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ENCLOSURE I

PHOTO RECONNAISSANCE SYSTEM

PROPOSAL AND SPECIFICATIONS

[redacted]

31 OCTOBER 1958

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WORK STATEMENT

DEVELOPMENT OF A PHOTOGRAPHIC SUBSYSTEM FOR A SATELLITE RECOVERY RECONNAISSANCE VEHICLE

31 OCTOBER 1958

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WORK STATEMENT

Development of a Photographic Subsystem
For a Satellite Recovery Reconnaissance Vehicle

1.0 SCOPE

In its broadest definition, the work shall consist of the design, development, production, and test of a complete photographic reconnaissance camera system for use in an orbiting satellite. The system shall be capable of photographing a given area of the earth's surface from the basic WS117L orbiting vehicle and shall be capable of traversing the exposed film into a recoverable capsule for eventual return to the surface of the earth. Neither the recovery system nor the final processing of the film are included within the requirements of this work statement. Within this broad framework, ITEK Corporation shall assume responsibility for the solution of a variety of technical problems. Because of the complex nature of these problems, a major effort will be devoted to their solution in order to insure a maximum probability of operational success.

1.1 Design

Although the detailed design engineering and fabrication of the operational cameras shall be undertaken by ITEK Corporation's principal subcontractor, the basic research leading to the choice of parameters of the high-acuity panoramic camera for this purpose is being performed by ITEK Corporation. Accordingly, it shall be ITEK Corporation's responsibility to maintain strict supervision and technical direction over the design efforts of its principal subcontractor. The lens system shall be designed by ITEK Corporation.

1.2 Research and Development

Because in fact nothing is known about the actual operation of a panoramic camera in an orbiting satellite, every effort shall be made to insure operational reliability under extremely rigorous conditions.

Although operational experience may later define the optimum approach to various problems, in the development phase multiple approaches to the solution of critical problems will be considered.

1.3 Production

The operational and prototype cameras shall be fabricated by ITEK Corporation's principal subcontractor. Lens cells for use in these cameras shall be fabricated by ITEK Corporation which shall also maintain close control over the fabrication effort of its principal subcontractor.

1.4 Tests

Completed cameras shall be subjected to an extensive test program as the most effective non-operational method for proving operational reliability. In addition to using in this program various equipments designed to reproduce the anticipated operational environment, ITEK Corporation shall design and fabricate a test fixture suitable for checking the resolution of the camera at simulated operational velocity and altitude as well as the dynamic effect of camera operation on the vehicle.

1.5 Field Operations

ITEK Corporation shall have the responsibility for providing engineering services for the installation and checkout of cameras in the operation vehicles and their final testing prior to flight.

All of the above activities are discussed at greater length in Exhibit I. The successful performance of each, whether at ITEK Corporation, at the facilit of its principal subcontractor, or at the facility of the prime contractor, are dependent on proper liaison and control.

Also, it is further recognized that security considerations of the stricte sort govern all phases of the work.

All specifications, documents, and/or drawings which are referenced in this proposal, but are not attached hereto, are hereby incorporated herin by reference.

2.0 DESIGN OBJECTIVE

2.1 Photo Quality - The photographs as finally produced on the ground shall be of such quality as to permit a ground resolution of 25 feet or better. This corresponds to resolution of the standard Air Force medium contrast test pattern as defined in MIL STD 150 with dimension W equal to 12.5 feet at the design altitude of 140 s. miles.

2.2 Location Accuracy - The design objective for locational accuracy of any point on photograph shall be $\pm$ 1 mile. Specifically, a port and starboard horizon will be recorded in each alternate frame to permit subsequent determination of pitch and roll angles to 0.1°. Yaw measurement will be accomplished by object matching in the overlap region between successive frames to 0.1°. A Digitote will be used to record vehicle time (5 digits) at center of scan to 0.1 sec precision. The Digitote output will be telemetered to ground on a minimum of 5 channels. A 160 cycle timing pip will be placed on one edge of the format during scan. Both the Digitote input and the 160 cycle signals will be externally provided.

2.3 Ground Coverage - During periods of proper light level, reconnaissance photography shall be obtained by ground command in a continuous strip for all vehicle time over the target area. Film capacity will be sufficient to provide for two nominal days operation.

Specifically, a nominal day's operation is defined as sufficient film capacity for 10% overlap at the design altitude of 140 s. miles on 2.1 inches of a 70 mm format for approximately 25,000 miles linear coverage by ground command. A supply spool will be provided for spooling thin base (3-1/2 mil)

70 mm film on a 4" diameter core to a diameter of 20". The film thus spooled will weigh not more than 40 lbs.

2.4 Image Motion Compensation - Provision will be incorporated for correcting the image motion due to orbital motion. For a design value of V/H = 0.0345 Rad/sec, capability will be provided for variation of ± 40%. A most probable value of V/H may be inserted prior to launch. Subsequently, a correction, based on tracking data, can be sent to the vehicle via a telemetry link.

2.5 Momentum Balance - The oscillating panoramic sweep assembly will incorporate momentum balancing. This is required to take out the major portion of the torque reaction effect on the vehicle which would cause a significant roll rate.

3.0 GENERAL

3.1 ITEK-Furnished Materials - ITEK shall, within the period of time specified in Part II hereof, furnish and deliver to the Prime the supplies, data and reports as set forth in Exhibit I attached hereto and hereby made a part thereof.

EXHIBIT I

	Quantity	Date
ITEM 1		
Systems Management Services:		
Provide Systems Management of the Photographic Sub-System as defined in Appendix A		1 May 1958 - 31 Oct.19
ITEM 2		
Design and fabricate camera and cassette space utilization mock-up in accordance with Appendix B, "High Acuity Panoramic Camera (HYAC II)" and Appendix C,"Cassette, Take-Up."		
Camera Mock-Up Space:	1	21 June 1958
	1	7 July 1958
Cassette Mock-Up Space:	1	21 June 1958
	2	7 July 1958

ENCLOSURE I

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	Quantity	Date
ITEM 3. Design and fabricate camera and cassette weight and balance mock-up in accordance with Appendix B, "High Acuity Panoramic Camera,(HYAC II)", and Appendix C, "Cassette, Take-Up."		
Camera Mock-Up, Weight and Balance:	1	12 July 1958
	1	19 July 1958
Cassette Mock-Up, Weight and Balance:	1	12 July 1958
	2	19 July 1958
ITEM 4. Design and fabricate a thermal mock-up of the camera and cassette to simulate the heat transfer conditions of the equipment:		
Camera and Cassette Mock-Up, Thermal	1	15 August 1958
ITEM 5. (a) Design and fabricate a lens weight and balance mock-up in accordance with Appendix D, "Lens, 24" , f/5 HYAC II", and (b) Provide lens cells for test.		
a. Lens Weight & Balance Mock-Up	1	15 July 1958
b. (1) Lens Cell for Test		
(a) Two for II A (Aluminum)	2	15 August 1958
(b) Two for II B (Aluminum)	2	15 January 1959
(2) Lens cells for environmental test		
(a) Two for shock, acceleration, vibration (Aluminum)	2	1 September 195[illegible]
(b) Two for temperature, altitude, humidity (Steel)	2	1 September 195[illegible]
(3) One preliminary cell for kinematic analysis (Magnesium)	1	15 August 1958
ITEM 6. Design and fabricate camera flight units and cassette flight units non-deliverable for use in test program less supply spool, in accordance with Appendix B, "High Acuity Panoramic Camera (HYAC II)" and Appendix C, "Cassette, Take-Up."	1	13 December 1958
	1	7 February 1959
ITEM 7. Design and fabricate camera flight units, less supply spool in accordance with Appendix B, "High Acuity Panoramic Camera (HYAC)."	1	31 January 1959
	1	14 February 1959
	1	14 March 1959
	1	11 April 1959
	1	18 April 1959
	1	16 May 1959
	1	30 May 1959
	1	4 July 1959
	1	18 July 1959
	1	15 August 1959
	1	5 September 195[illegible]
	1	12 September 195[illegible]

