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SYSTEMS REQUIREMENTS SPECIFICATION #14000169603

1.0 SCOPE

1.1 General

The general objectives of the "L" Program are to design, develop, produce and test equipment to provide a complete program of photo-reconnaissance of signated earth areas between 20° and 80° N latitude. The system shall be comprised of the following:

(a) The Thorad Booster.

(b) The Agena "D" satellite.

(c) A modified Mk 5A Recovery System.

(d) A panoramic camera subsystem for stereo or mono mode reconnaissance photography.

(e) A stellar-terrain camera subsystem for attitude-indexing reference.

(f) A space frame, including the following:

(f.1) All support structures for subsystems.

(f.2) All mechanical and electrical interfaces between subsystems.

(f.3) All mechanical and electrical interfaces between systems per (a), (b) and (c).

(f.4) Digital time generating subsystem.

(f.5) All flight programming equipment.

(f.6) All T/M and ground command system equipment.

[redacted]

[redacted]

1.1.1 The Satellite Vehicle

1.1.1.1 Booster. The Thor DM-21 missile with three solid rockets added for additional boost shall be the booster. This combination is known as the Thorad. The booster shall be GFE.

1.1.1.2 Agena-D Satellite. The satellite vehicle shall be the Agena-D produced by LMSC. A complete description of the Agena-D satellite will not be given. Certain information needed for payload subsystem design is:

1.1.1.2.1 Ascent Phase. The Agena-D satellite shall be capable of attaining orbit.

1.1.1.2.1.1 Flight Path Angle at injection: ± 15'

1.1.1.2.1.2 Flight Path Azimuth at Injection: ± 15'

1.1.1.2.1.3 Perigee Altitude: ± 7 nautical miles

1.1.1.2.1.4 Argument of Perigee: ± 14°

NOTE

ESTIMATED 3 SIGMA DISPERSIONS FOR EXACT SEQUENCE OF EVENTS

	Perigee (n.m.)	Period (min.)	Inclination Angle (deg.)	Perigee Latitude (deg.)	Availability Date
Agena D	+2,-12	± 0.3	± 0.9	± 30	July 1962
BTL Guided Thor and Agena D	+1,-3	± 0.25	± 0.25	± 15	1 Jan. 1963*

*If implementation is approved.

[redacted]

1.1.1.2.2 Orbit Parameters. The range of orbit parameters for operation are:

1.1.1.2.2.1 Inclination Angles: 60°, 65°, 70°, 75°, and 82°.

1.1.1.2.2.2 Perigee and Operating Altitudes: Nominal perigee shall be 110 nautical miles. Altitudes over the operational area may range from 80 nautical miles to 140 nautical miles.

1.1.1.2.2.3 Eccentricity: 0.015 nominal; .03 maximum; .005 minimum.

1.1.1.2.2.4 Period: Orbit periods may range from approximately 89 minutes to 95 minutes.

1.1.1.2.2.5 Argument of Perigee: Nominal latitude of perigee shall be 21° N.

1.1.1.2.3 Orbit Attitude. While in orbit, the Agena satellite shall be capable of maintaining attitude with respect to the local vertical to the following tolerances:

Axis	Attitude	Attitude Rate
Pitch	0° ± 1°	0.6°/min.
Roll	0° ± 3°	0.6°/min.
Yaw	0° ± 2°	0.3°/min.

1.1.1.2.4 On-Orbit Power: The Agena power supply shall furnish the following maximum energy to the [redacted] reconnaissance payload during a [redacted] flight:

+28V unregulated DC - 1900 watt-hrs.

+28V regulated DC - 1875 watt-hrs.

-28V regulated DC - 126 watt-hrs.

115V, 400 cps single phase - 40 watt-hrs.

1.1.1.2.5 Communications and Control. The Agena communications and control subsystem shall supply the vehicle-ground telemetry link.

1.1.1.2.5.1 An S-band transponder to accept ground station commands [redacted] a tracking signal.

1.1.1.2.5.2 An orbital programmer which allows camera operation, telemetry and beacon operation and initiates the recovery sequence. [redacted]

1.1.1.2.5.3 Real time commands shall be available for selection of V/H programs, operational modes and other programmable events.

