9204-SHC64-141

Copy # 3

6 October 1964

Gentlemen:

Itek is pleased to submit this proposal covering a seven (7) month feasibility study and design effort for Phase I of the "F" System Development Program.

This document replaces Itek proposal 9204-SHF64-69, and subsequent addendums thereto, previously submitted covering Phase I of the "F" System Development Program on a different task structure basis.

This proposal constitutes a bid for specific items of work, the details of which may be found in Section 1, entitled Work Statement, of the attached proposal.

Further, our prices for these items are in accordance with the schedule in Section 1.

Our prices do not contain federal, state, or local taxes, as none are believed applicable. Furthermore, the above prices do not contain a price or charge for royalties in excess of $250.

The price and delivery quotations found in this proposal are predicated on the following terms, conditions, and contract considerations:

1. That your activities will issue a cost-plus-fixed fee contract substantially in accordance with standard ASPR and AFPI provisions applicable to cost reimbursement type contracts with commercial institutions.

2. That subject proposal is valid for a period of sixty (60) days after which time, Itek reserves the right to amend the terms and conditions thereof.

3. That the costing as presented does not include consideration of facility acquisitions and leasehold improvements.

4. That the F.O.B. point of all items delivered under this contract is Lexington, Massachusetts.

Rent fee use of facilities

5. That fifteen (15) rolls (174,000 feet) of EK Type 4404 (7"inch wide) film be furnished GFE in order to perform the necessary testing required under this effort. Itek will provide the necessary spools to hold the above GFE film.

An addendum to this proposal will be submitted as soon as possible outlining a two (2) month Phase IA effort covering the period 1 February 1965 through 1 April 1965. The Phase IA effort will immediately follow the Phase I effort and its purpose will be to continue the detailed design of components of the cameras system which would not be affected by the results of the feasibility study, complete the final interface specification and initiate ground handling and facility equipment design.

We are enclosing, for your planning purposes, a schedule, budgetary quotation, and organization chart for Phase II of the "F" Program under Appendices B, C and D respectively of the attached proposal.

Attached herewith for your information and files are fully executed copies of the Contingent Fee Statement and Certificate of Current Pricing.

Very truly yours,

R. W. Philbrick,
Vice President

CONTINGENT FEE REPRESENTATION

Bidder represents: (a) That he has not employed or retained any company or person (other than a full-time bona fide employee working solely for the bidder) to solicit or secure this contract, and (b) that he has not paid or agreed to pay to any company or person (other than a full-time bona fide employee working solely for the bidder) any fee, commission, percentage or brokerage fee, contingent upon or resulting from the award of this contract, and requested by the Contracting Officer

Date of Execution

This is to certify that, to the best of my knowledge and belief:

(i) complete pricing data current as of 6 October 1964 have been considered in preparing the Proposal 9204-SHC64-141 and submitted to the Contracting Officer or his representatives:

(ii) all significant changes in the above data which occurred since the aforementioned date through 6 October 1964 have been similarly submitted; and no more recent significant change in such data was known to the undersigned at the time of executing this certificate; and

(iii) all of the data submitted are accurate.

Name ____________________________

Title ____________________________

Firm ____________________________

____

Date of Execution

9204-SHC64-141
Copy No. 3

7 October 1964

PROPOSAL FOR

FULCRUM CAMERA SYSTEM

FEASIBILITY STUDY

CONTENTS

CONTENTS

SECTION 1

WORK STATEMENT

TASK 1. OPTICAL BAR SYSTEM

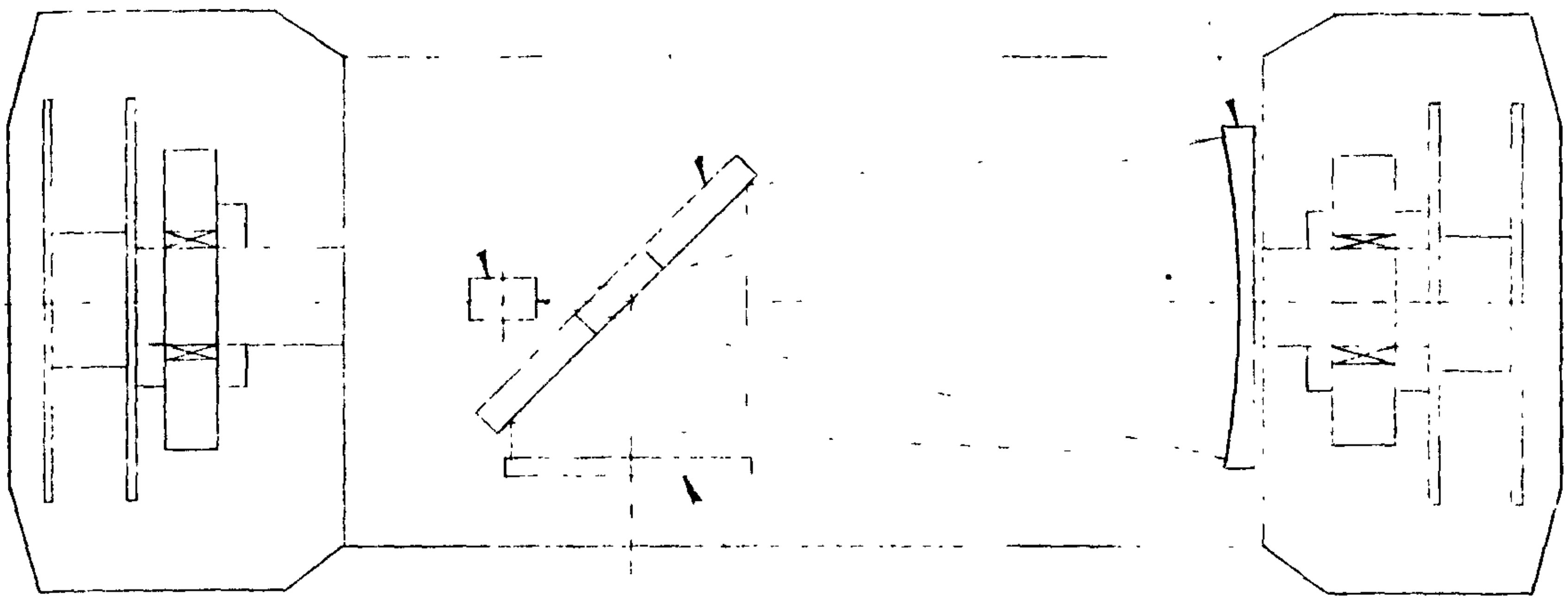
1.1 Film Transport System

Itek will design and fabricate a brassboard of a high speed film transport system for use in an optical bar type panoramic system which has the capability of maintaining film velocities to the level of accuracy consistent with the requirements of a high resolution (minimum of 100 l/mm on film) panoramic camera system for use in photography from orbiting satellites which may operate in a V/h range from 0.035 to 0.06 rad/sec. This transport will be suitable for use with a 60-inch f/3.0 Maksutov folded mirror system.

The principal features of this transport will include a minimum inertia film drum whose axis is perpendicular to the optical bar axis, continuous film transport having no skew rollers, an optical bar supported in two small diameter bearings with the film supply spool and intermediate take-up spool located at opposite ends of the optical bar. A method of coding the film will be incorporated such that an accurate accounting of the positions of the unexposed areas of the film can be maintained in order that these areas can be exposed at a later time. A careful study will be made of the reliability and practicality of the film reversing operation. Careful evaluation will be given to minimizing film wastage and power consumption.

The brassboard shall be a full scale, "true configuration," model of the film transport system including supply and take-up spools,

ROTATING OPTICAL BAR SYSTEM



~~SPECIAL HANDLING~~

SK66691

film drive drum, true film path with all dancers, rollers, etc., incorporated in an optical bar structure shortened by the elimination of the optical system but complete with all optical bar drive components, bearings, slip rings, etc. The film drive subassembly shall be complete with all necessary IMC motions and counter balances, fiducial marking, and film coding subsystems. Compromises of the "ultimate" design may be made, where necessitated by component availability, if the resultant brassboard is compatible with the "ultimate" design.

1.2 Camera System Design

The following system design efforts will be accomplished:

a. Perform a detailed design study (including layouts) of the main camera, incorporating film transport and optics indicating size, location and configuration of all significant subassemblies.

b. Perform a design study of camera structure, system support structure, and structural mounts to vehicle.

c. Prepare main camera specifications, establishing detail design and performance requirements.

d. Establish and maintain camera block diagrams, and timing diagrams.

e. Perform a detailed design study (including layouts) of the other components of the camera system (i.e., recovery take-up).

Prepare a detailed camera system assembly drawing indicating film path, light shielding, windows, cabling, and defining the relationship of the camera system components to the vehicle.

f. Perform an analysis of the camera system thermal requirements, including preliminary determination of insulation, heaters, sinks, special equipment materials and/or configurations, etc.

g. Establish system requirements for electrical controls and equipment i.e., programmer, clock, cabling, connectors, power, etc.

h. Maintain current estimates of system weights, balance, and inertias.

i. Prepare camera system equipment specifications, establishing detail design and performance requirements.

j. Establish and maintain camera system block diagrams, and timing diagrams.

k. Prepare an interface specification and installation drawings for relation of camera system to vehicle and recovery system, indicating dimensions and locations, weights, C.G.'s, inertias, momentum unbalances, power requirements, interface connectors, control commands, window size, vehicle mounts, light shielding, pressure control, attitude stabilization rates and accuracies, vibration, etc.

l. Conduct liaison with vehicle and recovery system contractors to establish and maintain system compatibility.

m. Prepare camera system performance (design) specifications (i.e., vibration, thermal, shock, acoustic, etc.) based upon vehicle and recovery system design data.

n. Fabricate and maintain a full-scale non operating (wooden) mockup of the complete photo system establishing all component sizes and locations, film paths, windows, support structure, vehicle mounts, interface connections, cable runs, etc.

o. Devise a feasible plan for and establish a practical method of incorporating into the camera a fiducial system such that a definite relationship can be established between image points and the original object points.

p. Consider the parameters affecting the maintenance of a pressure at the film transport area such that corona discharge can be obviated. If air bearings are used the spillage from these bearings will be accounted for and calculations made for additional make up air.

