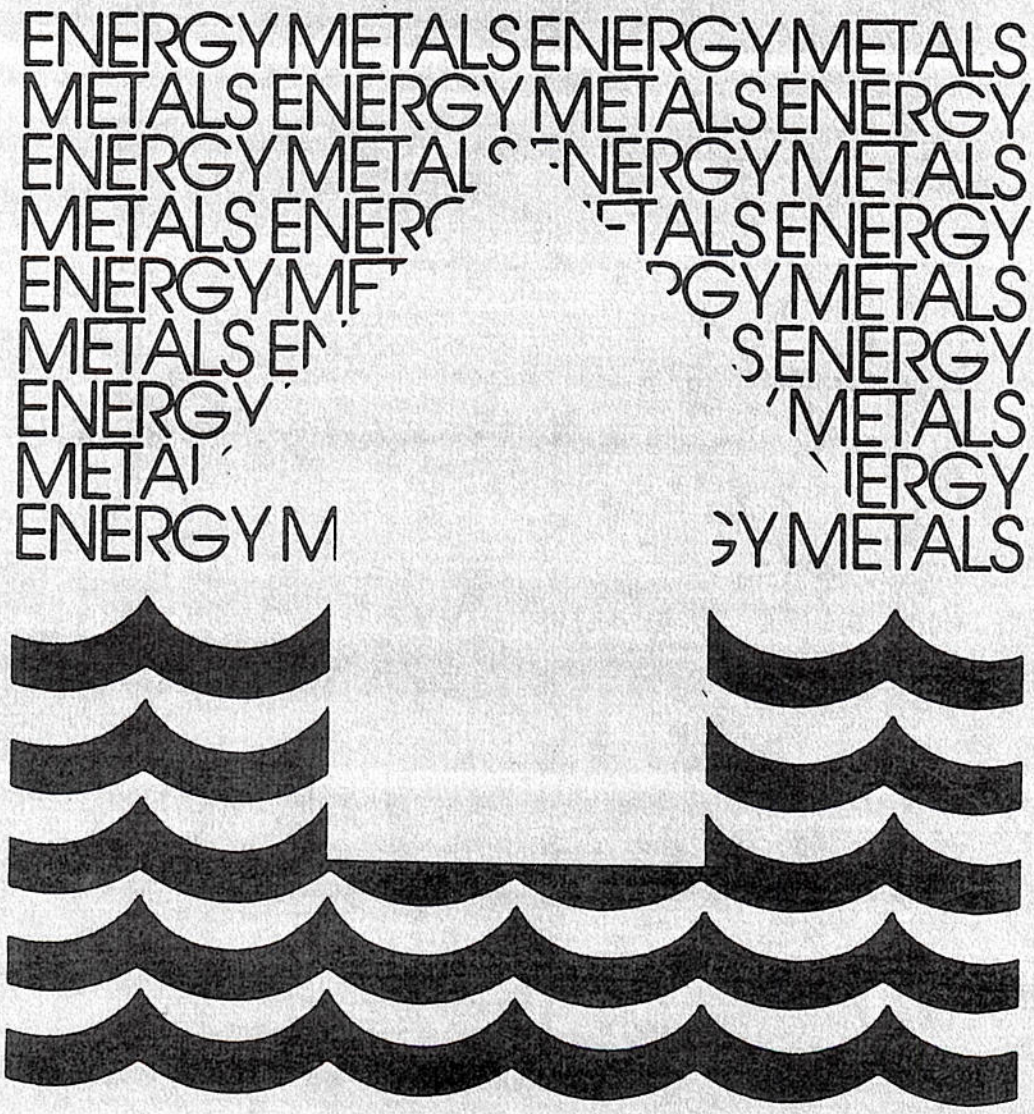

Deep Seabed Mining

Report To Congress

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
December 1983

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

THE ADMINISTRATOR

DEC 30 1983

Honorable George H. Bush
President of the Senate
Washington, D.C. 20510

Dear Mr. President:

It is my honor to transmit the Deep Seabed Mining Report of the National Oceanic and Atmospheric Administration (NOAA) to the Congress pursuant to Section 309 of the Deep Seabed Hard Mineral Resources Act (P.L. 96-283).

This report describes NOAA's progress in our continued development of the deep seabed mining program in a legally sound and environmentally sensitive manner, including the evaluation of initial applications for exploration licenses.

Sincerely,

John V. Byrne

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

THE ADMINISTRATOR

DEC 30 1983

Honorable Thomas P. O'Neill
Speaker of the House of Representatives
Washington, D.C. 20515

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Deep Seabed Mining

Report To Congress

Prepared by:
Office of Ocean and Coastal Resource Management
Ocean Minerals and Energy Division
2001 Wisconsin Avenue, N.W.
Washington, D.C. 20235

December 1983

U.S. DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary

National Oceanic and Atmospheric Administration
John V. Byrne, Administrator

National Ocean Service
Paul M. Wolff, Assistant Administrator

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EXECUTIVE SUMMARY

National Oceanic and Atmospheric Administration (NOAA) activities related to the implementation of the Deep Seabed Hard Mineral Resources Act (the Act) in fiscal years 1982 and 1983 are described in this report to the Congress. The effort has included the processing of applications from four multi-national mining consortia for NOAA licenses for exploration. The issuance of licenses was delayed as a result of conflicts among the four applicants with respect to their desired areas. A private arbitration agreement was worked out whereby the conflicts were resolved among the four applicants as well as with a French consortium which had applied to France for a license. Subsequently, all four applicants submitted amendments to NOAA and the license process has now resumed. NOAA expects to issue the initial licenses in late 1984. A Japanese consortium recently entered into the private arbitration agreement to resolve any conflicts among areas that may occur as a result of its application to Japan for a license. Therefore, some further U.S. amendments may be submitted to NOAA.

