SPECIAL HANDLING

SECRET

Copy No. 1

25X1

ENCL TO [redacted]

COPY OF

1 May 1963

25X1

Dear [redacted]

Enclosed are six (6) copies each of the booklets containing photo reductions of the briefing aids used during Dr. McMillan's visit. Each pair of copies is marked with the names of the individuals who should receive them, including one for your own file.

If you have any questions concerning them, don't hesitate to call.

Very truly yours,

[redacted]

25X1

DJ:cm
Enclosures (6)

DOCUMENT NO. 106
NO CHANGE IN CLASS. ☒
☐ DECLASSIFIED
CLASS. CHANGED TO: TS S C
NEXT REVIEW DATE: 2011
AUTH: HR 70-2
DATE: 16-7-81 REVIEWER: [redacted]

25X1

NRO review(s) completed.

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9040-63-659
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COPY 1 OF 6

PROGRAM OBJECTIVES

TECHNICAL INTELLIGENCE FROM A SATELLITE VEHICLE

1 FOOT GROUND DETECTION OR BETTER IN STEREO

HIGH TARGET ACQUISITION RATIO

ADEQUATE GEOGRAPHICAL COVERAGE

TIMELY SYSTEM RESPONSE

RAPID ECONOMICAL DEVELOPMENT

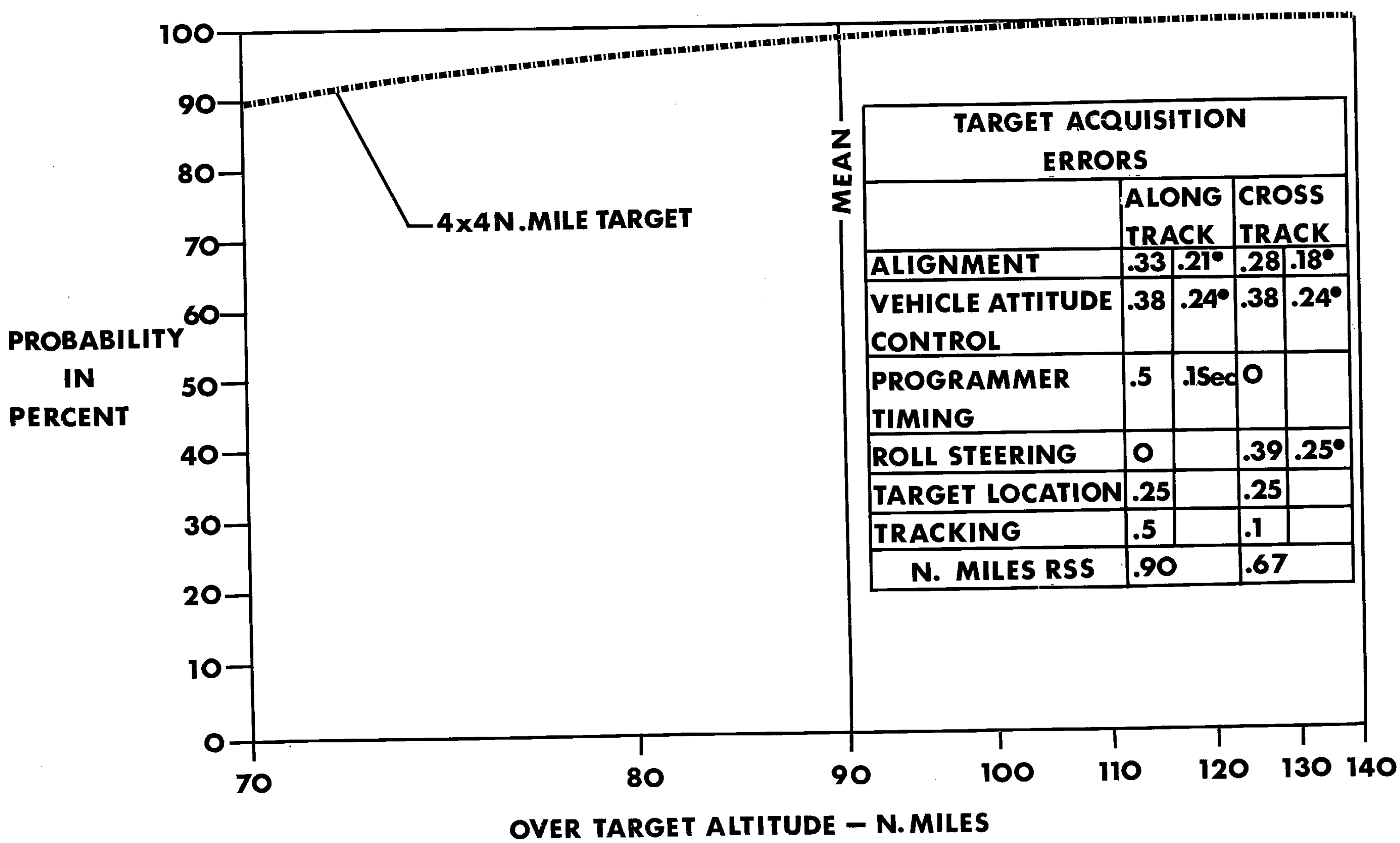
EARLIEST OPERATIONAL CAPABILITIES AND MINIMUM COST DURING OPERATION

SPECIAL HANDLING

RECONNAISSANCE REQUIREMENTS

TARGET SIZE	4 X 4 N. MILES
RESOLUTION	VERTICAL PHOTO DETECTION CAPABILITY OF 1 FOOT IN 2:1 - 4:1 CONTRAST RANGE AS PRESENTED TO CAMERA
STEREO	RESOLUTION IMPROVEMENT AND PHOTO INTERPRETATION AID
LOW ALTITUDE	90 N. MILES OVER AREA OF INTEREST 70 " PERIGEE
AVAILABLE TARGET SWATH	80 N. MILES WITH ± 30° ROLL STEERING
ACQUISITION RATIO	90% PROBABILITY OF PHOTOGRAPHING TARGET
ILLUMINATION	≥ 10° SUN ∢ 7 MONTHS TO 75° NORTH LAT. ≥ 20° " " 5 " " 75° " " NO LIGHT 3 " ABOVE 75° " "
MISSION	30 DAYS ON ORBIT WITH GROUND CONTACT FOR PROGRAMMING FLEXIBILITY AND WEATHER ALLOWANCE 80 LBS. OF FILM - 4 DAYS OF OPERATION

PROBABILITY OF TARGET ACQUISITION



TARGET ACQUISITION ERRORS	ALONG TRACK		CROSS TRACK	
ALIGNMENT	.33	.21°	.28	.18°
VEHICLE ATTITUDE CONTROL	.38	.24°	.38	.24°
PROGRAMMER TIMING	.5	.1Sec	O	
ROLL STEERING	O		.39	.25°
TARGET LOCATION	.25		.25	
TRACKING	.5		.1	
N. MILES RSS	.90		.67	

IMAGE MOTION FACTORS

90% PROBABILITY

STABILIZATION	PRESENT CAPABILITY			15 MONTHS		
		ALONGTRACK	CROSSTRACK		ALONGTRACK	CROSSTRACK
PITCH ANGLE	$\pm\frac{1}{2}°$	.005%	—	$\pm\frac{1}{4}°$	.001%	—
ROLL ANGLE	$\pm\frac{1}{3}°$	.002%	—	$\pm\frac{1}{4}°$	.001%	—
YAW ANGLE	$\pm\frac{2}{3}°$	—	1.18%	$\pm\frac{1}{3}°$	—	.53%
PITCH RATE	10° /HR	.1%	—	3° /HR	.032%	—
ROLL RATE	30° /HR	—	.32%	6° /HR	—	.06%
YAW RATE	10° /HR	—	0	3° /HR	—	0
CAMERA						
V/h SENSING AND CONTROL		.55%	—		.55%	—
	RSS	.56%	1.22%		.55%	.53%
EQUIVALENT V/h ERROR		$1\frac{1}{4}$%			$\frac{2}{3}$%	

RESOLUTION COMPUTATION

$d_g = \frac{h}{F}\left(\frac{1}{R_D}\right)$ $d_g = 1$ FT. h = 70 N. MI. MINIMUM
90 N. MI. MEAN

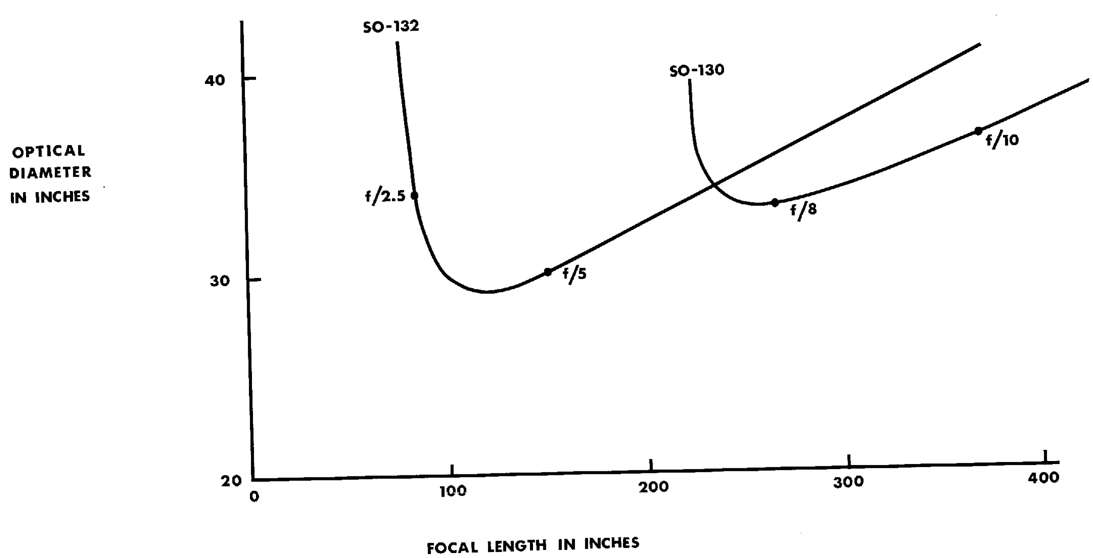
FILM	RESOLUTION (L/MM.)		EXPOSURE TIME FOR 20° SUN ∢		
	2:1	4:1	f 10	f 5	f 2.5
SO 130	90	120	1/100	1/400	1/1600
SO 206	140	205	1/50	1/200	1/800
SO 132	240	330	1/25	1/100	1/400

OPTICS				
	RESOLUTION (L/MM.)	150	300	600
	DEPTH OF FOCUS (.001 in.)	±4	±1	± 1/4

REQ. DYNAMIC RESOLUTION	(L/MM.)	46	112	197

OPTIMIZATION ANALYSIS

2:1 CONTRAST
20° SUN ANGLE
$\dot{\theta} = 0.17 \frac{\text{MILLIRADIANS}}{\text{SECOND}}$

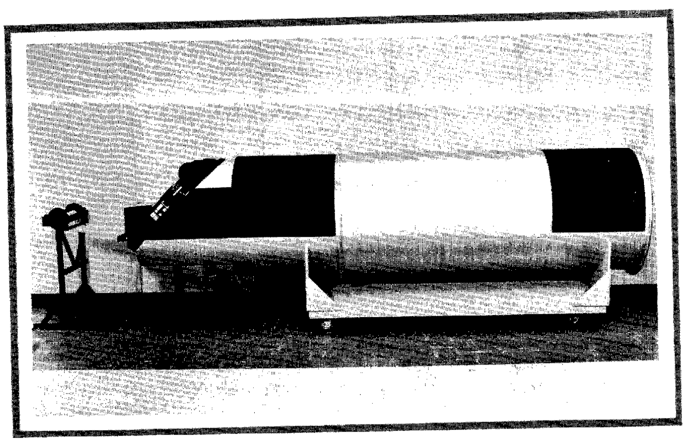


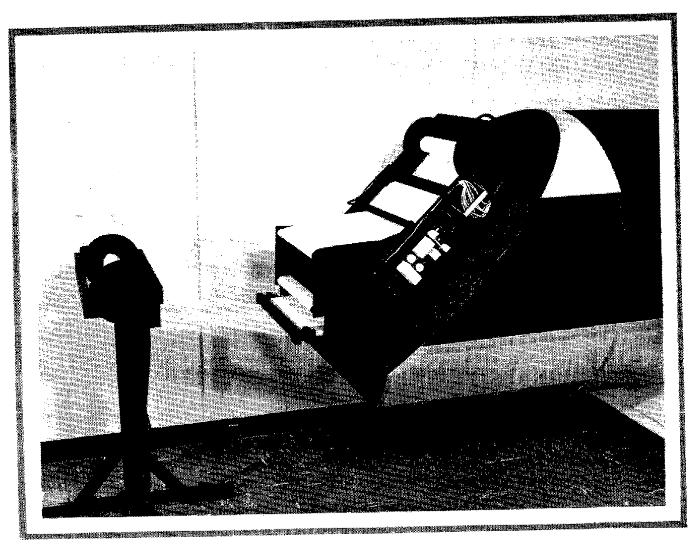
DESIGN SUMMARY

CAMERA	FOCAL LENGTH REQUIRED in.	FORMAT WIDTH in.	FILM TYPE	SCALE@ 70 n.m.	STEREO COVER IN SQ. n.m. WITH 80-180 LBS. OF FILM
f /2.5	85	6.5	SO -132	1:60,000	156,000-352,000
f /5	150	11.5	SO- 132 SO-206	1:34,000	50,000-113,000
f/10	365	28	SO-130	1:14,000	8,450-19,100

