheets to be provided by the Program Office.

2.3 Task III - System Configuration B Block Change Study

2.3.1 Block Change Plan

The contractor shall develop a recommended block change plan for the preferred System Configuration B program that provides for a system of Configuration A capability by 1978-1979. It is intended that this task concentrate primarily on defining the requirements, schedule and costs of an orderly block change at the segment and key subsystem level.

The contractor shall perform configuration change trade studies that consider at least the cost, technical risk, deployment, operational time lines, critical design characteristics, long lead procurement or development items and extent of retesting required.

2.4 Task IV - Software Requirements Definition Study

The contractor shall perform such studies as are necessary to define the major software packages required to support all aspects of the EOI System, exclusive of software peculiar to the P/F functions, for the recommended systems for both Configuration A and B. The functions to be performed by each major software package shall be identified,

and estimated costs and schedules prepared. Any critical development or risk areas should be clearly identified. It is intended that this study should not involve the detailed analysis of implementation techniques or computer program details.

The software requirements to be defined shall consider all aspects of the EOI System, to include the required support for hardware design, testing, integration, flight check-out, launch, on-orbit test and operation, and system performance evaluation. Requirements defined for each system segment (except the P/F) established in the previous tasks shall be reviewed and those requiring software development identified. These requirements should be grouped according to major logical functional blocks of software, along with identification of primary data requirements and interfaces. The contractor shall specifically address the requirements for software during launch and on-orbit check-out periods for both the Imaging Satellites and the Relay Satellites and identify a recommended approach.

Top-level functional block diagrams shall be developed, displaying all major software packages, major data files,

and interfaces, in addition to appropriate supporting analysis data.

2.5 Task V - System Performance Analysis Study

The contractor shall develop appropriate system performance analysis tools to provide the basis for prediction and evaluation of the overall performance of the total EOI System. These tools shall be applied to the evaluation of the systems relative to the system functional requirements. Variations about the preferred system designs shall be evaluated to define potential refinements to the selected configurations.

The analysis performed shall consider all appropriate aspects of system performance, including launch, system deployment and malfunction periods in addition to normal on-orbit operations.

2.6 Task VI - Phase II Preliminary Plan

The contractor shall prepare a preliminary plan of the efforts to be conducted during Phase II of the EOI System Definition. This plan shall define the contractor's program to develop during this phase for either system Configuration A or system Configuration B, detailed I/S-R/F-O/F designs, firm costs, schedules,

and comprehensive management plans. Also to be included is a section describing the contractor's resources and capabilities intended for application during Phase II System Definition and the Acquisition Phase.

2.7 Task VII - Special GSD Study

The contractor shall investigate the feasibility of achieving [redacted] GSD performance and the other system functional requirements for Configuration A in Attachment 1. The Configuration A characteristics of Attachment 6 shall be used with the exception of the GSD and I/S operating altitude, and/or focal length and f/number.

Studies shall be performed to a level necessary to provide the system characteristics and program cost/schedules for a recommended approach to achieve the [redacted] GSD. Efforts should be concentrated on the I/S segment of the system. Results shall be documented in the System Configuration Study Report.

3.0 DELIVERABLES

The following list of documents shall constitute the deliverables for Phase I System Definition.

3.1 Oral Briefings

3.1.1 Progress Reports

The contractor program manager shall present a monthly oral vu-graph progress report. Location of this briefing will be usually at the customer's facility. The duration of the briefing should not exceed 90 minutes.

3.1.2 Deliverables

One set of vu-graphs plus four copies of each briefing shall be delivered to the customer two (2) days prior to the scheduled presentation.

3.2 System Configuration Study Report

A System Configuration Study Report shall be prepared according to the following outline. This document shall be limited to 300 pages total for the Final Report and 150 pages total for the Preliminary Report.

Part I - System Configuration A Study

Section 1: Preferred System Configuration

Section 2: Schedule/Cost Data

Section 3: System Configuration Trade Studies

Part II - System Configuration B Study

Section 1: Preferred System Configuration

Section 2: Schedule/Cost Data

Section 3: System Configuration Trade Studies

Part III - System Configuration B Block Change Study

Section 1: Preferred Block Change Concept

Section 2: Schedule/Cost Data

Section 3: Configuration Change Trade Studies

Part IV - Special GSD Study

The following delivery dates apply to the System Configuration Study Report:

Preliminary - 2 November 1970 (6 copies)

Final - 15 December 1970 (6 copies)

3.3 Preliminary Performance Requirements Specifications

This deliverable shall consist of a single document page limited, prepared according to the following outline. Six copies of the Preliminary Performance Requirements Specifications are due 15 December 1970.

Part I - System Configuration A

Section 1: Preliminary EOI System Specification

Section 2: Preliminary I/S Segment Specification

Section 3: Preliminary R/F-O/F Segment Specification

Section 4: Preliminary Launch Facility Requirements

Section 5: R/S Performance Requirement Specification

Section 6: Preliminary Software Requirements Specification

Part II - System Configuration B

Section 1: Preliminary EOI System Specification

Section 2: Preliminary I/S Segment Specification

Section 3: Preliminary R/F-O/F Segment Specification

Section 4: Preliminary Launch Facility Requirements

Section 5: R/S Performance Requirement Specification

Section 6: Preliminary Software Requirements Specification

3.4 Design Studies Report

The Design Studies Report shall be page limited, and consist of the following sections. Six copies of this report due for delivery on 15 December 1970.

Section 1: System Performance Studies

Section 2: I/S Design Studies

Section 3: R/F-O/F Design Studies

Section 4: R/S Performance Requirements Studies

3.5 Phase II - Preliminary Plan

The Phase II Preliminary Plan shall be submitted in a single document, page limited, according to the following outline. Six copies of this plan are due for delivery 15 December 1970.

Section 1: Task Descriptions

Section 2: Task Plan/Schedule

Section 3: Resources and Capabilities