NATIONAL PLANNING CONFERENCE ON THE COMMERCIAL DEVELOPMENT OF THE OCEANS

WASHINGTON, D.C.
1976

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
DEPARTMENT OF THE INTERIOR
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
MARITIME ADMINISTRATION

CONFERENCE ORGANIZATION

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NATIONAL PLANNING CONFERENCE ON THE COMMERCIAL DEVELOPMENT OF THE OCEANS

PROPOSED PROGRAM

WEDNESDAY, JUNE 9, 1976

9:00	Opening by the Program Director, M. Pitkin
9:05	"The Ocean Imperative;" Secretary of Commerce Elliot Richardson
9:25	"Emerging Ocean Policy;" Senator Ernest F. Hollings
9:45	"The Resources of the Outer Continental Shelf;" - Representative John Murphy
10:05	Environmental Contribution to the Commercial Development of the Oceans; Russel Train, Environmental Protection Agency
10:25	Break
10:45	Lifelines - Rear Admiral J. Edward Snyder, Special Assistant to the Undersecretary of the Navy
11:05	Enforcing the 200 Mile Zone; Admiral Owen W. Siler, Commandant, U.S. Coast Guard
11:25	Labor's Contribution to the Commercial Development of the Oceans; William Moody, AFL-CIO

- OPEN LUNCH -

2:00 - 4:00	Paticipants adjourn to Airlie House

THURSDAY, JUNE 10, 1976

8;30 - 10:15 Panel meetins to analyze program elements, establish priorities and scope.

1. Oil and Gas Panel
   Chairman: Lincoln E. Warren, Manager, Exploration Affairs Gulf Energy and Minerals Company U.S.
   Vice Chairman: Donald Guier, Oil and Gas Division, Energy Research and Development Administration

2. Hard Minerals Panel
   Chairman: Marne A. Dubs, Director Ocean Resources Department, Kennecott Copper
   Vice Chairman: Amor Lane, Director, Office of Marine Minerals, National Oceanic and Atmospheric Administration
   Vice Chairman: Leigh Ratiner, Administrator, Ocean Mining Administration, Department of the Interior

3. Living Resources Panel
   Chairman: Dr. Donald L. McKernan, University of Washington
   Vice Chairman: Joseph Slavin, Associate Director, National Marine Fishery Service

4. Ocean Siting Panel
   Chairman: Robert H. Shatz, Vice President, TRW Systems and Energy
   Vice Chairman: James Gross, Director, Office of Maritime Technology, Maritime Administration

5. Municipal Services Panel
   Chairman: Dr. John P. Craven, University of Hawaii at Manoa
   Vice Chairman: Arthur Alexiou, Deputy Director, Office of Sea Grant, National Oceanic and Atmospheric Administration

10:15 - 10:30 Coffee Break

10:30 - 12:30 Continue Panel Session

10:20 - 2:00 Lunch

2:00 - 3:15 Continued Panel Session

Thursday, June 10, 1976 (Continued)

3:15 - 3:30	Coffee Break
3:30 - 5:00	Continue Panel Session
6:00 - 7:00	Social Hour
7:00 - 9:00	Dinner Speaker, Thomas Kleppe, Secretary of Interior

FRIDAY, JUNE 11, 1976

8:30 - 10:15	Panel meetings to analyze program elements and establish a recommended plan. Panel chairmen prepare reports. Same panel members and locations.
10:15 - 10:30	Coffee Break
10:30 - 12:30	Continue Panel Sessions
12:30 - 2:00	Lunch
2:00 - 3:15	Continue Panel Sessions
3:15 - 3:30	Coffee Break
3:30 - 5:00	Continue Panel Session
6:00 - 7:00	Social Hour
7:00 - 9:00	Dinner Speaker, Frederick Irving, Assistant Secretary of State

SATURDAY, JUNE 12, 1976

8:30 - 10:15	Plenary Sessions: Presentation of the Panels Reports and Recommendations
10:15 - 10:30	Coffee Break
10:30 - 12:00	Plenary Session for Forum Recaps
12:00	Conference Ends

CONFERENCE OBJECTIVE

The U.S. Maritime Administration (MARAD), the Energy Research and Development Administration (ERDA), the National Oceanic and Atmospheric Administration (NOAA), and the Department of Interior (DOI) have joined to demonstrate their strong interest in the future of the oceans bordering our nation. Through joint sponsorship of a national conference on "The Commercial Development of the Oceans," these agencies propose to use this forum to accomplish the following objectives:

(1) Critically review the status of the maritime and ocean industries and identify the major problems that are impeding the progress of these industries and the associated commercial development of the oceans.

(2) Generate a five-year near term program that the government can undertake in cooperation with industry to resolve as many of these problems as possible.

(3) Recommend specific actions in the form of program elements with associated priorities and resources for current implementation as part of a five-year plan.

The output of the conference thus will be a basic ocean development program which can be implemented within the framework of a yet-to-be developed national ocean policy.

An indication of the need for a review of this country's traditional low key approach to ocean development has been the increasing international interest in the ocean resources of the world and control of their utilization. Faced with many additional national priorities and budgetary restraints, the United States may well opt for a gradual oceans development involvement as opposed to the high priority programs of the space effort. Thus it might well be that such a program would entail a 25 year time frame in which the near term phases would see the generation of building blocks of knowledge and capability. These fundamentals, purposefully assembled into an active program will permit this country to avail itself of the wealth of resources in and beneath the waters which meet our shores.

Realistically, the commercial development of the oceans program might well occur in three phases. An enlargement of current oil and gas exploitation efforts fostered by the growing energy demand would seem a natural initial phase. This would likely be accompanied by an increase in the mass transportation utilization of the coastal waters in support of this augmented industrial activity and can be expected to serve as a stimulating environment for recreational pursuits in the near coastal zone. The second phase of activity might include the creation and expansion of various forms of mariculture, energy generation, and offshore mining which should be strongly stimulated by the technological base resulting from the increased offshore industrial activities experienced in the first phase. Once we have established an energy generation capability in one form or another in the coastal waters, it is natural to expect that a third phase, involving energy related industries, would follow. There is a strong possibility that increasingly rigid land use demands and environmental restrictions might well force relocation of the coastal cities' municipal services support industries into the offshore zone.

Since we are looking at resource exploitation and development, it is logical to structure our program in groupings which parallel the economic estimates of the worth of these resources. Hard minerals, oil and gas, living resources, ocean siting, and municipal services offer five principle areas upon which to build the program. No matter what the format, our program must be a balanced one which recognizes the essentials of commercial development: technical capability, economic feasibility, and cost effective implementation. It must also satisfy such national priorities as energy self-sufficiency, strategic natural resource independence, improved balance of payments, and the need for solution to the support services problems of our coastal urban centers.

Our goal is a dynamic program which will translate needs into action. To achieve this we must seek the advice and assistance of those who are involved in and responsible for commercial ocean development in this country and ascertain what initiatives are necessary to actively stimulate U.S.

ocean industry. This information, organized into program elements, outlines the objective, end product, benefit and plan of attack for each initiative. These program elements serve as the basis for a delphi type approach to the generation of the conference output. Conference evaluation of the elements in terms of funding levels and time frames together with group assessment of priorities and impacts will provide a definitive near and long term program for the stimulation of U.S. activities in the oceans.

The wealth of the oceans has been documented. International interest in a share of this wealth is manifestly evident. The need for a positive U.S. plan to become effectively internationally competitive in the development of these resources can no longer be rhetoric. Systematic implementation of the conference program will convert words to deeds and truly stimulate U.S. commercial development of its ocean resources.

WEDNESDAY JUNE 9	THURSDAY JUNE 10	FRIDAY JUNE 11	SATURDAY JUNE 12
DEPARTMENT OF COMMERCE AUDITORIUM	AIRLIE HOUSE - CONFERENCE ROOMS	AIRLIE HOUSE - CONFERENCE ROOMS	AIRLIE HOUSE - FEDERAL ROOM
REGISTRATION 7:30 AM - 9:00 AM	PANEL SESSIONS 8:30 AM - 10:15 AM	PANEL SESSIONS 8:30 AM - 10:15 AM	PLENARY SESSION 8:30 AM - 10:15 AM PANEL PRESENTATIONS
PLENARY SESSION 9:00 AM - 10:15 AM			
COFFEE BREAK 10:15 AM - 10:30 AM	COFFEE BREAK 10:15 AM - 10:30 AM	COFFEE BREAK 10:15 AM - 10:30 AM	COFFEE BREAK 10:15 AM - 10:30 AM
PLENARY SESSION 10:30 AM - 12:00 NOON	PANEL SESSIONS 10:30 AM - 12:30 PM	PANEL SESSIONS 10:30 AM - 12:30 PM	PLENARY SESSION 10:30 AM - 12:00 NOON FORUM RECAPS
OPEN LUNCH 12:00 NOON - 2:00 PM	LUNCH 12:30 PM - 2:00 PM	LUNCH 12:30 AM - 2:00 PM	
ADJOURN TO AIRLIE HOUSE 2:00 PM - 4:00 PM	PANEL SESSIONS 2:00 PM - 3:15 PM	PANEL SESSION 2:00 PM - 3:15 PM	
	COFFE BREAK 3:15 PM - 3:30 PM	COFFEE BREAK 3:15 PM - 3:30 PM	
INFORMAL SOCIAL HOUR 5:30 PM - 6:30 PM	PANEL SESSIONS 3:30 PM - 5:00 PM	PANEL SESSIONS 3:30 PM - 5:00 PM	
DINNER 6:30 PM	SOCIAL HOUR 6:00 PM - 7:00 PM DINNER 7:00 PM - 9:00 PM SPEAKER - SEC. OF INTERIOR THOMAS KLEPPE	SOCIAL HOUR 6:00 PM - 7:00 PM DINNER 7:00 PM - 9:00 PM SPEAKER - ASST. SEC. OF STATE FREDERICK IRVING	

Figure I-1 Commercial Development of the Oceans Conference Schedule

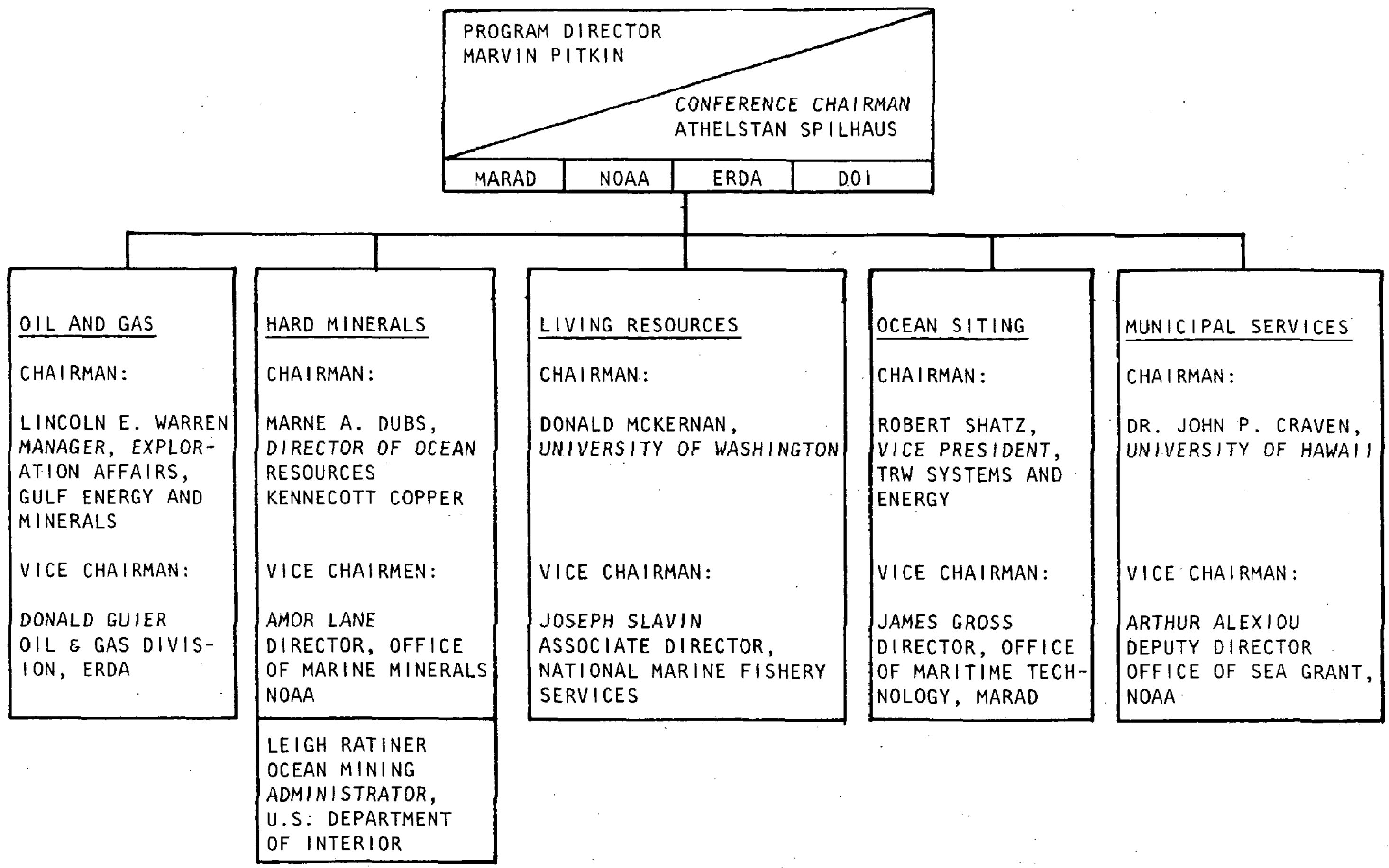
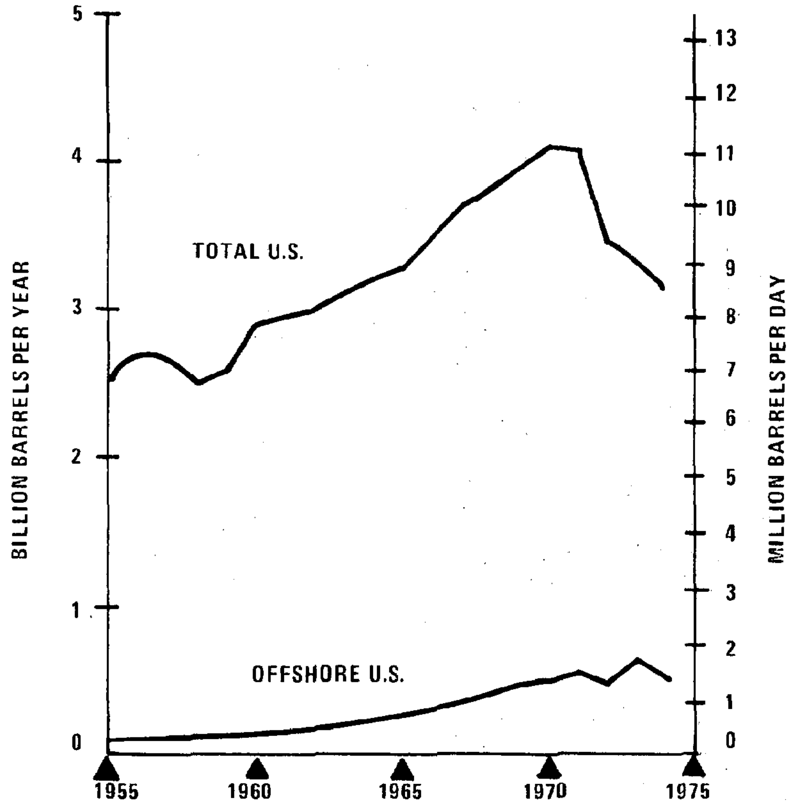


