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# EXTENSION OF SPATIAL FILTERING DEVELOPMENT FOR IMAGE ENHANCEMENT VIEWER

## INTRODUCTORY BACKGROUND:

[redacted] "Extension of Spatial Filtering Development for Image Enhancement Viewer," was submitted on 24 August 1961, and amended on 6 October 1961. The amendment excised several proposed development areas in order to concentrate on the one which appeared to be the most immediately promising. This development was for application of the rotating filter principle proved-out in the previous contract and reported in IL-9019-1, "Design and Construction of Frequency Attenuating Filters," 15 August 1961. The improvement of several of the optical and mechanical aspects of the instrument was also proposed. The proposal was divided into two Phases, the second to be initiated when and if the feasibility of the mechanical, rotating filters was established. Upon award of the contract, work was begun on Phase I.

25X1

## PRESENT STATUS:

The mechanical and optical improvements of the instrument were carried out successfully, but the mechanical, rotating filters did not prove feasible. The results of the Phase I work was reported on 31 August 1962 in the 9043 Status Report; Phase I, Final Report, and verbally to the contracting agency's technical representatives approximately a month prior to that date. In a series of studies paralleling the instrument modification, attempts were made (both analytically and experimentally) to examine the general problem of image, or more precisely, edge, enhancement. Because of the termination of the effort at the end of Phase I, these studies were not completed, although useful steps had been taken towards a formal statement of enhancement and an evaluation of the significant parameters.

Phase II work was not begun, pending review of the program, in the form of a redirected effort, as outlined in the final report.

PRESENT INSTRUMENTAL REQUIREMENTS:

It has been reasonably well-established that the Image Enhancement Viewer can be a useful tool when used in that type of operation for which it is pre-eminently suited; edge enhancement. The attempts to make continuous-tone spatial filters, while partially successful, have usually foundered on the rock of image quality. Stated otherwise, a successfully operational coherent optical system has too many inherent image-degrading qualities to provide images of equal or higher quality than those obtainable through incoherent illumination with a well-corrected lens. However, the enhancement afforded edges through the use of high-pass occluding filters, and the possibility of linking this operation with the technique of multiple-image printing renders the problem of extreme image quality of something less than primary importance.

The present configuration of the Image Enhancement Viewer is a vast improvement over the original model, the last two modifications having provided the capability of image magnification, precise film and focal plane registration, and significant increase in illumination level. On the other hand, there remain several, additional modifications which could usefully be incorporated to make the instrument more suitable for routine, operational use. These modifications, and the reasons justifying them were listed in Section 5 of the 9043, Phase I final report previously cited. Under the terms of the 9043, Phase II work statement, these modifications cannot be made since they require a redirected effort, as a work statement. The following section therefore details the suggested redirection.

PROPOSED REDIRECTION OF EFFORT:

There are two main areas of effort into which Phase II will be divided; a) Instrument modification, and b) Enhancement studies. These efforts will be made simultaneously, when possible, and the results of the enhancement studies incorporated in the operation and maintenance manual proposed for the equipment. The detailed breakdown follows.

Instrument Modification

1. Re-wire the Source Unit so that the input and output power leads and the additional control wiring pass through an Amphenol connector located on the forward unit plate.
2. Replace the present Object Unit with a new unit incorporating the following features: a) Selsyn positioning of the object vertically and horizontally, a total of two inches travel in both directions, b) separate the collimating lenses in order to operate in the correct Fraunhofer diffraction mode and to facilitate auto-collimation adjustment. The unit will be capable of handling carriers for film and plates. The carriers will be free of strain.
3. Install two new occluding filters in the filter unit, to be of 0.020 and 0.010 inches in diameter (nominal), approximately. This will extend the filter range by a factor of four (4).
4. Replace the three wooden bipods by two steel pedestals, to be anchored permanently at the contracting agency's facility. This will be shock-mounted and vibration-isolated as per the agency's building requirements.

