STAT

ELECTROPHOTOGRAPHIC PROCESSING TECHNIQUES

STAT CONTRACT NO. | TASK ORDER NO. 03(100,762)65-R

Monthly Narrative Report - February 1966

(Covering the period January 22, to February 22, 1966)

A. Current Status of Work

1. Electrical-Chemical Processing

Further corrective processing experiments employing photo masking techniques were conducted on the defocussed version of the specially-prepared composite transparency (density-segmented triangle array plus scene). However, as requested by the customer on February 8, 1966, further processing of these degraded transparencies using the time consuming photo copy techniques was stopped after that date. Processing was to concentrate henceforth on real imagery, such as available on the AFSPPL Film, Mission No. 40-09112, and using more advanced experimental techniques, e.g., modulated light, chemical, and spatial filtering. However, measurements were made of the results of partial correction on the defocussed transparency and comparisons made with measurements for the undegraded standard and the original defocussed transparencies. Analyses were made to determine the effect of the partial processing and the types of further processing needed.

From the AFSPPL Film, Mission No. 40-09112, frame number 46574 was selected for the initial phase of qualification of real images. Two types of images were selected: 1) a bar target and 2) an aircraft. The bar target consists of two density steps and contains image elements that are above and below the liminal (threshold) level. On the aircraft wing is a sub-liminal service designation whose recognition shall be a goal of the processing. The image consists of three density levels, (the service designation,

the wing, and the ground behind the wing. Actual image element dimensions are from 5 microns to 250 microns. These images have been enlarged from between 50 and 500 diameters by means of a phase contrast microscope. At these enlarged levels, it is possible to relate the CRT spot size to the image incremental element size for the density manipulation program. Micro densitometer traces have been made of the original scene area and the enlargements.

Debugging continued on the CRT modulated light printer. Several modifications were made to the printer which enabled preliminary tests to be made with it. Primary emphasis was to determine the uniformity of printing densities during the modulated and unmodulated modes. Low, medium, and high density levels, as well as zero, 50% and 100% modulation were the preliminary test points. However, certain faults were still noted in the printer outputs, e.g., cross-hatching and banding, and changes are now being made to attempt to correct these faults.

2. Electronic Processing

Final samples of transparencies processed with negative masking through the low resolution electronic processor were prepared and shown to the customer on February 8, 1966, to compare with transparencies prepared through the system with unmodulated light. At his request, enlarged positive copies of these transparencies as well as copies from the original negatives have been prepared for his examination.

On February 4, the low resolution electronic processing system was disassembled to start construction of the high resolution system. All [redacted] and STAT

STAT [redacted] components have been received except the Ferranti mumetal shields for the two kinescopes. They are promised by March 1.

Work is continuing on assembling and wiring the high resolution system on the aluminum bedplate.

3. Techniques Analysis

A mathematical model of modulated-light contact reproduction systems has been formulated. With appropriate interpretation of terms, the model attempts to describe the operation of the breadboard cathode-ray-tube printer, the low and high resolution breadboard electronic processing systems, and also the prototype film viewing tables. The model incorporates the line spread functions and spatial frequency responses of the major system elements: the original transparency, the kinescope beam, and the feedback circuits. Secondary system elements (e.g., lenses) are not included in this preliminary model.

With respect to the space domain, the line spread function of the contact image (i.e., the image reproduced by contact printing or viewing) is shown to be the difference between an unmodulated spread function (proportional to the spread function of the original transparency) and a modulated spread function. Correspondingly, the spatial frequency response of the contact image is shown to be the difference between an unmodulated frequency response (proportional to the frequency response of the original transparency) and a modulated frequency response.

Several tests of the model are being performed before it is incorporated fully in the techniques analysis. Specifically, the ability of the model to satisfactorily predict known phenomena such as low-frequency suppression and image erasure is being determined.

B. Problem Areas Encountered

Difficulties with the CRT modulated light printer have not made it possible to utilize this equipment yet in actual processing experiments. A concentrated effort is being made to make the necessary engineering corrections to this device. A hold was placed, at the customer's request, on the purchase of a dichroic mirror and a 2000 volt power supply for the high resolution electronic processor. This delay in purchase of these items will delay completion of the processor.

C. Projected Work for Next Month

1. Electro-Chemical Processing

a. Select images located in the sub-liminal region.

1) Associate the number of density steps in respect to the number of detail elements of the image.

2) Enlarge, adjust densities, fill in inter-space among density grains.

3) Measure density/intensity on Richards viewer.

b. Complete corrections on modulated-light printer and calibrate and evaluate printer (using target supplied by customer).

2. Electronic Processing

a. Complete construction of high resolution electronic processor

b. Calibrate and adjust processor

3. Techniques Analysis

a. Complete check out tests of mathematical model and analyze results.

b. Use model to analyze results of final processing with low-resolution electronic processor, specifically the microdensitometer traces of triangle edges.

4. Prepare Second Interim Report

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E. Documentation of Verbal Commitments and/or Agreement During the Period

A meeting was held with the customer on February 8, 1966 reviewing the financial and technical status of the EPT program. Several agreements were made at that time and documented in minutes of that meeting which have been transmitted to the customer. The key items were:

STAT 1. [ ] is not to take any action with regard to the following activities until directed to do so by the customer.

a) Rear Projection Viewer Study

b) Use of Photo Interpreter Consultants

c) Spatial Frequency Analyzer Development

STAT 2. [ ] was to supply a detailed listing of program costs broken down by task indicating personnel assignments (This was delivered on Feb. 23, 1966).

STAT 3. [ ] is to concentrate on processing of operational-type transparencies rather than artificially generated scenes.

4. The customer would supply a resolution target to measure the capability of the contact printer (supplied on February 25, 1966).

STAT 5. [ ] will provide positives of samples of the inputs to and the results of unmodulated and modulated processing by the low resolution breadboard electronic processor.