Meanwhile, NOAA and the Department of State have been engaging in discussions with government representatives of other seabed mining nations to develop an arrangement which would prevent conflicts among seabed mining operations of these nations' citizens.

In light of the near-term decisions that industry may need to make, such as whether to commit significant new levels of resources to further technology development, NOAA also is now proceeding with the development of commercial recovery regulations. U.S. companies then will be able to assess and plan for the complete legal framework under which they would operate.

In December 1982, NOAA published an Advance Notice of Proposed Rulemaking (ANPR) on this subject. Following the receipt of comments, several workshops were held and discussion papers prepared outlining tentative approaches to regulatory issues. Proposed regulations should be published in the FEDERAL REGISTER early in 1984 with final regulations around mid-year.

As promised in NOAA's Deep Seabed Mining Final Programmatic EIS (September 1981), research has continued to be focused on those environmental impact concerns not resolved during NOAA's Deep Ocean Mining Environmental Study (DOMES) project.

° Adverse effects of the surface plume on the eggs and larvae of tuna and billfish are not expected to be significant, based upon research by NOAA's National Marine Fisheries Service.

° Laboratory experimentation verified limited field observations during mining tests that the surface mining plume should sink very rapidly out of the upper water column.

° A scientific workshop on subsurface discharge of mining wastes concluded that discharge below 1000m had less potential for adverse environmental impact than surface discharge.

° Two projects were initiated to study the benthic environment, one to measure the variability in near bottom currents and suspended sediment

concentrations over a year at DOMES Site B, and the other to examine benthic populations both adjacent to one consortium's test mine tracks and those less than 10 kilometers away, but unaffected by the test mining activities. Also, the National Academy of Sciences was funded to examine the stable reference area concept and to define a cost effective research program to create a scientific base for designation of these areas.

° Future marine environmental research will emphasize the definition of key factors to assess benthic impact, characterization of the deep benthic environment, and analyses of the feasibility of an experiment to determine benthic response to a disturbance, such as seabed mining. In addition, NOAA is examining the potential for using satellites to detect the surface plume from mining vessels.

The concerns associated with the disposal of manganese nodule processing wastes also have been investigated through NOAA-funded research.

° A 4-year interagency effort was aimed at describing the composition of the nodules, updating the processing technology, and predicting the characteristics of the wastes.

° A study presently in progress will update and expand a 1977 report on the environmental and socio-economic impacts of manganese nodule processing activities.

Finally, the economics of deep seabed mining have been investigated through NOAA-funded research.

° Cost models for four-metal nodule mining ventures have been developed to evaluate the financial implications of commercial mining regulations.

° Criteria are presently being developed for possible future use in evaluating requests from industry to process the nodules abroad.

NOAA also has begun looking at considerations other than the legal regime which might constitute resolvable impediments to commercial seabed mining development.

The agency is considering four actions which could reduce impediments to commercial development by reducing costs and uncertainties facing the developing mining industry. One is confirming that, for tax purposes, the percentage depletion allowance provision would apply to mineral activity covered under the Act. The second is determining the impact of antitrust provisions on U.S. licensees who choose to share costs and cooperate in research, engineering development, and testing and evaluation. The third action is the leasing of stored or excess Federal property to industry to reduce equipment costs to industry and defray storage and maintenance costs to the taxpayer. NOAA is examining the range of equipment and leasing terms available under present law. Finally, NOAA also plans to work with other Federal agencies to ensure that regulatory actions take place on a predictable timetable and in the shortest time feasible, and that information gathering and paperwork requirements are coordinated to eliminate redundant requirements.

The presently depressed level of world metal markets has dimmed prospects for commercial mining in this decade. Nevertheless, nodule mining appears to be competitive with new sources of these metals, the resource appears vast, and the potential still exists for the United States to require specific metals in the nodules when traditional sources become unreliable or can no longer supply our needs.

CHAPTER I

INTRODUCTION

Purpose and Scope

This second biennial report to the Congress, submitted pursuant to Section 309 of the Deep Seabed Hard Mineral Resources Act (the Act), describes deep seabed mining activities conducted by the National Oceanic and Atmospheric Administration (NOAA) during fiscal years 1982 and 1983.

An overview of the nature of the resource and the status of industrial activities is offered in the remainder of this chapter. The domestic aspects of implementing the Act are addressed in Chapter II, while international aspects are summarized separately in Chapter III. Finally, considerations related to the future of deep seabed mining are addressed in Chapter IV.

Activities included in this report involve those resulting from: applications for NOAA licenses for exploration, the development of proposed regulations for future commercial recovery operations under NOAA permits, and international negotiations as authorized under the Act.

Activities reportable under the Act but not yet having occurred include: license and permit issuance and denial, resultant industrial activities, environmental impacts, and civil and criminal proceedings.