1.1.1.3 Reconnaissance Payload System. The payload system shall consist of a high acuity panoramic camera subsystem, a (terrain) indexing-(stellar) attitude camera subsystem, a digital clock, a recovery subsystem and a space structure subsystem.

[redacted]

1.1.1.3.1 Space Structure Subsystem. Space Structure Subsystem shall be provided by LMSC.

1.1.1.3.1.1 Aerodynamic and Space Structure. This will consist of 60-inch cyclindrical sections for mounting the panoramic camera subsystem, and a conical fairing for mounting the indexing attitude camera subsystem, the digital clock and the recovery subsystem. The aft portion of the cylindrical section shall provide a mating surface to the Agena D satellite.

1.1.1.3.1.2 Special Space Structure Provisions. The space structure shall include detachable doors over camera lenses which shall be activated upon command during orbit injection. The space structure shall also provide boots or other similar devices to seal the camera subsystem from light.

1.1.1.3.1.3 Roll Joint. LMSC shall provide a roll joint at the aft portion of the cylindrical section. This joint shall allow the payload section to be rolled through an angle of 30 degrees to right or left. During launch, this joint shall be secured by pin pullers or similar devices. On orbit it shall be capable of being activated by commands from the orbital

programmer in 15 degree increments. LMSC shall provide control systems required to [redacted]

1.1.1.3.1.4 Thermal Design. For the purpose of design, the operational temperature of the subsystem masses shall be considered to be in an environment 70° ± 10°F. Passive thermal control by means of emissive and reflective coatings shall be used wherever possible. Film paths near the outer skin or equipment heat sources have temperatures greater than 150° F shall be protected by thermal shields. Specific power dissipating components and temperature sensitive components or subassemblies shall be the subject of special consideration for negotiation by the Associate Contractors with SETD.

1.1.1.3.1.5 Telemetry Signal Conditioner. A signal conditioner capable of accepting instrumentation signals from the payload system and conditioning them into suitable form for transmission by the Agena telemetry system shall be provided.

1.1.1.3.2 Panoramic Camera Subsystem. The panoramic camera subsystem shall be provided by Itek. It shall consist of an optical system,

[redacted]

scanning drive, mirror positioning system, film advance mechanism, image motion compensation mechanism and data recording as described in following paragraphs.

1.1.1.3.2.1 Lens. The lens shall be approximately 66 inch focal length, f/5 Tessar (Hyac Type). The resolution shall approach diffraction limited performance at high contrast. The lenses shall be calibrated so that nodal points shall be nearly coincident with axis of rotation. Lens shall be focussed for vacuum conditions and shall maintain focus over temperature range of $70^{\circ} \pm 10^{\circ}$ F.

1.1.1.3.2.2 Mirror. A mirror oriented to look earthward from the satellite and covering at least 22° field shall be provided. The mirror shall not contribute significant resolution losses to the lens-film system.

1.1.1.3.2.3 Photographic Filter. A photographic filter shall be provided. The filter shall be of the proper value to be used as a haze filter for the selected film.

1.1.1.3.2.4 Scanning Drive Mechanism. A scan drive mechanism shall be provided to drive lens and slit in synchronism. Scanning speed

and scanning cycling rate will be proportional to V/H and will be designed to provide 10% overlap. The V/H programmer shall control the scanning drive mechanism.

1.1.1.3.2.5 Stereo Mirror Drive. The mirror and drive shall be capable of four positions, one of which will allow vertical photography and two of which shall allow positioning of the mirror +15° or -15° (fore and aft) from the vertical for obtaining convergent stereoscopic photography. The fourth position shall be a mirror stow position for launch.

1.1.1.3.2.6 Exposure. A focal plane shutter shall be provided to expose the film. Exposure time may be varied by installing a fixed slit of appropriate width prior to launch.

