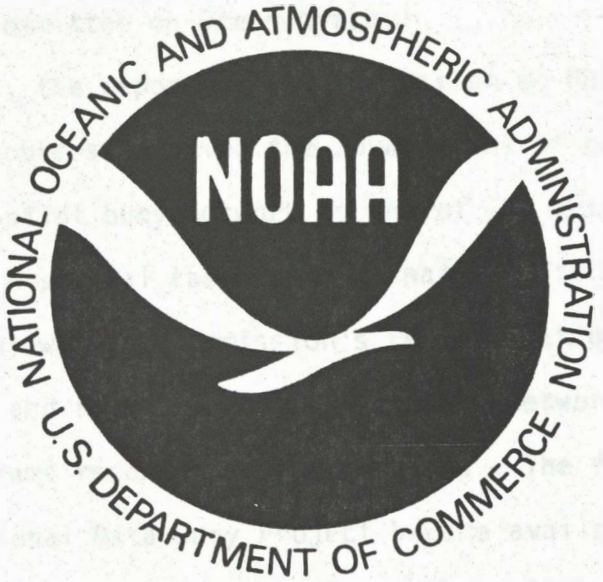
NDBCM W0547

U. S. DEPARTMENT OF COMMERCE ● NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL OCEAN SURVEY
NATIONAL DATA BUOY CENTER



DEVELOPMENT OF NATIONAL DATA BUOY SYSTEMS

20 SEPTEMBER 1971

INTRODUCTION

The National Data Buoy Project (NDBP) was established in December 1967 for the purpose of developing a national capability to deploy and operate networks of automatic buoys to retrieve useful information describing the marine environment on a reliable, real time basis. This was in response to a request by the National Council on Marine Resources and Engineering Development, commonly known as the Marine Sciences Council, and successor to the Interagency Committee on Oceanography.

In January 1969, the report of the Commission on Marine Sciences, Engineering, and Resources selected the advancement of buoy technology and deployment of a pilot buoy network as one of six activities deserving national priority. A special task force on national technology problems in November 1969 reviewed the Commission's recommendations along with other potential programs, and reaffirmed the pilot buoy network as one of only three national programs recommended for emphasis. The first funds appropriated for the National Data Buoy Project became available in January 1970, when $6.5 million were included in the Coast Guard 1970 appropriations.

On October 3, 1970, the National Oceanic and Atmospheric Administration (NOAA) came into being within the U. S. Department of Commerce as a result of Presidential Reorganization Plan Number 4. On October 6, 1970, by Executive Order 11564, the functions of the National Data Buoy Project were transferred to NOAA and placed under the direction of the Assistant Administrator for Environmental Systems. On July 12, 1971, the Project Office was transferred to National Ocean Survey (NOS), Office of Marine Technology, where it was designated as the National Data Buoy Center.

The basic concept of the National Data Buoy Systems involves the use of a number of buoys of one or more types, moored or drifting, in the deep ocean in a systematic array, equipped with various sensors to measure environmental parameters, and utilizing direct or satellite radio communications links to transmit the coded data to shore stations for dissemination to data processors and users. The buoys are to be unmanned automatic stations which are serviced at regular intervals, with a design goal of one year reliable, unattended operation.

Techniques exist for measuring most environmental parameters of major interest. However, the existing state-of-the-art in sensor technology does not provide the reliability required to meet the design goal of a one year service interval, due to both the hostile ocean environment and the very high mean-time-between-failure (MTBF) required of each component. In addition, other critical areas of buoy technology require development to achieve performance goals to implement a cost-effective data buoy system. The development of the required technology is the major objective of the Engineering Experimental Phase (EEP).

The Engineering Experimental Phase (EEP) buoys will be deployed in early 1972 and prototype limited capability buoys in the late summer of 1972. The next series of developmental buoys are to be deployed starting in July 1973. With a decision to proceed with engineering development in July 1974, the prototype (pilot) buoy network will commence operation in July 1977; and with a decision to proceed with the operational National Data Buoy Systems (NDBS) in January 1979, full system operations could begin in the second quarter of calendar year 1980.

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NATIONAL DATA BUOY PROJECT

BACKGROUND

The oceans and their contiguous water areas cover almost three quarters of the world's surface exerting substantial influence on the world's physical environment, both in the long term and immediate view. For many years, it has been recognized in both public and private sectors that a means to continously and reliably measure and predict the global environment would be of great benefit to the economy, human welfare, and national defense. Mathematical models of the world's environment have been developed to represent present conditions and extrapolate to the future. However, the models are severely limited in accuracy and extent of extrapolation by the lack of understanding of marine environmental processes, and the lack of raw data from the environment. This serious information gap has long been recognized by oceanographers and meteorologists.

In 1966, the Ocean Engineering Panel of the United States Interagency Committee on Oceanography (ICO) recognized that the development, deployment, and operation of consolidated national data buoy systems held considerable potential for the national interests, and requested that the United States Coast Guard manage an interagency-funded study to determine if National Data Buoy Systems were feasible. The feasibility study, completed in October 1967, accomplished four tasks: (1) Documentation of the extensive national requirements for marine meteorological and oceanographic data; (2) establishment of the technical feasibility of unmanned all-weather data buoy systems as the most cost-effective means for collection of a substantial segment of the national requirements; (3) development of representative plans for implementation of data buoy systems; and (4) identification of areas where substantial

national benefits would accrue from such systems. The President's Marine Sciences Council accepted the findings of this study as justification for beginning the research, development, testing, and evaluation of National Data Buoy Systems, and designated the Coast Guard to act as the lead agency in this effort. Other national and international planning activities have stressed the need for a coordinated data collection system utilizing buoys and other appropriate platforms. These efforts and most recent reports are:

MAREP - Federal Planning Guide for Marine Environmental Prediction

GARP - Global Atmospheric Research Program

MARMET - Federal Plan for Marine Meteorological Services (FY 68-72)

WWW - World Weather (Watch) Program, Plan for Fiscal Year 1970

IGOSS - Integrated Global Ocean Station Systems Working Group Reports

IDOE - Joint study report by the National Academy of Sciences/National Academy of Engineering for an International Decade of Ocean Exploration

The need for an improved marine observation system is best documented by the January 1969 report of the President's Commission on Marine Science, Engineering and Resources, Our Nation and the Sea, which states:

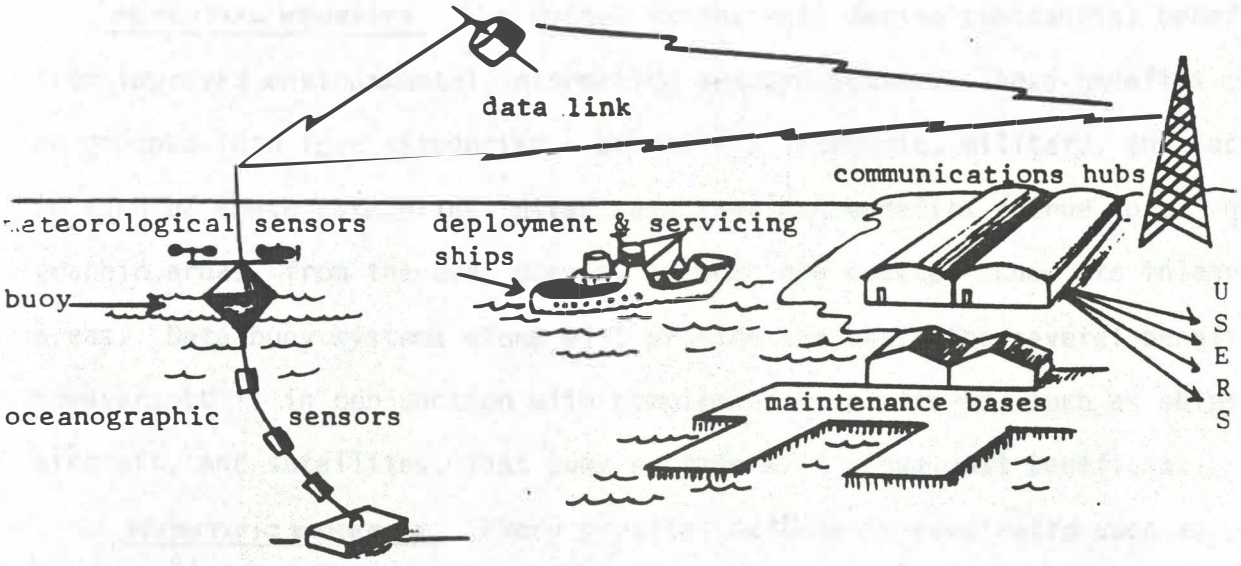
> "The Nation must have a comprehensive system for monitoring and predicting the state of the ocean and the atmosphere. The United States has the beginnings of such a system today, but it is inadequate to our needs and its organization is fragmented. Weather and ocean forecasts and warnings produced by such a system are essential to all one may wish to do in the sea and are critical to almost all human, industrial, agricultural and commercial activities on the land. They are essential for sea and air transportation, resource

exploration and exploitation, aquaculture and water management, and above all the protection of life and property. The Department of Defense also has persuasive needs for environmental services." National planning includes data buoy networks as a part of the National Environmental Monitoring and Prediction System, the Integrated Global Ocean Station System, the World Weather Program and the International Decade of Ocean Exploration.

NATIONAL DATA BUOY SYSTEMS

National Data Buoy Systems are visualized as networks of buoys designed to measure the oceanographic and meteorological parameters required in the national interest and of international benefit and to deliver that information to appropriate processing centers. National Data Buoy Systems are referred to as systems becuase they must include all of the components -- buoys, sensors, servicing ships, bases, data handling centers, communication nets, and trained personnel -- necessary to acquire data and deliver it reliably and at regular intervals. The plural "systems" is intentionally used to indicate that different types of hardware may be necessary to satisfy the needs identified for the deep oceans, the continental shelf areas, the estuaries and Great Lakes, and the Arctic - all areas in which significant needs exist for environmental information. Figure 1 illustrates the general concept of National Data Buoy Systems. Present plans call for measurement of the parameters listed in Appendix I hereto; however, these are subject to change as data requirements evolve.

GENERAL CONCEPT OF NATIONAL DATA BUOY SYSTEMS



REQUIREMENTS

Requirements (mission and benefits analysis) will focus on: (1) Cost-effectiveness/cost benefits analyses; (2) scientific investigations; and (3) user data requirements and changes in requirements over time. Cost analyses are performed to determine the most cost-effective means to satisfy user requirements and the sensitivity of the outcome to various environmental and technological factors. Cost-benefit analyses are to ensure the cost of the development, deployment, human, and defense benefits from the system. Scientific investigations are required because system design is dependent on precise knowledge of the nature of data to be collected and processed. Continuous contact with users of the system is required to assess data requirements and reflect changes in requirements as greater knowledge and experience are accumulated.

BENEFITS

POTENTIAL BENEFITS: The United States will derive substantial benefits from improved environmental information and prediction. These benefits may be grouped into four categories: Scientific, economic, military, and social. In each of these categories, direct and indirect benefits accrue to all geographic areas, from the deep oceans, through the coastal zones, to inland areas. Data buoy systems alone will provide the basis for several benefits; however, it is in conjunction with complementary platforms, such as ships, aircraft, and satellites, that buoy systems will prove most beneficial.

SCIENTIFIC BENEFITS: Every physical science is predicated upon an accurate and complete description of the object of that science. Once the oceans have been systematically observed and measured, theories and functional relationships can be developed or hypothesized, thereby leading to improvements in practical technology. At present, the identification of these functional relationships is hampered by a lack of sufficient high quality data. The deployment of deep ocean and coastal data buoy systems will provide data for major advances in understanding the ocean environment. These theoretical advances, when combined with a continuing inflow of synoptic data from buoys, will lead to increases in practical knowledge, which will in turn permit further expansion of the economic, military, and social benefits of the system.

ECONOMIC BENEFITS: Under contract with the Coast Guard, the Travelers Research Corporation developed an evaluation of the cost-benefits of an improved national environmental information and prediction system. Their study concludes that, even after potential benefits are minimized and costs maximized

in accordance with a conservative approach, the hypothetical data buoy system has a benefit-to-cost ratio between 1.8:1 and 8:1. These ratios were developed by considering the 15-year costs of acquiring and operating a global data buoy system but only the benefits that would accrue to the U. S. and for only the first 10 years of buoy system operation. Over a ten-year operational period, the projected benefits of the global system would range from $7 to $21 billion. The majority of benefits could, however, be derived from a smaller system of 150 buoys of extensive sensing capability, or their equivalent capability in smaller buoys, deployed in the North Atlantic, the North Pacific, and along the U. S. coastline. Current dollar cost of such a system would be $95 million for development, $133 million for acquisition, and $140 million for 10-year operating costs, for a total of $368 million. Even if these costs were doubled to provide for complementary and interfacing systems, benefit/cost ratios would still range from 9.5:1 to 28.5:1. The imprecise nature of benefit-cost projections is widely recognized, but it is clear that in the economic area alone, the benefits of the proposed system significantly exceed its costs, before the extensive scientific, social and military benefits are even considered.

Improved environmental information and prediction systems will enhance the safety, speed, efficiency and economy of the several transportation modes. Marine transportation, for example, can benefit from faster and less costly passage, lower cargo and ship damage, and improved design of ships and harbors. The Federal Highway Administration has identified such benefits as lives saved, improved safety, lower construction losses, improved travel efficiency, lower maintenance costs, and improved comfort and convenience. The benefits to air transportation are of a similar nature to the above.

As a second example, the $100 billion dollar U. S. construction industry suffers annual losses of between $3 and $10 billion as a result of adverse environmental conditions. Benefits that might accrue to this industry from improved short range forecasts have been estimated to total $300 million annually. Improved long range forecasting is estimated to offer financial benefits to the construction industry of from three to four times this sum.

The Petroleum Panel of the National Security Industrial Association, a group representing the offshore oil industry, has estimated that benefits in 1970 from improved prediction, primarily in the Gulf of Mexico, would range from $4.5 million to $34 million. A synoptic network of some 35 buoys in and adjacent to the Gulf of Mexico would cost approximately $30 million to acquire and $3.7 million per year to operate. Benefits to the offshore oil industry alone could match total acquisition and operating costs for the networks in the first year -- without including the extensive benefits to other industries, the general public and the scientific community.

