

**CONFIDENTIAL**

C-0445/DI-8E

26 April 1971

Chief, Logistics Branch  
NPIC

DIA/DI-8

**1540 Light Tables**

1. Reference: NPIC requisitions 5500-D306-71 and 5500-9310-71.

2. [redacted] has indicated a desire to procure the [redacted] 1540 light table in lieu the [redacted] model 1540. This decision was based on maintenance and operational considerations.

25X  
25X

3. As no contract has been consummated for [redacted] light tables and U. S. acceptance of the [redacted] case indicated a sole source guarantee request [redacted] 1540 light tables be procured and NPIC requisition 5500-D306-71 be so amended.

25X

4. Further request the one model 1540 light table requested by DIA (NPIC requisition 5500-9310-71) be added on to the [redacted] contract for the [redacted] model.

25X1

5. It is understood by this Office that both Army SPAD and NRTSC are also interested in purchasing [redacted] model 1540 light tables.

25X1

6. Please inform this Office should a substantial price differentiation develop between the model 1540 manufactured by [redacted] and that of the [redacted]

25X1

[redacted]

25X1

Logistical Officer  
DI-8

Declass review by NGA/DoD

(This document indicates a relationship between NPIC and the originator, therefore, a CONFIDENTIAL classification assigned)

GROUP 1  
Excluded from automatic  
downgrading and  
declassification

**CONFIDENTIAL**

Technical Requirements for the Production  
of the [redacted] Split-Format  
Light Table and Mount for Various Micro-  
stereoscopes

1. INTRODUCTION

These specifications describe the technical requirements to be met in the construction of production units of a Split-Format 1540 Light Table with ring mount for various microstereoscopes. These light tables shall be essentially the same as the [redacted] pro- 25X1  
totype developed under contract number [redacted] with exceptions 25X1  
which are included in this document. The detailed requirements for changes and modifications are contained in the body of this documentation. Unless otherwise specified, the production instruments fabricated under these technical requirements shall equal or exceed the performance of the pre-production model (when accepted) as defined in Paragraph 4.3.

2. GENERAL DESCRIPTION

This table shall incorporate two separate illuminated areas adjacent to each other along their shorter dimension so that their combined measurements shall be approximately 15" by 40". The longer dimension of these light sources will be parallel to the length of the spooled film/s being viewed.

Provision shall be made for viewing single rolls of 70mm, 5", 6.6" or 9.5" wide film; parallel viewing of two of the same width, or any combination of two different widths, of 70mm, 5", or 6.6" wide film;

and in-line viewing of two of the same widths, of 70mm, 5", 6.6", or 9.5" wide film. The table shall accommodate spools ranging up to and including the size of spool specified in Military Standard MS26565-22 loaded to capacity with film.

The table shall include a simple film looping mechanism which will allow forming a loop of film below the table in order that separated frames, on the same roll of film, may be arranged adjacent to each other for convenient stereo viewing. Looping of parallel rolls of film will not be required. This mechanism shall be capable of forming a continuous film loop from 0 to 76 inches.

A mount capable of being translated in both the X and Y directions shall be incorporated to support the microstereoscope at the correct height above the light table surface. This mount shall interface directly with the microstereoscope and shall incorporate both coarse and fine focus controls.

3. REQUIREMENTS

3.1 Illumination Sources

3.1.1 General - Two separate glass formats,  $14" \pm \frac{1}{2}"$  X  $20" \pm \frac{1}{2}"$  in size, shall be illuminated by easily replaced fluorescent-type sources. The distance between the two adjacent illuminated areas shall not exceed  $1\frac{1}{4}$  inches during normal viewing operations. In addition, the capability of synchronous tilting of the illuminated areas and the microscope mount and carriage, by means of a motorized drive continuously throughout the range of 0 to 15°

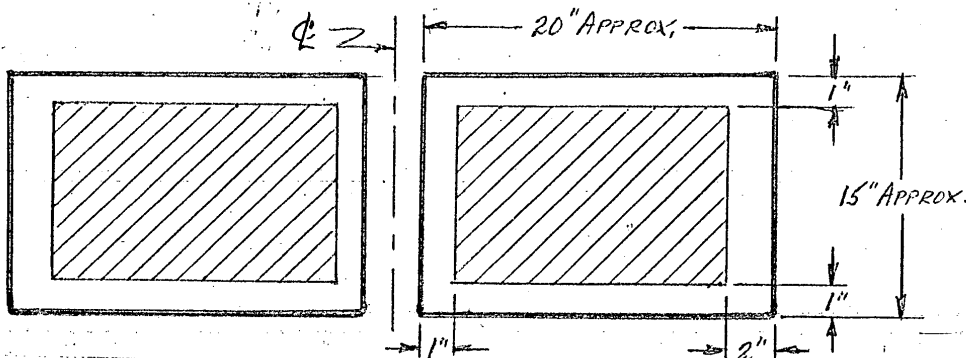
+ 1° shall be provided as an optional feature.