The Resource

Manganese nodules are small, irregular, potato-shaped concretions of manganese and iron minerals that are found on the bottom of many of the world's oceans and lakes. They were first discovered during the

1873-76 oceanographic voyage of the HMS CHALLENGER but remained scientific curiosities until their value as potential mineral resources was realized in the late 1950's. Although 79 elements have been identified in Pacific Ocean nodules, only four are of strategic and economic importance: manganese, copper, nickel, and cobalt. In spite of the worldwide occurrence of nodules, their population density on the seafloor and the concentrations of the value metals are highly variable. Main commercial interest therefore focused on an area in the east-central Pacific Ocean (Figure 1) that contains a higher concentration of high-grade nodules than other surveyed areas. These nodules have a high average percentage of the value metals, especially nickel (approximately 1.3 percent nickel, 1.1 percent copper, 0.2 percent cobalt, 25 percent manganese). This 13 million km^2 area - commonly known as the Clarion-Clipperton Fracture Zone - was the subject of NOAA's 5-Year Deep Ocean Mining Environmental Study (DOMES) and so is referred to as the DOMES area. This study formed the basis for many of the scientific findings in NOAA's Deep Seabed Mining Final Programmatic Environmental Impact Statement (September 1981). The DOMES area has been estimated to contain from 3.6 to 13.5 billion metric tons (dry weight) of nodules -- an apparently enormous resource for the future.

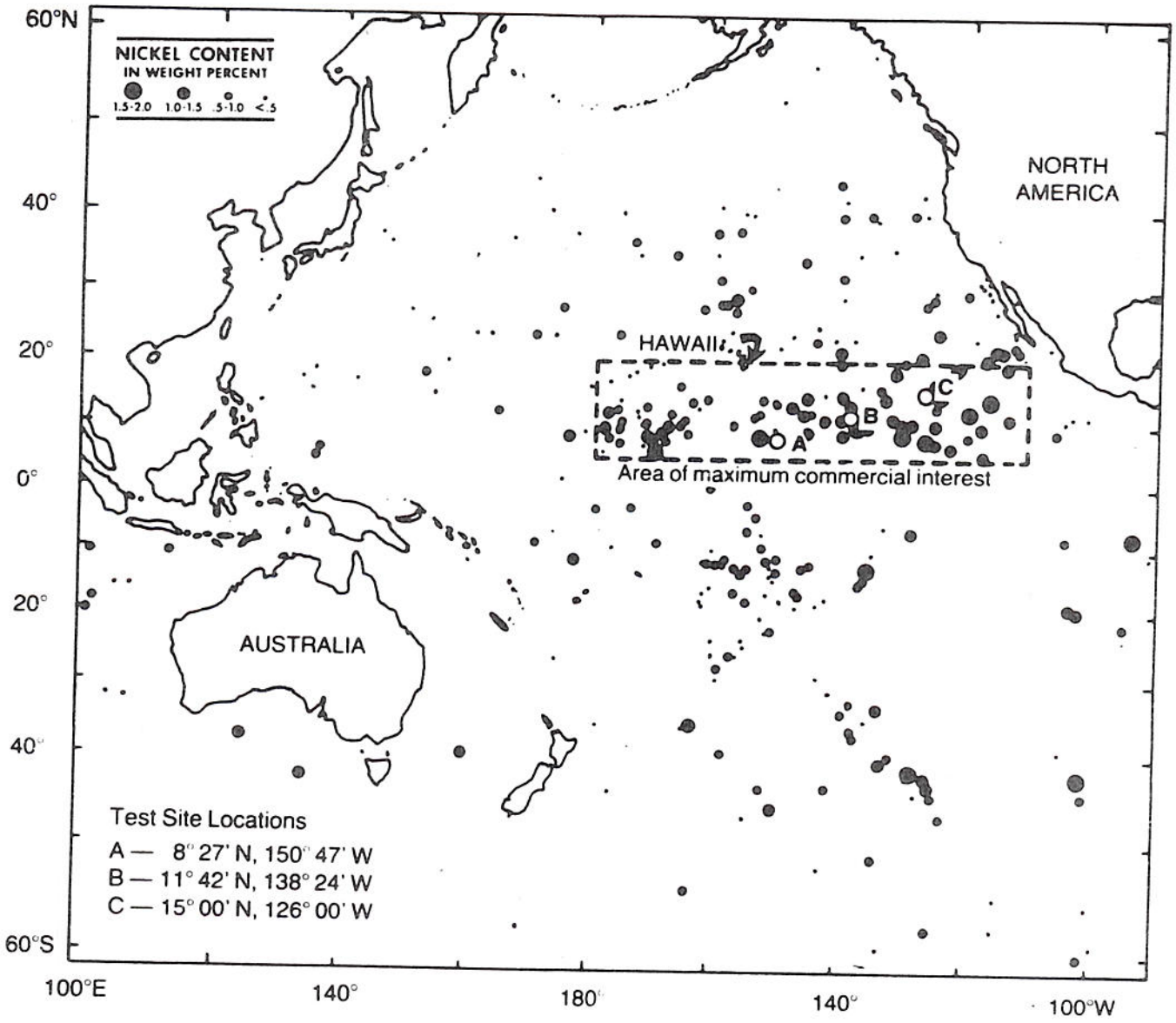

Figure 1 --Area of manganese nodule maximum commercial interest and high nickel concentration in nodules with DOMES test site locations (Horn, Horn, and DeLach, 1972).

The National Interest

The United States is dependent on potentially politically unstable foreign sources for two of the strategic metals found in manganese nodules: cobalt and manganese. Cobalt, which we import primarily from Zaire and Zambia, is used for the high-temperature alloys necessary in the aerospace industry. Manganese, imported primarily from Australia, Brazil, and South Africa (which is expected to be our major source in 15 to 25 years), is required in the steel industry. Nickel, used mainly in stainless steel and other high temperature steel alloys, is supplied by Australia and Canada - nations generally friendly to the U.S. Copper, in which the U.S. is nearly self-sufficient, is used mainly in electrical equipment.

