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PROGRAM MANAGEMENT AND SYSTEMS ENGINEERING SUPPORT FOR  
THE MARINE SEISMIC SYSTEM (MSS)(U) RAMCOR INC VIENNA VA  
D C JOHNSON 30 SEP 81 RC-271 N00014-80-C-0837

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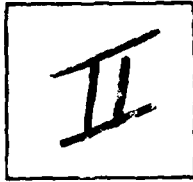
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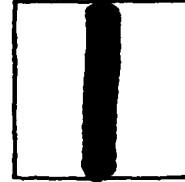
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DA 126282

DTIC ACCESSION NUMBER



LEVEL



INVENTORY

Rept. No. RC-271

DOCUMENT IDENTIFICATION

Final, 28 Sept. '81

Contract N00014-80-C-0837

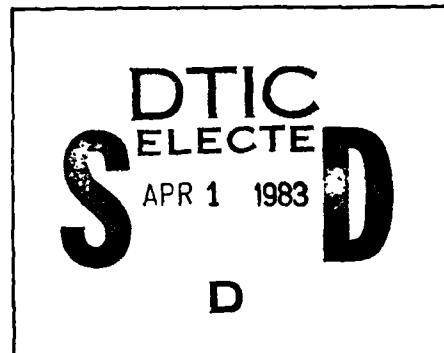
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PROGRAM MANAGEMENT AND SYSTEMS ENGINEERING  
SUPPORT FOR THE MARINE SEISMIC SYSTEM (MSS)

30 SEPTEMBER 1981

FINAL REPORT

800 FOLLIN LANE VIENNA, VIRGINIA 22180

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PROGRAM MANAGEMENT AND SYSTEMS ENGINEERING  
SUPPORT FOR THE MARINE SEISMIC SYSTEM (MSS)

28 SEPTEMBER 1981

CONTRACT NO. N00014-80-C-0837

FINAL REPORT - NO. RC-271

PREPARED FOR :

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## SECTION 1 INTRODUCTION

### 1.1 OVERVIEW

During the period beginning 16 June 1980 and ending 30 September 1981, RAMCOR, Inc. provided technical support to the Naval Ocean Research and Development Activity (NORDA) under Contract Number N00014-80-C-0837. Specifically, RAMCOR provided overall program management support and systems engineering support to the NORDA Marine Seismic System (MSS) Program. Within the context of this task such functions as system requirements analysis, alternative systems and deployment technique evaluations, program scheduling, and test planning were performed. Each of these tasks and their resultant deliverables will be discussed in subsequent sections of this document.

### 1.2 REPORT CONTENT

This document, which constitutes the final report under the contract, is intended to summarize specific tasks which RAMCOR, Inc. has completed for the MSS Program. It is divided into three sections. Section 1 presents a brief overview of the work performed followed by Section 2 which describes the performance of each individual task and relates them to the overall program requirements. Finally, Section 3 itemizes each deliverable produced during the performance of the contract.

## SECTION 2

### TASK PERFORMANCE

#### 2.1 PROGRAM BACKGROUND

To put the completed tasks, and their deliverables, into context and relate RAMCOR's efforts to the overall program requirements, it is appropriate to review the background of the MSS Program. The primary goal of the Marine Seismic System (MSS) is to collect multi-frequency seismic data from a sensor implanted in a deep-ocean borehole. Preliminary testing was completed in the Atlantic during FY-81 to demonstrate system feasibility and test the basic concept. A more extensive test is scheduled for FY-82 to collect at least 60 days of seismic data.

For scientific reasons, the geographical location chosen for this installation lies in the North Pacific between the Emperor Seamount Chain and the Kuril-Kamchatka Trench. This area is one of the most seismically active areas in the world and will give scientists their first opportunity to observe seismic events from within the basaltic crust of a descending plate. Additionally, in the event that a Comprehensive Nuclear Test Ban Treaty is instituted, the Marine Seismic System (MSS) will satisfy the requirement for a high quality seismic monitoring station to discriminate between natural seismic and nuclear events.

#### 2.2 GENERAL STATEMENT OF WORK

In support of the MSS Program described above, RAMCOR, Inc. provided program and management support to the Naval Ocean Research and Development Activity

(NORDA). Three specific task areas were pursued:

- Program Planning and Scheduling
- Program Issue Investigations
- Overall Program Support

Each of these areas are discussed in the following sections.

### 2.3 PROGRAM PLANNING AND SCHEDULING

A significant portion of the RAMCOR MSS effort was devoted to this task area. The goal was to provide a detailed plan for the overall MSS Program to ensure a cohesive and integrated effort by all program participants. In addition, it provided a comprehensive schedule of events as a management tool for the program manager. Utilizing this tool enabled NORDA and DARPA Program Managers to coordinate all program activities associated with system development and sea test preparation. The products resulting from this effort were the Program Plan and Milestone Chart, the Program Logic Chart, the Work Breakdown Structure for the March 1981 Sea Test, and the Prototype System Development Chart for the 1982 system.

The Program Plan and Milestone Chart is a detailed task interdependency chart which reflects all aspects of the MSS Program. The development of this document required RAMCOR to examine various borehole drilling/implantment techniques, sensor systems, and communications and data retrieval systems. From this, system requirements and performance criteria, major program



milestones, and decision points were then identified and merged into an integrated and time sequenced format. The MSS Program Manager was provided with a concise summary of all major schedule activities, allowing him to track significant events, readily determine variance from the program schedule, and assess the impact of a schedule slippage.