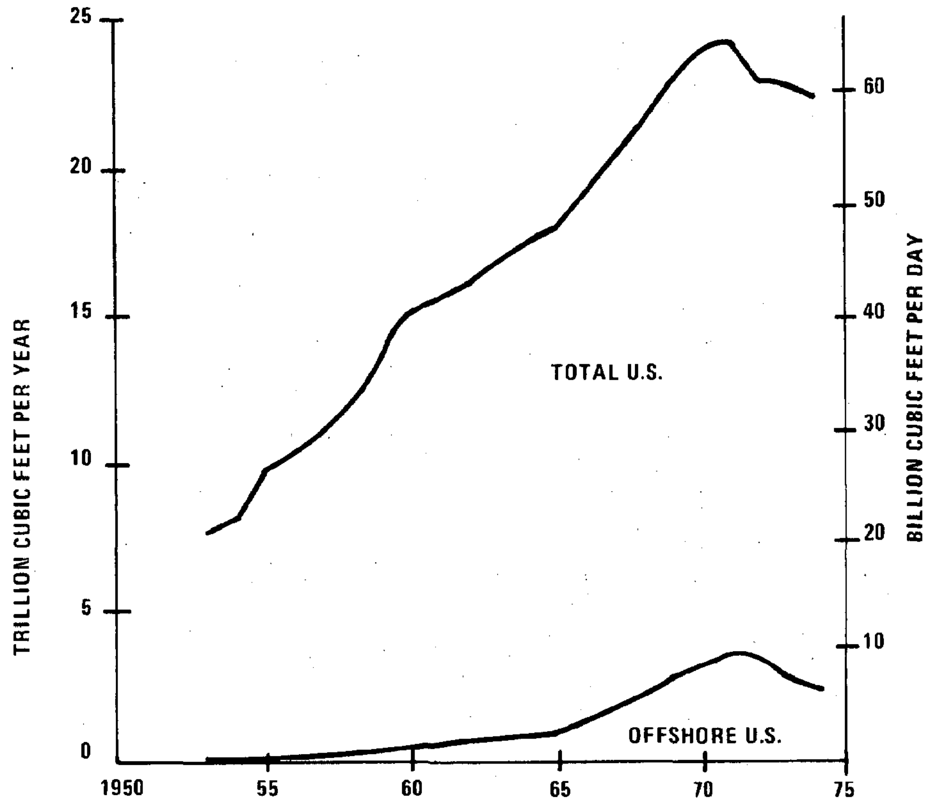
Figure I-2. Conference Organization



NOTE:

1. DATA FOR 1955-1960 FROM DEPARTMENT OF INTERIOR, OIL AND GAS JOURNAL, 71 JANUARY 29, 1973, p. 103, AND 71 APRIL 30, 1973, p. 126
2. DATA FOR 1960-1971 FROM JOHN P. ALBERS, ET AL, SUMMARY PETROLEUM AND SELECTED MINERAL STATISTICS FOR 120 COUNTRIES INCLUDING OFFSHORE AREAS, US GEOL. SURVEY PROF. PAPER 817, 1973
3. DATA FOR 1972 FROM SHERWOOD E. FREZON, SUMMARY OF 1972 OIL AND GAS STATISTICS FOR ONSHORE AND OFFSHORE AREAS OF 151 COUNTRIES, US GEOL. SURVEY PROF. PAPER 885, 1974
4. DATA FOR 1973 AND 1974 FROM INTERNATIONAL PETROLEUM ENCYCLOPEDIA, 1974-1975 AND OFFSHORE, JUNE 20, 1975

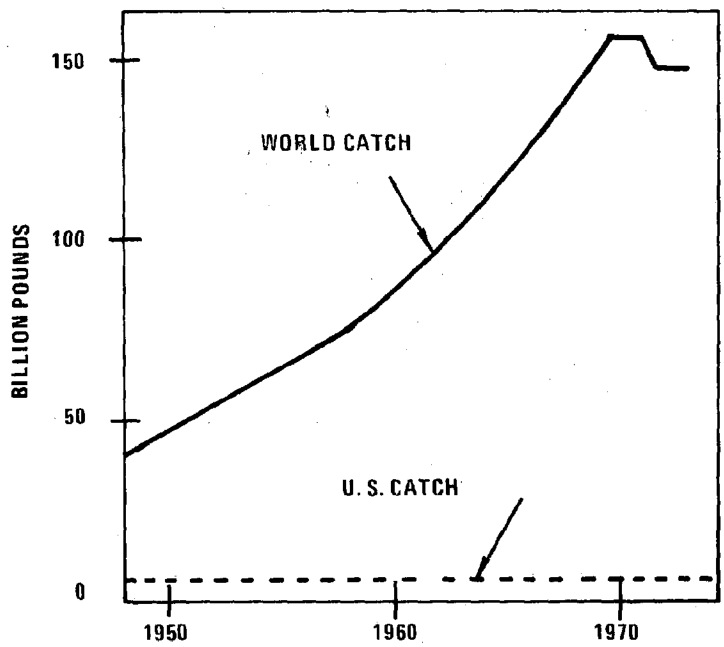
Figure I-3. Offshore and Total Oil Production in the United States



NOTE:

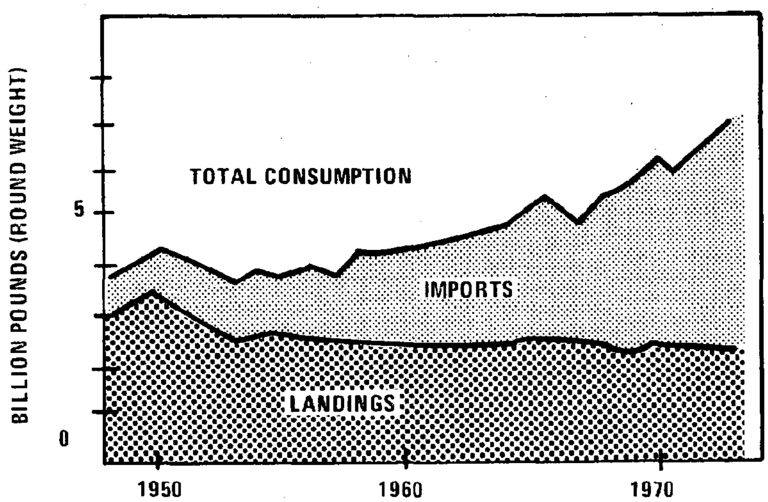
1. DATA FOR 1953-1960 FROM DEPARTMENT OF INTERIOR, OIL AND GAS JOURNAL, 71 JANUARY 29, 1973, p. 101; OFFSHORE, 33 JUNE 20, 1973, p. 81
2. DATA FOR 1960-1971 FROM JOHN P. ALBERS, ET AL, SUMMARY PETROLEUM AND SELECTED MINERAL STATISTICS FOR 120 COUNTRIES INCLUDING OFFSHORE AREAS, US GEOL. SURVEY. PROF. PAPER 817-1973
3. DATA FOR 1972 FROM SHERWOOD E. FREZON, SUMMARY OF 1972 OIL AND GAS STATISTICS FOR ONSHORE AND OFFSHORE AREAS OF 151 COUNTRIES, US GEOL. SURVEY PROF. PAPER 885, 1974
4. DATA FOR 1973 AND 1974 FROM INTERNATIONAL PETROLEUM ENCYCLOPEDIA, 1974-1975 AND OFFSHORE, JUNE 20, 1975

Figure I-4. Offshore and Total Natural Gas Production in the United States



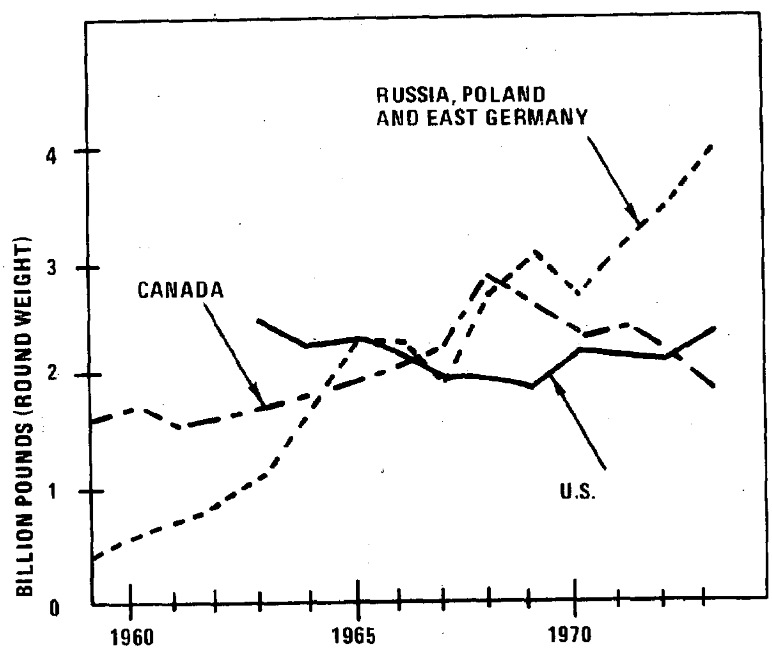
SOURCE: U.S. DEPARTMENT OF COMMERCE NATIONAL MARINE FISHERIES SERVICES, "FISHERIES OF THE UNITED STATES," ANNUAL ISSUES.

Figure I-5. United States and World Catches of Edible and Industrial Fish



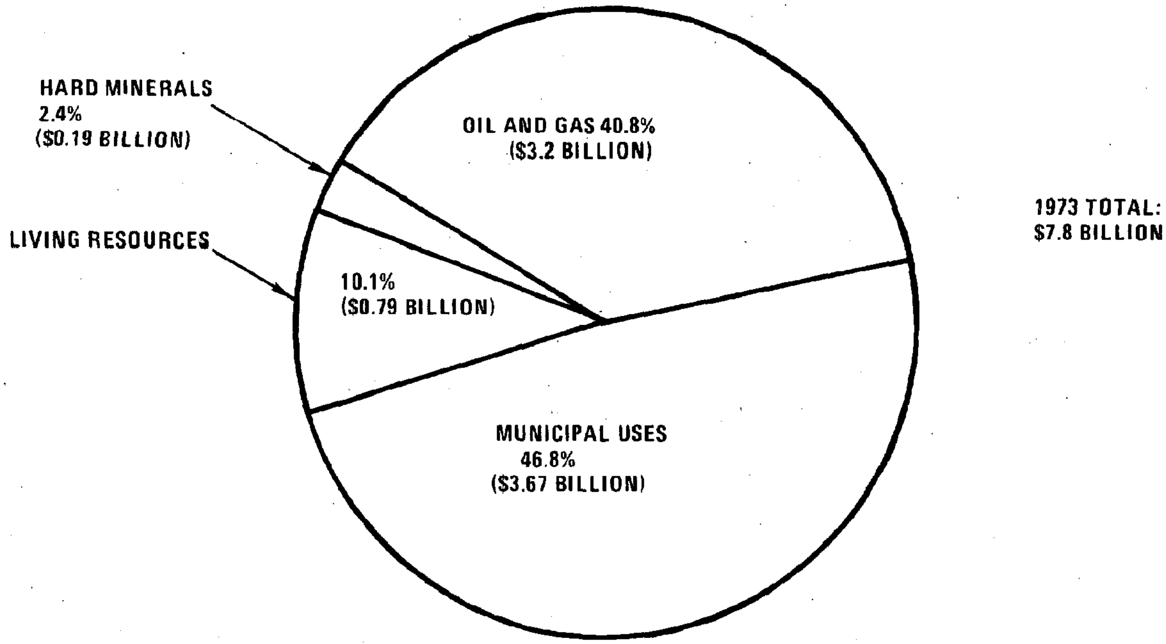
SOURCE: U.S. DEPARTMENT OF COMMERCE NATIONAL MARINE FISHERIES SERVICES, "FISHERIES OF THE UNITED STATES," ANNUAL ISSUES.

Figure I-6. Total U.S. Landings, Imports, and Consumption of Edible Fishery Products



SOURCE: ICNAF STATISTICAL BULLETIN, VOL. 23

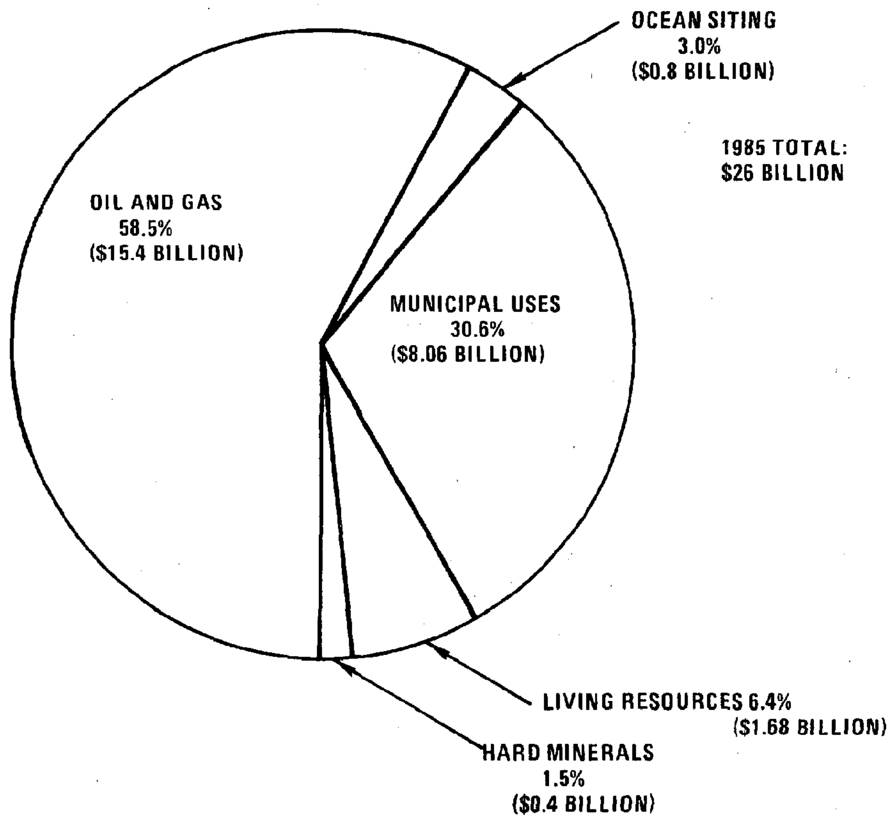
Figure I-7. Major Catches in the Northwest Atlantic



NOTES:
(1) GROSS OCEAN RELATED OUTPUTS IN 1973 DOLLARS.
(2) THE TOTALS MAY NOT EQUAL 100 PERCENT DUE TO ROUNDING.
(3) ADAPTED FROM "THE ECONOMIC VALUE OF OCEAN RESOURCES TO THE UNITED STATES," COMMITTEE ON COMMERCE, U.S. SENATE, BY ROBERT R. NATHAN ASSOCIATES, INC. 1973.

