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In reply refer to: T3410-66-135



14 April 1966

Declass Review by NGA.

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Post Office Box 8031
Southwest Station
Washington, D.C. 20024

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Reference: (1) [redacted] proposal [redacted] 65-184, dated December 1965
(2) [redacted] letter T3410-66-24, dated 24 January 1966
(3) Your document entitled "Additional Specifications to be Included in the Development of an Advanced Rear-Projection Viewer"

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Subject: Your Request for Proposal Number RD-12-66

Gentlemen:

This will confirm our discussions April 7 with members of your technical organization at our facility at [redacted]. Our response is organized to correspond with the paragraph numbers of your document to aid in your evaluation.

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1. Semi-Automatic Film Loading

We will provide the following:

- a. Automatic translation and rotation of film transport to load position.
- b. Automatic stop of film reel drive before film is run off spool. Manual override is provided to permit running off spool.
- c. Automatic disabling of the film transport in the event the film is loaded improperly or the follower arms have not been released.
- d. A hinged film gate will open for loading.
- e. Threading paths will be clearly and permanently marked on the main support plate of the transport.
- f. Time for loading the film transport will be less than one minute and we anticipate this time will be reduced to approximately 30 seconds for experienced operators.

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2. Film Positioning

We assume the intent of this requirement is to facilitate the automatic centering of the film. We propose to provide this capability as described in Paragraph 11 below.

3. Resolution

We will provide on-axis resolution of 10 lp/mm at 3X magnification linear to 6 lp/mm at 70X magnification and 15 inches off-axis resolution of 8 lp/mm at 3X magnification linear to 4.8 lp/mm at 70X using a high contrast resolution target.

As we mentioned in our letter January 24, we are developing a rear-projection viewer to fulfill the requirements of the Strategic Air Command. Preliminary results obtained from optimizing the 3X to 100X zoom lens for this viewer are encouraging. If we obtain resolution performance equal to or better than you require with this single zoom lens, this would permit us to provide you a screening viewer at an estimated savings of at least 15 percent of the unit price in production. We will keep you advised of our progress in this area.

4. Film Gate Temperature

Maximum film temperature in the film gate will be 100° F when used in an ambient room temperature of 80° F or below. The film gate temperature test will be run with film of 1.5 ND filling the gate. The light source will be adjusted to maximum brightness and the recording thermocouple placed in the film gate. The test will run for three hours.

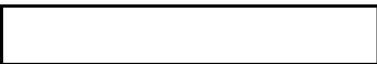
5. Film Aperture

The entire width of 9-1/2 inch film will be projected with the exception of a triangular area measuring 1-1/4 inch on a side in each of the four corners. This area will be vignetted at the 3X magnification only when 9-1/2 inch film fills the aperture. As the magnification is increased, this area will decrease until at approximately 3.7X the entire corner is filled.

6. Focus

In the static mode the imagery will remain in focus throughout the magnification range, provided the focus has been adjusted at the highest magnification. In the low magnification range (3X-30X),

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the imagery will remain in focus under dynamic conditions except as the magnification approaches 30X the effects of differential focus (resulting from film curl) will begin to become apparent. As the magnification is increased, retention of focus will be affected by the film as well as the operating mode. Under certain combinations of conditions, retention of focus may be excellent. Scanning along the length of the film will cause little, if any, change in focus. Transverse scanning is more susceptible to the effects caused by film curl. Several factors influence focus control which have a bearing on the problem (e.g., age and general condition of the film, variations in film base thickness, moisture content of the film and relative humidity, etc.). We are confident that mutually acceptable objective test conditions can be established to demonstrate operational suitability. Please refer to Page 4-21 of our proposal (Reference 1) for a more complete description of focus and its control.

7. Screen Brightness

We will meet the requirements as follows:

- a. A minimum brightness of 20 ft-lamberts at any magnification with a film of neutral density (1.5) in the film gate. The brightness is to be measured with a Spectra Brightness Spot Meter looking along an axis pointed to the pupil of the projection lens. The above value is based on a viewing screen in the system which has a gain of 2.5X.
- b. The screen will be uniformly illuminated and the illumination will not deviate by more than 10 percent (when measured as indicated in Paragraph 7a) except for the vignetting mentioned in Paragraph 5.
- c. The light intensity will be continuously variable from 100 percent to 50 percent of maximum.
- d. The color temperature will not fall below 3400° K.
- e. Based on the manufacturer's information, the brightness of the light source will diminish 30 percent during the 1000 hours of operation. Reduction in output is not linear with time, but is exponential, i.e., the most reduction will occur during the latter portion of the 1000 hours. A running time meter incorporated in the unit provides an indication of when the lamp should be replaced.

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8. Film Damage

We have met previous requirements to test and demonstrate that the viewer will not damage film. Mutually acceptable test and demonstration procedures can be established as part of this program.

9. Distortion

The distortion requirement of two percent or less will be met. The distortion is to be measured in the conventional manner, i.e., along radial lines whose point of origin is the center of the optical system.

10. Safety

The xenon lamp, when installed, will be completely enclosed in heavy gauge sheet metal to protect both the operator and the viewer. A tempered glass port in the lamp housing seals the aperture on the condenser side of the housing. Interlocks are provided and a thermal switch precludes opening the lamp housing while the lamp is on or still hot. A running time meter provides an indication when the lamp should be replaced prior to lamp failure. Ozone formation is prevented by the special quartz envelope of the lamp. A thermal switch in the lamp housing assures safe operating temperatures and automatically shuts the lamp off in the event of blower failure. Safety in handling the lamp is enhanced by permitting access to the lamp only when it has cooled and the internal pressure is greatly reduced. The lamp should be kept in a container at all times and removed only for relamping.

