OCS Study
MMS 98-0056

Observation of the Atmospheric Boundary Layer in the Western and Central Gulf of Mexico

First Annual Report

MMS U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

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Observation of the Atmospheric Boundary Layer in the Western and Central Gulf of Mexico

First Annual Report

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
CO	Contracting Officer
COTR	Contracting Officer's Technical Representative
DCP	Data Collection Platform
ERL	Environmental Research Laboratories
GFE	Government furnished equipment
GOES	Geostationary Operational Environmental Satellite
km	Kilometer
m/s	meters per second
mb	Millibar
MHZ	Megahertz
MMS	Minerals Management Service
NCDC	National Climatic Data Center
NESDIS	National Environmental Satellite, Data, and Information Service
NOAA	National Oceanic and Atmospheric Administration
NTIA	National Telecommunications and Information Administration
NWS	National Weather Service
QA	Quality Assurance
QC	Quality Control
RASS	Radio Acoustic Sounding System
RF	Radio Frequency
RH	Relative Humidity
RWP	Radar Wind Profiler
sec	Second
SMI	South Marsh Island 160A platform designator
STI	Sonoma Technology, Inc.
VRM	Vermillion 22D platform designator

1.0 INTRODUCTION

This is the first annual contractor progress report on the data collection portion of the Boundary Layer Study in the Western and Central Gulf of Mexico, initiated by the Minerals Management Service (MMS), U.S. Department of the Interior, in 1997. Radian International LLC was awarded the contract by MMS effective September 22, 1997. This annual report covers activities from that start date through September 30, 1998. Future progress reporting on an annual basis will detail data collection activities through their planned completion in 2001.

Section 2.0 of this report provides a project overview and status summary. Future annual reports will update the status summary portion of this section. Section 3.0 of this report provides project implementation details during the specific reporting period. For this report, Section 3.0 covers actions and results from project inception (September 22, 1997) through September 30, 1998. Future annual reports will similarly provide implementation actions and results applicable to the specific reporting period.

2.0 PROJECT OVERVIEW AND STATUS SUMMARY

2.1 Goals and Objectives

2.1.1 Goals

For the Gulf of Mexico, present data sets poorly represent how temperature, winds, and mixing height vary vertically over the atmospheric boundary layer and free troposphere. Estimates come from two sources: 1) automated weather stations measuring meteorological variables in the surface layer; and 2) observational satellites sampling the boundary layer and free troposphere at a few select altitudes. Because these techniques generally do not accurately or precisely measure for a range of altitudes, empirical constants and relationships are used to approximate vertical variations in temperature, winds, and other boundary layer properties. However, direct observations more accurately describe vertical variations because the cited estimates contain many assumptions and simplifications.

Applications using these estimated winds, temperature, and mixing heights exist, but they contain uncertainties from above simplifications. For instances the Minerals Management Service (MMS) applies such estimates in several ways when assessing changes in air quality from oil and gas production. The MMS requires meteorological inputs and computational routines in dispersion modeling. The MMS assessments use conceptual models of pollutant transport through the marine boundary layer and theoretical analyses on the marine boundary layer. The MMS then has an interest in collecting field observations of the vertical structure of the marine boundary layer because such observations would reduce uncertainties in environmental assessments.

Under this project, the MMS shall obtain field observations describing the vertical structure of the marine boundary layer over the Western and Central Gulf of Mexico for ongoing and future applications. The agency will accomplish this goal by establishing two (2) boundary layer profiler systems on offshore platforms for approximately three (3) years of data collection. The MMS requires acquisition, installation, and maintenance of equipment, data collection, data management, and routine reporting over the life of this project. The MMS will retain ownership during and after the time period.

Each system is to use existing, well-established technologies and procedures. Each system needs to make minimal demands on platform resources and produce no hazards to platform personnel or offshore radio transmissions.

This project will provide a valuable source of information to the National Weather Service (NWS) operations as the boundary layer observations are collected in real time and distributed. An arrangement will be set up to permit NWS direct access to the observations. The NWS will also supplement quality control and archive the observations at the National Climatic Data Center (NCDC).

2.1.2 Objectives

Accurately collect, record, and report meteorological observations for three years in the Western and Central Gulf of Mexico. These observations shall include temperature, atmospheric refractivity, and winds from the surface layer into the free troposphere. Surface data collected shall measure air and sea surface temperatures, pressure, winds, and humidity.

2.2 Organizational Structure

2.2.1 Organization

Figure 2-1 depicts the organization of the project team.

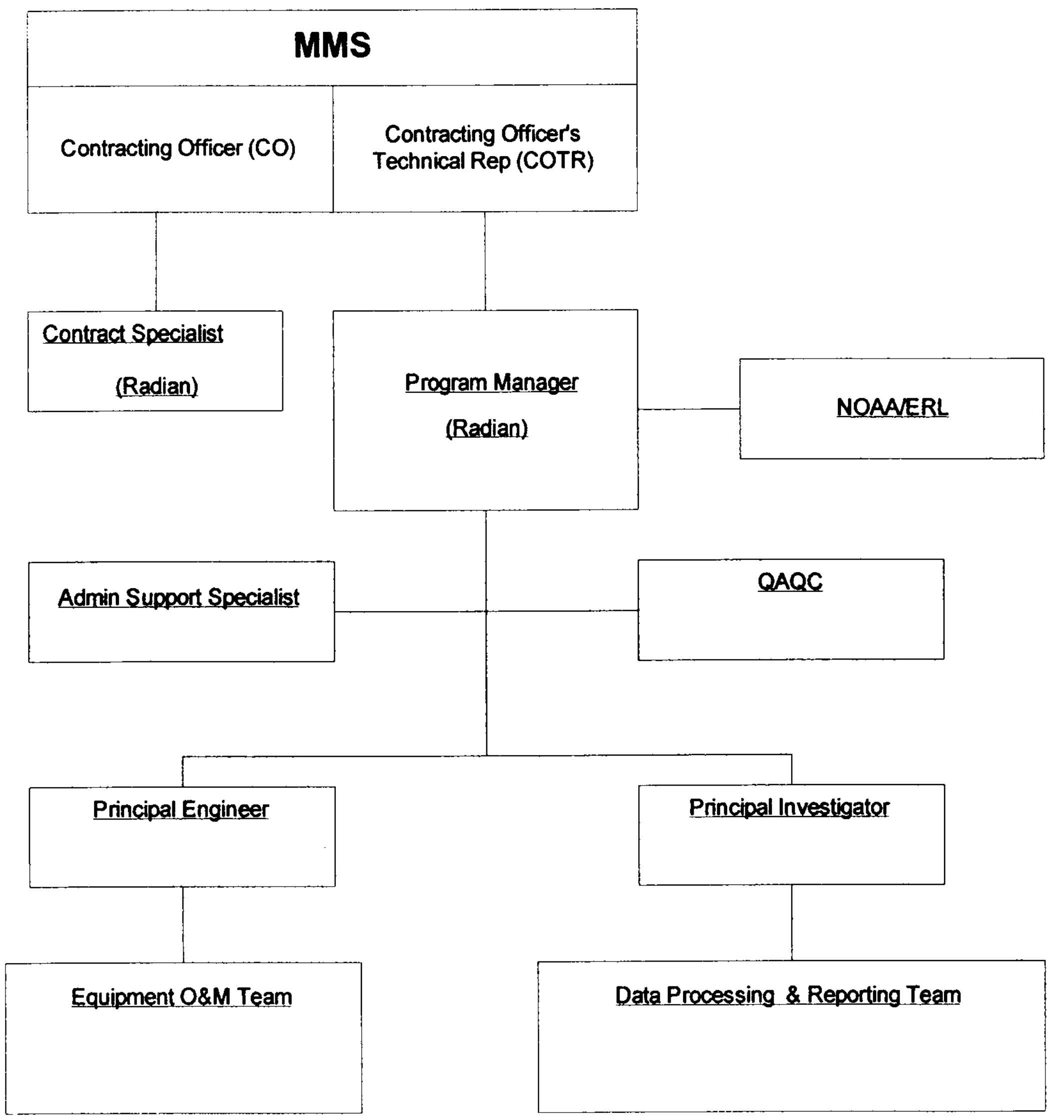

Figure 2-1. Organization of the Project Team

2.2.2 Responsibilities

Radian Team Position	Responsibilities
	All aspects of planning, organizing, directing, and controlling the project in accordance with contract requirements and specific project objectives and deliverables. Responsible to the MMS COTR for timely project reporting and to the MMS C.O., through the Radian Project Contract Specialist, for resolution of all contractual issues.
Principal Engineer	All aspects of equipment preparation, siting, performance, removal, and reports preparation related to these activities.
Principal Investigator	All data collection, processing, and reporting.
Contract Specialist	Supports the MMS C.O. and Radian Program Manager on all contractual issues.
QAQC Team	Supports the Program Manager in performing all administrative functions, including documents, records, and reports.
Admin Support Specialist **Program Manager**	Supports the Program Manager in performing all administrative functions, including documents, records, and reports.
Equipment Ops and Maintenance Team	Supports the Principal Engineer in performing all equipment-related activities.
Data Processing and Reporting Team	Supports the Principal Investigator in performing all data-related activities.