MILITARY BENEFITS: While the economic benefits expected to be derived from National Data Buoy Systems exceed system costs, military benefits also provide strong justification for systems implementation. A complete scientific interpretation of the seasonal and geographic characteristics of the ocean and atmosphere is mandatory for optimum prosecution of strategic planning and for deployment of naval forces. Data buoy systems will contribute greatly to the ability to understand and assess environmental variables and their relationships to military plans and operations. Naval activities that will benefit from buoy data include, but are not limited to, the following:

- Antisubmarine Warfare
- Amphibious Operations
- Mine Warfare
- Barrier Operations
- Replenishment at Sea
- Polar Operations
- Reconnaissance
- Ocean Surveys
- Optimum Ship Track Routing
- Deep Submergence Systems Research and Development

In addition, there is no question of the potential value of data buoy environmental information to the planning and execution of other Department of Defense operations such as those at the Eastern, Western, Pacific, and Eglin Missile Test Ranges, and in space system ocean recovery areas.

SOCIAL BENEFITS: Many of the benefits of National Data Buoy Systems can be classified as "social" since they are in the area of public health, safety and welfare. Data buoys will contribute to more precise marine and weather forecasts which in turn will increase efficiency and reduce losses in areas such as municipal utility operation, air and water pollution monitoring, snow and ice removal, and protective measures in preparation for hurricanes and tidal surges. Improved marine and weather warnings from increased environmental data acquisition will also result in greater public safety and enjoyment of activities such as boating, fishing and swimming.

SUPPORT:

All interested Federal Departments, the President's Office of Science and Technology, and the National Council on Marine Resources and Engineering Development have joined in supporting the NOAA program to develop the ability to implement National Data Buoy Systems.

By concurrent resolution in 1968, the Congress stated that the U. S. should give full support to the World Weather Program. It noted that unprecedented scientific and technological possibilities exist to improve the weather services of the U. S. and that such improvements would yield social and economic benefits of great magnitude. President Nixon in his report to Congress noted that activities in support of the Program are planned by eight federal agencies including the National Data Buoy Project.

The Coast Guard continues to actively support the National Data Buoy Center at an annual savings to NOAA of approximately $1.0 million by providing facilities and personnel for the buoy interrogation and data receiving equipment located at the Coast Guard Radio Station, Miami, Florida and by providing ship services to deploy and service developmental buoys in the Gulf of Mexico and off the East Coast.

DEVELOPMENT PROGRAM:

The National Data Buoy Center has adopted a "total systems" approach to developing the national capability to implement networks of unmanned automatic, environmental data buoys, preparatory to a future deployment decision. Automatic buoys are not being examined in isolation, but rather as part of an integrated system including the servicing ships, maintenance bases, communications links, and trained personnel which are necessary to maintain those buoys in continuous, reliable operation. The immediate goal of the Project is to deploy test buoys in FY 1972-73. The purpose of these buoys will be to demonstrate the immediate availability of the technology needed. This Advanced Development program will encompass (1) design of buoys of relatively limited sensing capability, (2) preliminary design studies on

high sensing capability buoys, (3) development, test, and evaluation of oceanographic and meteorological sensors, and (4) systems engineering and analysis on proposed operational NDB Systems. In addition to Advanced Development effort, a limited program of Exploratory Development will be pursued with the objective of advancing the technology of sensors, materials, power supplies, system design, and system capabilities.

EXPLORATORY DEVELOPMENT: State-of-the-Art oceanographic and meteorological instrumentation on which developmental sensors are based were designed primarily for manned applications, this effort, commencing in FY 1972, will concentrate on advancing technology in sensors and supporting equipment for unmanned applications.

ADVANCED DEVELOPMENT: Advanced Development efforts will concentrate on: (1) The deployment, testing, and evaluation of Engineering Experimental Phase (EEP) Buoys; (2) the specification and procurement of preprototype buoys; (3) the specification and procurement of low capability buoys; (4) supporting investigations; and (5) Systems Engineering, Program Control and Logistic Support. The EEP buoys procured during FY 71 will be deployed in the Gulf of Mexico in early 1972 for the test and evaluation of components until approximately 1973. In a parallel effort, Preprototype Buoy Components with reliability and performance characteristics of the pilot buoy network buoys as design goals will be specified and contracted for. Critical results from the Environmental Reporting Buoy (X ERB), which becomes operational in FY 72, and the EEP buoys will provide input to the Preprototype Buoy development. Low capability buoys, which sense fewer parameters and are either moored or drifting, will be specified and procured

for deployment in the late summer of 1972. These buoys are to be tested and evaluated for potential applications in a future National Data Buoy System at locations where user needs are smaller and/or to provide additional information in areas of special interest. Supporting investigations will be conducted in consonance with the development of the buoy systems to ensure that hardware and software required are available and to ensure selection of the optimal system as the ultimate operational network.

ACTIVITIES:

Fiscal Year 1969 - 71 activities of the National Data Buoy Project included:

- Deployment of the first Experimental Environmental Reporting Buoy (X ERB-1) 125 miles east of Norfolk. The buoy provides synoptic atmospheric and oceanic observations in near real time to users. It has further provided the Project with valuable operational experience in furtherance of its RDT&E mission.

- Preparation of a Requirements Development Plan outlining tasks necessary to define system performance characteristics, an Engineering Development Plan enumerating technical development tasks, and a Concept Formulation Plan. The potential benefits to transportation of improved prediction were studied, a contract was awarded for regional benefit studies in the Gulf region (which will enhance effectiveness of the EEP Buoy Deployment), and a study was made of natural variability of environmental phenomena.

- Studies and efforts in: Deep ocean mooring technology; environmental sensors technology; formatting and transmission of data; standardization and test requirements; design and performance requirements; and development of a profiling oceanographic sensor unit.

- Participation in a wide variety of interdepartmental, interagency, and national planning groups, and representing the U.S. buoy program at international meetings in France, Switzerland and Japan. An Industrial Data Users Meeting was held to provide liaison and guidance to the Project, as well as a Briefing to Industry for over 700 interested contractors. Workshops were held in data formatting and mooring problems. These liaison activities greatly benefitted the Project by establishing valuable interface with and input from interested bodies, as well as national and international recognition of the U. S. buoy effort.

- Award of contracts for EEP Ocean Platform fabrication and sensor procurement and development of specifications for related subsystems. These buoys will employ improved State-of-the-Art instrumentation. Design also proceeded on relatively limited capability prototype buoys, and design studies were performed on prototype high capability data buoys. Proposal evaluation for an OMEGA high frequency retransmission experiment to test and verify the required capability to locate drifting buoys.

- A Scientific Advisory Meeting of nationally and internationally known scientists had to (1) focus attention of the Scientific community on the Project; (2) relate NDBS to the solution of major environmental research problems; and (3) discuss the use of the data provided by these systems in on-going and proposed national and international programs.

- A study of optimum utilization of the six high frequency radio bands allocated for ocean data collection. Also participation in the Joint Scripps, Navy, and Coast Guard North Pacific (NORPAC) buoy experiment to compare communications results via high frequency radio with those of a communication relay satellite system.

- Participation in the Sea Lanes buoy (mooring) test and evaluation program. Also organization of a Buoy Mooring Problem Workshop.

- Relocation of the National Data Buoy Project from Washington, D.C. to NASA Mississippi Test Facility in order to utilize existing national facilities and capabilities.

- Extensive evaluation of available power sources, leading to a decision to limit further investigation to thermoelectric and diesel engine generators. Plans call for parallel contractual development and testing programs on these two types, to permit a future selection of one system for data buoy use. Award of a contract for development of liquid-fuel thermoelectric generator prototypes.