OIL AND GAS: PETROLEUM AND NATURAL GAS
GENERAL RESOURCES: MANGANESE NODULES, MAGNESIUM, CONSTRUCTION MATERIALS, SULFUR AND OTHER MATERIALS
LIVING RESOURCES: FOOD FISH AND INDUSTRIAL FISH
MUNICIPAL USES: RECREATION, TRANSPORTATION, AND COMMUNICATIONS

Figure I-8. Estimated Primary Economic Values of Selected Ocean Resources in 1973



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(2) THE TOTALS MAY NOT EQUAL 100 PERCENT DUE TO ROUNDING.
(3) ADAPTED FROM "THE ECONOMIC VALUE OF OCEAN RESOURCES TO THE UNITED STATES," COMMITTEE ON COMMERCE, U.S. SENATE, BY ROBERT R. NATHAN ASSOCIATES, INC., 1973.

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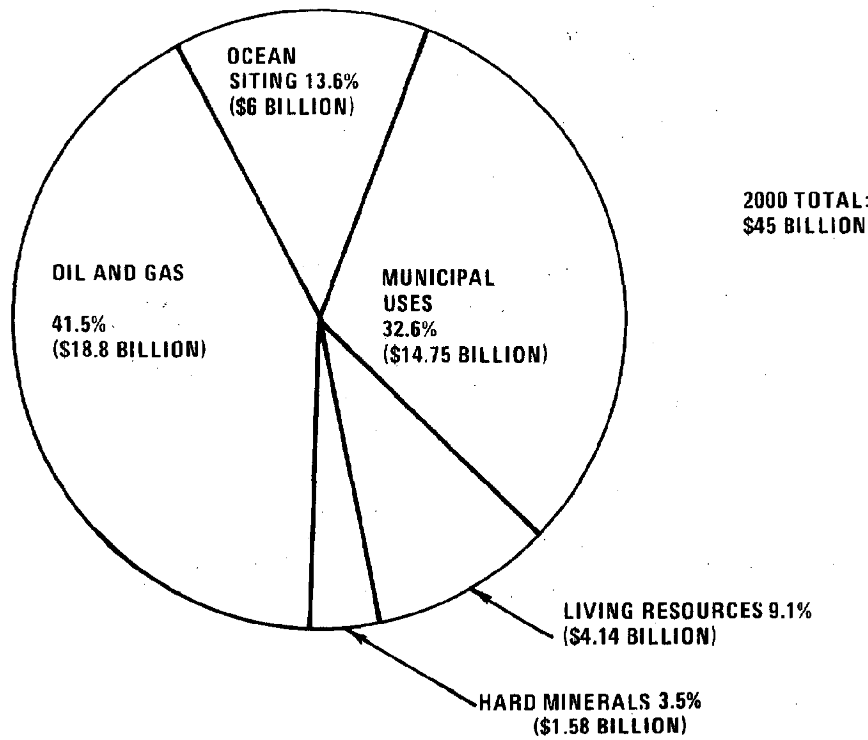
LIVING RESOURCES: FOOD FISH AND INDUSTRIAL FISH
MUNICIPAL USES: RECREATION, TRANSPORTATION AND COMMUNICATION
OCEAN SITING: ENERGY FROM CURRENTS, TIDES AND THERMAL GRADIENTS

Figure I-9. Projected Primary Economic Values of Selected Ocean Resources in 1985



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LIVING RESOURCES: FOOD FISH AND INDUSTRIAL FISH
MUNICIPAL USES: RECREATION, TRANSPORTATION, AND COMMUNICATION
OCEAN SITING: ENERGY FROM CURRENTS, TIDES AND THERMAL GRADIENTS

Figure I-10. Projected Primary Economic Values of Selected Ocean Resources in 2000

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CONFERENCE NOTES AND SERVICES

Location:

The Conference will be located as follows:

9 June 1976 - Department of Commerce Auditorium
14th Street Between Constitution Avenue
and E Street, N.W.
Washington, D.C.

Enter the auditorium by the main entrance
Department of Commerce Building on 14th Street

10, 11, 12 June 1976 - Airlie House
Warrenton, Virginia

Airlie House may be reached by private automobile via Interstate 66 from the Washington Beltway (Interstate Route 495) on the west side of Washington, D.C. Signs approximately one mile east of Warrenton, Virginia, will indicate the route from Route 66 to Airlie House.

Transportation via bus will be provided for conference participants desiring same from designated points in Washington direct to Airlie on 9 June and return to Washington on 12 June. Bus departure points and times will be published at the Commerce Auditorium on the morning of 9 June.

Parking:

Parking is not available at the Commerce Auditorium for participants. The nearest parking facilities are on Pennsylvania Avenue, N.W., just east and west of 14th Street; and on F Street, N.W., between 14th Street and 15th Street, N.W. Additional public parking is available on E Street, N.W., between 11th and 12th Street, N.W. Parking is available at Airlie House for those persons arriving by private automobile.

Dress

Casual clothes are acceptable for working sessions. Coats are requested for dinner.

Coffee:

Coffee will be served during the breaks.

Messages:

Messages for participants can be left at the registration desk during the conference by calling (202) 389-6824 at the Commerce Auditorium or (703) 347-1300 at Airlie House.

Copying Service:

A limited copying service is available at Airlie House for the convenience of participants. Arrangements should be made through the conference staff.

Secretarial and Graphics Services:

Secretarial and graphics services are available to each panel as required.

Conference Expenses:

No separate fee is charged for conference attendance but cost of overnight accommodations and meals will be charged to individual accounts. Coffee will be provided as a service of Airlie House and is included in the cost of room and meals. A daily fee of $8.00 per person is charged for persons attending the conference but not remaining overnight at Airlie House and is payable directly to Airlie House. Coffee and lunch are included in this fee.

The conference notebook and one copy of the final conference report are provided to participants through courtesy of the sponsors.

Extra meals, room service, bar and telephone charges will be for the account of the individual incurring the expense.

PANEL OPERATION

PANEL CHARTERS

The objective of each panel is to recommend a specific long-range program of government and industry sponsored activities in its assigned field covering the 1976 - 1981 time period. The activities may extend beyond the time period where appropriate, but they should all start within the time period.

The following panel charters have been developed to overview areas of responsibility unique to each panel, to avoid duplication between the panels and to assist the panels in rapidly defining their objectives. A far more detailed view of the topic areas to be addressed by each panel can be gained by a review of the suggested program elements contained in this volume.

A. OIL AND GAS PANEL

This panel is to consider technical problems related to the exploration, development production and transport of offshore oil and gas. The offshore petroleum industry is the largest of those to be considered by the conference. The large number of possible program elements suggests the scope of technical problems and opportunities in this area. To simplify the deliberations of the panel, the elements are grouped into the following Topic Areas:

(1) Production Systems and Components;
(2) Improving Existing Technology;
(3) Pipe Laying and Pipelines
(4) Platforms;
(5) Materials, Corrosion and Fouling Control;
(6) Arctic Developments;
(7) Pollution and Clean-up;
(8) Environmental and Design Data;
(9) Policy and Trends; and
(10) General Topics.

B. HARD MINERALS PANEL

This panel is to consider technical problems and research relevant to dredging and mining of hard minerals in coastal areas, Continental Shelf and slope as well as the deep ocean. Topics should include, at a minimum, survey techniques, improved recovery and handling techniques, mineral processing, environmental impacts, and potential markets.

C. LIVING RESOURCES PANEL

This panel is to consider technical problems pertaining to the commercial fishing industry, the examination of technological, biological, and environmental factors capable of potentially impairing U.S. fisheries, and an assessment of aquaculture/mariculture efforts as it relates to increasing our basic knowledge in this area. Short range objectives must be considered along with the beginning steps for longer range programs to insure the ocean industry's future. Topics should include fisheries management, new technology, information needs and marketing and have been grouped into the following topic areas to facilitiate the review process:

(1) Increasing Fish Production
(2) Habitat
(3) Implications of Extended Jurisdiction
(4) Improving Processing and Marketing of Fishery Products
(5) Aquaculture/Mariculture

D. OCEAN SITING PANEL

This panel is to consider problems related to present and proposed siting projects for power generation and transmission as well as siting considerations that are applicable to other ocean facilities. Due to the large number of suggested program elements, they have been grouped into the following topic areas:

(1) Energy Sources
(2) Applications
(3) Concrete and Other Steel Substitutes
(4) Design, and
(5) Policy, Trends and General Topics.

E. MUNICIPAL SERVICES PANEL

This panel is to deal with extensions of current uses and proposed future uses of the ocean, both near shore and offshore, related to urban systems and services such as transportation, waste management, recreation and offshore industrial facilities. The program elements are divided into the following topic areas:

(1) Transportation Applications

(2) Non-Transportation Applications

(3) Environment and Data, and

(4) Policy Trends and General Topics.

PANEL OPERATION

Each panel will consider a broad range of topic areas in a relatively short period of time. Therefore, the sponsoring agencies and participating organizations have prepared a set of suggested program elements to serve as a starting point for the panels' work. These suggestions cover a representative sample of the problem areas to be considered by each panel. Each program element is headed with the name of the panel and an index number for reference.

The panel's first order of business will be to clarify and refine as necessary, the set of program elements that will make up the recommended long range program. The panel should feel free to accept, modify, combine or reject any of the suggested elements, and develop new program elements as appropriate. Any new elements should follow the format shown on the following page. Consideration should be given to the duration and budget of each element to insure that they are both reasonable and realistic.

While the thrust of the conference is technological, institutional considerations may be inherent in the implementation of planned programs. In such cases, the panel should discuss and report on any problems or needed changes in legislation, subsidies or public policy needed to carry out the program elements or implement the results.

The panels' second task will be to establish the relative priorities for various elements of the recommended long range program. Priorities will be needed to aid in the adoption of the program since the facilities, equipment and money are often limited. Close cooperation between government officials and industry provides a sound basis for determining how to allocate available resources most effectively.

Panel Name

STATE TITLE OF PROGRAM ELEMENT

OBJECTIVE: State the objective or problem which the project is meant to apply to or resolve.

PLAN OF ACTION: Describe in time sequence action steps to accomplish objectives, for example, model tests, full scale test, system analysis, equipment design, etc. Plan could include one or all of the above or other approaches to the problem solution.

END PRODUCT: Describe the expected outcome and how the improvement will be implemented.

BENEFIT: Estimate cost savings anticipated or other intangible benefits.

SCHEDULE: Estimate project length and any significant milestones.

BUDGET: Estimate expected project cost over the scheduled time.

PRIORITY: To be determined by panel.

OIL AND GAS PANEL

Production Systems and Components

1-1 Stimulation of Natural Gas from Wells Which Produce Non-Commercial Quantities
1-2 Comparative Evaluation of Wet and Dry Approaches to Subsea Systems
1-3 Man Made Island Platforms
1-4 Surface Supported Sub-Surface Drilling System
1-5 Surface Independent Subsea Completion and Production System
1-5a Surface Independent Completion and Production System (Nuclear Power Supply)
1-5b Surface Independent Completion and Production System (Viewing and Control)
1-5c Surface Independent Completion and Production System (Manipulators)
1-5d Surface Independent Completion and Production Systems (Work Devices)
1-5e Surface Independent Completion and Production Systems (Leak Detection)
1-5f Surface Independent Completion and Production Systems (Pipe Joint Design)
1-5g Surface Independent Completion and Production Systems (Material R&D)
1-6 Development and Design of Systems to Produce Oil from Small Offshore Fields
1-7 Submarine-Supported, Sub-Surface Drilling System
1-8 Submarine Tug/Re-Supply Vessel
1-9 Mid-Depth, Surface-Independent, Drilling System
1-10 Surface Independent Sub-Surface Drilling System on the Bottom
1-10a Surface Independent Bottom Drill System (Warning Sensors)
1-10b Surface Independent Bottom Drill Systems (Multiple Operations)
1-11 Mid-Depth, Surface-Independent, Production System
1-11a Mid-Depth, Surface Free, Production System (Nuclear PWR)
1-12 Surface Independent Natural Gas and NGL Separation System
1-13 Surface Independent Well Workover System
1-14 Surface Independent Logistic Support for Undersea Petroleum Production Facilities

OIL AND GAS PANEL

Improving Existing Technology

1-15 Ocean Test Structure
1-16 Research Requirements for Gravity Structure
1-17 Nuclear Power Sources
1-18 Retractable Drill Bit
1-19 Improved Weight Handling Methods
1-20 Development of New Riser Techniques for Use in Drilling Deepwater Wells
1-21 Wave Forces on Randomly Oriented Tubes and Other Standard Shapes
1-22 Fatigue Analysis for Tubular Joints
1-23 Limits for Dropping Deadweight Anchors from the Surface
1-24 Improved Real Time Drill Bit Telemetry
1-25 Improved Stability for Semi-Submersibles
1-26 Investigation and Analysis of Cases of Failure of Mobile and Fixed Offshore Equipment
1-27 Investigation and Development of Alternate Methods of Connecting Pipes and Structural Shapes other than by Welding
1-28 Development of Improved Equipment and Techniques for Reentry of Deepwater Wells
1-29 Development of Improved Systems for Blowout Prevention in Drilling Deepwater Wells
1-30 Development of Improved Methods for Closing in Offshore Well Blowouts
1-31 Development of Improved Methods and/or Equipment for Measuring Pipe Stresses
1-32 Development of Improved Fire Protection Systems for Offshore Platforms
1-33 Reliability Evaluation of Mooring Lines
1-34 Identification of Column Design Problems
1-35 Standard Hull Series for Supply Vessels
1-36 Model Test Facilities
1-37 Investigation and Development of Cable-Supported Structures for Deepwater Use
1-38 Study of Vibration Problems in Offshore Structures and Evaluation of Methods to Avoid Vibration-Induced Failures
1-39 Investigate and Evaluate Pile Driving and Anchoring Systems and Equipment - Conventional Drop Hammers, Vibrating Hammers, Diesel Hammers Underwater Hammers, Drilling and Grouting as an Alternate to Driving
1-40 Development of Means of Forecasting Ranges of Operations for Certain Types of Mechanical Equipment Used in Offshore Activities
1-41 Development of Methods and Equipment for Improvement of Diving Performance and Work Time

OIL AND GAS PANEL

Pipe Laying and Pipe Lines

1-42 Deep Water Pipelaying Systems Analysis
1-43 Development of Improved Mechanical Connectors and Sealing Materials and Methods for Submarine Piping Systems
1-44 Development of Methods and Materials for Removal of Paraffin from Submarine Flowlines and Piping Systems
1-45 Development of Improved Insulation of Underwater Pipelines
1-46 Surface Independent Pipe Lay System
1-47 Design of Improved Instrumentation for Underwater Alignment of Pipelines

OIL AND GAS PANEL

Platforms

- 1-48 Below the Interface Platforms
- 1-49 Limitations on the Application of Ocean Surface-Piercing Fixed Drilling Platforms in the OCS
- 1-50 Deep Water Platforms, Floating
- 1-50a Ship Motion Theory Applied to Deep Water Platforms
- 1-50b Deepwater Platforms Heave Compensation Systems
- 1-50c Deep Water Platforms Improved Exploratory Downhole Pressure Sensors
- 1-50d Deep Water Platforms Moors
- 1-51 Development of Saturated Diving Systems for Servicing of Deepwater Production Equipment
- 1-52 Flippable Barge
- 1-53 Study to Provide Improved Methods for Underwater Inspection of Fixed Offshore Structures
- 1-54 Evaluation of Surveying Techniques for Offshore Construction and Recommendations for Improvement

