E73-10226
TMX-68926

MARINE RESOURCES AND OCEAN SURVEYS

Charles Cavert Room

Chairman, J. R. Greaves, (GSFC)

Co-chairman, E. L. Tilton, (ERL, MTF)

(E73-10226) MARINE RESOURCES AND OCEAN SURVEYS (NASA) 21 p HC $3.25 CSCL 08J

N73-17435
THRU
N73-17455
Unclas
G3/13 00226

E73-10227

Paper M 1

SEASONAL CHANGES OF LITTORAL TRANSPORT AND BEACH WIDTH AND RESULTING EFFECT ON PROTECTIVE STRUCTURES

Turbit H. Slaughter, *Geologist, Maryland Geological Survey, The Johns Hopkins University, Baltimore, Maryland*

ABSTRACT

The shorelines of Maryland's portion of the Chesapeake Bay exhibit seasonal changes in direction of littoral transport and resulting beach width. Observation and study of this process at selected locations emphasizes the necessity of study for a complete years seasonal cycle before stating erosion rates of an area to be protected by structures and the cyclincal presence or absence of beaches.

The purpose of this paper is to describe seasonal beach conditions at six selected sites and resulting physical changes to protective structures. The seasonal changes will be shown by 35mm slides of the sites and of ERTS-1 underflight photography of these sites. Through the use of ERTS-1 multi-spectral photography, it will be possible to make widespread predictions elsewhere in the Bay as a direct aid in protective structure design.

E73-10228

Paper M 2

RECOGNITION OF BEACH AND NEARSHORE DEPOSITIONAL FEATURES OF CHESAPEAKE BAY

Randall T. Kerhin, *Geologist, Maryland Geological Survey, The Johns Hopkins University, Baltimore, Maryland*

ABSTRACT

Beach and nearshore depositional features are being mapped with the objectives of determining a quick-look analysis of littoral drift and sedimentation patterns in areas of little or no data. Evaluation of beach and nearshore features aided in the selection of small boat harbors, shoreline protective structures, and general coastal zone development.

Through ERTS-1 aircraft support imagery, beach depositional features mapped are cuspate forelands, welded beach ridges, and recurved spits. The nearshore depositional features exhibit a bar and trough topography with three distinct types of sedimentary structures; longshore, transverse, and reticulated bars. Synoptic coverage of beach and nearshore depositional features by ERTS-1 data help in determining the general sedimentation patterns, growth of the beach features and stability of the bar and trough topography.

E73-10229

Paper M 3

APPLICABILITY OF ERTS-1 IMAGERY TO THE STUDY OF SUSPENDED SEDIMENT AND AQUATIC FRONTS

V. Klemas, R. Srna, W. Treasure, *College of Marine Studies, University of Delaware, Newark, Dela.*

ABSTRACT

Imagery from three successful ERTS-1 passes over the Delaware Bay and Atlantic Coastal Region have been evaluated to determine visibility of aquatic features. The overpasses took place on August 16, October 10, and December 3, 1972, with cloud cover ranging from about zero to twenty percent. Visual inspection, density slicing and multispectral analysis of the imagery revealed strong suspended sediment patterns and several distinct types of aquatic interfaces or frontal systems. Measurements from boats and photography from low altitude aircraft, performed before and during the satellite overpasses, permitted a limited degree of correlation between satellite and ground data on the type and quantity of suspended matter. In the upper and middle bay the interfaces intended to align along the flow axis of the river or parallel to the shoreline. At the mouth of the bay, there were fronts which were oriented at right angles to the flow axis and were strongly influenced by tidal conditions. The first type of interface tended to persist over most of the tidal cycle and could usually be associated with a strong change in color and turbidity, with Secci depths changing from 0.6 – 1.2 meters to 1.4 – 2.2 meters as one crossed it. The second type of interface was primarily a salt water intrusion during incipient flood tide, with associated discontinuities in salinity and temperature. The water samples contained sand particles in shallow areas while silt was predominently present in deeper waters. Multispectral scanner band 5 (0.6 – 0.7 microns) gave the sharpest definition of interfaces between waters of differing turbidity. Band 4 (0.5 – 0.6 microns), due to its deeper water penetration, was more sensitive to patterns having lower turbidity, yet was veiled by a uniform blanket of atmospheric scattering making identification of sediment patterns more difficult. Band 6 (0.7 – 0.8 microns) and band 7 (0.8 –1.1 microns) clearly delineated the shoreline and discriminated water from land in the marshes.