PROGRAM PLAN:

The program plan which has been evolved to organize activities through deployment of a Pilot Buoy Network is divided into several functional phases. These phases correspond to the level of buoy technology required at each stage of the program. The plan combines the deployment of state-of-the-art hardware, to provide early operational experience, with the orderly development of components to meet requirements of the Pilot Buoy Network. In the first phase of the program, Advanced Development activities will be carried on in two areas: (1) Initial development of Advanced Development test components to meet system requirements and (2) procurement and deployment of state-of-the-art hardware to provide early environmental data and to provide insight into buoy problems by exposing components to the environment. At the same time, Exploratory Development activity will be commenced, focusing

on advanced components to sense additional parameters (and/or to sense currently measurable parameters with improved performance). The subsequent stage of the program is development, deployment, and evaluation of Advanced Development Test components to insure component reliability in the (more advanced) prototype (pilot) buoy network. The final phase will be development of the prototype (pilot) buoy network. This program plan will permit the following development timetable:

a. Deployment of Engineering Experimental Phase Buoys in March of 1972;

b. deployment of prototype limited capability buoys by November 1972;

c. addition of Advanced Development high capability buoy components for test and evaluation starting in July 1973; and

d. contingent upon a decision to proceed to Engineering Development in July 1974, a prototype (pilot) buoy network in July 1977.

The Stratton Commission report in January 1969 recommended the prototype buoy network as one of six national programs deserving priority emphasis. In reviewing the Commission's report, the Marine Sciences Council has reaffirmed the desirability of advancing buoy technology and deploying a pilot buoy network to demonstrate feasibility and practical benefits.

CONCLUSION

A number of national activities emphasize the need for a marine environmental monitoring capability and affirm the wisdom of early development of unmanned buoys for this use. The increased importance of environmental pollution monitoring and control illustrates the need for buoy platforms for routine, operational use. The International Decade of Ocean Exploration will require automatic buoys for wide scale research use. In a similar manner, the proposed Global Atmospheric Research Program and similar expanding research programs include a substantial dependence on buoy-measured data. On an international scale, the World Meteorological Organization and the Intergovernmental Oceanographic Commission are both planning global observation programs, including the widespread use of automatic buoys. It is anticipated that the National Data Buoy Center will be responsive to most of these rising needs, and will provide important spinoffs for other areas of oceanographic research and operations.

NDBC PUBLISHED PAPERS

"The National Data Buoy Development Project" J. E. Wesler	IEEE Northeast Electronics Research and Engineering Meeting (NEREM 69), Boston November 5-7 1969. 1969 Nerem Record
"Telemetering Data Buoys" J. A. Hodgman	Oceanology International June 15, 1969
"National Data Buoy Systems, What and Why?" J. E. Wesler	The Journal of Environmental Sciences Jan - Feb 1970
"Buoys as Platforms for Environmental Measurements" J. E. Wesler	AIAA Papers No.69-155 AIAA 7th Aerospace Sciences Meeting Jan 20 - 22, 1970 NY
"To Instrument the Oceans: National Data Buoy Systems" J. E. Wesler	Offshore Technology Conference paper #1111, Dallas, Texas. For the First Annual Offshore, Technology Conference May 18 - 21, 1969
"National Data Buoy Systems - A decisive step forward" J. A. Hodgman & J. E. Wesler	Proceedings of the Fifth Annual Meeting of the MTS June 1969 Miami, Florida
"Buoys as Platforms for Environmental Measurements" J. E. Wesler	Journal of Hydronautics July 1969

"Communication Planning for National Data Buoy Systems" M. E. Gilbert	1969 Radio Technical Commission for Marine Services Assembly Proceedings. Cleveland, Ohio April 1969
"A Computer Simulation Model for the National Data Buoy High Frequency Telemetry System" M. E. Gilbert	Submitted for the 1970 Radio Technical Commission for Marine Sciences Assembly Proceedings April 1970, San Francisco
"Project Management for National Data Buoy Systems" J. A. Hodgman, W. F. Merlin	The Institute for Management Sciences Sept. 12 - 14, 1968 Cleveland, Ohio
"Automatic Environmental Data Buoys" V. W. Rinehart	Submitted to the Bulletin of the American Meteorological Society March 1970
"Management of the National Data Buoy Systems" L. Michael Flaherty, CDR John E. Wesler	Sperry Rand, Engineering Review, Undersea Systems 1970

ENDORSEMENTS

President Johnson's Message to Congress, March, 1968

Stratton Commission, January - February, 1969

Tribus Committee Report, November - December, 1969

Scientific Advisory Meeting, May, 1969

Industrial Data Users Meeting, May, 1969

REFERENCES

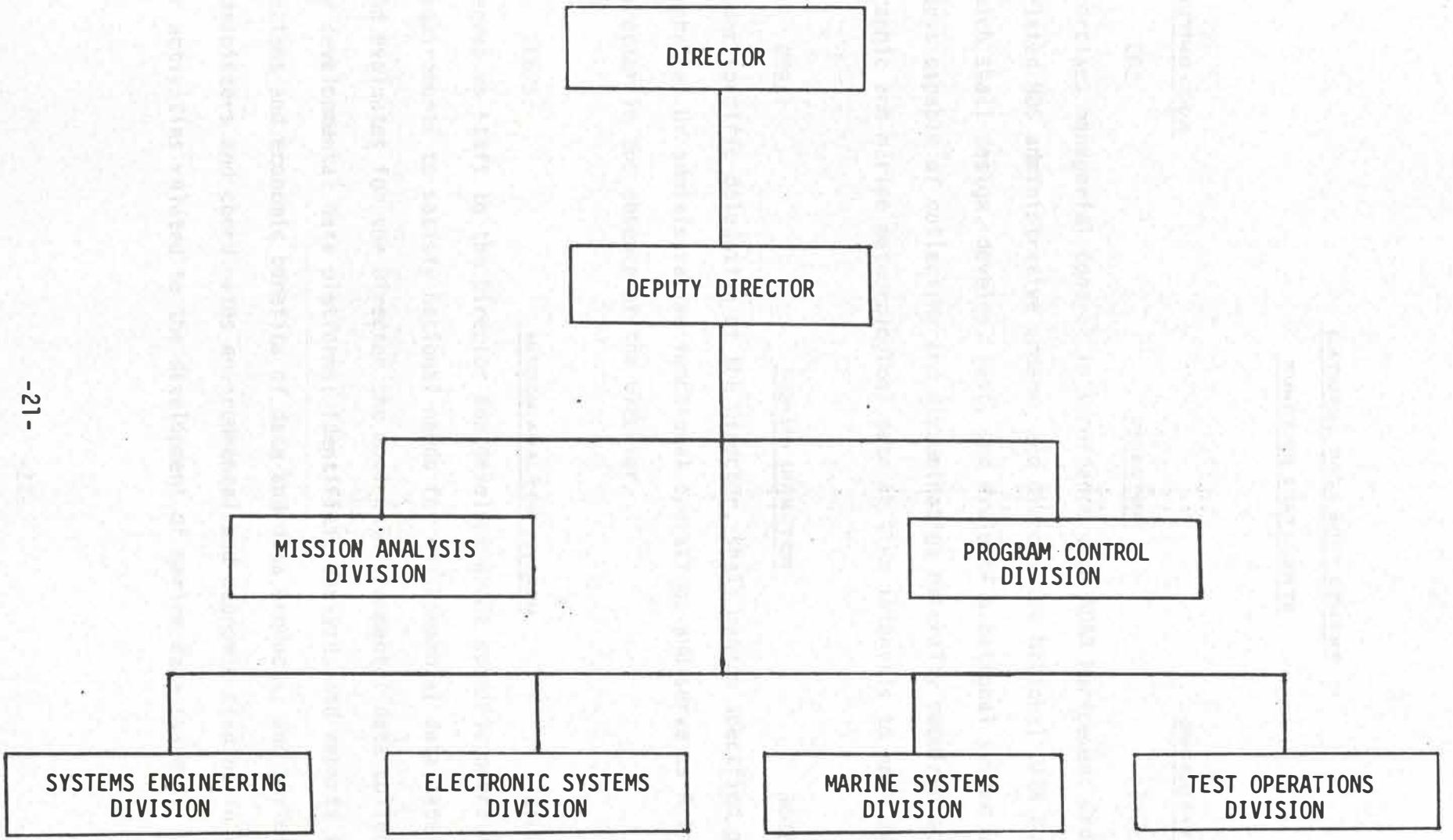
A Summary of the Study of the Feasibility of National Data Systems, Report 7485, The Travelers Research Center, February, 1968 (AD 665-314)

