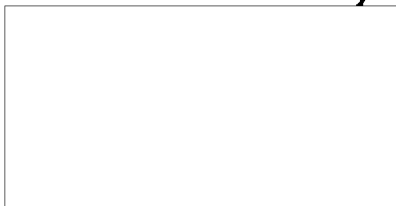


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9 November 1961

Declass Review, NIMA/DoD

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Dear 

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Enclosed you will find three copies of the 16 & 17th
Monthly Progress Reports on Contract Number 
Task Order No. 1, for the development of an Image Enhancement
Instrument.

Very truly yours



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16th and 17th MONTHLY PROGRESS REPORT
IMAGE ENHANCEMENT PROGRAM

CONTRACT No.
4 September through 4 November 1961

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During the period covered by this report, fabrication of all subassemblies of the enhancement instrument has been completed. Testing and final cabinet assembly are in progress.

Considerable re-working of the mechanical parts of the modulated light source proved necessary in order to eliminate the spurious deflection effects of magnetic fields and deflection coil current perturbations. Further difficulties were encountered in obtaining the correct light-response versus modulating voltage for the light source. The beam deflection system which maintains the moving spot in a circular trace involves the use of brushes and slip-rings; it proved necessary to add more filtering, and an additional set of brushes, to the design. Following these modifications, the performance of the unit is satisfactory; further improvement would require the addition of a light monitoring system and feedback loop to remove the remaining fluctuations which appear as bands in the output image.

The entire enhancement system has been placed in operation; preliminary results are most encouraging. It has been possible to demonstrate the enhancement, to visible output levels, of input material having density differences as low as 0.016 (estimated). The area scan filtering function is proving capable of increasing the contrast of fine detail and suppressing the coarse, as planned. Considerably more testing will be required to establish optimum area scan filter functions.

The data box recording device has been fabricated, and will be installed when the testing schedule will permit. The viewing optics were installed, but removed when the processing station developed a leak. Through such experiences, maintenance procedures have been learned, which, it is hoped, will eliminate such events in the future.

At this point in the development, it has been learned that certain elements of the system could benefit from re-design. The addition of the light regulation system has been mentioned above. Another area which would improve performance concerns the slow scan system; we infer from the presence of streaks in the output photograph that the motion in the slow scan is not smooth, so that the planned spot overlap is not perfect. The remedy for this has not been discovered. Considerably more testing and operation of the instrument will be required in order to reveal its full potential, and in order that correct and useful operating procedures may evolve.

Continued

16th and 17th Monthly Progress Report Task No. 1

The cabinet wiring has been completed as far as possible; the interconnections of the circuit cards are being made, and some of the circuit boards which were not previously wired in their final packaged form, are being assembled. Final assembly of the instrument will involve the mounting of the subassemblies, and the fitting of the hoods and covers. Some of the metal surfaces of the parts and covers have been left unpainted; final finishing will be accomplished after the drilling, filing, and fitting operations are complete.

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14th & 15th MONTHLY PROGRESS REPORT
IMAGE ENHANCEMENT PROGRAM

CONTRACT No.
4 July through 4 September 1961

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During the period covered by this report considerable progress has been made in the fabrication and test of the final subassemblies to be used in the instrument. As each subassembly is completed, it is added to the system; all elements will be tested in the completed system with the optical frame and electronic units outside the console. This procedure will facilitate trouble shooting and design modifications as the testing proceeds. The final installation of the subassemblies into the console will be made after the testing and "debugging" has been accomplished.

The modulated light source design approach was selected; it utilizes the moving spot ~~cathode~~ ray approach, with a 12 KV cathode ray tube, and P-16 phosphor. The unit is completely assembled, and is temporarily attached to the optical frame. The first tests of this unit together with the optical system of the output components of the Enhancer (consisting of collimator, rocking mirror, camera, film processor and projection station) have indicated satisfactory performance with regard to the quantity of light necessary for exposing the film.

The input transparency scanner has been successfully tested and has demonstrated very good performance with all three objective lenses. A resolution of 70 lines per millimeter has been demonstrated; the actual limit is in excess of this value.

The electronic circuitry continues to perform in accordance with the original objectives, satisfactory in every respect. It is being tested with the input transparency scanner. Minor circuit modifications and adjustments are under way.

While the complete system is being assembled and tested, work is continuing on the console in order that it will be ready for the installation of the internal parts when their performance is adequate. Sheet metal hoods (for the scanner and projection system) are being fabricated, and the cabinet wiring is under way.

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THIRTEENTH MONTHLY PROGRESS REPORT
CONTRACT
Image Enhancement Instrument
4 June through 4 July 1961

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During the period covered by this report, design and fabrication of sub-assemblies continued, and significant results pertinent to the modulated light output system were achieved.