1.1.1.3.2.7 Auxiliary Data Recording. Binary recording capabilities for digital clock readout time, roll position of IMC cam and stereo or mono-mode of operation shall be provided. This data block shall be positioned outside the active format area. Center of format and shrinkage markers in the form of mechanical fiducial marks shall be provided. These shall be provided on each lateral side of the format area.

1.1.1.3.2.8 Telemetry Transducers. Associate Contractor and Itek shall establish instrumentation functions to be telemetered. The instrumentation functions shall provide information for on-orbit analysis of camera subsystem operation. Thermal instrumentation shall be included.

1.1.1.3.3 Indexing-Stellar Attitude Camera Subsystem. Itek shall provide a combined indexing (terrain)-attitude (stellar) camera subsystem. This camera subsystem shall provide capabilities for [illegible] tion of the panoramic photography. The stellar camera shall provide means for determining vehicle pitch, roll and, in conjunction with terrain frame camera, provide yaw determination during photographic operations. The stellar-terrain framing subsystem shall be independently programmed to operate throughout any planned operational pass. The subsystem shall include an interval ometer system to trip shutters at proper time intervals to obtain 50-65% overlapping photography with the indexing camera subsystem.

1.1.1.3.3.1 Terrain Framing Camera only characteristics are:

Focal length - 38 mm.

Aperture - f/4.5

Frame mode of operation

Format $2\frac{1}{4}$ x $2\frac{1}{4}$ inches on 70 mm film.

1.1.1.3.3.2 Stellar Framing Camera only characteristics are:

Focal length - 75 mm.

Aperture - f/1.9

Frame mode if operation

Format 11 inches circular on 35 mm film.

1.1.1.3.4 Digital Clock. LMSC shall provide and check out the digital clock. Clock shall be capable of storing time unambiguously for a period of 5 days, and supplying upon request, signals to record binary time to the panoramic camera system for auxiliary recording on film. The clock error shall not exceed 10 milliseconds in any 12-hour period after accounting for clock drift and offset.

1.1.1.3.5 Cassette. The cassette is part of the panoramic camera as provided by Itek. The cassette will provide takeup spools and drive motors for the panoramic camera subsystem and the index-stellar attitude camera subsystem.

1.1.1.3.6 Recovery Subsystem. The basic recovery subsystem shall be the Mark 5A Satellite Recovery Vehicle defined by drawing number 198R300G12, "Vehicle Assembly - Satellite Recovery," as modified by drawing number 6K501. This shall be GFE to LMSC for subsystem modification, test, system integration and launch.

1.1.1.3.6.1 Modified Vehicle. LMSC shall modify the Mark 5A SRV in the following areas:

Aft Cover.

Parachute.

Destruct System.

Light Weight Ballast System.

1.1.2 RECOVERY FORCE

It is planned to use the existing Discoverer Recovery Force stationed at Hawaii, including the surface vessels and the aircraft operated by the U. S. Air Force.

[redacted]

1.1.3 SATELLITE TEST CENTER

1.1.3.1 U. S. Air Force at Sunnyvale will exercise command control over launch, en-route, and recovery operations.

1.1.3.2 STC shall supply computer time and data required for LMSC flight operations support.

[redacted]

1.1.4 GROUND AND TRACKING STATION COMPLEX

1.1.4.1 [redacted] will be operated as a ground control station and will perform tracking operations. This station is operated by the U. S. Navy.

1.1.4.2 [redacted] will function as a tracking and ground control station. Recovery sequence will be commanded by this station. LMSC will operate this station under contract to AFSSD.

1.1.4.3 [redacted] will function as a tracking and ground control station. In addition, [redacted] will be a recovery control center and will operate an auxiliary recovery tracking station located on Jarvis Island. LMSC will operate this facility under contract to AFSSD.

1.1.4.4 [redacted] will function as a tracking and ground control station. LMSC will operate this facility under contract to AFSSD.