5. Replace the present control panel by a new unit which is in the form of a wheeled console. This will incorporate all the power supplies and associated switches and transformers. It will place all the electrical power and control devices together and facilitate maintenance and simplify operation.
6. Provide current regulation to the DC power supply which eliminates necessity for prolonged and supervised "warm-up" time by skilled operators.
7. Install necessary cabling modifications.
8. Carry out minor miscellaneous engineering changes which will improve the general usefulness of the instrument, but are not sufficiently important to list here.
9. Prepare an operating and maintenance manual which will bring the instrument up to date and permit full utilization of the latest modifications. The results of the enhancement studies will be incorporated as they apply.
10. Metal-finish the instrument to provide protection against humidity, rust, and similar problems.

ENHANCEMENT STUDIES:

To complete the studies of edges and edge enhancement initiated under Phase I, it is proposed that the experimental work continue on edge enhancement through exposure addition and transmission multiplication. This study will examine the four basic enhancement possibilities, and will particularly be concerned with their inclusion in multiple-image printing. It is expected that the results of these studies will provide a final evaluation of the Image Enhancement Viewer usefulness, with a specification of the parametric effect of high-pass occluding spatial filters on enhancement.

PHASE II SCHEDULE

Phase II as outlined above, will be complete six (6) months from date of award. Shipment to contracting agency's establishment will take place subsequent to this period, at his convenience. All manuals, spare parts, etc., will be due and deliverable at that time. The instrument will be assembled, installed, adjusted, and calibrated by an [redacted] representative, at the contracting agency's establishment when delivered, or at a time specified by him. 25X1

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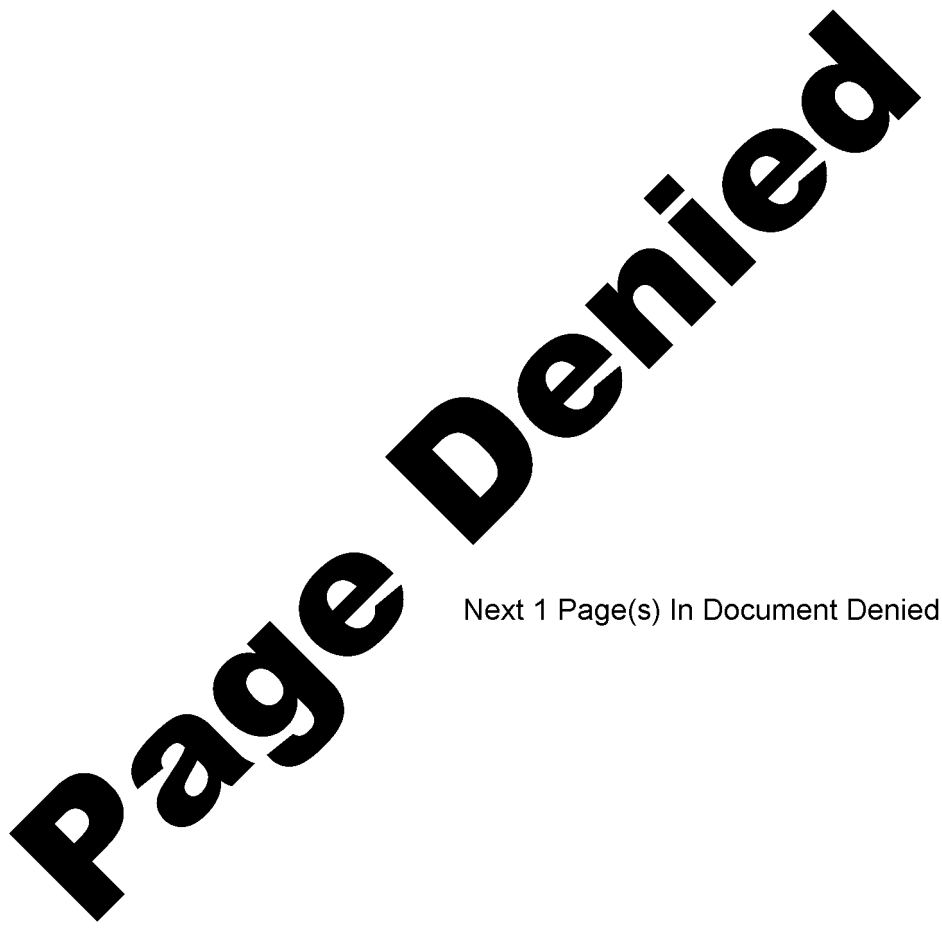


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