

DeSoto Canyon Eddy Intrusion Study

Annual Report: Year 2

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Author

Science Applications International Corporation

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615 Oberlin Road, Suite 300
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TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
	List of Figures	iv
I.	INTRODUCTION	1
II.	OVERVIEW AND CHRONOLOGY OF EVENTS	4
	2.1 Administration	4
	2.2 Cruise 2	4
	2.3 Special Cruise: Moorings B1 and D1	4
	2.4 Cruise 3	5
	2.5 Cruise 4	6
III.	DETAILS OF DATA COLLECTION AND ANALYSIS	7
	3.1 Time Series Data	7
	3.2 Hydrographic Data	7
	3.3 Ancillary Data	7
	3.4 Data Sharing	8

LIST OF FIGURES

<u>Figure</u>	<u>Caption</u>	<u>Page</u>
1	DeSoto Canyon Study Area	3

I. INTRODUCTION

This document describes progress by the Science Applications International Corporation (SAIC) team in accomplishing the principal objectives of the DeSoto Canyon Eddy Intrusion Study (Minerals Management Service (MMS) Contract 1435-01-96-CT-30825) during the second program year, July 1, 1997 through June 30, 1998. Briefly stated, the study objectives are to:

- document and analyze by means of *in-situ* current measurements, hydrographic data, and satellite images the Loop Current intrusions and interactions with the northeastern Gulf of Mexico (NEGM) slope. This study shall examine at a minimum the frequency and horizontal and vertical extent of these interactions and intrusions. Through the use of dynamical principles, a conceptual model shall be developed to explain how the Loop Current-slope interactions observed in the course of this study evolved;
- document and examine the dynamical processes of momentum, mass, and vertical vorticity exchanges that occur during Loop Current-slope interactions and other driving forces;
- estimate the frequency of Loop Current and secondary eddy interactions with the NEGM slope, and conduct and assessment of the vertical and horizontal current shears, exchanges of vorticity, momentum, and mass fields associated with these eddy-slope interactions; and
- elucidate the role of the DeSoto Canyon in Loop Current and eddy interactions and as a route of mass and momentum exchange between the shelf and deep water of the NEGM.

Three tasks are required to accomplish the listed objectives:

- (1) Field Work and Data Collection,
- (2) Data Reduction /Analysis and Synthesis, and
- (3) Program and Data Management.

Task 1 is being accomplished by SAIC scientists, principally Mr. James Singer, with assistance from Specialty Devices, Inc. of Plano, Texas. Task 2 will be accomplished by a team consisting of Drs. Peter Hamilton (SAIC), Tony Sturges (Florida State University (FSU)), Robert Leben (University of Colorado (CU)), Tom Lee (University of Miami (UM)), and Mr. James Churchill (Woods Hole Oceanographic Institution (WHOI)). Task 3 is the responsibility of Dr. Thomas Berger (SAIC - Program Manager) and Dr. Evans Waddell (SAIC - Data Manager).

The Louisiana Universities Marine Consortium (LUMCON) research vessel (R/V) Pelican is being used for all regularly scheduled cruises to deploy or rotate instruments and acquire hydrographic data. LUMCON is also providing logistics support and storage space to the program. Additional logistics support and storage of anchors is being provided by the Port of Pensacola.

The study area, mooring locations, and hydrographic lines are shown as PC ARCINFO coverages or ARCVIEW Shapefiles in Figure 1, superimposed on an AVHRR image on April 10, 1998, near the end of Cruise 4.