E 73-10230

Paper M 4

CORRELATION OF ERTS MULTISPECTRAL IMAGERY WITH SUSPENDED MATTER AND CHLOROPHYLL IN LOWER CHESAPEAKE BAY

D. E. Bowker, *NASA-LANGLEY Research Center, Hampton, Virginia* and P. Fleischer, T. A. Gosink, W. J. Hanna, and J. C. Ludwick, *Old Dominion University, Norfolk, Virginia*

ABSTRACT

The feasibility of using multispectral satellite imagery to monitor the characteristics of estuarine waters is being investigated in this study. Preliminary comparisons of MSS imagery with suspended matter concentrations, particle counts, chlorophyll, transmittance and bathymetry have been made. Visual correlation of radiance with particulates and chlorophyll has been established. Effects of bathymetry are present, and their relation to transmittance and radiance is being investigated. Greatest detail in suspended matter is revealed by MSS band 5, whereas chlorophyll is best detected by band 4. Near-surface suspended sediment load and chlorophyll can be observed in band 6.

Images received to date have partially defined extent and location of high suspensate concentrations. Turbid water of the James River enters Chesapeake Bay as a plume that can be traced along the southern shore and extends seaward to Cape Henry. An area of highly variable turbidity exists in the lower Bay between Hampton and Cape Charles, and may be related to strong tidal currents and large-scale bedforms found here. Net quantity of suspended matter in the lower Bay has been decreasing since the inception of the study, and represents the diminuition of turbid flood waters carried into the Bay in Summer, 1972. The results so far point to the utility of MSS imagery in monitoring estuarine water character for the assessment of siltation, productivity, and water types.

E73-10231

Paper M 5

PLUME DEVELOPMENT IN LONG ISLAND SOUND OBSERVED BY REMOTE SENSING

Frederick H. Ruggles, Jr., *U. S. Geological Survey, WRD, Hartford, Connecticut*

ABSTRACT

As the Connecticut River flows into Long Island Sound, large plumes are developed during the mixing of ocean and estuarine waters. Plumes were delineated for July 28, October 8, October 27, and December 2, 1972, by analyzing ERTS-1 imagery with the SRI Electronic Satellite Image Analysis Console (ESIAC). Insertion of MSS band 5 into the ESIAC produced the best result in this analysis. The four plumes that have been delineated provide the first input to a time-lapse analysis of circulation patterns at the eastern end of Long Island Sound.

E73-10232

Paper M 6

OBSERVATIONS OF SUSPENDED PARTICLE PATTERNS IN NEARSHORE NORTHEASTERN PACIFIC OCEAN WATERS BY ERTS-1 IMAGERY

Paul R. Carlson, Richard J. Janda and T. John Conomos, *U.S. Geological Survey, Menlo Park, California 94025*

ABSTRACT

The principal sources of nearshore turbid water seen on ERTS multispectral scanner imagery are river effluents, actively eroding headlands and coastal landslides, production of planktonic organisms, and waste effluents. Changes in the location and configuration of turbid water masses are related to variance in river discharge, intensity of surf action, and direction of nearshore currents, as well as availability of suspended particles. The large areal coverage of ERTS images has allowed comparison of the size, distribution, and gray shade (color) of adjacent river effluent plumes such as those associated with the Eel, Klamath, and Smith Rivers of the northern California coast. Variations in plume characteristics, best seen on the green and red bands, can also be related to differences in landforms and land use within these contributing river basins observed on the same image. Different turbid nearshore water masses are shown by dissimilar spectral signatures on ERTS imagery. These signatures apparently reflect differences in the relative proportions of lithogenous and biogenous suspended particles in distinctive water masses. The 18-day observation cycle allows definition of seasonal and storm-related variations in effluent dispersal patterns. Documentation of spatial and temporal distribution of turbid nearshore surface waters observed on ERTS images, when applied to studies of coastal currents and sediment distribution patterns, can provide a better data base for planning wise use of coastal resources.