3.1.1.1 Illumination Level - Each of the illumination sources shall provide a maximum level of at least 3,000 foot lamberts measured at the glass viewing surface, within a 2" radius of its geometric center, at any time after a minimum of 30 minutes continuous operation. The maximum levels of the two illumination sources shall not differ by more than 100 foot lamberts at the time of this measurement. The minimum level of each of the sources shall be 200 foot lamberts, measured at the glass viewing surface, within a 2" radius of its geometric center. These requirements shall be met with line input voltage of 117 volts. Between these two extremes, the illumination level shall be continuously variable throughout each of two over-lapping steps which shall be selected by appropriate switching. Logarithmic control of the illumination level shall be included, with the slow response of the control at the low illumination levels. With one of the two sources set a maximum or minimum illumination level, there shall not be a change of more than 100 foot lamberts in illumination level of that source when the illumination level of the other source is adjusted throughout its full range. Illumination level shall not decrease below 2400 foot-lamberts over an operating period of 4000 hours or three years, whichever occurs first. It is understood that during the first 100 hours of operation transient excursions may exceed this limit. Measurements will be taken with a specially configured Weston foot lambert meter presently in possession of the Government.

3.1.1.2 Color of Illumination - Broadband white illumination shall be required with a correlated color temperature of  $5,000^{\circ}\text{K} \pm 500^{\circ}\text{K}$  at all luminance levels, chromaticity aim points of  $x = 0.345$  and  $y = 0.358$ , and a color rendering index of 70 or higher. Measurements of these quantities will be made at the glass viewing surface with a  Scanning Spectroradiometer, Model No. 3000, with special fiber-optics probe, presently in possession of the Government. The phosphor chosen shall minimize radiation below 380 nanometers and above 750 nanometers. Since fluorescent sources have known ultra-violet radiation, the contractor shall produce certification by a nationally recognized authoritative source that no medical damage will result to operating personnel from ultra-violet radiation by the light sources of the tables produced under this contract. 25X1

3.1.1.3 Uniformity of Illumination - The maximum linear brightness gradient for each of the illumination sources shall not exceed 25% between any two measurements taken within the shaded areas on the following diagram. In addition, the brightness gradient shall be no greater than 50% over the entire 15" X 20" illuminated areas. The measurements for gradient shall be made with the Government-owned brightness meter, keeping the

sensing aperture of the meter wholly within the above defined boundaries. The gradient measurements shall be taken at an illumination level of 3,000 foot lamberts.



3.1.1.4 Flicker - Flicker must be at such a level as not to be visibly objectionable to the sponsor's operators at any light intensity level. Flicker frequency of each of the illumination sources shall exceed 80 Hertz except for low luminance (less than 500 foot lamberts) where frequencies down to 60 Hertz are acceptable. Beat frequencies of multiple lamp sources shall exceed the above levels.

3.1.1.5 Heat - The illumination sources shall be able to function continuously at maximum intensity over a 24-hour period, in a room with an 80°F ambient temperature. In addition, with film of 2.0 density covering at least 66% of the illuminated glass viewing surface, and the remainder masked, the temperature of the glass surfaces shall not exceed 100°F, or 30°F over ambient, whichever is higher. Also, no external surface of the table, or of the ancillary equipment, shall exceed 115°F or 30°F

over ambient, whichever is higher. These temperature measurements will be taken with illumination at maximum intensity and after temperature and light intensity stabilization of the light sources.

3.1.1.6 Diffuser - A suitable diffuser shall be located directly below the glass viewing stage of each illumination source.

3.1.1.7 Shade - Shades shall be provided at each of the illumination sources to mask light from the viewing surface not actually covered by film. Each shade shall be located between the diffuser and the illumination source, shall be mounted along the long dimension of the unit, and shall be extendible across the short dimension toward the operator's normal position; i.e., back to front. Means shall be provided for easy, convenient, extension, retraction, and firm intermediate positioning of the shade between its extremes of operation. These extremes shall be the fully retracted position, where the shade will not encroach upon the illuminated areas, and the fully extended position, where the shade shall mask the unused portion of the glass viewing surface when viewing a single 70mm wide roll of film.

