OCS Study
MMS 2000-009

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

Second Annual Report

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

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Second Annual Report

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and
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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

AGL	Above Ground Level
EC	Degrees Celsius
CD	Computer Disk
CDT	Central Daylight Time
CO	Contracting Officer
Comm	Communications
COTR	Contracting Officer's Technical Representative
CST	Central Standard Time
DCP	Data Collection Platform
ERL	Environmental Research Laboratories
GC	Gateway Computer
GFE	Government Furnished Equipment
GOES	Geostationary Operational Environmental Satellite
GPS	Global Positioning System
KHz	Kilohertz
km	kilometer
Max	Maximum
mb	millibar
Met	Meteorological
MHz	Megahertz
Min	Minimum
MMS	Minerals Management Service
m/s	meters per second
N	North
NA	Not Applicable
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
O&M	Operations and Maintenance
QA	Quality Assurance
QC	Quality Control
RASS	Radio Acoustic Sounding System
RC	Radar Computer
RF	Radio Frequency
RH	Relative Humidity
RWP	Radar Wind Profiler
sec	second
SMI	South Marsh Island 160A platform designator
STI	Sonoma Technology, Inc.
Tv	Virtual Temperature
UPS	Uninterruptible Power Supply
VRM	Vermillion 22D platform designator
W	West

1.0 INTRODUCTION

This is the second 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. Radian International LLC was awarded the contract by MMS effective September 22, 1997. This annual report covers activities during the second year of the project, through September 30, 1999. 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 the end of the First Annual Report (September 30, 1998) through September 30, 1999. 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 instance, 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.

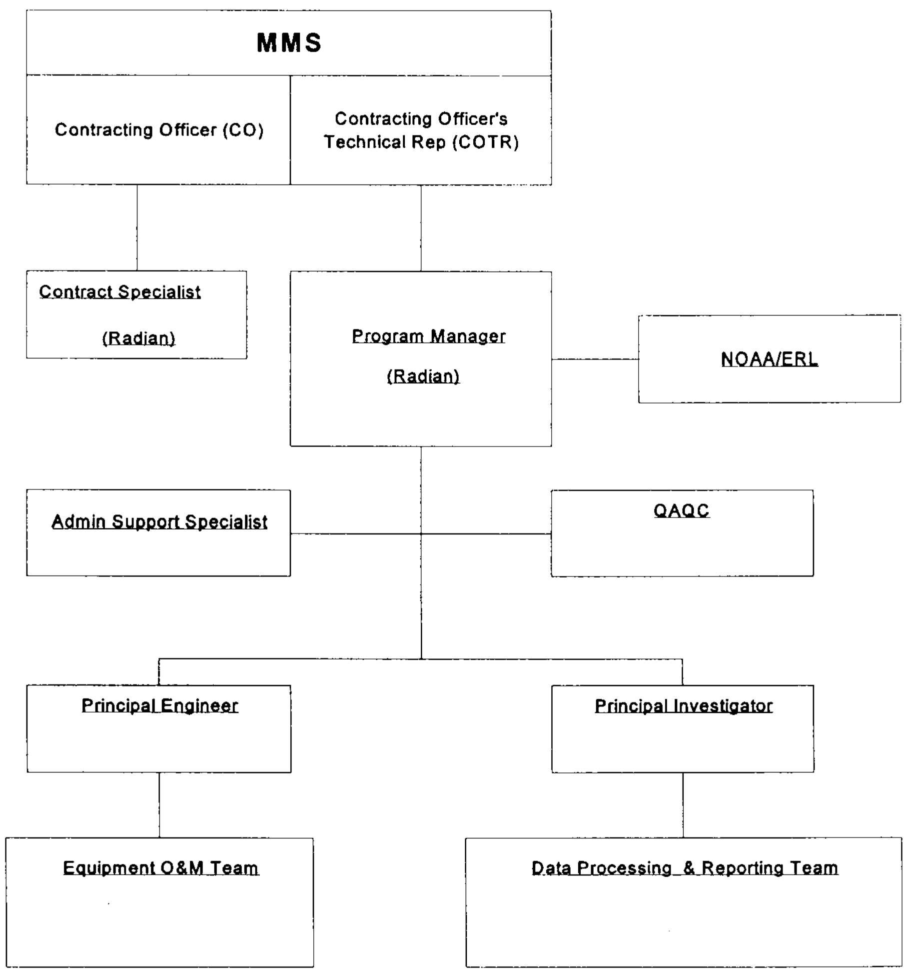


Figure 2-1. Organization of the Project Team

2.2.2 Responsibilities

Radian Team Position	Responsibilities
Program Manager	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 CO, 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 CO and Radian Program Manager on all contractual issues.
QAQC	Supports the Program Manager in performing all administrative functions, including documents, records, and reports.
Admin Support Specialist	Supports the Program Manager in performing all administrative functions, including documents, records, and reports.
Equipment O&M 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	2 sec	2° at 0.2 m/s
Air Temperature	Aspirated Sensor	Hourly	2 sec	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, pre-deployment 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.

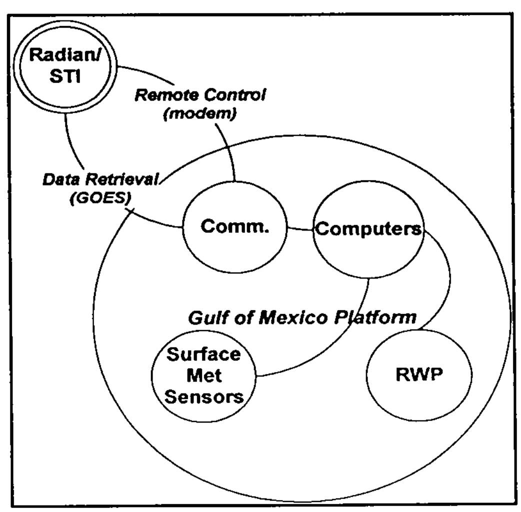


Figure 2-2. Site Equipment Subsystems and Interconnectivity

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. Meteorological monitoring systems were installed on two platforms in the northern Gulf of Mexico as illustrated in Figure 2-3. 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.

