50031

NPIC/TSSG/RED-065-70
13 February 1970

MEMORANDUM FOR: Chief, Special Contracting & Procurement Staff, TSSG/NPIC

SUBJECT : Request for Proposal for a Coherent White Light Viewer Breadboard #50031

1. It is requested that a copy of the enclosed Development Objectives for a Coherent White Light Viewer Breadboard (Attachment 1) be sent to:

[redacted] 25X1

2. This organization should be requested to submit a proposal prior to 1 April 1970 in response to the requirements set forth in the development objectives.

3. The Agency association is CONFIDENTIAL.

4. The nature and title of the work to be proposed on is unclassified.

5. Technical Services & Support Group plans to commit FY-1970 funds for this project.

6. In your communication with this prospective contractor, it is requested that the RED project number, as listed in the subject of this memorandum, be included as a part of the title. In addition, the contractor should be informed that should he submit an acceptable bid, he will be expected to conform to DB-1001 (Attachment 2), DB-1003 (Attachment 3), and Proposal Format (Attachment 4).

7. It is anticipated that sole-source procurement will be to the Government's advantage. This is based on [redacted] past performance in building a similar device for the USAF Rome Air Development Center, and the fact that some dollar savings may be realized due to partial use of efforts and technology common to both devices. Of course, this presupposes an acceptable bid. Final decision on this point will be made after analysis of the contractor's proposal. [redacted] has not been made aware of this sole-source intention. 25X1 25X1

Declass Review by NGA.

SUBJECT: Request for Proposal for a Coherent White Light Viewer Breadboard #50031

25X1

[redacted]

Chief, Research & Engineering Division, TSSG

Attachments: (4)
As stated

Distribution:
Orig - Addressee
1 - NPIC/TSSG/RED
✓2 - NPIC/TSSG/RED/SRB

25X1 NPIC/TSSG/RED/SRB/[redacted] (13 Feb 70)

Approved For Release 2005/05/20 : CIA-RDP78B04770A001700040007-4

12 February 1970

DEVELOPMENT OBJECTIVES
COHERENT WHITE LIGHT VIEWER BREADBOARD

1. INTRODUCTION

These development objectives set forth the requirements for a breadboard version of a rear projection viewer which utilizes a laser as the source of coherent light. The ultimate aim is two-fold: (1) to develop a light source which will improve the contrast and resolution of a projected image, and (2) to provide a unique light source for rear projection viewing of color film.

2. SCOPE

This development effort will consist of the design and fabrication of a coherent white light viewer breadboard suitable for evaluation of predicted increased resolution and for use as experimental equipment to determine light source specifications for color film viewers. To accomplish these tasks, three monochromatic laser outputs will be used as primary colors, and combined, additively, to form white light of selected chromatic content. An incoherent source of light will be provided for comparison purposes. Suitable optics, viewing screen and light manipulation devices will be included.

3. CONCEPT

Recent experiments using coherent light versus incoherent light as the source for rear projection viewing indicate that increased resolution on the screen is realized. This increase is estimated to be about fifteen percent (15%). However, due to the laser wavelengths used in these experiments, the image presented on the screen was in gradations of a greenish-blue color. While this may be acceptable (although undesirable) for viewing black and white film, it is obvious that when used with color film, it would present an unusual and misleading appearance.

Proper rendition of the colors when viewing color film by transmitted light is a complex task dependent on a combination of factors. Most important among these, other than the psychological aspect, are: (1) the actual color of the scene, (2) the lighting conditions at the instant of film exposure, (3) the color balance of the film (through a built-in filter), (4) control of the film development process, and (5) the spectral quality of the viewing light source. Of these five factors, when considering reconnaissance type photography, the first is fixed by uncontrollable circumstances; the second, although controllable to a limited extent by choice of time of film exposure, is, broadly speaking, fixed by nature; the third can be adjusted to close tolerances by the film manufacturer; and control of the fourth is well within the cpability of the film processing laboratory.

This leaves only the fifth factor, the light source, which is presently a subject of considerable controversy.

The spectral quality of the viewing light source is interrelated with the psychological aspects of color vision. Unexplained variations exist in human color perception between individuals. Present and future investigations of these variations will, hopefully, lead to specifications for a standard light source.

The device described in these development objectives is directed toward research into the aforementioned problem areas plus additional areas that may become known. This piece of equipment will be used primarily as a laboratory tool for evaluation purposes. The basic functions of the breadboard will be to allow investigation of the effects upon perceived resolution using a coherent versus an incoherent light source and to allow research into the psychological aspects of human color perception through manipulation of a coherent white light source which would have selected, but variable, dominant wavelengths and excitation purities.