1.1.4.5 South Point and Barking Sands, Hawaii, and the Christmas Island station, will provide tracking only.

1.1.4.6 Other ground stations as used in the Discoverer Satellite Project.

[redacted]

[redacted]

1.1.5 FACILITIES

The present facilities established for the Corona program will be used. Clean rooms to be used for the checkout of this system will be required both at A/P and at the launch base. Facilities presently established and in operation on the Corona program will be used as follows:

1.1.5.1 Fabrication, Assembly and Checkout of Classified Hardware.

The LMSC-operated checkout and classified hardware fabrication facility located in the San Francisco Bay area will be utilized.

1.1.5.2 Launch Complex.

1.1.5.2.1 The Vandenberg Air Force Base facilities will function as launch site and maintenance and storage depot for boost[redacted] and Agena satellites. VAFB provides [redacted] facilities which include a building for final checkout of the classified payload section. LMSC will operate these facilities under contract to Air Force Space Systems Division.

1.1.5.2.2 The Base building is used for final checkout as follows:

1.1.5.2.2.1 Clean rooms for checkout, maintenance of the cameras, final loading and assembly.

[redacted]

1.1.5.2.2.2 Dynamic and static balance for establishing correct moments and center of gravity of the recovery vehicle.

1.1.5.2.2.3 Facilities for producing the Reconnaissance Programming tape, acceptance testing, and final assembly.

1.1.5.2.2.4 A pyro room for loading of all pyrotechnic devices and activating the recovery vehicles.

1.1.5.2.3 Equipment and facilities available at VAFB are:

1.1.5.2.3.1 Complete Corona handling fixtures and dolly, overhead monorail for loading the balancing machines and an air conditioned truck (70°) for transporting the Corona payload to the launch pad.

1.1.5.2.3.2 Complete GSE equipment for checkout and trouble shooting of the payload with recorders for reduction of data.

1.1.5.2.3.3 Pad checkout panels and data

1.1.5.2.3.3 Continued:

recorders in the blockhouse of each launch pad for final checkout and analysis before launch.

[redacted]

[redacted]

1.1.6 GROUND SUPPORT EQUIPMENT

1.1.6.1 Ground support equipment as required for the Thorad booster and Agena-D satellite will be supplied, maintained and operated by pertinent contractor.

1.1.6.2 Existing GSE from other programs and current Corona programs will be used with necessary modifications whenever possible. All contractors will submit requirements to SETD for proper disposition and authorization of SSD.

[redacted]

[redacted]

1.1.7 LOGISTICS AND SPARES

LMSC will control logistics and spares for this project and will have direct responsibility for operations of the logistics control center. The functions of this center include requisitioning, movement, storage of project hardware including flight spares, test hardware, GSE, rework items, and salvageable materials.

1.1.7.1 Hardware requirements lists and inventory control will be maintained and established throughout the program.

1.1.7.2 Traffic control of shipments to and from contractors, test areas, and launch site will be properly maintained.

1.1.7.3 Status will be maintained and periodic inventory furnished.

[redacted]

2.0 REFERENCE DOCUMENTS

2.1 LMSC 6117B except Para. 1.2.4.1, 3.2.1.4, 3.2.1.5, 3.2.1.9, 4.3.1, 4.4, 4.6, 4.7, and 4.8

2.1.1 Paragraph 1.1.5 of 6117B is changed to read " AET Engineering Department of Contractor."

2.1.2 Delete from 6117B Para. 1.2.2.1 and substitute: "Equipment shall be transported by military transport aircraft and motor vans. The equipment shall be protected and packaged to withstand such conditions as well as shock and vibration prevalent during shipping."

2.1.3 Delete Para. 1.2.3 of 6117B and substitute: "Contractor storage facilities will ordinarily be air conditioned. However, heat and high humidity may occur, and equipment should be able to withstand such conditions."