E73-10233

Paper M 7

NEW INSIGHTS INTO THE COASTAL MARINE ENVIRONMENT OF THE BEAUFORT SEA FROM FIELD DATA AND ERTS-1 IMAGERY

Peter W. Barnes and Erk Reimnitz, *U. S. Geological Survey, Menlo Park, California*

ABSTRACT

Adjoining one of North America's largest petroleum reservoirs in northern Alaska is one of the nation's least known continental margins. Many of the marine geologic concepts developed from studies in lower latitudes cannot be applied here. Exploration and development activity, soon extending offshore, and increased needs for shipping by sea make the requirements for background knowledge for this area extremely urgent.

An extensive field program in the coastal Beaufort Sea test site area was completed during the spring and summer of 1972 using a wide variety of sensing techniques. Field data and ERTS-1 imagery have shown that the coastal environment is influenced by a complex of unique processes, most of which involve or are related to sea ice.

Active sedimentologic processes along the Arctic coast begin with the melting, flooding, and eventual overflow of rivers onto the sea ice. It is now apparent that only minor amounts of sediment are transported offshore at this stage. However, scouring of the sea bottom is significant at this time beneath strudels (drain holes) which develop in the fast ice canopy in the region of overflow.

Later in the season, during the period of maximum melting (late June and July), three water types interact - river effluents, sea-ice melt water, and sea water. On a transect normal to the coast, temperature and turbidity decrease with increasing distance from river mouths, which are sources of warmer, sediment-laden waters. Along the same transect, surface salinity values first increase then decrease owing to the melt-water contribution of pack ice offshore. Aerial patterns of temperature, salinity and turbidity, together with ERTS-1 imagery, delineate a region of consistently colder, saltier, and clearer water near the coast just east of the Colville River in Harrison Bay, suggesting an area of upwelling or a persistent clockwise circulation in the bay.

Shelf currents, especially bi-directional and parallel to the coast, are strong (up to 125 cm/sec), but intermittent. Spacecraft imagery and aerial photography often show the direction of these currents by wakes and downstream trails of smaller ice bits behind grounded ice blocks. Drifting ice movement is closely associated with the coastal wind directions, especially in shallow bays. Ice-movement vectors, generated from repetitive, overlapping images, indicate displacements of identifiable ice blocks of up to 22 km per day. The newly formed bay ice moves essentially downwind, whereas pack ice 100 km offshore displays the influence of both wind drift and current.

Drifting ice runs aground along depth contours corresponding to its draft. Ice "reefs" appear in the imagery often neatly outlining topographic highs as loci of grounding. Bathymetric, diving and side-scan sonar observations confirm intensive gouging in the seaward slopes of such highs.

E 73-10234

Paper M 8

ERTS-1 OBSERVATIONS OF SEA SURFACE CIRCULATION AND SEDIMENT TRANSPORT, COOK INLET, ALASKA

F. F. Wright, G. D. Sharma and D. C. Burbank, *Institute of Marine Science, University of Alaska, Fairbanks, Alaska*

ABSTRACT

Cook Inlet is a large, tide-dominated estuary in southern Alaska. Tidal amplitudes greater than 12 m occur in the upper inlet; currents in excess of eight knots (14 KPH) are routine. Much of the hinterland is still glaciated so large volumes of sediment-laden runoff are introduced into the upper inlet, near the city of Anchorage. This turbid water serves as an excellent tracer for surface circulation and fine sediment transport in the lower inlet.

Oceanographic cruises were conducted in August and September, 1972, to observe water characteristics during ERTS orbits. Temperature, salinity, sediment load, and other parameters were measured throughout the inlet. Salinity and temperature were within normal high latitude limits; suspended sediment concentrations were over 1000 mg/1 in the upper inlet. Because of weather, usable ERTS images were not obtained until November, 1972, but the MSS imagery considerably clarifies the ground truth observations. Analysis is incomplete, but ERTS data makes it clear that coriolis effect dominates circulation in the lower inlet. MSS-4 images, in particular, show the surface circulation of sediment-laden waters. Comparison of MSS Bands 4 and 5 and ground truth observations suggest MSS-4 penetration into the water column of several meters. Resolution has consistently exceeded expectations. Repetitive ERTS imagery of Cook Inlet permits the identification of pollutant trajectories, tidal rip currents, and overall assessment of surface circulation in Alaska's population and industrial center.