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	Quantity	Date
ITEM 8. Design and fabricate cassette flight units in accordance with Appendix C, "Cassette, Take-Up."	1**	13 September 1958
	2**	20 September 1958
	2**	27 September 1958
	1**	11 October 1958
	2	23 October 1958
	2	30 November 1958
	2	7 December 1958
	1	27 December 1958
	1	3 January 1959
	1	31 January 1959
	1	14 February 1959
	2	28 February 1959
	1	28 March 1959
ITEM 9. Design and fabricate supply spools compatible with the applicable paragraphs of Appendix B.	15	27 August 1958
	25	5 September 1958
	40	12 September 1958
	40	19 September 1958
ITEM 10. Fabricate a HYAC II A Lens, non-deliverable for use in the environmental test program in accordance with Appendix D.	1	11 October 1958
ITEM 11. Design a lens and filter based upon the design objectives stated in Appendix D, and fabricate a sufficient quantity of flight units to meet the over-all delivery schedule. This lens shall be designated HYAC II A.	1	26 October 1958
	1	23 November 1958
	1	30 November 1958
	1	21 December 1958
	1	4 January 1959
	2	8 February 1959
	2	15 March 1959
	1	19 April 1959
ITEM 12. Design a lens and filter giving improved lens-film performance over the II A, and fabricate a sufficient number of flight units for the remaining flight cameras. This lens shall be in accordance with Appendix D, and shall be designated HYAC II B.	1	19 April 1959
	1	17 May 1959
	2	22 June 1959
ITEM 13. Provide engineering services for the specification and design of instrumentation for the HYAC II camera in accordance with Appendix E, "Specification for Camera and Cassette Instrumentation and V/H Transducer."		1 May '58-1 Dec '

** These units are essentially the same as deliverable units but will not have been qualified and will not include transit cases.

	Quantity	Date
ITEM 14. Design, develop and fabricate a static simulator in accordance with Appendix F, "Simulators for HYAC II", to be used for camera testing.	1	17 November 1958
ITEM 15. Design, develop and fabricate portable simulators in accordance with Appendix F, "Simulators for HYAC II."	2	31 January 1959
ITEM 16. Design, develop and fabricate a dynamic simulator in accordance with Appendix F, "Simulators for HYAC II."	1	7 February 1959
ITEM 17. Design and fabricate test and check-out console in accordance with Appendix G, "Test and Check-Out Console for HYAC II."	1 1 1	6 December 1958 13 December 1958 7 February 1959
ITEM 18. Design and fabricate full supply spool handling and loading fixtures compatible with deliverable equipment.	1 1 1 1	31 January 1959 28 February 1959 14 March 1959 11 April 1959
ITEM 19. Design and fabricate film retrieval magazines in accordance with Appendix H, "Film Retrieval Magazines for HYAC II."	2 2 2 2	16 December 1958 23 December 1958 30 December 1958 6 January 1959
ITEM 20. Design and fabricate a go-no-go console in accordance with Appendix I, "Go-No-Go Console for HYAC II."	1	31 January 1959
ITEM 21. Supply and modify darkroom supplies and equipment in accordance with Appendix J.	2	15 December 1958
ITEM 22. Provide engineering-type operational and maintenance manual for equipment supplied under Items 7, 8, 15, and 17.		
Items 7, 8	6 6	Concurrent with first flight units Within 2-1/2 months after initial flight deliveries.
Items 15, 17		Concurrent with equipment deliveries

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ENCLOSURE 1

	Quantity	Date
ITEM 23. Provide spare parts in accordance with lists contained in Appendix K.		Within 30 days of delivery of flight units
ITEM 24. Design and fabricate transit cases for HYAC II camera in accordance with Appendix L, except that transit cases shall not be qualified environmentally.	1 for each fabricated camera	Concurrent with equipment deliveri
ITEM 25. Design and fabricate transit cases for film take-up cassette of HYAC II in accordance with Appendix M, except that transit cases shall not be qualified environmentally.	1 for each fabricated cassette	Concurrent with equipment deliveri
ITEM 26. Design and fabricate shipping cases for test console in accordance with Appendix N, except that shipping cases shall not be qualified environmentally.	1 for each fabricated Test Console less console for ITEK	Concurrent with equipment deliveries.
ITEM 27. Provide liaison and technical support in accordance with Appendix O.		
a. Training, Orientation, Test Support		1 Sept.'58-31 Dec.'58
b. Field Support		1 Jan. '59-31 Oct. '5
ITEM 28. Provide engineering services to support the test program described in Appendix P, "HYAC II Test Program."		1 Sept. '58-31 May '5
ITEM 29. Equipment and facilities to support the test program described in Appendix P, "HYAC II Test Program, Appendix P.		1 December 1958
ITEM 30. Provide engineering services to conduct the study tasks outlined in Appendix R, "Supporting Study Tasks, HYAC II," except that these services will terminate on 1 September 1959.		15 May '58-1 Sept.'5
ITEM 31. Reports and drawings as defined in Appendix S.		
a. Monthly Program Progress Reports	20 each	15th of each month
b. Briefing Aids for each Monthly Progress meeting.	1 set each	15th of each month
c. Sub-assembly Test Reports	-	In Monthly Report

		Quantity	Date
ITEM 31 (continued)			
d.	Reliability and Life Test Reports	-	In Monthly Report
e.	Environmental Acceptance Test Reports	3 each	As completed
f.	Final Report, Environmental Testing of Camera	20	45 days after completion of this phase.
g.	Final Engineering Report	20	45 days after completion of program.
h.	Special Reports	-	As required.
i.	Interim drawings	1 each	As completed.
j.	Final drawings.	1 set	45 days after completion of program.

ITEM 32.
Breadboards and mock-ups as described in Appendix T.

3.2 Prime-Furnished Material - The Prime shall furnish or cause to be furnished the items of Prime or Government Furnished Equipment listed below by the dates indicated:

ITEM 1.
Cassette installed in air frame to be assembled with a camera for use in the Dynamic Simulator — By 1 February 1959

ITEM 2.
Velocity sensing fixtures FCIC Part No. 789TE025 (to be transferred from Air Force Contract No. [redacted] — By 4 October 1958

ITEM 3.
Rolls of film as described in Exhibit II.

ITEM 4.
All equipment located at ITEK and originally supplied to Boston University, to be transferred from Air Force Contract No. [redacted] — By 1 September 19[redacted]

ENCLOSURE I

[redacted]

EXHIBIT II

FILM REQUIREMENTS

The Prime contractor shall cause to be supplied without charge 70 mm film with sufficient lead time to meet the following schedule:

Operational Needs

Type	Amount	Date
S.O. 1188	6 spools at 3500'	28 Feb 1959
S.O. 1188	7 spools at 7000'	28 Feb 1959
S.O. 1188	12 spools at 7000'	27 June 195
S.O. 1221	6 spools at 3500'	28 Feb 1959
S.O. 1221	7 spools at 7000'	28 Feb 1959
S.O. 1221	12 spools at 7000'	27 June 195