OIL AND GAS PANEL

Materials, Corrosion and Fouling Control

1-55 Development of Improved Procedures, Techniques and Materials for Corrosion Control of Offshore Platforms and Pipelines
1-56 Development of Environmentally Safe and Acceptable Materials and Methods for Control of Pier Fouling and Boring Organisms
1-57 Develop Rules for Cathodic Corrosion Protection Systems
1-58 Long Term Behavior of Materials in the Air Sea Interface
1-59 Improved Protective Coatings for Ocean Structures
1-60 Investigation of Methods, Materials and Systems for Control of Marine Parasite and Predator Incursions
1-61 Improved Cost/Effectiveness of Metallic Alloys in the Marine Environment
1-62 Evaluation of Computerizing Various Material Testing Techniques (X-Ray, Ultra-sonic, etc.) for Use in Offshore Construction Projects

OIL AND GAS PANEL

Arctic Developments

1-63 Arctic Bulk Shipping System (Surface)
1-64 Arctic Offshore Structure Technology
1-65 Analysis of Methanol Phase Change Plant
1-66 Arctic Methanol Transport Concept Evaluation
1-67 Extend the Season for Drilling Operations in Arctic Waters
1-68 Sea Access to Beaufort Sea
1-69 Analysis of Underwater Methanol Plant
1-70 Sea Floor Benchmarks and Sub-Bottom Benchmarks for Use in the Shear Ice Zone
1-71 Ship Transits Through the Arctic Ice Pack an Experimental Data Gathering Program
1-72 Small Bore Tunnelling for Pipelines Through Arctic Shore Fast Ice Zone
1-73 Shear Ice Zone Logistic Transport Vehicle
1-74 Establish a Civilian Under Ice OCS Communications Network and Traffic Control System in the Arctic Under a Joint U.S./Canadian Program
1-75 Development of Standardized Design Criteria for Construction and Emplacement of Artificial Arctic Islands
1-76 Arctic Submarine Methanol Tanker System Design
1-77 Arctic Methanol Pipeline and Ship System Definition
1-78 Large ACV's for Arctic Transportation
1-79 Tanker Submarine
1-80 Advanced High Speed Tunnelling Technology for Building OCS Underground Drilling Chambers Under Arctic Shore Fast and Shear Ice Zones
1-81 Water Reinjection in Arctic OCS Petroleum Fields
1-82 Under Ice Oil Spill Cleanup System
1-83 Development of Equipment and Systems to Deflect Icebergs from Fixed Offshore Platforms
1-84 Improvement of Deepwater Drilling Techniques in Arctic Waters
1-85 Arctic Marine Transportation and Ship Design
1-86 Arctic Submarine Route Survey
1-87 Arctic Submarine Port Facility
1-88 Ice Engineering
1-89 Shorefast and Shear Ice Zone Pipeline Laying System
1-90 Establish a Non-Military Under Ice Navigation Reference System for Use in the Arctic Under a Joint U.S./Canadian Program
1-91 Under Ice Salvage System
1-92 Pollution Monitoring and Alerting
1-93 Ocean Pollution Reduction from OCS Petroleum Operations
1-94 Tanker Spill Prevention
1-95 Capture and Collection of Upward Floating Petroleum from Bottom Mounted Drilling and Production Systems
1-96 Submarine Tanker Ballast Sea Water Undersea Processing to Remove Trace Amounts of Oil

OIL AND GAS PANEL

Environmental and Design Data

1-97 Remote Sea Floor Inspection System
1-98 Common Surface Platform for Baseline OCS Environmental Surveys as Well as Seismic and Route/Site Surveys for Petroleum Development
1-99 Development of Sensitive Geophysical Instrumentation to Identify Near-Surface Geologic Features of the Ocean Floor
1-100 Compilation and Development of Safety and Environmental Procedures and Measures for Deepwater Exploratory and Development Drilling
1-101 Surface Independent Seismic and Oceanographic Survey System
1-102 Development of Equipment and Methods for Sea Floor Surface Detection of Presence of Hydrocarbons Prior to Drilling
1-103 Long-Range Study of the Adaption of Marine Organisms to Oil Exposure

OIL AND GAS PANEL

Policy and Trends

1-104 Impact-On-Navigation Analysis
1-105 Planning for Uses of Abandoned Offshore Oil and Gas Platforms
1-106 Offshore Platform Alternate Collateral Uses
1-107 Increase in the Potential and Frequency of Major Marine Accidents
1-108 Military Threat Analysis
1-109 Terrorist/Criminal Threat Analysis
1-110 New Dis-Incentive Legislation
1-111 Evaluation of Tender - Assisted Rigs vs. Drill Ships for Deepwater Drilling

OIL AND GAS PANEL

General

1-112 Rescue/Salvage Equipment and Personnel Data Bank
1-113 Personnel Acquisition and Selection
1-114 OCS Nuclear Power Supply Requirements Definition
1-115 Oil/Sea Water Miscibility Under Ocean Depth Pressures
1-116 Personnel Retention and Incentives
1-117 Training Facilities - Officers
1-118 Training Facilities - Crew
1-119 Investigation of the Methods of Avoiding Energy Losses Between Production Offshore and Manufacturing Onshore
1-120 Intermediate Self-Propelled ACV's for Lightering Inter-Modal Transporters
1-121 Certification and Licensing
1-122 Short Voyage OCS Petroleum Field Gathering Submarine Tanker
1-123 Nuclear Power Supply Refueling in OCS Development Applications
1-124 Comprehensive Study of Application of Plate Tectonics to Oil and Gas Accumulation in Present Continental Margins
1-125 Comprehensive Study of Application of Plate Tectonics Theory to Ore Localization in Defining and Identifying New Areas for Mineral Exploration
1-126 Interactions of Surface Transport of Petroleum Products and Sea Bird Populations in the Western North Atlantic.

HARD MINERALS PANEL

2-1 Improved Exploration Techniques for Deep Ocean Mineral Deposits
2-2 Rare Metals from the Continental Shelf
2-3 Rare Metals from Seawater
2-4 An Exhaustive Mineral and Biological Survey of the U.S. Continental Shelves
2-5 Sea-Going Cutterhead Dredge
2-6 Manganese Nodule Extraction Procedures
2-7 Deep Ocean Environmental Test Facility
2-8 Mineral Genesis
2-9 Bottom Mapping of Deep Ocean Basins
2-10 Development of Sulfur as a Construction Material
2-11 Air Pollution Control Impact on Offshore Sulfur Production
2-12 Improved Sulfur Transportation
2-13 New Uses for Cobalt
2-14 Use of Ferromanganese Residue in Steel Making
2-15 Evaluate and Investigate Alternative Environmentally Safe Methods for Disposal of Tailings from Manganese Nodule Refinery Operations
2-16 Ocean Bottom Survey Systems
2-17 Remotely Operated Geological Submarine Device for Ocean Bottom Sampling
2-18 Development and Utilization of Undersea Vehicles in Arctic Seas
2-19 Marine Sand and Gravel Resources
2-20 Manganese Nodule Industry
2-21 The Use of Manganese
2-22 Development of On-Board Marine Mineral Assay Equipment
2-23 Design Long-Distance Pipeline Systems for Ocean Dredges
2-24 Preparation of Environmental Guidelines for OCS Hard-Rock Mining Operations
2-25 Implementation of Prototype Environmentally-Safe Marine Mining Operations for Sand and Gravel
2-26 Development of Incentives for Marine Mining
2-27 Environmental Impact of U.S. Deep Ocean Mining for Manganese Nodules
2-28 A Floating Prototype Metal Extraction and Processing System
2-29 Oceanographic and Meteorological Information for U.S. Commercial Development of the Oceans
2-30 Investigation of Structural Materials
2-31 Component and Systems Reliability
2-32 Design and Development of an Electric Motor for Subsea Use
2-33 Design and Development of a Closed Cycle Power Generator System for Subsea Use
2-34 Design and Development of High Power Semiconductor Switch Gear for Subsea Use

LIVING RESOURCES PANEL

INCREASING FISH PRODUCTION

3-1	Improved Methods of Living Marine Resources Management
3-2	Economic Incentives for Marine Fisheries
3-3	Stimulate Fish Harvesting Productivity
3-4	Improved Fish Locations and School Concentration Techniques
3-5	Improved Commercial Fishing Technology
3-6	Floating Food Processing Complex
3-7	Fishery Strategy and Engineering Research For Conservation of Northwest Atlantic Fisheries
3-8	Multi-Use Harvesting Vessel
3-9	Development of Processing Methods for Underutilized Fishery Resources
3-10	Multi-species Fish Preservation Systems Aboard Vessels in the Northeast Pacific
3-11	Development of A U.S. Fish Block Industry
3-12	Useful Microorganism From the Sea
3-13	Recovery of Shrimp Fishery Incidental Catch
3-14	Unmanned Fishing Systems
3-15	Control of Fish Stocks
3-16	Survey of Fish Holding Conditions Aboard Vessels
3-17	Developing Fisheries for Underutilized Fishes in the Eastern Gulf of Mexico
3-18	Industry - Government Ventures on Alaskan Surf Clam
3-19	Investigations on the Biology and Fisheries of Baitfishes in Florida
3-20	Determine Abundance and Seasonal Distribution of Scombroid Fish Stocks
3-21	Coastal Pelajic Fishery Development
3-22	Hydrogenated Fish Oils As An Energy Source In Milk Replacers
3-23	Development of Bottomfish Fishery In the Gulf of Mexico
3-24	Extension of Known Raw Material Resources
3-25	Study of Per Capita Consumption of Fish In the U.S.
3-26	Application of Alternative Technology In the Shrimp Fisheries
3-27	Application of Alternative Technology In the Spiny Lobster Fishery
3-28	Improving Fish Production At Sea
3-29	Development of Increased Knowledge Concerning Histamine and Histamine-Like Substances
3-30	Dynamics of Great Lakes Fisheries

LIVING RESOURCES PANEL

HABITAT

3-31	An Exhaustive Mineral and Biological Survey of the U.S. Continental Shelf (Also Hard Minerals Panel)
3-32	Investigation of Ocean Upwelling Process and Means of Commercial Utilization
3-33	Feasibility of Transplanting Fish Stocks Out of Their Native Habitat, e.g., Introduction of Salmon into the Nutrient-Rich Southern Ocean
3-34	Investigation of the Physiological Constraints of Unit Fish Stocks Movement
3-35	Application of Satellite Telemetry to Follow and Determine Migrating Fish Patterns
3-36	Consequences of Energy Related Activities On Marine Fish and Shellfish (Thermal Additions, Ozone, Chlorine)
3-37	Fishery Diaster Monitoring And Prediction System Development
3-38	Microconstituents and Environmental Impacts Considerations
3-39	Effects of Ocean Outfalls on the Prevalence of Tumors and Other Noninfections and Infections Dieases of Marine Fish and Shellfish
3-40	Environmental Impact In the Coastal Zone of the Southeastern U.S. - Follow-up Studies
3-41	Polychlorobiphenyls (PCB's) In Marine Fish
3-42	Effects On Marine Fish and Shellfish of Biologic and Abiologic Controls Utilized in Agriculture

LIVING RESOURCES PANEL

IMPLICATIONS OF EXTENDED JURISDICTION

3-43	Fisheries Resource Analysis: Shrimp and Associated Estuary - Dependent, Demersal Species
3-44	Soci-Economic Study of Commercial And Recreational Users of Louisiana Shrimp Resources As it May Relate To Future Entry Programs
3-45	Prototype Industry - State - Federal Data Management Systems
3-46	Economic Impact Study of Foreign Caught Fish Landings

LIVING RESOURCES PANEL

IMPROVING PROCESSING AND MARKETING OF FISHERY PRODUCTS

3-47 Broaden Consumer Food Fish Acceptance
3-48 Divise Methods For Identifying Toxic Fish and Develop Commercial Fish and Shellfish Detoxification Processes
3-49 Quality Assessment Survey
3-50 Coastal Small Business Co-op Development
3-51 Mechanized Fish Storage And Unloading
3-52 Identify Technologies Capable of Upgrading the Uses and Value of Industrial Fish
3-53 Problems Associated With the Presence of Nematodes In Surf Clams and Calico Scallops
3-54 Reduction of Present Energy Dependent Vessles
3-55 Revitalization of Our Domestic Oyster Industry
3-56 Organizing and Operating Fishery Insurance Cooperatives
3-57 Underlying Causes of Lipid Rancidity In Fish Muscle
3-58 Fishery Resources For the Future Including Underutilized Resources
3-59 Tarriffs and Nontarriff Barriers to Trade In Fish and Fishery Products
3-60 Food Fish Data Bank
3-61 Indentification and Elimination of Potential Pathogens In Seafood and Fishery Products
3-62 Market Research
3-63 Quarantine and Inspection Service For Marine Fish and Shellfish

LIVING RESOURCES PANEL

AQUACULTURE/MARICULTURE

3-64 Mariculture Integration With Platform Buffer Zone
3-65 Mariculture Stimulation Through Market Broadening
3-66 Use of Heated Water from Nearshore Power Plants to Accelerate Mariculture Output
3-67 Pilot Mariculture Bed To Use Ocean Thermal Ammonia Plant-Ship Cold Water Nutrients to Produce Shellfish and Lobsters
3-68 Feasibility Study of Using Treated Sewage Effluents as a Nutrient Source For Fish
3-69 Investigation of Accelerating Fish and Shellfish Maturation In the Presence of Warm Water and Use of Special Diets
3-70 Evaluation of U.S. Brackish Waters as Future Areas for Fish Pond Culture
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OCEAN SITING PANEL

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OCEAN SITING PANEL

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PROGRAM ELEMENTS

OIL AND
GAS

OIL AND GAS

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OIL AND GAS PANEL

Production Systems and Components

1-1	Stimulation of Natural Gas from Wells Which Produce Non-Commercial Quantities
1-2	Comparative Evaluation of Wet and Dry Approaches to Subsea Systems
1-3	Man Made Island Platforms
1-4	Surface Supported Sub-Surface Drilling System
1-5	Surface Independent Subsea Completion and Production System
1-5a	Surface Independent Completion and Production System (Nuclear Power Supply)
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1-10a	Surface Independent Bottom Drill System (Warning Sensors)
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1-11a	Mid-Depth, Surface Free, Production System (Nuclear PWR)
1-12	Surface Independent Natural Gas and NGL Separation System
1-13	Surface Independent Well Workover System
1-14	Surface Independent Logistic Support for Undersea Petroleum Production Facilities

Oil and Gas

I-1 STIMULATION OF NATURAL GAS FROM WELLS WHICH PRODUCE NON-COMMERCIAL QUANTITIES

OBJECTIVE: To investigate the feasibility of constructing a portable facility to collect natural gas from those offshore wells which produce gas in quantities not feasible for connection to the pipeline systems.

PLAN OF ACTION: The initial step would be to inventory the producing wells in the Texas-Louisiana offshore area and to determine the magnitude of the natural gas available which is not now being introduced into the pipelines. The overall components of the system will be a ship, pressure vessels, storage facilities, and gas compression facilities. In addition, methods of connecting the ship to the wells must be investigated and facilities for off loading the collected gas must be developed.