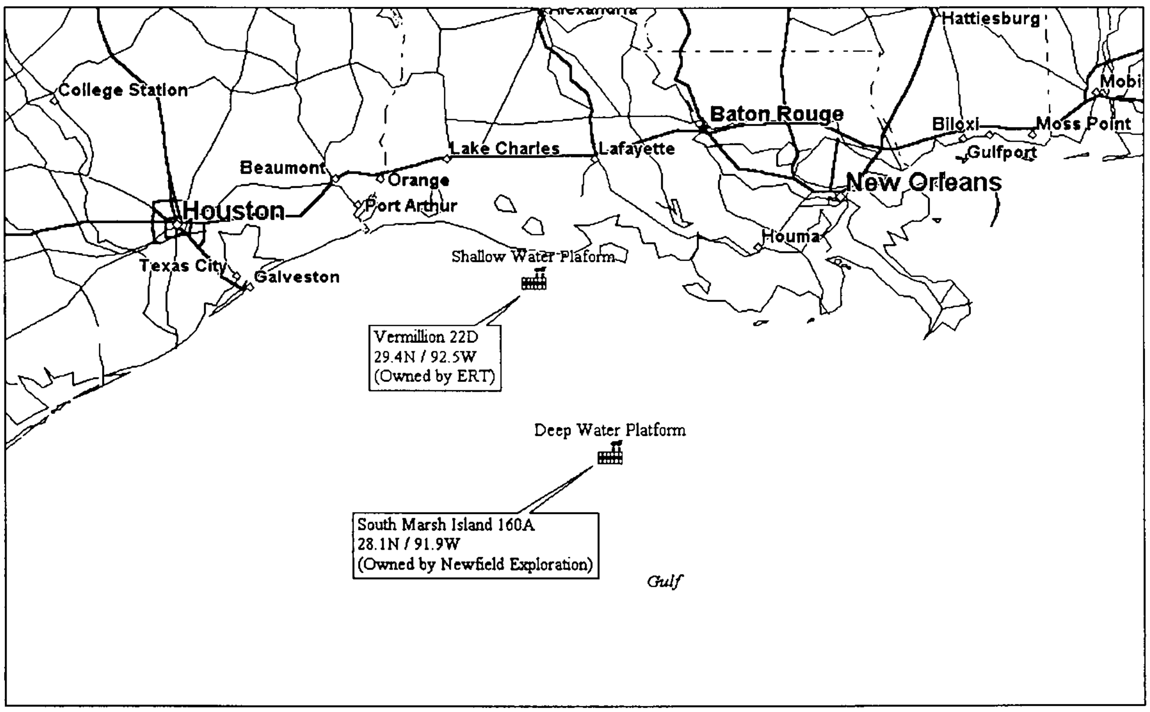


Figure 2-3. Location of Selected Monitoring Sites

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. A timelines overview of the first year of the project is shown in Figure 2-4.

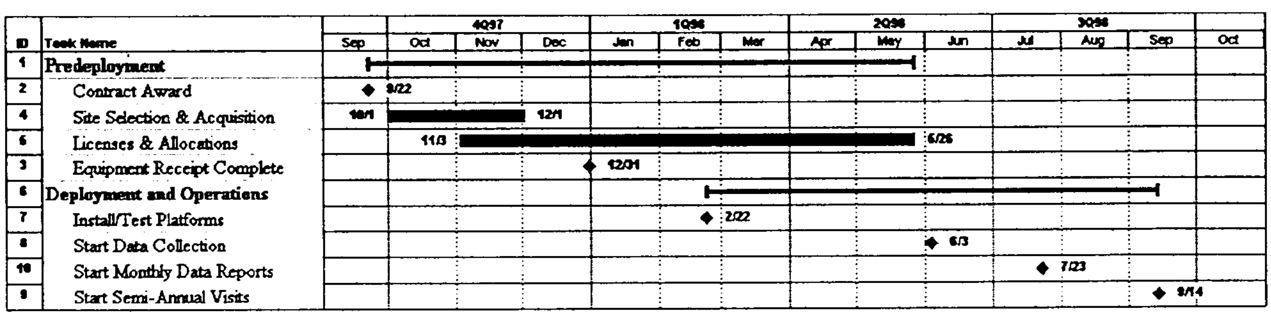


Figure 2-4. Principal Activities of MMS Boundary Layer Study September 1997 - September 1998

2.5 Status Summary as of September 30, 1999

Both platform sites continued to provide high data capture rates. Three unscheduled site maintenance trips were required during the second year of the project: one in October 1998, one in December 1998, and one in August 1999. Problems were experienced with the relative humidity sensors at both sites, a GOES DCP problem occurred at SMI 160A, an SST problem occurred at VRM 22D, and data transmission problems (interrupting radar profiler and surface met data) occurred at VRM 22D. Scheduled maintenance trips were accomplished in April and September 1999. Systems and meteorological sensors audits for both sites were performed during the April and September 1999 scheduled maintenance visits.

Real-time data losses due to failed communications or power outages were largely recovered by later manual data retrieval by maintenance technicians during site visits.

A potentially significant problem arose with the transfer of ownership of SMI 160A when the new owners, Newfield Exploration Company, levied the requirement for an Indemnity and Boarding Agreement that was unworkable from Radian and MMS points of view. This issue was eventually resolved when the new owners modified their position and waived the Agreement as a prerequisite for our project personnel to visit the platform site.