Testing Needs

Type	Amount	Date	Remarks
S.O. 1188	1 spool at 1000'	20 Sept. 1958	For use at FCIC
S.O. 1188	3 spools at 7000'	20 Sept. 1958	For use at FCIC
S.O. 1188	4 spools at 7000'	11 Oct. 1958	For use at FCIC
S.O. 1188	4 spools at 7000'	29 Nov. 1958	For use at FCIC
S.O. 1188	4 spools at 7000'	7 Feb. 1959	For use at FCIC
S.O. 1221	1 spool at 1000'	20 Sept. 1958	For use at FCIC
S.O. 1221	3 spools at 7000'	20 Sept. 1958	For use at FCIC
S.O. 1221	4 spools at 7000'	11 Oct. 1958	For use at FCIC
S.O. 1221	4 spools at 7000'	29 Nov. 1958	For use at FCIC
S.O. 1221	4 spools at 7000'	7 Feb. 1959	For use at FCIC
Dummy	4 spools at 7000'	27 Sept. 1958	For use at FCIC
Dummy	5 spools at 7000'	4 Oct. 1958	For use at FCIC
Dummy	6 spools at 7000'	29 Nov. 1958	For use at FCIC
Dummy	6 spools at 7000'	20 Dec. 1958	For use at FCIC
Dummy	3 spools at 7000'	7 Feb. 1959	For use at FCIC
S.O. 1188	1 spool at 7000'	4 Oct. 1958	For use at ITEK
S.O. 1188	3 spools at 7000'	8 Nov. 1958	For use at ITEK
S.O. 1188	2 spools at 7000'	6 Dec. 1958	For use at ITEK
S.O. 1188	3 spools at 7000'	10 Jan. 1959	For use at ITEK
S.O. 1221	1 spool at 7000'	4 Oct. 1958	For use at ITEK
S.O. 1221	2 spools at 7000'	8 Nov. 1958	For use at ITEK
S.O. 1221	3 spools at 7000'	6 Dec. 1958	For use at ITEK
S.O. 1221	2 spools at 7000'	10 Jan. 1959	For use at ITEK
Dummy	2 spools at 7000'	20 Sept. 1958	For use at ITEK
Dummy	3 spools at 7000'	4 Oct. 1958	For use at ITEK
Dummy	3 spools at 7000'	29 Nov. 1958	For use at ITEK
Dummy	3 spools at 7000'	20 Dec. 1958	For use at ITEK
Dummy	3 spools at 7000'	7 Feb. 1959	For use at ITEK

Testing Needs, cont.

S.O. 1188	5 spools at 7000'	13 Dec. 1958	For use at Prime
S.O. 1188	5 spools at 7000'	14 March 1959	For use at Prime
S.O. 1221	5 spools at 7000'	13 Dec. 1958	For use at Prime
S.O. 1221	5 spools at 7000'	14 March 1959	For use at Prime
Dummy	6 spools at 7000'	28 Nov. 1958	For use at Prime
S.O. 1188	1 spool at 7000'	4 Oct. 1958	For drop test
S.O. 1188	1 spool at 7000'	8 Nov. 1958	For drop test
S.O. 1188	1 spool at 7000'	22 Nov. 1958	For drop test
S.O. 1188	1 spool at 7000'	6 Dec. 1958	For drop test
S.O. 1221	1 spool at 7000'	4 Oct. 1958	For drop test
	1 spool at 7000'	8 Nov. 1958	For drop test
	1 spool at 7000'	22 Nov. 1958	For drop test
	1 spool at 7000'	6 Dec. 1958	For drop test

APPENDIX A

SPECIFICATION

SYSTEMS MANAGEMENT

31 October 1958

SYSTEM MANAGEMENT

1.0 SCOPE

1.1 This effort consists of planning, directing, supervision and control, appraisal, liaison, administration and security of the work performed by ITEK and its principal sub-contractor, Fairchild Camera and Instrument Corporation. It includes the technical direction and monitoring of Fairchild as well as such system analysis as is required to support the project. It includes liaison with the Prime, his customer and his other sub-contractors, as requested by the Prime. Project control and general project reporting are included under this task.

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APPENDIX B

SPECIFICATION

SME-DB-1(B)

HIGH ACUITY PANORAMIC CAMERA

HYAC II

31 OCTOBER 1958

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HIGH ACUITY PANORAMIC CAMERA

HYAC II

1.0 SCOPE

1.1 This specification covers one type of photographic high acuity panoramic camera for aerial reconnaissance. The basic design of this panoramic camera utilizes a curved focal plane arc with panoramic scanning by rotation of the lens about its nodal point.

2.0 APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on the date of this specification form a part of this specification to the extent specified herein.

SME-EB-5A Environmental Test Specification dated 31 October 1958

3.0 REQUIREMENTS

3.1 Component Parts - The camera shall consist of the complete photographic system including lens, camera structure, film advance mechanism image motion compensation, horizon recording optics, and time recording as described in the following paragraphs.

3.1.1 Horizon Recording - These units shall record both horizons. Recording shall occur on alternate frames only and shall be initiated by the closure of a switch at the nadir position.

3.1.2 Elapsed Time Recording - Elapsed time will be recorded on an area of the film outside the picture format and to be determined by convenience of camera design. The component selected for the recording shall be mutually accepted by the contractor and the customer and shall be provided with suitable inputs from the system in order to operate. Minimum size and weight shall be a major consideration in the choice of components.

3.1.3 Frequency Recording - During the scanning operation of the camera, a lamp pulsed by a fixed frequency shall record a series of equally spaced marks along the edge of the format. The Prime shall be informed of the input requirements necessary to the camera design.

3.1.4 Thermal Instrumentation - Thirteen modified Ruge BM-5 2400 ohm resistance thermometers will be installed in the camera.

3.2 Basic Camera Design

3.2.1 Configuration - The design of the camera shall conform to the basic configuration and space limitations as shown in Figure No. 1.

3.2.2 Camera Weight - The weight of the complete camera system shall be held to an absolute minimum; and shall not exceed 75 pounds. This 75 pound limit, however, shall not include the weight of the Digitote and its associated components and an additional 2 pound allowance for camera mounting structure as mutually agreed upon by the contractor and customer. Any weight associated with instrumentation shall also not be included within this 75 pound limit.

3.2.3 Lens Assembly - The main camera lens shall be a 24" focal length f5.0 high acuity optical system suitable for covering a 70 mm slit format as described in Appendix D. The lenses shall be calibrated so that the nodal points will be nearly coincident with the axis of rotation and the focal length will be held to 24.000" ± .005" at operational altitude and temperature of 70° ± 10° F.

3.2.4 Camera Scan Angle - The active format scan angle shall be 70° utilizing approximately 15° each of mechanical travel of the lens scanning system for acceleration and deceleration. This requires a total angle of scanning of approximately 100°.

3.2.5 Film Requirements - Unperforated thin base film of a nominal 3-1/2 mil (0.0035") thickness and 70 mm width shall be used. The emulsions that will be used with this camera shall be Eastman Kodak type SO-1221 and SO-1188.

3.2.6 Film Capacity - The camera shall be designed to use film properly wound on a 4" diameter core. The film spool of special design shall have a minimum of 1/8" spool flange projection above the full roll of film.

3.2.7 Space Between Picture Formats - The space between adjacent formats shall be utilized for data recording and shall be held to a minimum. The maximum space permitted between picture formats shall not exceed 2-1/2".

3.2.8 Allowable Film Wastage During Camera Start - The total allowance for film wastage during any starting of the film transport mechanism shall be a maximum of two (2) frames. This maximum wastage shall be the total average of starts over a full roll of film at maximum film speed. From the time the start sequence command is received, the camera system shall be up to speed in less than 15 seconds.

3.2.9 Format Width - The effective picture width of each frame shall be 2.1" + .03". Format dimensions and data recording details are shown in Figure 2.

3.2.10 Exposure Time - Exposure time shall be preset with one of three fixed slits to provide exposure times of 1/500 sec., 1/1000 sec., and 1/2000 sec. at the nominal scanning rate. These three (3) fixed slits shall be readily interchangeable.

3.2.11 Camera Cycling Rate Range - The camera shall be capable of providing a cycling rate range from .263 cycles per second to .613 cycles per second. This range shall be governed by a systems command driving the camera drive motor at the appropriate speed. Camera operation is initiated and terminated by the receipt or deletion of vehicle power derived from the basic vehicle programmer, with scanner positioned at end of scan cycle. The scanning drive of the camera shall be determined in flight by a V/H signal supplied by the vehicle and compatible with the camera servo system.