NOTE: Key Personnel Positions are highlighted in bold print above.

2.2.3 Subcontracting

The Radian team for this project includes Sonoma Technology, Inc., under subcontract to Radian. As joint collaborators with NOAA for commercializing NOAA radar profiler technology, Radian and STI have worked closely since 1991 on all aspects of radar profiler production and implementation, and have teamed on many previous field projects of this type. For this MMS-support effort, Radian will exploit STI's extensive experience in data collection, processing and reporting. This function will be performed by STI under the direction of the Principal Investigator provided by STI and reporting directly to the Radian Program Manager.

2.3 Implementation Planning

The following summary guidelines apply in project team efforts to achieve full performance of each task under the contract:

Task 1, Equipment	All equipment types listed in the contract are to be procured, with careful consideration of cost-benefit trade-offs.
Task 2, Field Plan	The most workable sites are to be identified and obtained; a comprehensive field plan is to be prepared and endorsed by MMS.
Task 3, Deployment & Operations	Two sites are to be operated and maintained, in an accident free manner, providing all required data types at 90% or greater capture level, with diligent QAQC and on-time reporting.
Task 4, Discontinuation of Monitoring	Equipment is to be fully checked, appropriately refurbished, and relocated as directed by MMS in a timely manner (within 30 days) after the data collection period.
Task, All	The project is to be completed within the estimated costing and on a time schedule approved by MMS.

2.3.1 Data Requirements

Table 2-1 lists each required data type, along with the applicable measurement instrument to be used, measurement frequency, and measurement accuracy.

Table 2-1. Meteorological Measurements at Each Site

Data Type	Instrument	Reporting Frequency	Sampling Frequency	Accuracy
Upper Air Measurements				
Wind Speed	LAP®-3000 RWP[1]	Hourly (55 minute average)	25 sec	1 m/s
Wind Direction	LAP®-3000 RWP[1]	Hourly (55 minute average)	25 sec	10°
Virtual Temperature	LAP®-3000 RASS[2]	Hourly (55 minute average)	25 sec	1°C
Refractivity Signal-to-Noise Ratio	LAP®-3000 RWP[1]	Hourly (55 minute average)	25 sec	NA
Surface Meteorological Measurements				
Wind Speed	Anemometer	Hourly	2 sec	0.2 m/s or 1%
Wind Direction	Anemometer	Hourly	2sec	2° at 0.2 m/s
Air Temperature	Aspirated Sensor	Hourly	2sec	0.5°C
Sea Surface Temperature	Infrared Sensor	Hourly	2 sec	0.5°C
Relative Humidity	Aspirated Sensor	Hourly	2 sec	±5%
Pressure	Barometer	Hourly	2 sec	1.5 mb

[1]Radar Wind Profiler
[2]Radio Acoustic Sounding System

Each of two off-shore oil platform sites in the Louisiana Gulf Coast is to be configured to fulfill these data requirements. The preferred locations of the respective two sites are approximately 10 km within the shoreline and approximately 50-80 km within the shoreline.

Collection of a three-year data record, with data capture rate greater than 90%, is to be achieved.

2.3.2 Logistics Responsibilities

The Program Manager will monitor all equipment and data handling logistics and will coordinate as appropriate with the MMS COTR.

The Principal Engineer will be responsible for all equipment logistics, including procurement, predeployment testing, shipping, installation, preventive and emergency maintenance, audits and calibrations, removal, refurbishment, and shipment to MMS storage. He will use the facilities and personnel resources of Radian's Boulder, Colorado electronics plant, with supplementation as needed from Radian's Austin, Texas electronics plant.

The Principal Investigator will be responsible for all data handling logistics, including sensor operating parameters, data retrieval, data reasonableness checks, audit and calibration report reviews, data validation, reporting, and archiving. He will use the facilities and personnel of STI's dedicated Weather Operations Center in Santa Rosa, California and will work closely with QA/QC team members provided by both Radian and STI.

The QA/QC team will monitor data and report quality and keep the Program Manager appraised of status, including any problems and recommended corrective action.

2.3.3 Selection of Sites

The site selection process must be completed as the first step in field project preparation. A location in shallow water is needed to measure how the marine boundary layer is affected by the land/sea breeze mechanism. Such a location was estimated to be within 10 km from the shoreline. A location in deep water is needed to measure how the marine boundary layer is affected by interaction between advecting air masses and colder waters in the Gulf of Mexico. Such a location is believed to be approximately 75 km from the shoreline. One deep-water site and one shallow-water site at a minimum will best fulfill data requirements.

2.3.4 Equipment

Figure 2-2 illustrates the site equipment subsystems that will be installed on each platform site, and the interconnectivity of these subsystems. The subsystems are:

- RWP (LAP®-3000 and RASS);
- Surface meteorological sensors;
- Computers; and
- Communications Interfaces.

Refer to Field Plan for detailed descriptions of these subsystems.

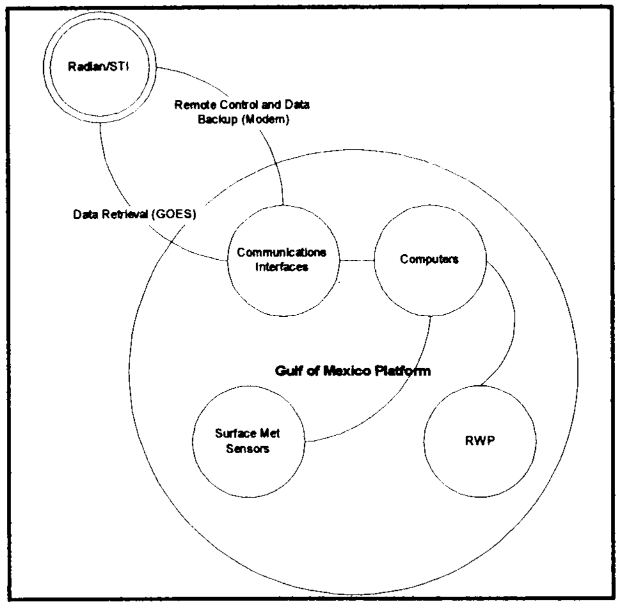

Figure 2-2. Site Equipment Subsystems and Interconnectivity

2.4 Status Summary as of September 30, 1998

Following contract award, the establishment of two off-shore Gulf of Mexico meteorological monitoring sites was successfully accomplished. Prior to the start of data collection, efforts included site surveys, hiring data management subcontractor, acquiring the measurement equipment, systems integration and pre-deployment testing, and installation on the platforms. While these preparatory efforts were underway, requests were submitted for GOES channel allocations and for RF licenses to operate the radar profilers and to transmit the data from the sites to the GOES satellite. Although all preparations were completed in time to begin data collection by March 1, 1998, the RF licenses did not arrive in time. The licenses were received in late May 1998 and the three-year data collection period began on June 3, 1998.

3.0 PROJECT IMPLEMENTATION DURING THIS REPORTING PERIOD

Work accomplished and results achieved during the first year of the project, September 22, 1997 through September 30, 1998, are detailed below.

Meteorological monitoring systems were installed on two platforms in the northern Gulf of Mexico as illustrated in Figure 3-1. The sensors on each platform include a 915 MHZ boundary layer profiler to measure vertical profiles of wind speed and direction, a 2 KHz RASS unit to measure virtual temperature profiles, and a suite of surface meteorological instruments. A GOES DCP (Data Collection Platform) is installed at each site to transmit hourly data via satellite communications to the project data management facility.

Activities during the first year included:

- Preparing and testing the radar profilers;
- Purchasing additional surface meteorological sensors;
- Obtaining GFE sensors and other hardware;
- Integrating the sensor and communications components;
- Developing procedures for data collection, analysis, and reporting;
- Modifying hardware and software to meet special MMS field conditions and communications requirements;
- Selecting and preparing oil platform sites;
- Obtaining RF licenses for communications and profiling operations;
- Installing the systems on the oil platforms;
- Operating and maintaining the data collection systems; and
- Submitting monthly status and data reports.