1.3 Test

Itek will generate a test plan, develop test equipment, and perform tests to clearly demonstrate the capability of the film transport brassboard. The model will be operated at both ambient atmospheres and in a vacuum chamber to ascertain the dynamic effects of the absence of air, detect the possible presence of corona discharge, and evaluate the eligibility of the required forward and reverse motion of the film. No further environmental testing will be undertaken in conjunction with this effort. Vacuum tests will be conducted using existing facilities which are currently being utilized on other Government contracts. This effort is predicated upon the use of these facilities on a non-interference basis.
All design, testing and evaluation shall conform to good comercial practice rather than to military specifications.

n. Fabricate and maintain a full-scale non operating (wooden) mockup of the complete photo system establishing all component sizes and locations, film paths, windows, support structure, vehicle mounts, interface connections, cable runs, etc.

o. Devise a feasible plan for and establish a practical method of incorporating into the camera a fiducial system such that a definite relationship can be established between image points and the original object points.

p. Consider the parameters affecting the maintenance of a pressure at the film transport area such that corona discharge can be obviated. If air bearings are used the spillage from these bearings will be accounted for and calculations made for additional make up air.

1.3 Test

Itek will generate a test plan, develop test equipment, and perform tests to clearly demonstrate the capability of the film transport brassboard. The model will be operated in a vacuum chamber to ascertain the dynamic effects of the absence of air and to detect the possible presence of corona discharge. No further environmental testing will be undertaken in conjunction with this effort. Vacuum tests will be conducted using existing facilities which are currently being utilized on other Government contracts. This effort is predicated upon the use of these facilities on a non-interference basis.

All design, testing and evaluation shall conform to good commercial practice rather than to military specifications.

At the conclusion of the seventh month, a detailed evaluation report of the two prototypes will be delivered. This report will include the following:

a. The results of experiments designed to measure the film velocity errors with description of measuring techniques.

b. Potential image degradation due to film velocity error.

c. The results of environmental chamber tests designed to examine film handling problems (such as corona discharge) at operational gas pressures and film velocities.

d. The results of experiments with EK Type 4404 7-inch film designed to test the prototype for film damage (scratching, etc.).

1.4 Gas Bearing Analysis

1.4.1 Franklin Institute Effort

Itek will subcontract to Franklin Institute the task of analyzing the problems associated with the utilization of gas bearings in a space environment. Parameters will be established such that the results of this analysis will be applicable to the bearing requirements of the proposed camera system. If gas bearings appear warranted, Franklin Institute personnel will be utilized on a consultant basis during the fabrication and testing of such a bearing.

1.4.2 Liaison Effort

Itek will maintain liaison with Franklin such that the study is pertinent and can be utilized to greatest effectiveness.

TASK 2. ONE THIRD FOCAL LENGTH SYSTEM

2.1 Film Transport Breadboard

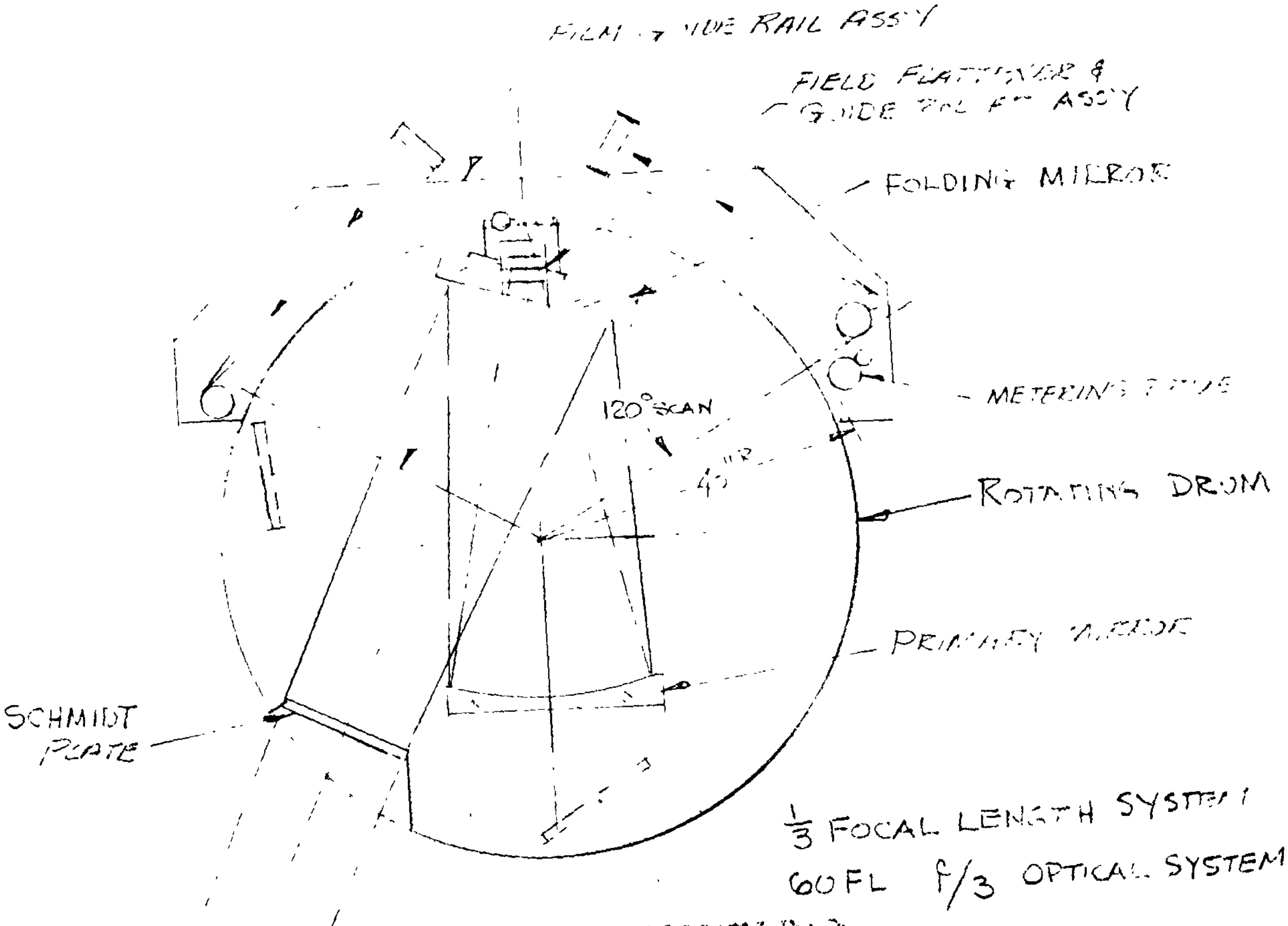
Itek will design, develop and test a feasibility breadboard of the continuous film transport system for the 1/3 focal length, 120° scan, camera system with the Schmidt-corrected optical system.

This breadboard shall be of the "table top" type, rather than a complete "true configuration" of the entire film transport system, for the purpose of demonstrating that the film can be continuously driven at a precise velocity past the scan head throughout the 120° scan angle. The breadboard shall incorporate film rails, scan head, film rollers and dancer loops, cross-track and along-track IMC motions as necessary, to clearly demonstrate feasibility.

Effort on this task shall be based upon the findings of a film drive analysis now being conducted for this configuration.

2.2 Camera Design

Itek will prepare the preliminary design of the 1/3 focal length main camera, incorporating the film transport which is described in Section 4.1. The camera shall consist of the Schmidt-corrected optical system, rotating about an axis 1/3 of the focal length from the nodal point with 120° scan and continuous motion film transport. Detailed camera layouts and specifications of the entire camera and major components shall be prepared.


120° SCAN
45°
ROTATING DRUM
SCHMIDT PLATE
1/3 FOCAL LENGTH SYSTEM
60FL f/3 OPTICAL SYSTEM

Itek will fabricate a full scale mock-up of a single camera in a vehicle framework to establish the in-vehicle configuration, camera to vehicle mount configuration, window position, and light trap methods.

The following design efforts will be accomplished:

a. Perform a detailed design study (including layouts) of the main camera, incorporating film transport and optics indicating size, location and configuration of all significant subassemblies.

b. Perform a design study of camera structure, system support structure, and structural mounts to vehicle.

c. Prepare main camera specifications, establishing detail design and performance requirements.

d. Establish and maintain camera block diagrams, and timing diagrams.

e. Prepare a detailed camera system assembly drawing indicating film path, light shielding, windows, cabling, and defining the relationship of the camera system components to the vehicle.

f. Maintain a current estimate of camera weight, balance and inertias.

g. Prepare an interface specification and installation drawings for relation of camera system to vehicle and recovery system, indicating dimensions and locations, weights, C.G.'s, inertias, momentum unbalances, power requirements, interface connectors, control commands, window size, vehicle mounts, light shielding, pressure control, attitude stabilization rates and accuracies, vibration, etc.

h. Conduct liaison with vehicle and recovery system contractors to establish and maintain system compatibility.

i. Devise a feasible plan for and establish a practical method of incorporating into the camera a fiducial system such that a definite relationship can be established between image points and the original object points.

j. Consider the parameters affecting the maintenance of a pressure at the film transport area such that corona discharge can be obviated. If air bearings are used, the spillage from these bearings will be accounted for and calculations made for additional make-up air.

2.3 Test

Itek will generate a test plan, develop test equipment, and perform tests to clearly demonstrate the capability of the film transport breadboard. The model will be operated in a vacuum chamber to ascertain the dynamic effects of the absence of air and to detect the possible presence of corona discharge. No further environmental testing will be undertaken in conjunction with this effort. Vacuum tests will be conducted using existing facilities which are currently being utilized on other Government contracts. This effort is predicated upon the use of these facilities on a non-interference basis.

All design, testing and evaluation shall conform to good commercial practice rather than to military specifications.

At the conclusion of the seventh month, a detailed evaluation report of the two prototypes will be delivered. This report will include the following:

a. The results of experiments designed to measure the film velocity errors with description of measuring techniques.

b. Potential image degradation due to film velocity error.

c. The results of environmental chamber tests designed to examine film handling problems (such as corona discharge) at operational gas pressures and film velocities.

d. The results of experiments with EK Type 4404 7-inch film designed to test the prototype for film damage (scratching, etc.).

TASK 3. OPTICAL DESIGN AND FABRICATION

3.1 Optical Bar System

3.1.1 Optical Design

A six month effort is planned for completion of a final optical design for the proposed system. The optical system to be designed shall be a 60-inch focal length, f/3 system, 6-inch field, capable of providing the best possible image quality on EK type 4404 film with a minus blue filter. The type of lens shall be a catadioptric, corrected by a Schmidt or meniscus, preferably with no aspheric surfaces. The overall length and other optical characteristics shall be suitable for the intended application.