"Our Nation and the Sea - A Plan for National Action," Report of the Commission on Marine Science, Engineering, and Resource, U. S. Government Printing Office, January, 1969

Proceedings of the First Scientific Advisory Meeting for National Data Buoy Systems, USCG National Data Buoy Project, July, 1969 (AD 695-501)

NATIONAL DATA BUOY CENTER

ORGANIZATION



NATIONAL DATA BUOY CENTER

FUNCTION STATEMENTS

ROUTING CODE		ORGANIZATION CODE
C62	DIRECTOR	3602000

Exercises managerial control in accordance with NOAA Management Orders and related NOS administrative orders, and directs the National Data Buoy Center which shall design, develop, test, and evaluate a national system of data buoys capable of collecting and disseminating naturally required oceanographic and marine meteorological data at time intervals to meet user needs.

C62x1	DEPUTY DIRECTOR	3602000

Under specific delegation of the Director, shall manage specified general technical or administrative functional operations and serve as Acting Director in the absence of the Director.

C625	MISSION ANALYSIS DIVISION	3602500

Serves as staff to the Director for developing the specific operational requirements to satisfy national needs for environmental data; analyzes and evaluates for the Director the marine environmental data collected by developmental data platforms; identifies, analyzes and reports applications and economic benefits of data and data products; and performs, administers and coordinates environmental and economic studies in regions or activities related to the development of marine data systems.

ROUTING CODE		ORGANIZATION CODE
C626	PROGRAM CONTROL DIVISION	3602600

Serves as staff to the Director for planning, programming and budgeting; program status evaluation; procurement planning and contract administration; and financial management. Coordinates funding priority lists, prepares project plans and budgets, and develops necessary documentation. Develops and administers a system for the collection and distribution of management information and nontechnical project documentation. Prepares procurement plans and procurement documents, and reviews contract progress. Provides financial liaison with the NASA Mississippi Test Facility and other Government agencies for contracting and other support services. Records and reviews contract costs; performs cost accounting and furnishes financial information and documentation to the Director.

C621	SYSTEMS ENGINEERING DIVISION	3602100

Performs functional analyses, develops system design and performance specifications, develops long-range procurement and schedule documentation, develops logistics requirements and conducts trade-off studies in order to evaluate the effectiveness, costs, and cost effectiveness of conceptual systems to be developed and procured; provides the test requirements for system testing and evaluation; compares actual system performance with planned performance. Prepares reliability/maintainability plans, models and procedures. Develops, maintains and implements configuration management plans and models.

ROUTING CODE		ORGANIZATION CODE
C622	ELECTRONIC SYSTEMS DIVISION	3602200

Designs, develops, and specifies oceanographic, meteorological, pollution and special platform sensors which collect data identified by system specification. Designs, develops and specifies equipment necessary to determine geographic locations of buoys. Designs, develops and specifies equipment necessary to collect, transmit, process and disseminate sensed data in desired format to data users. Draws upon test results and new technology to develop design modifications and new components to improve system performance. Translates system performance specifications into procurement documents, monitors procurement activities and, when appropriate, integrates components into systems.

C623	MARINE SYSTEMS DIVISION	3602300

Designs, develops, specifies ocean platforms, buoy moorings, electrical power systems and safety and protective devices for buoy systems. Designs, develops, and specifies unique shipboard and shore support equipment during development phases, and ships and shore support facilities for operational systems. Draws upon test results and new technology to develop design modifications and new components to improve system performance. Translates system performance specifications into procurement documents, monitors procurement activities and, when appropriate, integrates components into systems.

ROUTING CODE		ORGANIZATION CODE
C624	TEST OPERATIONS DIVISION	3602400

Develops and implements detailed operational plans for test and evaluation of developmental and operational systems and subsystems. Determines, plans, and coordinates force requirements to deploy, evaluate, service and operate systems under test. Develops logistics planning information and logistics plans for operational systems. Conducts operations and administers support contracts for test operations. Acts as primary liaison between the NOAA National Data Buoy Center and the Coast Guard Districts providing operational support. Provides management and other Divisions with analytical reports of actual system performance, trends in performance, failure reports, and significant information on handling and operating procedures. Manages and operates the shore based depot for inventory, maintenance and repair of system equipment and spares, dispatches equipment for manufacturer repair, and monitors equipment support contracts.

NATIONAL DATA BUOY CENTER

BUDGET INFORMATION

All allocations of funds in the National Data Buoy Center are linked to the "Work Breakdown Structure" (WBS). WBS systems are used in project management to separate funds into categories based on purpose or type of effort and timing. For instance, several WBS areas of the National Data Buoy Center are continuous, such as project management, and funded every year, while others are of finite duration, such as the Engineering Experimental Phase (EEP), and start, run for a period, and stop upon their conclusion. The WBS system is also used to control documentation and schedules that are critical to the development.

The WBS system can have a large number of numbered levels. The first level (or digit) is the most general and covers a broad segment of the Center activity. The second level (or digit) is a more specific breakdown within the second level, and so forth. Figure 1 is an illustration and taken from the NDBC Documentation Control Plan. In order to have a required, unique identifier for funds used for contracts, the NDBC uses the first four levels of the WBS plus a two letter alpha-numeric code.

First level WBS numbers and titles are as follows:

LEVEL NO.	TITLE
0	System/Project Management includes (01) Mission Analysis, (02) Systems Engineering, (03) Program Control, (04) Logistics Support Management, and (05) Project Office Support.

LEVEL NO.	TITLE
1	Drifting Limited Capability Buoy (DLCB) Program
2	Moored Limited Capability Buoy (MLCB) Program
3	Engineering Experimental Phase (EEP) Buoy Program
4	Preprototype Program
5	Prototype Buoy (Pilot) Network Program
6	Supporting Investigations Program (includes hulls, moorings, sensors, support equipment, etc.)
7	Environmental Reporting Buoy (ERB) Program
8	Exploratory Development Program

The funding allocations to these elements for FY 72 through FY 76 are given in Figure 2.