Installation of the meteorological monitoring systems at the two platform sites was completed during March 1998, but the monitoring systems were shut down temporarily while awaiting necessary RF licenses. The three-year data collection period started on June 3, 1998. An overview of the first year of the project is shown in Figure 3-2, and a description of the activities of this startup period is provided in the sections below.

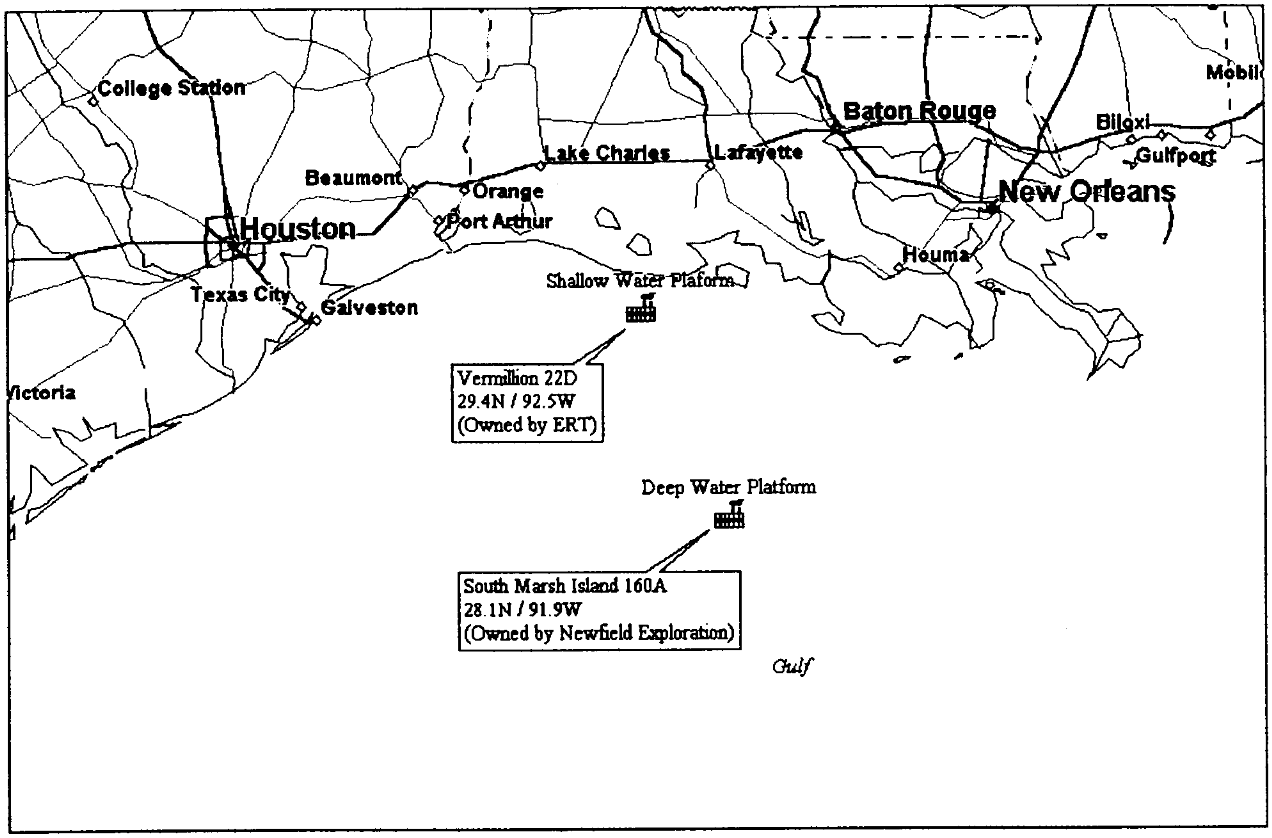

Figure 3-1. Location of Selected Monitoring Sites

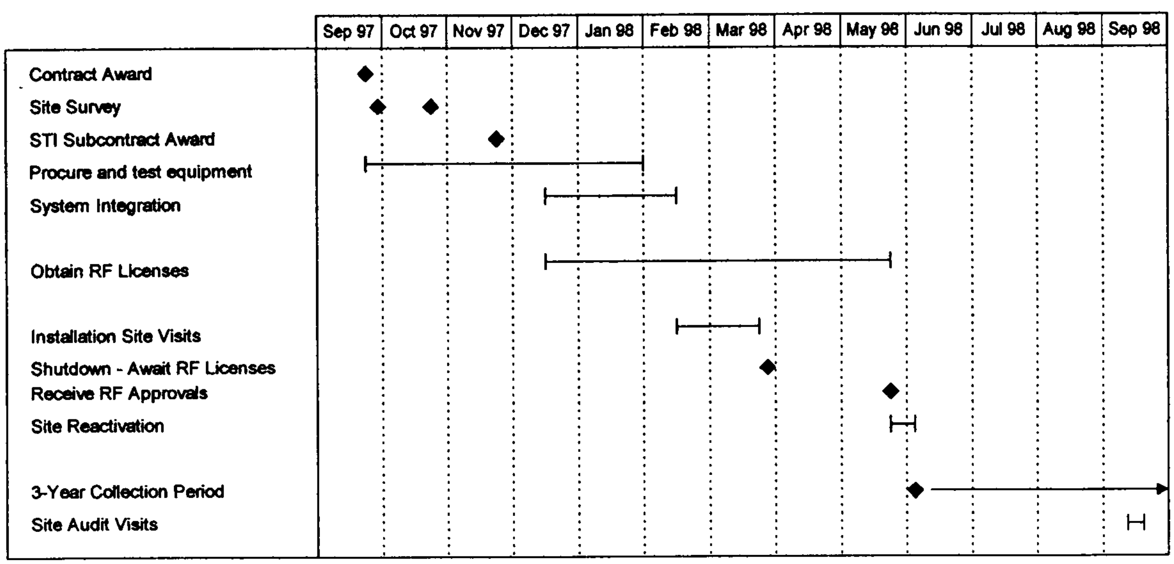

Figure 3-2. Principal Activities of MMS Boundary Layer Study September 1997 to September 1998

3.1 Management

MMS, Radian, and STI implemented a highly effective project team working relationship, using e-mail and telephone conferences to coordinate implementation actions and to resolve potential problems as they arose.

3.1.1 Personnel

Figure 3-3 shows the personnel that performed each of the project organization functions. As referenced in this document, the Radian/STI "key personnel" include Gary Zeigler (Program Manager), Carlton Schneider (Principal Engineer), and Tim Dye (Principal Investigator). During this reporting period, two project participants changed. Dr. Alexis Lugo-Fernandez replaced Bill Hutzel as MMS COTR and Sammy Young replaced John Miller as Radian Contract Specialist.

3.1.2 Communications and Coordination

Authority for all required project team decision actions to ensure timely, efficient, and competent accomplishment of all work under the contract is vested in the Program Manager. Authority for day-to-day decision making is delegated to the Principal Engineer for all equipment-related matters and to the Principal Investigator for all data collection and processing matters.

The flow of internal team communications and coordination began with the issuance of written Project Instructions by the Program Manager and a kick-off meeting of all projects participants hosted by the Program Manager. Project contractual requirements, the responsibilities of all product team members in fulfilling those requirements, as well as detailed scheduling and budget planning were discussed in detail. Team meetings were held at the call of the Program Manager on an as-required basis. The Principal Engineer and Principal Investigator convened meetings with project personnel supporting their respective functional areas on a regular basis to ensure the continued flow of effective and timely internal communications throughout the project.

Meetings of the project key personnel were convened on a scheduled basis at the end of each month at the call of the Program Manager or as requested by the Principal Engineer or Principal Investigator. These meetings provided assurances for timely flow of communications within the leadership of the project team and for the coordination on all matters requiring decision actions. Regularly scheduled monthly meetings included a review of all actions completed during the prior month which then served as the basis for monthly status reports issued by the Program Manager to MMS. Projected activities for the ensuing month were also reviewed at each monthly meeting.