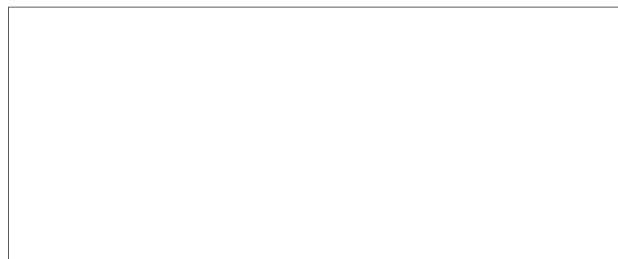
An electro-mechanical light modulator, using a galvanometer system, was conceived, following principles similar to that employed in sound-on-film recording. The deflection system was constructed, and included light-sensing feedback to improve frequency response. It has been demonstrated that such feedback will provide for adequate frequency response; future efforts will be devoted to the achievement of a suitable light intensity response characteristic. The cathode ray moving spot system, using a rotating yoke deflection system, has been placed in operation and is under test. It is planned to pursue both approaches until one is found which is adequate for the job. Both approaches currently look promising.

The design of the mirror mounts and lens mounts for the projector sub-system have been completed. Detail design of the viewing optics sub-system has been completed, and the parts are being fabricated.

Assembly and fitting of optical and mechanical components was continued. The film table and platen sub-assembly is 2/3 complete, the collimator lenses have been mounted, and several plane mirror mounts installed. Console modifications have been made to accommodate the frame and film table.

The slow scan, two-speed drive sub-assembly has been completed, and is ready for installation. The light-tight box, containing the film magazine, camera exposure station, and film processing station, has been completed, with the exception of the additions which will be necessary to accommodate the data block recording device. Assembly of the projector lamp housing has been completed.

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TWELFTH MONTHLY PROGRESS REPORT
CONTRACT

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Image Enhancement Instrument
4 May through 4 June 1961

During the period covered by this report, design of mechanical parts has progressed, and experimental work on the unsolved problem of the modulated light source for the Enhancement Instrument output was continued. Pertinent developments on the light source problem were as follows:

a. The metal backed, fixed spot cathode ray tubes were evaluated and found inadequate for the task.

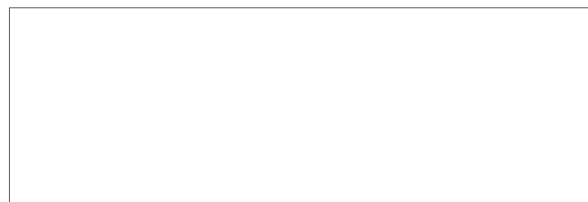
b. The moving spot cathode ray system appears promising, but the system under test, using electrostatic deflection methods, was found to have limitations with regard to the accuracy of sweep. It is felt that these limitations may be avoided by using a moving yoke magnetic deflection system. Accordingly, components for such an approach have been placed on order.

c. A galvanometer driven electro-mechanical light modulator, such as is used for sound-on-film recording, is currently under consideration. Direct application of existing modulators do not have adequate frequency response, but it is felt that the addition of feedback may improve the response adequately to make such an approach practical.

In the mechanical design area, the detailed design, and release to the shop for fabrication, of the light tight box in the camera output chain has been accomplished. This design includes the film magazine, exposure station and camera lens mount, and the development station. The latter has been received, and is ready for installation. Design of the projector lamp housing, including lamp, condenser lens system, and film projection station, was completed.

Assembly of optical and mechanical parts to the main frame of the instrument was initiated.

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ELEVENTH MONTHLY PROGRESS REPORT

CONTRACT [REDACTED]

Image Enhancement Instrument

4 April through 4 May 1961

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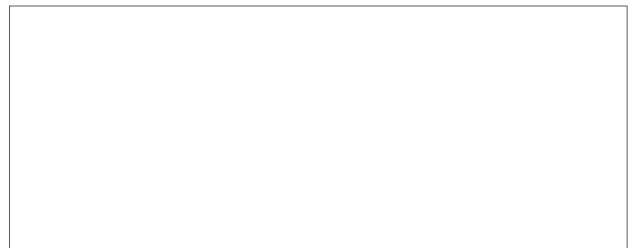
During the period covered by this report, instrument mechanical design has progressed, mechanical and electronic subassemblies have been fabricated, and experimentation with the light source output problem has continued.

For the modulated light source output, a breadboard of a system for utilizing a moving spot on a conventional cathode ray tube has been constructed and is undergoing tests. Receipt of the special metal-back cathode ray tubes (with stationary spot) was accomplished on April 28, and these tubes are under test.

Detailing of parts for the camera output chain has been initiated, with drawing releases to the shop for the film magazine and exposure station having been effected. A preliminary layout of the projection elements and the viewing optics has been completed.

Scanner arc lamp housings parts are fabricated, and light collector tubes have been assembled. Electronic circuit cards have been fabricated, and instrument control circuits are being designed.