All monthly data reports were delivered on schedule to the MMS COTR, as were the First Annual Report and Slide Set. In January 1999, Radian submitted a replacement CD for the June through November 1998 data. This replacement carried a correction to the data times that were unknowingly being recorded in CDT instead of CST. All data are subsequently being collected in CST, as originally intended.

3.0 PROJECT IMPLEMENTATION DURING THIS REPORTING PERIOD

Work accomplished and results achieved during the second year of the project, October 1, 1998 through September 30, 1999, are detailed below.

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 3-1 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), Richard West (Principal Engineer), and Tim Dye (Principal Investigator). Participant changes during this reporting period included: Richard West replaced Carlton Schneider as Principal Engineer; Craig Anderson replaced Mark Stoelting on the QAQC team; and Darlene Huebner replaced Jean Barnes as Administrative Support 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.

Routine meetings necessary for smooth implementations of the measurement sites have been replaced with as-needed teleconferences.

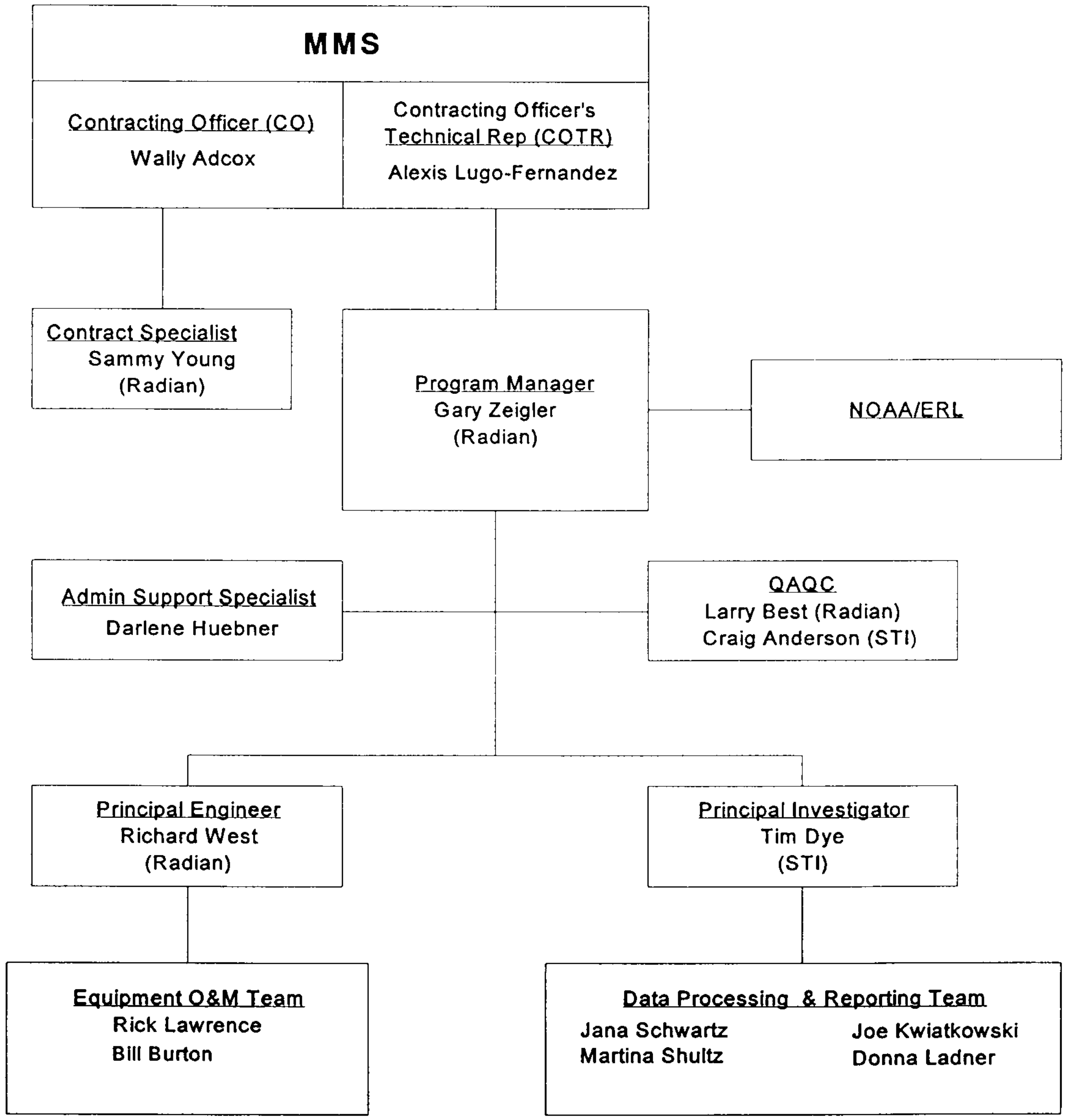


Figure 3-1. Project Team Personnel

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, is maintained in the office of the Radian Contract Specialist.

A copy of all documentation related to project accomplishment is 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 are maintained by the Principal Investigator. These records serve as the basis of monthly and annual reporting, as well as other formal submissions.

Equipment testing, installation, operation, maintenance, and quality assurance records are maintained by the Principal Engineer. The Principal Engineer also maintains a log of all scheduled and unscheduled site visit activities and the results thereof. These records serve 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 continue to be 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

Details on the original site-finding efforts and results are described in the First Annual Report. To recap, the following two platforms were selected for the study:

1) Vermillion 22D, operated by ERT, as the shallow water site and

2) South Marsh Island 160A, originally operated by Chevron, now by Newfield Exploration, as the deep 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 were required and received.