WORK BREAKDOWN STRUCTURE

NATIONAL DATA BUOY SYSTEM				
LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
WBS ELEMENT NO. DESCRIPTION	WBS ELEMENT NO. DESCRIPTION	WBS ELEMENT NO. DESCRIPTION	WBS ELEMENT NO. DESCRIPTION	WBS ELEMENT NO. DESCRIPTION
1 DRIFTING LOW CAPABILITY (DLCB) PROGRAM	11 DLCB OCEAN PLATFORM SYSTEM	111 DLCB BUOY	1111 HULL	
			1112 POWER SYSTEM	
			1113 DATA PROCESSING SYSTEM	
			1114 COMMUNICATIONS	
			1115 AUXILIARY SYSTEMS	
			1116 SPECIAL BUOY SYSTEMS	
			1117 POSITION LOCATING SYSTEM	
		113 SENSOR SYSTEM	1131 OCEANOGRAPHIC SENSORS	
			1132 N/A	
			1133 METEOROLOGICAL SENSORS	
			1134 N/A	
			1135 SPECIAL SENSORS	
			1136 SENSOR DECK UNIT	
		114 SUPPORT EQUIPMENT	1141 BUOY HANDLING SYSTEMS	
			1143 ELECTRONIC MAINTENANCE UNIT	
			1144 HYO/MECH MAINTENANCE UNIT	
			1145 COMMON SUPPORT EQUIPMENT	
			1146 SPECIAL TOOLS	
			1147 SENSOR SYSTEM SUPPORT EQUIPMENT	
	12 OLCB SUPPORT SHIP SYSTEM	121 HULL		

WBS–DLCB PROGRAM

Figure 1

FUNDING ALLOCATIONS FY 72 THROUGH FY 76 [1]

FIGURE 2

(in thousands)

WBS	FY 72	FY 73	FY 74	FY 75	FY 76
0	2,771	3,566	3,446	2,754	3,038
1	1,727	1,585	5,460	715	650
2	813	771	-0-	-0-	-0-
3	3,905	3,979	2,840	-0-	-0-
4	495	3,300	2,615	3,611	2,000
5	-0-	-0-	2,445	12,890	32,479
6	2,255	1,243	150	-0-	-0-
7	474	200	200	-0-	-0-
8	276	700	700	275	250
TOTAL	12,716	15,344	17,856	20,245	38,417

[1] - A thorough review of technical plans is underway and may result in some adjustments between elements for FY 74 through FY 76.

STATUS OF DATA BUOYS

NATIONAL DATA BUOY CENTER

STATUS OF X ERB-1 BUOY

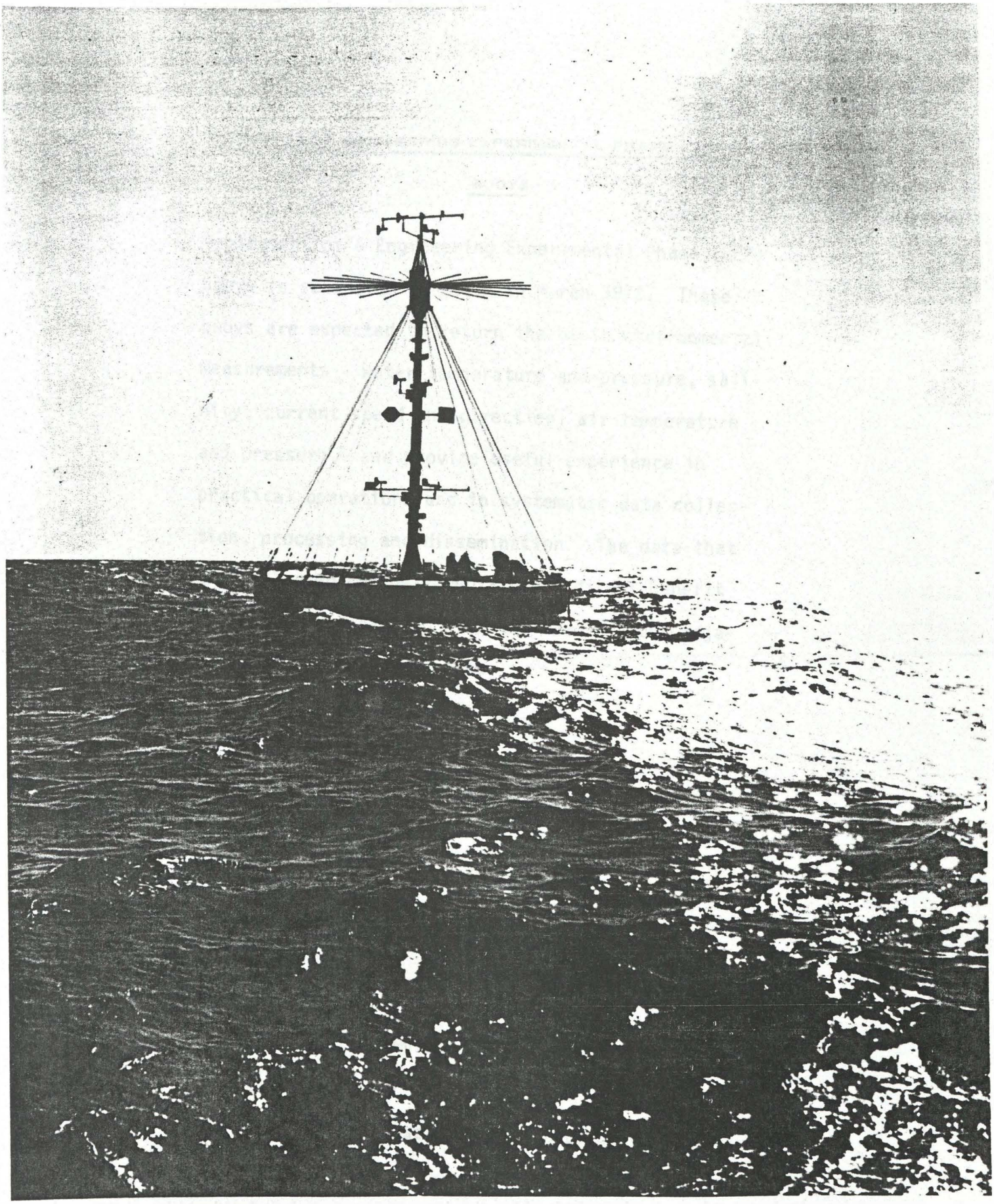
The first Experimental Environmental Reporting Buoy (X ERB-1) is deployed 125 miles east of Norfolk, the buoy provides synoptic atmospheric and oceanic observations in near real time to users. It has further provided the Center with valuable operational experience in furtherance of its RDT&E mission.

XERB-1 SYNOPTIC REPORTS

A. EVERY 3 HOURS:

1. AIR TEMPERATURE
2. BAROMETRIC PRESSURE
3. DEW POINT
4. WIND SPEED AND DIRECTION
5. SURFACE CURRENT SPEED AND DIRECTION
6. SURFACE WATER TEMPERATURE
7. WATER TEMPERATURE--

   11 READINGS AT DISCRETE INTERVALS TO 125 METERS
8. SOLAR RADIATION
9. PRECIPITATION AMOUNT



EXPERIMENTAL ENVIRONMENTAL REPORTING BUOY NO. 1

STATUS OF ENGINEERING EXPERIMENTAL PHASE (EEP)

BUOYS

Deployment of 6 Engineering Experimental Phase (EEP) buoys is scheduled to begin in March 1972. These buoys are expected to return the basic environmental measurements - water temperature and pressure, salinity, current speed and direction, air temperature and pressure - and provide useful experience in practical operations and in systematic data collection, processing and dissemination. The data that are collected can be immediate and direct benefit to weather forecasting over the land regions adjacent to the deployment area.