### 3.2 External Configuration

3.2.1 General - The basic features as mentioned in Paragraph 2, together with their necessary sub-components, shall be built

as a part of a convenient and sturdily designed elevating table.

3.2.1.1 Size - The entire unit shall measure no more than 62 inches in length, including film supports, and 31 inches in depth (front to back). Protrusions beyond the depth dimension shall be easily demountable with quick-disconnect type connections. The distance from the glass viewing surface to the bottom of the light table proper; i.e., the light enclosure and 0 to 76 inch film loop mechanism, shall not exceed 5.5 inches. A hinged cover shall be provided to enclose the under side of the film loop takeup area and translation of the film shall be accomplished with this cover closed. The inside surface of this cover shall be covered with some type of material such as teflon tape to prevent scratching of the film while being translated with the cover closed.

3.2.1.2 Elevating Table - The light table and microstereoscope mount shall be built as an integral part of an elevating table. This table shall be conveniently adjustable by means of a manual drive throughout a range of height, measured from the floor to the bottom of the light table proper, of 22 inches to 40 inches. The table shall be stable with no danger of tipping at all heights, up to and including its maximum extended position of 40 inches. The elevating mechanism shall provide firm positioning and locking of the light table proper throughout the elevation range. Manual operation of the elevating mechanism shall produce



response as fast as practicable and yet require no more than 12 pounds force on the actuating handle of a crank which will have a radius of 3 to 4 inches. In addition, the capability of elevating the table by means of a motor driven mechanism shall be provided as an optional feature. This motor driven system shall incorporate an emergency auxiliary hand crank that will smoothly and easily raise and lower the table, and provide firm positioning and locking of the light table proper throughout the elevation range. The purpose of this hand crank is to provide elevation and lowering of the table in the event of a power failure. For both the manual and motorized elevation systems positive stops shall be provided to prohibit travel above or below the specified range of height for the elevating table of 22 inches to 40 inches. The table shall be equipped with resilient-tired wheels, with nominal dimensions of 5" diameter by 1 5/8" width, each of which will have its own easily applied foot actuated, locking-type brake to prevent both the caster from swivelling and the wheel from rotating.

3.2.1.3 Viewing Position - The light table and the translating microstereoscope mount shall be designed to offer the microstereoscopes (Paragraph 3.5.1 pertains) in a comfortable viewing position with the operator standing or seated. It is understood that these conditions relate to the height of the illuminated glass viewing surface, the requirement for associated rhomboids

to adequately clear the film, and the varying working distances of the rhomboids of the microstereoscope.

3.2.1.4 Location of Controls - All controls, including the film hand wheels (on the manual version) shall be positioned so they can be easily manipulated. In this respect, it is understood that the location of the controls, as supplied on the pre-production model (when accepted), will be satisfactory.

3.2.1.5 Finish - To reduce specular glare, which may interfere with efficient operator performance, the external surfaces of the entire light table unit shall have non-glossy or semi-glossy finishes.

### 3.3 Film Spool Support

3.3.1 General - Four film support stations shall be provided to accommodate the various film widths and combinations described in Paragraph 2. They shall be designed so that they will support the heaviest full spools of film (1,000 ft. of  $9\frac{1}{2}$ " wide, 4 mil base film) when the spools are rotating at any film slew speed developed by the drive system.

3.3.1.1 Loading Mechanism - A means shall be provided for fast loading and unloading of either a single or two rolls of film of widths and combinations set forth in Paragraph 2. This loading system shall operate quickly and at the same time be positive in action. The spindle mechanism which engages and secures the

spool will be designed for easy one hand operation so that the fully loaded spool can be held in one hand while the holding mechanism is activated with the other. A positive but quick release lock shall be incorporated.

3.3.1.2 Brackets - At both ends of the table, two holding brackets shall be provided on each of the upper film support stations, two brackets on each of the lower film support stations. All brackets shall be removable, will operate freely on their ways to facilitate positioning, and shall be equipped with a quick-locking mechanism to hold them firmly in any selected position. Positioning of these brackets shall accommodate the various combinations of film formats specified in Paragraph 2 and shall provide adequate spacing between parallel webs of film so as to allow full speed translation of the webs in either direction without interference. The brackets shall be rigid enough to support the largest full roll of film specified in Paragraph 2, and under the conditions specified in Paragraph 3.3.1, without auxiliary means of support, under all operating conditions with either single or double spools of film. Film drive spindles on the brackets shall incorporate keys to mate with the drive slots in the flanges of the film reels.