WEIGHT COMPARISON

	CAMERA W/OUT FILM	STRUCTURE, PROGRAMER, ETC.	RECOVERY SYSTEM W/OUT FILM		TOTAL PAYLOAD (LBS. FILM)				
			MARK 5A	MARK 8	80	180	80—80 DBL. RECOVERY	180—180 DBL. RECOVERY	80-80-80-80 QUAD. RECOVERY
f/2.5	980	400	290	420	1750	1980	2120	2580	2540
f/5	920	650	290	420	1940	2170	2310	2770	2730
f/10	1360	1600	290	420	3330	3560	3700	4160	4120





STRIP CAMERA FEATURES

INHERENT SIMPLICITY

MINIMUM INTERNAL VIBRATION

ROLL CORRECTION OPTICS

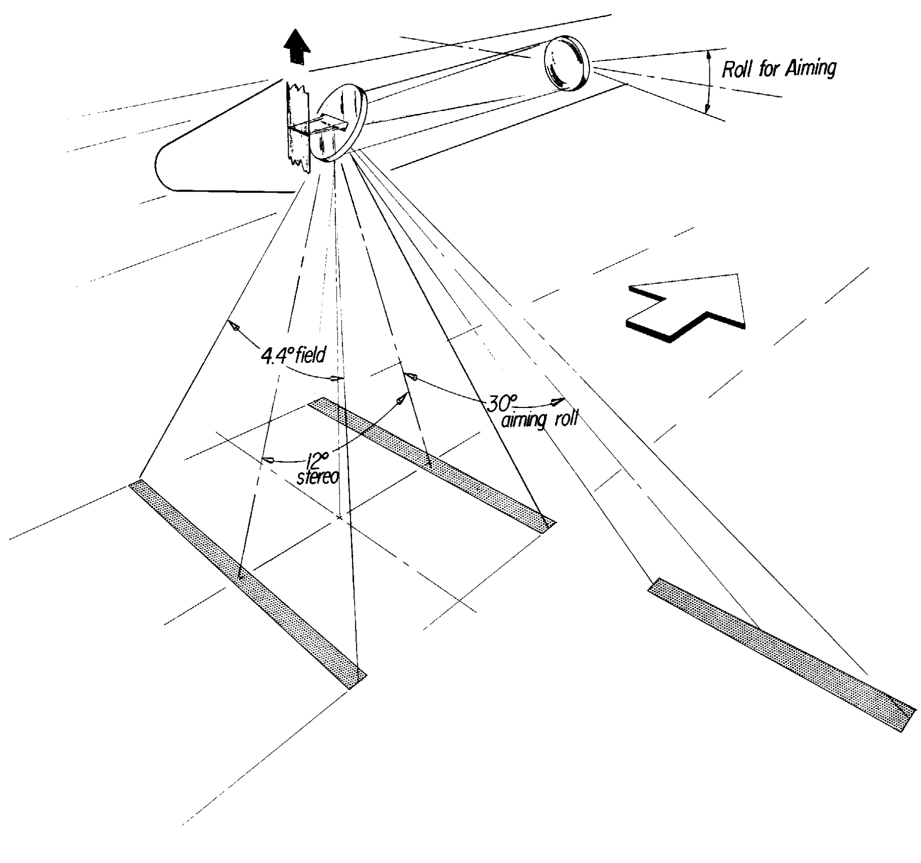
METAL MIRRORS

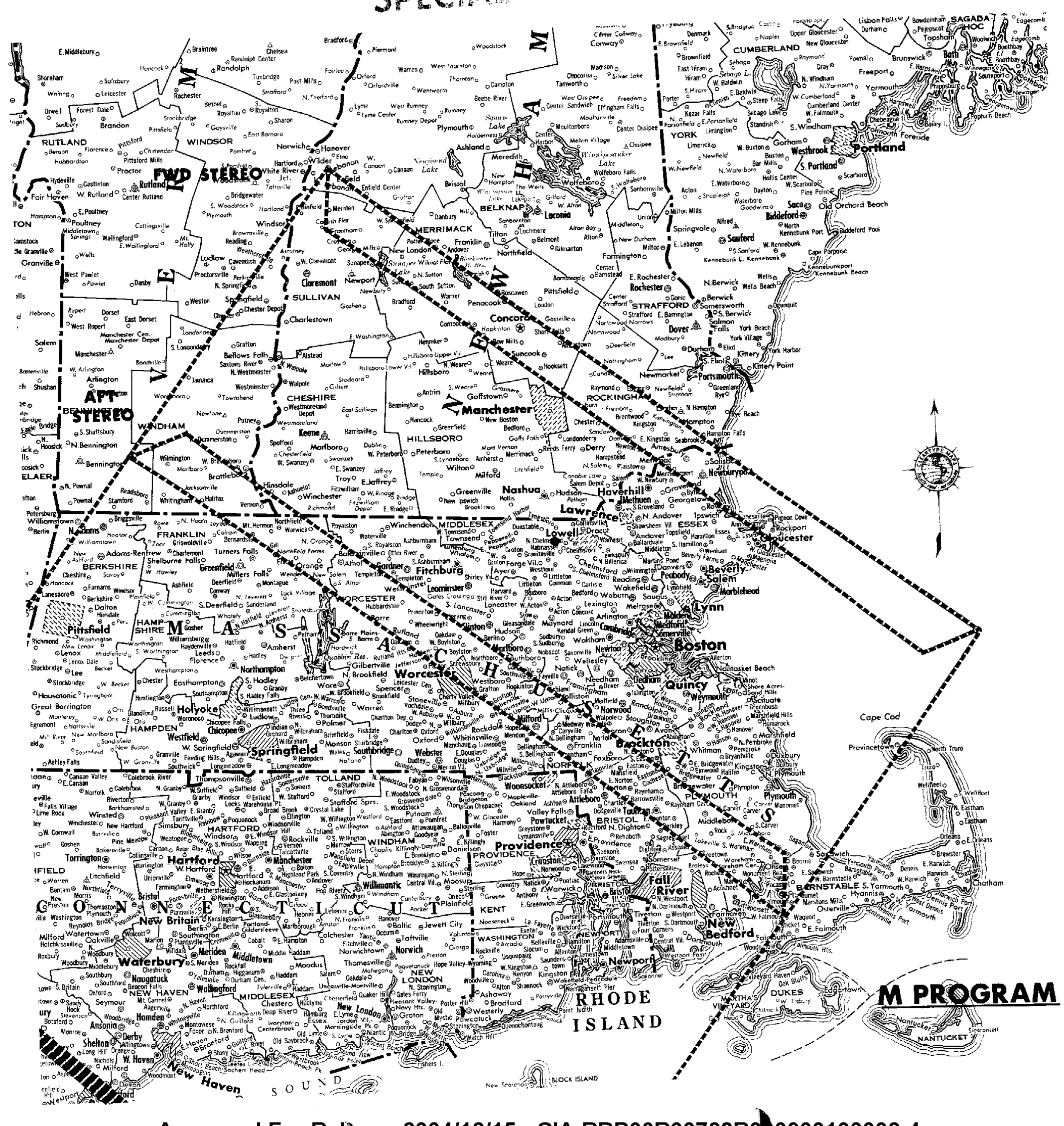
MINIMUM APERTURE OBSTRUCTION

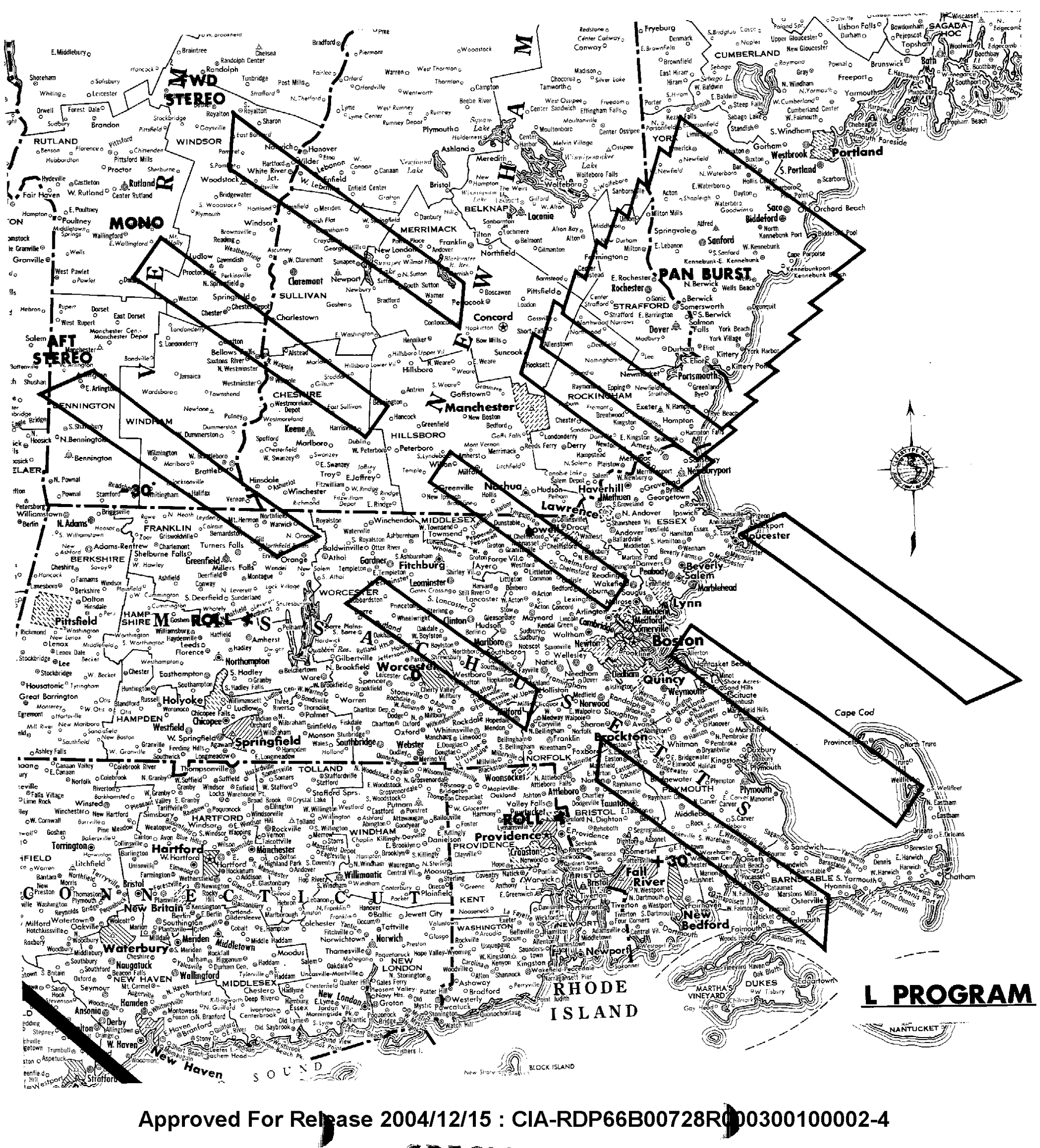
DECREASED THERMAL SENSITIVITY

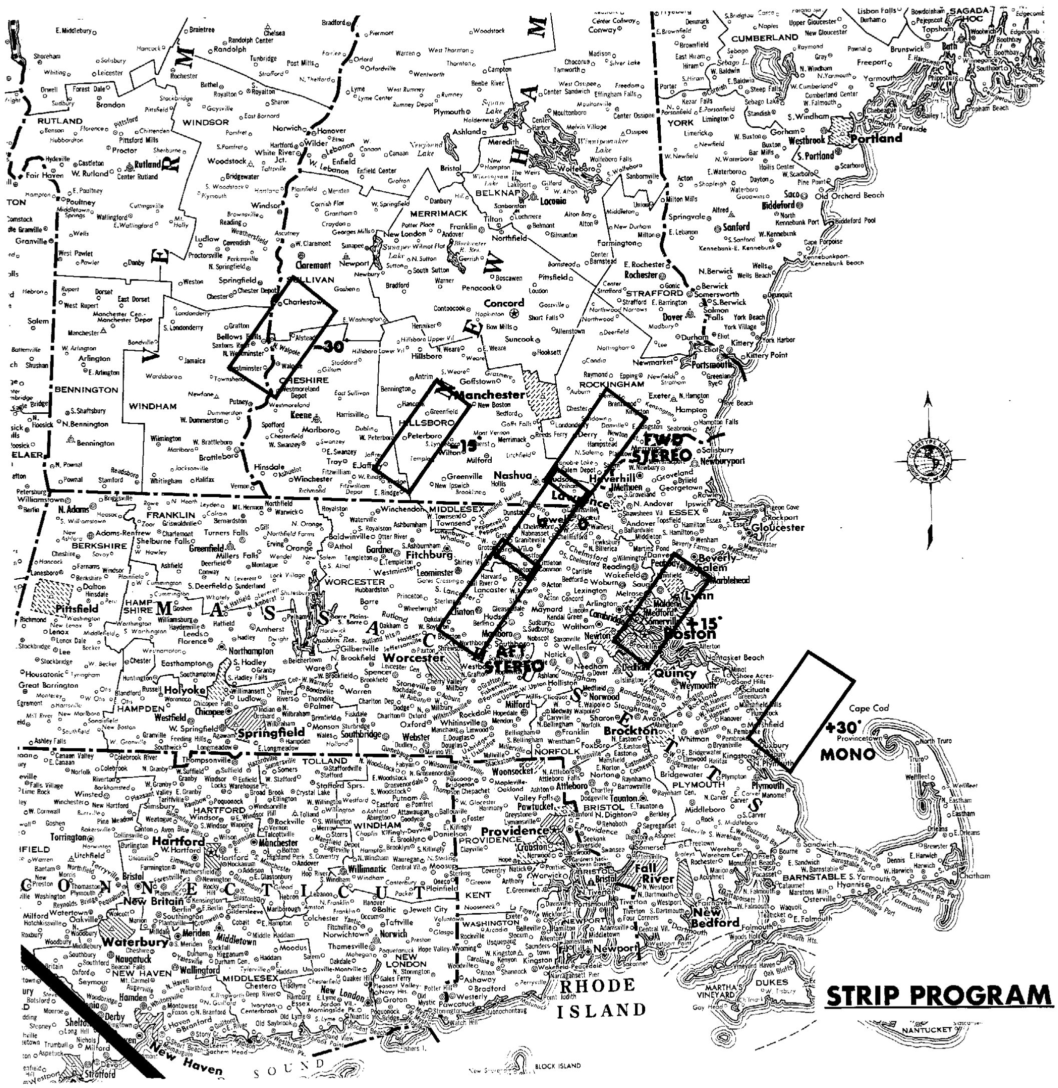
IMAGE MOTION DETECTION

STEREO STRIP GEOMETRY



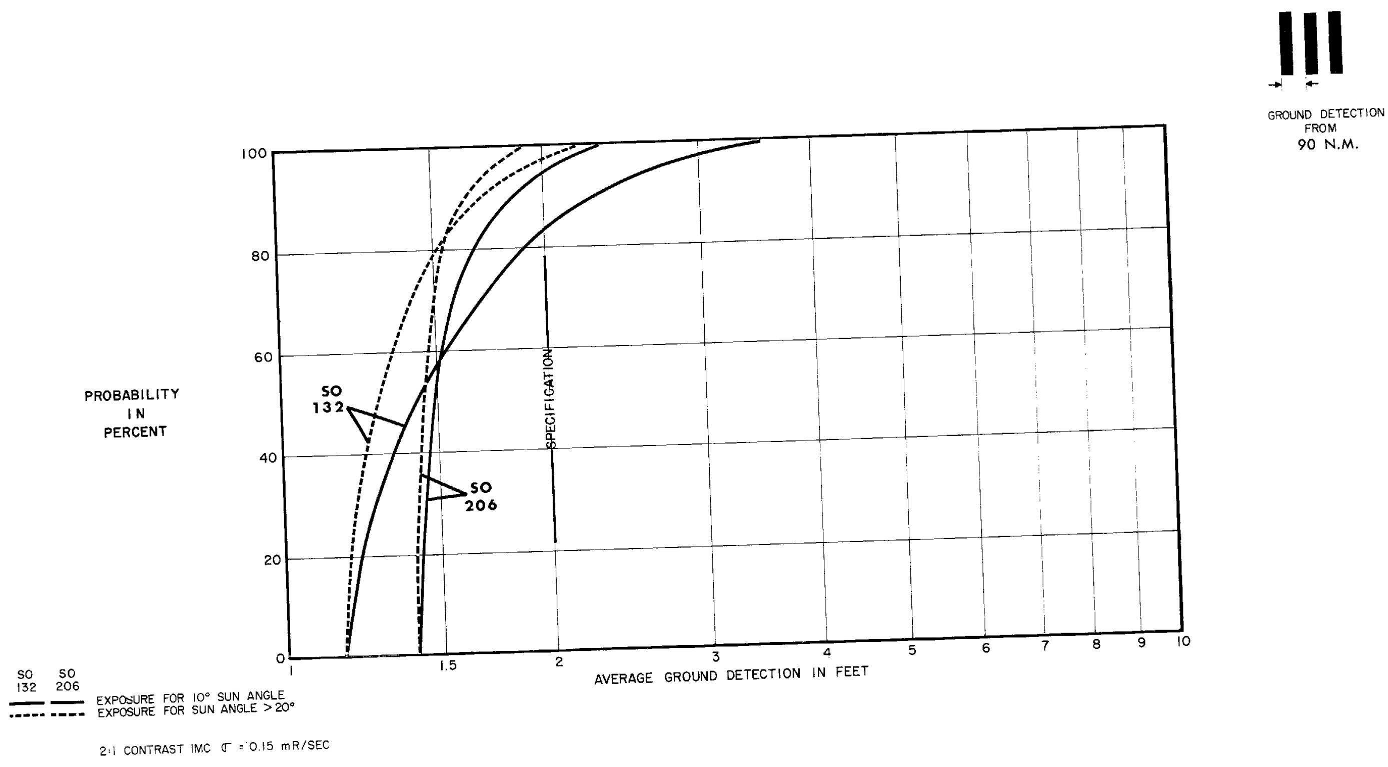