E73-10235

Paper M 9

SEDIMENT DISTRIBUTION AND COASTAL PROCESSES IN COOK INLET, ALASKA

Duwayne M. Anderson, Lawrence W. Gatto and Harlan L. McKim, *U. S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire 03755*

ABSTRACT

Regional hydrologic and oceanographic relationships in Cook Inlet, Alaska have been recognized from sequential ERTS-1 MSS imagery. Coastline configuration is well defined on bands 6 and 7 of images 1103-20513, 1103-20520, 1103-20522, 1104-20572, 1104-20574 and 1104-20581. Current patterns are visible in the inlet because of differential concentrations of suspended sediment. These patterns are most evident on bands 4 and 5. The circulation patterns within Cook Inlet are controlled primarily by the interaction between the semi-diurnal tides and the counter clockwise Alaska current. In general, heavily sediment laden water is seen to be confined to portions of the inlet north of the Forelands and west of Kalgin Island. Tongues of clear oceanic water are observed to enter the inlet through Kennedy Channel along the east shoreline in the vicinity of Cape Elisabeth. A recurring counterclockwise circulation pattern observed around Kalgin Island seems to result from the interplay of the northerly moving water along the east shore and the southerly moving, sediment laden, water along the west side of the inlet. Prominent, fresh water plumes, heavily laden with sediment are visible at the mouths of all major rivers. Relict plumes from as many as three tidal stages have been recognized. Tidal flats and a number of unmapped cultural features appear prominently in bands 5 and 6 of a number of images.

E73-10236

Paper M 10

DISTRIBUTION AND MOVEMENT OF SUSPENDED SEDIMENT IN THE GULF OF MEXICO OFF THE TEXAS COAST*

Ralph E. Hunter, *U.S. Geological Survey, Corpus Christi, Texas*

ABSTRACT

ERTS-1 imagery has proven very useful in studies of the distribution of suspended sediment in the Gulf of Mexico off the Texas coast. Moreover, by using suspended-matter concentrations as tags on water masses, much information on water movement can be obtained. The utility of suspended sediment as a tracer is dependent on the sediment remaining in suspension long enough to travel appreciable distances. Although the evidence is not conclusive, it seems likely that much of the suspended sediment in Gulf nearshore waters at any one time has remained in suspension since the time of its entry into the Gulf through rivers and tidal inlets.

Superimposed on the general offshore decrease in turbidity are more complex local concentrations of turbid water which may be classified as plumes or as bands. A plume is attached to its source river or inlet during its growth, but at the end of an ebb tidal cycle, the plume from a tidal inlet becomes detached and drifts passively. Most bands are aligned either parallel or obliquely to shore. Water movement in some oblique bands is known to be toward shore, whereas in others it is away from shore. The bands may originate in several ways: by the deformation of plumes after detachment from their source at a tidal inlet; by the concentration of suspended sediment in certain parts of helical circulation cells; by the concentration of suspended sediment in the convergence or divergence zones between water masses; or by drift along streamlines from localized sources, such as river mouths, where suspended sediment is being continuously supplied.

*Publication authorized by the Director, U. S. Geological Survey

E-33-10237

Paper M 11

OCEANOGRAPHIC MAPPING OF STRUCTURE AND DYNAMICS OF THE NORTHERN GULF OF CALIFORNIA BY THE USE OF SPECTRAL MODELING AND ERTS-1

L. K. Lepley, Gustavo Calderon and J. R. Hendrickson, *Office of Arid Land Studies, University of Arizona*

ABSTRACT

Distribution and flow of water masses at four depth intervals were determined by analyzing ERTS imagery through the use of optical models of classes of vertical oceanographic profiles. Data used for these models was obtained from shipboard measurements including surface spectral radiance, and optical and more conventional oceanographic depth profiles. The spectral models obtained were applied to radiance-contoured ERTS imagery in bands 4, 5, 6, and 7.