Dependence on foreign sources of metals can lead to uncertainties in supply ranging from cost instability to supply disruption. In addition to the possibility of political instability, foreign producers may retain more of their domestic output as they acquire their own capability to manufacture finished products. Also, as the sources of supply become more restricted, the ability of the mines to meet world demand can become a factor in determining both supply and price.

The establishment of a domestic deep seabed manganese nodule mining industry would provide the United States with: (a) a stable supply of strategic metals important to the economy at competitive prices, (b) a reduced annual balance of payments deficit, (c) increased investment in a basic industry, (d) regional employment benefits, and (e) continued leadership in new ocean technologies.

The presently depressed level of world metal markets has dimmed prospects for commercial mining in this decade. Nevertheless, nodule mining appears to be competitive with new sources of these metals and so must remain an option for United States industry in the decades ahead.

Mining Consortia

The deep seabed mining industry presently includes four multinational private sector consortia with U.S. members (Table 1) which have applied to NOAA for exploration licenses. In addition, there are two national private sector consortia presently developing their own deep seabed mining capabilities: the French consortium, Association Francaise pour L'Etude et la Recherche des Nodules (AFERNOD), and the Japanese consortium, Deep Ocean Resource Development Company (DORDCO). In addition to these six consortia, each of which has been involved in the complete spectrum of nodule mining research and development activities, exploration has reportedly been conducted by the USSR. Interest in Indian Ocean nodules has been expressed by India.

Recent and Planned Industrial Activity

Exploration activities during this period were allowable for those who had been engaged in exploration prior to enactment of the Act. However, most of the consortia activities during the last two years can be characterized as heavily oriented to shoreside engineering development, which was well funded early in the period, with severe retrenchment occurring in recent months due to continuing poor world metal markets and restricted cash flows as a result of the recent recession.

Activities planned by the consortia for their license phase efforts all involve the continued delineation of the important features of their

Table 1. Deep seabed mining consortia involving United States firms and parent companies, including dates of consortia formation, as set forth in applications filed with NOAA in February 1982.

Nation	Kennecott Consortium (KCON) (1/74)	Ocean Mining Associates (OMA) (10/74)	Ocean Management Inc. (OMI) (5/75)	Ocean Minerals Company (OMCO) (11/77)
United States		Essex Minerals Co. (U.S. Steel) 25% Sun Ocean Ventures Inc. (Sun Co.) 25%	Sedco, Inc. 25%	AMOCO Ocean Minerals Co., (Standard Oil Co. (Indiana)) 30.669% of OMCO Lockheed Systems, Co., Inc. (Lockheed Corp.) 6.329% of OMCO Lockheed Missiles & Space Co., Inc., (Lockheed Corp.) 38.64% of OMInc.
Belgium		Union Seas, Inc. a U.S. corporation (Union Miniere) 25%		
Canada	Noranda Exploration, Inc., a U.S. corporation 12% (Noranda Mines Ltd.)		INCO, Ltd. 25%	
Italy		Samim Ocean Inc., U.S. corporation (ENI/Italy) 25%		
Japan	Mitsubishi Corp. 12%		Deep Ocean Mining Co., Ltd. (DOMCO-19 Japanese Companies) 25%	
Netherlands				Ocean Minerals, Inc. (OMInc., a U.S. corp.) 63.002% of OMCO -Rilliton B.V. 48.68% of OMInc. (Royal Dutch/Shell Group) -RKW Ocean Minerals 12.68% of OMInc., (Royal Boskalis Westminister N.V.)
United Kingdom	Kennecott Corp., a U.S. corporation (Sohio/BP) 40% R.T.Z. Deep Sea Mining Enterprises, Ltd. (Rio Tinto-Zinc) 12% Consolidated Gold Fields, PLC 12% BP Petroleum Dev., Ltd. 12% (The British Petroleum Co., p.l.c.)			
West Germany			AMR 25% (Preussag A.G., Salzgitter A.G., Metallgesellschaft A.G.)	

proposed license sites. All of them already have conducted extensive seafloor studies, as long ago as the early 1960's, as well as at-sea technology testing, so all license activities are designed to augment what they already know. The activities will deal with: mapping of detailed seafloor topography, including detection of obstacles; assessment of manganese nodule abundance, grade, and variability; learning more about engineering properties of the seafloor; and the collection of environmental baseline data. Most information will be obtained by remote sensing via acoustic techniques and photography; some will be obtained by sampling.

Further mining system tests may be conducted, but probably not early in the license phase.

Technology Presently Contemplated for Mining

The first generation mining technologies under consideration by the United States consortia are all hydraulic type systems. Hydraulic systems - using either submerged centrifugal pumps or air lift systems - will recover nodules in a seawater slurry and pump them through a pipeline from a seafloor collector to a mining ship on the ocean surface. The hydraulic collector likely will sweep the bottom in nearly adjacent swaths; each swath may be up to 20 meters (65 feet) wide. One consortium's collector will be self-propelled. The other collectors probably will be towed across the seafloor by the mine ship. Both types of systems have been tested by the consortia and monitored by NOAA.