FWD STEREO
APT STEREO
M PROGRAM
RHODE ISLAND
Boston
Portland
Manchester
Concord
Worcester
Springfield
Hartford
Providence
Fall River
New Bedford
Lawrence
Lowell
Fitchburg
Brockton
New Haven
Waterbury
New Britain
Cape Cod
NANTUCKET
SOUND


FWD STEREO
MONO
AFT STEREO
PAN BURST
+30°
L PROGRAM
CONNECTICUT
RHODE ISLAND
Boston
Portland
Manchester
Concord
Worcester
Springfield
Hartford
Providence
Cape Cod
NANTUCKET


-30
15
FWD STEREO
AFT STEREO
+15°
+30° MONO
Cape Cod
STRIP PROGRAM
RHODE ISLAND
CUMBERLAND
Portland
Concord
Manchester
Boston
Worcester
Springfield
Hartford
Providence
New Bedford
NANTUCKET

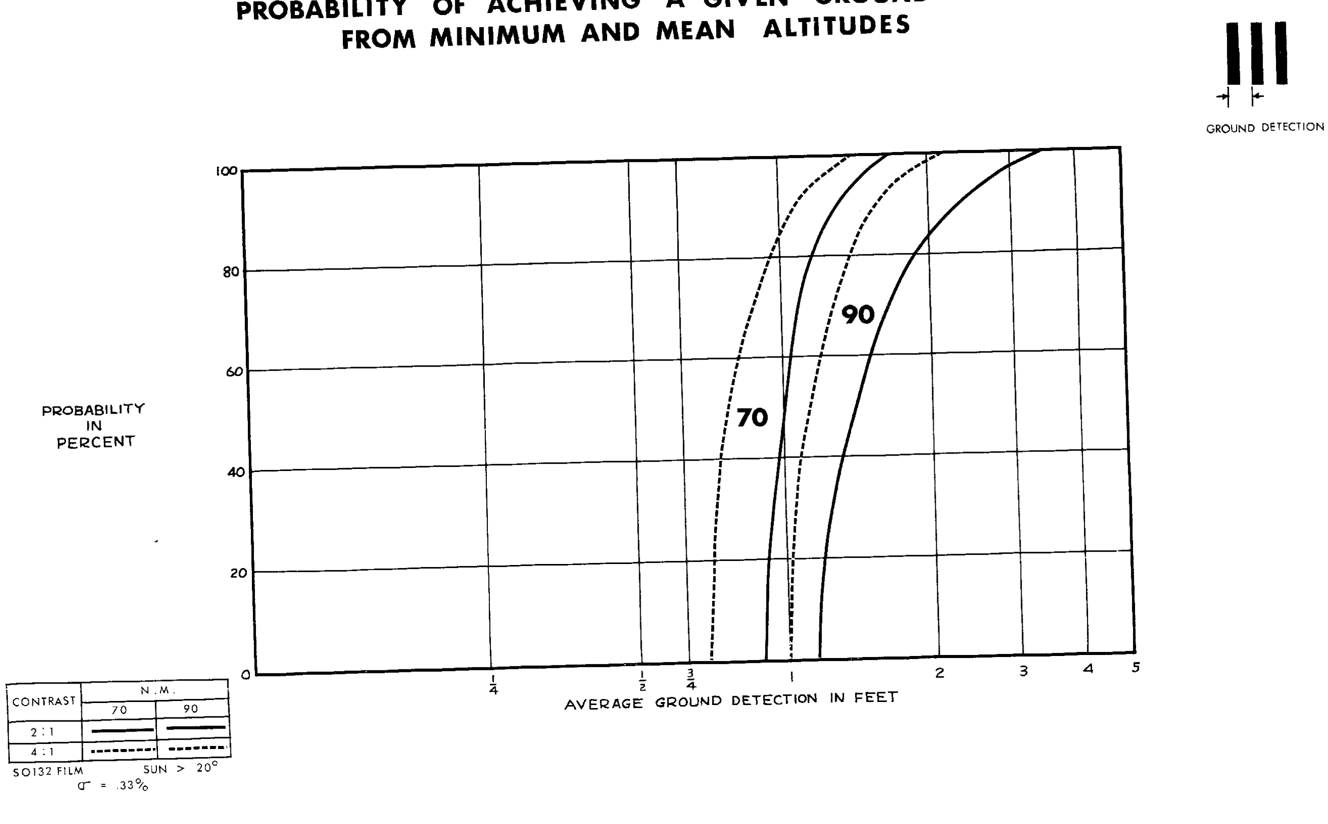
STEREO STRIP CAMERA SYSTEM

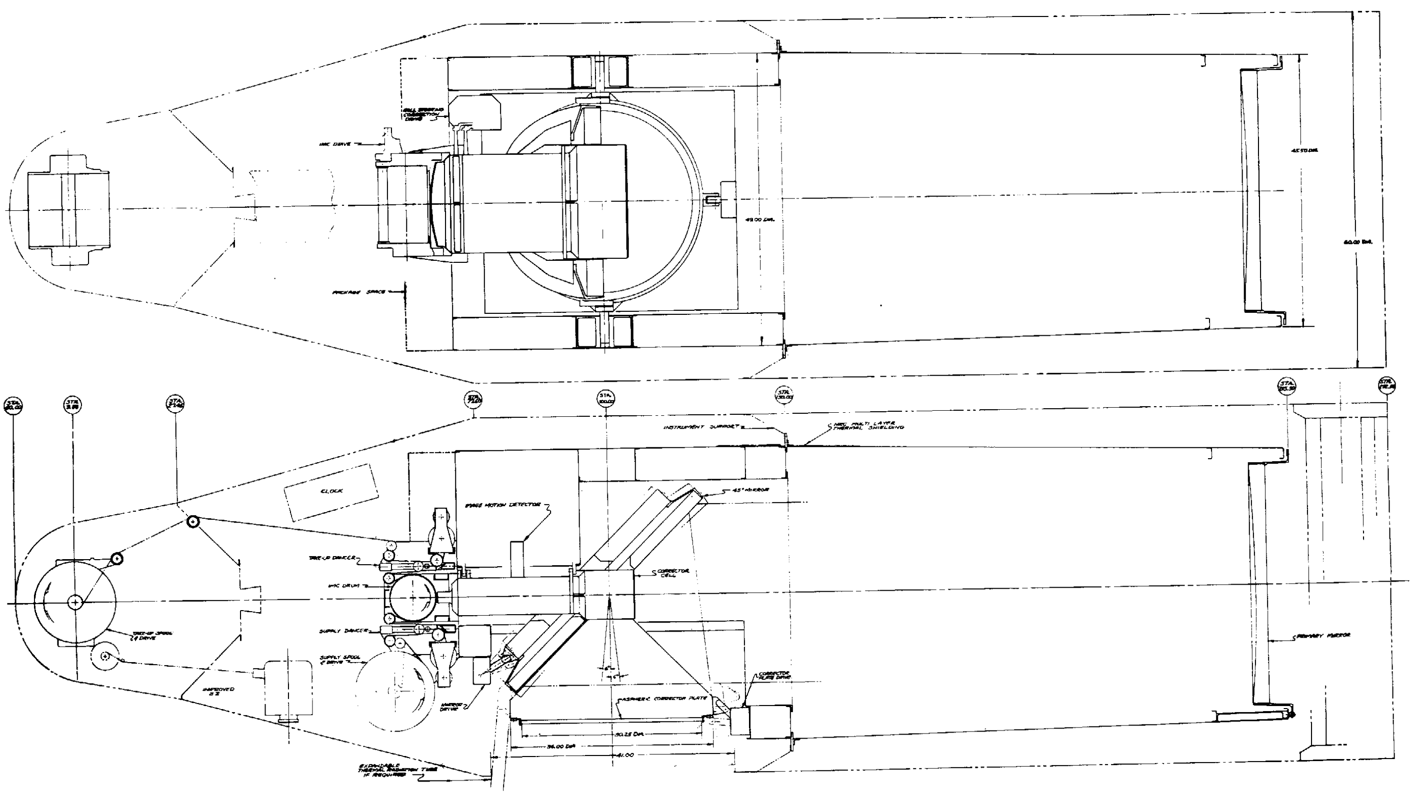
PROBABILITY OF ACHIEVING A GIVEN GROUND DETECTION



