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FOURTH BI-MONTHLY PROGRESS REPORT
UNIVERSITY OF ALASKA
ERTS PROJECT NO. 110-1
March 31, 1973

- A. TITLE OF INVESTIGATION:
Coordination and Establishment of Centralized Facilities and Services for the University of Alaska ERTS Survey of the Alaskan Environment
- B. PRINCIPAL INVESTIGATOR/GSFC ID: Albert E. Belon/UN318
- C. PROBLEMS IMPEDING INVESTIGATION:
The CDU-200 Color Display Unit to be used for the processing and display of ERTS digital tapes has not yet been delivered by the manufacturer, Interpretation Systems, Inc. (ISI). Although we have developed other methods of processing and displaying ERTS digital data, they are much less effective and more costly than the CDU-200 approach would provide. ISI has now established a firm delivery date of May 25 for the completed and tested CDU-200.
The lack of NASA funding for coordination, management and report preparation for this project continue to be a great limitation and source of concern.
- D. PROGRESS REPORT:
 - 1. Accomplishments during the reporting period
 - a. Coordination and management of the University of Alaska ERTS program
Much of these activities during the reporting period were concerned with the preparation of several reports, publications and papers presented at meetings by the University of Alaska's ERTS investigators. In addition one general meeting and numerous individual meetings were held to exchange information and provide advice and technical assistance to U of A ERTS investigators. Project 110-1 also received, logged in, and transmitted incoming ERTS data to the 12 U of A ERTS projects, maintained up-to-date files, maps and catalogs of available ERTS data, and supervised the activities of technical staff. As mentioned earlier, none of these coordination and management activities are supported by project 110-1 funds, but they are reported here nevertheless because they are relevant, and in fact essential, to the effective performance of the U of A ERTS program.

N73-20417
 E73-10459) COORDINATION AND ESTABLISHMENT
 OF CENTRALIZED FACILITIES AND SERVICES
 FOR THE UNIVERSITY OF ALASKA ERTS SURVEY
 OF THE ALASKAN ENVIRONMENT (Alaska Univ.,
 Fairbanks.) 8 p HC \$3.00
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Preparation of reports - All reports prepared by the 12 U of A ERTS projects are received, edited and transmitted to NASA by project 110-1. During the February-March period these reports included:

- 12 combined bi-monthly and semi-annual progress reports
- 12 revised data handling plans
- 5 manuscripts for the NASA ERTS-1 symposium (projects 110-1, 110-3, 4, 8, 12 and 13)
- 1 interim scientific report (project 110-1 and 110-3)
- 1 journal publication (project 110-12)

Presentations at the NASA ERTS-1 Symposium (March 5-9, 1973)

The University of Alaska presented five papers at the ERTS-1 symposium. All were apparently very well received and their results were mentioned in the daily summary sessions as well as Associated Press releases which appeared in Alaskan newspapers. Mr. John M. Miller, co-investigator on project 110-1, presented three of the U of A papers, two of which were authored or co-authored by personnel of project 110-1. The paper by John M. Miller and Albert E. Belon entitled "A multidisciplinary survey for the management of Alaskan resources utilizing ERTS imagery" was selected as one of four outstanding symposium papers, and at NASA's request, it was presented a second time at a plenary session attended by over 1000 people. We understand that these four papers will be published by NASA as a special brochure illustrating the applications and benefits of the ERTS program.

Preparations for short course on ERTS applications

A remote sensing short course emphasizing ERTS applications will be given in Juneau, Alaska during the week of April 2, 1973, by scientific and technical personnel of project 110-1. The five-day course involves formal lectures (70%) as well as workshop-laboratory sessions (30%), and is directed toward the operational needs of state and federal agencies in southeastern Alaska. Previous similar courses given in Fairbanks in December and Anchorage in January proved to be highly successful in stimulating the use of ERTS imagery among operational government agencies. These activities are sponsored by the University of Alaska and NASA through a separate grant, but they draw heavily on the activities and results of the U of A ERTS projects 110-1 to 14.

Operation of ERTS Data Users Room - Over 750 ERTS scenes of Alaska involving more than 20,000 NASA and U of A data products and approximately 2500 aerial photographs in black and white and color formats are systematically filed and catalogued in the ERTS Data Users Room. This valuable source of Alaskan remote sensing data, in close proximity to viewing devices and data processing facilities is extensively utilized by ERTS users in the University, government agencies, and the public sector. The increasing utilization of the ERTS users room requires a considerable level of effort to maintain the reputed high efficiency of our operations.

b. Establishment of Data Processing Facilities

Optical and Photographic Instrumentation - The budget of project 110-1 provided for the design and construction of a color-additive viewer and the purchase of a logEtronics photographic printer. Both items of equipment have been in use since last fall, the first principally by U of A investigators and the second by technical personnel of project 110-1. In addition numerous items of optical and photographic equipment have been assembled and adapted for use in the U of A ERTS program. Generally we feel that we are relatively well equipped for ERTS analyses. The one strategic piece of equipment that we lack and desire, but do not currently have the funds to purchase, is a Bausch and Lomb Zoom Transfer Scope. Acquisition of this powerful device is included in our ERTS-B proposal.