RESOURCES

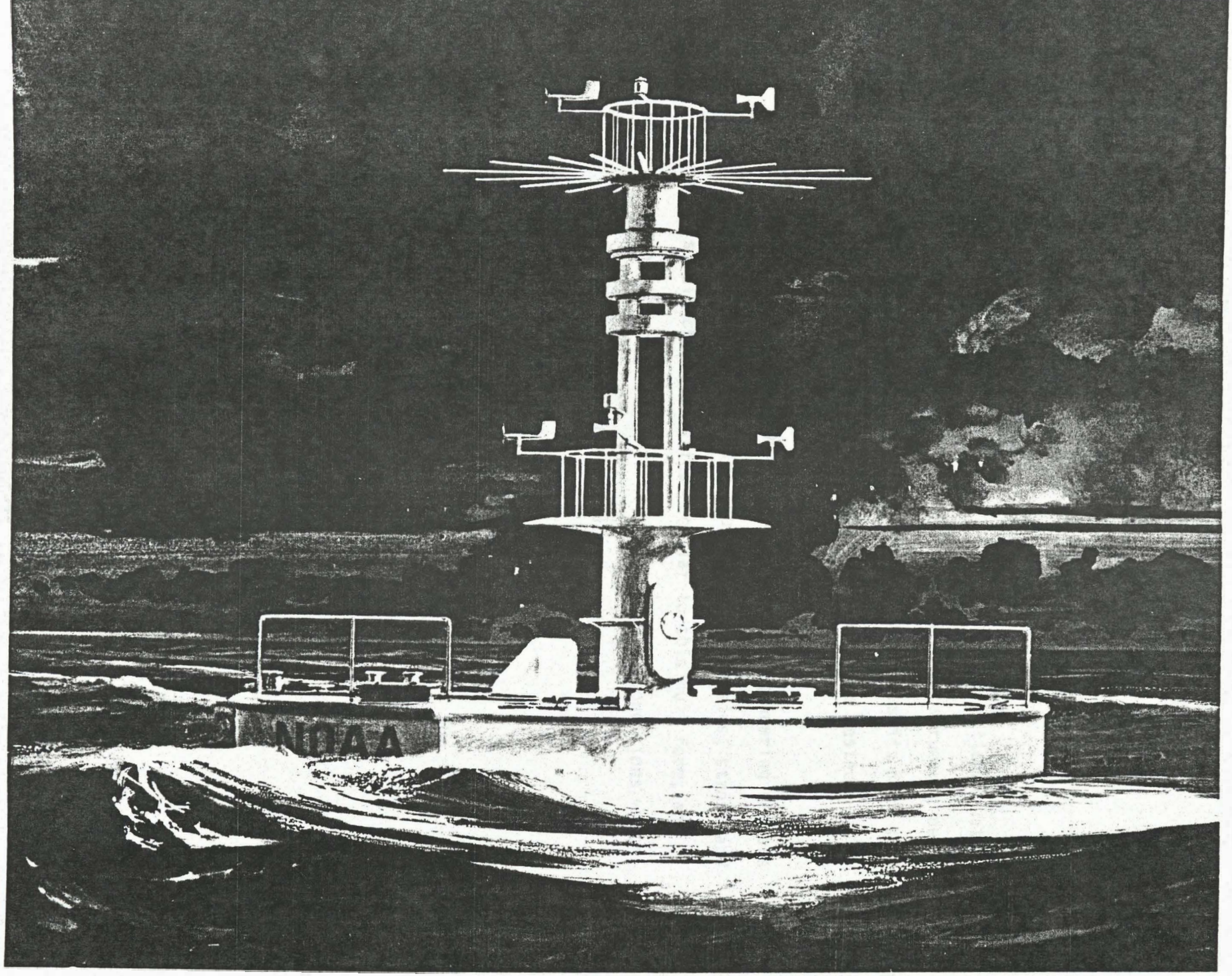
NDBC Contract NOAA, NOS, USCG

CONTRACTOR

General Dynamics, Electro Dynamic Division

and

Wesingthouse Electric Corporation



ENGINEERING EXPERIMENTAL PHASE (EEP) BUOY

STATUS OF HULL/MOORING EXPERIMENTAL BUOY

The purpose of this buoy is to afford the National Data Buoy Center the opportunity to acquire, instrument, deploy and evaluate an ocean platform which has as its most salient feature a new and unique hull form which should be tested.

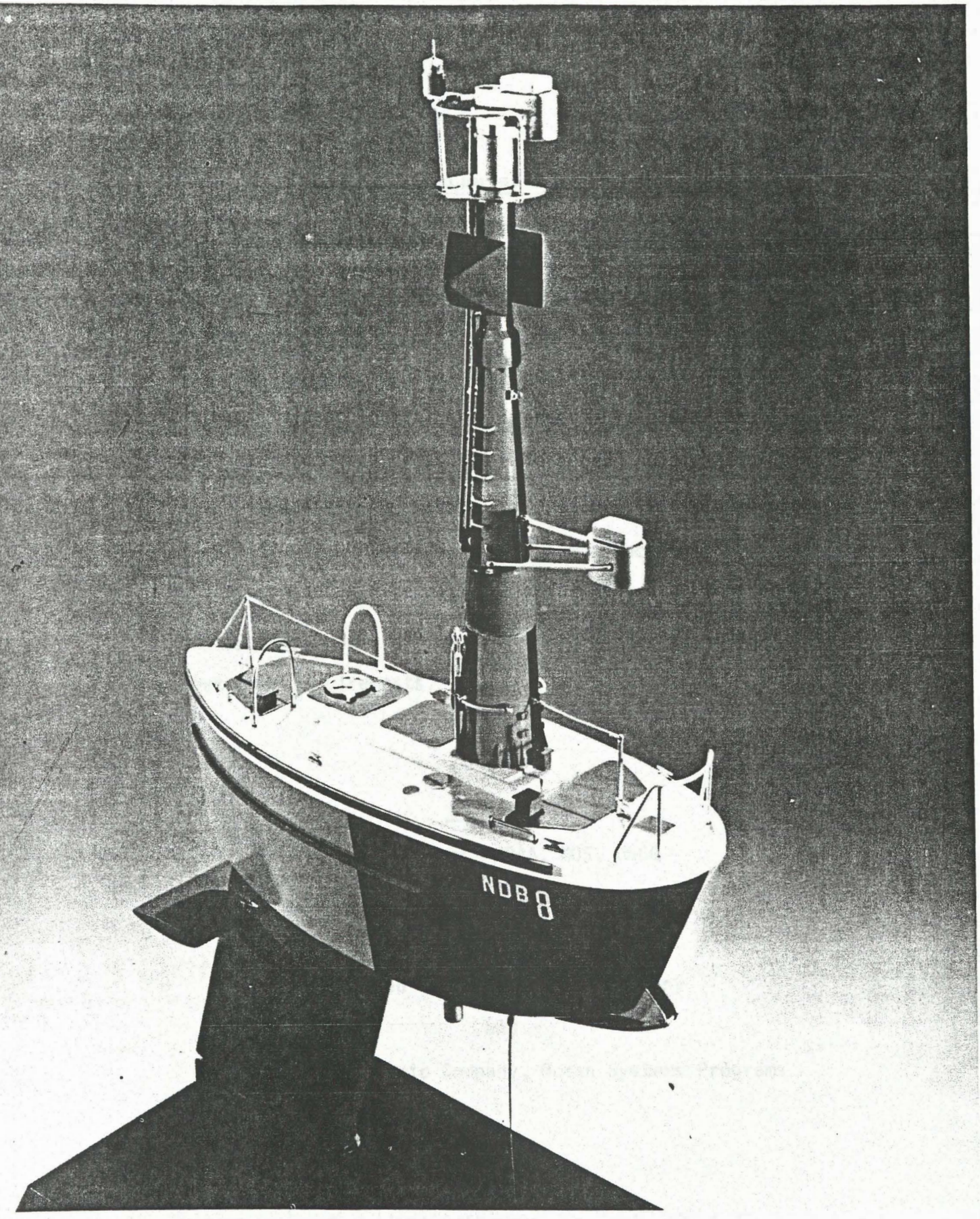
The instrumentation will be primarily engineering sensors to measure buoy motion, hull/mooring dynamics, stress and strain characteristics peculiar to this hull form, and the internal and external environmental conditions which act as buoy forcing functions.