STEREO STRIP CAMERA SYSTEM

PROBABILITY OF ACHIEVING A GIVEN GROUND DETECTION FROM MINIMUM AND MEAN ALTITUDES




PACKAGE SPACE
INSTRUMENT SUPPORT
CLOCK
IMAGE MOTION DETECTOR
45° MIRROR
TAKE-UP DANCER
IMC DRUM
CORRECTOR CELL
SUPPLY DANCER
SUPPLY SPOOL
IMPROVED
MIRROR DRIVE
CORRECTOR PLATE DRIVE
ASPHERIC CORRECTOR PLATE
30.25 DIA.
36.00 DIA.
41.00
EXPANDABLE THERMAL RADIATION TUBE IF REQUIRED
PRIMARY MIRROR

STEREO STRIP MISSION OBJECTIVES

1-FOOT GROUND DETECTION

ACCURATE SPOTTING ABILITY

STEREO/MONO PROGRAM-VARIABLE IN SAME MISSION

EXPOSURE CONTROL FOR HIGH AND LOW SUN ANGLES

ROLL STEERING FOR TARGETS NOT BENEATH FLIGHT PATH

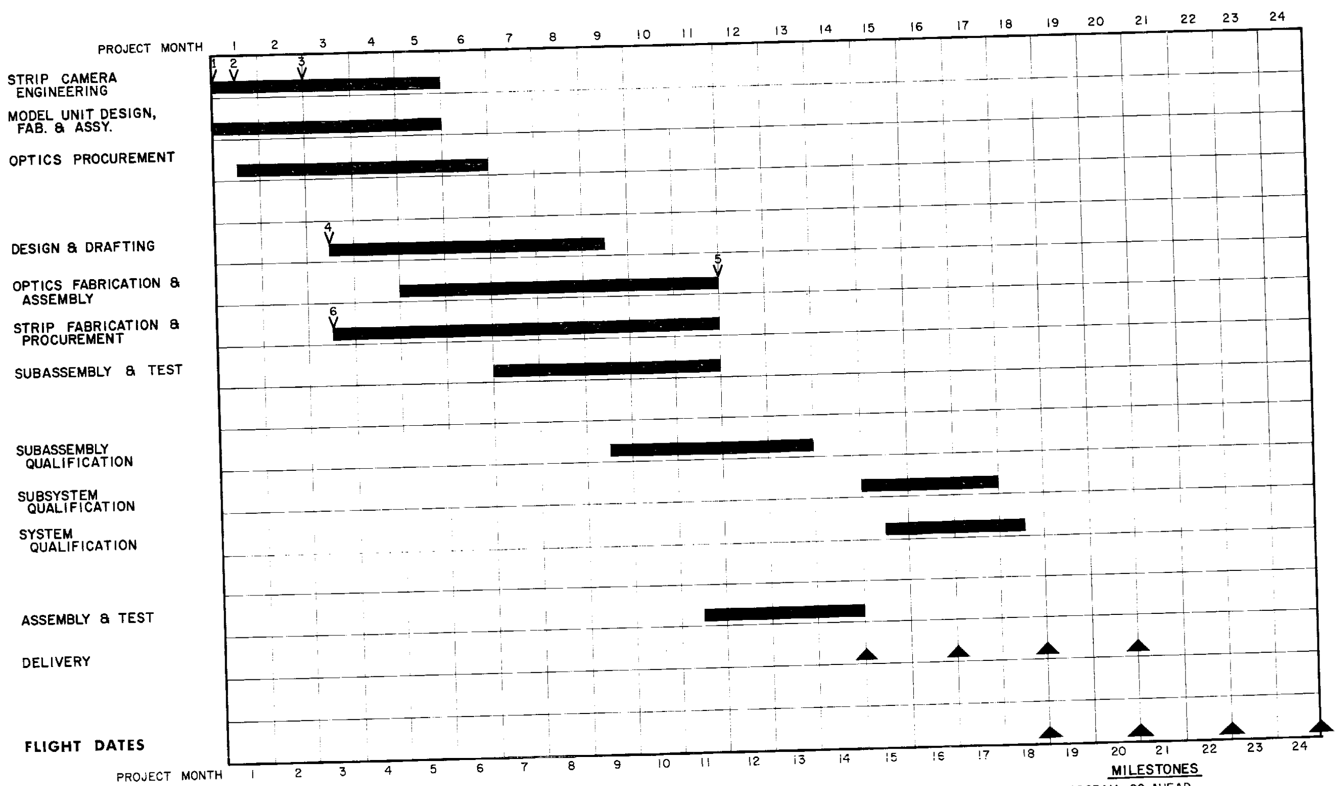
MISSION LIFE —30 DAYS — MULTIPLE RECOVERY CAPABILITY

LOCATION DETERMINED FROM STELLAR/INDEX PHOTOGRAPHY

STEREO STRIP SPOTTING CAMERA CHARACTERISTICS

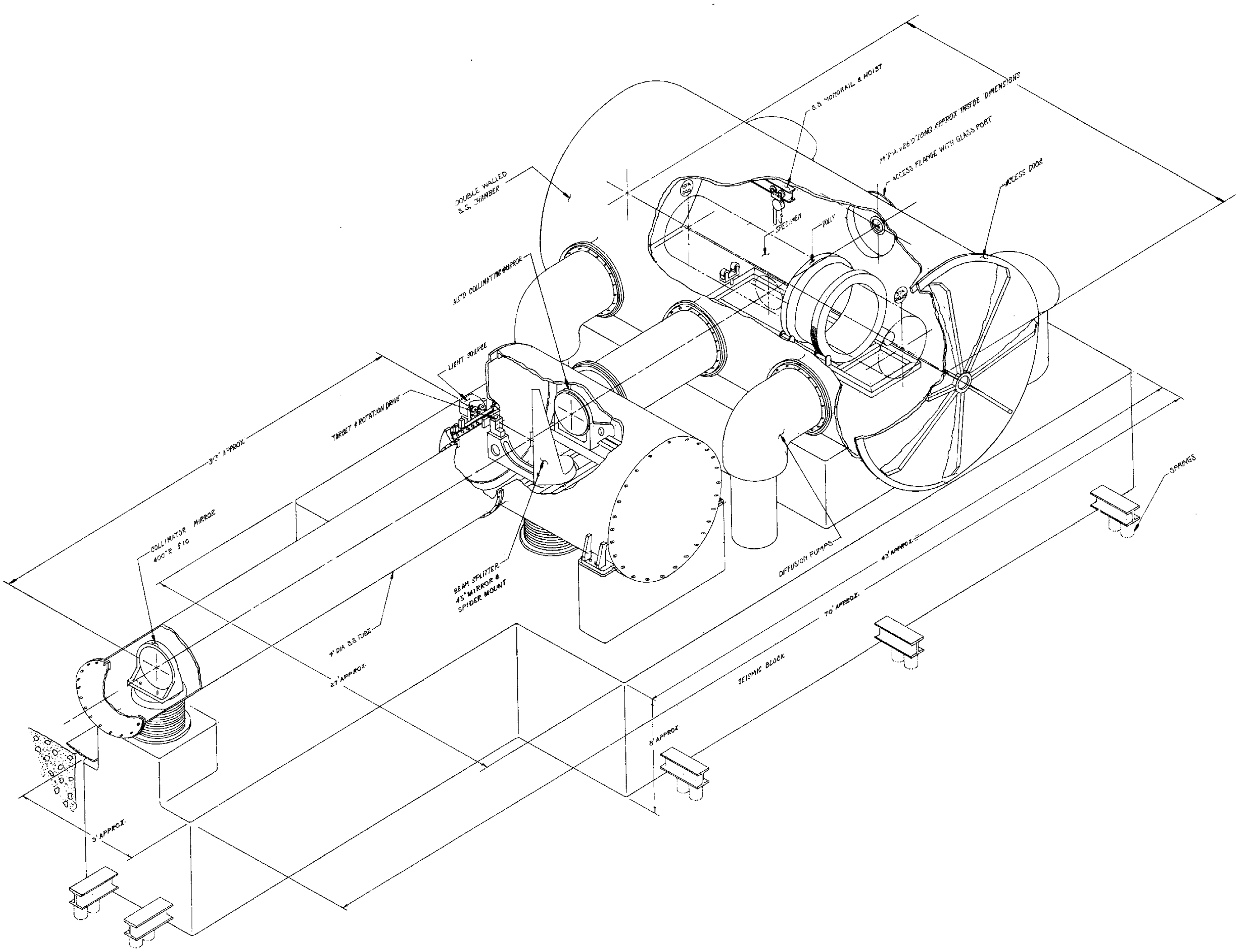
ALTITUDE OVER TARGET		
MEAN		90 N. MI.
MINIMUM		70 N. MI.
OPTICS		150" f/5
SCALE AT 70 N. MI.		1:34,000
RESOLUTION	CONTRAST	4:1 2:1
OPTICS/FILM		150 – 125 L/MM.
CAMERA RESOLUTION (50% PROBABILITY)		130 – 112 L/MM.
GROUND DETECTION AT 70 N. MI.		3/4 – 1 FT.
FILM		
FORMAT WIDTH		11 1/2 INCHES
CAPACITY (80-180 LBS.)		3,300 – 7,500 FT.
PHOTO COVER FROM 70 N. MI.		
STEREO FRAME SIZE		5.4 x 13 1/2 N. MI.
STEREO COVERAGE		50,000 – 113,000 SQ. N. MI.
LATITUDE COVER	10° SUN ∢	7 MONTHS TO 75° NORTH
	20° SUN ∢	5 MONTHS TO 75° NORTH