11. Joystick Motion and Positioning

- a. We will provide a control to automatically position the film transport so the film center is under the center of the optical system. A dial control, marked in film width, will be mounted on the control panel. Below the dial there will be a pushbutton which upon being depressed will cause the transport to center the size film shown on the dial.
- b. We will provide a control to automatically rotate the film transport to a reference position. A dial control, marked in degrees of rotation, will be mounted on the control panel. Below the dial there will be a pushbutton which upon being depressed will cause the transport to rotate to the reference position.

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- c. The joystick control assembly will be movable and a spiral extension cord will permit operation of the viewer from a distance up to four feet from the viewer control panel.

We appreciate the opportunity of meeting with members of your technical organization to discuss your requirements in depth for an advanced rear-projection viewer. We believe we have met the intent of these requirements. After you have reviewed our comments we believe it would be advantageous to discuss the alternate methods of contracting proposed in our letter January 24.

We are looking forward to participating in this program with you.

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[Redacted]

Very truly yours,

[Redacted Signature]

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[Redacted]

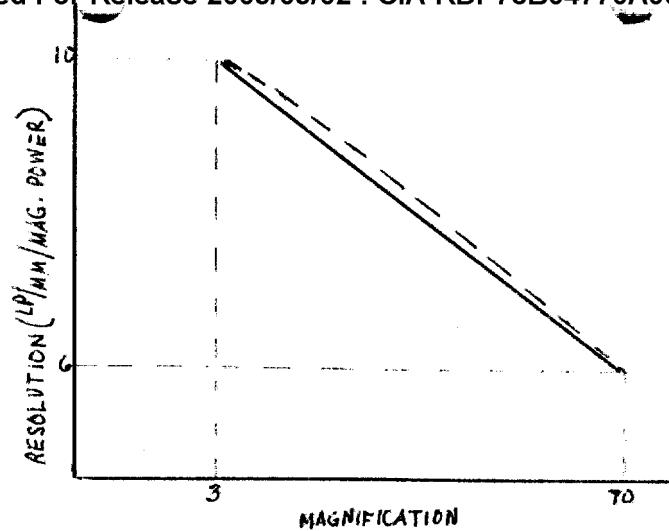
ADDITIONAL SPECIFICATIONS TO BE INCLUDED IN THE DEVELOPMENT OF AN ADVANCED REAR-PROJECTION VIEWER.

1. Semi-Automatic film loading. The operator simply loads the film spool in the transport and attaches the end of the film to a device which then carries it through the projection platen to the take up spool. The take up spool can be a special design; however, no adjustments should be required to accommodate various film sizes. The removal of the take up spool will not be required i.e., a fixed film clamping take up spool would be acceptable.

2. Film Positioning. The mid-point of all the various film widths will always be positioned at the mid-point of the film projection gate.

3. The resolution requirements are 10 lp/mm/magnification power 3X and 6 lp/mm/magnification power @ 70X using a high contrast resolution target. These values are to be read on the viewing side of the screen and should not vary more than 20% over the entire screen. The resolving power should be no less than shown in Figure 1 (solid line) below.

It should exhibit no less than a linear decrease between the maximum and minimum points. There is no objection to the curve being concave downward as shown dotted below.



4. Maximum acceptable film temperature in the film gate is 100°F when used in an ambient room temperature of 80° or below. Temperature tests will be made with silver halide film, in a static state, with a fogged density of 1.5, completely filling the entire gate, with the light source burning continuously at maximum brightness for three hours.

5. The film aperture shall measure no less than 9.5" X 9.5". The entire width of the 9.5 inch wide film will be projected.

6. The imagery shall automatically be in focus at any magnification either in the static viewing mode or in the transport mode. This requirement does not apply to the high speed slew mode; however, the operator must be able to scan the film at a selected rate (depending on the magnification) with the entire projected image remaining in sharp focus. The necessity for manual focus adjustment when changing from the static to the dynamic viewing mode will not be required, nor will a focus adjustment be required when the magnification is varied. A focus adjustment is permitted for emulsion up or down variations and initial loading.

7. Screen Brightness. The screen brightness, as viewed from the position of the observer, will have a minimum acceptable luminance of 20ft.-lamberts at any magnification. This luminance will be measured with a film of neutral density (1.5) filling the film plane. The screen will be evenly illuminated and at no point will the illumination deviate by more than 10%. This brightness requirement will not be obtained from 3X to 3.7X in the one inch square area at the corners of the screen. It is required that the light intensity be continuously variable from 100% to 50% of the above values. The color temperature of the illumination shall never fall below 3400°K. The brightness of the original light source shall not diminish by more than 10% during the first 1000 hours of operation.

8. Film Damage. There will be absolutely no damage to the film either in the static or dynamic conditions.

9. Distortion. The optical system is to be so designed that when the image is in sharp focus there will be no apparent color fringing on the screen when the screen is inspected with a 10X magnifier when a calibrated grid is projected; geometric distortion of the images at the screen shall not exceed 2 per cent.

10. Safety. The xenon arc lamp shall be adequately enclosed to completely protect the operator from a possible explosion of the lamp.

11. Joystick Motion and Positioning. Push button controls shall be provided to automatically center the projection system over the mid-point of the film. Another push button control shall provide

automatic image rotation to a reference position. The joystick motion control shall be extremely sensitive -- the film speed will not vary when the joystick is positioned at a constant deflection. The null position shall be positive and limited in range. The joystick control assembly shall be removable from the viewer to permit the operator to control the image motion at a distance up to 4 feet away from the viewer.