Features mapped by direct photo-interpretation of ERTS imagery include submerged shoals, current streamlines, and location of possible upwellings, downwellings and submarine springs.

Paper M 12

E 73-10238

OCEANOGRAPHIC FEATURES IN THE LEE OF THE WINDWARD AND LEEWARD ISLANDS: ERTS AND SHIP DATA

Kirby J. Hanson, *NOAA, Environmental Research Laboratories, AOML/SAIL, 15 Rickenbacker Causeway, Virginia Key, Miami, Florida 33149*

ABSTRACT

Analysis of the ERTS data in portions of the eastern Carribbean are presented for October, 1972 showing features which are, as yet, not explained.

Ground truth data obtained in that area during November, 1972 are presented. These include vertical temperature structure in the mixed layer and thermocline, and surface measurements of salinity, temperature, and chlorophyll.

The application of these studies to fisheries management is discussed.

E73-10239

Paper M 13

REMOTE SENSING OF OCEAN CURRENTS USING ERTS IMAGERY

George A. Maul, *National Oceanic and Atmospheric Administration, Atlantic Oceanographic and Meteorological Laboratories, Miami, Florida*

ABSTRACT

Major ocean currents such as the Loop Current in the eastern Gulf of Mexico have surface manifestations which can be exploited for remote sensing. A time series to study certain aspects of the surface expression of this current was begun in August 1972. Surface chlorophyll-a concentrations, which cause the shift in color from blue to green in the open sea, were found to have high spatial variability; significantly lower concentrations were observed in the current. The cyclonic edge of the current is an active convergence zone which causes a peak in chlorophyll concentration. The dynamics also cause surface concentrations of algae, which have a high reflectance in the near infrared. Combining these observations gives rise to an "edge effect" imagery delimiting the current's boundary under certain environmental conditions. Frequently the sea-state in the current is higher than in surrounding water due to differential shear. When high seas introduce isotropic scatterers, white caps, and foam, the reflectance is dominated by scattering rather than absorption. This has been detected in ERTS imagery and used for current location. It raises the interesting prospect that multispectral sensing of ocean color is further complicated by sea state, or conversely, ERTS is a better sea-state sensor than ocean color sensor.

E73-10240

Paper M 14

USE OF ERTS DATA FOR MAPPING ARCTIC SEA ICE

James C. Barnes, *Environmental Research and Technology, Inc., Lexington, Massachusetts 02173*

ABSTRACT

The purpose of this investigation is to evaluate the application of ERTS data for detecting and mapping Arctic sea ice. The specific objectives are to determine the spectral bands most suitable for detecting ice, to measure the scale and types of ice features that can be detected, and to develop interpretive techniques for differentiating ice from clouds and for mapping ice concentrations. Because of the inaccessibility of the polar regions ice survey, which is required for both economic and scientific purposes, is by its very nature a problem that can benefit from space technology. The results of this study will lead eventually to the operational use of future satellite data and, thus, to a more cost effective means for ice survey.

The preliminary analysis of some 30 passes over the Arctic indicates that ice can be detected in the ERTS images because ice surfaces often have a higher reflectance than clouds, ice edges are usually more sharply defined than cloud edges, ice fits coastlines and islands, spatial frequencies of ice features are often different from clouds, and ice features can be identified from one day to the next when repetitive coverage is available. Ice features mapped from two passes crossing northern Hudson Bay and four passes crossing the Banks Island-Amundsen Gulf area in late July agree well with ice conditions depicted on concurrent ice charts. These analyses indicate that ice floes as small as the "small floe" (20 to 100 μm) can be detected.

The initial investigation of the multispectral characteristics of sea ice and other features has concentrated on a comparison between the MSS-4 (0.5 to 0.6 μm) and MSS-7 (0.8 to 1.1 μm) bands. Examination of these spectral bands in passes crossing the Beaufort Sea-Banks Island area and the Greenland Coast indicate that multispectral analysis is useful for distinguishing ice floes from surrounding brash ice and ice cakes, for detecting puddling on the ice surface as opposed to cracks or fractures through the ice, and for identifying broken cloud fields over ice surfaces. In areas of nearly solid ice cover, greater detail is evident at the MSS-7 spectral band primarily because differences in reflectance between ice floes, brash ice,and cracks and openings are greater. Also, reflectance variations within some ice floes, which are evident at MSS-7, may be associated with hummocks, ridges, or refrozen cracks.