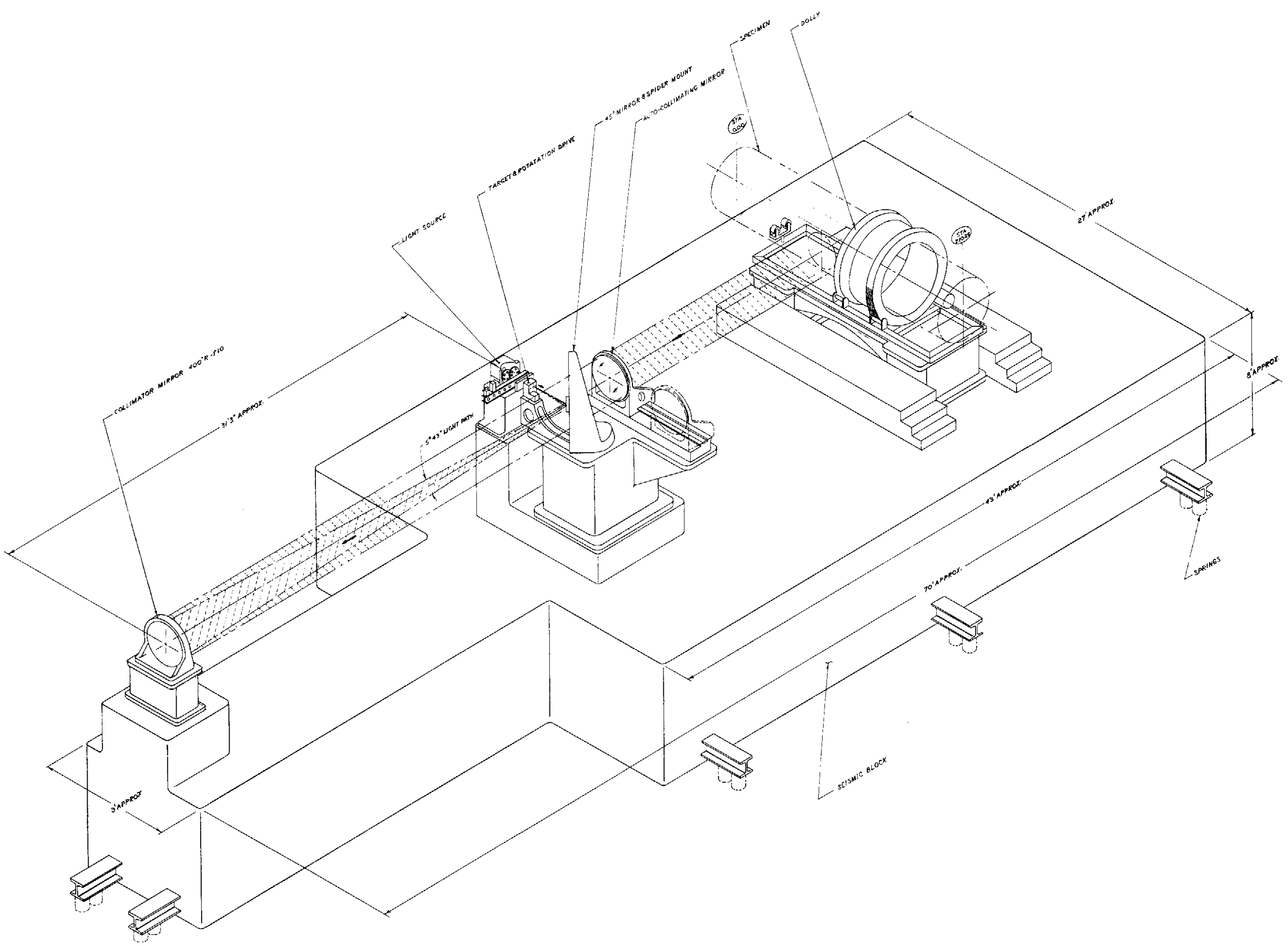
STEREO STRIP CAMERA SYSTEM

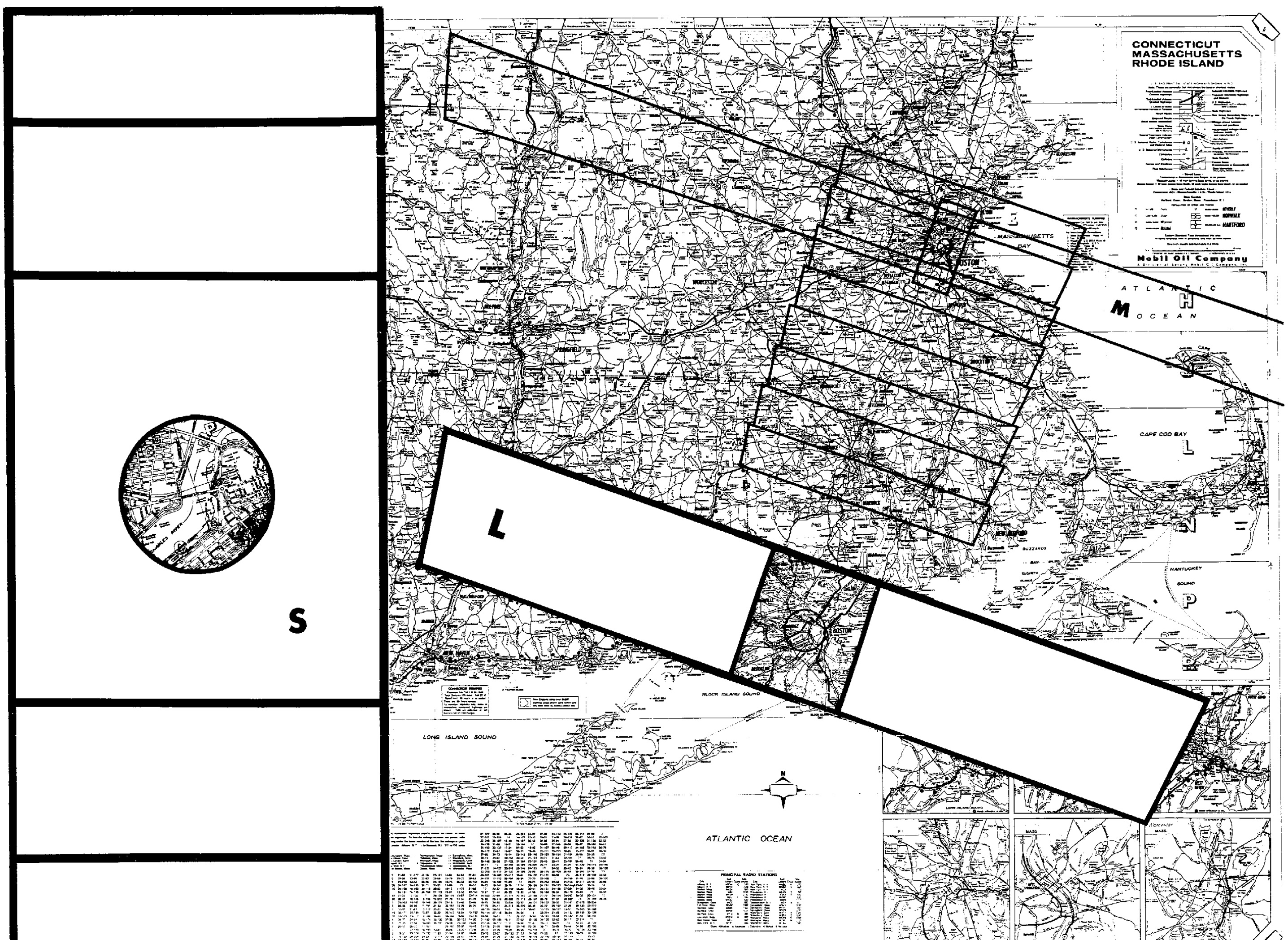


MILESTONES

1. PROGRAM GO-AHEAD
2. PRELIMINARY INTERFACE FREEZE
3. FINAL INTERFACE FREEZE
4. CAMERA DESIGN FREEZE
5. FIRST SET OF OPTICS COMPLETE
6. LONG LEAD ITEMS RELEASED


S.S. MONORAIL & HOIST
14'DIA. x 26'0" LONG APPROX INSIDE DIMENSIONS
ACCESS FLANGE WITH GLASS PORT
ACCESS DOOR
DOUBLE WALLED
S.S. CHAMBER
SPECIMEN
DOLLY
AUTO COLLIMATING MIRROR
LIGHT SOURCE
TARGET & ROTATION DRIVE
COLLIMATOR MIRROR
400'R f10
BEAM SPLITTER
45° MIRROR &
SPIDER MOUNT
DIFFUSION PUMPS
4' DIA S.S. TUBE
27' APPROX.
70' APPROX.
43' APPROX.
SEISMIC BLOCK
8' APPROX.
3' APPROX.
SPRINGS


LIGHT SOURCE
TARGET & ROTATATION DRIVE
45° MIRROR & SPIDER MOUNT
AUTO-COLLIMATING MIRROR
SPECIMEN
DOLLY
STA 210.25
27' APPROX.
8' APPROX.
43' APPROX.
70' APPROX.
SPRINGS
SEISMIC BLOCK
COLLIMATOR MIRROR 400"R - f10
31'3" APPROX.
5°43" LIGHT PATH
5' APPROX



CONNECTICUT
MASSACHUSETTS
RHODE ISLAND
Mobil Oil Company
MASSACHUSETTS BAY
ATLANTIC OCEAN
CAPE COD BAY
LONG ISLAND SOUND
BLOCK ISLAND SOUND
ATLANTIC OCEAN
L
S
M
H
L
P

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PROJECT 9040 ORGANIZATION AND OPERATION

6 JUNE 1962

25X1

9040 Project Manager

CONTENTS

Approved For Release 2004/12/15 : CIA-RDP66B00728R000300100002-4

ILLUSTRATIONS

I. INTRODUCTION

Project 9040 Organization and Operations briefly describes the manner in which the Project functions within the Optical Systems Division of Itek Corporation for fulfillment of contract obligations. This publication is not classified in the literal sense. It does, however, contain information which Itek would prefer to keep confidential.

The nucleus of the 9040 organization is a group who have worked together as a team throughout the entire Itek Project 9118 Program. Additional personnel have been acquired to form an efficient streamlined organization in a special branch of the Optical Systems Division.

The 9040 Project as of June 1 comprises approximately 130 people, of which 95 are directly assigned in Department 390, including 15 engineers, 35 designers and draftsmen, 35 in procurement and assembly, 10 in management and administration, and outside support of 35 people from manufacturing, optics, quality assurance and field service.

Figure 1, Manpower Forecast, shows the project manpower buildup to date by principal function. A total program cost-to-complete through September 1963 is currently in process for submission of a cost proposal and an early contract negotiation.

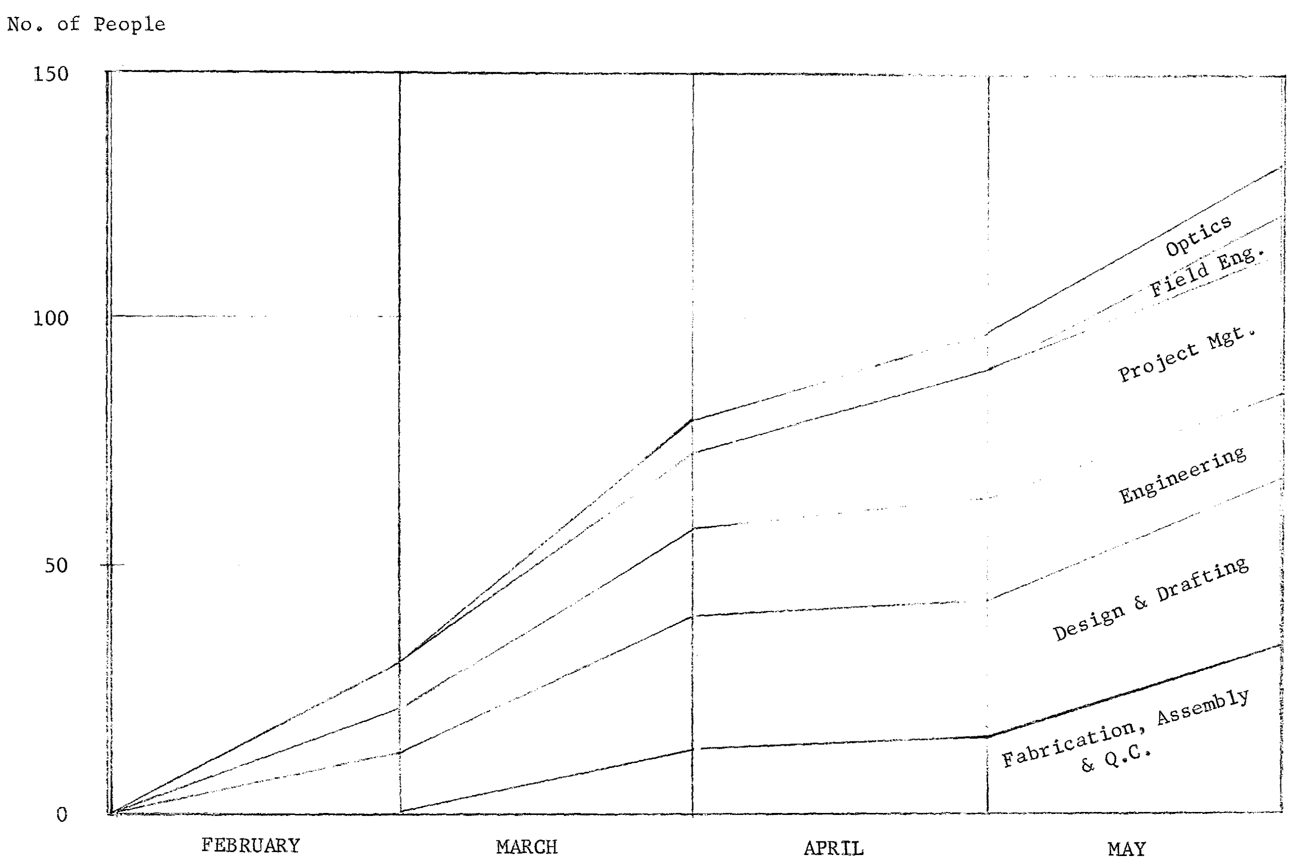

Figure 1. 9040 Manpower Forecast to Date

II. ORGANIZATION

Optical Systems Division

The Optical Systems Division of Itek Corporation indicates a strong project organization for fulfillment of research and development contracts of both ground and flight equipments.

Project departments are set up exclusively for a specific program and are made as self-sufficient as possible. Functional ties to individuals that are assigned to projects are maintained serving as a central headquarters for reassignment of personnel and to insure that company policies and procedures are applied throughout all projects.

Advanced Programs Branch: The advanced programs branch incorporates departments 310 and 390 and provides integration and continuity between projects.

Engineering Branch: The Engineering Branch provides a "homeroom" within the division from which assignments of engineers and designers and draftsmen are made to a specific project. In addition, all projects are subject to technical review by the System Design Staff.