In addition to the nodules, bottom water, sediment, and some macerated benthos will be drawn into the collector. Most of this extraneous material will be ejected at the seafloor; however, some of this material will be transported up the pipeline and, after separation from the nodules,

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discharged at the sea surface. The two activities, ejection near the seafloor and sea surface discharge, are the twin perturbations leading to most of the environmental effects research. Direct collector contact, while having an environmental impact, is unavoidable if nodules are to be mined.

CHAPTER II

DOMESTIC ASPECTS OF IMPLEMENTATION OF THE DEEP SEABED HARD MINERAL RESOURCES ACT

Results of Promulgation of License Regulations for Exploration

On September 15, 1981, pursuant to the Act, NOAA issued regulations for deep seabed mining exploration licenses and a Programmatic Environmental Impact Statement (PEIS) assessing the environmental effects of deep seabed mining.

Pursuant to Section 970.200(d) of the exploration regulations and at the request of the license applicants, NOAA subsequently conducted pre-application consultations with representatives from each consortium. The purposes of the consultations were to assist applicants in the development of adequate applications and to assure that they understood how to respond to all the provisions of the regulations. As a part of the consultations, several of the consortia submitted draft applications which were reviewed by NOAA.

In early 1982, NOAA received license applications from the four domestic consortia (Table 1) for a total of 10 separate exploration areas in the DOMES area. Although all applications were received by March 12, 1982, formal processing did not begin until June 21, 1982, pending Law of the Sea and reciprocating states negotiations. All applications ultimately were determined to be in full compliance with NOAA regulations, thus establishing an initial priority of right for each consortium for the issuance of licenses for the respective areas applied

for. However, each application area overlapped with the area of at least one other application filed either in the United States or in another country during the same period.

As a method to resolve overlap among the pioneer areas applied for, and consistent with procedures authorized in NOAA regulations, the four multi-national consortia, which include U.S. companies, and AFERNOD signed a private arbitration agreement to exchange coordinates for their respective areas and to establish a mechanism to resolve conflicts voluntarily among themselves. Certification of the United States applications, which is an interim step between receipt of the application and issuance of the license, could not be completed pending the resolution of conflicts.

New entrants, i.e., persons that commenced exploration activities with respect to a particular area after June 28, 1980 - the date of passage of the Act - have been allowed to submit license applications for such areas since January 3, 1983. However, to date there have not been applications in the United States by any other entities besides the four original consortia.

In accordance with the Act (Section 103(e)), NOAA consulted with, and provided a copy of each application, for their review, to each Federal agency with expertise concerning, or jurisdiction over, any aspect of the recovery or processing of hard mineral resources. This consultation and opportunity for subsequent agency recommendation for or against certification are required before NOAA may certify an application. Although no Federal agency recommended against certifying the applications, several had pertinent comments which NOAA has utilized. For example, the National Park Service was concerned about the protection of offshore cultural

resources and the possible hazards from artifacts such as munitions. NOAA thus anticipates that the terms, conditions, and restrictions issued with each license will have a requirement for the licensee to notify NOAA of any shipwrecks or other cultural materials uncovered. Similarly, the Department of Defense reminded NOAA of the requirement for each consortium to comply with export licensing requirements on controlled technology and equipment. NOAA has apprised the consortia of this requirement.

In May 1983, the above five international consortia signed a final settlement agreement resolving the overlaps among their initial application areas. This agreement was subject to several closing conditions, which now have been satisfied. As a result of the private conflict settlement agreement, the four U.S. applicants recently have filed amendments to their applications with NOAA. These would reduce the number of proposed U.S. licensed areas to seven. In September 1983, the Japanese consortium DORDCO, which had applied for an exploration area in Japan subsequent to the other consortia's applications, signed a private arbitration agreement with the other five which outlined procedures for resolving conflicts should the DORDCO site overlap any of the readjusted sites of the other consortia. Some further U.S. amendments may be submitted to NOAA as a result of any conflicts with DORDCO.

The recent submission of the amendments to U.S. applications has enabled NOAA to resume processing the license applications. The information submitted with the amended applications has been found to be in substantial or full compliance with NOAA's regulations. As a result of the amendments, a divergence of licensing schedules is emerging.

Since the original license applications were filed, NOAA has continued to work on development of the site-specific Environmental Impact Statements (EISs) and terms, conditions, and restrictions (TCRs) that must accompany each exploration license. NOAA expects to begin to issue the licenses in late 1984.

With respect to coordination with other Federal agencies, NOAA has continued to work closely with the Environmental Protection Agency on the development of a general National Pollutant Discharge Elimination System (NPDES) permit for deep seabed mining exploration activities. An NPDES permit is required by Section 109(e) of the Act. EPA has proposed that, initially, a general permit will be issued for five years to cover only the discharges associated with the operation of survey ships engaged in exploration activities prior to at-sea testing. The general permit will be amended or re-issued to cover at-sea mining systems tests if industry conducts these tests under a license.

Development of Proposed Commercial Recovery Regulations

Following the exploration and possible test mining activities under an exploration license, the second phase in the development of a deep seabed mine site will involve the issuance of a commercial recovery permit. Although the Act prohibits commercial recovery before January 1, 1988, NOAA recognizes the need for the consortia to be able to proceed with their efforts toward developing a commercial recovery capability. In light of the near-term decisions that industry may need to make as to whether to commit significant new levels of resources to further technology development, NOAA is proceeding now with the development of commercial recovery regulations. U.S. companies then will be able to assess and plan for the complete legal framework under which they would operate.