An optical design will be carried out using our 924 computer. The length constraints of the system will require modification of existing programs. The mechanical and thermal tolerances will be programmed and analyzed and system analysis will be done to evaluate the effect of environment upon the optical system.

As a backup factor, a lens design will be procured from an independent source which will be evaluated along with the Itek design. This will be carried only to a stage sufficient to determine feasibility and image quality.

A technical summary will be prepared at the end of each month. A preliminary lens design and tolerancing analysis will be presented at the end of the third month. A final report will be supplied at the end of the sixth month covering all design and analysis carried out. Continuous system analysis and consulting services will be supplied to the project and to the optical manufacturing departments.

The preliminary design will be satisfactory for prototype fabrication of elements. The final design shall incorporate all features appropriate to production quantities.

We have studied the effects of thermal gradients and their optical effects on flat windows and these investigations will be extended to cover the heat transfer to and through the faces and of the aspheric corrector plate. Calculations will be made of the defocusing and aberration effects of uniform temperature excursions to determine the degree to which such effects can be tolerated in operation.

The thermal analysis capability of the Vidya Division of Itek will be utilized to predict the effect on the optical elements of albedo and other thermal disturbances.

3.1.2 <u>Fabrication</u>

The two plate ribbed primary mirror, the folding mirror, and the aspheric plate are of a sufficiently critical nature and present enough unique fabrication and mounting problems to warrant Itek proposing the fabrication of prototypes of these elements and the cells required to mount them to the optical bar proper.

Investigations into materials and structures, as well as fabrication, assembly and test techniques will be conducted to assure optimum selection of components and manufacturing methods conducive to as efficient a production schedule as is feasible for systems of this type. The use of cast-in-place epoxy locating shoulders, foamed-in-place resins and elastomeric mounting will be examined for suitability of application.

3.1.3 Optical Testing

Itek will generate a test plan and carry out such tests as are required to assure optical, mechanical, thermal and operational integrity of the individual element-mount combinations. Ritchie tests using laser interferometric techniques will be utilized in the testing of the folding mirror.

3.2 One Third Focal Length System

3.2.1 Design

Itek will design a Schmidt-corrected catadioptric 60-inch f/3.0 optical system suitable for use in a panoramic system which is to be rotated about an axis located 20-inches behind the node of emergence.

3.2.2 Fabrication

Since the optical fabrication problems associated with this camera design are essentially the same as in the optic bar design no element fabrication is necessary.

3.2.3 Testing

Tests similar to those predicated in 3.1.3 would be utilised to check the Schmidt plate.

TASK 4. FACILITIES STUDY

The purpose of this task is to survey Phase II facility and equipment requirements for environmental test, project administration and engineering, fabrication, assembly, field service, and mission support. Particular attention will be given to leasehold improvements and government furnished equipment. Any long lead items which might delay scheduled delivery of operational equipment will be identified to the contracting agency as soon as they are evident.

Specifications for facilities and equipment will be prepared in sufficient detail to obtain cost and delivery quotations from vendors and provide a basis for equipment procurement and detailed design of special purpose installations.

Schedules and costs of facility construction and furnishing, including pertinent backup data, will be developed and presented in a summary document.

TASK 5. SYSTEM ANALYSIS

5.1 System Dynamics

Determination will be made of the magnitudes and frequencies of the disturbing forces and torques and their effect on camera structural distortion to ascertain the resulting focal shift, and/or synchronization errors and craft reactions. The effects of gyroscopic torques, momentum and dynamic unbalances and mechanism accelerations will be evaluated. The analysis will be utilized in the selection of configurations, choice of materials and the determination of required structural stiffness as well as in the evaluation of system performance.

5.2 Optics

We will maintain quantitative knowledge of all optical factors which affect system performance. The following factors will be determined:

The size and shape of the central aperture obstruction of the system

The optical transfer function of the system

The T stop of the system

Straylight or veiling glare in the system

In addition to maintaining the best possible current record of these quantities, camera designers will be given all inputs to ensure that optimum light baffling and straylight trapping procedures are used, and that the best mounting methods are employed.

5.3 Photographic Considerations

Film marking and an associated detection system for locating film position will be investigated and evaluated.

Knowledge of all film factors which will affect photographic performance of the system will be maintained.

A record of the current expected exposure time will be kept for the system.

Design engineers will be kept informed of important factors which will affect the performance of the film under operational conditions.

Factors pertaining to the interaction of the film and the mechanical transport system will be analyzed.

5.4 System Performance

An analytical determination of the resolution and modulation transfer functions of the basic optical system and the effects of vibration, focal shift, synchronization error, image motion compensation error, distortion of the lens, and their combination with the film transfer function.

Experimental determination made of the subsystem performance will be compared with the allowable values in the error budget. Sub system performance will be utilized to provide a prediction of system resolution and modulation transfer function. An experimental determination of system resolution will be compared with the predicted values and deviations will be investigated.

TASK 6. PROGRAM ANALYSIS

This task consists of a continuing analysis of total program requirements for Phase II. This task will be closely coordinated with and complementary to Task 4. Areas which will be considered include: development and production organization; procurement, fabrication, testing, and material handling problems of a special nature; field service requirements; and comprehensive program schedules. Particular emphasis will be placed on the development of realistic schedules and identification of critical long lead items. Items which could jeopardize the schedule objectives of Phase II will immediately be communicated to the procuring agency.

The information generated in this analysis task will provide the foundation for a realistic and comprehensive program plan for Phase II, and minimize the possibility of unanticipated developments.

SUMMARY OF DELIVERABLE ITEMS

Contractual requirements of the Phase I Program are as summarized below:

Item	Quantity	Description	Delivery Date
1	1	Brassboard of constant velocity film transport system suitable for optical bar type panoramic system and incorporating optic bar bearing system	1/31/65
2	1	Evaluation report of the performance and operational feasibility of Item 1.	1/31/65
3	1	Task 5 Summary report giving a detailed report of the system analyses	1/31/65
4	1	Preliminary interface specification defining the optical bar camera system envelope, weights, power requirements, and other camera system spacecraft interface factors.	11/16/64
5	1	Full scale wooden design mockup of the complete optical bar camera system in a space frame representing the vehicle	1/31/65
6	1	Report summarizing the optical bar camera design	1/31/65
7	1	Engineering specifications for the fabrication of the optical elements	9/30/64
8	1	Interim report covering the design and expected performance of the optical systems	9/30/64
9 & 10	1	Prototype elements of the optical bar system to include one each Schmidt plate, primary mirror and folding mirror consistent with the requirements of the lens design.	1/31/65

Item	Quantity	Description	Delivery Date
11	1	Final optical design report covering all aspects of the optical design and fabrication studies and stating requirements for putting the designs into production.	12/31/64
12	1	Breadboard of a continuous film transport system for the 1/3 focal length, 120° scan, panoramic camera system.	1/31/65
13	1	Evaluation report of the performance and operational feasibility of Item 12.	1/31/65
14	1	Full scale wooden mockup of a single 1/3 focal length camera within a space frame representing the vehicle.	1/31/65
15	1	Preliminary interface specification defining 1/3 focal length camera system envelope, weights, power requirements, and other camera spacecraft interface factors.	11/21/64
16	1	Report summarizing the 1/3 focal length camera design.	1/31/65
17	1	Report of facility requirements, costs, schedules, and specifications for their construction.	12/31/64
18	1	Program plan for Phase II.	12/31/64
19	1	Summary report comparing the rotating optical bar system and the 1/3 focal length system. This should compare the results of the individual feasibility studies, state Itek's opinion as to the manufacturing problems of each design, and recommend the design which is most likely to fulfill the total operational requirements without compromising the basic mission objectives	1/31/65

SECTION 2

PROJECT ORGANIZATION CHART

Page Denied

SECTION 3

PHASE I SCHEDULE

SECTION 4

PHASE I COSTS

PROJECT 9204
SCHEDULE OF DIRECT LABOR HOURLY RATES
OVERHEAD AND G & A RATES

Labor Rates for Period 10-2-64 through 2-1-65

Labor Class	Hourly Rate
Executive Engineer	$10.20
Staff Engineer	7.62
Senior Engineer	5.77
Engineer	4.46
Junior Engineer	3.63
Senior Technician	3.42
Technician	2.81
Designer	4.50
Draftsman	2.38
Senior Draftsman	3.27
Optical Shop	3.38
Technical Writer	4.40
Illustrator	3.67
Reproduction	2.72
Technical Typing	1.93
Senior Inspector	3.37
Experimental Machinist	2.83
Senior Experimental Machinist	3.34
Senior Assembler	1.98
Project Secretary	2.16