4. REQUIREMENTS

4.1. General Configuration - The overall size and weight of the breadboard and its supporting table will be kept to an absolute minimum. This factor is of paramount importance, since the equipment will be subject to occasional moves through doors no greater than thirty-six (36) inches in width. Partial dismantling will be acceptable.

4.2. Optical System

4.2.1. Resolution - The resolution specification for the complete optical system is 10 lines/millimeter/magnification power using a high contrast (1000:1) resolution target. This value is to be read on the viewing side of the screen. While this requirement must be met when using either of the light sources specified in paragraph 4.2.5.1, it is anticipated that the coherent light source with resolution enhancement will out perform the incoherent light source.

4.2.2. Color Fringing - 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 it is inspected with a 10X magnifier.

4.2.3. Magnification - The optical system will provide a magnification of 4.5X on the screen.

4.2.4. Screen - A Polacoat LS-60G rear projection screen will be furnished with the breadboard. The size of the screen will be 15 X 15 inches. Provision will be made for easy removal of this screen and insertion of like-sized test screens to be furnished by the sponsor.

4.2.5. Illumination

4.2.5.1. Light Sources - Two light sources, each of which will be capable of satisfying the screen brightness requirements set forth in paragraph 4.2.5.2., will be provided. One will be a coherent source (laser/s), incorporating a coherent array for resolution enhancement, and the other will be a suitable incoherent source.

4.2.5.2. Screen Brightness - The screen brightness, as measured from the surface of the side of the screen nearest the observer, will have a minimum luminance of twenty (20) foot lamberts. This luminance will be measured at the optical center of the screen surface with a film having a density of one point zero (1.0) filling the film plane and with a screen having a single side lambertian gain of one installed. The screen will be evenly illuminated and at no point will the illumination deviate by more than ten percent of the maximum value. It is required that the light intensity be continuously variable from one hundred percent to fifty percent of the twenty foot lambert luminance value, controllable by the operator of the equipment (not necessarily the screen observer). The above specified luminance conditions will apply for either the coherent or incoherent light sources when they are adjusted for equal energy white light. Equal energy white light, for purposes of this document, will be defined as white light equivalent to equal amounts of the three primary colors as used in the International XYZ System adopted by the Commission Internationale de l'Eclairage (CIE).

4.2.5.3. Coherent Light Manipulation - A simple system will be provided in the paths of the three primary laser colors to allow for choosing white light of various dominant wave lengths and excitation purities. This simple system will include calibrated indicator markings so that the equipment operator (not necessarily the screen observer) may set in various percentages of the three primary colors and recover previous settings, if necessary.

4.2.5.4. Incoherent Light Manipulation - A simple filter system will be provided in the path of the incoherent light source to allow for choosing white light of various dominant wave lengths and excitation purities. Appropriate filters will be provided for adjusting the incoherent light output to equal energy white light as defined in paragraph 4.2.5.2. This system will be designed for convenient use by the equipment operator (not necessarily the screen observer).

4.2.5.5. Intensity Manipulation - A simple system for varying the intensity of the light reaching the screen from either the coherent or incoherent light sources will be provided. This system will be designed for convenient use by the equipment operator (not necessarily the screen observer).

4.2.5.6. Light Source Selection - A simple device will be provided for selecting either the coherent or incoherent light source to the total exclusion of the other. A capability for switching from one source to the other in less than 10 seconds is mandatory. This device will be designed for convenient use by the equipment operator (not necessarily the screen observer).

4.2.6. Focus - A simple system for focusing either projected image on the screen will be provided. When set, the projected image will be in sharp focus at all points on the screen. This system will be designed for convenient use by the equipment operator (not necessarily the screen observer).

4.2.7. Film Chip Holder - A simple device suitable for holding 100 X 100 millimeter film chips in the optical path, flat and perpendicular to the principal ray of the optical system will be provided. An X and Y drive capable of allowing projection of any portion of the film chip onto the screen will be incorporated. This device will be designed for convenient use by the equipment operator (not necessarily the screen observer).

4.3. Construction

4.3.1. Mechanical

4.3.1.1. Breadboard Base and Table - The light sources and all components of the optical system will be mounted on a breadboard base having sufficient rigidity to insure continued optical alignment after initial leveling and alignment on a fabricated steel table. This table, to be furnished by the contractor, will incorporate a suitable number of leveling jacks placed strategically across the top surface of the table. Ancillary equipment will be placed on racks under the table. Suitable flexible connections between the ancillary equipment and the breadboard components will be provided.