In December 1982, NOAA published an Advance Notice of Proposed Rulemaking (ANPR) on commercial recovery regulations (47 FR 57903), soliciting early public participation in the rulemaking process. After receiving comments on the ANPR, NOAA held meetings for interested Federal officials on the retention of the manganese tailings from three-metal processing, and on coordination of Federal responsibilities affecting onshore activities. A public workshop also was held on marine environmental issues.

Based on the comments on the ANPR and the meetings, NOAA developed tentative approaches to commercial recovery issues and prepared discussion papers outlining these approaches. The discussion papers then were distributed to solicit comments on the approaches. By the end of the 1983 fiscal year, a substantial portion of draft regulations had been prepared, as had a draft regulatory impact analysis, a draft regulatory flexibility analysis, and a draft environmental assessment. The target date for publication of the proposed regulations in the FEDERAL REGISTER is January 1984, with final regulations about six months later.

Environmental Impact Findings

As a result of NOAA's monitoring of industry at-sea mining tests during the Deep Ocean Mining Environmental Study (DOMES), NOAA's PEIS (September 1981) was able to determine that most of the initial mining concerns had a very low probability of causing a significant adverse environmental impact. Other concerns, however, either appeared to be certain to cause a negative impact, although of unknown significance, or were unresolved at the time. Because the tests were only pilot-scale and of short duration, NOAA emphasized that it was essential for the PEIS findings to be validated

through additional research and during monitoring of industry mining system endurance tests. Although no at-sea systems tests have occurred since the publication of the PEIS and test mining will not occur until 1986 - 1988 at the earliest, NOAA-sponsored research has been conducted on those remaining environmental issues that are not adequately resolved.

The following discussion summarizes NOAA research funded in FY-1982 and 1983, although not necessarily completed during those two years. A more thorough discussion of this environmental research and of previous research projects can be found in NOAA's Five Year Marine Environmental Research Plan, 1981-85. This plan will be updated every two years.

A. Surface Plume

The hydraulic mining systems expected to be used in first-generation commercial mining will recover manganese nodules from the seafloor and pump them up a pipeline to a mining ship on the surface. Bottom water, sediment, and macerated biota will be recovered with the nodules, carried up the pipe and, after separation from the nodules, discharged at the sea surface. There was concern that the surface plume generated by this discharge had the potential for causing adverse effects on the biota in the upper water column. Research during FY-1982 and 1983 focused on potential effects on fish larvae and the behavior of the surface plume.

° The effect of the surface plume on the eggs and larvae of commercially important fishes (tuna and billfish) has been investigated by NOAA's National Marine Fisheries Service. A report has been prepared on the distribution of these fishes, their larval feeding behavior and reproductive patterns, potential effects on the larvae from the surface plume, the possibility of accelerated spawning periods resulting from

aggregation around mineships, and the possible effects on year-class strength. The report concluded that there likely will be no significant adverse impact from the plume due to its rapid dilution and dissipation.

° A laboratory experiment was funded to measure wet densities and size spectra of particles in samples of mining discharges, and verified earlier, limited field observations that the surface plume sinks more rapidly than expected. This is apparently due to the closely bound aggregates of clay particles that are not broken apart during transport through the mining pipe and therefore sink more rapidly than individual particles. Additionally, the settling velocity distributions showed extremely small percentages of particles having slow settling velocities. Although these analyses were conducted on discharges from test mining, and thus should be verified during commercial scale mining, the results do indicate that there appears to be a low probability of adverse effects from the surface plume due to rapid sinking (as well as high dilution).

° In order to minimize environmental impacts at the sea surface, it has been suggested that the mining waste material be discharged below the biologically productive surface waters. In August 1983, NOAA held a meeting of scientists with expertise in the mid-water column environment to consider the potential for harmful effects from subsurface discharge and to identify requirements for a baseline and monitoring program if this method were to be used. The scientists concluded that, based on present information, discharge below 1000 meters is environmentally preferred over surface discharge, but this is compounded by the difficulty of monitoring a subsurface plume. Because of this tradeoff and the lack of evidence of a significant adverse effect from a surface discharge, NOAA, at present, will allow either type of discharge.

B. Benthic Plume

The action of the nodule collector as it moves along the seafloor will cause environmental impacts through destruction of the benthos in its path and through the creation of a plume of fine-grained sediment. This plume may bury the smaller benthic animals and dilute their food supply at distances away from the mine site. Research aimed at obtaining a better understanding of the significance of these impacts has been initiated by NOAA.

° In 1983, NOAA began a research effort directed at examining benthic recolonization at the site where Ocean Mining Associates conducted test mining in 1978 (monitored by NOAA during the DOMES project). Scientists from Scripps Institution of Oceanography, in cooperation with Deepsea Ventures, Inc., surveyed the site and obtained box cores in an area directly adjacent to the test mining tracts and from an area thought to be unaffected by the mining plume. These two sets of samples are being analyzed to determine if there is any significant faunal difference between them. If there is an effect, it may be attributable to mining. Additionally, the samples from the unaffected area will provide more data on the benthic community in the area of DOMES Site C.