The sequence of steps would include:

1. Inventory of producing offshore facilities not now connected to pipelines.

2. Determination of commercially feasible size vessel for the collection facility.

3. Choice of compression facilities, those compression facilities being driven by natural gas from the wells.

4. Pressure vessel storage capacity investigation.

5. Component development of off loading facilities and availability of existing pipelines to "dispose" of the gas.

END PRODUCT: The expected outcome will be the evaluation of the system for collecting natural gas so as to encourage industry and government to make use of this valuable and heretofore unrecoverable resource.

BENEFIT: To add to the national energy pool the supply of natural gas which exists in the offshore areas and which are not now being recovered. Intangible benefits include: commensurate reduction of imports into the country to meet energy demands. Benefits to the companies would lie in the sale of the gas and benefits to the state and federal government would take the form of severance taxes collected on the wells which fall within that category.

SCHEDULE: The project would require approximately eighteen months and significant milestones would be the completion of the inventory of non-commercial wells and the location of facilities to dispose of the collected gas.

BUDGET: Approximately $90,000 over eighteen months, $60,000 during one calendar year and $30,000 during the other.

PRIORITY:

1-2

COMPARATIVE EVALUATION OF WET AND DRY APPROACHES TO SUBSEA SYSTEMS

OBJECTIVE: To determine whether, from an overall systems standpoint, the wet, i.e., use of divers and robot equipment, or dry, i.e., use of manned submarine equipment, is the most promising approach to devising systems for oil and gas recovery in deep or ice covered waters.

PLAN OF ACTION: The sequence of steps would include:

1. Obtain data on existing wet and dry equipments.

2. Determine applicability of existing designs to potential offshore reserve use.

3. Formulate new concepts if required.

4. Make tradeoff study between wet and dry systems.

END PRODUCT: Report presenting estimates of development, construction, installation and operating costs of candidate systems and conclusion containing recommended approach.

BENEFIT: Optimizing R&D expenditures by channeling them in most cost effective manner.

SCHEDULE: 1 year

BUDGET: $50,000

PRIORITY:

Oil and Gas

1-3 MAN MADE ISLAND PLATFORMS

OBJECTIVE: To determine potential of man made islands as oil and gas recovery platforms on U.S. Outer Continental Shelf, including the Arctic.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate the current state of the civil engineering art in offshore artificial islands for exploratory drilling.

2. Determine areas where water depths indicate viability from a cost standpoint of man made island.

3. Determine conditions which indicate advantageous use of islands, i.e., extensive reserves, adverse surface conditions such as rough water, icing, etc.

4. Evaluate applicability of such islands to long term production systems.

5. Make tradeoff of cost effectiveness of bottom siting or floating platforms and man made islands for oil recovery operations in areas indicated. Parameters explored should include water depth, material cost, ice forces and similar variables.

END PRODUCT: Report presenting potential sites for man made islands and cost comparison between such islands and other platform concepts, including a body of engineering data on artificial island design and design evaluation.

BENEFIT: Increased financial information for industry and basis for determining use of man made islands for collateral uses. More cost effective platforms for oil production equipment.

SCHEDULE: 1 year

BUDGET: $100,000

PRIORITY:

1-4 SURFACE SUPPORTED SUB-SURFACE DRILLING SYSTEM

OBJECTIVE: To design and develop a bottom oriented deep water OCS drilling system supported from the ocean surface as an initial step to fully submerged operations.

PLAN OF ACTION: The sequence of steps would include:

1. Review prior studies and/or buy from industry, as appropriate. In particular, Japanese OCS system design should be reviewed.

2. Sponsor development and demonstration of such a system including an automated, or largely automated, drilling system.

3. Participate in at-sea tests with the system and disseminate data to petroleum industry.

4. Facilitate financial encouragements to industry with MarAd.

END PRODUCT: A design for a workable undersea drilling system which could possibly meet Gulf of Alaska concerns of CEQ and permit offshore operations in this region.

BENEFIT: Federal sponsorship of effort with "front end money" accelerates development and demonstration of advanced system.

SCHEDULE: 10 years

BUDGET: $5 million

PRIORITY:

1-5 SURFACE INDEPENDENT SUBSEA COMPLETION AND PRODUCTION SYSTEM

OBJECTIVE: To design and develop a bottom oriented deep water OCS well completion and petroleum production system. The system is completely deployed, operated, and supported submerged by a nuclear powered submarine platform system as the ultimate form of OCS production capability.

PLAN OF ACTION: The sequence of steps would include:

1. Review prior studies and/or buy from industry, as appropriate.

2. Sponsor development and demonstration of such a system including a largely automated production facility with a nuclear power source.

3. Participate in at-sea and under ice testing of the system and disseminate data to the petroleum industry.

4. Facilitate and encourage the use of the system through financial or other incentives to industry. Coordinate incentives program with MarAd.

END PRODUCT: A design for a fully proven undersea surface independent production system which fully meets the needs for a minimum-pollution-potential OCS production capability.

BENEFIT: Offshore petroleum production without any weather factor permitting most economic design approach for most demanding OCS areas including the Arctic, under ice.

SCHEDULE: 10 years

BUDGET: $17 million

PRIORITY:

1-5a SURFACE INDEPENDENT COMPLETION AND PRODUCTION SYSTEM (NUCLEAR POWER SUPPLY)

OBJECTIVE: Conceptual engineering design for subsurface PWR/OCS power supply.

PLAN OF ACTION: The sequence of steps would include:

1. Define specifications appropriate to applications.
2. Review SOA.
3. Scope operational impact of under ice operation.
4. Identify modifications to SOA.
5. Develop conceptual design.

END PRODUCT: Conceptual design for subsurface PWR for OCS applications.

BENEFIT: Fully submerged petroleum operations can be provided with needed power.

SCHEDULE: Twelve (12) months

BUDGET: $250,000

PRIORITY:

Oil and Gas

1-5b SURFACE INDEPENDENT COMPLETION AND PRODUCTION SYSTEM (VIEWING AND CONTROL)

OBJECTIVE: To expedite and expand the use of low light level, color compensated underwater TV systems and acoustic imaging devices to assist in remote control and viewing of bottom operations.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate prior work by industry and governmental agencies with the objective of advancing state of the art technology.

2. Prepare a plan for federal support of the needed technical development and cost reduction technological effort.

3. Participate in joint program with users to support developers of these hardware systems.

4. Disseminate data on tests of these devices used in actual OCS petroleum operational tasks.

END PRODUCT: Body of data on advanced TV sensor systems and acoustic imaging devices for OCS petroleum development activities.

BENEFIT: More reliable and rapid operation of undersea petroleum control systems.

SCHEDULE: 5 years

BUDGET: $5 million

PRIORITY:

1-5c SURFACE INDEPENDENT COMPLETION AND PRODUCTION SYSTEM (MANIPULATORS)

OBJECTIVE: To determine the needs for heavy duty remote control manipulators capable of lifting and positioning equipment, turning valves and performing other tasks in the undersea petroleum development scenarios.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate existing manipulator designs.

2. Derive designs for a variety of manipulators in close cooperation with industry.

3. Develop and test pilot models of advanced manipulators.

4. Disseminate data to industry.

END PRODUCT: Body of engineering data on advanced undersea manipulators.

BENEFIT: Improved ability to perform well completion tasks.

SCHEDULE: 5 years

BUDGET: $3 million

PRIORITY:

Oil and Gas

I-5d SURFACE INDEPENDENT COMPLETION AND PRODUCTION SYSTEMS (WORK DEVICES)

OBJECTIVE: To develop and refine tools to facilitate bottom completion and production.

PLAN OF ACTION: Manipulator, translation tracks, and special tools for performing oil production system tasks from within vehicles need to be developed and integrated into submersible deisgn. Manned submersible provided power tools and devices require development to provide diver local assistance.

1. Evaluate the specific tasks to be performed.

2. Prepare a plan in conjunction with industry to develop the needed tools.

3. Design, build and test tool systems at sea.

4. Disseminate results to the industry as a whole.

END PRODUCT: Body of engineering data on advanced underwater tools for submersibles to use and to assist divers in OCS petroleum operations.

BENEFIT: More rapid completions, interconnections of flow lines control system checkout, etc.

SCHEDULE: 5 year

BUDGET: $5 million

PRIORITY:

I-5e SURFACE INDEPENDENT COMPLETION AND PRODUCTION SYSTEMS (LEAK DETECTION)

OBJECTIVE: Develop means to measure wellhead leaks, incipient flow line failures and alarm for faulty conditions in operating petroleum production facilities on the bottom, offshore.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate the applicability of acoustic flowmeter and other high accuracy volumetric flow sensors as custody transfer metering devices.

2. Evaluate range of sensitivity required and possible sensor means available.

3. Prepare a plan with industry cooperation to develop a leakage detector system.

4. Design, build and test system at sea.

5. Disseminate results of performance tests to industry as a whole.

END PRODUCT: Body of data on proven equipment for wellhead and deep water flow line leak detector systems.

BENEFIT: More reliable OCS petroleum operations with lower spill potential.

SCHEDULE: 3 years

BUDGET: $3 million

PRIORITY:

Oil and Gas

1-5f SURFACE INDEPENDENT COMPLETION AND PRODUCTION SYSTEMS (PIPE JOINT DESIGN)

OBJECTIVE: To improve the design and to minimize the failures of riser pipe rotary joints at the bottom of the ocean due to uncontrolled platform motions in the seaway.

PLAN OF ACTION: The sequence of steps would include:

1. Analyze the motions of normal surface floating OCS petroleum drilling and production platforms to determine the stresses imposed on the pipe joints between the pipeline along the ocean floor and the riser pipe.

2. Determine available design means to improve the joint both in construction phase, operational cycling and for maintenance and repair.

3. Perform tradeoff studies of possible vertical motion limiting of the platform on complete bottom submergence of platform to eliminate the pipe joint fatigue problem.

END PRODUCT: A proven and demonstrated design for OCS platform riser pipe rotary joints.

BENEFIT: Fewer offshore spills from broken joints. Less down time for repair.

SCHEDULE: 2 years

BUDGET: $100,000

PRIORITY:

Oil and Gas

1-5g SURFACE INDEPENDENT COMPLETION AND PRODUCTION SYSTEMS (MATERIALS R&D)

OBJECTIVE: Perform needed R&D program in materials technology to determine the best means to inhibit hydrogen embrittlement in offshore platform structures and pipelines.

PLAN OF ACTION: The sequence of steps would include:

1. Research current failures and modes of failure.

2. Evaluate new materials in lab fatigue tests.

3. Test new materials in at-sea tests.

4. Prepare specifications and codes to be used in materials selection for specific uses.

END PRODUCT: New specifications for materials application.

BENEFIT: Fewer casualties caused by improper or inadequate materials used in OCS equipment.

SCHEDULE: 5 years

BUDGET: $750,000

PRIORITY:

1-6 DEVELOPMENT AND DESIGN OF SYSTEMS TO PRODUCE OIL FROM SMALL OFFSHORE FIELDS

OBJECTIVE: To effectively exploit oil resources from smaller type fields that do not justify capital investment in fixed platforms.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate current development and production methods to determine potential for economic scaling down.

2. Determine feasibility of using mobile rigs for drilling production wells.

3. Evaluate possible use of subsea completions or variations thereof.

4. Investigate economic feasibility in terms of recommended equipment required, procedures, and available reserves.

5. Recommend further development work.

END PRODUCT: Proposed system of extracting oil from offshore fields that are currently uneconomical to produce.

BENEFIT: Increase in oil supply.

SCHEDULE: 1 year

BUDGET: $125,000

PRIORITY:

Oil and Gas

I-7

SUBMARINE-SUPPORTED, SUB-SURFACE DRILLING SYSTEM

OBJECTIVE: To develop an oil well drilling system capable of operation under the Arctic ice pack.

PLAN OF ACTION: The sequence of steps would include:

1. Prepare detailed design of a submarine capable of being mated with and supporting the surface-supported sub-surface drilling capsule.

2. Develop, build and test prototype system.

END PRODUCT: A proven surface independent oil well drilling system.

BENEFIT: Ability to drill on the Arctic outer continental shelf free of the ice pack and extend oil field availability.

SCHEDULE: Develop design and test - 3 years; 1st unit engineering, construction test and evaluation - 5 years.

BUDGET: Develop design and test - $190 million; 1st unit engineering, construction test and evaluation - $210 million.

PRIORITY:

1-8

SUBMARINE TUG/RE-SUPPLY VESSEL

OBJECTIVE: To develop the necessary vessel to support a surface independent oil field development and production system.

PLAN OF ACTION: The sequence of steps would include:

1. Prepare the detailed design of a submarine tug/re-supply vessel.

2. Develop, build and test a prototype vessel.

END PRODUCT: A surface independent, oil field development and production system.

BENEFIT: Ability to conduct major oil field development and production free of the sea surface and extend field availability.

SCHEDULE:	Dev. Design and Test	2 years
	1st Unit Engr. Prod., Const. Test and Eval.	4 years

BUDGET:	Dev. Design and Test	$ 45 million
	1st Unit Engr. Prod., Const. Test and Eval.	$130 million

PRIORITY:

1-9 MID-DEPTH, SURFACE-INDEPENDENT, DRILLING SYSTEM

OBJECTIVE: Shallow submerged or under ice drilling operations with surface independence but without the need for full pressure depth design of a bottom mounted drilling system.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate the advantages of a diver depth system as compared to bottom oriented drilling systems and surface piercing conventional drilling systems.

2. Sponsor development of a pilot model of such a system.

3. Participate in at-sea and under ice testing of the system and disseminate data to the industry.

4. Facilitate and encourage the use of the system through financial or other incentives to industry. Coordinate incentive program with MarAd.

END PRODUCT: A design for a fully demonstrated surface independent mid-depth, bottom anchored, drilling system operatable at diver depths as opposed to on-the-bottom.

BENEFIT: Alternative design for fully submerged drilling system.

SCHEDULE: 5 years

BUDGET: $2 million

PRIORITY:

1-10 SURFACE INDEPENDENT SUB-SURFACE DRILLING SYSTEM ON THE BOTTOM

OBJECTIVE: To design and develop a bottom oriented deep water OCS drilling system deployed to the operating site and supported on the bottom by a new design, nuclear powered, submarine platform as the ultimate form of surface independent exploratory and production drilling.

PLAN OF ACTION: The sequence of steps would include:

1. Review prior studies and/or buy from industry, as appropriate.

2. Sponsor development and demonstration of such a system including an automated, or largely automated, drilling system.

3. Participate in at-sea and under ice testing of the system and disseminate data to the petroleum industry.

4. Facilitate and encourage the use of the system through financial or other incentives to industry. Coordinate incentives program with MarAd using existing legislative mandates.

END PRODUCT : A design for a fully proven undersea surface independent drilling system which fully meets the needs for a minimum-pollution-potential OCS drilling capability.

BENEFIT: Offshore drilling without any weather factor permitting lowest day rate costs to be realized in most demanding OCS areas including the Arctic, under ice.

SCHEDULE: 10 years

BUDGET: $20 million

PRIORITY:

Oil and Gas

1-10a SURFACE INDEPENDENT BOTTOM DRILL SYSTEM (WARNING SENSORS)

OBJECTIVE: To develop an undersea scanning sensor system to assess the analog of "cloud cover" as seen by the under ice platform operator.

PLAN OF ACTION: The sequence of steps would include:

1. Sensors serve as a perimeter detection system for surface obstacles which may be approaching, including ice and vessels.