3.2.12 Reaction and Momentum Balance - The design of the camera shall provide a minimum of residual reaction and momentum to the basic vehicle.

3.2.13 Optical Scanning Rate - The optical scanning rate shall be a function of the camera cycling rate and shall vary proportionately with the camera cycling rate.

3.2.14 Forward Motion Compensation Rate - The required forward motion compensation rate at the nadir shall be .828 inches/second for the nominal cycling rate of .438 cycles per second. The camera drive mechanism shall be such that there is a fixed mechanical relationship between the forward motion compensation rate and the scanning rate. Therefore, the forward motion compensation rate ranges from .497 inches/second to 1.159 inches/second. The relationship of the forward motion compensation and the cycling rate has been established for a 10% overlap condition at the nadir.

3.3 Performance Requirements

3.3.1 Camera General Performance - Every effort shall be made to produce a high acuity photographic camera which, when operated, will produce a minimum degradation of static lens-film resolution. The design objective shall be such that photography taken under simulated operating conditions utilizing the simulator described in Appendix F shall not be degraded by more than 10% of the static lens-film resolution.

3.3.1.1 Forward Motion Compensation Accuracies - The forward motion compensation mechanism and the servo system shall have performance compatible with the design objective of paragraph 3.3.1.

3.3.1.2 Lens Drive Smoothness - The lens drive system, which is used for focal plane scanning in addition to forward motion compensation shall be smooth such that no appreciable visual banding can be detected with the unaided eye on the resulting photograph.

3.3.2 Data Recording Performance

3.3.2.1 Horizon Recording - The design objective for the horizon recording shall be such that roll and pitch information can be extracted to an accuracy of $\pm 0.1^{\circ}$. Yaw measurements shall be extracted by overlap measurements of adjacent photographs and it shall be a design objective that these measurements will yield yaw accuracies of $\pm 0.1^{\circ}$. For calibration purposes, four fiducial marks of sufficient quality, spaced 90° apart, shall be recorded on each horizon exposure.

3.3.2.2 Time Recording - Time shall be recorded on each frame from the appropriate command system to produce time information to within 0.1 second. A digital recording head shall be utilized in the camera for this purpose and the time recording accuracy shall be in accordance with the accuracy of the command.

3.3.2.3 Center of Format Recording - A single fiducial mark locating the center of the format along the scan axis of the frame shall be recorded outside of the picture format area and on each exposure. In conjunction with this mark, a second fiducial shall be accurately placed 3.000" $\pm$ .001 from the center of format fidicual to permit shrinkage measurements.

3.3.2.4 Serial Number Recording - A camera serial number shall be recorded outside of the picture format area.

3.3.3 Focal Plane Accuracy - The curved focal plane shall be a fixed arc of 24" nominal radius. The accuracy of the focal plane shall be compatible with the lens system and the general camera performance requirements of paragraph 3.3.1.

3.3.4 Power Consumption of Camera System - The total power consumption of the camera system shall be held to an absolute minimum and shall be compatible with the following sources. The maximum total average power permitted from all these sources shall not exceed 165 watts. The power required by the Digitote and its associated components shall not be included in this 165 watt total.

(a) 28 volt battery supply varying from 22 to 29.5 volts
(b) 28 volt DC supply, regulated to $\pm$ 0.5%
(c) 115 volts AC, 2000 cycles, single phase, regulated to $\pm$ 1.0% in frequency and $\pm$ 5.0% in voltage.
(d) 115 volts AC, 400 cycles, three phase, regulated to $\pm$ .02% in frequency and $\pm$ 1.0% in voltage.
(e) 115 volts AC, 400 cycles, single phase, regulated to $\pm$ 1.0% in frequency and $\pm$ 5.0% in voltage.

3.4 Camera Design Details

APPENDIX B

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3.4.1 Allowance for Film Splices - The camera film handling systems and guides shall be designed to allow for smooth passage of the required number of proper film splices expected in each roll of operational film. The camera shall be capable of passing film that has been properly butt spliced [illegible] tape.

3.4.2 Film Loading - The camera shall be capable of being loaded in subdued light using live film for leader without excessive light striking of the supply of live film.

3.4.3 Main Lens Light Shield - The main lens light shield design shall be mutually agreed upon between contractor and the customer. For convenience of installation, this light shield may be attached to the lens assembly after the camera has been installed in the vehicle.

3.4.4 Film Transport Rollers - A minimum diameter of 1" shall be used for all rollers in the film transport system.

3.4.5 Instrumentation Requirements - For the purposes of telemetering, the following functions shall be brought to the camera main connector:

(a) Thirteen Temperature Signals - The temperature sensors shall be located in the camera as mutually agreed upon between the contractor and the customer.

(b) Four (4) V/H Signals

(c) One (1) Light Leak Signal - (The light leak transducer shall be supplied by the contractor.)

(d) One (1) Center of format signal.

(e) One (1) Film transport signal.

(f) Five (5) Elapsed time signals (Representing 5 digits)

NOTE: The increase in weight due to above instrumentation requirements is considered Customer-sponsored and therefore for the purposes of contractual weight agreements, shall not be charged to the final camera weight.

3.4.6 Operational Temperature - For the purposes of design, the operational temperature shall be $70^{\circ} \pm 10^{\circ}$ F.

3.4.7 Thermal Considerations - To assure stable operational temperatures, the following design features shall be incorporated.

(a) Structural Plate No. 1 - Shall have black finish on side facing supply spool. Opposite side shall have a highly polished reflective surface finish. Plate No. 1 shall be thermally insulated from Plate No. 2 wherever practical.

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3.4.7 (cont.)

(b) Structural Plate No. 2 - Shall have highly polished evaporated gold finish of 10 to 12 microinch thickness on side facing Plate No. 1. Opposite side shall have a black finish.

(c) Structural Plate No. 3 - Shall have a black finish on side facing Plate No. 1. Opposite side shall have highly polished evaporated gold finish of 10 to 12 microinch thickness.

(d) Supply Spool Thermal Shield - Shall be of light weight construction, polished on the inside and polished gold finish of 10 to 12 microinch thickness on the outside.

(e) Camera Double Thermal Shield - Shall extend from Plate No. 1 to Plate No. 3, but insulated from Plate No. 1. The double thermal shield shall be comprised of two gold plated skins sandwiching on insulating spacer with a thermal conductivity k equal to..028 BTU/hr./sq.ft./°F/ft. or less.

(f) Component Thermal Insulation - All heat generating components mounted on Plate No. 2 shall be insulated from Plate No. 2 wherever practical.

(g) Sub-Plates, Spacer Posts and Gussets - Sub-plates, spacer posts and gussets between Plate No. 1 and Plate No. 2 shall be prepared with suitable thermal radiating qualities compatible with over-all camera thermal requirements wherever practical.

(h) Boot, Lens to Camera - The boot from lens to camera shall have a highly polished gold surface on both sides.

(i) Boot, Camera to Vehicle - The boot from camera to vehicle shall be black on side facing lens and have a highly polished gold surface on opposite side.

(j) Boot Clamps - Boot clamps shall have appropriate thermal finishes compatible with the requirements of (h) and (i).

NOTE: The increase in weight due to above thermal requirements is considered Customer sponsored and therefore for the purposes of contractual weight agreements, shall not be charged to the final camera weight.

The above designs shall be incorporated commencing with the second non-deliverable camera.

APPENDIX B

3.5 Mock-ups - Appropriate space and weight and balance mock-ups shall be provided in accordance with the Work Statement. A simple mock-up shall be fabricated to be used in space utilization application. An accurate simulator of the final camera configuration shall be fabricated to permit the ready mock-up of total system weight and balance. A mock-up designated to be retained at the contractors facilities for the duration of the program shall reflect the current external configuration whenever changes occur.

3.6 Engineering Manual - An engineering manual shall be furnished which shall contain test and service procedures necessary to assure the satisfactory operation of the system. This manual shall be furnished in the form of standard ozalid reproduction and need not be prepared to any Military Specification.