Instrumentation for Digital Processing and Display of ERTS Data

R. Porter, ERTS Programmer, and I. Soos, Design Engineer, both from the Geophysical Institute, visited Interpretation Systems, Inc. of Lawrence, Kansas during the week of March 5 to 9. ISI is manufacturing the digital color display (CDU200) for use with our ERTS projects, and is considerably overdue with its completion.

The original intention of the visit was so that Geophysical Institute personnel could assist with the final debugging and thus learn the device from both a maintenance and operational viewpoint. However, it was soon apparent that although most (not all) of the components were available, it would be a considerable period of time before the device was ready for "final debugging". It was thus decided that it would be impractical to remain in Lawrence for the extended period that would be required to see the CDU-200 through to final completion.

Problems associated with reading of digital tapes from our computer seem to be largely solved. Several tapes, in some cases containing up to 1,000 feet of data, were read without error. Additional testing disclosed a very intermittent error on "backward read". This problem should be solved when the retry facility is added to the operational program.

Although there is a great deal yet to be accomplished, considerable progress has been made since the last visit. The 25" color monitor has been modified and is ready for inclusion in the system. The Kennedy tape drive, the Xebec controller, the PDP 11/05 minicomputer, the large wire wrap panel which is to receive printed circuit cards, and the fans and power control unit are all mounted and in operation in the final cabinet. The software was operational as far as the status of the hardware would allow. The disk interface was not complete, but a phone call on March 25th indicated that the disk interface to a video monitor has been checked out but the computer disk interface is not yet complete.

The Geophysical Institute's contract with ISI specifies a significant penalty clause for late delivery. It is expected that part of the penalty will be adjusted by the inclusion of the VP-8 option by ISI. This option includes a light table, a vidicon, a VP-8 image analyzer and digitizer, and an X-Y-Z display. These additions will allow the display (and/or digitizing) of images such as those made by the NASA aircraft for the ERTS projects. It is expected that the vidicon will allow for these supplemental images to be displayed in a manner similar to overlaying, on images derived (enhanced or classified by signature) from the original digital ERTS computer tapes. This device will also be very useful for "hands-on" investigator use where manipulations such as density slicing are all that is required. It is expected that this mode of operation will fill an important gap in the learning process without the cost and delay associated with using the University's IBM 360/40 to first convert the MSS tapes for input to the CDU.

ISI has also agreed as part of the penalty clause to pay expenses for R. Porter to be present in Lawrence during the last week prior to shipment to Alaska. This would allow an opportunity to become completely familiar with the operation and software. I. Soos spent considerable time examining the documentation supplied with the various components and the engineering drawings made by ISI for the system. Deficiencies were noted and suggestions were made for the final form of the maintenance documentation.

Some time was also spent with a stand-alone VP-8 system at ISI. This system allows density slicing and X-Y-Z display of images. Numerous images of current interest to University of Alaska ERTS investigators were used, and 35mm slides were made from the color monitor. Although these "density-sliced" results will be of some assistance to several investigators, it is obvious that much more could be accomplished if the investigators were present and could actually operate the device themselves.

It appears that the CDU-200 will have numerous features not originally specified in the contract to ISI. As the capabilities of the CDU-200 are increased, a significant reduction in the use of the IBM 360/40 is expected. The additional advantage of real-time hands-on operation by the various ERTS investigators are apparent.

The CDU-200 and the fully-interfaced VP-8 image analyser are presently in the final stages of assembly at ISI's plant in Lawrence, Kansas. Following the hardware check-out in late April, the basic software for operation of the system will be completed and debugged in early May. We hope that it will be possible for Mr. Robert Porter, project 110-1 programmer, to participate in the final tests. The manufacturer has scheduled delivery of the complete system in Fairbanks on May 25, 1973. On the basis of our visit at ISI in March, and subsequent telephone conversations, we believe that a May 25 delivery is realistic and will be met. It is now clear that previous unmet delivery schedules were the results, not only of delayed component deliveries, but also of honest but grossly overoptimistic estimates of the amount of effort necessary to assemble and debug this very complex equipment. It is expected that, upon delivery of the system, the VP-8 image analyser will be immediately available for operation by U of A investigators (the stand-alone VP-8 was in fact operational in March and was utilized by project 110-1 personnel). We have furnished to ISI test tapes, processed ERTS digital tapes and the associated ERTS photographic products. Therefore we also expect that the CDU-200 will be performing ERTS data analyses with a few days of its installation; however its full capabilities will not be achieved for several weeks because specialized computer programs will need to be prepared for various types of classification schemes.

c. Development of ERTS Data Processing Techniques

Because the purpose of project 110-1 is to develop data processing techniques for the use of the other 11 U of A ERTS projects, a balanced approach of photographic, optical and digital data processing has been followed.