2. Examine the possible technical approaches that could be used.

3. Prepare a plan for joint federal and industry development of the system.

4. Build, test and evaluate performance under the ice.

5. Disseminate data and findings on the use of the system to industry.

END PRODUCT: Body of data about undersea obstacle avoidance perimeter detection sensors and performance.

BENEFIT: Fewer accidents caused by damage to undersea platforms due to ice cover contacts.

SCHEDULE: 5 years

BUDGET: $1.5 million

PRIORITY:

1-10b

SURFACE INDEPENDENT BOTTOM DRILL SYSTEMS (MULTIPLE OPERATIONS)

OBJECTIVE: To evaluate means for simultaneous surface independent drilling of two exploratory wells to permit imporved control of the drilling operation and to permit accelerated exploratory drilling and step out drilling for field delineation.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate on land techniques and determine best means to apply approach offshore.

2. Develop a plan to build and operate prototype systems in a cooperative program with industry.

3. Test and evaluate equipment.

4. Disseminate results to industry.

END PRODUCT: Body of data on practical undersea systems to permit simultaneous drilling of multiple wells.

BENEFIT: Faster field delineation, safer operations, lower cost of operation per foot of holes drilled.

SCHEDULE: 10 years

BUDGET: $40 million

PRIORITY:

1-11 MID-DEPTH, SURFACE-INDEPENDENT, PRODUCTION SYSTEM

OBJECTIVE: To develop a shallow submerged or under ice production operations with surface independence but without the need for full pressure depth design of a bottom mounted production system.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate the advantages of having a diver depth system as compared to bottom oriented drilling systems and surface piercing conventional production platform systems.

2. Sponsor development of a pilot model of such a system.

3. Participate in at-sea and under ice testing of the system and disseminate results of tests to industry.

4. Facilitate and encourage the use of the system through financial or other incentives to industry. Coordinate incentive program with MarAd.

END PRODUCT: A design for a fully demonstrated surface independent bottom anchored mid-depth system for operation at diver depths.

BENEFIT: Alternate design for fully submerged production system.

SCHEDULE: 5 years

BUDGET: $5 million

PRIORITY:

Oil and Gas

1-11a MID-DEPTH, SURFACE FREE, PRODUCTION SYSTEM (NUCLEAR PWR)

OBJECTIVE: Provide conceptual design for surface accessible PWR power supply.

PLAN OF ACTION: The sequence of steps would include:

1. Determine specifications.

2. Define state-of-the-art of appropriate nuclear power supplies.

3. Identify modifications (redesign) of current nuclear power supplies necessary for OCS applications.

4. Develop conceptual design.

END PRODUCT: Achievable characteristics for the state-of-the-art of PWR for OCS applications.

BENEFIT: Nuclear power supplies for OCS development.

SCHEDULE: Twelve (12) months.

BUDGET: $150,000 to $400,000

PRIORITY:

1-12 SURFACE INDEPENDENT NATURAL GAS AND NGL SEPARATION SYSTEM

OBJECTIVE: To develop a surface independent capability to process the associated natural gas and light liquid fractions into a form that is transportable from an undersea petroleum production facility.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate the feasibility of an undersea methanol or "Methyl Fuel" phase change plant.

2. Evaluate the design of surface independent separation of unwanted associated chemicals such as H_2S, salt water, etc. under at-depth operating pressures down to 3,000 ft. depth. If unfeasible at these depths, determine maximum practical depth for a mid depth facility.

3. Participate in design and production fo a demonstration pilot plant and disseminate data to industry.

END PRODUCT: Proven design for a surface independent means for handling all aspects of undersea petroleum production.

BENEFIT: 10 years

BUDGET: $7 million

PRIORITY:

1-13 SURFACE INDEPENDENT WELL WORKOVER SYSTEM

OBJECTIVE: Surface independence of the well workover function to permit fully submerged operation of the entire sequence of petroleum drilling and production steps.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate the functional requirements for the well workover functions to determine needed characteristics for a fully submerged system.

2. Sponsor design and development of a fully submerged system approach.

3. Participate in at-sea and under ice testing and demonstration of the system and disseminate results to industry.

4. Facilitate the use of the system through financial and other incentives. Coordinate incentives program with MarAd.

END PRODUCT: A design for a fully proven surface independent well workover system.

BENEFIT: Improved access to more OCS petroleum in difficult operating regions.

SCHEDULE: 10 years

BUDGET: $1 million per year

PRIORITY:

1-14 SURFACE INDEPENDENT LOGISTIC SUPPORT FOR UNDERSEA PETROLEUM PRODUCTION FACILITIES

OBJECTIVE: To bring into being the necessary undersea and under ice OCS petroleum development support systems. The offshore workboat and resupply boat of the present has an undersea analog, the logistic and support submarine.

PLAN OF ACTION: The sequence of steps would include:

1. Review prior studies and/or buy from industry as appropriate.

2. Sponsor development and demonstration of such a system. This program is a rough analog of the 10 year program of support to Arctic Air Cushion Vehicle (ACV) sponsored by the Advanced Research Projects Agency (ARPA)of DOD.

3. Participate in at-sea and under ice testing of the system and disseminate results to industry.

4. Facilitate and encourage use of the system through incentives to industry. Coordinate financial incentives with MarAd.

5. Examine collateral uses such as search and rescue with USCG.

END PRODUCT: A design for a fully demonstrated undersea, surface independent logistic support submarine system.

BENEFIT: Accelerated access to OCS petroleum resources in difficult operating areas.

SCHEDULE: 10 years

BUDGET: $50 million

PRIORITY:

OIL AND GAS

IMPROVING EXISTING TECHNOLOGY

OIL AND GAS PANEL

Improving Existing Technology

1-15 Ocean Test Structure
1-16 Research Requirements for Gravity Structure
1-17 Nuclear Power Sources
1-18 Retractable Drill Bit
1-19 Improved Weight Handling Methods
1-20 Development of New Riser Techniques for Use in Drilling Deepwater Wells
1-21 Wave Forces on Randomly Oriented Tubes and Other Standard Shapes
1-22 Fatigue Analysis for Tubular Joints
1-23 Limits for Dropping Deadweight Anchors from the Surface
1-24 Improved Real Time Drill Bit Telemetry
1-25 Improved Stability for Semi-Submersibles
1-26 Investigation and Analysis of Cases of Failure of Mobile and Fixed Offshore Equipment
1-27 Investigation and Development of Alternate Methods of Connecting Pipes and Structural Shapes other than by Welding
1-28 Development of Improved Equipment and Techniques for Reentry of Deepwater Wells
1-29 Development of Improved Systems for Blowout Prevention in Drilling Deepwater Wells
1-30 Development of Improved Methods for Closing in Offshore Well Blowouts
1-31 Development of Improved Methods and/or Equipment for Measuring Pipe Stresses
1-32 Development of Improved Fire Protection Systems for Offshore Platforms
1-33 Reliability Evaluation of Mooring Lines
1-34 Identification of Column Design Problems
1-35 Standard Hull Series for Supply Vessels
1-36 Model Test Facilities
1-37 Investigation and Development of Cable-Supported Structures for Deepwater Use
1-38 Study of Vibration Problems in Offshore Structures and Evaluation of Methods to Avoid Vibration-Induced Failures
1-39 Investigate and Evaluate Pile Driving and Anchoring Systems and Equipment - Conventional Drop Hammers, Vibrating Hammers, Diesel Hammers Underwater Hammers, Drilling and Grouting as an Alternate to Driving
1-40 Development of Means of Forecasting Ranges of Operations for Certain Types of Mechanical Equipment Used in Offshore Activities
1-41 Development of Methods and Equipment for Improvement of Diving Performance and Work Time

1-15 OCEAN TEST STRUCTURE

OBJECTIVE: To appraise, verify and calibrate present design force calculation procedures for space-frame structures and to develop diagnostic research information upon which to base improvements in design procedures.

PLAN OF ACTION: The sequence of steps would include:

1. Design a small scale (1:3 to 1:6) test structure for installation in 65 ft. of water in the Gulf of Mexico. Instrument to measure: (1) total base shear and overturning moment on structure, (2) spatial and temporal distribution of hydrodynamic forces, (3) interference phenomena, (4) forces on members above mean water level, and (6) wave height, water particles velocity, wind speed and direction, barometric pressure and temperature.

2. Make direct comparisons between measured and predicted forces.

END PRODUCT: Correlation between design methods and test data.

BENEFIT: 2 years

BUDGET: $3 million

PRIORITY:

1-16 RESEARCH REQUIREMENTS FOR GRAVITY STRUCTURE

OBJECTIVE: To outline a research program to improve foundation design technology (Ref: OTC Paper 2371, 1975).

PLAN OF ACTION: Gravity structures have certain advantages over pile-supported structures in that they are easier to place and more readily recoverable. It cannot presently be realized because of a confidence gap between pile supported platforms and gravity structures. Foundation research may prove that gravity structures can be acceptable where they are now considered questionable. It is proposed to establish a team of researchers and operators to define what research is required to close this gap, specifically including: offshore sampling techniques, in situ soil testing, soil properties under cyclic loads coupled with their application in finite element analyses, centifuge models and field instrumentation for monitering foundation movements, and induced pore water pressures and soil stresses.

END PRODUCT: A comprehensive research plan for increasing confidence in the use of gravity structures.

BENEFIT: To improve the quality and capability of offshore gravity structures.

SCHEDULE: 1/2 year

BUDGET: $50,000.

PRIORITY:

1-17 NUCLEAR POWER SOURCES

OBJECTIVE: To develop commercial marine power sources for submerged oil drilling and production, and submarine oil transportation system.

PLAN OF ACTION: The sequence of steps would include:

1. Develop suitable "family" of commercial marine nuclear power systems in the range of 6,000 to 60,000 HP for submerged oil production and transport systems.

2. Design one or more prototype systems, based if appropriate on naval reactor technology, but modified for maximum economy of operation.

3. Develop, build and test prototype system, or systems.

END PRODUCT: Tested, proven and certified design(s) of commercial marine nuclear power system(s), in power range(s), suitable for a variety of off-shore applications.

BENEFIT: Ability to conduct major oil production free of sea surface.

SCHEDULE:

Dev. Design & Test	3 years
1st Unit Engr., Const. Test & Eval.	5 years

BUDGET:

Dev. Des. & Test	$20 Million	For 1 size at
1st Unit Engr., Const., Test & Eval.	$30 Million	small end of spectrum

PRIORITY:

Oil and Gas

1-18 RETRACTABLE DRILL BIT

OBJECTIVE: Stimulate the Oil and Gas industry by improving its productivity.

PLAN OF ACTION: With the costs of on site drill operations exceeding $60,000 daily and increasing as drill sites move into deeper and rougher areas, the necessity for reducing drilling times becomes paramount. A present time consuming operation is the need to overhaul the entire drill string in order to change or clean drill bits. The impact of a successful technique for bit retrieval without the need for tripping the drill string would materially reduce drilling times and improve productivity.

1. Review past industry efforts to produce a retractable bit and problems associated therewith. Analyze these efforts in the light of present operational drilling procedures.

2. Determine what technology is needed to overcome indicated shortcomings revealed by the analysis. Explore the possibility of new approaches to the bit replacement procedure.

3. Develop a program of funding, scheduling and probability of success which will provide the necessary basic technical capability for competitive industrial development of a retractable drill bit or alternate technique.

END PRODUCT: Technology planning base for commercial development of a retractable drill bit.

BENEFIT: Stimulate commercial ocean development and impact energy crisis solution.

SCHEDULE: 1 year

BUDGET: $50,000

PRIORITY:

Oil and Gas

1-19 IMPROVED WEIGHT HANDLING METHODS

OBJECTIVE: To stimulate the Oil and Gas industry by improving its productivity.

PLAN OF ACTION: A considerable portion of exploratory and production drilling activity is devoted to the repeated handling of heavy materials such as drill pipe, casing, and blow out preventers. The techniques used often involve time consuming apparatus such as stiff leg derricks and slow speed hoists and provide for weight movements over routes which are relatively fixed. The application of modern weight handling techniques to rig operations offers a potential for speeding the drilling operation and reducing the costly on site times of the rigs.

1. Analyze the requirements for weight handling operations associated with the various phases of rig drilling activity. Volumes, weights, frequencies, routes, distances and other such paremeters involved in the operations should be examined for commonality with the objective of defining a basic weight handling scenario.

2. Design a replacement system employing modern techniques such as conveyer systems, articulated cranes, magnetic hoists and computerized control.

3. Perform a life cycle cost/benefit analysis of the replacement design considering both current and projected drilling location and depth requirements and compare with similar analysis of existing weight handling techniques.

END PRODUCT: An analyzed data base upon which to make judgements with regard to the feasibility of proceeding with prototype/production installations and tests.

BENEFIT: A potentially faster and safer offshore drilling capability.

SCHEDULE: 1 year

BUDGET: $300,000

PRIORITY:

1-20 DEVELOPMENT OF NEW RISER TECHNIQUES FOR USE IN DRILLING DEEPWATER WELLS

OBJECTIVE: To develop a dependable deepwater drilling riser system.

PLAN OF ACTION: The sequence of steps would include:

1. Survey of current riser sizes, diameters, and materials used.

2. Determine extent and effect of environmental forces - wave, current, etc. - acting on riser.

3. Determine range of forces acting on riser due to self-weight (including subs, etc.); torsion and dynamic forces due to drilling in different rock formations; and pressures exerted due to drilling fluid.

4. Investigate feasibility of adding buoyancy chambers to relieve stresses.

5. Compile most advantageous systems based on material quality, riser diameter, addition of buoyancy, positioning of drill rigs. etc.

END PRODUCT: Development of more reliable and efficient riser for deepwater drilling.

BENEFIT: Increased efficiency of deepwater drilling operations.

SCHEDULE: 3 years

BUDGET: $250,000

PRIORITY:

1-21 WAVE FORCES ON RANDOMLY ORIENTED TUBES AND OTHER STANDARD SHAPES

OBJECTIVE: To develop a general form of wave forces on arbitrarily-oriented tubes, as well as other standard shapes such as rectangular, and elliptical cross section structures.

PLAN OF ACTION: Engineers from the Chicago Bridge and Iron Company have prepared a general form of wave forces on an arbitrarily-oriented tube. Some laboratory work has been carried out. (Reference: OTC Paper 21, 1975).

1. Document applicable existing research on wave forces.

2. Plan and conduct test work to establish the validity of mathematical formulation.

3. Develop more extensive data for C_M (inertia coefficient) and C_D (drag coefficient) for various tube orientations and other standard shapes.

END PRODUCT: A design technique for predicting wave forces on various standard shapes. A manual with information relating wave forces and tubular, rectangular and elliptical shapes.

BENEFIT: Better knowledge of environmental forces will result in safer structures at minimum cost.

SCHEDULE: 2 years

BUDGET: $180,000

PRIORITY:

Oil and Gas

1-22 FATIGUE ANALYSIS FOR TUBULAR JOINTS

OBJECTIVE: To develop and verify a technique for prediction of fatique failure of tubular joints found in offshore structures.

PLAN OF ACTION: (Ref: OTC Paper 2208)

The design of tubular intersections has been substantially advanced by modern methods of structural analysis, finite element. However, the fatigue analysis methods for tubular joint intersection are still under development. Industry sponsored research was aimed at this problem but test agreement was more qualitative than quantitative.

In cooperation with sponsoring industry participants, review research progress theories and conclusions to date. Design and conduct additional experimental testing to verify the applicability of fracture mechanics predictions to prediction of crack growth. Develop design procedures.