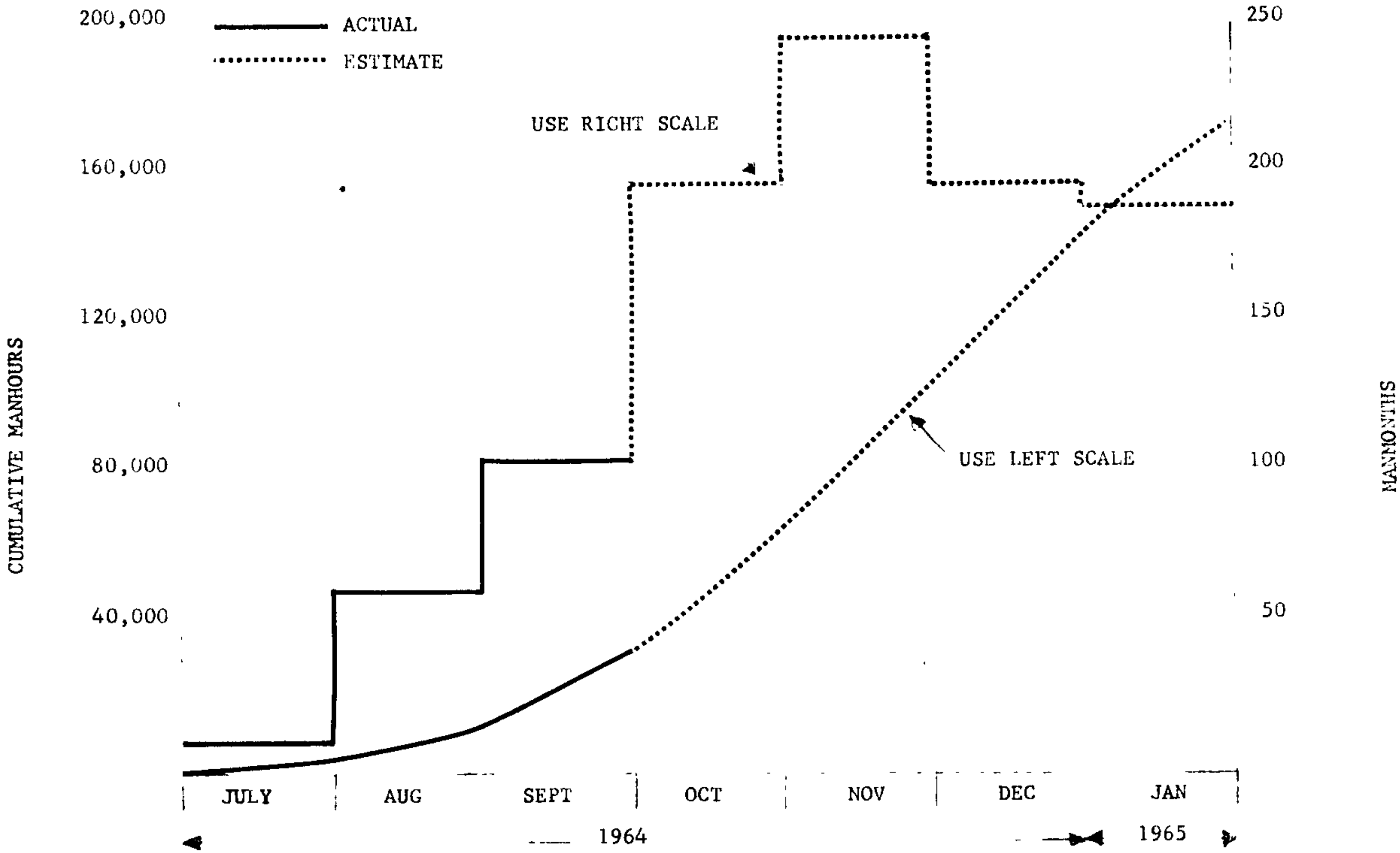
Overhead and G & A Rates

Overhead, Inception through 10-2-64	150%
Overhead, Period 10-2-64 through 2-1-65	150%
G & A, Inception through 10-2-64	15%
G & A, Period 10-2-64 through 2-1-65	14.5%

SECTION 5

MANPOWER REQUIREMENTS

Approved for Release: 2021/04/09 C05087910


200,000
160,000
120,000
80,000
40,000
CUMULATIVE MANHOURS
ACTUAL
ESTIMATE
USE RIGHT SCALE
USE LEFT SCALE
250
200
150
100
50
MANMONTHS
JULY
AUG
SEPT
OCT
NOV
DEC
JAN
1964
1965

APPENDIX A - RESUMES

Approved for Release: 2021/04/09 C05087910

JOHN A. WOLFE
Manager, Advanced Projects, Optical Systems Division of Government Systems

Special Qualifications

Organization and management of technical development and production programs.

Experience

1958-Present: Itek Corporation. Presently, responsible for all phases of execution on major contract involving the development and limited production of photo-optical and electromechanical systems. Formerly, project head and staff engineer on similar projects.

1948-1958: Boston University Physical Research Laboratories, Boston, Massachusetts. Project engineer and research associate. Designed methods and apparatus for testing the performance of gyroscopically stabilized aerial camera mounts. Designed and developed an airborne high-resolution television reconnaissance system, infrared scanning systems, electrical control systems, and an airborne azimuth stabilization system.

Education

B. S. in electrical engineering, Massachusetts Institute of Technology, 1948.
M. S. in electrical engineering, Northeastern University, 1956.

Associations

Institute of Electrical and Electronics Engineers; Sigma Xi; Coblentz Society.

FRANCIS J. MADDEN
Staff engineer, Projects Department of Optical Systems Division of Government Systems

Special Qualifications

System R&D engineering on panoramic cameras and special photo-optical systems.

Experience

1958-Present: Itek Corporation. Responsible for the system design and engineering coordination of a photo-optical program.

1951-1958: Mechanical engineer, Boston University Physical Research Laboratories, Boston, Massachusetts. Designed pressurized containers to carry electronic instrumentation used in upper atmosphere research. Designed a synchronized, three-motion picture camera array which provided 100-percent film coverage of any event. Designed an armored, five-channel recording galvanometer and special parachute swivel bolt which, through a series of slip rings, carried information from strain gauges in the parachute webbing to the recording galvanometer. Designed two lens-polishing tables, and the mechanical components for a six-inch interferometer. Project engineer, development and testing of a twin metrogon lens camera. Designed a 240-inch, f/10 mirror camera and the same system scaled down to a 75-inch focal length. Project engineer, development of a system for obtaining accurate geodetic references. Project engineer, design of equipment necessary for the study of an airborne camera of high resolution with minimum mass. Project engineer, design and development of feasibility model of HYAC I. Designed a 100-inch, f/16 infrared camera. Former instructor in physics, Boston University College of Liberal Arts. Former lecturer in basic engineering thermodynamics, Boston University College of Industrial Technology.

Education

B.S. in mechanical engineering, Northeastern University, 1951.

Patents

One patent pending.

CALVIN S. MORSER

Chief mechanical engineer, Engineering Branch of Government Systems

Special Qualifications

Engineering program management; design and development of navigation systems, tracking mounts and systems, hydrostatic bearings and fluid flow controls.

Experience

1963-Present: Itek Corporation. Chief mechanical engineer.

1955-1963: Marine Equipment Department, Nortronics Division, Northrop Corporation, Needham, Massachusetts. Program manager and chief engineer for the design, development, and production of a precision celestial tracking periscope drive system, and a submersible radiometric sextant, both for use in the Polaris submarine navigation system. Design of large precision tracking mounts, hydrostatic bearings, and control valves for nuclear reactors.

1954-1955: Schlage Lock Company, San Francisco, California. Design and development of small precision mechanisms and hydraulic components for high production manufacture.

1951-1953: California Research and Development Company, Livermore, California. Design and development of a 60-foot diameter high vacuum vessel and associated vacuum system for a linear particle accelerator.

1948-1951: Humble Oil and Refining Company, Houston, Texas. Design and development of the marine support equipment required for an offshore oil well drilling and production program.

1946-1948: General Electric Company, Lynn, Massachusetts. Development, testing, and evaluation of aircraft gas turbines.

1942-1946: US Navy. Lieutenant, USNR. Engineering duties involved the repair and maintenance of submarines in naval shipyards.

Education

B.A. in mechanical engineering, Stanford University, 1940.
B.S. in naval architecture and marine engineering, Massachusetts Institute of Technology, 1942.

Associations

Society of Naval Architects and Marine Engineers; American Society of Naval Engineers.

Patents

Three patents issued.

WILLIAM N. SNOUFFER
Assistant to vice president and general manager,
Government Systems

Special Qualifications

Administration and management of technical activities and personnel.

Experience

1959-Present: Itek Corporation. Administrative assistant to vice president of Government Systems. Served as project manager on three projects, 1961 to 1962.

1957-1958: Waltham Laboratories, Sylvania Electric Products, Inc., Waltham, Massachusetts. Assistant project manager (5 months) and project manager (10 months) for Plato Antimissile Missile System, responsible for all phases of a complex antimissile radar system project.

1937-1958: U.S. Air Force. Commissioned officer. Specialized in communications and electronics. Held command and staff positions in major Air Force Commands, prepared initial plans for the aircraft warning system for Alaska, supervised technical training for Army, Navy, and Air Force in atomic energy project at Sandia Base, New Mexico.

Education

Coe College, 2 years preengineering, 1931-1933.
B.S. in engineering, U.S. Military Academy, 1937.
M.S. in electrical engineering, University of Illinois, 1948.

Associations

Air Force Association.

ROBERT R. BACHELDER
Senior aeronautical engineer, Engineering Branch

Special Qualifications

Analysis and design of structures for aerospace applications.

Experience

1963-Present: Itek Corporation. Payload preliminary design. Structural analysis and test planning for optical systems.

1961-1963: Radio Corporation of America, Burlington, Massachusetts. Project engineer for development of major spacecraft structure. Specified instrumentation and data reduction techniques for program to determine spacecraft stage separation shock response.

1959-1961: U.S. Army. Assigned to Jet Propulsion Laboratory, Pasadena, California. Performed structural design and analysis of Ranger and Mariner vehicles. Developed computerized analytic techniques.

1957-1959: Research assistant and research engineer, Massachusetts Institute of Technology, Cambridge, Massachusetts. Developed computer programs for structural analysis.

Education

B.S. in civil engineering, Massachusetts Institute of Technology, 1957.
M.S. in civil engineering, Massachusetts Institute of Technology, 1959.

Associations

AIAA.

Awards

Tau Beta Pi, Chi Epsilon.

JULES COHEN
Manager of technical planning for Graphic Processing Division

Special Qualifications

Organization, planning, scheduling, and evaluation of engineering operations and technical support activities.

Experience

1963-Present: Itek Corporation. Manager of technical planning for the Graphic Processing Division of Government Systems. Responsible for coordinating the technical planning activity within the division; organizes and carries out the marketing and proposal efforts required to implement the plans. Former project manager on a classified program.

1955-1963: Perkin-Elmer Corporation, Norwalk, Connecticut. Manager, Research Facility. Responsible for administrative and technical aspects of various classified and company development programs. Previously, engineering section head on driftsight, image motion compensation, radar photoreproducer programs, and other classified programs.

1953-1955: Belock Instrument Company, New York City, New York. Chief of mechanical design. Responsible for the mechanical design and fabrication of the Navy RS-12 and RS-14 Multi-Target Radar Simulation Programs.

1952-1953: Fairchild Camera and Instrumentation Corporation, New York City, New York. Lead design engineer for a series of aerial reconnaissance cameras.

1951-1952: Kollsman Instrument Corporation, New York City, New York. designer for the automatic astro-compass.

1948-1951: Kollmorgen-Optical Corporation, New York City, New York. Designer of submarine periscopes, navigation devices, and telescopic sights.

1946-1948: Remington-Rand, Incorporated, New York City, New York. Responsible for detailing microfilming equipment in the Photo-Records Laboratory.