° NOAA is presently conducting a cooperative research program with Oregon State University (OSU) to obtain a better understanding of the bottom currents and suspended particulate matter concentrations in the DOMES area. OSU, as part of the National Science Foundation's Manganese Nodule Program (MANOP), is studying the processes affecting manganese nodule formation, taking geochemical measurements both in the water column and on the seafloor at several oceanic sites, one site

corresponding to DOMES Site B. NOAA supplemented these measurements through the provision of near bottom current meters and nephelometers. Instrumentation was deployed for one year and so will provide an improved understanding of the annual variability of environmental conditions and perhaps give insight into the correlation of certain geochemical and physical parameters since numerous measurements were taken simultaneously. Long-term current measurements will help NOAA fine-tune its benthic plume model. Nephelometer readings will give a better estimate of the amount of suspended matter the benthic community is naturally exposed to so that better estimates can be made of the relative increase of suspended material that the benthos will be exposed to from the benthic plume.

° In order to fulfill the Executive Branch's mandate under the Act to negotiate with other mining nations for the purpose of establishing stable reference areas (SRA), NOAA requested the Ocean Policy Committee of the National Academy of Sciences (NAS) to evaluate the scientific validity of the SRA concept and to design a cost-effective means to implement it. The committee determined that the concept is scientifically valid if two types of SRAs are defined: Preservation Reference Areas (PRAs) and Impact Reference areas (IRAs). PRAs, designated through international negotiations, would be used " ... to insure a representative and stable biota of the deep seabed." IRAs would be part of a minesite and would be studied before and after mining to assess the impacts of commercial mining. The committee also recommended a research program to provide the scientific basis for designating such areas and effectively assessing impact. The highest priority research project recommended was the conduct of a small-scale, controlled "impact" experiment to identify

the biological parameters that record impacts most reliably and to determine if the benthic plume will cause an impact at distances from the minesite.

C. Process Waste Disposal

The sheer volume of wastes to be disposed and the inadequately known chemical and physical nature of the wastes have made the disposal of manganese nodule processing rejects a great concern. The following discussion summarizes NOAA-initiated research addressing this waste disposal problem in FY-1982 and 1983.

° A four-year interagency effort (NOAA, Fish and Wildlife Service, Environmental Protection Agency, Bureau of Mines) to characterize the wastes associated with manganese nodule processing is expected to be completed in 1984. The overall objective of this cooperative research effort is to provide information needed by Federal and state agencies in preparation for receipt of industry's commercial waste management plans. Individual reports have been completed on the following: a description of the morphology, mineralogy, and elemental composition of the Pacific Ocean nodules; an update of the five most economical and technically feasible nodule processing techniques and flowsheets; a prediction of the physical and chemical characteristics of nodule processing waste material; and an analysis of the wastes generated under laboratory processing conditions. Only the preparation of the final report remains to be completed.

° Arthur D. Little, Inc. is presently conducting a NOAA-funded study which will update and expand a 1977 report that provided an environmental and socio-economic assessment of manganese nodule processing activities. This new report will reflect more recent information on

processing techniques, environmental regulations, potential industrial strategies, and the implementation of key statutes.

D. Continuing Environmental Research

NOAA is also funding Oregon State University, Woods Hole Oceanographic Institution, and Scripps Institution of Oceanography, among others, in a cooperative program to 1) evaluate the feasibility of conducting the controlled "impact" experiment recommended by the Ocean Policy Committee; 2) develop improved models to a) define effective sampling strategies to assess impact, and b) identify benthic recolonization patterns following disturbances; and 3) complete analysis of the dominant faunal groups from the DOMES samples to provide data for input to the biological models. The completion of these tasks will provide a substantial improvement in the understanding of the deep benthic environment and the strategies required to assess impact in a cost-effective manner. If the recommendation from the first task is to conduct the experiment, NOAA will proceed with its implementation in order to better define what effects can be expected from the benthic mining plume.

NOAA would like to develop remote sensing techniques to be able to monitor water column environmental effects resulting from mining. The use of satellites may prove to be a viable method for determining large scale baseline conditions and for monitoring the effects resulting from the surface discharge from mining ships. NOAA's Deep Seabed Mining Program is presently working with its National Environmental Satellite, Data, and Information Service (NESDIS) in evaluating the potential for using remote sensing to monitor deep seabed mining activities. As a part of this cooperative work, NESDIS will process selected satellite

data that were previously recorded over the proposed mining sites in the DOMES area. Should the technology appear to be available when deep ocean mining is expected to be initiated and sensitive enough for monitoring purposes, a long term data base will be developed and the mathematical base finetuned to meet the specific needs for monitoring the distribution of the surface plume and any biological effects.

Mining Economics Research

In order to evaluate the financial implications of regulations being considered for commercial mining operations and future regulatory decisions, NOAA has funded the Texas A&M University (TAMU) to develop cost models for four metal manganese nodule mining ventures. The TAMU models represent improvements, in the sense of involving a greater degree of cost detail, of the original "MIT Model" developed by the Massachusetts Institute of Technology to assist in Law of the Sea deliberations. TAMU is now examining economy of scale by evaluating several production levels.

As part of its previously mentioned NOAA-funded study, Arthur D. Little, Inc. is also preparing an up-to-date capital and operating cost estimate for "likely" processing schemes. One aspect of the study deals with the manganese conservation issue. For example, costs will be developed for the future recovery of manganese from tailings ponds. This will enable NOAA to evaluate the conservation implications of a three-metal producer who does not market manganese but, rather, disposes of it with process tailings in a manner that does not render it unavailable for future use.

In addition, the University of Hawaii has been funded by NOAA to assist in the generation of criteria for possible future use in evaluating requests to process manganese nodules abroad. Specifically, the findings

will assist NOAA in addressing the Act's provisions permitting the NOAA Administrator to allow foreign processing by a permit applicant if such a situation is necessary for the economic viability of the operation.