END PRODUCT: Fatique design procedures for tubular joints.

BENEFIT: Rationally designed tubular joints to minimize fatique failure.

SCHEDULE: 2 years

BUDGET: $250,000

PRIORITY:

1-23 LIMITS FOR DROPPING DEADWEIGHT ANCHORS FROM THE SURFACE

OBJECTIVES: To determine whether normal methods for dropping deadweight anchors are safe with heavier weights.

PLAN OF ACTION: Deadweight anchors are dropped from platforms with reasonable accuracy by stringing them out on neutrally buoyant lines and letting them freefall with line tension automatically maintained. As the with line tension automatically maintained. As the anchorweight is increased the effect of shock and possibility of line breakage becomes more severe.

Plan and conduct an analytic study and/or test program to determine practical limits to this method of placing deadweight anchors. Consider combinations of anchorweight and line strength, and bottom characteristics if necessary. Specify alternate methods for placing heavier weights and effect on deployment cost.

END PRODUCT: Anchor placing design information

BENEFITS: Better knowledge of anchor/line behavior for safer anchoring

SCHEDULE: 2 years (Study Only)

BUDGET: $100,000

PRIORITY:

1-24 IMPROVED REAL TIME DRILL BIT TELEMETRY

OBJECTIVE: To improve deep hole telemetry techniques in order that real time data may be reliably obtained from the drill bit end of the string. Current techniques are marginally satisfactory to depths of only about 12,000 feet and at great expense in time to obtain the data. Experiments in acoustic data transmission through the ground/water path as well as through the string or casing itself have proven unsuccessful as have attempts to modulate the drilling mud flow.

PLAN OF ACTION: A systematic and imaginative review of past efforts and the current relevant physical sciences may suggest untried approaches which could prove successful. One such technique would be to modulate the torque on the drill string from the bit end and demodulate the driving torque to recover the data sensed down hole.

The sequence of actions will be to review past efforts and to envision new techniques which may prove worthy of pursuit.

END PRODUCT: One or more reasonable alternatives to current practices of down hole data retrieval may be discovered. Worthy candidates would then become eligible for R & D funding for their development.

BENEFIT: The possible benefits could be the evolution of new and better techniques that come to light due to the efforts of a team less constrained by current and past practices, and therefore less reluctant to broach different solutions.

SCHEDULE: This project should permit discovery of any promising techniques within two years and could be followed in two more years by prototype demonstrations.

BUDGET:

First 2 years Research and trial designs	$220,000
Second 2 years Prototype development & tests	600,000
	$820,000

PRIORITY:

Oil and Gas

1-25 IMPROVED STABILITY FOR SEMI-SUBMERSIBLES

OBJECTIVE: To increase the stability in heave and pitch motion of the present and future generations of semi-submersibles through the expedient of adding virtual mass whose presence is felt only during upward excursions of the semi.

PLAN OF ACTION: A device, the Sea Ratchet, has been tested in 1/84th model scale in scaled, random and regular waves wherein reduction of sea-induced heave by a factor of 2.7 and pitch by a factor of 6 were demonstrated. Because of time and funding limitations, only one configuration was tested, wherein the Sea Ratchet was suspended a scaled depth of 100 meters beneath the surface.

Theoretical analyses are required to permit quantification of results to be expected from expanded model tests as well as to permit extrapolation to larger scale performance. The sequence of actions is theory development, expanded 1/84th scale model tests, design, construction and at-sea test of prototype.

END PRODUCT: The end product is a prototype Sea Ratchet which may be scaled appropriately to any semi-submersible deployed in heavy weather areas of operation.

BENEFIT: The reductions of sea-induced platform motions will result in substantially fewer down time days whose costs, per platform, often exceed $10 million per year in the North Sea. Intangible benefits may include a reduction of pollution attributable to platform motions as well as increased habitability.

SCHEDULE AND BUDGET: Project elements and their cost over a 4 1/2 year period are suggested as follows:

First Year Continued 1/84 scale model tests	45,000
Design 1/4 scale model for sea tests	90,000
Second Year Construct 1/4 scale model	800,000
Third Year Complete 1/4 scale model and begin sea test	850,000
*Fourth Year Design full scale Sea Ratchet Design prototype construction	100,000
*Fifth Year Complete construction and conduct sea tests	3,000,000
	$6,785,000

*Phases to be cost shared with industry.

PRIORITY:

1-26 INVESTIGATION AND ANALYSIS OF CASES OF FAILURE OF MOBILE AND FIXED OFFSHORE EQUIPMENT

OBJECTIVE: To determine causes of failure as a means of preventing furture failures (analogy with airplane accidents)

PLAN OF ACTION: The sequence of steps would include:

1. Record known historical cases of failure of mobile and fixed offshore equipment.

2. Determine and categorize failure modes, e.g. structural, mechanical, corrosion, foundation, etc.

3. Evaluate influence of accompanying factors including a) weather, wind , waves, currents, electrical storms, etc. b) construction plant misuse or plant inadequacy c) castrophes such as fire, hurricane, earthquakes, etc. d) impact of passing vessels e) design inadequacy.

4. Analyze cases of failure and determine if avoidable.

END PRODUCT: Report and analysis of failures of offshore equipment.

BENEFIT: Prevention of reoccurrence of failures.

SCHEDULE: 1 year

BUDGET: $75,000

PRIORITY:

1-27 INVESTIGATION AND DEVELOPMENT OF ALTERNATE METHODS OF CONNECTING PIPES AND STRUCTURAL SHAPES OTHER THAN BY WELDING

OBJECTIVE: The sequence of steps would include:

1. Inventory of U.S. and foreign patented and unpatented methods and practices of joining pipe and structural sections other than by welding including such techniques as cementing, flanged connections, screwed connections, etc.

2. Evaluate connections based on pressure rating, dependability of each connection, skills necessary, tolerances, life expectancy.

3. Recommend systems for further development.

4. Initiate R & D project including prototype testing under actual field conditions.

END PROJECT: Development of useable hardware for non-weld pipe and structure joining.

BENEFIT: Providing an alternate and potentially more reliable and less costly joining method in offshore construction projects.

SCHEDULE: 3 years

BUDGET: $500,000

PRIORITY:

1-28 DEVELOPMENT OF IMPROVED EQUIPMENT AND TECHNIQUES FOR REENTRY OF DEEPWATER WELLS

OBJECTIVE: To reduce time loss in re-entering previously drilled wells.

PLAN OF ACTION: The sequence of steps would include.

1. Survey and evaluate existing and proposed methods.

2. Study hardware now in use including templates and guides in sea floor.

3. Investigate use of cables and buoys to move and re-enter holes, remote control submarine systems, magnetic radio and sonic "pinger" units, recall buoys, a sub-bottom profiling and sidescan television.

4. Investigate current "fishing" tool technology.

5. Coordinate and integrate findings from above studies and recommend adoption of most reliable system and proposals for further development work.

END PRODUCT: Implementation of more reliable systems for deepwater well re-entry.

BENEFIT: More efficient drilling procedures on deepwater wells.

SCHEDULE: 2 years

BUDGET: $100,000

PRIORITY:

1-29 DEVELOPMENT OF IMPROVED SYSTEMS FOR BLOWOUT PREVENTION IN DRILLING DEEPWATER WELLS

OBJECTIVE: To increase personnel safety, reduce environmental hazards and promote drilling efficiency.

PLAN OF ACTION: The sequence of steps would include:

1. Inventory and evaluate all BOP systems currently in use in terms of causes and performance

2. Determine efficiency, effectiveness and reliability of muds, cements, and other down-hole chemicals under high pressure and temperature to aid in blowout prevention

3. Investigate efficiency and usefulness of down-hole logging instrumentation to provide early warning of blowouts

4. Investigate proposed development of maintenance-free BOP package using latest technology and equipment

5. Initiate development program

END PRODUCT: More effective blowout prevention system

BENEFIT: 3 years

BUDGET: $250,000

PRIORITY:

1-30 DEVELOPMENT OF IMPROVED METHODS FOR CLOSING IN OFFSHORE WELL BLOWOUTS

OBJECTIVE: To shut blowouts as soon as possible after occurrence.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate historical incidents of blowouts, onshore and offshore; inventory the methods used to shut in wells; and evaluate the effectiveness of each for offshore adaptation.

2. Determine type of mobile rig most suitable for drilling deflection hole.

3. Investigate use of telemetry as remote control on blowout preventers.

4. Investigate and evaluate use of muds, cements, chemicals, etc. for closing in well blowouts.

5. Recommend most feasible procedures and indicate areas where further R & D efforts would be desirable.

END PRODUCT: Compendium of methods to close in offshore well blowouts.

BENEFIT: Improved protection of life and property.

SCHEDULE: 3 years

BUDGET: $250,000

PRIORITY:

1-31 DEVELOPMENT OF IMPROVED METHODS AND/OR EQUIPMENT FOR MEASURING PIPE STRESSES

OBJECTIVE: To control and minimize stresses in installing and operating pipelines.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate presently used methods and apparatus used in measuring pipe stresses, e.g. strain gauges, etc.

2. Contact engineering departments of universities, testing companies and groups, pipeline designers and contractors, oil companies, pipe manufacturers and fabricators, etc. to evaluate proposed methods of measurement.

3. Evaluate all proposals and make recommendations for prototype R & D work on most feasible approaches.

4. Set up program and monitor results.

END PRODUCT: New improved technique or apparatus for measuring pipe stressing.

BENEFIT: Better control of pipelaying and pipeline operations.

SCHEDULE: 1 year

BUDGET: $100,000

PRIORITY:

1-32 DEVELOPMENT OF IMPROVED FIRE PROTECTION SYSTEMS FOR OFFSHORE PLATFORMS

OBJECTIVE: The sequence of steps would include:

1. Study of historic record of fires in offshore structures, causes and response-effectiveness.

2. Investigation of present fire prevention and control systems including study of fire monitoring services, detection instrumentation, extinguishing apparatus, structural controls for isolation of fire use of non-flammable materials, personnel response procedures, personal equipment, storage.

3. Study of transferring specific applicable onshore technology to offshore structures.

4. Classification of fire hazards in offshore structures and design criteria used in construction to minimize same.

5. Recommendations for new materials, equipment, apparatus, systems, design concepts, etc. to prevent and control fires.

6. Preparation of comprehensive handbook relating to most current fire prevention and control to be used by design engineers, contractors, operating personnel, and assigned fire-fighting personnel.

7. Recommendations for proposed testing programs.

END PRODUCT: Report on fire protection incorporating most current knowledge and recommendations for new approaches.

BENEFIT: Improved personnel safety.

SCHEDULE: 1 year

BUDGET: $150,000

PRIORITY:

1-33 RELIABILITY EVALUATION OF MOORING LINES

OBJECTIVE: To determine tradeoffs between the cost of redundance in mooring lines and platform safety.

PLAN OF ACTION: Current practice for mooring platforms by anchor involves the use of approximately twelve mooring lines which fail at predictable intervals. Design and conduct analytic and material studies to determine the operational and cost tradeoffs in reducing the number of mooring lines and improving material/construction criteria to maintain at least an equal degree of system reliability.

END PRODUCT: Mooring system tradeoffs.

BENEFIT: Possible cost and operational economics by simplifying the anchor mooring system.

SCHEDULE: 1 year

BUDGET: $100,000

PRIORITY:

I-34 IDENTIFICATION OF COLUMN DESIGN PROBLEMS

OBJECTIVE: To solve the practical problems of column design for offshore construction and design.

PLAN OF ACTION: (Reference: The State-of-the-Art of Metal Column Design, OTC Paper 2203)

"... the state of column research capabilities is such that no theoretical experimental or computational obstacles should prevent the solution of just about any desired problem in the field of metal compression element instability. While many problems of practical significance have been solved, many more yet need be solved before the designers of all types of metal structures have all the necessary tools to design their structures with confidence safely and economically ... The practitioners and the researchers need to come together, identify the problems needing solution and find financial means to solve them. This latter point is vital, because the sophisticated experimental and computational work is very expensive. Thus identification, planning, financing and research go hand in hand ... (Also to be included is) simplification into design formulas, charts or design aids, and the testing of the new procedures in the design office."

END PRODUCT: Column design formulas, charts and design aids.

BENEFIT: Rationally designed metal columns for safer, less expensive structures.

SCHEDULE: 1/4 year (planning effort only)

BUDGET: $15,000

PRIORITY:

1-35 STANDARD HULL SERIES FOR SUPPLY VESSELS

OBJECTIVE: To develop a family of hull forms for offshore supply vessels.

PLAN OF ACTION: There are a great number of small supply vessels servicing U.S. offshore platforms. Most of these vessels are designed by small naval architects or shipyards with very little good design data. In general, little tank testing is being done. Because motions are critical in approaching a platform, this project is proposed.

1. Determine a basic family of hull forms both with and without chine.

2. Plan and conduct a model test program covering normal parameter values. Testing is to include resistance, motion and maneuvering.

3. Prepare design charts or tables including some comparison of chined and non-chined vessels.

END PRODUCT: Supply vessel standard series.

BENEFIT: Safer and better performing vessels particularly in approaching platforms. Increased productivity.

SCHEDULE: 3 years

BUDGET: $350,000

PRIORITY:

1-36 MODEL TEST FACILITIES

OBJECTIVE: Develop model test facilities for large offshore vehicles and structures that are capable of scaling models of deep ocean structures under environmental conditions simulating the soil/water interface, the water column (current profiles), and the air/sea interface. The facilities should be capable of model testing structures to a minimum of 3,000 feet (scaled), and be capable of scaling waves up to 100 feet.

Current industrial, academic and government tow and model basin test facilities are limited to surface testing for limited scale sizes and wave heights. Larger scale model test (such as for semisubmersible drill rigs) must be tested overseas. No adequate facility exists for deep water structures and significant wave heights to which offshore structures are subjected. Model test data under deep ocean simulated conditions will represent a significant cost savings in the development of offshore work vehicles and structures.

PLAN OF ACTION: The sequence of steps would include:

1. Study and identify test facility requirements.
2. Develop plans for facility and test equipment.
3. Construct facility.

END PRODUCT: A test facility and equipment capability for deep ocean systems similar to that developed and constructed by NASA for the space program.

SCHEDULE: Study and plan, 1 year; facility construction, 4 years.

BUDGET: Study and plan, estimated $500,000; facility construction, estimated $100 million.

PRIORITY:

1-37 INVESTIGATION AND DEVELOPMENT OF CABLE-SUPPORTED STRUCTURES FOR DEEPWATER USE

OBJECTIVE: To evaluate the problems and possibilities of using cable-supported structures for underwater portions of offshore structures.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate three-dimensional cable structures immersed in a moving fluid and subject to static and dynamic loads.

2. Evaluate the different methods of analysis of such structures.

3. Study examples of cable-supported structures presently in use in offshore industry.

4. Discuss methods of construction of cable structures in deepwater.

5. Recommend future applications of cable structures in the deepwater environment.

END PRODUCT: An understanding of cable-supported underwater structures and their application to the offshore platform construction.

BENEFIT: An indication of the potential applications of future use of cable-supported structures and their use in offshore construction.