2.2 MIL-E-1D Electron Tubes and Crystal Rectifiers.

2.3 MIL STD 150 Photographic Lenses.

2.4 LMSC 447969 Agena Systems Electrical Interface except following paragraphs: -

2.5 LMSC AO 88430 Design Requirements for Electrically Initiated Pyrotechnics

2.6 LMSC 1072405 High Potential Test Requirements.

2.7 Engineering Spec. Electrical wiring SP660 (8 Dec. 1960).

[redacted]

3.0 REQUIREMENTS AND PERFORMANCE CHARACTERISTICS

3.1 Operational Considerations

3.1.1 Reconnaissance payload shall be capable of operating during north-south portions of orbits and south-north portion of orbits.

3.1.2 Area of photographic operations shall lie between 20° N. latitude and 80° N. latitude.

3.1.3 Panoramic and indexing camera subsystems shall be capable of operating on orbital paths whether altitude above terrain is increasing or decreasing.

3.1.4 Stereo mode of panoramic camera operation shall be primary; therefore monoscopic mode shall be secondary.

3.1.5 Orbit lifetime of the satellite shall be one to four days during which vehicle photographs can be taken at intermittent times.

3.1.6 Photographic operational times of 30 minutes duration [redacted] may occur.

3.1.7 Programming shall assume 90 percent tolerance on orbit parameters.

3.1.8 In-flight knowledge of ephemeris shall be provided to define target locations relative to the vehicle so that 75 percent probability of acquiring programmed targets shall be attained. Target inputs shall be latitude and longitude of targets to nearest 0.1 degree.

3.1.9 Primary mission shall obtain coverage of specific targets. For flight programming purposes a target shall be assumed to be 10 miles square.

[redacted]

3.1.10 It shall be possible to locate photographed targets within ± 2 miles with respect to local geodetic datum.

3.1.11 It shall be possible to produce photographs of such quality as to permit a ground resolution of 5 feet or better from a nominal altitude of 110 nautical miles. This corresponds to resolution of the standard Air Force low contract (2:1) test pattern as defined in MIL STD 150 with dimension W equal to 2½ feet.

3.1.12 Reconnaissance payload system shall operate unpressurized. Vacuum ranging from 10^{-3} to 10^{-8} mm Hg will be encountered.

3.2 Panoramic Camera Subsystem

3.2.1 Camera Scan Angle. The active format scan angle shall be approximately 22.5°. If additional scanning for acceleration and deceleration is necessary, this should be held to limits per dwg. TLL-100 (LMSC)

3.2.2 Film Requirements. The panoramic camera shall be capable of handling 3½ mil (0.0035") thick photographic film, and polyester materials varying in thickness between 1.8 mils and 4 mils. Film is 5 in. wide Eastman Kodak SO 130 and SO 132.

3.2.3. Film Capacity. The panoramic camera shall use film properly wound on a 4-inch diameter core. The take-up spool shall be capable of accommodating 7,600 feet of film per 3.2.2.

3.2.4 Space Between Picture Formats. The space between adjacent formats shall be used for data recording, as agreed upon by contractors, Customer, and SETD, and shall be held to a minimum.

3.2.4.1 Format shall be defined in latest revision release drawing ITEK No. 43704, which shall be considered

[redacted]

official only when it bears the signatures of

ITEK, LMSC, SETD, and the Customer.

3.2.4.2 All prior printings must be identified "Preliminary".

3.2.5 Allowable Film Wastage During Camera Start. Film wasted during any operating start shall not exceed one (1) frame. This maximum wastage shall be the total average over a full roll of film at maximum film speed. From "start", sequence command the camera system shall be up to speed in less than 5 seconds.

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

3.2.7 Exposure Slits. A number of exposure slits shall be provided to give a range of exposures suitable for use with SO 130 and SO 132 across the expected range of camera cycling rates.

3.2.8 Reaction and Momentum Balance. The operation of the camera shall introduce no residual reaction and momentum to the basic vehicle.

3.2.9 Cycle Counter. A counter included in the camera system shall provide signals for telemetering the cycle count.

3.2.10 Stereo Mode. Stereo photography will be 8 frames forward and 8 frames aft, each set of 16 exposures to cover approximately 50 nautical miles (on earth surface) along the vehicle flight path. [redacted]

3.2.11 Measurement of Photo Quality. Design objective shall be 90% of static-lens-film resolutions obtained on the Mann Bench. The panoramic camera shall produce photographs with a minimum resolution of 80 lines/mm on SO-132 film when cycled at a 110 nautical mile simulated altitude, with the DRT moving MIL-STD-150 medium contrast targets.