E73-10241

Paper M 15

BIOMASS IN THE UPWELLING AREAS ALONG THE NORTHWEST COAST OF AFRICA AS VIEWED WITH ERTS-1

Dr. Karl-Heinz Szekielda, *University of Delaware, Newark, Delaware* and R. J. Curran, *NASA, Goddard Space Flight Center, Greenbelt, Md.*

ABSTRACT

The test site along the northwest coast of Africa represents an area with an arrid climate and high concentrations of phytoplankton caused by upwelling. The analysis of ERTS-1 data showed that plankton can be detected with channels 4 and 5 of the MSS. Ground truth measurements indicated chlorophyll concentrations up to 15 micrograms per liter. The correlation between continuous recordings of chlorophyll on the ground and observations with ERTS-1 show the potential in monitoring biomass and/or chlorophyll from space.

Heterogeneities and short-time fluctuations in the concentration of biomass were observed with ERTS-1. It is concluded that the structure of phytoplankton distribution as viewed with satellites can hardly be detected with the conventional measurements on board the research vessel.

E73-10242

Paper M 16

ERTS IMAGERY AS AN AID TO FISHERIES MANAGEMENT IN THE NORTHERN GULF OF CALIFORNIA

J. R. Hendrickson, Alfredo Cota, Gustavo Calderon and L. K. Lepley, *Department of Biological Sciences, University of Arizona*

ABSTRACT

Commercial fishing activity in the northern Gulf of California is presently a trial and error process, and product often varies widely with respect to area and time of catch. Monitoring and predictive processes could be expected to optimize fishing effort and support needed management activities.

Turbidity patterns, extent of intertidal exposure, and other oceanographic phenomena detectable by ERTS imagery were studied in relation to selected fisheries in the northern Gulf. Particular attention was given to local variations in the species composition of surface plankton relative to turbidity conditions, interpretation of migratory activity of a commercial fish species through use of ERTS-1 imagery, and mapping of commerical clam beds by synoptic satellite imagery.

E73-10243

Paper M 17

APPLICATION OF ERTS-1 IMAGERY TO THE HARVEST MODEL OF THE U.S. MENHADEN FISHERY

Paul M. Maughan, *Earth Satellite Corporation, 1747 Pennsylvania Ave., Washington, D.C. 20036*

ABSTRACT

Preliminary results of an experiment to demonstrate the utility of ERTS-1 imagery for providing significant information to the harvest model of the menhaden industry are reported. This "utilization" experiment (so described because of its industrial implications) is but one segment of a multi-agency, multi-experiment program undertaken cooperatively by the federal government and private industry. Participants in the study included Earth Satellite Corporation and the National Fish Meal and Oil Association, the National Marine Fishery Services' Fisheries Engineering Laboratory, Pascagoula Laboratory, and Beaufort Laboratory and the NASA Earth Resources Laboratory.

The objective of the utilization experiment was to define fish/environmental relationships that can be correlated with ERTS-1 observable oceanographic features. Fisheries and related environmental data were obtained discontinuously throughout the 1973 menhaden (a surface schooling, coastal species) fishing season in Mississippi Sound. The field data collection period began in June and terminated with the end of fishing at the end of October. Shipboard observations were taken from several commercial menhaden boats on an average of three days each week. Depending on weather and aircraft availability, low-level overflights were made on a weekly basis. During selected ERTS-1 transects, major field exercises were accomplished utilizing multi-level aircraft underflights and numerous surface vessels occupying specified positions. These "main days" provided the bulk of the concurrent multi-level, multi-platform data.

All cooperatively obtained surface and aircraft data were entered into a computerized ERTS-1 data bank, which is available to all participants. Each experiment therefore can utilize the full complement of data.