Education

Studies in mechanical engineering, New York University.
Various engineering management courses and seminars, New York University.

Associations

Optical Society of America; Society of Photographic Scientists and Engineers.

EDMUND J. GALAT
Staff electrical engineer, Optical Systems Division

Special Qualifications

Strong background in radar system design and supervision.

Experience

1963-Present: Itek Corporation. Signal processing of video and radar information.

1961-1963: RCA, Aerospace Communications and Control Division, Burlington, Massachusetts. Senior member of the technical staff and lead engineer on a program to develop a guidance coupler for a satellite program, a program to develop and electronic countermeasures analyzer, and a program to provide an integrated air traffic control tower for the AN/TSQ-47 System.

1960-1961: Sylvania Corporation, Waltham, Massachusetts. Directed project on the AN/MPQ-32 Radar System Track Signal Processor; designed the range servo-system and target detection circuitry.

1954-1960: RCA, Moorestown, New Jersey. Project engineer involved in the design of ranging systems for precision radar tracking systems. These included the AN/FPS-16, BMEWS, and Tradex systems. Areas of interest were range tracking, target detection and acquisition, and synchronization equipment design.

Education

B.S. in electrical engineering, University of Massachusetts, 1954.
Graduate study at the University of Pennsylvania and Northeastern University.

Associations

Institute of Electrical and Electronics Engineers

NORMAN S. GORALNICK
Electrical engineer, Advanced Programs Branch of Optical Systems Division

Special Qualifications

Design of control and pulse circuitry using transistor and semiconductor techniques.

Experience

1958-Present: Itek Corporation. Design of systems involving extensive use of semiconductor logic. Formerly, worked on control circuitry in the electrical design of viewers.

Education

B. S. in electrical engineering, Tufts University, 1958.

GEOFFREY C. HARVEY
Manager, Optical System Research Department

Special Qualifications

Experimental, geometrical, theoretical, and practical optics.

Experience

1958-Present: Itek Corporation. Directing groups dealing with experimental, geometrical, theoretical, and practical optics.

1945-1958: University of Tasmania, Australia. Lecturer in physics. Administered a second year physics course and developed experimental courses in physics. Developed optical field testing facilities for initiation of atmospheric optics studies. Responsible for the establishment of operational evaluation of photographic reconnaissance systems for the Royal Australian Air Force Aeronautical Research and Development Unit. Graduate lecturer in physical optics, Fourier optics, and communication theory.

1956-1957: BU Physical Research Laboratories. Research associate. Fulbright scholar. Worked on the prediction of photographic range for missile photography.

Education

B.Sc. in optics, University of Tasmania, Australia, 1945.

ROBERT S. HILBERT
Senior photo-optical engineer, Optical Design Department

Special Qualifications

Lens design, optical shop techniques.

Experience

1963-Present: Itek Corporation. Lens designer. Responsible for the optical design and analysis of a variety of lens systems. Specific types of lenses worked on include: catadioptric, wide angle, ultraviolet, wide spectrum, and copying lenses.

1962-1963: Institute of Optics, University of Rochester. Lens designer and graduate work towards Master's degree.

Summer 1962: University of Rochester. Lens designer.

Summer 1961: The Perkin-Elmer Co., Inc., Danbury, Connecticut. Optical engineer.

1959-1960: Itek Corporation. Precision optician.

Summer 1958: Frank Cooke, North Brookfield, Massachusetts. Optical technician.

Education

B.S. in optics, University of Rochester, 1962.
M.S. in optics, University of Rochester, 1964.

Associations

Optical Society of America.

Publications

Master's thesis, A Study of Catadioptric Systems; coauthor, R. E. Hopkins, University of Rochester volume on Optical Design of Mirror Systems, 1962.

Awards

American Optical Fellow, University of Rochester, 1962.
Future Scientist of America (for cycloramic camera design), 1957.

ROGER K. LEE
Staff mechanical engineer, Electro-Optical Systems Department

Special Qualifications

Experienced in gas laser technology, reflecting and infrared photographic systems, optical and electronic scanning systems, and computer storage methods.

Experience

1963-Present: Itek Corporation. Engaged in the development of high resolution scanning devices.

1959-1963: Laboratory for Electronics, Inc., Boston, Massachusetts. Research and development on air stabilized, magnetic recording devices which are now part of the LFE product line and of satellite systems. Study of advanced computer storage techniques other than conventional magnetic recording or magnetic thin films. Studies were carried out on magnetic thermoplastic recording, which led to the consideration of laser actuated recording devices. Responsible for laser development and study of optical data handling techniques on a company sponsored program. Among the items produced on this program were the first multitube gas laser, electro-optic modulators, and a random access optical scanner.

1955-1959: Electronics Corporation of America, Cambridge, Massachusetts. Special project engineer under the vice president of engineering. Activities included commercial production of automatic cooking apparatus and mechanical engineering of military optical devices, including the design of a lightweight Schmidt telescope and data recorder, automatic airborne tracking camera, photocell ruling engine, star tracker, high speed shutters, and the construction of mosaic photocells.

1951-1955: Boston Naval Shipyard, Boston, Massachusetts. Engaged in the application of electronic measuring techniques to observing mechanical behavior of various shipboard equipment and machinery, ultraprecision balancing of large machinery _in situ_, vibrating structure designs, and development of Michelson interferometer techniques for calibrating vibration transducers.

Education

B.S. in mechanical engineering, Massachusetts Institute of Technology, 1951.

Patents

Several patents on thermal and pneumatic control devices.

FREDERICK C. MACNEIL

Optical engineer, Engineering Branch of Government Systems

Special Qualifications

Research and development of electro-optical systems.

Experience

1963-Present: Itek Corporation. Performing analytical research applicable to laser receiving systems.

1958-1963: Radio Corporation of America, Burlington, Massachusetts. Engineering scientist. Participated in the development of airborne infrared warning systems, trackers, radiometers, missile seekers, and reconnaissance systems as well as other visible and ultraviolet design programs.

1951-1958: Baird-Atomic, Inc., Cambridge, Massachusetts. Senior optical engineer. Participated in research and development of infrared trackers, analyzers, visible star trackers, and visible and infrared spectroscopic instrumentation.

Education

B.S. in physics, Boston College, 1951.

ROBERT R. SHANNON
Executive physicist, Optical System Research Department

Special Qualifications

Optical physics, lens design, image evaluation, computing methods.

Experience

1959-Present: Itek Corporation. Staff physicist and senior lens designer. Responsible for supervising and performing work in lens design and image analysis from both theoretical and engineering viewpoints; lens design for large reconnaissance systems; development of high speed computer programs for use in optical design, optical-photographic system analysis, and as an aid in fabrication of large systems. Performed and supervised theoretical and experimental studies of image formation and analysis. Responsible for development and construction of equipment for measurement of the spatial frequency response of optical and photographic systems. Conducted an investigation of signal and noise problems in high resolution aerial photographic and radar systems.

1954-1959: University of Rochester, Rochester, New York. Graduate student in physics and optics. As graduate assistant, performed research on microphotography and image evaluation.

1953-1955: Eastman Kodak Company, Rochester, New York. Optical engineer. Performed research on infrared tracking systems and on microphotography.

Education

B.S. in optics, University of Rochester, 1954.
M.A. in physics, University of Rochester, 1957.
Ph. D. (pending) in optics, University of Rochester; formal work complete.

Associations

Optical Society of America; Society of Photographic Scientists and Engineers; Sigma Xi.

Publications

Numerous papers on optics and transfer function equipment and tests.

DR. F. DOW SMITH
Manager, Optics Division

Special Qualifications

Direction of research programs; research in optics.

Experience

1958-Present: Itek Corporation. Planning and management of research programs in optics, photography, electronics, and documentary indexing as applied to graphic information systems.

1955-1958: Boston University Physical Research Laboratories. Director.

1951-1955: Boston University Physical Research Laboratories. Research associate.

1948-1951: University of Rochester, New York. Teaching assistant, optics.

1949-1950: Bausch & Lomb Optical Co., Rochester, New York. Research assistant.

1947-1948: National Research Council, Ontario, Canada. Research assistant.

Education

B. A. in physics, Queens University, Canada, 1947.
M. A. in physics, Queens University, Canada, 1948.
Ph. D. in optics, University of Rochester, 1951.

Associations

Sigma Xi; American Association of Physics Teachers; Optical Society of America; American Association for the Advancement of Science (AAAS); U. S. A. Committee of International Commission of Optics; Armed Forces NRC Vision Committee.

Publications

Author of several articles and papers dealing with various aspects of optics.

RICHARD SZYMCZAK
Senior technical writer, Publications Department

Special Qualifications

Documentation cost estimating and contractual negotiations.

Experience

1961-Present: Itek Corporation. Project writer establishing project documentation requirements and preparing handbooks and reports.

1959-1961: Sylvania Electric Products, Inc., Needham, Massachusetts. Staff member of program office in charge of half-million dollar handbook program for Sylvania — BMEWS. Established, administered, and monitored BMEWS training program.

1957-1959: AC Spark Plug Division, General Motors, Milwaukee, Wisconsin. Project writer in research and development area for THOR guidance system.

Education

B.A. in English, Northeastern University, 1957.
Certificate in electronic engineering technology, Capitol Radio Engineering Institute, 1960.

Associations

Institute of Electrical and Electronics Engineers; Society of Technical Writers and Publishers.

JOHN T. WATSON
Executive engineer, development planning staff

Special Qualifications

Geometrical optics and high resolution photography; airborne and aerospace reconnaissance systems design.

Experience

1958-Present: Itek Corporation. Engaged in the design of systems for high acuity optics, photography, and reconnaissance.

1947-1958: Boston University Physical Research Laboratories. Research associate. Designed and developed the first differential surface refractometer for testing homogeneity of index in large glass blanks. Set up electronic equipment for the study of the photometrics and the refraction of the atmosphere for prediction of photographic range. Designed extreme-focal-length all-mirror unobstructed-aperture camera and carried out experiments from Pike's Peak to show haze penetration as a function of wavelength, film contrast, weather, and focal length. Performed experimental work in satellite photography. Carried out laboratory experiments to determine detection and recognition criteria for photographic details.

1946-1947: University of Maine, Orono, Maine. Instructor in physics.