The Program Logic Chart is another management-oriented visual representation produced for the use of the MSS Program Manager. During the development of this chart, RAMCOR performed system requirements analysis, examined alternative systems and deployment techniques, and integrated the findings into a decision aid which presents varying degrees of system performance as a function of the effectiveness of the sensor systems, communications and data retrieval systems, and borehole drilling/implantment techniques. This charts primary function is to provide the MSS Program Manager with a valuable decision-making device. It allows him to determine the impact of various courses of action in the actual developmental cycle and assess the impact upon the overall performance of the final system.

The Work Breakdown Structure for the March 1981 Sea Test is a detailed chart identifying the responsibilities of the various Marine Seismic System (MSS) Program participants for the 1981 feasibility demonstration test. Its generation reflected the technical aspects of the program and required close technical liaison and coordination between program participants in order to define areas of responsibility, minimize scheduling problems, and facilitate the accomplishment of scientific goals during the testing period.

The Prototype System Development Chart for the 1981 System is an in-depth activity schedule which coordinates the design and developmental activities of the various program participants on the specific subsystems associated with the MSS System. This chart allows the MSS Program Manager to monitor the various stages of system development, note any variance from the program schedule, determine its impact, and reschedule necessary program elements as a function of the impact on the total program. Moreover, the Prototype System Development Chart serves as a reference for the program participants and helps ensure timely performance and technical coordination of tasks requiring parallel efforts and overlapping functions.

#### 2.4 PROGRAM ISSUE INVESTIGATIONS

In addition to Program Planning and Schedule Development, RAMCOR addressed programmatic and technical issues on the Marine Seismic System (MSS) Program in two program point papers. The papers, entitled "Payoff's from NORDA's Participation in the MSS Program" and "Marine Seismic System Program Alternative Deployment Concepts," were submitted under this task area.

The first paper, developed the payoffs inherent from NORDA's participation in the Marine Seismic System (MSS) Program. This task consisted of an examination of system objectives, the risks associated with the development and deployment of MSS, and the capabilities required to increase the program's probability of success. A conclusive analysis comparing the capabilities required to enhance program success and those inherent at NORDA was then conducted.

The "Marine Seismic System Program Alternative Deployment Concepts" study presents the results of a survey of existing, or near term, which could be considered as alternatives to a drillship for placing seismic packages in predrilled boreholes. The study was an in-depth examination of the limitations and requirements of reentering existing boreholes. Additionally, a survey of various manned and remotely-operated vehicles was conducted in an effort to determine their value in MSS application. The results of this effort were then addressed in terms of which alternative deployment method would be most feasible, available, and cost effective.

## 2.5 OVERALL PROGRAM SUPPORT

In addition to the specific areas of support previously mentioned, RAMCOR provided overall program support to the NORDA Marine Seismic System (MSS) Program Office. This effort included technical coordination for, and documentation of, the proceedings and issues generated by the MSS Interface Coordination Meetings. In addition, technical reviews of overall system designs and performance requirements, MSS problem areas, and other issues pertinent to the system requirements and developmental cycle were an integral part of this effort.

RAMCOR also provided technical briefing data and materials for program briefings in support of the NORDA Program Office. These briefings outlined the basic concept, the ultimate objectives and overall schedule of the Marine MSS Program for major program reviews and program sponsor briefings.

### SECTION 3 DELIVERABLES

The following list of deliverables were produced by RAMCOR, Inc. for the Marine Seismic System (MSS) Program under Contract No. N00014-80-C-0837.

- PROGRAM PLAN & MILESTONE CHART  
A detailed chart of key milestone events, decision points, and design and development activities for the Marine Seismic System (MSS) Program projected through FY 83.
- PROGRAM LOGIC CHART  
A graphic display which shows varying degrees of system performance as a function of the effectiveness of the sensor systems, communications and data retrieval systems, and drilling/implantment techniques.
- PROGRAM BRIEFINGS (THREE)  
(40-45 VUGRAPHS)  
Program briefing materials which outlined the basic concept and objectives of the Marine Seismic System (MSS) Program.
- WORK BREAKDOWN STRUCTURE FOR MARCH 1981 SEA TEST  
A detailed chart which describes the responsibilities of the various Marine Seismic System (MSS) Program participants for the March 1981 at-sea test.
- PROTOTYPE DEVELOPMENT MILESTONE CHART  
An in-depth design/developmental activity schedule for the 1982 prototype system.

- PAYOFF ANALYSIS OF NORDA'S PARTICIPATION IN THE MSS PROGRAM

A discussion of NORDA's capabilities, experience, and inherent advantages for participation in the Marine Seismic System (MSS) Program.

- ALTERNATIVE DEPLOYMENT CONCEPTS ASSESSMENT

A report which presents the results of a survey of existing or near term vehicles which could be considered as alternatives to a drill-ship for Borehole Instrumentation Package (BIP) implantment.

- MINUTES OF MSS INTERFACE COORDINATION MEETINGS (FOUR)

Documentation of various meetings which focused upon system design issues and scheduling requirements, MSS problem areas, etc.

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