- 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 and received.

There have been no problems with our licenses during this reporting period.

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

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

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.

During this reporting period no procedure or data flow changes were needed or made. There were some problems with real-time data collection due to GOES DCP and platform power disruptions, but all were addressed in timely fashion to keep capture rates high.

3.3 Site Operations and Maintenance

During this reporting period we performed two regularly scheduled site visits and three unscheduled visits, all described below.

- **9-10 October 1998 Unscheduled Visit**
  SMI-160A: Synergistics GOES DCP was replaced with spare. The platform operator accidentally broke the DCP power switch while attempting to restore power to the unit after it had been shut down during passage of Hurricane Georges. The data collected between 29 Sep/0900 and 10 Oct/0700 CST at the platform was not transmitted via GOES during the DCP down time but was returned on disks to STI for archiving.

  VRM-22D: The sea surface temperature sensor was replaced with a spare. The sensor failed at 1200 CST on 1 Oct with data loss for SST covering 1 Oct/1200 through 9 Oct/1700 CST.

- **17 December 1998 Unscheduled Visit**
  We performed an unscheduled maintenance visit to VRM-22D on 17 Dec. to replace the SST sensor that failed on 2 Nov. While there, we replaced the RH sensor as a precaution due to the suspect appearance of its data during Nov and Dec.

- **20 April 1999 Scheduled Visit**
  We performed a scheduled visit to both platform sites on 20 April. SMI-160A audit confirmed all surface met sensors except for RH passed audit criteria. VRM-22D audit confirmed all surface met sensors passed audit criteria.

- **6-7 August 1999 Unscheduled Visit**
  Cleared up a transmission data loss problem at VRM-22D. Upper air data resumed normal flow, but an unresolved surface met data communications problem continued to keep data from being transmitted (it was being saved on site).

- **29-30 September 1999 Scheduled Visit**
  SMI-160A: Needed to reboot the Gateway to clear it from a non-working status. The UPS had a battery problem. Platform personnel will ship it to Austin for repair. Audit of met equipment showed everything to be within tolerances. Performed data backups to zip disks, later sent to STI for archives.

  VRM-22D: Troubleshot and cleared the met data transfer problem that had remained unresolved after the unscheduled August 1999 site visit. Replaced short-haul modem with direct RS-232 connection that should improve met data transfer reliability. Repaired a hole in the datalogger NEMA-4 box. Replaced atmospheric and sea-surface temperature sensors. Audit of met equipment showed all to be in tolerances. Performed data backups.

3.4 Data Measurements

3.4.1 Description

The radar profiler is pre-programmed to take measurements continuously, and to alternate between recording vertical profiles of wind and recording vertical profiles of virtual temperature. During periods in which it is recording wind measurements, it is also pre-programmed to do so using alternating short and long transmission pulses. The resultant "dual-mode winds" produced include "low-mode winds" and "high-mode winds." Low-mode winds are the wind measurements made using the short transmission pulse. Advantages of low-mode winds are that they start at the lowest possible altitude above the radar profiler and that they have the best possible vertical resolution. High-mode winds are the wind measurements made using the long transmission pulse. The advantage of the high-mode winds is that they extend to the highest possible altitude above the radar profiler.

The data flow for the study is shown in Figure 3-2.

The Gateway computer on each platform continuously collects data from the radar profiler, the surface meteorological instrument datalogger, and the Global Positioning System (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.

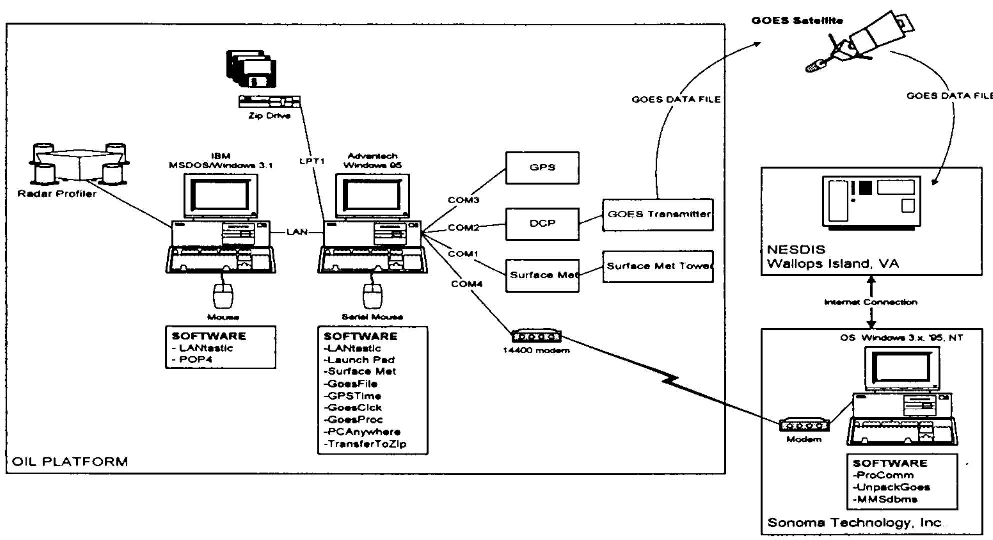


Figure 3-2. Data Flow for MMS Boundary Layer Study

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
(which is defined as the total number of hours during the reporting period)

As of the date of preparation of this annual report, data rates for September 1998 through August 1999 were available and are included. The data capture rates for September 1998 through August 1999 from the VRM 22D site are shown in Table 3-2, and from the SMI 160A site in Table 3-3. 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 September 1998-August 1999 collection period was 92.4%. The capture rate for the total program through August 1999 was 93.4%. Although the whole 12-month period exceeded 90% capture rate, not all months did for the following reasons:

- September 1998. Low capture rates at both platforms were due to power down times associated with the platform evacuations in reaction to an approaching tropical storm and Hurricane Georges.