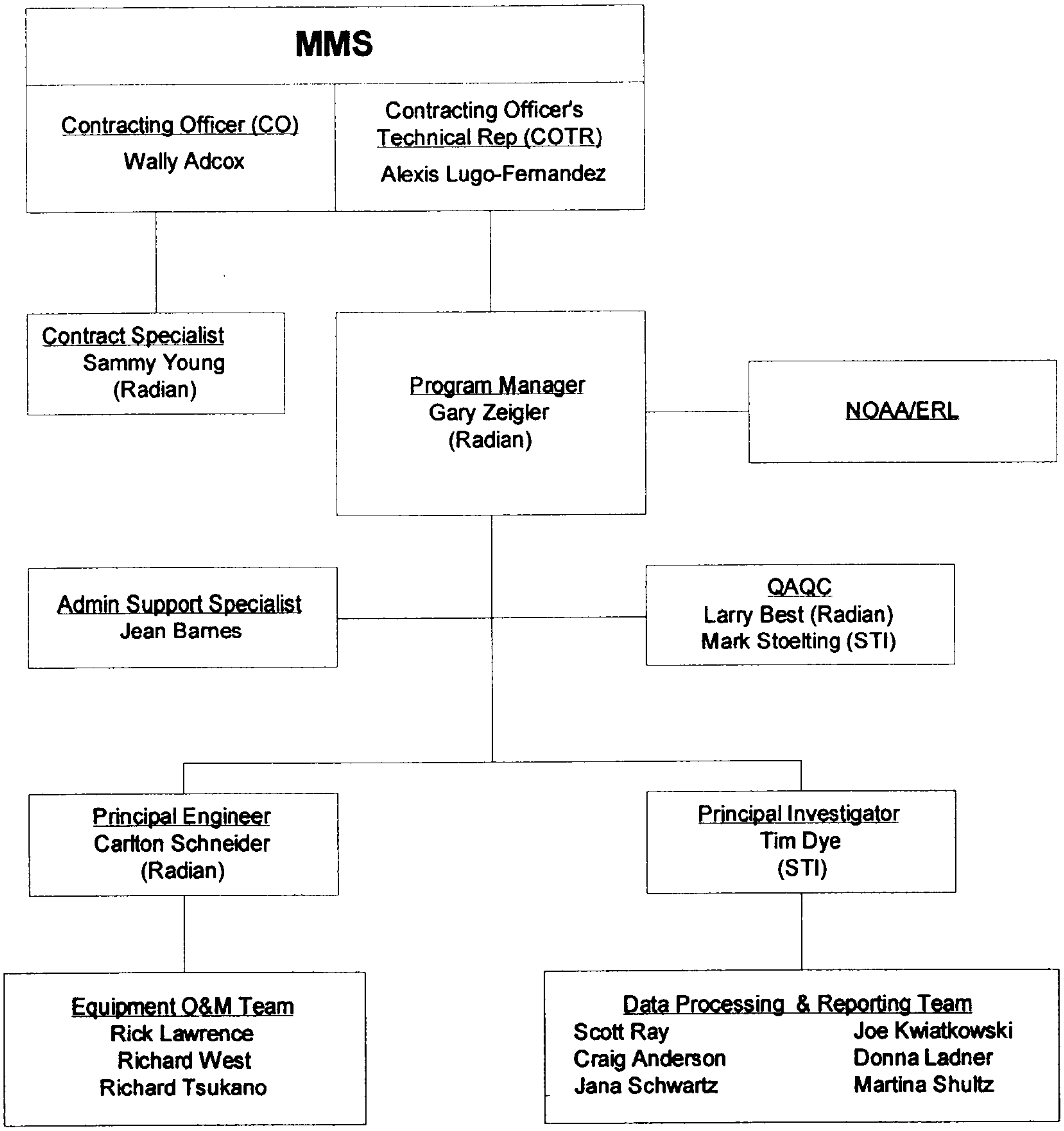

Figure 3-3. Project Team Personnel

All formal external communications and coordination by project team members were directed through the Program Manager. Informal communications and coordinating with personnel and agencies outside the project team were encouraged by individual team members as necessary to ensure effective accomplishment of the routine work within the responsibility of the respective team participant. Issues that arose during such informal external contacts were immediately reported through the project management chain to the Program Manager for formal resolution.

3.1.3 Record Keeping

The project contract file, including copies of all correspondence with the MMS Contracting Officer has been maintained in the office of the Radian Contract Specialist.

A copy of all documentation related to project accomplishment has been maintained in the office of the Program Manager. These documents include all project directives, reports of trips and meetings, record copies of all written deliverables submitted to MMS, and copies of all written correspondence between the Program Manager and the MMS COTR.

Data collection and processing, chain of custody, and other quality assurance records have been maintained by the Principal Investigator. These records served as the basis of monthly and annual reporting, as well as other formal submissions.

Equipment testing, installation, operation, maintenance, and quality assurance records have been maintained by the Principal Engineer. The Principal Engineer also maintained a log of all scheduled and unscheduled site visit activities and the results thereof. These records served as the basis of monthly and annual reporting, as well as other formal submissions, that were initiated by the Principal Engineer, through the Program Manager, to MMS as contract deliverables.

Photographic records of all significant project activities were taken by project team members, under the direction of project key personnel, as inputs to MMS under the "Presentation Slide Sets" deliverable requirement of the contract.

3.2 Site and Equipment Preparation Logistics

3.2.1 Site Selection

On September 22, 1997 the MMS COTR provided Radian a list of candidate oil platforms to serve as data collection sites for the boundary layer study. He requested that the shallow water site be selected on a line between Cameron and Sabine Pass, and that the deep water site be selected on the 150m to 200m isobath between the Ship Shoal and Garden Banks blocks. Additional criteria included:

- Manned platform, if possible, to help assure continuous operations;
- Adequate space for the radar profiler antenna;
- Minimal obstructions or towers which would cause radar profiler interference clutter;
- Environmentally controlled shelter space available for electronics; and
- Shelter within 150m of the radar profiler antenna location.

On September 30 a Radian field engineer surveyed the candidate platforms to assess their suitability as data collection sites. He first flew through the area to make a quick visual inspection of the platforms, looking for adequate space for the radar profiler antenna, presence of a shelter for the electronics, and the absence of structures which could cause radar clutter. He took pictures of the platforms and visited the most promising deep water platform. A suitable shallow water platform was not located on this visit.

The area was visited again on October 22, 1997 to further attempt to locate a usable manned platform near the coast. Several workable candidates were identified.

After coordination with the MMS staff and the platform operators, the following two platforms were selected for the study:

1) South Marsh Island 160A, operated by Chevron, as the deep water site; and

2) Vermillion 22D, operated by ERT, as the shallow water site.

3.2.2 RF Licenses

For the MMS boundary layer study, RF licenses are required for the GOES satellite data up-link and for the wind profiler operating frequency.

- The profiler data is transmitted using a two-minute per hour channel of the NOAA/NESDIS Geostationary Operational Environmental Satellite (GOES) system. Allocation of the channel from NESDIS and permitting from NTIA to transmit to the GOES satellite at 402 MHZ are required.

- The wind profiler measurements are based on radar pulses centered at 915 MHZ. Permission from NTIA to operate the two profilers in the Gulf of Mexico in this band was required.

Radian coordinated with NOAA ERL staff on procedures for communicating profiler data via GOES, and also on the steps required to request GOES allocations. The necessary applications for the GOES channel allocations were completed and submitted to NESDIS in December 1997. On 20 January 1998 an allocation for one minute per hour was received. Radian immediately went back to NESDIS and received the necessary two minute per hour allocation, as originally requested.

The RF license applications for operating at 402 MHZ and 915 MHZ were completed and submitted through MMS to the Department of the Interior in January 1998.

In February, Radian arranged to temporarily borrow GOES channels from the NOAA Aeronomy Laboratory so that system integration and testing could proceed while waiting for the NTIA approvals.

In the last week of March 1998, the Department of the Interior submitted the RF applications to NTIA. Soon thereafter, NOAA withdrew the temporary loan of the GOES channels because they were required for a NOAA field project.

The RF broadcast approvals were received from NTIA on 26 May 1998, and the three-year data collection period began a few days later, on 3 June 1998.

3.2.3 Equipment

The radar wind profilers employed in this MMS project were manufactured at Radian's assembly plant in Boulder, CO. Each was integrated with surface meteorological sensors and data communications components from MMS and from commercial vendors. Custom modifications to the two systems were made to adapt to the harsh environmental conditions expected on the platforms and also to support the unique data communications requirements. The components were also tested at the Radian Boulder facility before deployment to ensure the reliability of the fielded systems. Table 3-1 lists the equipment deployed.