Materiel Department: The Materiel Department provides individuals to specific projects to provide quick reaction and improved purchasing service to the project. In addition, major subcontracts are handled by the central procurement group.

Model and Prototype Shops Department: The Model and Prototype Shops department assigns model control personnel to a specific project. The or where shop loading does not permit the work to be placed within the company, outside vendors are contacted via the assigned purchasing agents under the direction and guidance of project model control. In addition, mechanical and electrical technicians are assigned to specific projects for breadboards and prototypes and assembly of deliverable equipment.

Quality Assurance Department: A quality assurance representative is attached to a project providing an independent channel directly to management. Q.A. personnel are attached to witness tests, accept equipment, etc. This serves as a check on the project in terms of monitoring equipment performance, compliance with specifications, etc. In addition, quality control performs an incoming inspection function on all parts and material from outside vendors as well as an inspection of all fabrication and assembly work performed "in house".

Environmental Laboratory: The Environmental Laboratory provides equipment and services to projects for engineering, acceptance, environmental and qualification tests. Environmental lab personnel are involved with specific projects in equipment design, review and generation of specifications, test equipment and fixture design and all other functions necessary for project environmental testing.

Project 9040

Project 9040 (See Figure 2) is comprised of a "project office", department 390 operations, and inter-company relations with: Optics and Manufacturing, who act essentially as subcontractors to the project office; Quality Assurance, providing test monitoring and quality control; Itek, Palo Alto, providing field personnel. All light dotted lines indicate attachment or other arrangement rather than assignment.

Project Office: The following are the definitions, functions, and responsibilities of the 9040 Project Manager and his Staff, which comprise the "Project Office".

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department operations and administration to optimize use of available resources. Responsible for inter- and intra-company liaison as it may effect the Project.

Project Contracts Manager: Under the daily direction of the Project Manager and under the direction of the Manager of the Contracts Management Department for matters of compliance with policies, the Project Contracts Manager: establishes a communications channel; formalizes instructions received from the customer; participates in planning of anticipated contract requirements; participates in proposal preparation; chairs, when delegated by the Manager of Contracts Department, the contract negotiation team; reviews progress and submits contract status reports; insures compliance with contract requirements including approval of overtime and subcontracts; requests and obtains all waivers and deviations; and expedites approval and collection of billed costs.

Project Scheduler: Under the direction of the Project Manager, and in conjunction with the Contracts Manager, the Project Administrator, and the Project Operations Director, establishes project plans and schedules to meet contractual program requirements insuring a timely integration. Assists in programming performance against schedules, and preparing schedule reports to the Project Manager, cognizant project personnel, and other Itek organizations. In addition, prepares material for submission of required schedule reports via the Contracts Manager, to the Customer and Systems Engineering. Recommends schedule and resource adjustments when required.

Project Administrator: Under the direction of the Project Manager, the Project Administrator is responsible for all general administrative functions required for compliance with Itek procedures and contractual requirements. Responsible for all publications and briefing aids, personnel actions, space and equipment requirements and adherence to security policies. Insures adequate project cost control including providing direction to budgets and cost estimating personnel assigned to the Project, cooperating with project personnel in the development of financial budgets adequate for cost control and the evaluation of project financial performance in conjunction with schedule performance, and reporting therein to the Project Manager.

<u>Project Operations Director</u>: Under the direction of the Project Manager, the Project Operations Director is responsible for the integration of the activities of Engineering, Design and Drafting, Model Control, Model Shop and Assembly and the Environmental Laboratory for all phases of operation of Project 9040. Insures that all contractual commitments are fulfilled on schedule and within allocated budget.

<u>Department 390 Operations</u>

Department 390 operations may be described as follows. Project 9040 Engineering is divided into four major groups:

The Systems Engineering Group is responsible for establishing and integrating all system and subsystem parameters to insure that the final product satisfies all requirements and is compatible with the equipment specification and the established external interfaces.

The Electrical Engineering Group is responsible for the design and packaging of all electrical circuitry.

The Mechanical Engineering Group is responsible for the design of all mechanical devices and for their incorporation into the structure.

The Structural Engineering Group is responsible for design of the primary structure and for maintaining a detailed weight summary. In addition, they review all design work to ascertain that structural integrity will be maintained.

When the initial design concept had been established the unit was broken down into functional subsystems. To each of these a team, consisting of a systems engineer, an electrical engineer and a mechanical engineer, was assigned. Each team is responsible for selecting a basic approach, completing a detail design analysis, including analog computer studies when necessary, and working directly with assigned design draftsmen and electrical or mechanical technicians to develop a final design layout and circuit schematic.

A team of the four engineering group supervisors is responsible for guiding and coordinating the efforts of the subsystems teams. This team provides the overall system design layout and circuit schematics. This team also keeps the project operation director informed of day to day progress against the schedule and calls his attention to problems requiring action by project management as they arise.

Services groups under the Project Operations Director work with engineering within the project structure. The groups take care of much of the routine detail, freeing the engineers to devote their time to the technical problems involved in the design and test of the equipment.

The Design and Drafting Section assigns designers and draftsmen who work with the engineers to create the required drawings. In addition, they maintain uniform drafting standards, keep the Engineering Drawing List up to date, and in conjunction with the Model Control Group, schedule the completion of detail drawings to meet procurement lead times.

The Model Control Section consults with engineering to determine what long lead items are anticipated. These are then ordered as soon as their requirement is established. When unforeseen procurement problems arise, engineering is consulted so the best solution to these difficulties can be found.

The Model Shop and Assembly Section provides technicians to work with engineering on the construction and testing of breadboard and prototype assemblies. In addition, they advise engineering of any drawing deficiencies or manufacturing difficulties encountered during assembly in order that modifications may be considered at the earliest possible time. Engineering aides work under the technical guidance of engineers to accomplish performance and qualification tests of deliverable equipment during the development phase.

Environmental Laboratory

The Environmental Laboratory works in conjunction with engineering to accomplish environmental testing.

Quality Assurance

A Quality Assurance Group is attached to the Project. Their function is to monitor project performance in terms of deliverable equipment performance to ensure compliance with company workmanship standards and tests in accordance with applicable specifications and test procedures.

Optics

Optics relationship to Project 9040 in the optical systems division is analogous to a major subcontractor. Specifications, schedules, and budgets are negotiated and a member of the optics organization is assigned to the project as liaison.

Field Engineering

Under the direction of the 9040 Project Manager, the Itek Palo Alto personnel are provided as required to ensure that 9040 field activities are accomplished.

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III. CONTRACT MANAGEMENT OPERATIONS

Contract Management

By Company Policy, a Contracts Manager is assigned from the Contract Management Department to every contract awarded to Itek. Project 9040 has a full-time Contracts Manager assigned owing to its relative importance, magnitude, and complexity. His daily direction is received from the Project Manager, while notification of changes in Company and other policy regulations are maintained by direction from the Manager of the Contracts Department.

More specifically, assignment of the Contracts Manager is made as soon as a proposal team is formed. The requirements are to provide guidance to the team by insuring compliance with the Customer's requirements, Company Policies relating to pricing, review or formulation of applicable contract clauses, participation in formulation of the Work Statement, Specification, and Schedule.

It is also the function of the Contracts Manager to chair, when delegated by the Manager of the Contracts Department, the formal megotiations of the definitive contract as well as changes of scope that may occur. As applied to Itek 9040 the Contracts Manager also represents the formal communications link between the Corporation and the customer, SE, the associate(s), and other organizations.

Some of these responsibilities are indicated in the following to show how the Corporation and Project 9040 comply with specific requirements of the Contract and Company Policy:

Documents: As is customary in most contracts, the Contract and its contract clauses in turn makes reference to support documents. A summary of these are as follows:

Work Statement: The purpose of this document is to list the equipments to be delivered, the work to be accomplished, obligations assumed by organizations other than Itek, and otherwise include all deliverables such as reports, manuals, etc.

Specification: The purpose of this document is to identify the specific technical description of the equipments to be delivered. This document is prepared in accordance with the format of an applicable Military Specification which is customarily used by the industry.

Schedule: The purpose of this document is to list every item to be delivered by Itek and items to be received from organizations other than Itek and identify the dates by which those items will be completed.

Proposal Procedure: Company Policy CR 1, Proposal Preparation and Processing, is implemented by Project 9040 as follows: Upon completion of the negotiation of the work to be performed as detailed in the Work Statement, Specification, Schedule, and by contract clauses; the Project Manager convenes a meeting of all supervisors who will contribute hours or dollars to the accomplishment of the program. At this meeting these documents are reviewed in conjunction with Task Statements which are written to describe each of the various subphases of the Program. These Task Statements, by subphases, are written around the Project cost collection system which has been previously determined.

The estimates received from the Project supervisors are then reviewed in specific detail by Project Management after which a Rough Order Magnitude estimate is performed for further review. These raw costs are then given to the Budgets and Estimating Department for pricing in accordance with Company Policy. In parallel with the pricing effort, the technical portion of the proposal package is gathered from existing documents, and the proposal transmittal letter is prepared by the Contracts Manager.

The completed proposal is then finally reviewed by the Optical Systems Division and Itek Corporation Management. Changes are incorporated, and the proposal letter signed by an Officer of the Corporation, and then mailed to the Customer.

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Communications: The Contracts Manager establishes and maintains a channel of all formal communications to and from the customer and other organizations regarding contract matters, as well as the exchange of technical, schedule, and budget matters. He also reviews informal correspondence between Project Management or other personnel both inter- and intra-company and maintains copies in the master file.

Overtime: The 9040 Customer requires that overtime be forecasted on a quarterly basis with actuals reported on a monthly basis. Overtime expended in excess of the forecast will have approval requested at the quarter forecasted. Itek recognizes the undesirability of prolonged overtime in terms of decreasing efficiency as well as excess costs to the Customer. For this reason prior weekly overtime requests are filed by each supervisor to 9040 Project Management which details the Department, the names of personnel, the specific task to be performed, the number of hours required, and the reason why this work cannot be performed on a straight-time basis. These requests must be approved by the Project Manager and are monitored by Project Administration for the actual hours expended against the budget. Owing to the schedule of the Contract, the Program must be forecast on an average 50-hour week. However, we intend to accomplish this average only by specific approval in limited areas rather than effect a 50-hour week for all Department 9040 personnel. Figure 3 shows examples of the overtime forms that are used to implement this procedure.

Reports: The responsibility of complying with report requirements of the Contract is assigned to the Publications Group, except for scheduling reports. They gather the necessary detail from the supervisors concerned and present the detail to the Project Manager for approval and to the Contracts Manager for submission in accordance with our obligations.

Change Control: The Change Control Procedure is established to accept the change requirements or investigation requests from within the Project, from within Itek, or from any source outside of Itek.

In the case of an investigation request, the Project Office reviews the request, obtains necessary responses from other organizations,

Figure 3. Examples of Overtime Control Forms

and responds with the effect on the technical objective and price or delivery.

In the event a mandatory change is issued prior to such an investigation request, the same Project group reviews the requirement, establishes the technique of compliance and issues direction to the Project organization. If price is affected, a proposal is prepared in accordance with the Project and Company Proposal Procedures.

IV. PLANNING AND SCHEDULING

Introduction

The function of Project Planning and Scheduling is implemented in Project 9040 by the assignment of a Scheduler as a part of the project management team in a staff capacity to the Project Manager. This allows for integrated planning between all project levels of organization, the development of detailed schedules supporting each of these groups and the timely analysis and rescheduling of problem areas where required thus insuring the successful completion of major delivery milestones.

Proposal Planning

During the time when the technical proposal is being prepared, a semi-detailed plan establishing known tasks and milestones and their interfaces is prepared using the Program Evaluation Review Technique (PERT). This PERT flow plan provides the basis for the proposal schedule and establishes to a first-order the immediate work activities necessary upon proposal acceptance and contract go-ahead.

First Unit - Project R&D Planning and Scheduling

Contract go-ahead provides and makes firm the customer's equipment requirements and delivery dates. The impact of these requirements and delivery dates are then completely analyzed and all new events and activities are incorporated into a new detailed PERT plan covering the engineering, design and drafting, procurement, fabrication and assembly, and test of the first unit. This PERT flow plan is then adjusted to make maximum use of present and contemplated manpower efforts where trade-offs in time, resources and/or performance can either improve the delivery date or the confidence in achieving the desired delivery on time. This adjustment in the PERT plan is a continuing process as the project continues and unforeseen events and requirements occur. The PERT statistical technique provides the Project Manager and Planner a tool which is both diagnostic and prognostic and quantifies knowledge about the uncertainties faced in completing project activities and tasks on time, thereby aiding in the formulation of timely decisions. Detailed project schedules of the required project activities and milestones are prepared in bar-chart form for easy reference and use. A PERT Schedule Chart displaying the flow plan against a background of time fixes the project time requirements for every event and activity. All schedules are updated as required and the PERT Schedule Chart is distributed biweekly with current completion status indicated. As a further means of displaying biweekly progress and the overall trend in sustaining the scheduled contractual delivery date, a PERT Status Thermometer Chart is maintained which shows the predicted variation from the delivery date each time a computer analysis and status up-dating is performed.