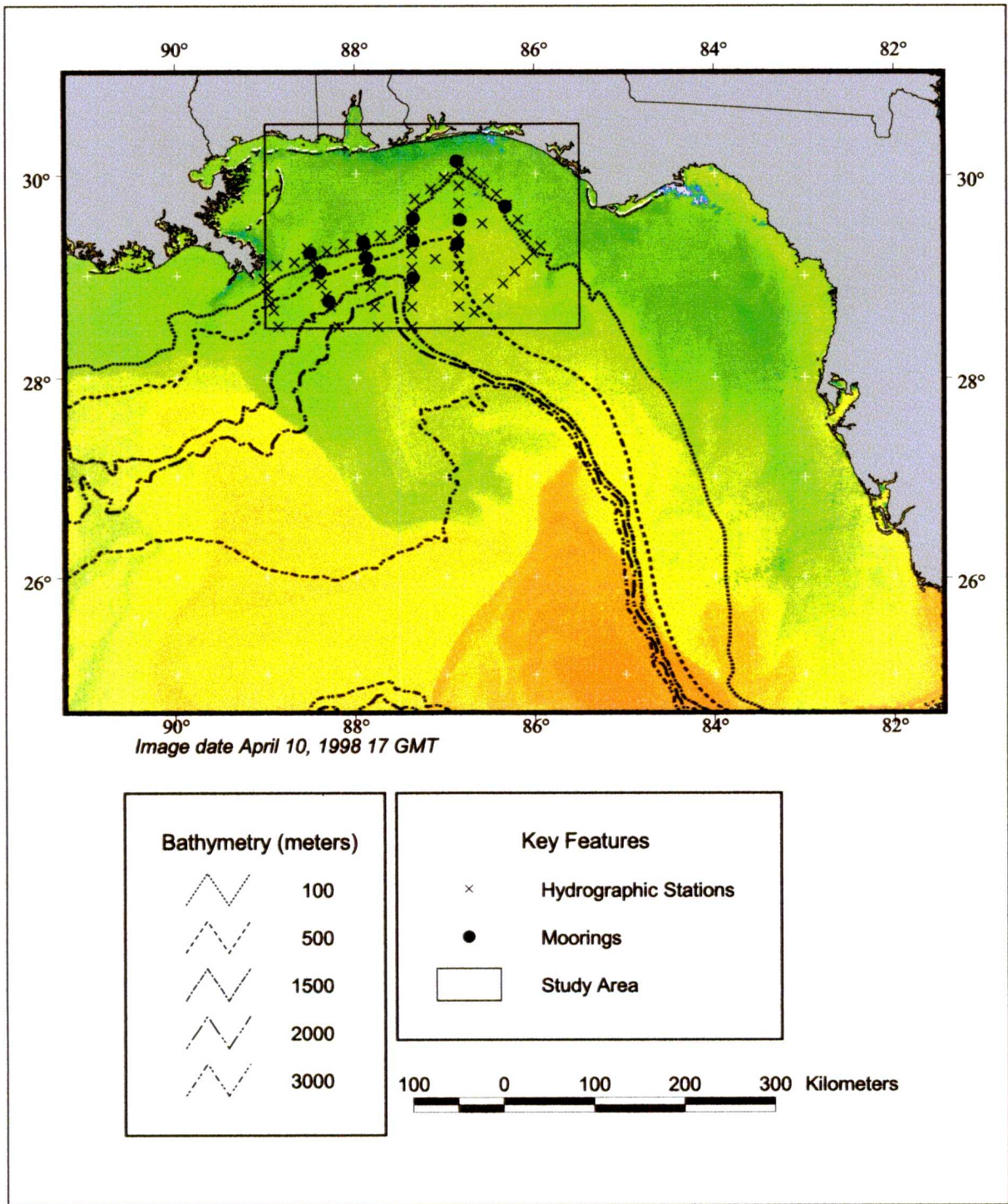


Figure 1. DeSoto Canyon Study Area.

II. OVERVIEW AND CHRONOLOGY OF EVENTS

This section briefly describes the activities completed from July 1, 1997 through June 30, 1998.

2.1 Administration

SAIC completed and submitted revisions to the original schedule to reflect actual cruise dates, based on negotiations with LUMCON. Additional surface marker buoys have been provided by MMS as GFE to replace buoys lost to vandalism and weather. The tether for the surface marker buoys has been redesigned.

