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College Station, Texas 77843

Research conducted through the  
Texas A&M Research Foundation

A&M Project 286-13

THE SPACE OCEANOGRAPHY PROJECT

STATUS REPORT

1 January 1968

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Report prepared 1 January 1968

by

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Project Supervisor

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## INTRODUCTION

This present status report covers the period from September 1, 1967 to January 1, 1968. Due to the University holiday schedule there were only sixteen working days in December, 1967 and so it seemed reasonable to include the month of December in this particular report. The background information of this effort as well as the scientific objectives aimed at with the present research program were stated in the Status Report on SPACE OCEANOGRAPHY PROJECT for February 1966 - October 1966.

Most of the investigations programmed in this project depend on the information obtained from the flights made with the research aircraft NASA 926 Convair 240 and the recently instrumented NASA 927 P3A.

Due to the inability to obtain the necessary ground truth facilities no missions were flown during this period.

## CURRENT PROJECT STATUS

Partially reduced apparent antenna temperature data taken during Mission #41 (February 24-25, 1967) by the MR 62 and MR 64 passive microwave radiometers on board the NASA 926 Convair 240 aircraft were received in December. Analysis of these data will begin soon by Jack Paris. These data will be compared with the data obtained by infrared and visible light sensors. Since no ground truth was collected during Mission #41, only qualitative comparisons will be made. The main objective of this particular study is to develop techniques to be used with the more accurate passive microwave data expected from the passive microwave radiometers scheduled for installation on board the NASA 927 P3A aircraft in August, 1968.

During the period covered by this report two position papers were prepared. Ground truth requirements necessary for successful utilization of aircraft and spacecraft remote sensing experiments were enumerated in one of these papers entitled, Ground Truth Requirements for Remote Sensing of Oceanographic Features by James E. Arnold, et al., pointed out that well-planned ground truth information was the basis of any useful results in determining the value of the remote sensing experiments.

Within the geographic area in which Texas A&M University is working, arrangements have been made to make maximum utilization of the R/V ALAMINOS for sea data and coastal stations for river discharge, temperature

and sediment content. From these sources we hope to gain a representative picture of the three dimensional structure of the ocean and the atmosphere within the test area.

In the second paper, Oceanographic Comment on APOLLO 501 Mission Photography by LCDR Don Walsh and James E. Arnold, the photography taken during the APOLLO 501 Mission was examined for oceanographic uses. It was pointed out that the recognizable surface features were the ice fields of the Antarctic and surface roughness given through the sun glint pattern. Ocean color itself was generally of uniform nature displaying none of the color gradations apparent in the GEMINI photographs. It was also apparent that a large percentage of the ocean surface was cloud covered, either by those in large scale atmospheric systems or by convection set up by the sea-air interaction processes. It is believed that the latter features may be used to some extent for examining the surface temperature field with careful interpretation. It is also important to have a knowledge of the cloud pattern behavior over various sea characteristics so that future remote sensing experiments may be effectively planned.

Ocean cloud cover can provide numerous complications in the sensing of the ocean surface by infrared methods. As was pointed out above, the ocean surface is cloud covered to a great extent. To complicate matters even more there are areas that appear cloud free from satellite altitudes but actually contain scattered oceanic cumulus. There are two obvious effects that propagate into the remote sensing

of the ocean surface. The first is that the color hue of the ocean surface changes, and the second is that infrared temperature data of the surface also contain cloud top pictures integrated together to produce a modified apparent surface temperature. It is apparent that this problem could provide serious difficulties from satellites at the height of the APOLLO Mission or from the more conventional weather observing satellites. Resolution at the GEMINI altitudes was sufficient to eliminate this problem.

Cloud photography taken on the over water portion of Mission #58 (August 30, 1967) from the Mississippi Delta to Tampa, Florida has been compared with satellite photography on the same day as well as with sea surface temperature patterns determined from commercial ship reports. It was found that the oceanic cumulus was most active in the region of warm water, as has been pointed out in a previous report, and that much of the small cumulus was not visible in the ESSA satellite photography.

Examination of the weekly composite sea surface temperature maps compiled from commercial ship reports reveals that, a correlation between the sea surface currents and surface temperature distribution might be feasible. There appears to be time consistent weakening and intensifying of temperature gradients in areas where known currents exist in the Gulf of Mexico. The applicability of this to satellite observed synoptic temperature patterns is obvious. An effort is being made to find a period when reliable NIMBUS radiometric data relatively free from cloud

contamination exists to examine NIMBUS IR temperature patterns of the Gulf of Mexico for synoptic temperature patterns. At the same time cloud effects are also being studied and their distortion of the temperature pattern as determined from ship reports.