3.7 Design and Selection of Components - The design and selection of components for this camera shall be compatible with the performance and environmental requirements of the system. The best available items shall be used and the components need not be in accordance with specific military specifications.

3.8 Environmental Conditions - The components and over-all camera shall be designed in accordance with specification SME-EB-5A, entitled "Environmental Test Specification - dated 9 September 1958". The components to be evaluated shall be tested in accordance with Schedule I attached. The environmental tests performed are detailed under the Qualification Test Section, paragraph 4.

3.9 Spare Parts - A complete list of spare parts required for the camera shall be submitted.

4.0 QUALIFICATION TESTING

4.1 Acceptance Tests - Acceptance tests shall be performance tests to be accomplished on each deliverable camera system to assure proper functioning of the equipment. The tests shall be in conformance with the requirements of Acceptance Test Specification, SME-EB-3A attached hereto as Enclosure 1.

4.2 Environmental Tests - The environmental testing shall be performed on selected components and the first non-deliverable flight units for the purposes of qualifying the deliverable equipments. The components to be tested and the tests they are to undergo are included in Schedule I attached and hereby form a part of this specification. The environmental tests shall be as indicated in the following paragraphs which reference the appropriate paragraph of the Environmental Test Specification, SME-EB-5A, dated 9 September 1958, attached hereto as Enclosure 2 The tests selected represent the most critical in accordance with the requirements and therefore shall constitute the qualification test specification for the camera system.

APPENDIX B

4.2.1 Temperature, Altitude, and Humidity Tests - The temperature, altitude and humidity tests shall be conducted in accordance with the requirements of paragraph 4.2.1 of the Environmental Test Specification, Enclosure 2 attached hereto.

4.2.2 Drop Tests - Drop tests shall be conducted in accordance with the requirements of paragraph 4.2.4.2 of the Environmental Test Specification, Enclosure 2 attached hereto.

4.2.3 Vibration Tests - Vibration tests shall be conducted in accordance with the requirements of paragraph 4.2.2 of the Environmental Test Specification, Enclosure 2 attached hereto.

4.2.4 Shock Tests - Shock tests shall be conducted in accordance with the requirements of paragraph 4.2.4 of the Environmental Test Specification, Enclosure 2 attached hereto.

4.2.5 Acceleration Tests - Acceleration tests shall be conducted in accordance with the requirements of paragraph 4.2.3 of the Environmental Test Specification, Enclosure 2 attached hereto.

4.2.6 Explosion Proof Tests - Explosion proof tests shall be conducted in accordance with requirements of paragraph 4.2.6 of Environmental Test Specification, Enclosure 2 attached hereto.

APPENDIX B

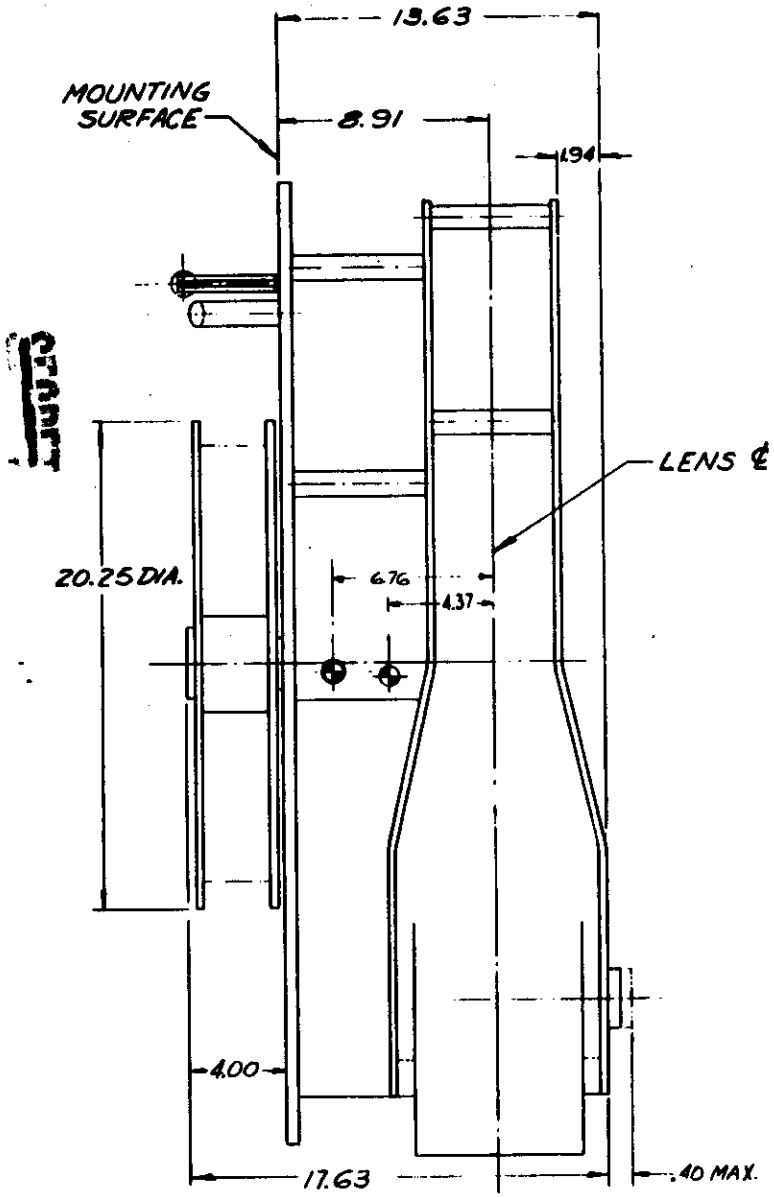
SCHEDULE I

COMPONENT ENVIRONMENTAL TEST SCHEDULE

Part No.	Name	Temperature Alt., & Hum. TS 956-2001	Vibration TS 956-2003	Shock TS 956-2002	Accel. TS 956-2004
956-174	Transistor	X			
956-427	Solenoid, F.	X	X	X	X
956-428	Solenoid	X	X	X	X
956-508	Tach. Generator	X			
956B30	Preamplifier Assy.	X	X	X	
956B139	Accelerating Control Assembly	X	X	X	
956B72	Clutch and Brake Assembly	X			
956B74	Clutch Assembly	X			
956B76	Clutch Assembly	X			
956B77	Brake Assembly	X			
956B127	Recording Assy, Digitote	X	X	X	X
956B79	Fiducial Assembly	X	X		
956B82	Recording Assembly	X	X	X	X
956B87	Drive Motor Gear Assy	X			
956B144	Supply Assembly, Synch, Pulsing	X	X		
956C10	Lamp Assy, Freq.		X		
956B4	Spool Assembly		X	X	X
956B122	Platen Assembly	X			
956B63	Main Mtg Plate Assy		X		

