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STUDY OF TIME LAPSE DATA PROCESSING
FOR DYNAMIC HYDROLOGIC CONDITIONS

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TYPE I PROGRESS REPORT

- a) Title: STUDY OF TIME-LAPSE DATA PROCESSING FOR DYNAMIC
HYDROLOGIC CONDITIONS

ERTS-A Proposal 342-B

- b) GSFC ID PR154

- c) Problems Impeding Progress Insufficient Data

Not enough ERTS data yet has been received for significant data processing. For some of our participating investigators, however, we are addressing many of their data processing requirements by experimental simulation with ERTS data that is in hand.

- d) Accomplishments

(1) During Reporting Period

During this period we have incorporated into this system some additional special circuitry for ERTS image analysis. Still more additional circuitry for this purpose is planned, some of which will be added in the very near future. These additions and the purpose they will serve are discussed in the sections below on accomplishments. Figure I illustrates the current physical set-up of the Console System. In the center, is the main console, which contains the magnetic disc video recorder with two separately addressable sections, a solid state video picture display, numerous functionally-grouped controls for mixing and manipulating the displayed images and a video wave-form monitor. This video waveform monitor can function as a simple microdensitometer. In addition to the main video picture display there are five other video monitors; the three small ones atop the main console monitor independently but in fixed manner one of the two sides of the magnetic disc and the input camera, respectively. To the right and placed one atop the other are a color monitor and an additional general utility monitor respectively.

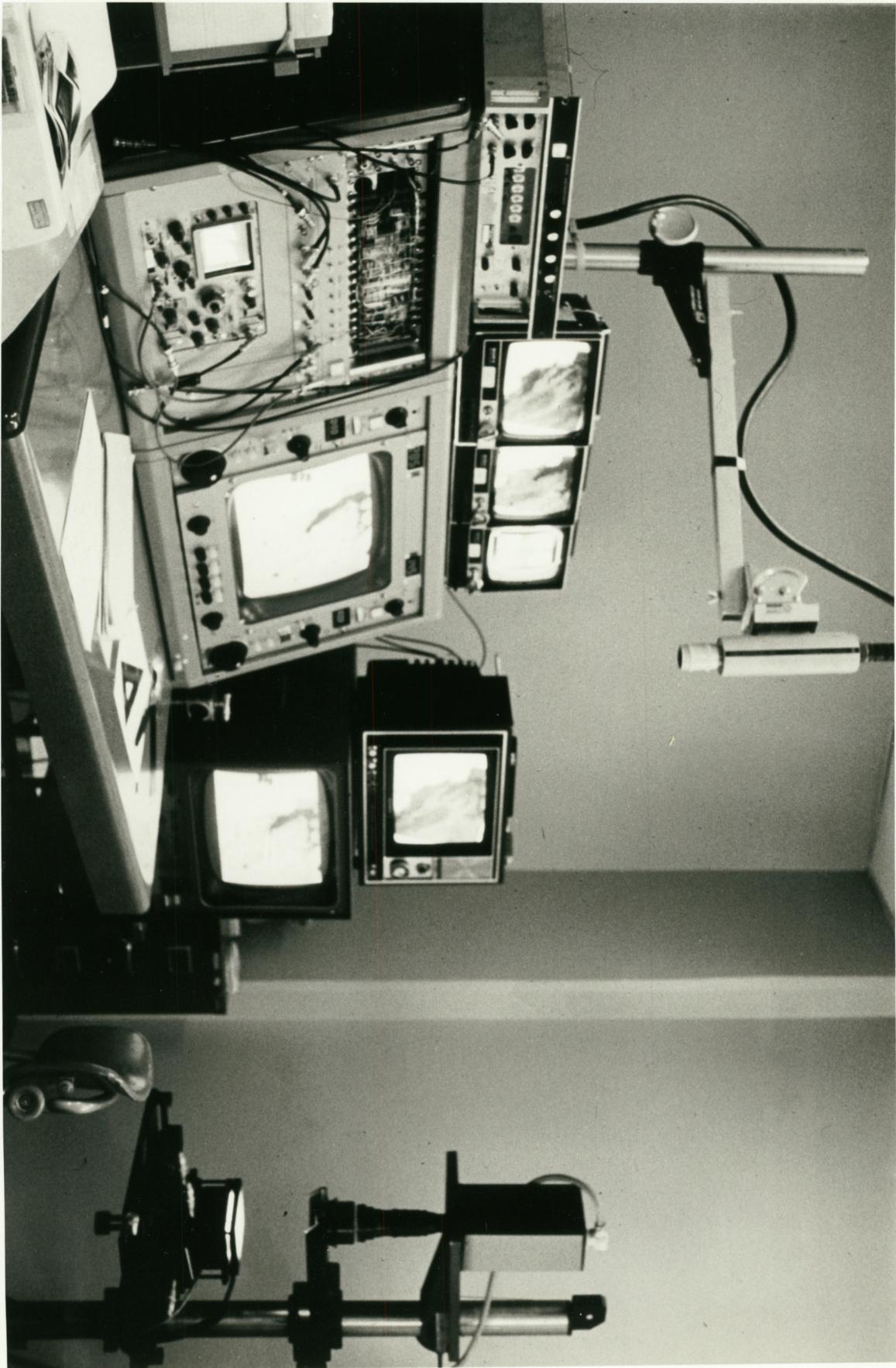


FIGURE I SRI ELECTRONIC CONSOLE FOR PROCESSING SATELLITE IMAGERY IN TIME LAPSE MODE

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Overhead is a small video camera focused on the console table top which permits an operator-analyst to trace or sketch on maps or work pads image information that is of interest showing on the main video monitor. Further it provides one rapid means for creating a thematic mask that can then be entered into the system, filled in electronically and desired area information automatically displayed digitally on the digital counter atop the left hand section of the console.