1941-1946: Bausch and Lomb, Rochester, New York. Optical engineer. Carried out experimental work on range-finder design, and instrument and lens design for oblique-type photogrammetric projectors. Had responsibility for maintaining equipment and standards for optical control on production items. Performed lens and instrument design for a rectifying printer accepting 9- by 9-inch formats.

Education

A. B. in physics, University of Maine, 1942.

Associations

Optical Society of America; Sigma Xi.

RESUME

JOHN B. FRIAUF

Program Planning and Analysis

Special Qualifications

Program planning and operations research

Experience

1963 — Present: Itek Corporation. Corporate Planning. Development and integration of long range corporate programs.

1960-1963: Hughes Aircraft Corporation, El Sequndo Division. Chief, Program Planning. Development of manufacturing program plans for aircraft and missile guidance systems; manpower and sales forecasting: Introduced new planning techniques, including PERT. Chief, Operations Analysis. Operations research studies of manufacturing operations, machine shop scheduling, inventory control, management control systems.

1958-1960: Yale University. Teaching assistant in industrial administration and operations research.

1954-1958: U. S. Coast Guard. Chief Engineering Officer, U.S.C.G.C. Avoyel. Operation and maintenance of shipboard machinery. Planning and supervision of shipyard repair periods, including recommissioning.

1954: Esso Standard Oil Company, Linden, New Jersey. Project Engineer, Equipment Inspection Division.

Education

B.E. Mechanical Engineering, Yale University, 1954.

M.S. Industrial Administration, Yale University, 1960.

Associations

Tau Beta Pi; Sigma Xi; The Institute of Management Sciences.

MORTON I. RADIS
Staff Mechanical Engineer

Special Qualifications

Systems Development Engineer in Photo-Optical Data Processing Equipment.

Experience

1964 – Itek Corporation – Leader of Mechanical Engineering group for development of precision film transport and control devices.

1956-1964 – Radio Corporation of America.

1959-1964 – RCA Camden & Moorestown, New Jersey. Systems Development Engineer for research, development and design of Optical Data Processing Systems for sonic signal correlation and analysis. Developed precision film transports, photo-optical devices, rapid film processors, image transfer techniques and opto-mechanical signal analyzers.

1958-1959 – RCA Princeton, New Jersey. Design Engineer on attitude and control problems for TIROS weather satellite. Developed spin reduction control equipment, infrared horizon detector and camera orientation instruments.

1956-1958 – RCA Camden, New Jersey, Design Engineer, Airborne Fire Control Systems for large, integrated, tactical electronic systems for manned interceptor type aircraft. Also responsible for engineering liaison with airframe manufacturer.

1952-1956 – Philco Corporation, Philadelphia, Pa. Design Engineer, military electronic systems; computing optical bomb sight (ASB-1); Terrier Missile Guidance and Fuzing Systems.

1950-1952 – Ballistic Research Laboratories, Aberdeen Proving Ground, Md., Ordnance Engineer in weapons systems effectiveness studies.

Education

B.S. Mechanical Engineering, Drexel Institute of Technology, 1950. Graduate studies at Univ. of Maryland, Univ. of Delaware, and Johns Hopkins University.

Associations

American Association for Advancement of Science; American Institute for Aeronautics and Astronautics.

Papers and Patents

"Application of Ceramics in Gas Turbines" D.I.T. Seminar 1950; "Some Parameters for an Infrared Horizon Scanning Instrument", RCA Technical Memorandum, 1958.

Patent Disclosures

Optical Correlation Precision Tachometer; Optical Signal Frequency Analyzer (two).

APPENDIX B

PHASE II SCHEDULES

~~SPECIAL HANDLING~~

BID TO: Classified

TYPE OF CONTRACT: CPFF

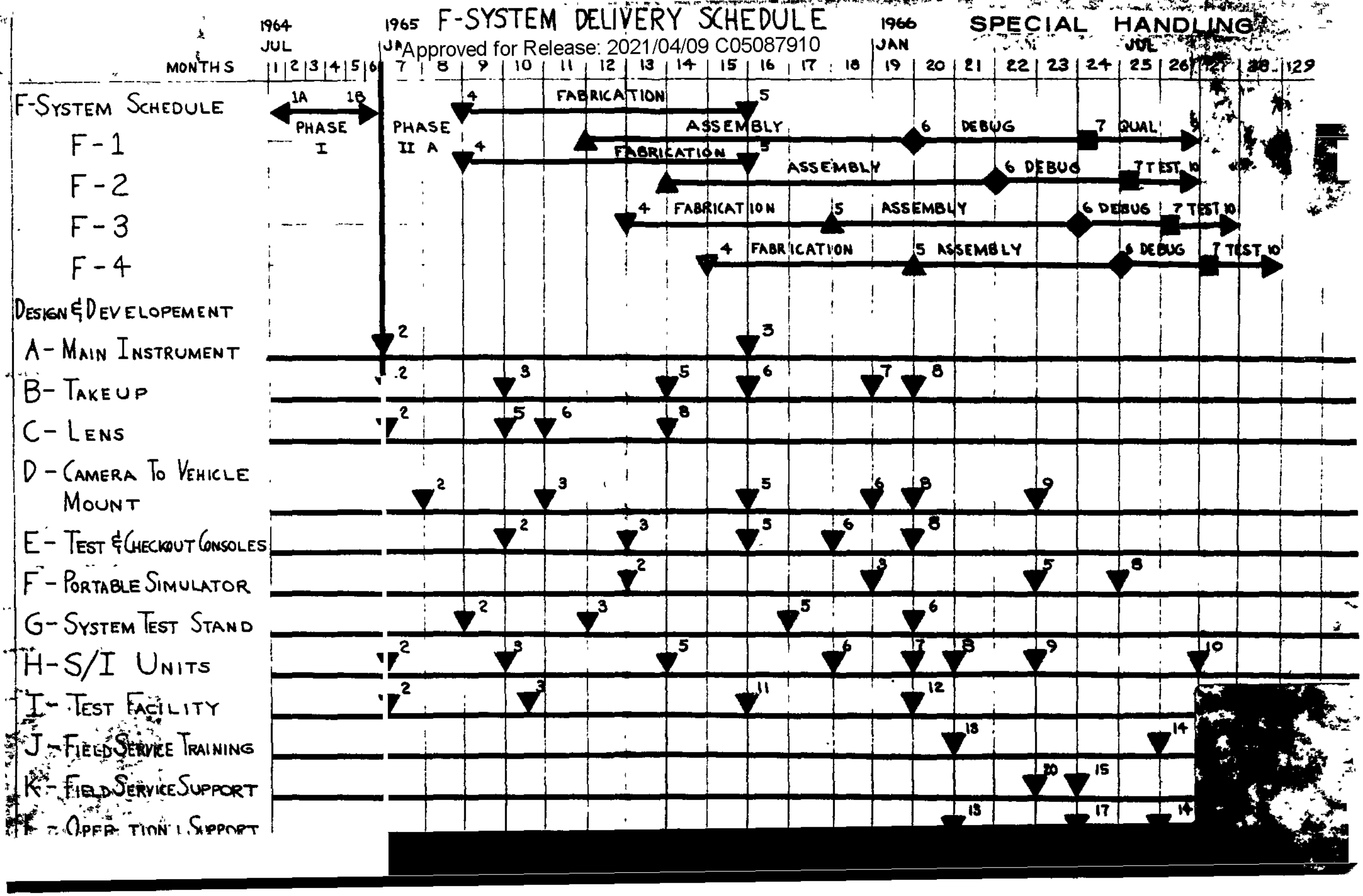
DATE: 7 October 1964

PROJECT 9204
TOTAL ESTIMATED COST

Inception thru 1 February 1965

	Project Management	TASK I Optical Bar System	TASK II 1/3 FL System	TASK III Optical Design	TASK IV Facilities Study	TASK V System Analysis	TASK VI Program Analysis	Total Program
DIRECT LABOR HOURS	25,030	87,019	34,755	10,972	2,529	11,857	1,681	173,843
DIRECT LABOR DOLLARS	$109,751	$423,426	$149,731	$ 59,660	$ 13,323	$ 72,810	$ 11,678	$ 840,379
OVERHEAD	164,627	635,139	224,596	89,491	19,985	109,215	17,517	1,260,570
MATERIAL AND SUBCONTRACT	10,781	244,377	61,506	64,954		30,001		411,619
SPECIAL TEST EQUIPMENT		22,369	10,000					32,369
SPECIAL EQUIPMENT		12,000						12,000
TRAVEL	13,876			71				13,947
COMMUNICATIONS	2,852							2,8[illegible]2
CONSULTING		1,000		2,979				3,979
OTHER DIRECT LABOR	3,94[illegible]	66						4,012
OVERTIME PREMIUM	1,874	11,748	3,909	486	243	739	71	19,070
OTHER DIRECT COSTS	448	1,026		200				1,[illegible]71
SUBTOTAL	308,155	1,351,151	449,742	217,841	33,551	212,765	29,266	2,602,471
G & A	45,130	197,401	65,287	31,744	4,909	30,969	4,262	379,702
VIDYA		66,659	7,435	6,450				80,[illegible]44
TOTAL COST	353,285	1,615,211	522,464	256,035	38,460	243,734	33,528	3,002,717
PROFIT	31,796	145,369	47,022	23,043	3,461	21,936	3,017	275,644
TOTAL	$385,081	$1,760,580	$569,486	$279,078	$ 41,921	$265,670	$ 36,545	$3,338,361

~~SPECIAL HANDLING~~


F-SYSTEM DELIVERY SCHEDULE
SPECIAL HANDLING
1964 JUL
1965 JAN
1966 JAN
JUL
MONTHS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
F-System Schedule
PHASE I
PHASE II A
1A
1B
FABRICATION
ASSEMBLY
DEBUG
QUAL
TEST
F-1
F-2
F-3
F-4
Design & Developement
A - Main Instrument
B - Takeup
C - Lens
D - Camera To Vehicle Mount
E - Test & Checkout Consoles
F - Portable Simulator
G - System Test Stand
H - S/I Units
I - Test Facility
J - Field Service Training
K - Field Service Support