Photographic and optical data processing: This aspect of project 110-1 activities has been completed to the extent specified in the ERTS contract and within the funding available for this purpose. The techniques which have been developed are described in detail in the semi-annual technical report and the revised data handling plan submitted in February, 1973.

Digital data processing: This aspect of project 110-1 activities probably will not be completed until the end of July, primarily because the color display unit, CDU-200, will not be delivered by the manufacturer until May 25, 1973, that is seven months behind schedule (see previous section of this report). All the preparations that can be made prior to delivery of the system have been performed. It is expected that some ERTS analyses utilizing the CDU-200 can be performed within a few days of the installation of the system, but the development and testing of the more complex computer programs (in machine language) for various classification schemes will need to await delivery of the CDU-200.

In the absence of the CDU-200, digital processing techniques utilizing the U of A IBM 360 computer and typewriter print-outs have been developed and have been utilized by U of A ERTS investigators for several weeks. In particular a supervised classification scheme has proven to be very effective for vegetation analyses (projects 110-3 and 110-14). Unfortunately the delay of the CDU-200 has caused additional programming and computer costs to accomplish tasks which were expected to be performed more effectively by use of the CDU-200. As a result, project 110-1's funds for the development of digital data processing techniques are running dangerously low, and it will be necessary during the next period, before the CDU-200 is delivered, to both conserve funds and seek University funding to complete this aspect of our activities.

The impact of the delayed delivery of the CDU-200 on the other U of A projects is actually not as severe as it might seem because it has prompted the projects which planned extensive use of the CDU to adopt a more balanced approach to ERTS analyses and interpretation.

Their utilization of photographic and optical data processing techniques has had the desirable impact of providing greater appreciation for the applicability and limitations of ERTS imagery and better conceived plans for digital data processing. In addition the availability (after May 25) of the VP-8 image analyser, which was not originally included in the CDU-200 system, will provide an extremely valuable capability for low-cost density slicing of ERTS and aerial photographs. This capability will be particularly valuable for analyses of snow cover by projects 110-4, 5 and 13 and coastal sedimentation patterns by projects 110-8 and 110-9 who have received so far little useful ERTS data. Therefore, although we deplore the delayed delivery of the CDU-200, we feel that the much increased capability and versatility of the combined CDU-200 and VP-8 system will partially offset the unfavorable impact of the delay.

2. Plans for the next reporting period

- a. Coordination - These activities will continue at approximately the same level of effort and will include:
 - a general meeting of U of A ERTS investigators at the end of May when the CDU-200 and VP-8 image analyser are delivered.
 - frequent consultations with investigators and graduate students involved in the U of A ERTS program.
 - receipt, cataloguing and transmittal to investigators of 1973 ERTS data, and assistance in the preparation of ERTS data requests.
 - revision and preparation of the ERTS-1 symposium paper by Miller and Belon for inclusion in the special NASA brochure on the applications and benefits of the ERTS program.
 - presentation of a remote sensing short course in Juneau during April 2 - 6 for ERTS users in state and federal agencies.
- b. Establishment of ERTS data processing facilities

We will monitor closely ISI's progress in the final assembly of the CDU-200 hardware and software, and we hope to participate in the final check-out of the system in Lawrence, Kansas, prior to delivery on May 25, 1973.
- c. Development of ERTS data processing techniques

Since the optical and photographic techniques have already been developed, we will concentrate our activities on the supervision of the performance of the work orders for the other projects by project 110-1 technical staff. In particular a serious attempt will be made to lower the cost of data processing while maintaining superior quality standards by pooling work orders for the same basic data products.

Until the CDU-200 and VP-8 system are delivered, we will conserve funds budgeted for the development of digital data processing techniques, and we will confine our activities to the supervision of digital data processing for the other U of A ERTS projects.

- E. SIGNIFICANT RESULTS:
None beyond those described in the publications listed below and mentioned in previous reports.
- F. PUBLICATIONS:
Miller, J. M. and A. E. Belon, A Multidisciplinary Survey for the Management of Alaskan Resources Utilizing ERTS Imagery, NASA ERTS-1 Symposium, Washington, D.C., March 1973.

Anderson, J. H., L. Shapiro and A.E. Belon, Vegetative and Geologic Mapping of the Western Seward Peninsula, Alaska, Based on ERTS-1 Imagery, NASA ERTS-1 Symposium, Washington, D. C., March 1973.

Anderson, J. H. and A. E. Belon, A New Vegetation Map of the Western Seward Peninsula, Alaska, Based on ERTS-1 Imagery, Interim scientific report, NASA contract NAS5-21833, February, 1973.
- G. RECOMMENDATIONS:
None
- H. CHANGE IN STANDING ORDER FORMS:
None
- I. ERTS IMAGE DESCRIPTOR FORMS:
None because no new ERTS data were received during reporting period.
- J. ERTS DATA REQUEST FORMS:
One submitted on 1 February 1973. (data received)