3.2.12 Image Motion Compensation Accuracies. The forward motion compensation mechanism and scan drive system shall have performance compatible with the required photographic quality objectives across the specified range of orbit altitudes and speeds.

3.2.13 Lens Drive Smoothness. The lens drive system, used for focal plane scanning and forward motion compensation, shall not cause visible banding in ground scenes. For measurement purposes, amount of banding will be determined by using a stable diffuse DC light source or a strobe light.

3.2.14 The panoramic camera subsystem design weight shall not exceed 605 pounds.

3.3 Indexing (Terrain) - Attitude (Stellar) Camera.

3.3.1 Alignment of Optical Axes. The indexing attitude cameras shall be mounted on an stable integral mount to verify optical axes at a divergent angle of 120 degrees ± 1 minute of arc, under flight temperature environment.

3.3.2 Film Transport System. The index camera and attitude camera shall have independent film transport systems.

3.3.3 Mounting. The attitude (Stellar) camera lens shall look eastward on north-south orbits.

[redacted]

3.3.4 Distortion. Both attitude and index lenses shall be calibrated for distortion. Data shall be supplied to LMSC for inclusion in flight data to customer.

3.3.5 Time. The digital clock shall provide a time word for recording on each exposure of the index-attitude camera.

3.3.6 Shutter Synchronization. The shutter of the index-attitude camera shall be synchronized to trip during the shutter open time of the attitude camera.

3.3.7 Reseau. Index camera shall be equipped with a calibrated reseau grid, 2.5 mm. x 2.5 mm. Grid lines shall be approximately 5 microns in width. Center of grid shall be located within ± 25 microns of the lens principal ray.

3.3.8 Camera Control. Index-attitude camera shall have an integrating volometer to control forward overlap of the indexing photography to 55% at an average altitude as selected for the mission. This camera control shall not be resettable by ground command.

3.3.9 Weight. The indexing-attitude camera subsystem shall have a max. weight of 20 pounds including empty supply spools.

3.4 Cassette

3.4.1 Component Parts. The cassette will consist of the take-up spools and film take-up drive systems.

3.4.2 Configuration. The design of the cassette will conform to the basic configuration and space limitation as shown by LMSC drawing No. T55-110 attached herewith.

3.4.3 Cassette Weight. The weight of the complete cassette without film shall not exceed 20 pounds.

[redacted]

3.4.4 Mounting Provisions. Provision will be made for mounting the cassette within the recovery vehicle in accordance with the mounting provisions as shown in LMSC Drawing No. 155-[redacted] attached herewith.

3.4.5 Maximum Temperature Indicator. Provide a passive method of indicating maximum temperature in excess of 200° F experienced by take-up spool.

3.4.6 The cassette shall be capable of being started and stopped at least 300 times during the taking up of a complete roll of film.

3.4.7 Anti-Back-Up Device. The cassette shall be deisnged to incorporate an electro-mechanical anti-back-up mechanism in the spool drive system to prevent the take-up spool from unwinding. This anti-back-up device shall be capable of being released for test and check-out purposes by applying 28 volts DC on an appropriate pin connection. The anti-back-up device shall be mechanically engaged when the voltage is removed.

3.5 Space Structures, Thermal Design. The space structure thermal design shall:

3.5.1 Establish uniform ambient temperature of the lens cell and platen support tube to maintain force.

3.5.2 Minimize temperature gradients affecting mission.

3.5.3 Provide thermal shields for film paths.

3.6 Commands and Programming.

3.6.1 Camera on/off operation using autocycle mode, V/H timer synchronization, stereo/mono mode, discrete roll commands, and indexing-attitude camera on/off signals shall be provided by the Agena Command Programmer.

