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SECOND QUARTERLY PROGRESS REPORT

LANDSAT FOLLOW-ON INVESTIGATION

NO. ~~21300~~
21300

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- A. TITLE OF INVESTIGATION: LANDSAT Survey of Near-Shore Ice Conditions Along the Arctic Coast of Alaska
- B. PRINCIPAL INVESTIGATOR: Dr. William J. Stringer
- C. PROBLEMS IMPEDING INVESTIGATION: None
- D. PROGRESS REPORT:

1. Accomplishments This Reporting Period:

- a. Presentation of Scientific Paper. A paper "Ice Motions in the Vicinity of a Grounded Floeberg" was presented at the Port and Ocean Engineering Under Arctic Conditions (POAC) Conference held in Fairbanks during August 1975. This work was partly described under 'Significant Results' in our first quarterly report.
- b. Compilation of Prior-to-Contract LANDSAT Data of Ice Conditions Along Alaskan Coast. 1:2,500,000 maps of Alaska were prepared showing the center points of all Alaskan coastal LANDSAT data with less than 20% cloud cover. One map was made for each major sea-ice related coast (Beaufort, Bering, Chukchi) for each LANDSAT cycle.
- c. Acquisition of Hard Copy LANDSAT Sea Ice Data. The maps developed in 'b' were used as a guide to determine which LANDSAT cycles gave the best coverage of the areas under consideration. Then hard copy of 1:500,000 scale of all data for selected cycles were ordered from the Sioux Falls laboratory. Generally, for each ice year one very early (February-March) and one late (June-July) cycle was selected. The cost of this order was divided among a number of projects, this project funding approximately one-third the entire order.
- d. Preparations to Map at 1:500,000 Scale Completed (see Section D.2.a). A major problem encountered when attempting to map near shore ice conditions along a snow-covered coast is that the shore line often is not recognizable over an entire LANDSAT image, but yet pressure ridges, leads and other ice features are very easily recognized. To solve this problem, clear plastic overlays have been prepared from a 1:500,000 map base which show the coast, and sufficient major topographical features such that the image and map may be brought into registration. Ice maps are then prepared by tracing pertinent information from this superimposed pair.

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 (E76-10070) LANDSAT SURVEY OF NEAR-SHORE
 ICE CONDITIONS ALONG THE ARCTIC COAST OF
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Using a pantograph, bathmetric data was transferred from standard U.S. Coast and Geodetic Survey maps to these overlays. This was a time-consuming but very important accomplishment. Many near-shore ice features are related to bathmetry and this relationship must be taken into consideration. Yet the existing detailed charts have been prepared at a wide range of scales from 1:700,000 to 1:400,000. This made necessary the rather tedious work with the pantograph.

- e. Aircraft Data Was Obtained. See Section J.1., "Aircraft Data".
- f. Preparation of Sea-Ice Maps Begun. Using 1:500,000 hard copy LANDSAT data and overlays described above, maps of near shore ice conditions for the Beaufort Sea during 1974 have been made for the earliest complete LANDSAT cycle. These maps represent only the first step towards analysis of ice conditions for that year. Some preliminary analysis has been greatly enhanced by the availability of NASA-provided U-2 photography along the Beaufort Sea coast for that year. (See plans for next reporting period.) (See also Section J.2. on the utility of U-2 photography.)

2. Accomplishments by Others this Reporting Period Directly Related to this Project

- a. 1:500,000 scale color-additive viewer. The University of Alaska LANDSAT coordination program has obtained a 1:500,000 scale I²S color-additive viewer to replace the existing I²S 1:1,000,000 scale color-additive viewer previously available. This is a significant accomplishment, greatly enhancing our data analysis capabilities.

E. INTERACTION WITH OTHER INVESTIGATORS AND AGENCIES

1. Communications with the Habitat Protection Division, Alaska Department of Fish and Game have established that a significant benefit to their coastal zone management tasks could be obtained from certain aspects of this study as currently planned and also from a small amount of additional work not anticipated. We plan to work as closely with this potential user of our data as possible, still keeping in mind that as interest in petroleum exploitation along the Alaskan coast increases, there will be many other interested groups and agencies and we should still follow our initial objectives of studying and locating hazardous ice conditions along these coastal areas.

F. PLANS NEXT REPORTING PERIOD

During this period we will concentrate on producing maps of ice conditions along the Alaskan coast. Hard copy LANDSAT data described above will be used for beginning and end of ice season maps. The color-additive viewer will be used to produce maps intermediate of those times. Some interpretation will be made

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but it would be unwise to concentrate on this aspect of the project until ice conditions from year to year can be studied and compared. This mapping process should be nearly completed by the end of the next reporting period.

G. RECOMMENDATIONS

We again recommend that low sun-angle LANDSAT data of the Alaskan coastal areas be obtained. Not only would this extend the time of coverage of data into the ice season, but also the low sun-angle enhances identification of many ice features -- particularly pressure ridges.

H. FUNDS EXPENDED

As of August 30, 1975, the total funds expended by this project were \$7,176, from a total budget of \$28,337.

I. DATA USE

Value of data allowed	Value of data ordered	Value of Data Received as of 9/30/75
\$5,900	Standing Order	\$2,201.75

J. AIRCRAFT DATA

1. Recent Data Acquisition. As part of the Outer Continental Shelf environmental assessment program, a U. S. Geological Survey aircraft flew a reconnaissance flight from Barrow to Cross Island during June 1975. Side-looking airborne radar and wide-angle panchromatic photography were obtained. This data has been archived at the remote sensing library at the University of Alaska and will be a valuable asset to this project.
2. Utility of NASA-Provided Photography. Mention was made in Section D.1.f. of NASA-provided U-2 photography. We have found this color-infrared photography to be of great value in interpreting LANDSAT imagery. We plan to analyze the LANDSAT data coincident with this photography in great detail before analyzing other LANDSAT scenes. Based on our examinations to date, our confidence in LANDSAT's ability to distinguish ice conditions has been enhanced well beyond earlier expectations. It should be noted that this photography was obtained in early July, toward the end of the normal ice season. At this late date, the snow had long since melted from the ice, baring the structure of various ice features for close examination.

K. PUBLICATIONS

1. Attached is a copy of The Northern Engineer containing our article on Katie's Floeberg.

2. The written version of the paper "Ice Motions in the Vicinity of a Grounded Floeberg" is in preparation and should be available shortly.

L. SIGNIFICANT RESULTS

See attached sheet.

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TITLE: LANDSAT Survey of Near-Shore Ice Conditions along the Arctic Coast of Alaska

PRINCIPAL INVESTIGATOR: William J. Stringer

DISCIPLINE: Oceanography

SUBDISCIPLINE: Ice Dynamics

SUMMARY OF SIGNIFICANT RESULTS: Comparison of late season U-2 color infrared sea ice photography and early ice season LANDSAT sea ice imagery has made possible the identification of subtle features seen on early season LANDSAT imagery in the near shore areas. The U-2 imagery positively linked these features to ice conditions generally not observable by LANDSAT because of the time of year when they take place. In particular, ice formed in place largely as single sheets appears light while ice deformed by considerable rafting appears darker when viewed on LANDSAT imagery. Because the ice is snow-covered at the time this imagery is obtained, this underlying structure must be revealed by the topography of the snow surface, and the resulting light-scattering characteristics.