On the left is a teletypewriter and paper punch unit that provides both hard copy and machine-readable logging of data obtained by the operator analyst.

The area-measuring modifications outlined in the proposal work statement are being implemented. Several procedures for creating binary masks by video brightness thresholding, by manual drawing, and by manual outlining (using the cursor) with automatic fill in have been demonstrated, in principle, to visiting participating investigators. At present the new circuitry is in the breadboard stage. The automatic fill in feature does not yet work as well as it should with the result that the time required for editing (image clean-up) is excessive. This problem is being investigated.

During the reporting period we were visited by two participating investigators, Dr. C. C. Reeves, Jr. (UN168) of the Department of Geosciences of Texas Tech University, Lubbock, Texas, and Dr. Mark F. Meier (IN045) U. S. Geological Survey, Tacoma, Washington. They actually participated in processing ERTS Data using the console to obtain a fuller understanding of the available range of the data processing via the use of the time lapse sequencing and other capabilities provided by the electronic system.

Dr. Reeves was here from October 10 through October 14th examining available techniques for data processing of ERTS-A data for the Water

Budget of the Texas High Plains Playa lakes. Drs. Meier and Post spent October 26, viewed the results of initial data processing of ERTS imagery previously forwarded to SRI, and took the opportunity to do additional data processing of ERTS data that the investigators brought with them. Appendix A in a Project File memo of our activities in behalf of Dr. Meier's investigation to evaluate ERTS Imagery for Mapping and Detection of Change of Snow Cover on Land and on Glaciers.

Such actual cooperative participation in the data processing program emphasizes some of the problem areas that could arise in their investigation based on ERTS satellite imagery. Further it provides us at SRI with additional knowledge of the direction in which to expand the console capabilities to best serve the needs of the participating investigators.

(2) Planned for Next Reporting Period

During work with Dr. Reeves' Texas Playa images and with Dr. Meier's glacier images, a color display was temporarily rigged to the console in attempts to make subtle features more visible to the operator. The improvement was so marked that it now appears that some form of color capability should definitely be added to the console for work with ERTS multispectral imagery. To achieve time-lapsed color we need both A and B disc memories. Thus, with the original plan of building area-delineating masks on the A disc, we cannot simultaneously have time-lapsed color and the area-measuring feature. This now appears to be a sufficient limitation that we are examining alternative methods of storing the binary area masks that might be implemented within the existing budget. One possibility would be to add to the disc another fixed magnetic head and associated read/write circuitry. Use of a storage tube or a solid state memory is also being considered.

Accordingly, we plan to complete and incorporate within the console system the new breadboarded circuitry for area measurements, binary masks, area outlining by manual manipulation of the cursor and automatic area fill in. We plan to further explore the use of time-lapsed color for enhancement as well as adding this capability as a permanent feature of the Electronic Console system.

During the next reporting periods we should interact with several other participating investigators who hopefully, will have the necessary sequential ERTS data for processing. Dr. Reeves plans to visit again when he has significant ERTS data over his area of interest. Dr. Meier has requested that for the time being we continue data processing experimentation with specified portions both of existing ERTS imagery and that yet to be acquired during the next period. He feels that such experimentation will soon lead to an optimum procedure for processing the bulk data that he hopes to obtain in the future for his investigations.

Items e through k N/A



MEMO

APPENDIX A

to: Project 2165 File

DATE: October 31, 1972

FROM: W. E. Evans

LOCATION: L2111

SUBJECT: Visit of Mark Meier and Austin Post on 10-26-72

CC: S. Serebreny

In preparation for this visit and in response to requests stated in Meier's letters of 16 October and 17 October, the following image situations had been entered into disc storage in the console:

I Register Images to Maps

- A) Mt. Hood; Full size and 3 sectional enlargements registered to U.S.G.S. maps.
- B) Wrangell Mountains: Full size and 2 sectional enlargements, registered to U.S.G.S. maps and to Austin Post Glacier map.

II Separate clouds from snow, ice, and land.

- A) Wrangell mountains; Full size and lower right corner expansion, displayed in two colors for two ERTS cycles (18 Aug and 4 Sept.).
- B) Bearing Glacier; Full frame, and expansion on Berg Lake, displayed in two colors and for two ERTS cycles.

III Vancouver Island

Two scenes, 3 bands each, registered to each other and to the Glacier Map. Displayed in several color combinations.

IV To compare 9" x 9" prints and 70 mm positive transparencies, the N. Vancouver Island image (E 1028-18533-6) was entered at two different magnifications from both sources.

Activities during the 26 October visit

The above-listed prerecorded situations were displayed and discussed. All agreed that the two-color display was useful in portraying the difference between snow, ice and clouds (white), and land or vegetation. W.E.E. agreed to improve the control of the color display and to attempt to enhance any spectral differences between clouds, snow, and ice.

The usefulness of time-lapse in differentiating between clouds and snow was demonstrated in the Wrangell mountain sequence.

The area-measuring modification to the console were still in a breadboard stage, but the following procedures were demonstrated in principle:

- 1) Multi-point cursor readout to TTY.
- 2) Hand tracing of features using overhead TV camera.
- 3) Creation of binary mask using thresholding on video brightness signal.
- 4) Creation of binary mask by manual outlining and automatic fill.
- 5) Creation of binary mask by manual fitting.

Preliminary attempts were made to register the N. Cascade 70 mm image to Meier's 1 : 1M drainage basin map. It was agreed that this would go more smoothly with 70 mm transparencies, and Meier promised to have some made. We will refine our techniques for measuring snow area within these basins, and will order all available spectral bands to aid in these requirements.

WEE:ec