- April 1999. The GOES transmitter at the VRM site failed on 11 April causing sporadic real-time data loss. The transmitter was repaired on 20 April during a routine maintenance visit. All data between 11 and 20 April were collected at the site, downloaded to zip disks, and returned to STI for archival.

- June 1999. VRM continued to experience sporadic GOES transmission dropouts which denied us real-time data. The most significant problem led to an outage from 18 to 23 June associated with a local platform power distribution problem. After the platform power was up and stabilized we were able to remotely, with the help of a platform employee, get the transmission of data to begin.

- August 1999. During July 1999, a problem was experienced with only the radar profiler portion of the VRM data stream. This problem manifest itself as invalid data being reported by the VRM radar profiler during the periods 12-13 July, 17-19 July, and 20-31 July. During July, all possible efforts were exhausted in trying to resolve the problem by remote means. Therefore, as of the end of July, we had exhausted trouble-shooting options via remote means and were preparing to make an unscheduled maintenance visit to VRM. As this unscheduled visit was about to be made, we lost all data flow from VRM on 3 August 1999. We subsequently visited the VRM platform on 6-7 August and found that the platform had taken a direct lightning hit on 3 August. We fixed the radar profiler during the site visit and restored GOES transmission of the radar profiler data. We were unable to restore the transmission of the surface met data at that time, however, because the surface met data are not being received by the hub computer from the datalogger. Following our visit, we sent a replacement surge protector to the platform and had it installed by a platform operator. Unfortunately, that did not restore the transmission of the surface met data. The site visit of 30 September 1999 found a serial port problem in that the short-haul modem was damaged. The situation was resolved and met data flow resumed. The large met data file was copied and returned to STI for purposes of recovering the lost data since 3 August.

Table 3-2.
Data Capture Rate for VRM 22D Site, September 1998-August 1999

Date	Upper Air Winds	Upper Air T_v	Surface Met
Sep-98	80.7	81	100
Oct-98	95.2	95.3	95.3
Nov-98	96.8	96.7	96.9
Dec-98	97.3	97.3	97.3
Jan-99	94.2	94.2	94.2
Feb-99	97.6	97.6	97.6
Mar-99	95.4	95.4	95.8
Apr-99	74.4	74.4	71.9
May-99	97.9	97.9	98.7
Jun-99	72.8	72.6	72.4
Jul-99	98.8	91.8	98.8
Aug-99	87.0	78.4	8.7
Annual Average	90.7	89.4	85.6

Table 3-3.
Data Capture Rate for SMI 160A Site, September 1998-August 1999

Date	Upper Air Winds	Upper Air T_v	Surface Met
Sep-98	85.3	85.5	100
Oct-98	90.7	91	87.6
Nov-98	98.9	98.8	99
Dec-98	87.5	87.4	94.8
Jan-99	99.5	99.5	99.5
Feb-99	96.1	96.1	96.1
Mar-99	97.7	97.7	98.1
Apr-99	98.9	99	99.3
May-99	98.5	98.5	99.3
Jun-99	98.1	98.1	98.1
Jul-99	97.9	97.9	97.9
Aug-99	99.3	99.5	99.5
Annual Average	95.7	95.8	97.4

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.

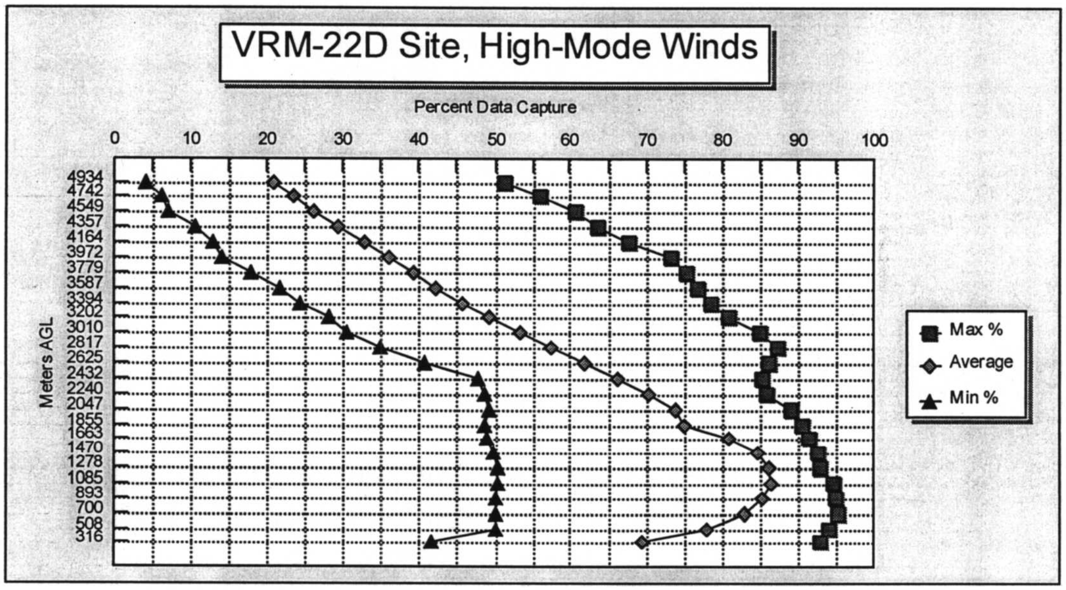
As of the date of preparation of this annual report, data rates for September 1998 through August 1999 were available (and data for September 1999 were being processed). These figures illustrate data recovery rate for each site in a series of graphs that are labeled "Max %", "Average", and "Min %". The graphs are, respectively:

- The maximum monthly recovery rate over the twelve months in the sample;
- The average monthly recovery rate over the twelve months in the sample;
- The minimum monthly recovery rate over the twelve months in the sample.