Table 3-1. Meteorological Equipment Specifications

Measured Parameter	Sensor Manufacturer	Sensor Model	Sensor Specifications	
Wind Speed	RM Young	RMY 05305-5	Accuracy: Range:	±0.2 m/s 0 to 40 m/s
Wind Direction	RM Young	RMY 05305-5	Accuracy: Range:	±3° 0 to 360°
Temperature	Campbell Scientific, Inc.	HMP35C	Accuracy: Range:	±0.5°C -35° to +50.0°C
Relative Humidity	Campbell Scientific, Inc.	HMP35C	Accuracy: Range: Accuracy: Range:	±2% RH 0-90% RH ±3% RH 90 to 100% RH
Pressure	Vaisala	PTA-427	Accuracy: Range:	±0.6 mb 600 to 1060 mb
Sea Surface Temperature	Everest Interscience, Inc.	4000.4GL	Accuracy: Range:	±0.5°C -40°C to 100°C
Upper-air Wind Speed	Radian	LAP®-3000 RWP[1]	Accuracy: Range:	±1.0 m/s 0 to 24 m/s (per beam)
Upper-air Wind Direction	Radian	LAP®-3000 RWP[1]	Accuracy: Range:	±10° 0 to 360°
Upper-air Virtual Temperature	Radian	LAP®-3000 RASS[2]	Accuracy: Range:	±1.0°C 5°C to 40°C

[1] Radar Wind Profiler

[2] Radio Acoustic Sounding System

The key steps in assembling and integrating the equipment suites for the two platforms were:

- Prepare and test the two 915-MHZ wind profilers;
- Add custom modifications to the profilers for platform operation;
- Adapt Gateway software to support surface met sensors and GOES data transfer;
- Purchase Radian-procured portion of surface met equipment;
- Receive and integrate MMS-provided surface met components;
- Procure GOES Data Collection Platforms;
- Write custom software modules to compress data for GOES data links; and
- Integrate and test complete systems at Radian's Boulder facility.

3.2.4 Data Processing

The data processing and communications tasks include preparing the data at the sites, transmitting the data back through GOES, receiving the data at the STI Weather Operations Center, analyzing and storing the data, and submitting data reports. The following steps were accomplished between the start of the project and March 1998:

- Adapt Gateway computer to ingest surface meteorological data;

- Write Gateway module to generate compressed data packets for GOES transmission;

- Configure Gateway to send hourly data packets to NESDIS via the GOES RF up-link;

- Develop procedures to retrieve data packets from NESDIS computer;

- Develop procedures to decode and analyze the data;

- Specify, in coordination with the MMS COTR, the content and format of monthly data reports; and

- Develop software and procedures to support data archival and report generation.

3.2.5 Installation Activities

As described in Section 3.2.1 of this report, the two platform sites were selected on the basis of information gathered during two visits to the Gulf of Mexico area in September and October of 1997, in coordination with MMS and platform operations staff.

Special requirements for the two sites were identified. For example, there was limited space in the air conditioned shelter at SMI 160A for the Radar and Gateway Computers. Also shared telephone connections to the computers at each site were arranged. The positioning of electronic and antenna components and the resulting cabling requirements were determined for each site.

The equipment was shipped to the Louisiana coast in early February 1998. The monitoring equipment was installed at the SMI 160A site on February 16-19, and at VRM 22D on February 20-22. The spares were positioned in Lafayette, LA on February 23.

Radian staff made two return visits to the sites on 3-8 March 1998 and 24-26 March. During these visits a number of identified instrumentation issues were addressed and resolved. Although all equipment installation had been completed, the two sites had to be placed in a temporary shutdown mode on March 25, 1998 when NOAA had to withdraw their GOES channel loan (as noted in Section 3.2.2 of this report).

The RF broadcast licenses requested from NTIA by the Department of the Interior for this MMS project were received on May 26, 1998. Site reactivation was started on May 27 and the sites were visited on June 1-3. Equipment readiness checks were completed and both sites were operational as of the afternoon of June 2 and the data collection period began on June 3, 1998.

3.3 Site Operations and Maintenance

The planned three-year data collection period began on June 3, 1998. Regularly scheduled site visits were planned at six-month intervals, with the first such visit scheduled in September 1998.

No unscheduled site visits were required between June and September, 1998. Data collection continued without interruption for all sensors on both platforms during this period, except for a period of about four days in late September due to Hurricane Georges (as described below).

Tropical storm Earl passed through the Gulf of Mexico in early September. Both platforms were evacuated for several days. Before departure, the VRM 22D platform's power was shut off causing 38 hours of radar data loss spanning 1-2 September. The surface meteorological data at VRM 22D was, however, successfully captured as its battery powered backup was sufficient to last through the passage. No data were lost at the SMI 160A platform as power there was not shut down upon evacuation.

The first regularly scheduled site visit to the platforms occurred September 14-17, 1998. Clearing a problem with the Gateway computer restored the GOES transmission at the VRM 22D site. The data that had not been transmitted via GOES was downloaded.

Hurricane Georges passed through the area in late September. Both sites were evacuated and the power was turned off at both sites. Power outages caused loss of 98 hours of radar data at VRM 22D spanning 26-30 September and 94 hours of radar data at SMI 160A spanning 25-29 September. The surface data collection continued uninterrupted because the battery-backup was able to keep this portion of the system working during the four-day evacuation period at each platform.

At SMI 160A, GOES transmission of the data did not resume when the platform operators returned to the platform and restored power to the system on September 29. One of the operators accidentally broke the power switch on the GOES Data Collection Platform unit while restoring power. It was confirmed that the profiler was collecting data. An unscheduled maintenance visit was planned for October 9, 1998 to install the spare GOES unit on the SMI 160A platform so that the failed unit's power switch can be repaired.

3.4 Data Measurements

3.4.1 Description

The data flow for the study is shown in Figure 3-4.

The Gateway computer on each platform continuously collects data from the radar profiler, the surface meteorological instrument datalogger, and the GPS receiver. Once each hour, the latest data are packed into a compressed format and transmitted through the GOES satellite link to a database on the NOAA/NESDIS system in Wallops Island, VA.

Automated procedures in the STI weather operations facility are used to retrieve and unpack the data files. The STI staff reviews the data daily to ensure that all of the collection systems are operating correctly. At the end of each month, the prior month's data are processed to quality-stamp any suspect and invalid measurements. A monthly data report is then generated. The validated monthly data are also loaded into a database archive.

3.4.2 Data Capture Rate

The data capture rate measures the up-time of the integrated data collection and communications systems at each site. It is defined using:

Data Capture Rate = (NumRec/NumPos)*100

where:

NumRec = number of hours of data received at STI during the reporting period
NumPos = number of hours of data possible during the reporting period

As of the date of preparation of this annual report, data rates for June, July and August 1998 were available (and data for September 1998 were being processed).

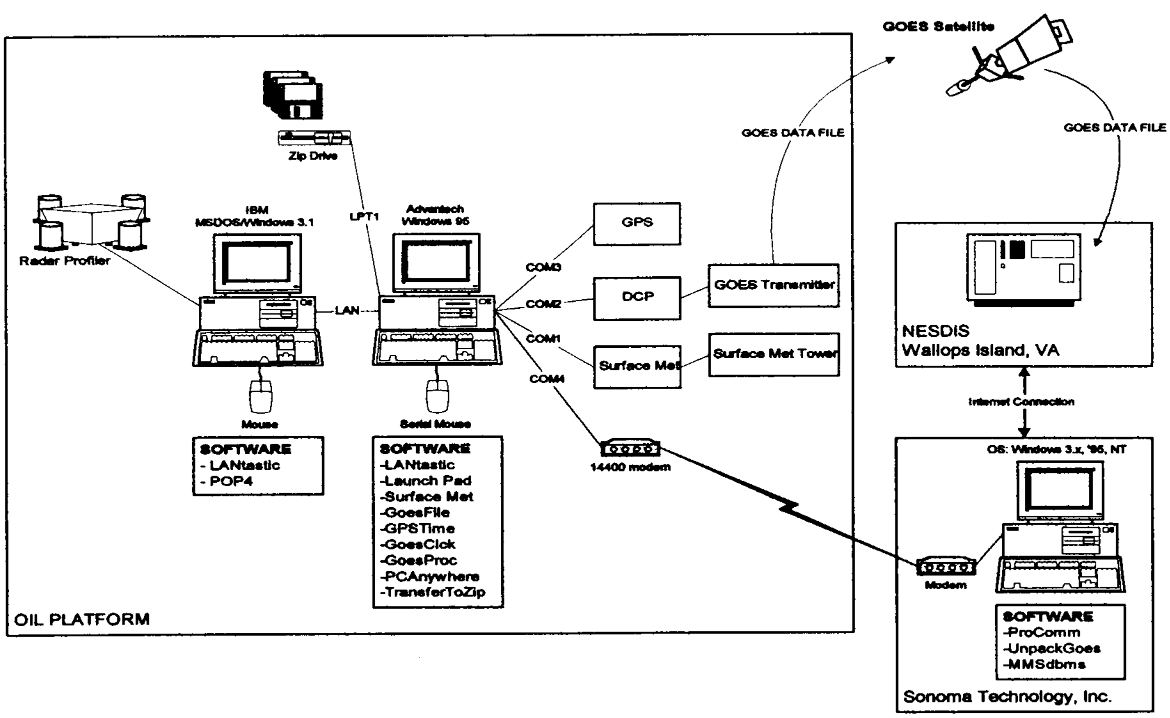

Figure 3-4. Data Flow for MMS Boundary Layer Study

The data capture rates for June-August 1998 for the VRM 22D site are shown in Table 3-2.