## PROJECTED RESEARCH WORK

It is hoped that during the coming quarter the February cruise of the R/V ALAMINOS can be compared with the coming NIMBUS flight. It is our intention to compare cloud coverage obtained from all sky cameras and the sea surface temperature data taken on the ALAMINOS with the photographic and infrared data taken by the NIMEUS satellite. In this manner we hope to gain some idea of satellite observed temperature patterns in the Gulf of Mexico with those taken by the ship.

The examination will involve an attempt to determine the effect of ocean cumulus coverage on the satellite observed surface temperature features. The fine scale cloud features may be determined from the satellite photography. It is also planned to integrate the vertical temperature structure determined from the cruise data into an interpretation of the possible short term surface temperature changes as observed from the satellite.



## SUPPLEMENTARY INFORMATION

### A. Personnel

The following personnel are presently employed, full or part-time, on the Space Oceanography Project, Project 286-13. Personnel assisting with the project but not supported through the budget are also indicated.

Arnold, James E.	Co-Investigator
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Boykin, Rosemary E.	Technician II
Capurro, Luis R.A.	Principal Investigator
Cornelio, Hector	Technical Assistant II
*Franceschini, Guy F.	Co-Investigator
*Huebner, George L.	Associate Professor
*Ibert, Edward R.	Research Associate
*Leipper, Dale F.	Co-Investigator
Moyer, Vance E.	Co-Investigator
Paris, Jack F.	Research Assistant
Pehl, Corinne A.	Secretary
Thompson, A.H.	Co-Investigator
*Walsh, Don	Naval Officer

\* Personnel assisting with the project but not supported through the budget.

B. Staff Travels and Meetings Attended

September 15 - October 7, 1967 - Dr. Luis R.A. Capurro attended meetings of the Upper Mantle Project in Zurich, Switzerland.

September 20, 1967 - Dr. Dale F. Leipper attended a meeting of the Gulf Universities Research Corporation (GURC) for the planning of the Gulf Science Year here in College Station, Texas.

September 23, 1967 - Dr. Vance E. Moyer represented Texas A&M University at a briefing of GURC and National Aeronautics and Space Administration (NASA) at Clear Lake, Texas.

September 28, 1967 - Dr. Dale F. Leipper attended meeting of American Society for Oceanography in Houston, Texas.

September 29-30, 1967 - Dr. Dale F. Leipper attended a meeting of the Steering Committee of the Earth Sciences Curriculum Project in Denver, Colorado.

October 23, 1967 - Dr. Arnold H. Bouma attended GURC Annual Meeting in Dallas, Texas.

October 25-27, 1967 - Dr. Arnold H. Bouma attended meeting of the Gulf Coast Association of Geological Societies in San Antonio, Texas.

October 29 - November 4, 1967 - During this week LCDR Don Walsh was in Washington, D.C. on a trip sponsored by the Navy Office of Material.

The purpose of the visit was to provide a series of technical briefings on SPOC for the Office of Naval Material and the Oceanographer of the Navy. In all, three presentations were made on the Space Oceanography Program work done here at A&M.

November 7, 1967 - Dr. Dale F. Leipper met with personnel of the Bureau of Commercial Fisheries at Galveston, Texas for the coordination of future cruises with the Oceanography Department at Texas A&M.

November 19-21, 1967 - Dr. Dale F. Leipper and Mrs. Rosemary E. Boykin attended the Symposium on MANPOWER IN OCEANOGRAPHY held in Houston, Texas by the American Society for Oceanography. Dr. Leipper presided as President of the National Society.

November 19-22, 1967 - Dr. Edward R. Ibert and Dr. Arnold H. Bouma attended the Geological Society of America Annual Meeting held in New Orleans, Louisiana.

December 3-5, 1967 - Dr. Dale F. Leipper participated in the annual seminar of the Link Foundation held in New York City, New York.

December 6-7, 1967 - Jack F. Paris attended Earth Resources Aircraft Program Scheduling Conference at MSC/NASA, Houston. Overflights have been tentatively planned for Mission #66 and #71 in February 1968 and May 1968.

December 18, 1967 - March 30, 1968 - Dr. Luis R.A. Capurro will be participating in cruises in the Southwest Atlantic and Weddell Sea to measure currents and to study origin of the Atlantic Bottom Water. These cruises are sponsored by the National Science Foundation.