3.6.2 Auto Cycle Mode of Operation

3.6.2.1 The command pulse, 50-500 milliseconds duration, initiates a period of 16 cycles.

3.6.2.1.1 Monoscopic-mode results in 16 consecutive frames.

3.6.2.1.2 Stereo-mode results in 8 stereo pairs. The ground coverage gaps between stereo-pairs will equal the photo coverage.

3.6.2.2 For continuing operation in either mono or stereo-mode, each additional period (per 3.6.2.1.1 or 3.6.2.1.2) requires a pulse.

3.6.2.2.1 Request to continue pulse, must phase with preceeding period as follows: between command + 2 seconds to shut-down - 2 seconds.

3.6.2.2.2 A maximum operate span of 20 minutes must be verified during test and not exceeded in flight.

3.7 All electrical and electronic assemblies and components shall meet general requirements specified by LMSC 447969, Agena System Electrical Interface. Specific application of portions of this specification shall be subject to negotiation by Associate Contractor and SETD.

3.8 Semi-Conductors

To aid in establishing a ground rule philosophy in component parts selection and application the following guides are recommended.

3.8.1 Silicon devices should be used for signal work at low to medium power levels.

3.8.2 Germanium devices should be used for power transmission in excess of 28 watts.

3.8.3 Requirements and characteristics of MIL-E-1D must be considered minimum, and no component shall be used that is not vendor certified or tested to the limits of that specification.

3.8.4 MIL-S-19500 does not expand vibration and thermal parameters sufficient to verify flight worthiness.

3.8.5 The environmental requirements of LMSC 6117D may be used as minimum levels, provided sufficient de-rating is applied to verify thermal competence.

3.8.6 All semi-conductors must be X-ray inspected, per specification to be furnished by LMSC.

3.9 Selection of Parts

3.9.1 All parts must function correctly following exposure to Qualification Test Requirements plus all possible flight

environments. Capability must be verified as stated in para. 4.2.2 and 4.2.3.

3.10 Materials

3.10.1 Metals: Metals shall be of the non-corrosive type or be suitably protected (subject to the thermal requirements) to resist corrosion during maximum service life. (Test, Storage, Launch & Flight)

3.10.2 Protective Treatment: Any materials that are subject to deterioration when exposed to the environmental conditions likely to occur during service usage, shall be suitably protected to assure capability beyond performance requirements.

4.0 QUALITY ASSURANCE AND RELIABILITY PROVISIONS

4.1 Design Review

The design shall be reviewed in phases; the phases being, Subsystem Design Review, Component Design Review, Parts Application Review, and Operability Review.

4.1.1 Subsystem Design Review: The Subsystem Design Reviews shall be held with SETD during the design span. The times chosen shall allow the incorporation of changes in system design without effect on schedule. The Subsystem Design Review shall identify and explore potential problem areas. The engineering analysis will cover configuration, redundancy, human factors associated with manufacturing, assembly checkout or repair, and all other elements for successful subsystem design. The Subsystem Design Reviews shall establish reliability goals for all subassemblies and components comprising the total subsystem. Major components requiring documentation of reliability shall be defined during this review.

4.1.2 Component Design Review: Component Design Reviews shall be held during the design span, and no later than the start of development testing of the first engineering model. Reviews will be made in the fields of stress analysis, electrical design and mechanical design. The reviews shall consider structural, mechanical, electrical, electronic, environmental, and human factors influencing the components. The objective of the Component Design Review shall be the identification of potential sources of unreliability in

components and provide a measure of in-development component "normal time to failure". Reviews of major components, defined in Subsystem Design Review, shall be submitted to SETD as a part of reliability documentation. Reviews of other components need not be submitted to SETD, but shall be available upon request.

4.1.3 Parts Application Review: Parts Application Reviews shall be made on a continuing basis. The reviews will verify the designers' parts selection, and assist the designers in obtaining required performance without reducing reliability. Part failure rates may be taken from published reports, or other documents, where sufficient data cannot be obtained directly within the time span of the program. The Parts Application Reviews will be submitted to SETD.