The unexpected complexity of the physical environment in Mississippi Sound precluded simplistic analysis of fish/environment relationships. Preliminary indications are that an association does exist between fish availability and differences in water transparency (turbidity) within the Sound. A clearer relationship is developing between major turbid features imaged by ERTS-1 and location of successful fishing attempts. On all occasions where relatively cloud-free ERTS-1 overflight days coincided with fishery activity, overlays of catch location on ERTS-1 images show an association of school position with interfaces between imaged turbid features. Analysis is currently underway to determine persistence of such associations in an attempt to define minimum satellite return time necessary to maintain continuity of associations.

Within the context of the menhaden harvest model, benefits which may accrue to the industry can be measured in terms of reduced dependence on spotter aircraft for generalized fish school location. The satellite repeat time is of critical importance to this application.

E73-10244

Paper M 18

PLYMOUTH AND DUXBURY BAYS, MASSACHUSETTS: SUBAERIAL AND SUBMARINE FEATURES DEPICTED ON MSS IMAGERY AS COMPARED WITH AERIAL PHOTOGRAPHY AND CONVENTIONAL MAPS AT 1:1,000,000; 1:250,000; AND 1:125,000 SCALES

Richard S. Williams, Jr., *U.S. Geological Survey, EROS Program Office, Washington, D.C. 20244*

ABSTRACT

A part of the July 28, 1972, ERTS-1 MSS scene (1005-15005) of southern New England, which includes the Plymouth and Duxbury Bays area of Massachusetts, has been specially studied because of the variety of subaerial coastal features (baymouth bars, shoals, etc.) and submarine details (shoals, dredged channels, etc.) depicted. MSS bands (NDPF) 4, 5, and 7 positive transparencies and a color composite transparency made from these bands were studied at 1:1,000,000; 1:250,000; and 1:125,000 scales. Subaerial coastal features are depicted at scales of 1:1,000,000 and 1:250,000 in considerably more detail than conventional maps at identical scales. Submarine detail is depicted at scales of 1:1,000,000; 1:250,000; and 1:125,000, with the 1:125,000, enlarged ERTS-1 image, comparable to the 1:125,000 color infrared aerial photograph at the same contact scale. At least to scales of 1:250,000 the ERTS-1 imagery of this environment provides two-dimensional coastal subaerial and submarine information superior to conventional map products.

Paper M 19

WATER DEPTH ESTIMATION WITH ERTS-1 IMAGERY

D. S. Ross, *International Imaging Systems, Mountain View, California*

ABSTRACT

Contrast-enhanced 9.5 inch ERTS-1 images were produced for an investigation on ocean water color. Such images lend themselves to water depth estimation by photographic and electronic density contouring.

MSS-4 and -5 images of the Great Bahama Bank were density-sliced by both methods. Correlation was found between the MSS-4 image and a hydrographic chart at 1:467,000 scale, in a number of areas corresponding to water depth of less than 2 meters, 5 to 10 meters and 10 to about 20 meters. The MSS-5 image was restricted to depths of less than 2 meters.

Where reflective bottom and clear water is found, ERTS-1 MSS-4 images can be used with density contouring by electronic or photographic methods for estimating depths in about 2, 5, and 10 meter steps, while MSS-5 images would indicate very shallow water.

E73-10246

Paper M 20

CALCULATIONS OF WATER DEPTH FROM ERTS-MSS DATA

Fabian C. Polcyn, *Environmental Research Institute of Michigan, Ann Arbor, Michigan*

ABSTRACT

ERTS-1 MSS data taken on October 10, 1972 of the Little Bahama Bank are being used to demonstrate the use of ERTS-1 data for mapping of shallow water features for the purpose of upgrading world navigation charts. Marked reflectance differences occur for the shallow water areas in Bands 4, 5, and 6. Digital processing of two adjacent data tapes within the ERTS frame covering an area of about 40 by 40 miles have been completed. Correlation of depth measurement at 1, 1-1/2, and 4 fathoms has been successful. A mathematical model for depth measurements using ratio of voltages in Band 4 and 5 has been successfully developed and is being tested for accuracy. Additional studies for areas near Puerto Rico and in Northern Lake Michigan will be undertaken. Satellite data will also provide geographical evidence for verifying existence or nonexistence of doubtful shoal waters now appearing on world charts and considered to be hazardous to shipping.