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Comments?

24 September 1962

MEMORANDUM FOR: Chief, Technical Plans and Development Staff

THROUGH : Chief, Technical Development Branch

SUBJECT : Trip Report to [redacted] 25X1A to Observe the Working Prototype of a New Recording and Programming Micro-Densitometer

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1. On 18 September 1962 at 11:00 AM, I arrived at the [redacted] 25X1A. In company with [redacted] 25X1A I was ushered to a restricted area where they proceeded to demonstrate their newly designed nine inch square stage micro-densitometer. This instrument was planned and constructed with first considerations of it performing certain precision linear measurements in (X,Y) coordinates not possible with their ultra-precision optical measuring instruments.

2. In working with this new recording micro-densitometer, I found that it is possible to scan automatically with a one-micro circular spot any diagonal or (X,Y) coordinates on a $9\frac{1}{2}$ inch wide aerial type film.

3. They have plans for providing takeup reels for $9\frac{1}{2}$ inch film on either end of the stage. A substage microscope fitted with a zoom-type ocular system (6 to 60X) is used to observe and focus the area being scanned.

4. A small projected spot of light above the stage strikes the top surface of the transparency three inches to the left of the axis of the scanning microscope. By observing the image by substage flourescent light, the operator may move the point located by the projected spot an accurately measured distance to the right for positioning his point of scan.

5. The specifications of this instrument are nearer to the one desired for the TSB program than any existing micro-densitometer.

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6. In conference with the gentlemen mentioned above until 1810 hours, we discussed various methods of micro-densitometer construction. Their opinions of the micro-densitometer used as a linear measuring device and improvements in fabricating other similar instruments will be noted on a separate sheet attached to this report.

[redacted] 25X1A

ATTACHMENT TO TRIP REPORT

28 September 1962

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25X1A During the conference with officials of the [redacted] and the [redacted] 1100 hrs. to 1810 hrs., on 18 September 1962, the following points of their new micro-densitometer or "the [redacted] Data-Microanalyzer" were discussed. 25X1A

1. The working instrument the [redacted] had on display consisted of two parts. The sensing unit, weighing about 2000 pounds, occupied about four by six feet of floor space. The recording unit, weighing about 600 pounds, connected to the sensing unit by cable, took up about thirty by forty inches of floor space. This recorder unit had a pulsating feature which penned an exact unit of measurement on the paper chart adjacent to the film density trace. This measurement indication varies automatically with any change of scanning speed. 25X1A

The recording unit is fitted with a programmed memory system. Similar trace patterns could be redrawn at a later date and matched with known or unknown future signals of the same area. They explained that this can be used in aerial photography as part of the soil erosion control program. This memory system can also be used in certain crop control areas of the United States. Micro-densitometer tracings across aerial photos of farm areas identify the type of crop and indicate whether it is of sparce or of heavy growth.

2. They rule out using a slit aperture for purposes of linear measurement. When scanning in any of the X, Y, or diagonal coordinates, any size slit results in inconsistent, inaccurate readings. They prefer to make available a series of five or six snap-in diaphrams, each with a particular size of circular aperture, the smallest of which will be one micron. Several diaphrams with precut slits will be supplied as needed for other analyses.

3. The understage microscope with the zoom-type ocular (6X to 60X) provides for a photomicrographic attachment. With the 6X magnification an approximately three-quarters of an inch area of the scan line can be photographed.

4. By directing a two-inch ring of less than 10 pounds of air pressure directly on the transparency, the film is forced flat enough to eliminate the use of a cover glass. The supply of this air comes from a large cylinder of moisture filtered nitrogen gas which serves very well for about two weeks duration with average every day intermittant use.

5. They have another system along the same line of thought but with a counter-stream of air from the top and one from the bottom of the stage around the optic system. The film is supported between these apposing air blasts there-by eliminating all glass at the stage

level. They claim that by regulating the pressure of air on both surfaces of the transparency, with slightly more pressure on the top surface, the image can be kept at a very critical focus over distances in excess of thirty inches in all coordinates. Their tests indicate that more stability and accuracy of focus can be maintained across that length of area than any other means of glass support. They named these systems the single or double "air puck system."

6. Other known applications of their micro-densitometer as relating to photo data assessment were discussed as part of their sales pitch.

To measure distance between portions of the image, the shape of the image detail will influence the choice of the aperture. Measurement of small images for density levels and assessment of uniformity of the image require a small circular aperture. Transparent samples such as original negative, positive projection transparency or a color transparency, and reflection samples such as paper prints, printon and the like, can be measured. In basic optical forms, these methods of measuring density are similar to that used in macro-or large area densitometry, where areas using a 4, 5 or 7 mm aperture are sometimes used.

It can be used as a acutance test in the study of the image recording capabilities of the photographic processes. This micro-densitometer is used to draw the density-distance curves over "knife edge" exposures in performing these tests.

In resolving power analyses, samples are exposed to the typical bar pattern or the newer sine-wave patterns used for resolution or resolving power tests. A slit aperture is generally utilized for this application.

In granularity analyses the output curve is a plot of the random density fluctuations that are due to the silver grains in the emulsion (use a small circular aperture).

As a measuring instrument it is used for the measuring of star images and evaluating intesity in astronomical photography. In aerial photography it is used in the measurement of small distances for scaling and mapping problems. It is used to measure optical density of small microscopic samples, it evaluates samples of photographic materials where the recorded image is of importance.

It is used in ballistic photography and schlieren techniques. It measures distances between transients in the photographic record of a CRT output. It evaluates records made by cathode ray tube photography.

In photometry it is used for measuring densities of small images in order to assess the brightness of the object in the original scene.

In graphic arts it is used for studying dot structure in halftone work, dot size, size growth, density gradients, etc.

It is used as an optical system for automatic bank check clearing.

The instrument is used to study ink characteristics and deposition on actual type faces and halftone plates.

The applications of this micro-densitometer are unlimited. The imagination of the operator could very well be the limiting factors for this instrument.

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