Table 3-2. Data Capture Rate for VRM 22D Site, June-August 1998

	Upper Air Winds	Upper Air T_v	Surface Met
June 1998	99.3	99.3	99.3
July 1998	93.8	93.8	93.8
August 1998	97.0	97.0	97.0

The data capture rates for the same period for the SMI 160A site are shown in Table 3-3.

Table 3-3. Data Capture Rate for SMI 160A Site, June-August 1998

	Upper Air Winds	Upper Air T_v	Surface Met
June 1998	98.2	98.2	98.2
July 1998	97.4	96.2	97.5
August 1998	99.7	99.7	99.6

The goal of the MMS program is to achieve a capture rate of 90% or higher. The average capture rate for all sensors for the initial three-month collection period was 97.5%.

3.4.3 Data Recovery

The data recovery rate is defined as the percentage of valid data captured by each instrument while the integrated system is operational. It is calculated using:

Data Recovery Rate = (NumVal/NumRec)*100

where:

NumVal = Number of valid hours of data received during the reporting period
NumRec = Number of hours of data received at STI during the reporting period.

The data recovery rate provides a method to evaluate the performance of the instruments.

As of the date of preparation of this annual report, data rates for June, July, and August were available (and data for September 1998 were being processed).

The data recovery for the two sites for the high wind mode is shown in Figure 3-5. The relatively low data capture at low altitudes at the SMI site can be attributed to interference from sea clutter. The VRM profiler installation is less sensitive to sea clutter and did not experience similar data losses.

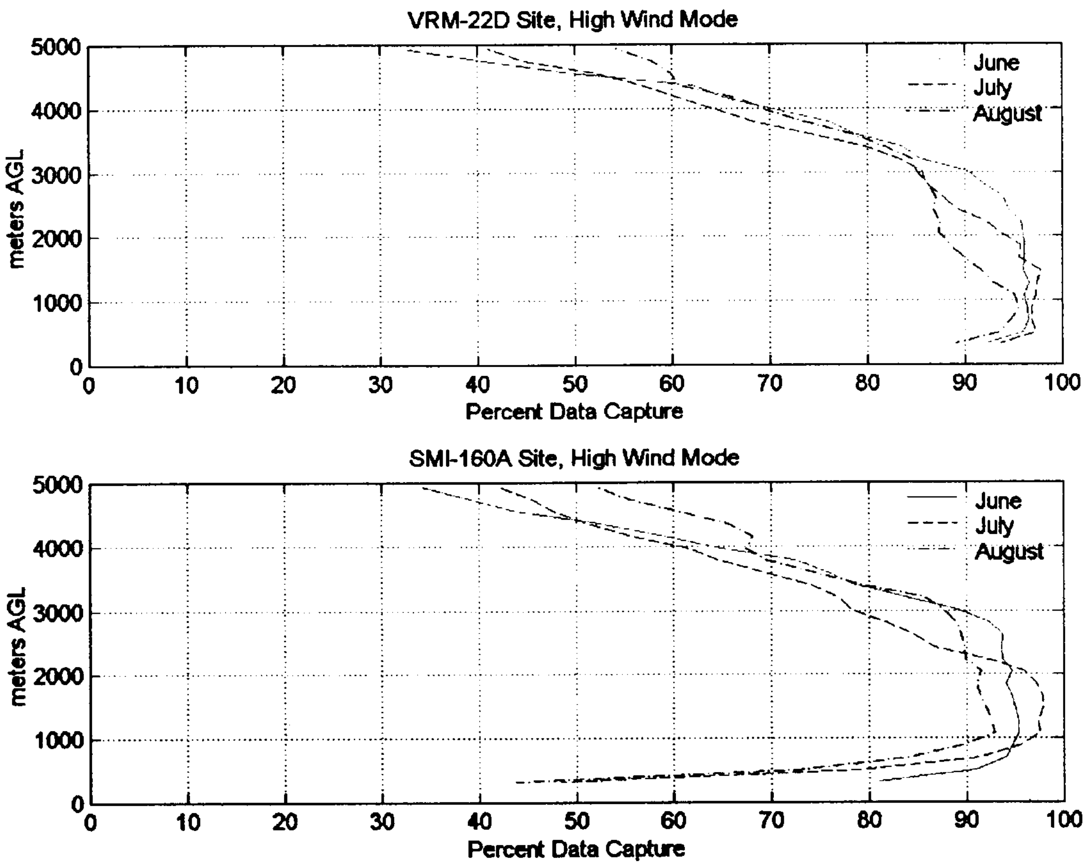

Figure 3-5. Data Recovery for Radar Wind Profiler High Wind Mode, June-August 1998

The data recovery rate for the low wind mode is shown in Figure 3-6. Both sites experienced data losses at the lowest altitudes due primarily to sea clutter interference.

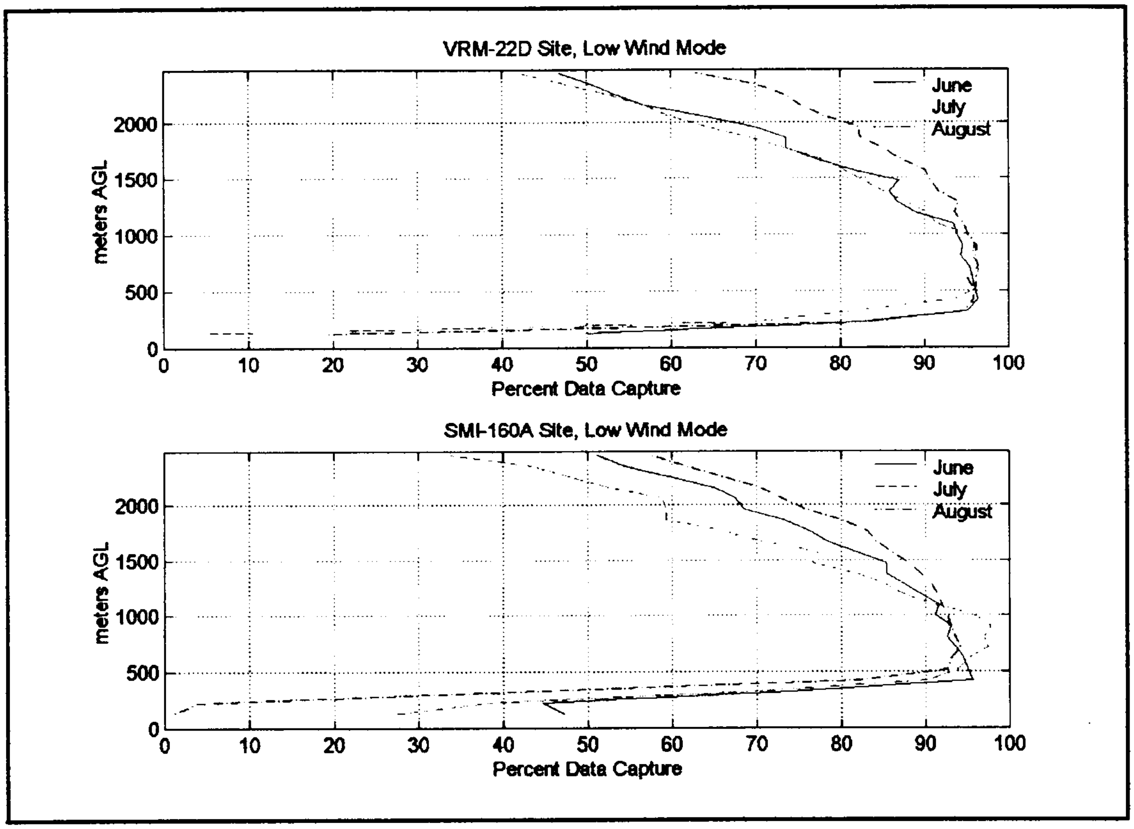

Figure 3-6. Data Recovery for Radar Wind Profiler Low Wind Mode, June-August 1998

In the RASS mode, virtual temperature profiles are measured by using the scattering of radar pulses from acoustic waves. The data recovery for the radar profiler RASS mode is shown in Figure 3-7.