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NINTH MONTHLY PROGRESS REPORT
Image Enhancement Program
Contract 
4 February through 4 March 1961

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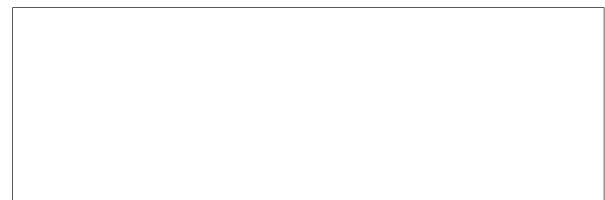
During the period covered by this report the first model of the rocking mirror scanner mechanism has been assembled and placed in operation. The modifications to the arc lamp power supply have been incorporated and the construction of the final unit initiated.

Tests of the projector system optics, including back illuminated screen, have been completed and the components appear satisfactory. The modulated light source cathode ray tube has been the subject of considerable testing, and the quantity of light output has been found to be considerably below the expected value. Some additional tubes with the capability for more intense light output are on order. A reduction in system speed is under consideration in order to alleviate this problem.

The instrument housing and mechanical design has been continued, with completion of the design for framework, mountings, lens holders, film table, etc. The major area of design remaining concerns the camera output chain.

Progress is in conformance with the schedule outlined in the second quarterly report.

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SIXTH MONTHLY PROGRESS REPORT
Image Enhancement Program

Contract

1 November - 1 December 1960

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During the period covered by this report, the following tasks were accomplished:

a. Mechanical design of the rocking mirror scanner has progressed very well and fabrication of some of the parts has been initiated.

b. Operation of the breadboard experimental scanner has continued with improved test images recorded on glass plates, and with the improved photomultiplier circuit. Test results are encouraging.

c. Testing of the automatic-gain-control function of the video amplifier revealed insufficient speed of response; re-design is in progress.

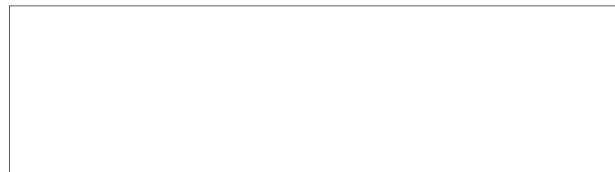
d. The desirability of incorporating a rapid film processor and back illuminated projection system in the instrument has received consideration. Such an approach will have marked advantages in the operation of the system.

e. A presentation of the program was made in Washington, D.C. on November 17, 1960. On the same trip, the Inc. rapid processing technique was reviewed for suitability in the application discussed above.

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Progress is accelerating.

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FIFTH MONTHLY PROGRESS REPORT

Image Enhancement Program

Contract

1 October - 1 November 1960

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During the period covered by this report, the following tasks were accomplished:

a. Under test conditions, the photomultiplier circuit developed spurious response which required considerable re-design to suppress. Performance is now satisfactory.

b. The video amplifier, and electronic filter circuit design has been undertaken, and construction and test of a bread-board chassis is underway.

c. The optical analysis has been completed for the scanner and readout part of the system. The suitability of some of the optical components which are to be utilized will require experimental verification.

d. Detailed mechanical design of the oscillating mirror scanner has been initiated.

Progress is as anticipated.

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THIRD MONTHLY PROGRESS REPORT
CONTRACT NO [REDACTED]

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Image Enhancement Instrument
1 August--1 September 1960

During the period covered by this report the following work has been accomplished :

a. The initial experiment involving single spot scanning of a photographic image has been placed in operation. Considerable valuable information has been obtained pertinent to the optical, mechanical, and electrical design of the enhancement instrument. Significant enhancement results will require a more intense light source and a more sensitive photomultiplier tube. Both of these devices have been procured and are being prepared for the experimental program.

b. A presentation of the [REDACTED] program was made to the Joint Chiefs committee on August 30.

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c. [REDACTED] has been retained on a consulting basis. [REDACTED] is currently investigating the optical techniques best suited to achieve the desired performance.

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To date \$16,000 has been expended on the project. This represents 19% of the total contract estimated cost. Progress is approximately 1 month behind schedule. A deliberate delay has been introduced in initiating the mechanical design of the scanner in order to insure that, when it is initiated, the design will be based on sound optical principles.

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SECOND MONTHLY PROGRESS REPORT
CONTRACT NO. [REDACTED]
Image Enhancement Instrument
1 July---1 August 1960

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During the period covered by this report the study program has progressed on schedule, and some parts and equipment for the laboratory breadboard experimental set-up have been received and preliminary testing has been accomplished. Color filters, dichroic mirrors, low pressure mercury vapor light source and a photo-multiplier tube have been placed in operation and performance is satisfactory. The first experiment, involving single spot scanning, awaits the receipt of additional optical parts, and the completion of fabrication of some of the scanning disk parts.

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[REDACTED] has been active in the mechanical and optical design of the breadboard experimental set-up, and in the study of the optical mechanical scanner for the deliverable instrument. [REDACTED] has been active in all aspects of the electronic circuit design.

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To date 685 manhours have been applied to the project, and purchase orders have been placed for equipment and parts costing approximately \$2840.00. Costs and progress are as anticipated.

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