The horizontal (or x) scale is the percent of data recovery and the vertical (or y) scale is the measurement altitude in meters AGL.

3.4.3.1 Radar Profiler High-Mode Wind Data

The data recovery for the two sites for the high-mode wind is shown in Figure 3-3. The relatively low data recovery 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.



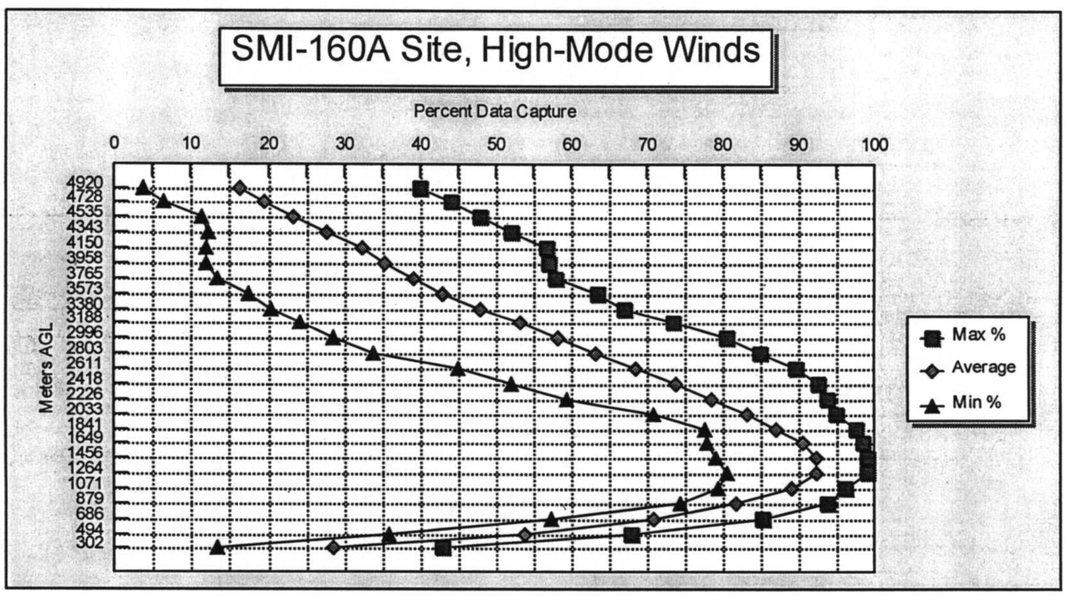
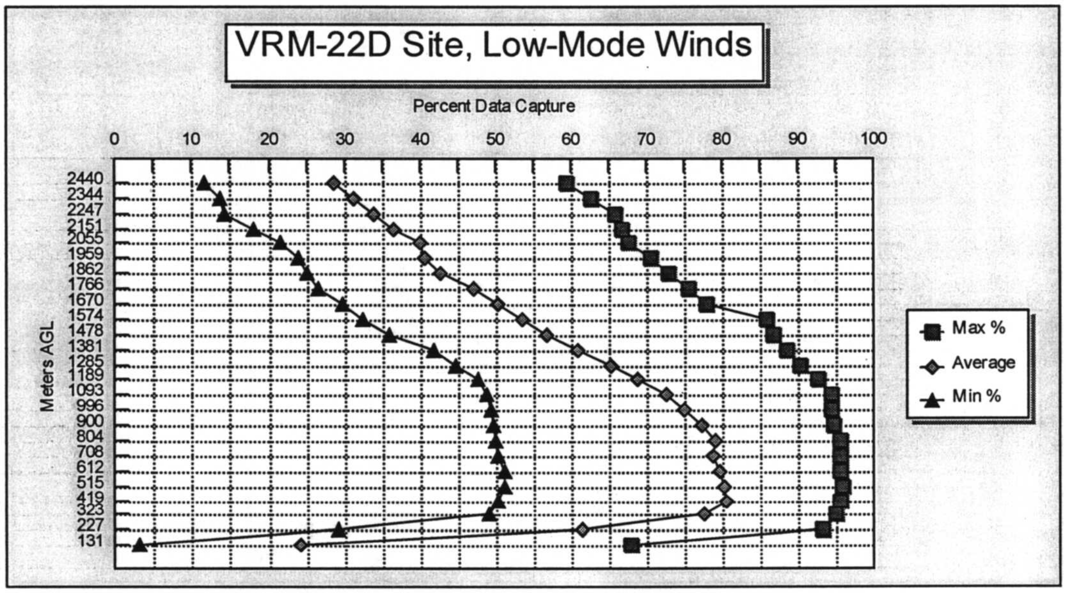


Figure 3-3. Data Recovery for Radar Wind Profiler High-Mode Winds, September 1998 - August 1999

3.4.3.2 Radar Profiler Low-Mode Wind Data

The data recovery rate for the low-mode wind is shown in Figure 3-4. Both sides experienced data losses at the lowest altitudes due primarily to sea clutter interference.