The Program Manager, Data Manager and one PI attended the MMS Information Transfer Meeting (ITM) in December 1997. The Program Manager participated in joint meetings with participants in related programs being conducted in the northeastern Gulf of Mexico during a meeting at University of South Florida in St. Petersburg, Florida in April 1998.

2.2 Cruise 2

Cruise 2 was completed during July 8-19, 1997. This cruise took one day longer than planned due to the effects of Tropical Storm Danny, which forced the ship off station and prevented rotation of Mooring B1. Instruments on this mooring had sufficient memory to go until the next scheduled cruise in November, however the SeaBird SeaCAT CTDs and the Aanderaa RCM-7 were battery limited.

Mooring D1, the trawl resistant bottom mounted ADCP at the head of DeSoto Canyon, was not recovered although the acoustic release indicated release. The mooring was found about 200 m along the 100 m isobath from its initial position. This is an area of intense bottom fishing activity, at least seasonally.

2.3 Special Cruise: Moorings B1 and D1

In the previous report we noted that mooring D1 trawl resistant bottom mount could not be recovered and that Tropical Storm Danny prevented rotation of mooring B1. After several discussions between SAIC and MMS it was decided to schedule a special cruise in mid to late August to recover the bottom mount at D1 and rotate mooring B1. Plans were made to attempt recovery of the bottom mount by, ironically, using a shrimp trawl and to have an ROV on standby in Pensacola in case the trawl recovery was not successful. The decision was also made to replace the bottom mount with a conventional mooring similar to that in place at mooring A1. Note that during Cruise 2 a short mooring similar to

A1, but with an Aanderaa RCM-7 in place of the in-line ADCP, had been placed near D1 as a backup. This mooring was to be redeployed with an in-line ADCP (from old D1) as the new D1 mooring. During the same cruise mooring B1 would be rotated. Just prior to the cruise we received information that the surface marker at C1 was missing (the mooring had been rotated just before the appearance of Tropical Storm Danny) so replacement of the marker buoy was added to the tasks for the special cruise.

The special cruise was completed during August 19-22, 1997 using R/V TOMMY MUNRO. The first trawl at the D1 mooring actually snagged the mooring and raised it to the surface rather delicately balanced on the trawl's tickler chain, however the crew was unable to get a line on the mount and it returned to the bottom. Three more passes were made without success so the vessel proceeded to Pensacola to load the waiting ROV. This approach was successful and the bottom mount was back on deck about an hour and a half after the search began. Subsequently the standby mooring was recovered and the vessel returned to Pensacola to debark the ROV. The vessel then returned to the D1 site and deployed the taut-line mooring. Next the marker buoy at C1 was replaced. Finally the rotation of mooring B1 was accomplished. On approach the mooring the surface marker buoy was found to be missing, again presumably a casualty of Tropical Storm Danny, so the mooring was shortened to be similar to A1 by removing the uppermost 28" float, a SeaBird CTD and 40 m of wire.

On site evaluation of the D1 mooring failure to release was attributed to a corroded spring which was to provide tension on the release hook, a function performed on taut-line mooring by buoyancy of the floatation elements above the vertically oriented releases. The mooring will be returned to Flotation Technology in Maine at their expense for further detailed evaluation of the design. Evaluation of the remaining tether for the missing surface marker at B1 showed a fatigue failure of the bungee tether. Probably the same failure mode accounts for the loss of the marker at C1. The previous loss of the marker at E1 was caused by a cut tether, not storm action. The tethers will be redesigned and replaced during a later scheduled cruise. Hopefully the two missing marker buoys will be recovered and returned.

2.4 Cruise 3

Cruise 3 was completed as scheduled November 11-22, 1997. Reported loss of surface marker buoy at mooring E1 was confirmed. The surface marker buoy at mooring C1 was also missing, however, data from the upper SeaCAT were complete. As only one marker buoy was available, it was deployed at mooring C1 with a redesigned tether. Loss of the two marker buoys was probably due

to fatigue failures of the tether. A special event survey, consisting of three parallel shipboard ADCP survey lines (approximately 60 nm long) and 18 XBT stations along two of the lines, was completed on the last day of the cruise. The survey lines ran parallel to the 100 m isobath and between Lines B and F and were designed to examine an area of possible offshore flow southeast of the Mississippi River Delta which had been observed in altimetry and AVHRR imagery. Both 150 kHz and 600 kHz shipboard ADCPs were used in this survey.