December 19, 1967 - Dr. Edward R. Ibert traveled to Austin, Texas to participate in the Gulf Science Year Panel meeting.

APPENDIX A

SPOC Data Bank

- GEMINI III - XII Missions, 70 mm Color Transparencies - Full set
- Mission #26, Flight 1, Mississippi Delta, 70 mm Reconofax IV (IR),  
Positive Imagery, Roll #1, July 6, 1966. CONFIDENTIAL
- Mission #26, Flights 2 & 3, Mississippi Delta, 70 mm Reconofax IV (IR),  
Positive Imagery, Roll #2, July 6, 1966. CONFIDENTIAL
- Mission #26, Flights 1, 2 & 3, Mississippi Delta, 35 mm AAS-5 (UV),  
Positive Imagery, July 6, 1966. CONFIDENTIAL
- Mission #26, Mississippi Delta, Nikon Plus-X, Data Panel, July 6, 1966.  
UNCLASSIFIED
- Mission #26, Mississippi Delta, RC-8, Black & White Photography,  
1200 Contact prints, July 6, 1966. UNCLASSIFIED
- Mission #34, Flights 6 & 7, Mississippi Delta and Timbalier Bay,  
RC-8, Plus X, Roll #1, Positive Print (transparency),  
October 17, 1966. UNCLASSIFIED
- Mission #34, Flights 6 & 7, Mississippi Delta and Timbalier Bay,  
Nikon Data Panel, Plus X, Roll #6, October 17, 1966.  
UNCLASSIFIED
- Mission #34, Flight 7, Mississippi Delta, Microwave Radiometry,  
October 17, 1966. UNCLASSIFIED
- Mission #35, Site 32, Weslaco, Texas, Approximately 30 foot section  
of Roll #1, from #8443, on SO-271. RC-8 Color Ektachrome  
IR Film, Duplicate Positives. UNCLASSIFIED
- Mission #37, Flight 1, Timbalier Bay & Haze Investigation over  
Mississippi Delta, RC-8 Color Ektachrome IR Film,  
Positive Transparencies, Roll #1, 2, & 3, December 14,  
1966. UNCLASSIFIED
- Mission #37, Flight 1, AAS-5 (UV), 35 mm, Positive Imagery, December 14,  
1966. CONFIDENTIAL

- Mission #37, Flight 1, Nikon Plus X, Data Panel, December 14, 1966.  
UNCLASSIFIED
- Mission #37, Flight 2, Mississippi Delta, Nikon Data Panel, Plus X,  
35 mm, Rolls 1 & 2, December 14, 1966. UNCLASSIFIED
- Mission #41, Mississippi Delta, Nikon Data Panel, Plus X, 35 mm,  
Duplicate Positive Transparencies, 24-25 February 1967.  
UNCLASSIFIED
- Mission #41, Mississippi Delta, AAS-5, (UV), 35 mm, 24-25 February 1967.  
CONFIDENTIAL
- Mission #41, Mississippi Delta, Reconofax IV, (IR), Positive Imagery,  
Rolls 1, 2 & 3, 24 February 1967. CONFIDENTIAL
- Mission #41, Mississippi Delta, Microwave Radiometry, 24 February  
1967. UNCLASSIFIED
- Mission #41, Mississippi Delta, Microwave Radiometer Data, Antenna  
Temperatures, 24 February 1967. UNCLASSIFIED
- Mission #41, Mississippi Delta, RC-8, Color Ektachrome IR, Positive  
Transparencies, Rolls 1-10, 24 February 1967. UNCLASSIFIED
- Mission #50, Mississippi Delta, Nikon Data Panel, Plus X, 35 mm,  
Duplicate Positive Transparencies, 12-16 June 1967.  
UNCLASSIFIED
- Mission #50, Mississippi Delta, Multi-Band Camera, Duplicate Positive  
Transparencies, 12 June 1967. UNCLASSIFIED
- Mission #50, Mississippi Delta, Reconofax IV, IR Imagery, Duplicate  
Positive Transparencies, 12 June 1967. CONFIDENTIAL
- Mission #58, Mississippi Delta, RS-7 Camera, Duplicate Positive  
Transparency, 30 August 1967. CONFIDENTIAL

T-38 Aircraft High Altitude Photography

- Mission #34, Timbalier Bay Area, 70 mm Color Transparencies, taken at  
50,000 feet, October 17, 1966. UNCLASSIFIED
- Mission #37, Mississippi Delta and Timbalier Bay Area, 70 mm Color  
and Color IR Transparencies, taken at 50,000 feet,  
December 14, 1966. UNCLASSIFIED

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