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MONTHLY STATUS REPORT
TECHNICAL CONSULTING SERVICES
FOR
EARTH RESOURCES PROGRAM
NASW-2317

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**CASE FILE
COPY**

by

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TECHNICAL CONSULTING SERVICES
FOR
EARTH RESOURCES PROGRAM
September Status Report

Summary

Evaluation of several sets of test data shows a normal amount of variability in gamma and Dmax on KODAK Aerial Duplicating Film (ESTAR Base) SO-467. However, Kodak is now furnishing to engineers at GSFC a full set of test data for each coating of SO-467 film.

Several glass-enclosed sensitometer step tablets are being made for the Herrnfeld instrument at GSFC. These tablets include a gray scale and uniformity check areas as well as tribar resolution patterns imaged in a durable chromium layer.

In a letter to Mr. Jaffe on 24 September we recommended that the Sioux Falls EDC procure four new enlarging printers and study the value and economics of a system for printer automation based on edge coding. This technique is the subject of a meeting to be held at GSFC on 16 October 1973.

Work Completed to 30 September 1973

During a visit to Goddard Space Flight Center on 12 September we discussed data derived from tests run to check the film-process uniformity of KODAK Aerial Duplicating Film (ESTAR Base) S)-467. At a previous session in Rochester on 7 September Kodak and GSFC representatives compared test results

on the uniformity of this product. At that time a maximum range of 0.1 density at 2.4 density was reported for SO-467-13-3. The uniformity of coating SO-467-15-5 was even better than this value. However, a single test run on the Tech Ops sensitometer on SO-467-13-8 showed a drop of 0.6 at density 2.4 over an interval of 5 feet in one roll.

This substantial drop in D_{max} has not been confirmed in later tests at GSFC or in Rochester. Typically, the 2σ range in gamma on one roll of SO-467 is ± 0.05 at a value of 0.90, a condition producing only moderate changes in D_{max} .

Later in September Kodak representatives from film testing, manufacturing, and service divisions visited GSFC to conduct further tests on SO-467 film and to discuss additional data requested by GSFC engineers. Consequently, Kodak is now supplying to GSFC copies of all uniformity tests run on each coating of this product. No new testing is involved, but information currently generated for SO-467 film should aid GSFC engineers in reducing print variability.

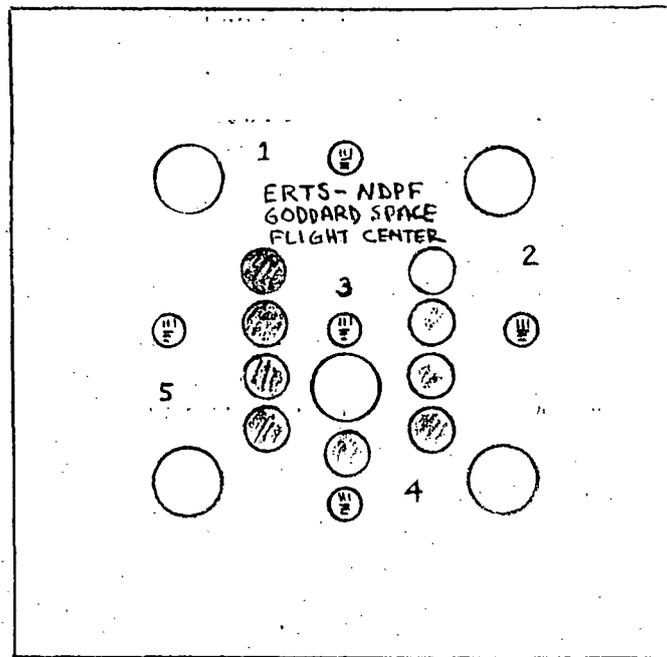
When testing SO-467 film at GSFC we noted poor uniformity of illumination in the Herrnfeld sensitometer. A film strip flashed without using the step tablet showed a peculiar pattern of bar-shaped images that resembled the lamp filament. This pattern has a Δ density of 0.02 and is not

caused by film or processing. The reason for the pattern is unknown, as there are no optics except a plane, first-surface mirror between the lamp and the film. We will continue to study this problem and will measure illumination uniformity in a new Herrnfeld sensitometer to be delivered to GSFC in October.

As an aid in film and processing evaluations at GSFC we started manufacture of several new tablets for the Herrnfeld sensitometer. The tablets have the pattern and dimensions shown in Figure 1 and comprise a film image sandwiched between two glass plates. The thinner top plate carries five low contrast tribar patterns etched in chromium to form a durable resolution test object. The film image includes a nine step gray scale, labeling, and five areas for testing uniformity over the 70mm frame.