Continuing Activities

NOAA anticipates that in the future licensees will be submitting other amendments to their licenses. Initial amendments will continue to reflect the results of the conflict resolution process, with work on issuing initial licenses continuing into 1985. Subsequent amendments probably will involve adjustments to exploration plans made as exploration technology improves. In addition, NOAA will be receiving reports on the progress licensees have made toward delineation of their potential mine sites. These submissions will be reviewed by NOAA for adherence to regulatory requirements and consistency with exploration plans. During the license period, it is also expected that licensees will be requiring guidance on permit application requirements which NOAA will refine as more information becomes available from the licensees and NOAA-funded research programs. Such consultations could be quite extensive, especially when preparing for environmental baseline data collection. Mining equipment tests may be conducted during the mid-to-late term of the license and will require substantial NOAA preparation (e.g., supplemental site-specific environmental impact statements) and oversight in order to monitor technology performance and environmental effects.

The other main thrust of NOAA's seabed mining program, which can be conducted independently of industry's schedules, will be the conduct of generic research pursuant to Section 109(a) of the Act. This research will provide: 1) a better assessment of potential environmental effects

from mining, 2) a cost-effective environmental monitoring program for industry implementation, and 3) an improved understanding of the deep sea environment. This program will complement NOAA's DOMES by concentrating on the impact on the benthic environment where relatively little effort has been directed in the past and where an impact will occur. NOAA's research will focus on the potential severity of this impact to the deep sea environment.

CHAPTER III

INTERNATIONAL ASPECTS OF IMPLEMENTATION OF THE DEEP SEABED HARD MINERAL RESOURCES ACT

Designation of Reciprocating States

Pursuant to Section 118 of the Act, the Department of State and NOAA have been consulting with other seabed mining nations, to develop an arrangement which would prevent conflicts among the seabed mining operations of these nations' citizens. An agreement reflecting this arrangement would in turn provide a basis for the Administrator of NOAA to designate the other signatory countries pursuant to Section 118, and thus preclude the licensing or permitting of overlapping areas.

With respect to the evolution of such international efforts, in conformity with uniform procedures previously negotiated among the United States, Great Britain, West Germany, and France, in early 1982 applications for exploration licenses were received in these four countries from their respective seabed mining companies. These countries then negotiated and signed in September 1982 an agreement on criteria and procedures for resolving overlaps among this simultaneous group of "pre-enactment" explorer applications.

In early 1983, our efforts were expanded to include more detailed discussions among all of the interested seabed mining nations, to develop the type of conflict prevention arrangement mentioned above. A major part of the effort has been devoted to developing terms which are politically and legally acceptable to the other countries, while not running counter to the requirements of the U.S. statute, which requirements

must be met before NOAA may recognize the licenses issued by other governments. These discussions are expected to be concluded soon.

NOAA, in accordance with Section 118(f) of the Act, has also been working with other mining nations in establishing a network whereby environmental information can be exchanged on research efforts and regulatory measures to protect the environment.

CHAPTER IV

THE FUTURE FOR DEEP SEABED MINING

Reduction of Impediments to Commercial Development

NOAA has begun looking at factors other than the legal regime which might resolve impediments to commercial seabed mining development. As a result of this effort, NOAA recently has undertaken internal consideration of four potential actions which may reduce costs and uncertainties facing the infant seabed mining industry, while imposing little or no cost on the general public. The areas being considered are outlined below.

A. Percentage Depletion Allowance for Deep Seabed Minerals

NOAA is undertaking discussions with the Treasury Department to determine whether that department interprets the percentage depletion allowance deduction available under the Internal Revenue Code as being applicable to minerals produced by a permittee operating under the provisions of the Act. Over the coming months, NOAA, in consultation with the Treasury Department and other affected agencies, will determine if such interpretation is appropriate, and if any legislative action should be considered.

B. Facilitation of Cooperation Among U.S. Licensees

Seabed mining licensees in the United States face different treatment than foreign companies, as a consequence of various factors, including United States antitrust provisions which limit opportunities for cost sharing and cooperation in research and development, engineering

development, and testing and evaluation programs. NOAA, in consultation with other affected agencies, plans to consider the effects of such provisions, including pending antitrust legislation, on U.S. companies pursuing seabed mining.

C. Leasing of Underutilized Federal Property

On occasion, items of Federal property are placed in storage, or maintained in excess quantities, in anticipation of future needs. Deep seabed mining operators may have certain equipment needs (e.g., for ships capable of performing bathymetric surveys in mid-ocean) which could be met more economically by leasing stored or excess Federal property than by lease or purchase of similar equipment from other sources. Making Federal property available in these cases could reduce costs for the industry, while defraying for a period of time the storage and maintenance costs ultimately paid by the public. NOAA is examining the range of equipment and leasing terms which may be available under present law, with a view to advising industry of opportunities it may wish to pursue.

D. Facilitation of Regulatory Processes of Other Agencies

Because certainty regarding the timing and nature of the regulatory process is necessary to the conduct of business planning efforts on the scale associated with a deep seabed mining project, NOAA intends to work with other Federal agencies whose responsibilities yield regulatory requirements affecting the industry (particularly with respect to onshore facilities) to develop means of assuring, to the extent practicable, that regulatory actions will take place on a predictable timetable and in the shortest time feasible, and that information gathering and paperwork requirements are coordinated, where possible, to eliminate redundant requirements.