4.1.4 Operability Review: The operability review shall be made following the completion of test on the first engineering model. Ease of operation adjustments, parts replacement, and equipment maintenance of the subsystem during pre-flight operations will be reviewed. Ground support equipment shall be reviewed for operability, compatibility, reliability, maintainability, and human engineering. The Operability Review shall be reported to SETD.

4.2 Classification of Tests: Inspection and testing shall be classified as follows:

4.2.1 System Qualification Tests: Qualification test objective is to prove system reliable beyond operational requirements. Tests shall be run on a complete system, to verify compliance with performance requirements. Tests shall be run with no

adjustments or repairs during the course of the test. If any modifications are necessary after the completion of any qualification test, the test must be re-run. Explicit waiver may be granted, upon demonstration that the modification will not affect the response to the particular test. The system shall be qualified to the applicable limits of LMSC 6117B, using environments specified for the "Payload Area." LMSC shall accomplish these tests.

4.2.2 Component and Subassembly Qualification: All components and subassemblies shall be separately qualified to the limits applicable in LMSC 6117B, dated 1 July 1960, using environments specified for Payload Area. Components, subassemblies and parts need not be given qualification tests if prior qualification under test conditions at least as severe as required in this specification are documented. Specific acceptance must be granted by SETD for each component or subassembly prior to qualification. Parts qualifications shall be presented to SETD.

4.2.3 Acceptance Tests: Acceptance tests shall be run on production units to verify workmanship and operability. The individual test shall be run with no adjustments or repairs during the course of the test. If any modifications or repairs are made following the completion of any acceptance test, all tests previously run on the unit must be repeated, unless an explicit waiver is granted, based on the demonstration that the modification or repair will not affect the response to the particular test or tests. Such tests will be witnessed by SETD and recommendations thereon shall be made to the Government.

[redacted]

4.2.4 Individual Tests

4.2.4.1 System Qualification Tests: All tests shall be performed as required by SETD approved D.C.S. and defined by Qualification Test Specifications. Directing documentation, Test Procedures, must be released prior to start of test. Certification of performance, Test Report with data, must be presented to SETD to verify test completion success for the following:

4.2.4.1.1 Vibration Test

4.2.4.1.2 Thermal-Altitude

4.2.4.1.3 Voltage Sensitivity

4.2.4.1.4 High Temperature

4.2.4.1.5 Low Temperature

4.2.4.1.6 Optical Resolution

4.2.4.2 System Acceptance Tests: These tests shall be performed to Acceptance Test Specifications, per Test Procedure to verify manufacturing capability to flight objectives.

4.2.4.2.1 Vibration

4.2.4.2.2 Altitude

4.2.4.2.3 Functional

4.2.4.2.4 Optical Resolution

4.2.5 Test Specifications, Methods, and Procedures

4.2.5.1 Test Procedures: All Qualification and Acceptance Test Specifications and Procedures shall be prepared

[redacted]

by the associate contractor, and approved by SETD prior to the performance of the Qualification and/or Acceptance Test.

4.2.6 Reports and Monitoring

4.2.6.1 System Qualification Test: All qualification tests results shall be reported to SETD, giving in detail all failures, repairs necessary, and malfunctions not resulting in failure. SETD shall witness all qualification tests.

4.2.6.2 Component and Subassembly Qualifications: Reports on component and subassembly qualification tests shall be reported to SETD. SETD may witness such tests.

4.2.6.3 Acceptance Test: The acceptance test shall be reported to SETD. All failures, repairs, and malfunctions not resulting in failure shall be reported. SETD shall witness or review all acceptance tests.

4.2.7 Camera Subsystem Test Equipment

Test equipment shall be delivered or modified as directed by S.S.D.

5.0 DOCUMENT RESPONSIBILITIES SPECIFICATIONS AND PROCEDURES

Associate Contractors shall prepare and submit to SETD all required specifications for subsystems and equipment for which they are responsible.

5.1 Design Control Specifications

5.2 Qualification Specifications and Procedures

5.3 Acceptance Test Specifications and Procedures