2.5 Cruise 4

Cruise 4 was completed without incident other than the following discussion on the surface marker buoy at C1. The 'C1' surface marker buoy was on station so surface markers with new design tethers were placed on moorings B1 and E1. The Coast Guard had twice reported receiving reports of 'C1' being off station in 200 m of water about 23 nm southwest of its nominal position (100 m isobath). The alternate C1 marker was subsequently determined to be a large discus, ownership unknown. The Coast Guard was provided with this information and presumably disposed of the buoy in some manner.

III. DETAILS OF DATA COLLECTION AND ANALYSIS

3.1 Time Series Data

This data set includes current meter data, CTD data from six moored SEACAT/MicroCAT instruments, and thermistor data. The time series data acquired and processed thus far comprises a full year of data.

3.2 Hydrographic Data

This data set consists of the hydrographic station data acquired during each of four cruises. Data from the Chemical Oceanography and Hydrography Program will be used as well since these cruises, which began in November 1997, occur at roughly the same schedule as this program.

CTD data were collected using a SeaBird 911+ CTD system with an SBE 11 deck unit. The system was calibrated by the manufacturer in March 1997 and again in February 1998 prior to the beginning of each years' field measurements. At the time of recalibration, after the first three cruises, only minor adjustments in the calibrations were required. In addition, during each cruise bottle salinities were collected from mixed layers (one for each cast when possible). These provided a preliminary indication that the calibration of the instrument was holding steady (well within the expected accuracy of the instrument).

Salinity time series data from various current meters and SeaBird SeaCAT or MicroCAT CTs were adjusted by comparing with calibrated CTD casts made near each instrument at the beginning and end of a deployment period. The CTD measurements determined whether an offset (common occurrence with GO MkII current meters) or instrument drift had occurred, and the time series salinity data were adjusted accordingly.

3.3 Ancillary Data

The principal ancillary data types include satellite imagery provided by US Geological Survey, satellite altimetry data being processed by University of Colorado, and appropriate meteorological data.

Satellite images of the northeastern Gulf of Mexico (area from 22.0°N to 31.6°N and 79.0°W to 92.7°W) are available from the USGS web page.

Thumbnail images are reviewed online and the images with cloud free coverage of the study area (and vicinity) are then downloaded. Navigation data are contained in the GeoTIFF image header, thus, these images can be used directly in ARCVIEW and in Imagine without conversion. It is anticipated that no further imagery will be downloaded until early fall when the surface waters of the Gulf of Mexico cool sufficiently to show some contrast between different water types. Images for the period October 1996 through December 1997 have been archived on CD-ROM by USGS. Images for Spring 1998 have been downloaded from USGS.

Satellite altimetry data are archived at the University of Colorado and will be used in data analysis and synthesis. These data may be seen at the Colorado Center for Astrodynamic Research (CCAR) web site at

http://shaman.colorado.edu/~leben/gom_rgdr.html.

Appropriate meteorological data will be acquired as needed during the project. None, other than weather forecasts related to each cruise, have been acquired to date.

3.4 Data Sharing

Data sharing agreements were reached by all NEGOM program participants at a coordination meeting at University of South Florida, St. Petersburg, Florida in late April. Most program data, other than imagery, is to be hosted on a TAMU web site. Due to the volume of time series data collected by the DeSoto Canyon Eddy Intrusion Study, these data were placed on CD-ROM (approximately 450 MB for Year 1) and distributed in early July 1998 to all participating institutions in the coordination meeting. These data were provided in standard NODC formats.



The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.



The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The **MMS Royalty Management Program** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.