RESOURCES

NDBC Contract NOAA, NOS, USCG

CONTRACTOR

Lockheed Missiles & Space Company



LOCKHEED MISSILES AND SPACE COMPANY

STATUS OF MOORED LIMITED CAPABILITY BUOYS (MLCB)

Deployment, operation, maintenance, and retrieval of approximately 10 Moored Limited Capability Buoys (MLCB) is scheduled to begin in November 1972. The MLCB's will be deployed to test and evaluate the state-of-the-art design and measure the basic meteorological and oceanographic parameters; i.e., air temperature and pressure, wind speed and direction, water temperature and pressure at various specified depths. In addition to performing missions in concert with DLCB's, MLCB's provide an alternative mix for use with high capability buoys where more limited data collection capabilities meet user requirements.

RESOURCES

NDBC Contract NOAA, NOS, USCG

CONTRACTOR

Lockheed Missiles & Space Company

and

General Electric Company, Ocean Systems Programs

STATUS OF DRIFTING LIMITED CAPABILITY BUOYS (DLCB)

Deployment, operation, maintenance, and retrieval of approximately 20 Drifting Limited Capability Buoys (DLCB) is scheduled to begin in November 1972. The DLCB's will be deployed by multimission ships and/or tenders, principally to evaluate their usefulness and measure the basic meteorological parameters; i.e., air temperature and pressure, wind speed and direction, water temperature. DLCB's are expected to be of considerable value to scientific experiments and for providing intensive, short term coverage of storm "breeding" grounds and critical regions.

RESOURCES

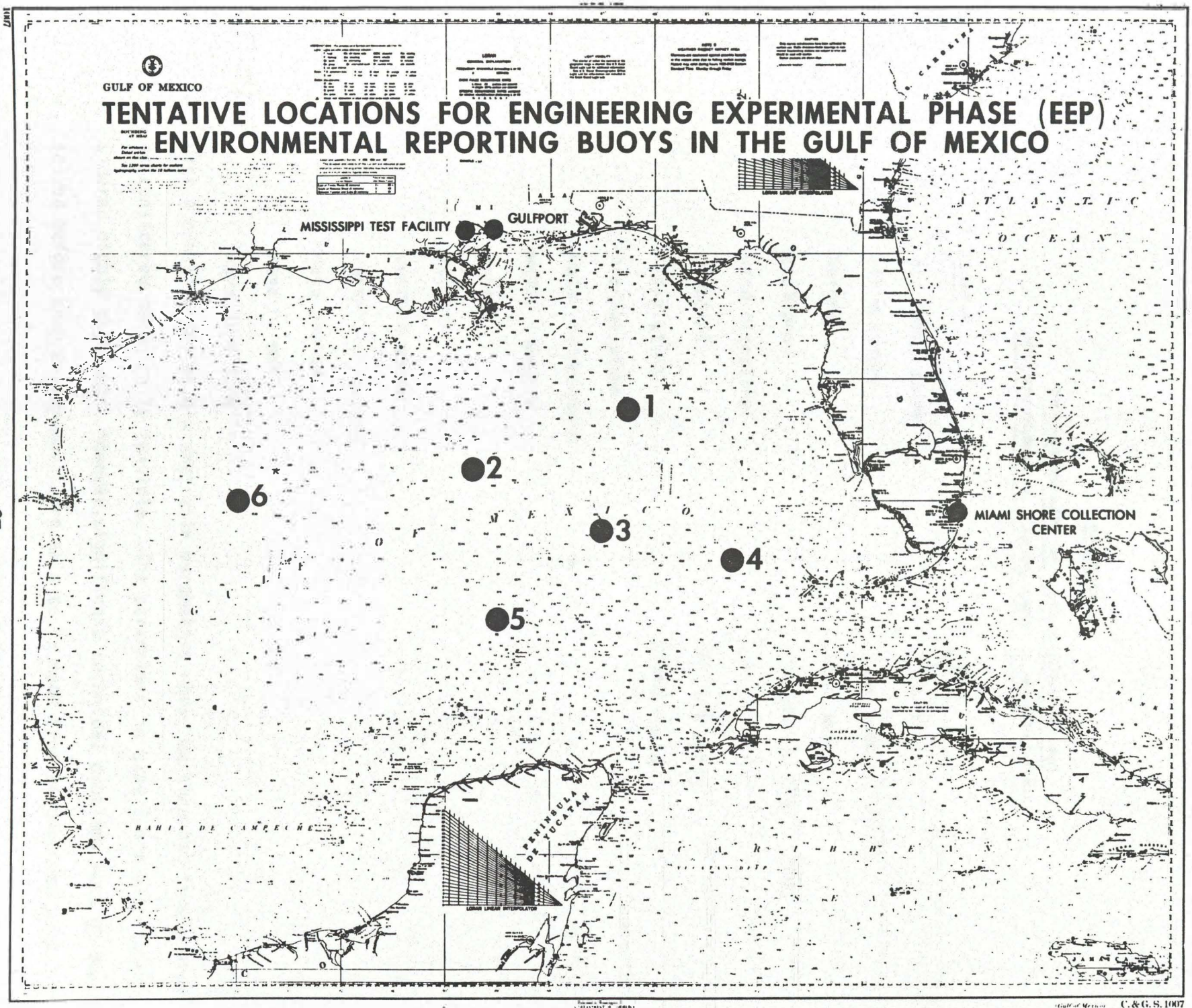
NDBC Contract NOAA, NOS, USCG

CONTRACTORS

Magnavox

and

General Electric Company, Oceans Systems Programs


GULF OF MEXICO
TENTATIVE LOCATIONS FOR ENGINEERING EXPERIMENTAL PHASE (EEP)
ENVIRONMENTAL REPORTING BUOYS IN THE GULF OF MEXICO
MISSISSIPPI TEST FACILITY
GULFPORT
MIAMI SHORE COLLECTION CENTER
1
2
3
4
5
6
PENINSULA DE YUCATAN
BAHIA DE CAMPECHE
ATLANTIC OCEAN
C. & G. S. 1007

APPENDIX I

TENTATIVE LIST OF OCEANOGRAPHIC AND METEOROLOGICAL PARAMETERS TO BE MEASURED

LIST A	LIST B
air temperature	visibility
air pressure	cloud base height
height	cloud amount
windspeed	atmospheric electricity
wind direction	ambient light
dewpoint	ambient noise
insolation	sound speed
precipitation	
water temperature	
water pressure	
depth	
salinity	
current speed	
current direction	
wave period	
wave height	
wave direction	

List A contains the highly desirable parameters whose measurement from a buoy is considered technically feasible. The parameters in List B are also considered highly desirable; however, significant technical problems must be resolved before such measurements are able to be made from an unmanned buoy.