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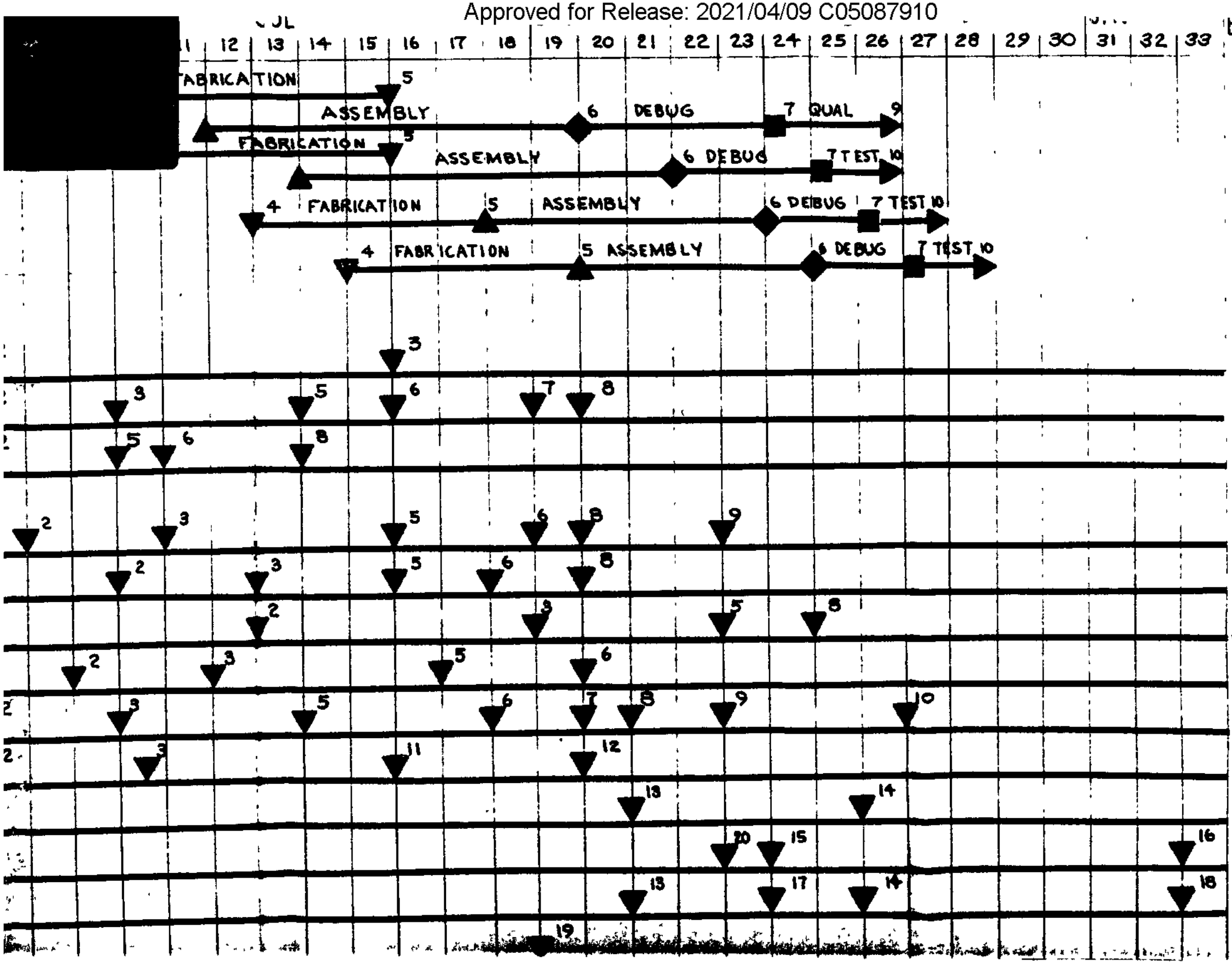
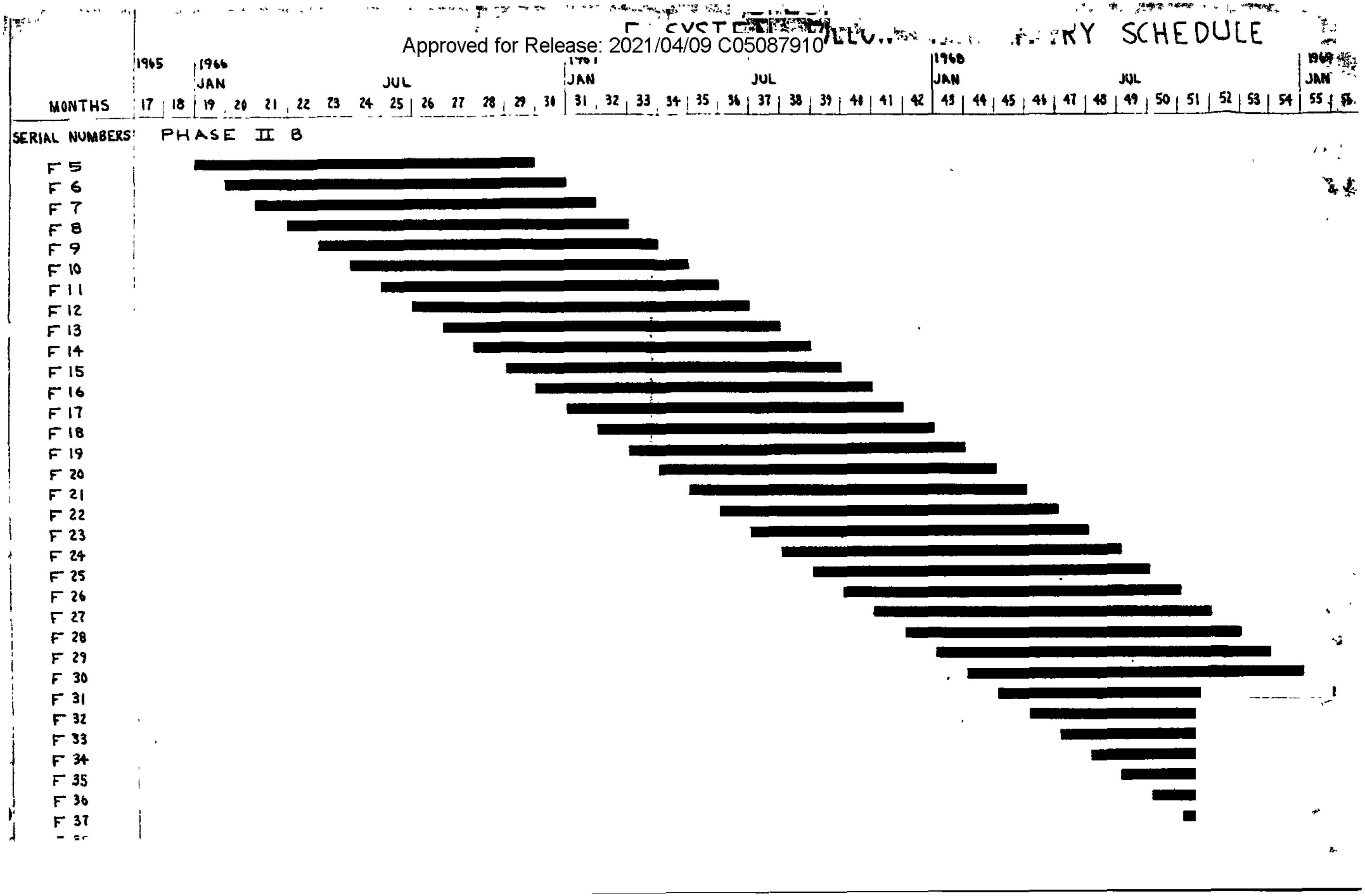


EVENT	DESCRIPTION
1A	STUDY GO AHEAD
1B	STUDY COMPLETE
2	DESIGN START
3	DESIGN COMPLETE
4	FABRICATION START
5	FABRICATION COMPLETE
6	ASSEMBLY COMPLETE
7	DEBUG COMPLETE
8	TEST COMPLETE
9	QUAL. COMPLETE
10	SHIP COMPLETE
11	BUILDING COMPLETE
12	INSTALL & CHECK EQUIP COMPLETE
13	FIELD SERVICE/OPS. TRAINING START
14	FIELD SERVICE/OPS TRAINING COMPLETE
15	FIELD SERVICE OPERATION START
16	FIELD SERVICE OPERATION COMPLETE
17	OPERATIONAL SUPPORT START
18	OPERATIONAL SUPPORT COMPLETE
19	GO AHEAD DATE FOR FOLLOW ON UNITS
20	FIELD SERVICE FACILITIES


SCHEDULE
1965
1966
JAN
JUL
JAN
JUL
1968
JAN
JUL
JAN
MONTHS
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55
SERIAL NUMBERS
PHASE II B
F 5
F 6
F 7
F 8
F 9
F 10
F 11
F 12
F 13
F 14
F 15
F 16
F 17
F 18
F 19
F 20
F 21
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F 37