4.3.1.2. Cabinet - A minimum cost, easily removable, but sturdy, cabinet type cover will be provided to enclose the light sources and all optical components except the viewing screen. The screen, mounted rigidly and perpendicular to the breadboard base, will be available for easy viewing by an observer through a suitable aperture in the side of the cabinet. Convenient access doors will be provided in the

sides of the cabinet for ease of illumination and optical adjustments by the equipment operator (not necessarily the screen observer). The intent and purpose of this simple cabinet is to provide for isolating the light inside the projector from the eyes of the screen observer, either directly or by reflection.

4.3.1.3. Painting - The table and both the exterior and interior of the cabinet, including the components housed therein (other than lenses, mirrors or the screen) will be coated with a non-reflecting black paint to the extent that spurious reflected light will be minimized.

4.3.2. Electrical

4.3.2.1. Power - This equipment will be capable of operating on 208 volt, plus or minus 2%, 60 Hertz, single phase, alternating current. Proper fusing will be supplied to prevent circuit overloads, and a spare fuse/s will be located immediately adjacent to each fuse holder (circuit breakers may be substituted for fuses, if desired). A heavy duty, Underwriter's Laboratory listed, 3-conductor electrical extension cord with 3-prong Hubbel, or equivalent, twist lock plug will be furnished with the breadboard for connection to the operating power source. This cord will be at least 20 feet long.

4.3.2.2. Circuit Diagram - To expedite maintenance, an electrical circuit diagram will be permanently attached to the inside of one of the cabinet access doors.

4.3.3. Cooling - Should liquid cooling be required, the coolant will be of a type which is not injurious to personnel or to the equipment itself. Particular attention should be directed toward designing a system which will direct any leaks away from the screen observer and the equipment operator. An easy coolant replenishment method should be supplied if a closed-circuit system is used. In addition, all areas of the cooling system must be accessible for inspection and maintenance. Should water be used as the coolant in an open-circuit system, appropriate filters will be furnished to preclude clogging of water jackets or piping.

4.3.4. Safety

4.3.4.1. General - It is essential that personnel exposure to hazardous situations be minimized. This should be accomplished first, by eliminating hazardous conditions through effective design and secondly, by protecting personnel from hazards that cannot be eliminated.

4.3.4.2. Minimum Precautions - The following minimum safety precautions will apply: (1) All external, non-current-carrying metal parts must be electrically connected and grounded; (2) Provision must be made to prevent personnel from coming into contact with circuits operating with an open circuit potential of 30 volts or more and a capability for delivering 2.5 peak milliamperes or more into a short circuit--where necessary, interlocks will be employed; (3) Special precautions to completely protect personnel from possible breakage or explosion of lamps must be made; (4) Moving parts (e.g., ventilating fans, drive belts, gears, etc.) must be enclosed; (5) Sharp edges or corners should be avoided; (6) Design shall preclude inadvertant blockage of ventilating air intakes or exhausts; (7) Ventilating air exhaust shall be directed away from the equipment operator and the screen observer; (8) Design shall preclude the possibility of direct viewing of the laser beam or of the laser beam striking any smooth reflecting surface which might accidentally produce a specular reflection into the eyes of nearby personnel; (9) Appropriate warning signs shall be strategically placed as necessary.

4.4. Manuals - Three (3) copies each of an operators and a maintenance manual will be supplied with the equipment in accordance with the Government Specification DB-1003, attached. Exception--Xerox, or equal, copies of typewritten content, bound in loose leaf form, are acceptable. (Technical specification manuals, available from major parts suppliers, should be included.)

5. MISCELLANEOUS

5.1. Operating Environment - The equipment will normally be used in an area having an ambient temperature of 72°F plus or minus 2°, and a humidity of 55% plus or minus 5%.

5.2. Inspections - Preliminary inspection of the finished product will be conducted at the contractor's plant. Final acceptance will be made at the sponsor's facility.

5.3. Reporting - The contractor will be required to submit monthly, final and financial reports in accordance with the Government Specification DB-1001, attached. The final report will summarize the progress of the work. It will be completed within the allowable cost of the contract and will be forwarded to the Consignee/s specified in the contract no later than thirty (30) days after the agreed contract period.

5.4. Proposal Format - Submission of any proposal in response to these development objectives will conform to the attached Guide for Proposal Format. This provision is mandatory.

5.5. Resumes - Accompanying each proposal there will be a detailed one page resume covering each of the contractor's personnel who will contribute fifty percent or more of their time to this effort.

6. GENERAL

The contractor should be guided by the principle that the end product of this effort (a breadboard) will be used primarily by highly qualified engineering and scientific personnel for testing under controlled laboratory conditions. Esthetic appearance should therefore be subordinate to performance and cost.