APPENDIX B

4 CAMERA CG, NO FILM
5 CAMERA CG, SUPPLY 400' FULL



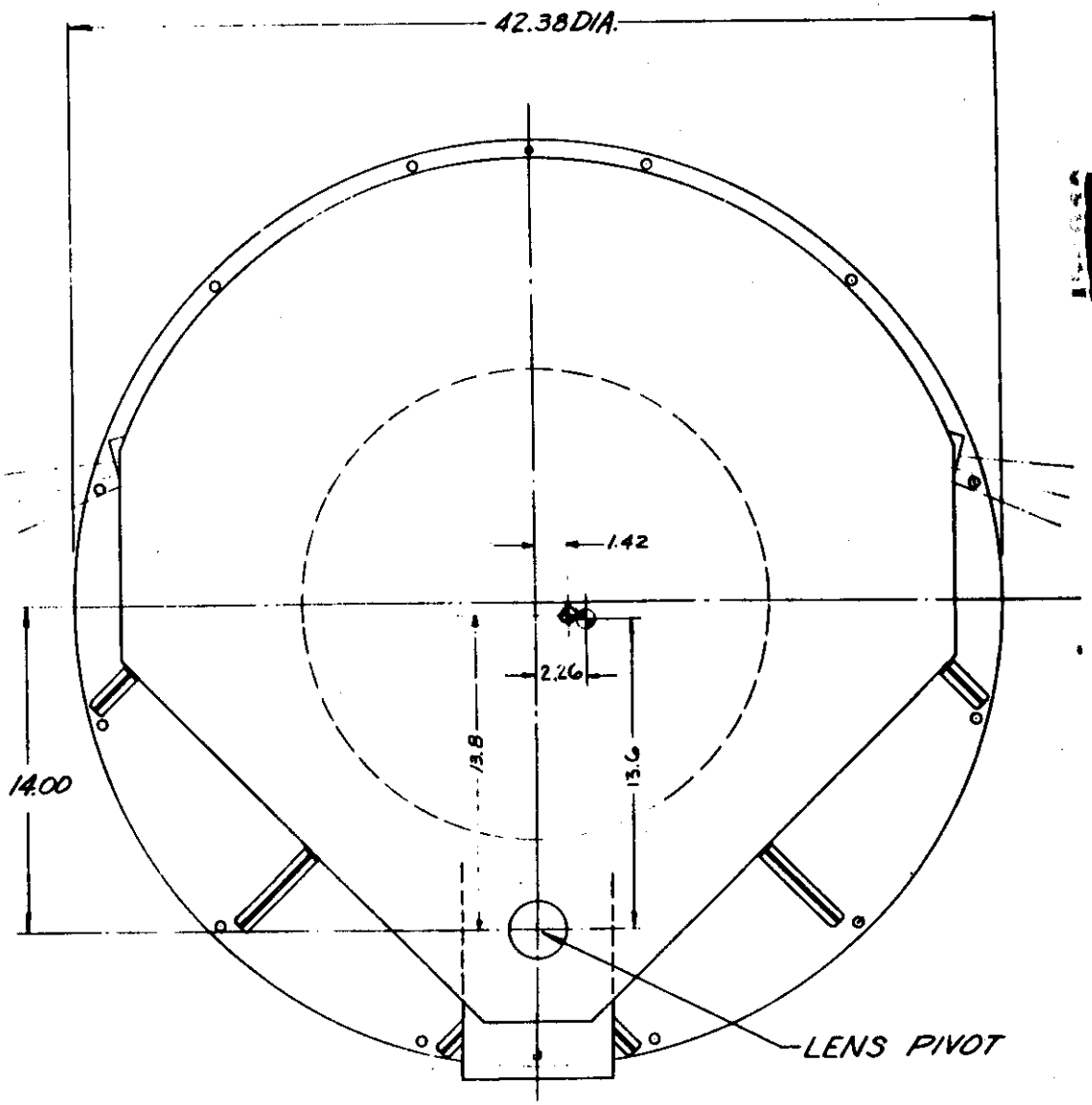
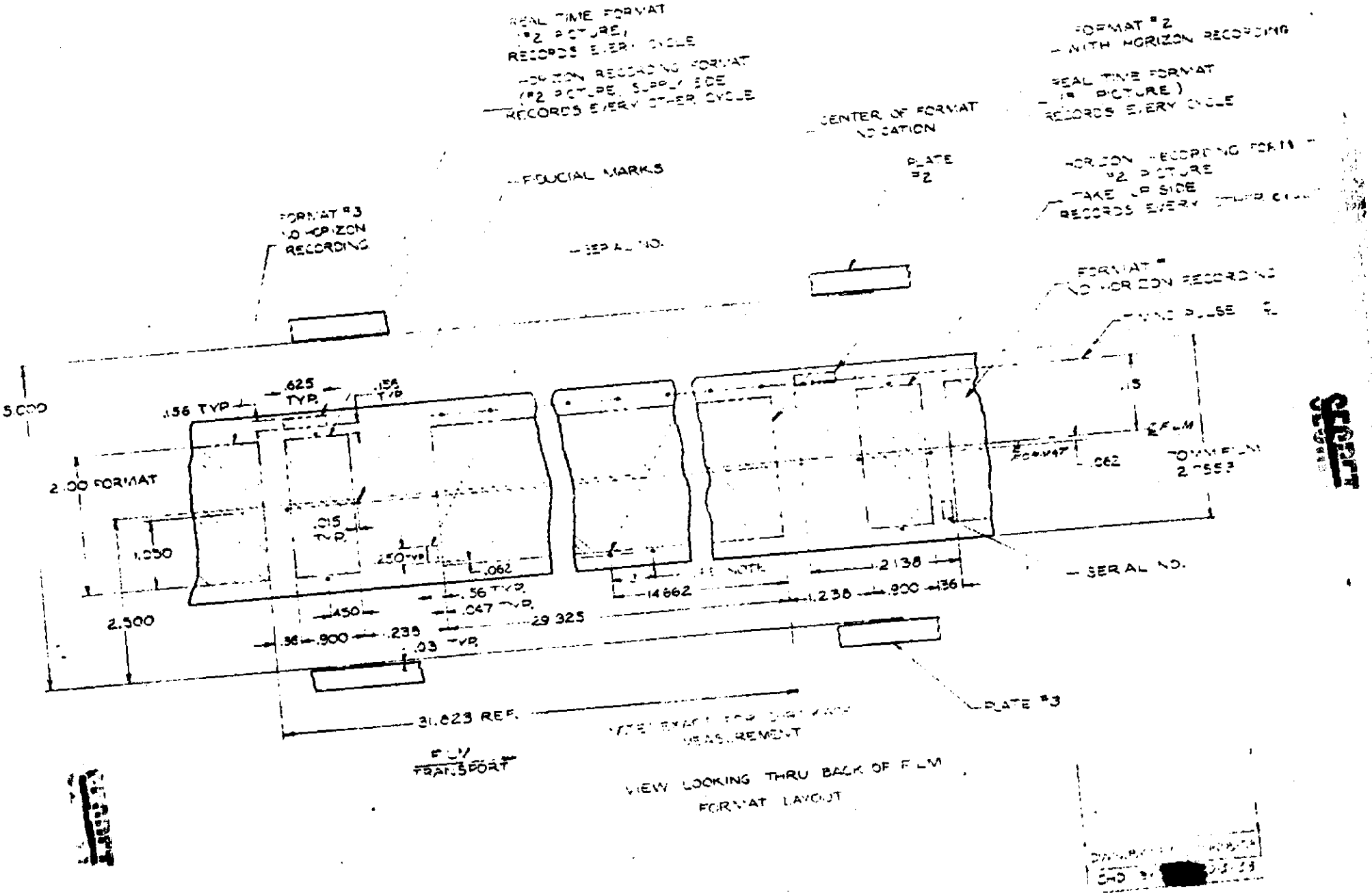


FIG 1


REAL TIME FORMAT
(#2 PICTURE)
RECORDS EVERY CYCLE
HORIZON RECORDING FORMAT
(#2 PICTURE, SUPPLY SIDE
RECORDS EVERY OTHER CYCLE
FIDUCIAL MARKS
SERIAL NO.
CENTER OF FORMAT
INDICATION
PLATE
#2
FORMAT #2
WITH HORIZON RECORDING
REAL TIME FORMAT
(#1 PICTURE)
RECORDS EVERY CYCLE
HORIZON RECORDING FORMAT
#2 PICTURE
TAKE UP SIDE
FORMAT #3
NO HORIZON
RECORDING
FORMAT #
NO HORIZON RECORDING
SERIAL NO.
PLATE #3
5.000
2.00 FORMAT
2.500
1.050
.156 TYP.
.625
TYP.
.156
TYP.
.015
TYP.
.250 TYP.
.062
.56 TYP.
.047 TYP.
.450
.36
.900
.235
.03 TYP.
29.325
14.662
1.238
.900
.136
2.138
.062
2.555
31.623 REF.
FILM
TRANSPORT
VIEW LOOKING THRU BACK OF FILM
FORMAT LAYOUT

Acceptance Test Specification

SME-[redacted]-3(A)

High Acuity Panoramic Camera

Part No. 956A1

31 October 1958

Enclosure 1

APPENDIX B

[redacted]

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Enclosure 1
APPENDIX B

DRAFT

1 SCOPE

1.1 It is the purpose of this specification to outline and describe the acceptance tests which must be performed on the subject equipment in order to assure the proper functioning of this equipment.