Multi-Delivery Planning and Scheduling

With the first unit milestones and work activities integrated and scheduled in detail, the requirements of each additional unit are considered by developing an Assembly Sequence Chart. This chart is a variation of the Line of Balance production plan and establishes graphically the time spans of major Line Flow subassemblies and their priority into the final installation and assembly sequence. Calendar dates are applied to the assembly sequence chart for each unit and this provides Model Control specific need dates of all parts on hand for each major subassembly of each unit. With the use of both historical and standard fabrication and procurement time span setbacks, detailed parts and subassembly scheduling for multiple unit production is achieved.

Those specific unit subassemblies, which due to quantity or usage, cannot be included on the standard assembly sequence chart are scheduled individually on Itek ADM-8 schedule forms. Progress monitoring and an evaluation of current status for each deliverable PAN unit are done on a biweekly basis. Progress and status, information on critical problem areas, effects on delivery, possible courses of action and recommended changes in schedules are reported to the Project Manager and Project Operations Director. Project review and schedule status briefings are held biweekly with the Project Manager and supervisors attending. Upon approval, required schedule changes are incorporated into individual PAN unit schedules. Delays in procurement and/or assembly and test are each evaluated as to their impact in final unit delivery by using a PERT procurement, assembly and test flow plan and computer statistical output for each PAN unit.

Ground Support and Auxiliary Equipment Planning and Scheduling

The requisite ground support equipment such as Test and Checkout Consoles, Instrumentation Consoles, Shipping and Handling Dollies and Transit Cases must be completed and available based on PAN unit schedule need and the contractual work statement. Auxiliary equipment requirements such as special tools and test equipment, assembly and test fixtures, company capital acquisitions and facility changes are also directly integrated with the PAN unit schedule and completion dates support the tasks and activity efforts leading to on-time PAN delivery.

Estimated work and procurement time spans are applied to each item of Ground Support and Auxiliary Equipment and this provides a detailed schedule which establishes effort need and priority. The detail considered in planning and scheduling this equipment is dependent upon the scope and intricacy of the individual item. Individual item and equipment schedules are prepared and distributed to cognizant supervisors. Progress monitoring is conducted biweekly and both actual and anticipated schedule delays reported together with their effect on PAN unit delivery.

V. FISCAL CONTROL

Introduction

Project cost estimates, budgets, and collection is based on Project Organization and equipment requirements. This correlation is provided by the Project 9040 Labor Charge Matrix. Material charges are by subsystem and equipments (See Figure 4).

Project Charge Matrix

The Project 9040 Labor Charge Matrix provides a subproject designation for each major project functional group, i.e. Project Management and Administration, -9040.01; Structural/Mechanical Engineering - 9040.09.

Principal task work areas common to one or more functional subproject groups have each been given a common alpha designation to be used in completing and describing the effort involved. 9040.09C, an example of a completed charge description by this system indicated mechanical engineering effort on special tools and fixtures. Each combination of subproject number and alpha designation as shown on the enclosed Labor Charge Matrix provides an area of cost collection.

Definitions

Forecast: The forecast is the cost estimate proposed to and accepted by the Customer. It reflects the target costs and defines the intensity and duration of effort in all phases of the project.

Budget: The budget is the estimate of costs on all phases of the Project. It serves as a mechanism for the day-to-day cost control of each phase of the Project by imposing realistic estimates against which the Project Engineer and/or Task Supervisor must measure his performance.

		A MECH. - PAN	B ELEC - PAN	C MECHANICAL SPECIAL TOOLS & FIXTURES	D ELECTRICAL SPECIAL TEST EQUIPMENT	E MECHANICAL GSE GHE & DOLLIES	F ELECTRICAL GSE C/O CONSOLES	G ACCEPTANCE TESTS	H QUALIFICATION TESTS	J BREADBOARDS	Y PROGRAM	K SPARES
9040.01	PROGRAM MGT & ADMINISTRATION										Y	K
9040.02	PUBLICATIONS	A					F	G	H		Y	
9040.03	SECURITY										Y	
9040.04	SUPERVISION & SERV. DESIGN, DRAFT, & CONTROL										Y	K
9040.05	DESIGN	A	B	C	D	E	F					
9040.06	DRAFTING	A	B	C	D	E	F					
9040.07	CHECKING	A	B	C	D	E	F					
9040.08	SYSTEMS/ELECTRICAL ENGINEERING		B		D		F	G	H			
9040.09	STRUCTURAL / MECH. ENGINEERING	A		C		E		G	H			
9040.11	MODEL SHOP ELECTRICAL ASSEMBLY		B		D		F	G	H	J	Y	K
9040.12	MODEL SHOP MECHANICAL ASSEMBLY	A		C		E		G	H	J	Y	K
9040.14	MANUFACTURING FABRICATION	A	B	C	D	E	F			J		K
9040.15	APPLIED OPTICS	A										
9040.16	ENVIRONMENTAL LAB	A		C				G	H			
9040.17	MODEL CONTROL										Y	K
9040.18	QUALITY CONTROL INSPECTION	A	B	C	D	E	F			J	Y	K
9040.19	MANUFACTURING ASSEMBLY	A	B				F					K
9040.20	RESEARCH OPTICS	A										
9040.21	QUALITY ASSURANCE ENGINEERING							G	H		Y	
9040.22	PALO ALTO SUPPORT ENGINEERING	A	B		D		F	G	H		Y	

Figure 4. Project Charge Number Matrix

Cost-To-Complete: Cost-to-complete is a budget, as defined above, which is prepared periodically as a means of verifying previous estimates or establishing new estimates.

Reporting: Reporting is the timely collection and dissemination of fiscal data to the Project for analysis.

Analysis: Analysis is the periodic, detailed review by the Project of fiscal data and schedule information, in order to evaluate technical progress with reference to dollar expenditures so that proper action or controls can be exercised.

Coding for Project Cost Control: (See Charge Matrix for individual cost element by organization and equipment.)

Sample Charge Number 9040.14C

Project (9040)--------------------Total Project

Subproject (9040.14)--------------Major Project Task

Subphase (9040.14C)---------------Principal Area (Special Tools & Fixtures)

Task Assignment/Selective Work Orders: Work orders describing tasks as identified in the matrix both technically and in terms of established budgets, are issued to task leaders for their guidance and control. These orders are amended as necessary to incorporate any changes of scope or direction and are used as a tool in the analysis and conduct of the program. These work orders are used together with a schedule as the basis of cost estimating and control. See sample form, Figure 5.

Project Reports: A budget is established from the negotiated program which includes the total summary and subproject area of cost. The subproject charge Matrix is the basis and point of control.

Collection of Costs: Reports from Management Information Services as furnished to the Project on a weekly basis are:

Itek **TASK ASSIGNMENT/ SELECTIVE WORK ORDER**

☐ **PROJECT TASK ASSIGNMENT** DATE ____________

PROJECT DEPT. NO. ☐ **PROJECT WORK ORDER** **WORK ORDER NO.**

SHEET ________ NO. ________

PROJECT NAME OR NO. ______________________

TASK SUPERVISOR

STATEMENT OF TASK:

PROJECT CHARGE NUMBER ASSIGNED

REVISION DATA

ASSIGNMENT DATA

DEPT. NO. ________

DEPT. NAME ________

DEPT. MGR. ________

TASK SUPVR. ________

SECTION HD. ________

APPROVAL

DEPT. MGR.

TASK SUPERVISOR

DISTRIBUTION:

DEPT. MGR. ________

TASK SUPVR. ________

SECTION HD. ________

SCHEDULES ________

COST EST. ________

PURCHASING ________

CONTRACTS ________

PWO FILE ________

DELIVERY REQUIREMENTS TO PROJECT:

CLASSIFICATION OR NAME	19 AUTHORIZED TIME IN HOURS PER MONTH												TOTAL

Project Material Cost: This reports current weekly dollar commitments and expenditures in dollars by subproject from purchase orders, plus current expenditures from progress payment orders, freight invoices, and stores requisitions.

Project Other Direct Charges: This reports current weekly expenditures for travel, communications, contract labor, consultants, and overtime premium. Other reports are received and are used for analysis.

Weekly Project Reports; The weekly costs which are collected are then posted to the total cost and subproject budgets.

Financial Control Meeting: Weekly subproject budgets are distributed to the appropriate task leaders and the total summary and sub-project detail is furnished to the Project Manager. Weekly meetings are held within the project with all task leaders to discuss cost, scheduling, and technical problems. A biweekly meeting is held with the Advanced Programs Manager and 9040 Project Manager. A monthly meeting is held with the Optical Systems Division and the Advanced Programs Branch.

VI. ENGINEERING

The Engineering Section as shown in Figure 6 is responsible for directing and integrating all technical aspects of Project 9040. Technical assistance and direction for all project groups and participation in both acceptance and qualification testing will be provided. Engineering integrates all changes as shown by approval signatures on all drawing changes. A description of these functions is as follows:

Systems Engineering Group:

This group has the primary responsibility of analysing the Customer's specifications and generating from these a set of system requirements for use as the basis for all technical direction. Continuous subsystem analysis to insure overall system compatibility and compliance with approved specification is required to fulfill the overall system design integration responsibilities.

Electrical Engineering Group:

The Electrical Group, following the system parameters, has the responsibility to design all servo and control systems using the latest developments in circuit design and to provide all technical direction for electrical and electromechanical packaging and cabling. This group designs and develops breadboards where required and provides electrical engineering support to all companion groups.

Mechanical Engineering Group:

The Mechanical Engineering Group has the responsibility to design

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Structural Engineering Group:

This group provides overall structural designs compatible with interface requirements and establishes amplification or attenuation factors for subassembly and component shock and vibration limits to insure compliance with specification requirements. Extensive structural testing will be employed to verify the structural integrity of the design. The Structural Group will maintain accurate weight and C. G. Control and publish a weekly report on same for Project Management review.

VII. DESIGN, DRAFTING, AND SERVICES

The Design, Drafting, and Services Section is responsible for the preparation of all drawings on airborne and ground equipment, and special tools and fixtures. In addition, the Section, in accordance with Company policies E-1 and E-2, coordinates all engineering change orders and releases, and maintains a specification library and a reproduction capability. These groups are shown on the Section organizational chart, Figure 7.

Design and Drafting:

The Design and Drafting Groups are responsible for preparing all drawings to good commercial practices, and referencing all applicable Federal and MIL specifications on the drawings. Drawings which may require numerous changes are drawn on Mylar. Layout drawings are properly planned and of such quality that they may be used in lieu of assembly drawings.

Master schematics are maintained current on a day-to-day basis, and all affected activities are issued current prints to insure that they are working to the latest issue.

Drawings from previous programs which are applicable to Project 9040, with few alterations, are being used to save drafting time. Sepia copies of such drawings are made, and all references to the previous programs are removed.

Engineering Services:

The Engineering Services Group is responsible for preparing Family Trees and engineering drawing lists, maintaining drawing lists and status cards, and coordinating engineering releases and engineering change notices.

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The Family Trees and engineering drawing lists contain the drawing numbers for all parts and assemblies required for the end product.

The drawing number list is maintained to control, assign, and issue consecutive drawing numbers as new drawings are released.

The drawing status cards include a history of the drawings from initial release through subsequent revisions.

Engineering Release forms are prepared for all new drawings at the time of issue.

Engineering Change Notices are processed by the Engineering Services Group and distributed along with the revised drawings.

Reproduction:

The Print Reproduction Room stores, reproduces, and maintains all Project drawings and documents generated within the Design, Drafting, and Services Section. Classified drawings and document masters are secured in the Print Room and reproduction of the classified material is controlled in accordance with security directives.

Library:

The Specification Library contains over 3000 Federal, Military, and Industrial Specifications and Standards, and files of over 4000 commercial vendors. The library continually up-grades its files with the aid of the Department of Defense Index and vendor perpetual mailing lists.

VIII. MODEL CONTROL

The Model Control Section has the responsibility of procuring all parts required for the 9040 Program. Procurement is based on allocated time spans as indicated in the Program Schedule, resulting in the timely arrival and assembly of parts.

The Model Control Section contains four functional Groups, as shown in Figure 8 : Records and Order Writing; Purchasing; Stores; and Coordinating.

Records and Order Writing

This Group receives the released drawings from the Design, Drafting, and Services Section. Based on the program's needs, the Group procures all components as the drawings are released such that they will coincide with the over-all program schedule. Components will be procured by either internal fabrication or by purchase, depending on shop capability and loading conditions. After the make or buy decision in accordance with Company policy PT-2, Purchase Requests are issued to the Purchasing Group, or internal work orders are issued to the Production Control Section. Internal work orders contain the estimated fabrication hours and the need-date. If the need-date cannot be met by the Production Control Section, the work order is voided and a Purchase Request is issued to the Purchasing Group for outside fabrication.

Records of revisions to released drawings are maintained so that components in stores or open order are also registered.