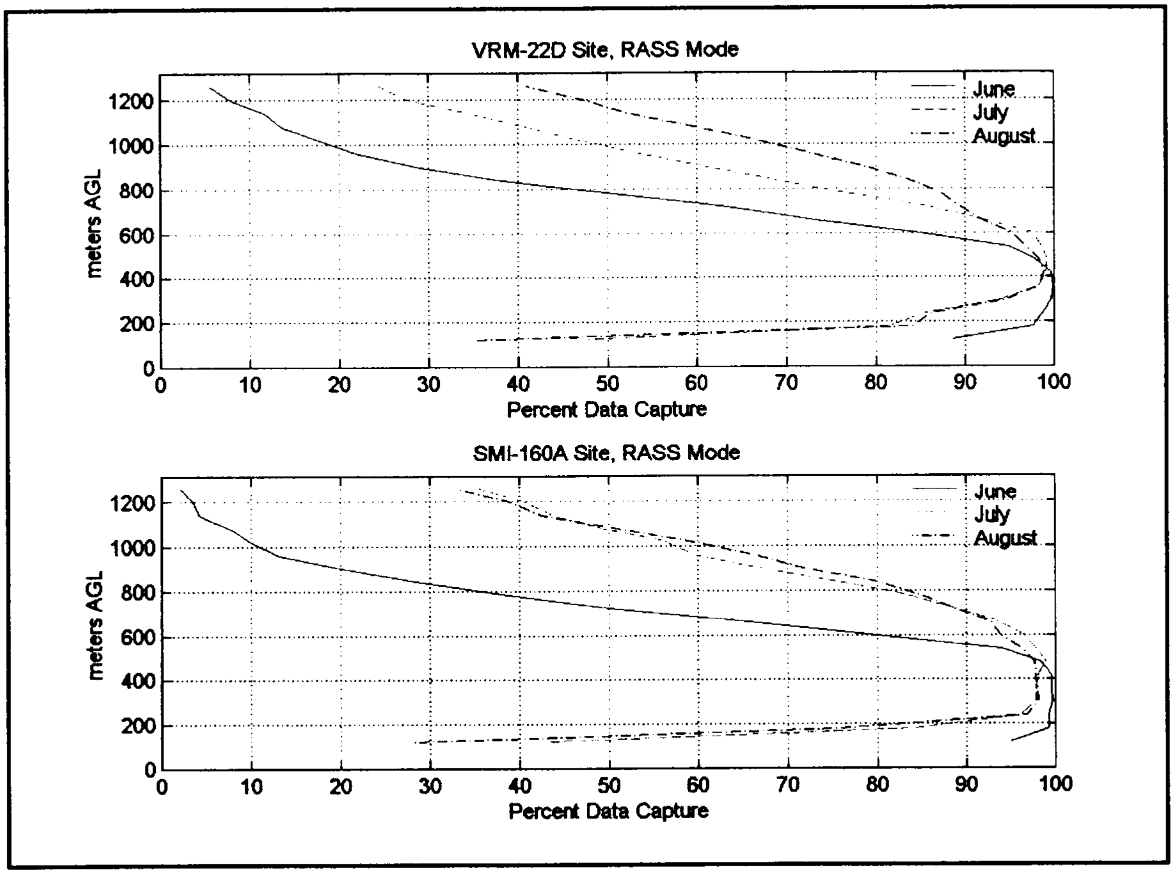

Figure 3-7. Data Recovery for Radar Wind Profiler RASS Mode, June-August 1998

RASS data losses at the lower altitudes during July and August are due to a configuration problem, and not due to clutter interference as in the wind modes. In the RASS mode, the acoustic source is programmed to sweep across a frequency band that corresponds to the range of expected atmospheric virtual temperatures. For the initial part of the collection period, the maximum temperature was set too low, resulting in lost data at low altitudes on hot days. During a site visit in September, the parameter set was adjusted to cover a higher temperature range so that the lower altitude data would not be lost.

3.4.4 Examples of Wind and Temperature Profiles

Wind profiles for the high-altitude wind mode at the South Marsh Island deep water site for August 28 are shown in Figure 3-8.

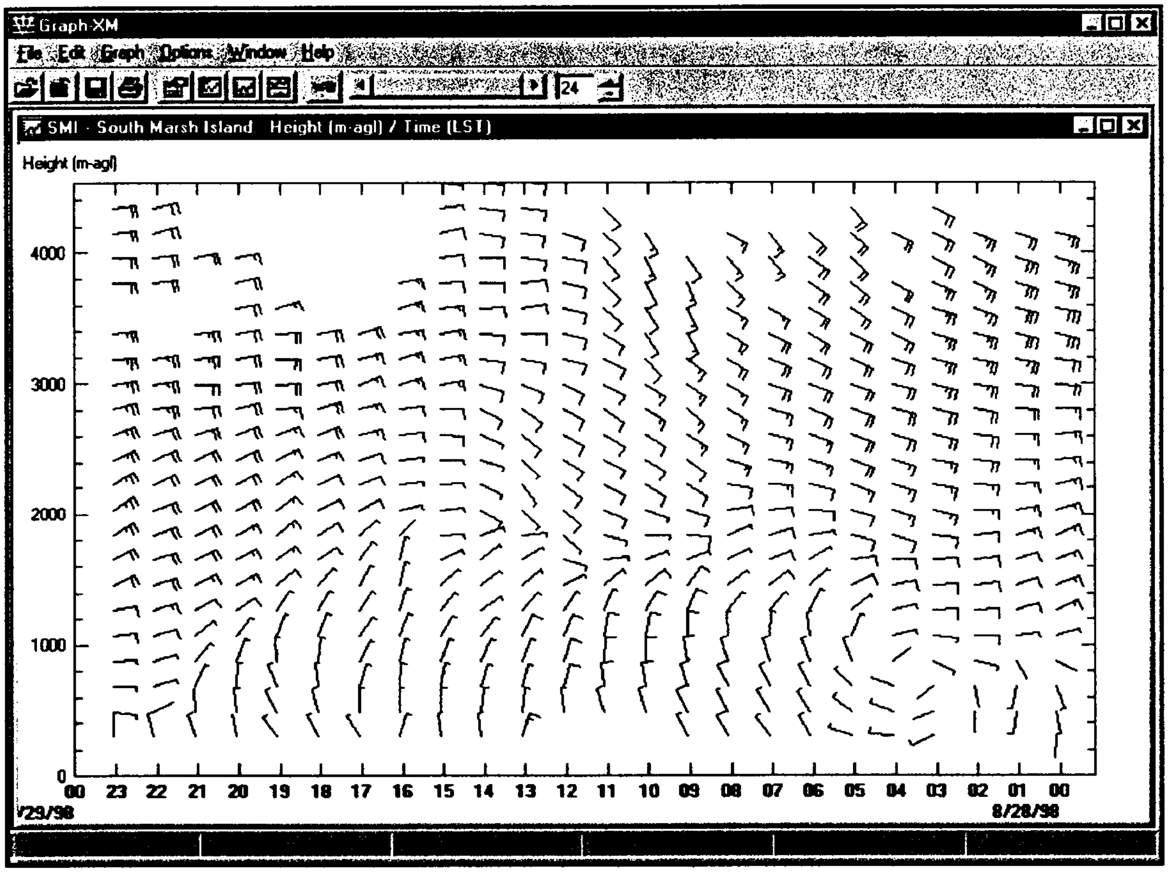

Figure 3-8. High Wind Mode Profiles for SMI 160A on August 28, 1998

Advancing time runs along the horizontal scale (x-axis from right to left). In this example, measured winds above approximately 2000 m are consistently from the east, whereas winds below that altitude show changing boundary layer conditions in detail.

Sample virtual temperature profiles measured by the wind profiler in the RASS mode at the Vermillion site on August 28 are shown in Figure 3-9.