Idler spindles shall not be keyed. A visual reference scale and indexing device with positive detents shall be provided to allow accurate positioning of the brackets to hold the various

width spools and assure accurate tracking across the glass viewing surfaces of the film parallel to the longitudinal axis of the light table and to each other.

### 3.4 Film Transport

3.4.1 General - The film transport shall be designed for motorized operation, with a manual drive provided as an option.

3.4.1.1 Film Capacity - Each film support station, and its associated film transport shall be capable of handling the various width films and combinations thereof as described in Paragraph 2.

3.4.1.2 Film Movement - Provision shall be made for bi-directional movement of the film at each film support station by means of motors of suitable capacity. The film drive motors shall be controlled by a control knob configured for high and low speed ranges. The low speed range shall provide positive and smooth film positioning throughout a range of speeds of 0 to 1 inch per second. The high speed range shall provide positive and smooth film positioning throughout a range of speeds of 0 to 500 feet per minute. The maximum speed on the high speed range shall permit 1000 feet of 4 mil base,  $9\frac{1}{2}$ " wide film to be transported in three minutes or less. The film drive, in the maximum speed range, shall be capable of a film speed no less than 20 inches

per second. With the two rolls of film mounted in parallel, it shall be possible to drive one of the rolls in one direction and the other roll in the opposite direction, individually or simultaneously. Also, with two rolls of film mounted in parallel, it shall be possible to drive both rolls of film in the same direction individually or simultaneously. An attachable manual film transport drive capable of film movement shall be included for emergency power off operation. In addition, a manual film transport drive which will provide positive and smooth film positioning and the same directional film movement as the motorized drive system shall be provided as an optional feature.

Film drive systems shall allow all required sizes of film to be transported in any mode, including emulsion up or emulsion down, at maximum speed without causing the film to track improperly in any manner.

3.4.1.3 Rollers - A minimum number of rollers shall be positioned so that film can be transported either emulsion up or emulsion down. The rollers shall have a surface that does not scratch the film. Motion of the rollers, while transporting one web of film, will not cause translation of a parallel web of film.

3.4.1.4 Film Tension - Both the motorized and the optional manual drive systems shall maintain enough tension on the film at all film speeds and conditions of acceleration and deceleration of the film to prevent slack loops of film from forming. The motorized tension system shall produce a film web tension of no more than 2 pounds per inch of film width. The

optional manual film drive shall incorporate solid-disk handwheels with revolving handles. The handles shall be mounted on the handwheels on a  $2\frac{1}{2}$  inch crank radius.

### 3.5 Microstereoscope Carriage and Mount

3.5.1 General - A precision mount shall be provided to place any of the following microstereoscope systems in correct position for focus and for comfortable viewing of film materials located on the two 15" by 20" glass viewing surfaces: (a)  Zoom 70 Stereoscope with or without 2X wide-span rhomboid attachments; (b)  Zoom 240 Stereoscope System (Model 28) with all relays; i.e., 0.43X, 1.0X, and 2.0X; (c)  Zoom 240 Stereoscope with the Advanced Stereo Rhomboid, Model II; (d)  Versatile Stereoscope with all relays; i.e., 0.43X, 1.0X, and 4.0X; (e)  Dual Power Measuring Macroscope. The following general criteria will apply: (1) Design and positioning of carriage and mount shall permit convenient access for installation and removal of viewing instruments and film, and shall interface directly with the optical instruments specified above by means of a mounting ring integral with the mount. (2) Mounting devices shall be sufficiently rigid to preclude instrument misalignment and loss of collimation of the optics with respect to the viewing surface during normal handling and operation. (3) Control of the microstereoscope carriage in X and Y translation shall require

only one hand for operation. (4) Provision shall be made to preclude accidental damage from contact of the optical instruments with the structure of the table. (5) Counterbalancing shall be incorporated to preclude unwanted motion of the carriage when in the optional tilted position. (6) Easily accessible adjustment devices shall be included so as to achieve parallelism between the microstereoscope mount and glass viewing surfaces. These adjustment devices shall be readily accessible without the necessity of dismantling any part of the table.