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Purchasing

Purchasing is responsible for maintaining vendor contacts to purchase all items issued on Purchase Request forms from the Records and Order Writing Group, according to scheduled need-dates.

Stores

Stores receives all procured parts from the Quality Assurance Section. A Daily Receiving Log is maintained and distributed to all affected activities.

Stores kits all subassembly components 3 weeks before the kit is to be issued to the Assembly Group of the Model Shop and Assembly Section. All items not available for kitting are recorded on a Request to Expedite form. One copy of this RTE is placed on an Immediate Visual Inspection board, a second copy is placed in an envelope within the kit box, and a third copy is used to generate a shortage list. The shortage list is forwarded to the Expediting Group so that all parts become available by the need-date.

Coordinating

This group serves as an arm of Model Control in coordinating and in keeping the Records and Order Writing Group advised on the status of shop and vendor orders.

IX. MODEL SHOP AND ASSEMBLY

The Model Shop contains the necessary personnel and equipment required to support the project in assembly and testing of all breadboards, prototypes, and deliverable equipments.

Technical direction is supplied by Engineering; scheduling requirements are established by the Scheduler; parts and procurement information is provided by Model Control; and drawings are furnished by Design and Drafting.

The organization of this group is shown in Figure 9 and indicates the same electrical and mechanical divisions as exist throughout the project.

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X. FIELD ENGINEERING

Field Engineering is organized into three key functions: liaison, field engineering and support engineering. Efficient control and effective operation are planned to provide adequate support with the associate contractor in areas of environmental and system performance tests, system checkout and calibration, equipment installation and integration, pre-operation planning, detailed analysis, system evaluation, operational preparation, and analysis.

To achieve the maximum effectiveness and versatility of personnel engaged in the program at the field location, a combination of a rotating and a fixed work station team concept will be employed. Station teams of skilled and experienced engineers and technicians will service each instrument or item of test equipment from the time of delivery at the field site until the unit is operational. A rotating team will support all pre-operation tests and checkout tasks and prepare the unit for operational readiness. By establishment of such a team concept, each team can provide maximum support to the program, as dictated by the delivery and operational schedules at the various field work stations.

When field service teams require additional technical and/or operational support, the support engineering section will furnish engineering specialists and analysts as necessary in the areas of installation, test, checkout and operational support to supplement, when necessary, field engineering at all locations.

The major pre-operation and post-operation analysis and preparation of any required reports will also be the responsibility of support engineering.

XI. FACILITIES

The facilities at Itek are uniquely suited to the needs of programs requiring the design and development of photo-optical systems. The following description of our facilities and experience reflects this capability and emphasizes our interest in this area.

Itek has available the fabrication, assembly, and test facilities for the proposed program. The following paragraphs summarize Itek's optical, environmental, and thermal facilities. Project 9040 utilizes the optical facilities for optics fabrication, the 128 project area for design and assembly of units, and the environmental lab for system test and checkout.

Project 9040 Area, 128

Project 9040 occupies approximately 15,733 square feet of the 128 facility. A breakdown by project areas is as follows:

Route 128 Facility

Project Office	1,260 sq. ft.
Design and Drafting	2,800 sq. ft.
Main Assembly	3,610 sq. ft.
Purchasing	350 sq. ft.
Model Control	1,340 sq. ft.
Publications	200 sq. ft.
Plans and Schedules	220 sq. ft.
Computer	210 sq. ft.
Stock Room	1,400 sq. ft.
Reproduction	512 sq. ft.
Engineering	995 sq. ft.
Prototype Test Area	1,188 sq. ft.
Lens Assembly	1,200 sq. ft.
Subassembly	448 sq. ft.

Optical Facilities

The research effort on high-precision optical components is the responsibility of Optics. The development and fabrication of these components is carried out by Applied Optics. Figure 10 is the floor-plan of the optical research and fabrication areas.

Optics research activities are concentrated in three areas: Theoretical optics, lens design, and image evaluation. Theoretical optics research is chiefly concerned with the field of classical diffraction theory, especially in the calculation of image intensities involving third- and fifth-order spherical aberrations related to circular and annular apertures. Theoretical and experimental studies on spatial filtering in the diffraction plane covering occluding and attenuating filters, as well as sharp and unsharp original edges, are currently in progress. These investigations will lead to advanced image-enhancement techniques whose importance in the role of photo-interpretation can scarcely be overemphasized.

In the area of lens design, investigation is being made of fifth-order aberrations, the programming of lens designs on the Itek Corporation LGP-30 and PDP-1 computers, and the development of automatic correlation techniques.

In the area of image evaluation, optical engineers have calculated system performance in terms of sine-wave response by techniques that have enabled excellent correspondence to be achieved between theoretical predictions and empirical confirmation.

These research activities will ultimately coalesce into a capability allowing image structure to be calculated and frequency response determined from design data, thus making possible satisfactory evaluation predictions before the fabrication phase.

The developmental activities of Applied Optics can be illustrated by three current efforts that have received considerable attention. The first is a sine-wave lens testing bench that is in the final fabrication stages. Also nearing completion is a precision edging apparatus on which centering, edging, and beveling can be performed with tolerances held to as close as one ten-thousandth of an inch. This machine was developed to

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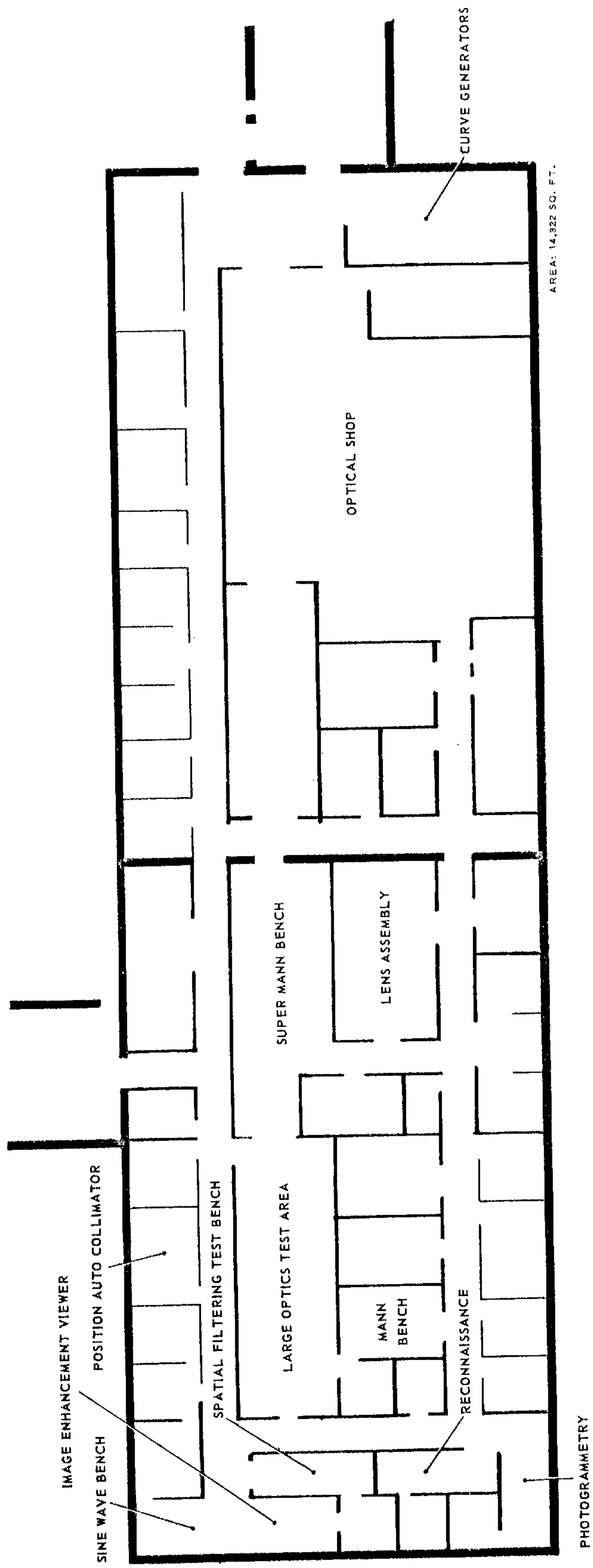

Figure 10. Optical Research and Fabrication Area

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expand the capabilities of the optical shop. A new approach to the precise measurement of the contours of aspheric optical surfaces is being tested; the highest precision is required, and the design goal is to determine surface characteristics to within one micron.

The optical shop is well equipped to handle the high-precision, "custom" optical requirements demanded of it. Its facilities include some of the largest curve-generating equipment, single-spindle polishing machines for 16-inch-diameter optics, and large drapers for optics of greater diameter. The optical shop has strong capabilities for the precision assembly that plays such a key role in the performance of Itek's high-acuity reconnaissance systems. Mechanical accuracy in the cells and optical elements is stressed to ensure the closest possible matching of dimensions. The facilities also include excellent coating apparatus for both small and large optical elements, and a complement of precision optical benches for testing small- and large-focal-length lenses visually, photographically, and in terms of sine-wave response.

In the past, the emphasis in Applied Optics has been on the design and fabrication of systems applicable to aerial reconnaissance. Many of the current research and development activities are oriented toward an expansion into areas of interest involving unique systems, subsystems, and components that will demand extremely close tolerances and will be applicable to a broader range of government and commercial requirements. As a part of this continuous program, the optical scientists maintain close contact with state-of-the-art developments in the United States, and with optical research groups in Sweden, France, England, Germany, and Japan.

Applied Optics includes among its staff members two expert photogrammetrists who are working on extending the photogrammetric art into the area of highly specialized mapping. Recent work has involved the development of new precision rectification techniques.

Over the past several years, experimental and operational lenses were developed which have performed close to the limits set by the aperture diameter. These lenses have been constructed and tested, and been found to be limited only by the inherent residual secondary spectrum of a refractor design. For reference, the most important recent lenses are listed in the following:

Focal Length, in.	f/No.
12	5
24	5
24	3.5
66	4 and 5

Each of these lenses has constituted an improvement in the state-of-the-art. The last two are especially notable in that their inherent secondary spectrum has been significantly reduced.

The production of such lenses naturally requires experience and attention to detail far beyond that necessary for the usual optical work. For example, these lenses have produced photographic resolution exceeding 150 lines per millimeter. Additionally, a 0.5-percent tolerance on focal length has been maintained.

Typical tolerances required and satisfied in achieving this resolution are:

Radius	0.003 to 0.05 percent
Element thickness	±0.001 inch
Air spaces	±0.0001 inch
Surface quality	1/4 fringe or better, spherical and aspheric

In these systems the element diameters extend up to 15 inches, and a new edger was developed for precision centering of the larger sizes. Elements with an edge thickness of four inches have been centered, flatted, and beveled with less wedge than 0.0002 inch. The elements are all complete and have passed critical measurement control.

Environmental Laboratory

The Itek Environmental Test Facility encompasses 12,000 square feet of floor space and has equipment of the latest design available for environmental testing. The 28,000-pound force shaker system (the largest manufactured to date) is capable of vibrating a 5000-pound load at 5 g. The large vacuum chamber is designed to operate at ultrahigh vacuums. The Dynamic Resolution Tester (DRT)is a vacuum chamber mounted on a 750,000 pound, spring-floated, seismic block which prevents ground vibrations from

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degrading the accuracy of dynamic optical tests. The work area is air-cleaned and temperature-controlled.

Small Vacuum-Chamber: Consists of a vessel six feet in diameter and eight feet long. Included are the necessary pumps and equipment to achieve a pressure of 1×10^{-6} mm Hg in four hours.

Guardite Temperature Chamber: A temperature chamber with three-cubic-foot capacity. Temperature range is -100 to 250^{o}F.

American Research Climatic Chamber: This climatic chamber has a 96-cubic-foot capacity. Temperature range is -100 to 250^{o}F, and humidity range 20 to 95 percent. The chamber is capable of simulating altitudes up to 200,000 feet.

International Research Temperature/Humidity Chamber: This chamber has interior dimensions of three cubic feet and is capable of producing temperatures of -35 to 240^{o}F. Humidity range is 5 to 99 percent.

Barry Shock Machine, Model 1500: Capable of applying shocks of up to 100 g, and of handling loads of up to 500 pounds. Shock pulses may be square, half-sine wave, or sawtooth. Shock duration may be varied from 2 to 20 microseconds.

Avco Shock Machine: Capable of handling a 40-pound load and producing shock pulses of square, sawtooth, and half-sine wave configurations. Shock durations of 2 to 20 microseconds, and accelerations of 5 to 400 g, are possible.

Consolidated Electro Dynamic Mass Spectrometer, Model 24-120: Detects one part of helium in 10 million parts of air at 0.2-micron pressure. System may be used for both vacuum and pressure leak-testing. Pressure testing is controlled by using a sniffer probe which has a self-contained metal leak. Auxiliary equipment includes mechanical roughing pump, standard calibrated glass leak, and audio alarm.

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