2. APPLICABLE DOCUMENTS AND DRAWINGS

2 1 The following documents and drawings form a part of this specification.

ITEK Specification "High Acuity Camera, HYAC II"
FCIC Drawing No. 956-A1 Final Assembly
FCIC Drawing No. 956-SD10 Electrical Schematic - Camera
FCIC Drawing No. 956-WD2 Wiring Diagram - Camera

3. ACCEPTANCE TESTS

These tests are divided into two groups, namely, Mechanism Tests and Photographic Tests.

3.1 Mechanism Tests: - The following tests will be made on each camera in order to check mechanical and electrical operation.

3.1.1 Film Transport: - Load camera with dummy film and operate over the limits of the camera cycling rate. Start and stop camera several times. Look for erratic operation and formation of slack in film. No slack or loops should appear. Observe film transport indicator pulse being transmitted to telemetering system. This pulse will have a magnitude of 4.0 ± 5% D.C. volts and a repetition rate of 6.37 ± 5% pps at maximum film speed (20 in/sec.). The pulse duration at this speed will be approximately 108 milliseconds.

3.1.2 Center of Format: - Observe the "Center of Format" pulse being transmitted to the telemetering system. This pulse will occur once every camera cycle and will be 4.0 ± 5% D.C. volts in magnitude. The pulse duration will not be less than 100 milliseconds at the maximum camera cycling rate.

3.1.3 Time Indicator Light Source: - Place the emulsion speed switch in the "ASA" position and observe the pulse which appears across the time indicator lamps. This pulse will have a peak amplitude of approximately 8.0 volts and will occur once every camera cycle. Check the synchronization of the lamp pulse and the movement of the digitote dials. The lamp pulse will occur when the digitote dials are motionless.

3.1.4 Digitote: - In order to check the operation of the "Digitote" unit measur the time required for the one (1) second telemetering transducer of the "Digitote" to make one complete revolution. The time will be 10.0 ± 1.0% seconds. The output of this transducer will be a step function consistin of 10 equally spaced steps per revolution. The maxim um voltage output of the transducer will be 4.0 ± 5% D.C. volts. Check for the presence of a telemetering signal from each dial of the "Digitote".

3.1.5 Horizon Camera Fiducial Lamps: -In order to obtain an indication of the operation of the fiducial lamps for each horizon camera, observe the voltage which appears at fiducial lamp test point for each camera. A voltage will appear at these test points every other camera cycle. When the "center of format" switch closes, the voltage will rise from zero to approximately 28 volts instantaneously and remain at this value until the "center of format" switch opens. The voltage then returns to approximately zero over a long period of time. If the return to zero voltage is instantaneous, all lamp circuits are open.

3.1.6 Frequency Recording Lamp: - Place the emulsion speed switch on the "ASA 10" position and observe the pulse which actuates the recording lamp. This pulse will be approximately 4.5 volts in magnitude and 1 + 10% milliseconds in duration. The frequency of the pulse will be 160 ± 0.05%. This pulse occurs only in the forward scan portion of the camera cycle.

3.1.7 Temperature Indicators: - Check the output of each temperature indicator to the telemetering system. Make these tests at room temperature and compare with the calibration data supplied with indicators.

3.1.8 Cycling Rate: -Operate the camera at various V/H command voltages and determine the cycling rates. These rates will be as follows:

V/H Command DC Volts	Cycling Rate Cycles/Sec.
5.250	0.269 ± 4%
8.250	0.421 ± 4%
12.000	0.613 ± 4%

3.1.9 Operational Test - Camera and Cassette: - Operate camera and cassette as a system and observe film handling performance. The camera system will be up to speed in 6 to 10 seconds.

3.1.10 Light Sensor: - Check the output of the light sensor to the telemetering system. Compare with calibration data supplied with the sensor.

3.1.11 V/H Transducer: - Determine the proper operation of the V/H transducer by checking the operation of the stepping switch and the generation of V/H and telemetering signals for each switch position. The signals generated by the transducer will be as follows:

Switch Position	Telemetering Signals DC Volts* Read Out Nos.				V/H Signal D.C. Volts
	4	3	2	1	
1	1	1	1	4	0
2	1	1	4	4	3.00 ± 3%
3	1	1	4	1	3.75 ± 3%
4	1	4	4	1	4.50 ± 3%
5	1	4	4	4	5.25 ± 3%

*NOTE: Voltage Tolerance ± 5%

3.1.11 (cont)

Switch Position	Telemetering Signals DC Volts* Read Out Nos.				V/H Signal D.C. Volts
6	1	4	1	4	6.00 ± 3%
7	1	4	1	1	6.75 ± 3%
8	4	4	1	1	7.50 ± 3%
9	4	4	1	4	8.25 ± 3%
10	4	4	4	4	9.00 ± 3%
11	4	4	4	1	12.00 ± 3%

* NOTE: Voltage Tolerance + 5%

3.2 Photographic Tests:

3.2.1 Actual Photography: - Locate Camera on roof of building, or suitable tower and take actual photographs over the range of camera cycling rates. Develop film and examine to determine the following items:

3.2.1.1 Lens Drive Smoothness: - Examine each photograph for visual banding. The lens drive will be considered smooth if no appreciable banding can be detected with the unaided eye.

3.2.1.2 Film Scratch and Pressure Marks: Examine photographs for excessive marking.

3.2.1.3 Time Recording: - A picture of the "Digitote" face will appear between the main picture formats. It will be possible to read the elapsed time with the unaided eye.

3.2.1.4 Horizon Recording: - Photographs from the Port and Starboard Cameras will appear between the main picture formats. These pictures will be of good quality. Each side of the format will be bisected by a fidicual mark. These marks will be well defined and visible to the unaided eye.

3.2.1.5 Center of Format: - Examine photographs for the appearance of a "Center of format" mark. This mark will indicate the center of the main picture format and will be located between the edge of the film and the format. This mark will be visible to the unaided eye.

3.2.1.6 Frequency Recording: - Examine film for laydown of timing marks. These marks will be visible to the unaided eye and will appear as a series of dots extending from one end of the format to the other.

3.2.1.7 Scan Rate: - In order to determine scan rate, measure the distance between timing marks. These marks will be equally spaced when the camera is scanning at constant speed. The distance between marks for various scan rates follows:

Scan Rate Degrees/Sec.	Distance between Marks Inches
110.25	0.2876 ± 2%
173.25	0.4535 ± 2%
252.00	0.6596 ± 2%

3.2.2 Tests Using Collimator: - Mount camera in Collimator and determine the following:

3.2.2.1 Resolution: - The degree of resolution should be determined for both static and operating conditions. Examination of the resolution charts on the film will indicate that the photography has not been degraded by more than 10% of the static lens-film resolution.

3.2.2.2 Horizon Camera Location: - Determine the relationship of the port and starboard horizon camera optical axes with the camera "center of format" axis. The angle between each horizon camera optical axis and the "center of format" axis will be 75 ± 0.1 degrees.