3.5.1.1 Focus - A readily accessible fine and coarse focusing adjustment shall be furnished as an integral part of the mount. These adjustments shall be smooth acting with minimum play between the hand controls and the actual mechanism. The fine focus shall be adjustable at all points within the range of the coarse focusing adjustment. The focusing motion gear ratios shall be commensurate with the magnification ranges of the Microstereoscopes specified in Paragraph 3.5.1.

3.5.1.2 Translation - Manual translation of the microstereoscope mount shall be provided. With any of the microstereoscopes fixed in the mount, and using the center of the scope as a reference, translation in the Y direction shall be adequate to cover the full 15" depth of the glass viewing surface. The translation in the X direction shall be maximum commensurate with the overall length of the glass viewing surface and the mount clearance requirements. Also, it is required that the horizontal plane of the microstereoscope mount and the viewing surfaces be parallel within 0.015 inches over the entire translation field of the stereoscope mount. Adjustment devices necessary to achieve

this parallelism shall be readily accessible without the necessity of dismantling any part of the table. In addition, a motorized drive capable of driving the mount at traverse speeds within the range of 0 to 0.5 inches per second shall be provided as an optional feature and shall incorporate the same capability, with respect to the distances of translation and parallelism of microstereoscope mount and viewing surfaces, as the manual system.

3.5.1.3 Carriage and Mount Rigidity - Because of the high magnification, small depth of focus, and long cantilever of the rhomboid relay systems, the microstereoscopes to be used on this table are extremely susceptible to vibration. Therefore, the carriage and mount shall be designed with sufficient rigidity so that, when viewing with any of the microstereoscope systems defined in Paragraph 3.5.1, visible vibrations induced by the carriage and mount shall be minimized.

3.5.1.4 Carriage Motions - The motions of the carriage mount shall have low friction coefficients, be smooth (without binding) and positive acting, and as free of self-induced vibrations as possible. With the carriage lock disengaged, or with the motor drive deactivated, a force of 4 pounds or less shall be sufficient to move the carriage in any combination of X and Y directions, in either the horizontal or optional tilted positions.



3.5.1.5 Locks - The focusing mechanism shall be self-locking. Easily engaged locks shall be provided to hold the mount of the microstereoscope carriage firmly at any position of its travel in the X and Y directions. With the carriage locks engaged, a force of 10 pounds or greater shall be required to move the carriage in any combination of X and Y directions. Additional locking devices shall be included to preclude carriage motion during transportation of the table.

### 3.6 General Requirements

3.6.1 Construction - This equipment shall meet the highest commercial standards of construction.

3.6.2 Maintenance - Ease of maintenance shall be a primary consideration in the design of this light table. Convenient access to the internal portions of the table shall be effected by strategic location of cover plates or access panels equipped with quick acting captive screws. A complete and accurate circuit diagram shall be provided for easy reference (e.g., mounted inside an access panel). Any special tools required for routine maintenance shall be provided. A simple elapsed-time meter shall be attached so as to indicate the total time of operation of the light sources.

3.6.3 Cooling - Liquid coolant, if required for the high intensity light source, shall be of a type which is not injurious to operating or maintenance personnel or to the equipment itself. The liquid cooling system shall be self-contained and leak free. Any leaks

developing in the cooling system within an operating period of 4000 hours or three years, which ever occurs first, shall be corrected at the expense of the contractor. The liquid coolant shall not discolor with time. Any discoloration of the coolant within an operating period of 4000 hours or three years, which ever occurs first, shall be corrected at the expense of the contractor. An easy coolant replenishment, flushing, and draining method will be provided. In addition, all areas of the cooling system shall be accessible for inspection and maintenance. The coolant over-temperature warning light incorporated shall be red in color and prominently displayed.

3.6.4 Noise - The noise generated by the components of the table, in both static and dynamic conditions, shall be regulated so as to minimize annoyance to either the operator or other workers in the area. Maximum equipment noise energy levels shall not exceed the Noise Criterion 45 curve values set forth in the noise criterion (NC) curves attached, with both light sources at maximum intensity and two webs of 6.6 inch film translating at 1 foot/second. The noise generated in all additional modes of operation shall not exceed that produced by the acceptable pre-production model when operating in any of these modes.

Noise measurements will be taken at a point approximately 48 inches above the floor and approximately 15 inches in front of the center of the table. Measurements of noise will be made with a Hewlett-Packard loudness analyzer presently in possession of the Government.