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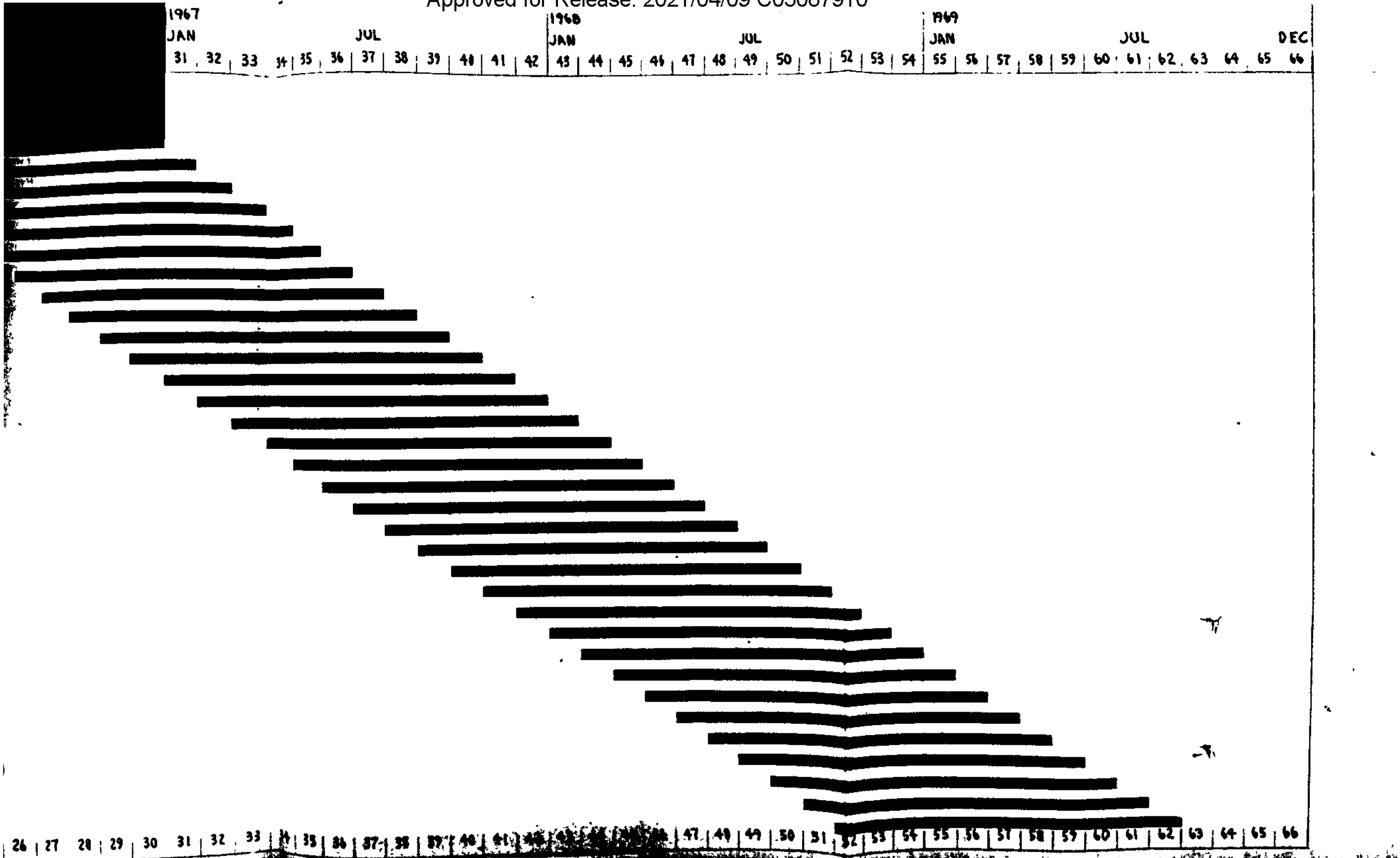


SPECIAL

APPENDIX C

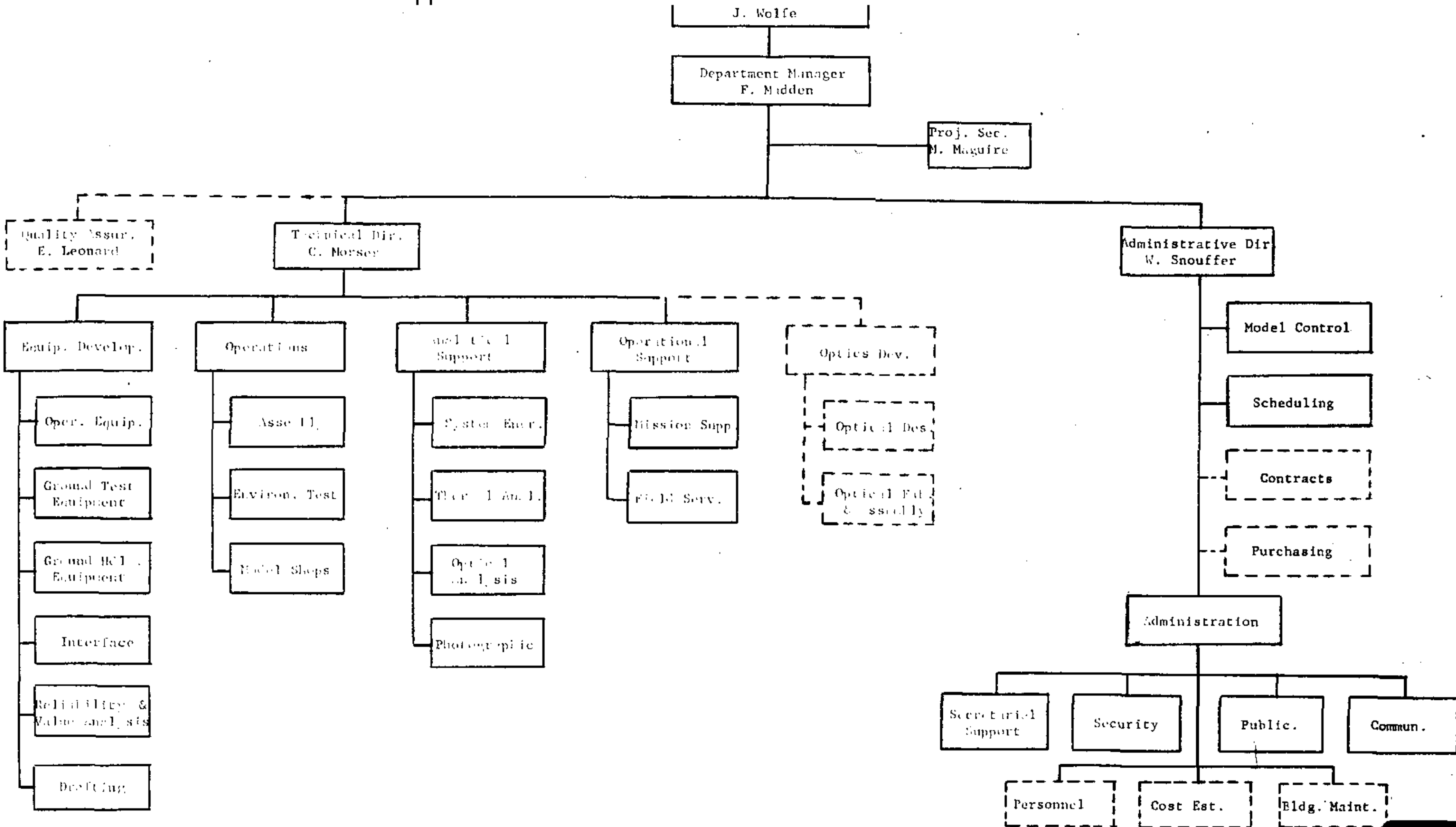
ROM PHASE II COSTS

"F" SYSTEM PROGRAM
PRICING SUMMARY [illegible]

Description	(1) Engineering Qualification Model	(3) Engineering Flight Test Units	34 Operational Units	Total
A. Project Management	$ 1,740,000	$ 520,000	$ 2,800,000	$ 5,060,000
B. Operational Equipment				
Cameras	3,120,000	8,550,000	49,500,000	61,170,000
Lens	375,000	1,025,000	6,500,000	7,900,000
Take-Up Cassettes	300,000	500,000	2,500,000	3,300,000
Clocks	125,000	300,000	1,200,000	1,625,000
Cut & Splice Device	100,000	45,000	350,000	495,000
Double Frame Camera	500,000	225,000	1,900,000	2,625,000
Spools	100,000	150,000	500,000	750,000
Total Operational Equipment	$ 4,620,000	$10,795,000	$62,450,000	$77,865,000
C. Auxiliary Ground Equipment				
Shipping Containers				
Main Instrument	50,000	60,000	180,000	290,000
Take-Up Cassette	4,000	3,600	20,000	27,600
Clock	500	900	5,000	6,400
Cut & Splice	1,000	500	3,000	4,500
Double Frame Camera	2,000	1,500	8,500	12,000
Assembly Dollies	35,000	60,000	80,000	175,000
Portable Simulator	80,000	-	60,000	140,000
System Test Stand	65,000	36,000	20,000	121,000
Test Consoles	150,000	100,000	100,000	350,000
Total AGE	$ 387,500	$ 262,500	$ 476,500	$ 1,126,500
D. Back-Up Engineering & Analysis				
Systems Engineering	370,000	110,000	425,000	905,000
Interface Board	235,000	70,000	220,000	525,000
Thermal Design & Analysis	300,000	100,000	340,000	740,000
Total Back-Up Engineering & Analysis	$ 905,000	$ 280,000	$ 985,000	$ 2,170,000
E. Environmental Test	$ 600,000	$ 132,000	$ 2,240,000	$ 2,972,000
F. Operational Support				
Field Service	360,000	360,000	2,040,000	2,760,000
Operational Support	120,000	165,000	986,000	1,[illegible]
Total Operational Support	$ 480,000	$ 525,000	$ 3,026,000	$ 4,[illegible]
G. Environmental Test Facility	2,950,000	-	-	2,[illegible]
TOTAL	$11,682,500	$12,514,500	$71,977,500	$96,[illegible]

~~SPECIAL HANDLING~~

APPENDIX D PHASE II ORGANIZATION



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~~SPECIAL HANDLING~~

STATUS	DATE	PROJ MGR	ISSUED BY	SEC'T SPVSR	CUSTOMER	PROJECT TITLE	TYPE OF CONTRACT	PAGE OF	PROJECT NO.
						PROGRAM			

1965

NAME	TOTAL HOURS	TASK
		WEEK ENDING – 7/12, 19, 26, 8/2, 9, 16, 23, 30, 9/6, 10/4, 11, 18, 25, 11/1, 8, 15, 22, 29, 12/6, 13, 20, 27, 1/3, 10, 17, 24, 31, 2/7, 14, 21, 28

VACATION | START FSC STUDY OF ARRAY DESIGNS

START FAB PHOTODIODE ARRAY MASKS AT FSC (FOR SIMPLE OR INTERMEDIATE ARRAY DESIGN)

DEL DATE FOR SIMPLE OR INTERMEDIATE DESIGN

BB MODEL OF ARRAY (SIMPLE-TYPE FOR EARLY TESTING)

COMPLETE MECH & ELEC DESIGN (SCAN GENERATOR, SWITCHING CIRCUITS, VIDEO AMP, KA-56 MODIFICATIONS, CONTROL BOX, ETC)

COMPLETE BB EVALUATION

* RECEIVE SIMPLE ARRAY HEAD FROM FSC

COMPLETE FAB OF FINAL FEASIBILITY MODEL

* COMPLETE DEBUGGING, TESTING & EVALUATION – DELIVER FINAL MODEL (SIMPLE ARRAY)

* OR AS BELOW

** RECEIVE INTERMEDIATE ARRAY

COMPLETE TESTING & EVALUATION – DELIVER FINAL MODEL (INTERMEDIATE ARRAY)

[redacted]

BASED ON 6 MONTH DELIVERY (IF 5 MONTH DELIVERY – FINAL UNIT [redacted]