Environmental Test Specification

SME-EB-5(A)

High Acuity Panoramic Camera, Part No. 956A1
Cassette, Take-Up, Part No. 956E2

31 October 1958

Enclosure 2

APPENDIX E

SECRET

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Enclosure 2

APPENDIX B

1.0 SCOPE

1.1 It is the purpose of this specification to outline and describe the environmental tests which must be made on the High Acuity Panoramic Camera, Part No. 956A1, and the Cassette, Take-Up, Part No. 956A2, in order to demonstrate that the airborne system is capable of meeting the General Environmental Specification L-2916 dated 29 March 1958 Rev. 30 April 1958, and NCS 1411 and 1412 dated 6 May 1958. These tests will be made on the first non-deliverable flight units for the purpose of qualifying the deliverable equipment.

2.0 APPLICABLE SPECIFICATIONS AND OTHER PUBLICATIONS

2.1 The following documents form a part of this specification to the extent specified herein.

A. Specifications

SME-DB-1A High Acuity Panoramic Camera
SME-DC-3B Cassette, Take-Up
SME-EB-3A Acceptance Tests - High Acuity Panoramic Camera
SME-EB-4A Acceptance Tests - Cassette, Take-Up
MIL-C-9435 Chamber, Explosion Proof Testing

3.0 REQUIREMENTS

The equipment shall be capable of tolerating the following environments.

3.1 Non-Operating Conditions

3.1.1 Temperature, Humidity and Atmospheric Pressure

3.1.1.1 Temperature

(a) Lower Limit - Plus 20°F for periods of at least one hour duration.

(b) Upper Limit - Plus 160°F for periods of two hours.

3.1.1.2 Humidity: - Relative humidities up to 100 per cent, including condensation during temperature change.

3.1.1.3 Atmospheric Pressure

(a) Upper Limit - 30.5 inches of mercury

(b) Lower Limit - 5×10^{-5} inches of mercury

3.1.2 Vibration: - Equipment shall be capable of withstanding along each of three major mutually perpendicular axes sinusoidal vibration as follows

(a) 5 - 24.5 cps at 1⅛ inch zero to peak
(b) 25 - 2000 cps at 7.5 g.

3.1.3 Acceleration: - Equipment shall be capable of withstanding accelerations as follows:

(a) Longitudinal Axis - 12 g's for 5 minutes
(b) 2 Lateral Axes at Right Angles - 3 g's for 5 minutes

3.1.4 Shock - Equipment shall be capable of withstanding the following shock conditions:

(a) When the equipment is not packaged for shipment, it shall be capable of withstanding a shock of 20 g's at least three times along each of three mutually perpendicular axes.

3.1.5 Additional Non-Operating Tests which apply to Cassette

(a) Acceleration - Roll Axis of Vehicle - 25 g's for 3 minutes. The cassette need not be operable after this test.
(b) Shock - Roll Axis of Vehicle - Three 75 g shocks. The cassette need not be operable after this test.

3.2 Operating Conditions

3.2.1 Temperature, Humidity and Atmospheric Pressure

3.2.1.1 Temperature - Plus $70^{\circ} \pm 10^{\circ}F$

3.2.1.2 Humidity - Zero to 70 per cent

3.2.1.3 Atmospheric Pressure - 30.5 to 5×10^{-5} inches of mercury

3.2.2 Vibration: - None

3.2.3 Acceleration: - None

3.2.4 Shock: - None

3.2.5 Explosion: - Equipment shall operate in an ambient explosive atmosphere without causing ignition of such atmosphere.

4.0 TESTING

4.1 Test Conditions

4.1.1 Atmospheric Conditions - Unless otherwise specified, herein, all tests required by this specification shall be performed at an atmospheric pressure of between 28 and 32 inches of mercury, a temperature of between plus $60^{\circ}F$ and plus $95^{\circ}F$, and a relative humidity of not more than 90 per cent.

Enclosure 2
APPENDIX B

4.1.2 Tolerances - The maximum allowable tolerances on test conditions during environmental testing shall be as follows:

(a) Temperature - plus or minus 5°F
(b) Barometric Pressure - plus or minus 5 percent
(c) Relative Humidity - plus or minus 5 percent
(d) Vibration Amplitude - plus or minus 10 percent
(e) Vibration Frequency - plus or minus 2 percent
(f) Shock - plus or minus 10 percent
(g) Acceleration - plus or minus 10 percent

4.1.3 Measurements - All measurements shall be made with instruments of laboratory precision type, whose accuracy has been certified.

4.1.4 Temperature Stabilization - Temperature stabilization has been reached when the temperature of the largest centrally located internal mass of the equipment does not vary more than 5°F from the temperature ambient to the equipment.

4.2 Test Procedures

4.2.1 Temperature-Altitude-Humidity Tests

4.2.1.1 Rate of Change of Temperature - During change of chamber temperature, the temperature rate of change shall be 0.75 to 1.25°F per minute.

4.2.1.2 Tests - The following test sequence shall be conducted:

(a) Prior to placing Camera and Cassette in test chamber, performance record tests must be performed in accordance with paragraph No. 3 of FCIC Specification No. SME-EB-3 and paragraph No. 3 of FCIC Specification No. SME-EB-4. These tests must be performed in the atmospheric conditions outlined in paragraph 4.1.1 of this specification with the following exceptions:

(1) Temperature Range - plus 60°F to plus 80°F.
(2) Relative humidity of not more than 70 percent.

(b) Place the equipment in the test chamber at the conditions specified in paragraph 4.1.1 (load camera with a full spool of film). The chamber temperature and relative humidity shall be stabilized and maintained at plus 160°F and greater than 95 percent, respectively, for a period of three hours.

(c) Reduce the chamber temperature to plus 20°F and maintain at this temperature and a relative humidity of greater than 95 percent for one hour.

(d) Return chamber to conditions specified in paragraph 4.1.1.

(e) Repeat the above temperature humidity cycle two (2) times.

(f) After the three (3) temperature humidity cycles have been completed, stabilize the camera and cassette at 70°F and operate. Reduce the chamber internal pressure to one millimeter of mercury, within a period of ten (10) minutes, and maintain at one millimeter of mercury for a minimum of ten minutes. While the chamber pressure is at one millimeter of mercury, conduct tests on the camera and cassette in accordance with paragraphs 3.1.1, 3.1.2, 3.1.7, and 3.1.8 of FCIC specification SME-EB-3 and paragraph 3.1 of FCIC specification SME-EB-4. Compare with test results obtained in paragraph 4.2.1.2 (a) above. Test results must fall within the tolerances given in specification Nos. SME-EB-3 and SME-EB-4.

(g) Return chamber to conditions specified in paragraph 4.1.1 and remove camera and cassette. Subject camera and cassette to complete acceptance tests as described in paragraph No. 3 of FCIC Specification No. SME-EB-3 and paragraph No. 3 of FCIC Specification No. SME-EB-4. Test results must fall within the tolerances given in these specifications.

4.2.2 Vibration Tests

4.2.2.1 Test Conditions - The camera shall be tested with a spool of film attached. The cassette shall be tested without film on spool. Vibration shall be applied through the mounting points of the equipment to major air frame structure. All tests must be performed in the atmospheric conditions outlined in paragraph 4.1.1 of this specification. Test shall be conducted with the equipment inoperative.

4.2.2.2 Sweep Tests and Determination of Resonant Frequencies - The vibrations given in paragraph 3.1.2 shall be applied along each of three major mutually perpendicular axes. At the specified vibration values, a sinusoidal sweep shall be performed starting at the lower frequency limit and continuing at a constant octave sweep rate to the upper frequency limit in one-half hour. The resonant frequencies for each axis shall be determined by the following methods:

(a) Increased accelerations measured on the equipment with constant input accelerations, measured at the equipment mounting points.

(b) Excessive noise emitted from equipment.

At the conclusion of the sweep test on each axis, the equipment under test shall be examined for mechanical failure.

4.2.2.3 Resonant Frequency Tests - If resonant frequencies are found, the equipment shall be vibrated for a period of five (5) minutes at each resonant frequency and at the amplitude specified in paragraph 3.1.2. After resonant frequency tests on each axis, examine equipment under test for mechanical failures.