#0027765

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DEVELOPMENT OBJECTIVES

IMPROVED SCREEN FOR REAR PROJECTION VIEWERS

1. INTRODUCTION.

These development objectives describe the requirements for improvement in the performance of rear-projection viewer screens.

Rear projection viewers are commonly used for assessing information content of aerial photography. For this purpose, the photography is generally reproduced as positive transparencies on roll film. Depending on the quality and scale of the original image, projection magnifications from 5X to 50X are used. Most of the objectionable limitations in the character of the projected image can be attributed to the screen. These are particularly unacceptable at the higher magnifications.

2. CONCEPT.

2.1. Purpose. Rear-projection screens are typically some sort of diffusing medium. In this application, the diffuser is necessarily mounted on a rigid support such as glass -- generally on the back, away from the viewer. Such a system has several objectionable characteristics:

2.1.1. Causes dispersion and diffraction, thereby introducing color and graininess.

2.1.2. Back-scatters as much as 50% of the incident illumination, thereby reducing efficiency.

2.1.3. Reflects a high percentage of ambient light and internally reflects a considerable portion of the dispersed projection light -- both effects significantly diminish contrast.

A rear-projection screen should be developed which would significantly minimize these degrading effects.

2.2. Scope. Developments which would alleviate all the limitations described in 2.1.1., 2.1.2. and 2.1.3. are required; at the same time, attention must be given to the following:

2.2.1. Resolution must be comparable to that of existing screens.

2.2.2. Size as large as 30"x30" must be feasible.

2.2.3. Economy must be consistent with that of typical rear projection viewers.

2.3. Philosophy. Numerous approaches to the solution of this problem should be considered and evaluated by the contractor. Each approach should be pursued until it is proven unfeasible, and the approach and its evaluation should be completely documented to that point. If an approach proves feasible, then its documentation should be augmented by an operational 12"x12" sample. The deliverable items will consist of a report which chronicles all investigation and evaluation, and 12"x12" breadboards of all developments believed to be significant in light of the stated objectives.

3. REQUIREMENTS.

3.1. Appearance. The screen should reproduce or transmit an image with minimum color contribution and graininess. Appearance approaching that of the virtual image in a direct-viewing optical system is the goal.

3.2. Efficiency. Conventional light-scattering screens exhibit mutually exclusive properties of axial gain and angular gain. To increase angular gain (luminance) more scattering is required, and this, in turn, decreases axial gain. More important, this also increases back-scattering and reduces efficiency. Consequently, it is required that the improved screen display relatively uniform luminance (±15%) over a solid angle of 90° centered on the axial ray with less than 15% back-scattering.

3.3. Contrast. The primary property which degrades contrast in conventional screens is internal and external reflectance. The improved screen should minimize this property. A reflectance characteristic approaching that of black velvet is ideal.

In an ambient light level of 5 foot-lamberts and an incident signal intensity range of 2000 to 1, the improved screen should display a brightness range of 1000 to 1.

3.4. Resolution. The improved screen should exhibit a resolution of 10 lines per millimeter at 90% modulation transfer function: the desired goal is 20 lines per millimeter at 90% MTF.

1. BRIGHTNESS DIST. LOBE 90°
2. REDUCE LOSS OF CONTRAST DUE TO AMB. LIGHT
3. INCREASE EFF.
   A. REDUCE BACKSCATTER
   B. INTERNAL REFLECTIONS
4. SAME RESOLUTION AS PRESENT SCREENS
5. MINIMIZE GRAINULAR APP.
6. POLYCHROMATIC USAGE