These patterns will be used primarily as end-of-roll targets for exposure of Eastman Electron Recording Film (ESTAR Base) SO-438. This exposure will be monitored at subsequent duplication stages through the NDPF to insure proper image quality and uniformity. If the targets are satisfactory, additional copies may be made for use at JSC and the EROS center.

FIGURE 1
GLASS SENSITOMETER TABLET
FOR
GSFC



Full Size

0.060" glass with chromium
tribar target

Film with gray scale

0.190" Kodak glass

Size $3 \frac{7}{16}'' \times 3 \frac{7}{16}''$

All densities are Status A blue; density tolerance = ± 0.02

Background = 0.80 density

Three chromium bars in tribar pattern = 0.18 density

Resolution target range - 16 lp/mm to 256 lp/mm

Step Tablet Densities

1.70	0.12
1.29	0.33
1.08	0.47
0.94 0.80	0.65

While at GSFC we delivered 70mm and 9.5 inch rolls of KODAK Low Contrast Fine Grain Aerographic Duplicating Film (ESTAR Base) SO-355 for tests of lower gamma color printing. When used as an intermediate stage, this product can produce color prints from ERTS photography that have 10% to 20% lower gamma and should reveal increased detail in water and vegetated areas. This test should start in October.

Engineers at GSFC had not implemented recommended improvements to reduce flare in the second EN-70 3.37X enlarger. Apparently technicians were not available to work on this machine. Work was proceeding on the two new ECP-70 printers that were returned from repair by General Electric Company. However, the ECP-70's were not yet operating properly.

On 13-14 September we delivered twenty 70mm printer targets with calibration data to engineers at the Sioux Falls EDC. Activities during this visit included an evaluation of equipment needs at the EDC, a review of progress on equipment installation at the new data center, and meetings with Mr. Allen Watson and personnel on the Technicolor staff. Three new processing machines were in place at the new EROS center, but these can not be operated until mixing tanks and a waste treatment facility are completed. Probably, the photographic laboratory will not begin activities at the new site until 1 January 1974, although other parts of the data center are moving now.

Following this visit to Sioux Falls a letter was sent to Mr. L. Jaffe detailing our recommendations for new equipment at the EDC. The principal need is for enlarging printers for making 3.37X, 6.74X, and 13.4X prints from ERTS 70mm negatives. Two enlargers are needed for work at 13.4X to meet the especially heavy demand for these enlargements.

The laboratory has made 3.37X and 6.74X enlargers by modifying low cost, limited duty, commercial machines, but these devices produce variable image quality and can easily damage the 70mm negatives. The EROS facility receives many orders for large size prints yet does not have a good printer for the 13.4X enlargement.

The new enlargers must have lenses of superior quality, specifically designed for this set of conjugates and field angles, and yielding the maximum possible resolution and uniformity. The printer design should eliminate vibration and maintain consistently high photographic quality without adjustment during extensive periods of daily use. It is very important that motors, shafts, surfaces, film gates, and cleaners do not damage the negative during positioning and exposure of each frame.

A second recommended feature for the EDC is an automated system for printer operation. Presently, frames are manually selected and positioned in the printer gate; the printer operator reads the

customer order card and makes the required exposures. Since this operation is slow and often damages the negative, an automatic system is needed for advancing and positioning the film, making the required exposures, and safely rewinding the negative for storage. Sensors on the printer would detect code marks on the edge of the negative in order to select and position each frame. The system could be controlled by the customer order cards generated in the data management computer.

This automatic system should be valuable at several NASA and Interior facilities and could be applied readily to new photography as it is received. Application of edge coding to existing negative rolls might be accomplished over a period of several years. A complete system should include the new optical printers for EDC as well as installation of detectors and other changes to existing printers.

A meeting to discuss this system in more detail will be convened by Mr. J. Sos on 16 October at GSFC. At that time the participants hope to review economic factors and alternative solutions to this problem.

Plans for October

The new sensitometer tablets will be delivered to GSFC, and the production and use of similar patterns at other facilities

will be studied. A review meeting with Mr. Jaffe is scheduled for 1 October 1973. On 16 October we will participate in a meeting at GSFC to evaluate alternative proposals for automated printer operation using edge coding. A visit is planned to the Johnson Spaceflight Center.