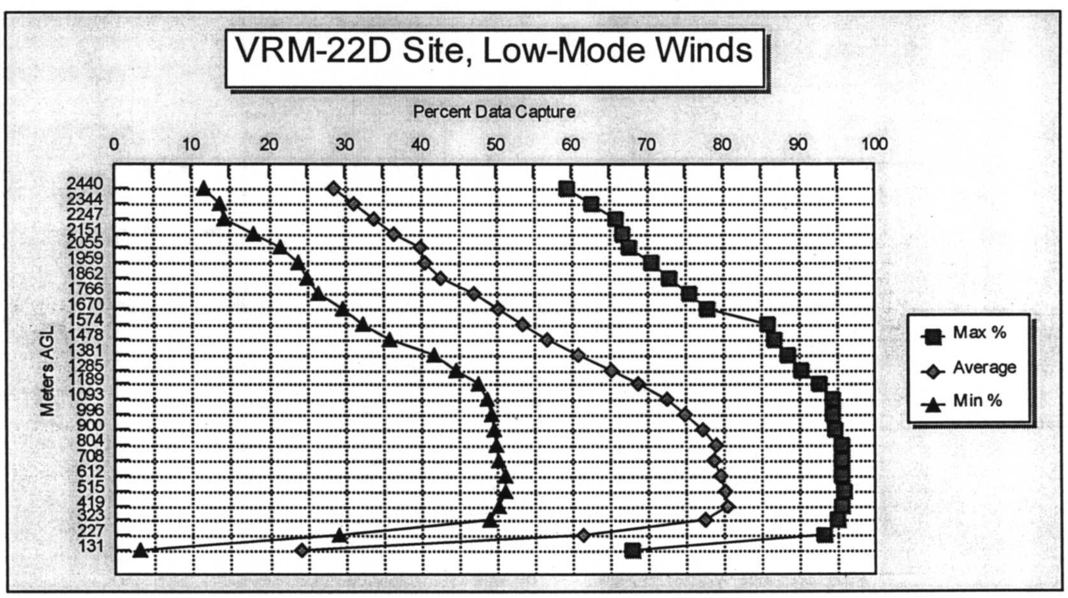
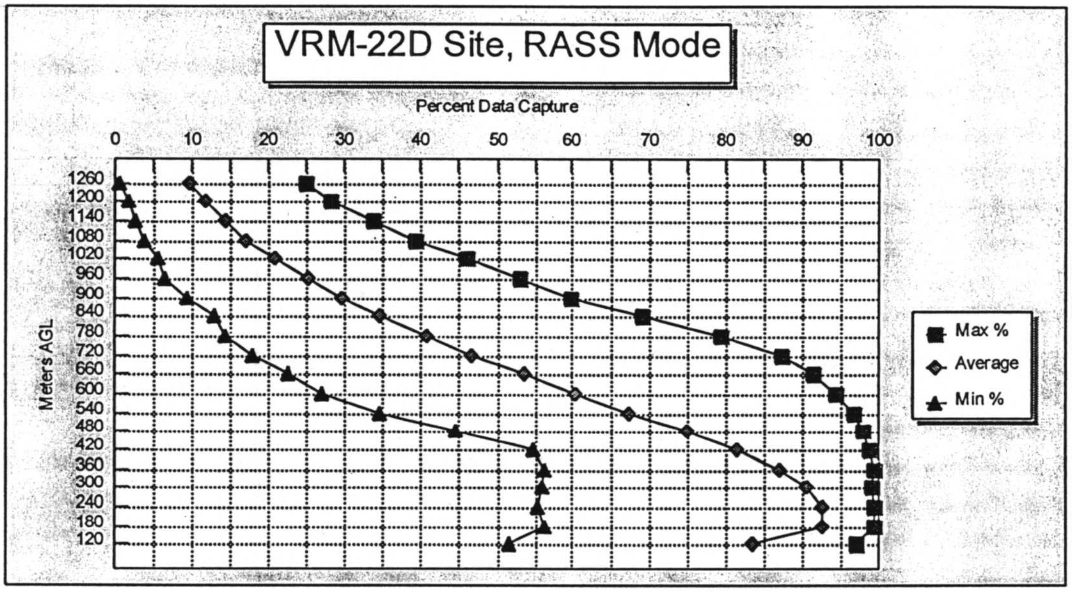


Figure 3-4. Data Recovery for Radar Wind Profiler Low-Mode Winds, September 1998 - August 1999

3.4.3.3 RASS Temperature Data

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 3-5.



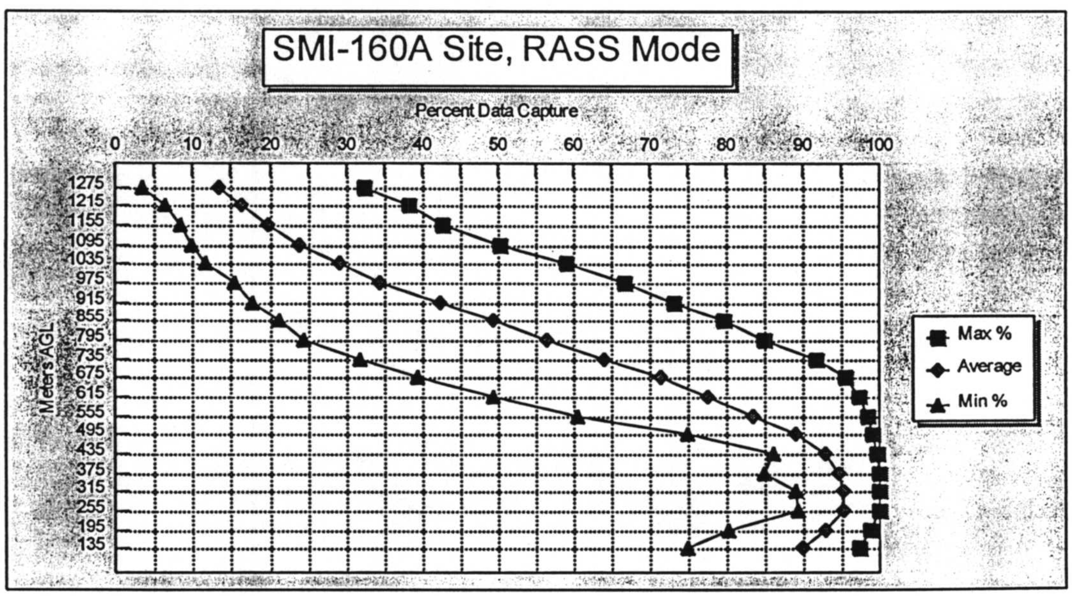


Figure 3-5. Data Recovery for Radar Wind Profiler RASS Mode, September 1998 - August 1999

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: Spares occasionally falling below safe quantity levels at off-site storage locations.