3.6.5 Vibration - Vibration generating components (e.g., film drive motors, ventilating fans, pumps, etc.) shall be mounted so as to provide maximum vibration attenuation at frequencies above 5-10 Hertz. The intent of this requirement is to prevent light table induced imagery vibrations. It will be tested by viewing a target through the various microstereoscopes with power off, and noting if degradation of imagery occurs with the light table systems on. Natural frequencies or resonances of the table above 10 Hertz will be attenuated.

3.6.6 Safety - The following minimum safety precautions shall apply: (1) All external, non-current carrying metal parts shall be electrically connected and grounded. (2) Provision shall be made to prevent personnel from coming into contact with electrical circuits operating with an open circuit potential of 30 volts or more and a capability of delivering 2.5 peak milliamperes or more into a short circuit. (3) Glass table surfaces will be 3/8" thick, ground and polished both sides, plate glass. (4) Moving parts such as ventilating fans, drive belts, or gears, shall be shielded or enclosed to prevent inadvertent access by the operator. This requirement does not necessarily apply to the film spool, film, and film spool spindles. However, all handwheels will be disconnected and non-rotating while their respective motorized systems are being operated. (5) Sharp edges or corners will be avoided. (6) Design shall preclude inadvertent blockage of ventilating air intakes or exhausts. (7) Ventilating air

exhaust shall be directed away from the operator. (8) Appropriate and highly visible warning signs shall be strategically placed as necessary.

3.6.7 Controls - Operating controls which are placed on the front of the long side of the table nearest the operator shall not protrude above the plane of the working surface. A main power switch shall be strategically placed and will incorporate a three-position switch: OFF-PREHEAT-POWER ON. The main power switch shall have associated with it white frosted indicator lights which will be on to indicate when the switch is in either the PREHEAT or POWER ON position. These lights shall cause a minimum of interference to the operator's vision when he is engaged in normal film viewing activity. When the switch is in the PREHEAT position, only the preheat circuits shall be energized. In the POWER ON position, all circuits shall be energized. Both POWER ON and PREHEAT circuits shall be adequately fused. All controls shall be clearly marked and conform to human engineering practices with respect to location, size, shape, and ease of manipulation. Controls for illumination and film transport shall be shape coded so as to allow non-visual operation. Pictograms shall be included to indicate proper motor rotation switch settings for various film loadings similar to those used in the prototype instrument.

3.6.8 Power - This equipment shall be capable of operating in all modes on 117 volt, plus or minus 15 volts, 60 Hertz, single

phase, alternating current. Circuit breakers of suitable capacity shall be supplied to prevent circuit overloads. A retractable, lockable, heavy duty, Underwriters Laboratory approved, 3-conductor electrical extension cord with a NEMA 5-20P 3-prong plug attached to the extension cord by screws and incorporating a cord clamp, shall be furnished with the table for connection to the operating power source (unless otherwise specified). This cord shall be at least 20 feet long. In addition, a non-retractable power cord at least 20 feet long shall be provided as an optional feature. Means shall be provided for stowing this optional power cord when not in use. Also, a standard (Universal 52-62) 3-prong plug attached to the extension cord by screws and incorporating a cord clamp, shall be available as an optional feature.

4. MISCELLANEOUS

4.1 Instruction Manual - An instruction manual describing proper installation, operation, and maintenance of the light table shall be provided with each instrument. This manual shall conform to the requirements listed in Specification No. DB-1003 attached.

4.2 Basic and Optional Equipment - The basic 1540 Light Table as produced under this contract shall provide the following capabilities: 1000 foot rolls of film, 0 to 76 inch film takeup loop, manual table elevation, motorized film transport, and manual microstereoscope

carriage and mount. In addition, options shall be available that may be incorporated on the basic table to provide any one or all of the following capabilities: motorized table elevation, manual film transport, motorized microstereoscope carriage and mount, and motorized continuous tilt of the illuminated surfaces and carriage. It is the intent that these options will be replacements for, and not additions to, their alternative configurations.

4.3 Production Testing - The first production instrument constructed under this contract shall be considered a pre-production model and shall be subjected to a period of testing and evaluation to determine conformance with the technical requirements and intent of this contract. Discrepancies noted as a result of this testing and evaluation shall be corrected in this instrument at the expense of the contractor. All instruments delivered under this contract shall meet or exceed the performance of the pre-production model. Discrepancies noted as a result of inspection of the delivered instruments shall be corrected at the expense of the contractor.

4.4 Dust Cover - A plastic protective cover shall be provided to protect the viewing surfaces of the table and associated optics when the equipment is not in use.