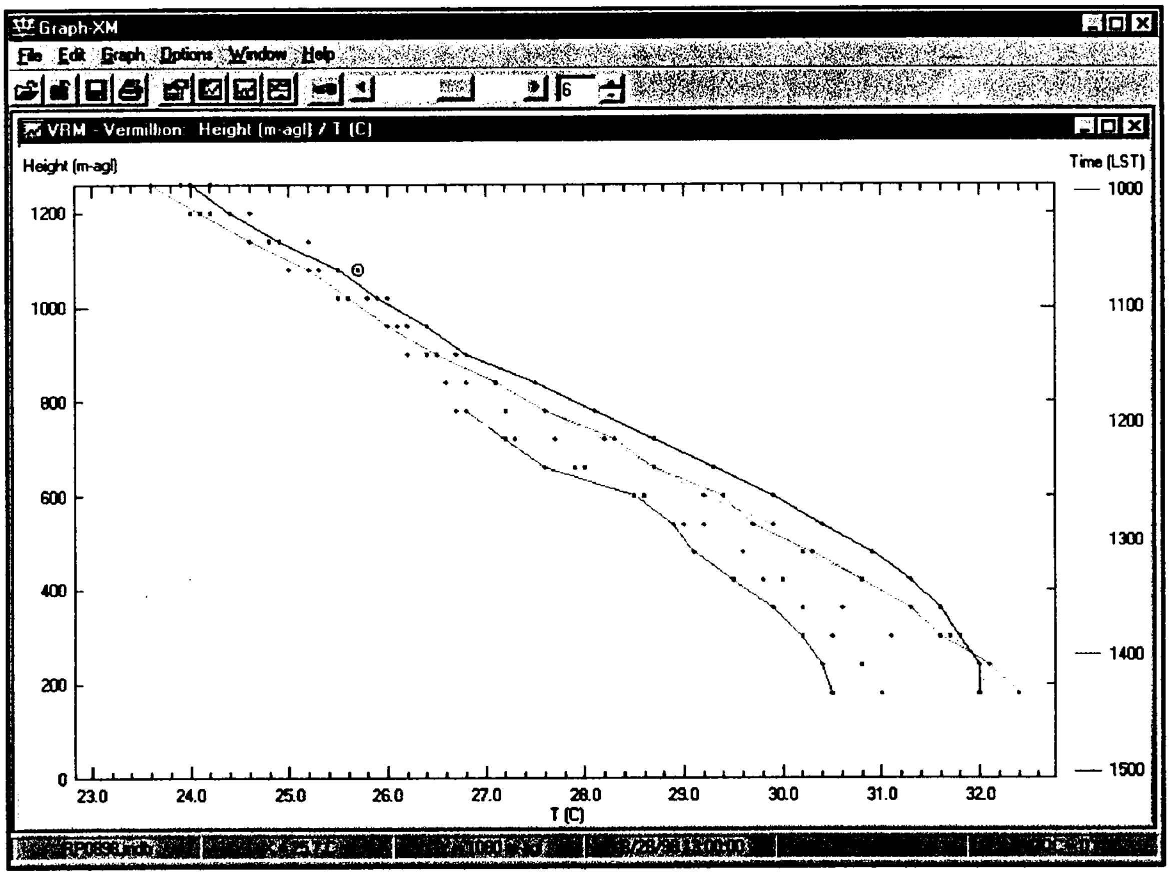

Figure 3-9. Virtual Temperature Profiles for VRM 22D on August 28, 1998

The leftmost temperature profile is at 10:00 am with right most at 3:00 pm (15:00). This shows typical expected warming of the lower atmosphere into the day's heating cycle.

3.5 Problems Encountered and Corrective Action Taken

3.5.1 Management

No problems involving the management of the project were experienced during this reporting period.

3.5.2 Site And Equipment Preparation Logistics

a. Problem: *Long lead time for receipt of GOES DCP equipment.*

   Corrective Action: Radian borrowed GOES DCP equipment and a GOES channel allocation from NOAA's Aeronomy Laboratory for use during the software development, testing, and integration phase.

b. Problem: *Delays in receiving GOES channel allocation and RF broadcast approvals.*

   Corrective Action: Radian prepared the application forms and helped walk them through the approval cycle in the various organizations involved: MMS, Department of the Interior, NOAA/NESDIS, and NTIA. The process still took several months longer than anticipated, and the start of the data collection period was delayed until after the RF approvals were received in late May 1998.

c. Problem: *Temperature/RH sensor failure.* Several of the original Government-furnished temperature/relative humidity sensors failed during system integration and testing.

   Corrective Action: MMS purchased new sensors and provided them to Radian as additional GFE.

d. Problem: *Limited space in A/C shelter at SMI 160A.*

   Corrective Action: Radian adapted the Radar and Gateway Computers to share a single CRT, keyboard, and mouse.

e. Problem: *Antenna alignment.* The antenna orientations could not be performed accurately at either site during the initial installation visit, February 16-22, 1998, because of thick cloud cover.

   Corrective Action: During the return site visits in March 1998, both antennas were oriented using the prescribed solar boresight measurement procedure.

f. Problem: *Poor telephone line quality.* The digital links to the computers at both sites initially had a high failure rate because of noise on the telephone lines.

Corrective Action: This was fixed by switching from PC Anywhere communications software to ProComm communications software, which operates more reliably in high noise conditions. Radian implemented this change.

g. Problem: *Unstable circuit breakers.* The circuit breakers controlling the platform-provided power to the radar profiler electronics at VRM 22D failed often because of high sensitivity to the noisy power on the platforms.

Corrective Action: This was fixed by replacing them with more robust commercial circuit breaker components. Radian implemented this change.

h. Problem: *RASS noise level at VRM 22D site.* The acoustic sources for the RASS virtual temperature profile measurements were located directly over the crew quarters, creating a potential for interfering with their sleep.

Corrective Action: During a site visit, Radian lowered the acoustic source strength level to reduce annoyance to the crew.

3.5.3 Site Operations and Maintenance

a. Problem: *GOES DCP failure.* The GOES Data Collection Platform failed during the final installation at SMI 160A in late May 1998.

Corrective Action: The failed component was replaced with the spare and returned to Synergetics for repair. The repaired DCP was received in July 1998.

b. Problem: *Sale of SMI 160A platform.* In July 1998, the SMI 160A platform was sold by Chevron to Newfield Exploration. The new owner agreed to continue supporting the project and new management and operations contacts were identified. No data were lost during the transition period from Chevron to Newfield. However, the new owner requires that Radian sign an Indemnity and Boarding Agreement (for access to the platform) which includes wording not acceptable to Radian.

Corrective Action: Radian has provided a written statement of the problem to the MMS Contracting Officer and requested MMS assistance in resolving the problem (through negotiation of compromise wording for the required Agreement).

c. Problem: *Tropical Storm Earl and Hurricane Georges.* Both platforms were evacuated on August 31, 1998 due to the approach of Tropical Storm Earl. During passage, 38 hours of radar profiler data from VRM 22D were lost due to a power outage. Surface meteorological data was collected at VRM 22D during the power outage using battery backup power. Radar profiler and surface meteorological data were collected successfully at the SMI 160A platform during the storm passage. In late September, as Hurricane Georges approached, both platforms were again evacuated. During passage, four days of radar profiler data were lost due to power outages. Surface meteorological data were collected at both sites during the power outages using battery backup power. Thereafter, data measurements resumed except that the SMI 160A operator broke the power switch on the GOES transmission equipment while attempting to turn it back on.

Corrective Action: Radian scheduled a site visit to SMI 160A to install the spare GOES DCP at SMI 160A (so that the failed unit's power switch can be repaired).

3.5.4 Data Measurements

a. Problem: *RASS data loss due to maximum temperature configuration setting.* RASS data capture rates unexpectedly dropped during July and August 1998 and the problem was diagnosed as a configuration issue involving the radar profilers' maximum expected temperature value set too low (and being exceeded during the exceptionally hot weather experienced during July and August).

Corrective Action: Radian increased the maximum expected temperature configuration setting during site audit visits conducted September 14-17, 1998.

3.6 Summary and Recommendations

The objective of this MMS project is to accurately collect, record, and report meteorological observations for three years in the Western and Central Gulf of Mexico. These observations shall include temperature, atmospheric refractivity, and winds from the surface layer into the free troposphere. Surface data collected shall measure air and sea surface temperature, pressure, winds, and humidity.

As documented in this annual report, tasks completed during the first year of work on this project successfully supported the objective. Site and equipment preparation were completed as planned, except that RF license applications took longer to process through the Department of Interior (requesting agency) and the NTIA (approving agency) than anticipated. Following receipt of the necessary RF licenses in late May 1998, the three year data collection period was initiated as of June 3, 1998. All data measurements collected were quality checked on a daily basis and were processed and documented by formal reporting on a monthly basis. The project's data capture rate goal of 90% established by MMS was exceeded during each of the three data month reports completed as of this annual report.

One unresolved problem existed as of the end of the first year of the project. This stemmed from a recent change in ownership of the SMI 160A platform, on which one of the project's two meteorological monitoring systems is sited. The new platform owner, Newfield Exploration, has presented the MMS contractor, Radian International LLC, a proposed Indemnity and Boarding Agreement for Radian to sign in order to allow its project personnel continued access to the platform to service the MMS data collection site. As of the end of this annual reporting period, the two companies have not been able to agree on the wording of the required Agreement. Radian has requested negotiated wording of the Agreement to eliminate excluding the platform owner from liability for Radian personnel visiting the platform in instances where injury may be sustained due to platform owner negligence. The issue has been referred to the MMS Contracting Office for resolution assistance.

Recommended actions are that project data collection and reporting be continued, as originally planned and as subsequently implemented during the first year of project effort, and that the Indemnity and Boarding Agreement problem be resolved as soon as possible to help assure that Radian maintenance personnel have timely continued access to the SMI 160A platform for MMS equipment servicing as necessary.

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.