Corrective Action: Routinely sent faulty sensors taken from platform sites to the manufacturers for repair. Quick returns kept spares quantity to proper levels.

3.5.3 Site Operations and Maintenance

a. Problem: GOES DCP on SMI inoperative due to a broken power switch.

Corrective Action: Repaired during unscheduled maintenance trip 9-10 October 1998. Restored functionality 0700/10 October 1998. Data collected between 29 September 1998/0900 and 10 October 1998/0700 CST at the platform, but not transmitted via GOES during the DCP down time was copied to disk and mailed to STI for archiving.

b. Problem: The GOES satellite system was inoperative for 18 hours on 27 October 1998, causing us to not receive data during 0100-1800 CST that date from both sites.

Corrective Action: This was a NESDIS problem that they fixed. Lost data was saved at site and was copied to disk during the 17 December unscheduled maintenance visit and sent to STI archives.

c. Problem: The "Indemnity and Boarding Agreement" required by the new owner of SMI-160A, Newfield Exploration Company, created a problem potentially impacting our future access to this site.

Corrective Action: Following unsuccessfully attempting to negotiate revised wording with Newfield, Radian signed a limited-time agreement under their terms to cover the 9-10 October 1998 unscheduled maintenance visits. After much negotiations among Radian, MMS, and Newfield Exploration Co., we received a waiver to their Indemnity and Boarding Agreement on 15 December 1998. This allows us access to SMI site and transportation to support this MMS project.

d. Problem: Temporary interruptions of data flow from SMI occurred in December 1998.

Corrective Action: In every case, the platform site operator helped us resolve the problems and to restore normal data flow.

e. Problem: A DOS window problem on the SMI GC resulted in loss of 37 hrs of data in October 1998.

Corrective Action: Upon identification of an open data port, corrective actions were taken, and routine operations restored. While these data were not transmitted, they were recovered during the 17 December unscheduled maintenance visit and sent to STI archives.

f. Problem: Lower than 90% capture rate for upper air data was seen at SMI in December 1998 due to failure of the local area network between the RC and GC.

Corrective Action: The network connection was repaired during the December 1998 unscheduled maintenance visit. Data flower normally after that.

g. Problem: During January-May 1999, strong aloft and surface winds at both sites frequently reduced the data recovery for RASS above 500m AGL and for profiler winds below 1000m AGL in the low-mode and below 500m AGL in the high-mode.

Corrective Action: No solution, just situational.

h. Problem: VRM system "lost track" of its time on the evening of the 10 April 1999 resulting in data stoppage. The few data files that got through were showing up with dates nine days ahead.

Corrective Action: Resolution was to reboot the radar computer and to remotely reset all wrong dates in launchpad manually. This strange event may have been related to platform generator problems, power outages, and the Uninterruptible Power Supply (UPS) crashing in the middle of a time reset session from the GPS clock. This problem took five days to resolve, unfortunately, mostly because of the platform power problems taking that long.

i. Problem: Radar profiler data from the VRM site was intermittent during July 1999. A problem of non-receipt of both the radar profiler and surface met data from VRM that was experienced during June was resolved remotely through system resets and an unscheduled maintenance visit was not necessary. However, during July a different problem was experienced with only the radar profiler portion of the VRM data stream. This new problem manifest itself as invalid data being reported by the VRM radar profiler during the periods 12-13 July, 17-19 July, and 20-31 July. While making preparations for a maintenance visit all data flow from VRM was lost on 3 August 1999.

Corrective Action: Visited the VRM platform 6-7 August 1999 and found that the platform had taken a direct lightning hit on 3 August 1999. We fixed the radar profiler during the site visit and restored GOES transmission of the radar profiler data. We were unable to restore the transmission of the surface met data at that time, however, because the surface met data were not being received by the hub computer from the datalogger. Following our visit, we sent a replacement surge protector to the platform and had it installed by a platform operator. Unfortunately, that did not restore the transmission of the surface met data. During the scheduled maintenance visit to the VRM platform in September 1999, we isolated the problem to the short-haul modem that transfers sensors' output to the data logger. We corrected the problem during that site visit.

3.5.4 Data Measurements

a. Problem: The SST and RH sensors are the most problem-prone of the sensor suite. For example, the SST sensor at VRM failed in October 1998, November 1998, and September 1999.

Corrective Action: Replaced the VRM SST sensor during the unscheduled maintenance visits in October and December 1998 and the scheduled maintenance visit in September 1999. During our December 1998 VRM site visit, we added to the SST sensor an extension tube to try to protect the lens from any sea salt spray contamination. We also sent an identical tube to the SMI operators for installation on that site's SST sensor.

b. Problem: We discovered in December 1998 that the radar profilers at both sites were set to automatically adjust their time keeping for daylight savings time and back again to standard time. We had thought this feature was disabled.

Corrective Action:	Data reports sent under daylight savings time were off one hour as data was represented in the reports as CST. The data was subsequently adjusted to the correct times and replacement CD sent to MMS/COTR in January 1999.

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 second year of work on this project successfully supported the objective. Site and equipment were rigorously monitored, problems quickly addressed, and reports submitted on time. 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.

Recommended action is that the project data collection and reporting be continued, as originally planned and as subsequently implemented during the first two years of project effort.

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.