SCHEDULE: 1 year

BUDGET: $150,000

PRIORITY:

1-38 STUDY OF VIBRATION PROBLEMS IN OFFSHORE STRUCTURES AND EVALUATION OF METHODS TO AVOID VIBRATION-INDUCED FAILURES

OBJECTIVE: To evaluate vibration problems in offshore structures caused by equipment and environmental forces and discuss methods to prevent structures problems and failure.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate pressure pulsation as a cause of structural vibration in offshore platforms and structures.

2. Investigate environmental forces and other factors that can cause vibrations on platforms.

3. Evaluate various damping methods and computer analysis together with proper layout to avoid problems of fatigue and failure.

4. Implement field tests to evaluate these methods of analysis and design.

END PRODUCT: An increased understanding of vibration motions on offshore platforms and methods used to mitigate structural fatigue and failure.

BENEFIT: Additional engineering knowledge of the problems and potential solutions of vibration associated with offshore platforms caused by environmental forces and equipment pressure pulsations to provide improved design characteristics.

SCHEDULE: 3 years

BUDGET: $300,000

PRIORITY:

1-39 INVESTIGATE AND EVALUATE PILE DRIVING AND ANCHORING SYSTEMS AND EQUIPMENT - CONVENTIONAL DROP HAMMERS, VIBRATING HAMMERS, DIESEL HAMMERS, UNDERWATER HAMMERS, DRILLING AND GROUTING AS AN ALTERNATE TO DRIVING

OBJECTIVE: To survey modern equipment and methods in driving large diameter piles for offshore platforms and structures.

PLAN OF ACTION: The sequence of steps would include:

1. Survey of design methods for large diameter offshore platform piles.

2. Survey of equipment and methods used to install large diameter offshore platform piles.

3. Survey of new equipment to be used for offshore platforms in deeper waters.

4. Recommend most cost-effective methods and systems by type of offshore construction activity.

END PRODUCT: Criteria of suitable methods used for designing and constructing large diameter pile foundations for offshore structures.

BENEFIT: Increased knowledge of modern large diameter pile foundation design and construction particularly as they relate to applications for offshore platforms.

SCHEDULE: 1 year

BUDGET: $75,000

PRIORITY:

1-40 DEVELOPMENT OF MEANS OF FORECASTING RANGES OF OPERATIONS FOR CERTAIN TYPES OF MECHANICAL EQUIPMENT USED IN OFFSHORE ACTIVITIES

OBJECTIVE: Optimize means to estimate costly equipment downtime due to weather, unsuitable usage and other limitations.

PLAN OF ACTION: The sequence of steps would include:

1. Inventory and classify vessels in use and operations carried out by them.

2. Forecast of operations requirements for offshore industries for immediate and foreseeable future.

3. Inventory latest generation equipment under construction and being planned.

4. Integrate vessel capabilities and industry requirements, and categorize by weather environment, geographic location, logistics, specialized equipment capacity, backup services, universal equipment application, and other pertinent parameters.

END PRODUCT: Inventory of equipment types and ranges of capabilities under escalating environmental conditions and other factors.

BENEFIT: To provide a more meaningful rational selection of offshore mechanical equipment.

SCHEDULE: 2 years

BUDGET: $150,000

PRIORITY:

1-41 DEVELOPMENT OF METHODS AND EQUIPMENT FOR IMPROVEMENT OF DIVING PERFORMANCE AND WORK TIME

OBJECTIVE: To increase efficiency of diving operations.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate breathing mixtures diving/working at all depths which will allow cessation of diving without time-consuming decompression steps.

2. Investigate all other medical/environmental factors limiting diving operations.

3. Investigate current and proposed development of an all-temperature work suit, including footwear and head gear, to provide longer work periods in cold water.

4. Investigate communications and lighting systems, compressors, decompression equipment, etc.

5. Recommend specific items for further R&D.

END PRODUCT: Improved diving equipment and techniques.

BENEFIT: Lengthening of diving work time and increased safety.

SCHEDULE: 1 year

BUDGET: $75,000

PRIORITY:

Oil and Gas

PIPE LAYING AND PIPE LINES

OIL AND GAS PANEL

Pipe Laying and Pipe Lines

1-42 Deep Water Pipelaying Systems Analysis
1-43 Development of Improved Mechanical Connectors and Sealing Materials and Methods for Submarine Piping Systems
1-44 Development of Methods and Materials for Removal of Paraffin from Submarine Flowlines and Piping Systems
1-45 Development of Improved Insulation of Underwater Pipelines
1-46 Surface Independent Pipe Lay System
1-47 Design of Improved Instrumentation for Underwater Alignment of Pipelines

1-42 DEEP WATER PIPELAYING SYSTEMS ANALYSIS

OBJECTIVE: To determine the design limitations inherent in very deep water pipelaying systems. Within the identified limits perfect the design concept to the ultimate state. Formulate a plan to accelerate submerged pipelaying systems not subject to these limits.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate technical issues such as platform heave motions producing dynamic tensile strength limit stresses on pipelines during pipelaying in deep, rough waters.

2. Determine what mitigating techniques can be used with surface platforms, if any.

3. Extend the design limits of over-the-stern pipeline catenary supporting "stingers".

4. Evaluate the use of smaller pipe bundles from multiple pipe reel sections. Pipeline flow losses can be traded off against pipelaying feasibility.

END PRODUCT: Body of data on limits to surface oriented pipelaying.

BENEFIT: Advanced technology applied to OCS petroleum development.

SCHEDULE: 1 year

BUDGET: $100,000

PRIORITY:

1-43 DEVELOPMENT OF IMPROVED MECHANICAL CONNECTORS AND SEALING MATERIALS AND METHODS FOR SUBMARINE PIPING SYSTEMS

OBJECTIVE: To facilitate installation, repair, and maintenance of submarine piping systems.

PLAN OF ACTION: The sequence of steps would include:

1. Inventory and describe using drawings and descriptive data the existing procedures and installation of connecting submarine piping.

2. Investigate all potential means of connecting and sealing pipes, drillstems, and casings (from onshore drilling, mining, and other industries) where the technology would be transferable to underwater use.

3. Solicit industry input (both national and international) and co-operation in researching most effective systems.

4. Determine most feasible approaches and arrange and carry out prototype testing.

END PRODUCT: A more dependable and reliable method of installing mechanical piping connectors.

BENEFIT: Reduction in costs and time in the installation and repair of pipe connections.

SCHEDULE: 3 years

BUDGET: $250,000

PRIORITY:

1-44 DEVELOPMENT OF METHODS AND MATERIALS FOR REMOVAL OF PARAFFIN FROM SUBMARINE FLOWLINES AND PIPING SYSTEMS

OBJECTIVE: To improve product flow.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate and evaluate effectiveness of all types of current materials and methods currently used such as "pigs" in the form of spheres, wire brush, polystyrene delayed-action soluble pigs, etc.

2. Evaluate effectiveness of pig launching and receiving stations and instrumentation systems involved.

3. Determine chemical properties of built-up paraffins and evaluate rationale for paraffin-dissolving chemicals and their effectiveness.

4. Consider environmental aspects of paraffin disposal.

5. Recommendations of most cost effectiveness and environmentally effective state-of-the-art and possible improvements.

END PRODUCT: Recommended guidelines for prevention, removal and disposal of paraffin from submarine piping.

BENEFIT: Increased product flow.

SCHEDULE: 1 year

BUDGET: $60,000

PRIORITY:

1-45 DEVELOPMENT OF IMPROVED INSULATION OF UNDERWATER PIPELINES

OBJECTIVES: To provide better insulation materials and methods for submarine pipelines.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate current and proposed onshore systems of pipeline insulation in terms of materials used, methods of application, insulation properties, pressure ratings, costs, etc.

2. Develop research project to study feasibility of onshore technology transfer to offshore environment considering pressure, salt water, construction and installation procedures, life expectancy, etc.

3. Make recommendations based on project findings.

END PRODUCT: Development of materials and systems for submarine pipeline insulation.

BENEFIT: Use of more reliable, longer-lasting and cost-effective insulating materials and methods.

SCHEDULE: 1 year

BUDGET: $150,000

PRIORITY:

1-46 SURFACE INDEPENDENT PIPE LAY SYSTEM

OBJECTIVE: To design and develop a bottom-contour-following-capable nuclear submarine pipelaying platform to permit deep ocean and under ice pipelaying and pipeline maintenance independent of surface conditions.

PLAN OF ACTION: The sequence of steps would include:

1. Review prior studies and/or buy from industry, as appropriate.

2. Sponsor development and demonstration of such a system.

3. Participate in at sea and under ice demonstration of the system in operational pipelaying and pipeline maintenance and disseminate data to industry.

4. Facilitate and encourage the use of the system through financial or other incentives to industry in a coordinated program with MarAd.

END PRODUCT: The design of a fully proven undersea surface independent pipelay and pipeline maintenance submarine system.

BENEFIT: Offshore pipeline construction and maintenance in the worst OCS weather and ice conditions become routine.

SCHEDULE: 10 years

BUDGET: $70 million

PRIORITY:

1-47 DESIGN OF IMPROVED INSTRUMENTAION FOR UNDERWATER ALIGNMENT OF PIPELINES

OBJECTIVE: To speed up the construction and maintenance of submarine pipelines.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate casting systems for aligning underwater pipelines.

2. Study of present-day remote control systems and instrumentation.

3. Investigate systems proposed for improving alignment instrumentation and systems.

4. Determine most feasible approaches and arrange and carry out prototype testing.

END PRODUCT: To facilitate efficient and economical construction and maintenance of underwater pipelines.

SCHEDULE: 2 years

BUDGET: $250,000

PRIORITY:

OIL AND GAS

PLATFORMS

A. Floating

B. Bottom Sited

C. Man Made Islands

D. Erection, Siting, Inspection

OIL AND GAS PANEL

Platforms

1-48 Below the Interface Platforms
1-49 Limitations on the Application of Ocean Surface-Piercing Fixed Drilling Platforms in the OCS
1-50 Deep Water Platforms, Floating
1-50a Ship Motion Theory Applied to Deep Water Platforms
1-50b Deepwater Platforms Heave Compensation Systems
1-50c Deep Water Platforms Improved Exploratory Downhole Pressure Sensors
1-50d Deep Water Platforms Moors
1-51 Development of Saturated Diving Systems for Servicing of Deepwater Production Equipment
1-52 Flippable Barge
1-53 Study to Provide Improved Methods for Underwater Inspection of Fixed Offshore Structures
1-54 Evaluation of Surveying Techniques for Offshore Construction and Recommendations for Improvement

1-48 BELOW THE INTERFACE PLATFORMS

OBJECTIVE: To investigate the feasibility of using drilling platforms which operate just below the air sea interface rather than just above as do present semi-submersibles. Specially, a submarine shaped structure is envisioned which up-ends for drilling but transits in the conventional submarine orientation. Dynamically controllable in the six degrees of freedom and presenting a relatively small water plane area, such a platform has no need for moorings, will exhibit essentially zero wave induced motions, and will be capable of transit speeds two to three times that of present semis.

PLAN OF ACTION: Minor analysis is required in order to extrapolate from the known performance of existing vessels such as FLIP and ALBACORE to a full scale platform. A design based on drilling technology as well as submarine technology will flag areas requiring component development. Possible areas of concern may include the ability of gas turbines as well as other machinery to operate continuously in either of two orientations, the allocation of the volume bounded by the pressure and the fairing hulls, and the ability of man to acclimate to a bimodal orientation, to mention a few.

A recommended sequence of actions is to: perform a trade-off analysis to determine the worth of such a platform with emphasis on initial cost, operational costs, heavy weather operation and transit, habitability, and environmental impact; design, build and test small scale model for evaluations in a wave making facility; perform data analysis to justify design go-ahead.

END PRODUCT: The end product of these investigations will be the establishment of worth and feasibility of a below the interface plaform.

BENEFIT: Estimates, based on a very preliminary conceptual design, indicate the following attributes for such a platform: a reduction in construction steel by a factor of 1/10th that used in the larger semis today, a reduction of wave induced motion to essentially zero, a significant increase in transit speed.

SCHEDULE AND BUDGET:

First year Trade-off analyses	$ 120,000
Second year Model design and construction	600,000
Third year Model tests	380,000
Fourth year Model test data analysis	200,000
	$1,000,000

PRIORITY:

1-49 LIMITATIONS ON THE APPLICATION OF OCEAN SURFACE-PIERCING FIXED DRILLING PLATFORMS IN THE OCS

OBJECTIVE: To determine the regions of the OCS where environmental conditions such as earthquakes, free floating ice, and tsunamis would serve to bar the use of fixed drilling platforms.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate the experience of oil drilling operations in the North Slope.

2. Evaluate equipment design limitations, some of which may be fundamental, others of which may be subject of successful redesign.

END PRODUCT: Provide engineering guide lines for appropriate surface piercing platform design choices as a function of OCS areas.

BENEFIT: Fewer drilling platform losses.

SCHEDULE: 1/2 year

BUDGET: $25,000

PRIORITY:

1-50 DEEP WATER PLATFORMS, FLOATING

OBJECTIVE: To identify most promising existing deep water drilling platform concepts and propose alternate approaches, if indicated.

PLAN OF ACTION: Screen existing designs and performance records of drilling/production platforms suitable for use in depths of 1,000 ft. or greater so as to be able to select most versatile, most cost effective, and to determine areas in which further development is most necessary.

END PRODUCT: Report showing comparative performance of platforms with recommendations for R & D effort for specific components.

BENEFIT: Selection of most cost effective platforms for use in U.S. OCS regions and determination of areas for R & D most likely to yield profitable results.

SCHEDULE: 1/2 year

BUDGET: $25,000

PRIORITY:

Oil and Gas

1-50a SHIP MOTION THEORY APPLIED TO DEEP WATER PLATFORMS

OBJECTIVE: To extend the use of existing ship motion computer programs to various types of offshore platforms for use in OCS petroleum development.

PLAN OF ACTION: The sequence of steps would include:

1. Review current computer programs.

2. Derive, or measure on actual platforms at sea the coefficients for motion modeling.

3. Develop such coefficients for different sea states for different geographic regions.

4. Factor in effects of mooring with slack or taught moors.

5. Product and disseminate data on computer analysis results.

END PRODUCT: Body of design data, criteria and procedures.

BENEFIT: Improved and safer naval architectural designs for OCS petroleum development platforms. Less expensive platforms.

SCHEDULE: 2 1/2 years

BUDGET: $200,000

PRIORITY:

1-50b DEEPWATER PLATFORMS HEAVE COMPENSATION SYSTEMS

OBJECTIVE: The sequence of steps would include:

1. Evaluate ongoing industry program.

2. Formulate plan for joint/government/industry sponsorship of further equipment design and test to develop operational heave compensation systems.

3. Disseminate results to industry.

END PRODUCT: Body of data on heave compensation devices and systems.

BENEFIT: Extend drilling operations in outer continental shelf areas subject to heavy seas.

SCHEDULE: 1/4 year

BUDGET: $15,000

PRIORITY:

Oil and Gas

1-50c DEEP WATER PLATFORMS IMPROVED EXPLORATORY DOWNHOLE PRESSURE SENSORS

OBJECTIVE: To improve the downhole pressure sensor art to permit instantaneous detection of incipient gas bubbles or "kicks."

PLAN OF ACTION: The sequence of steps would include:

1. For surface floating platforms the heave motion masks the small rate of change of downhole pressure under conditions of a "kick." Quick blowout preventer control system response is needed upon indication of a "kick."

2. Evaluate and test downhole, or at least on the ocean floor, incipient gas bubble detectors with telemetry to the surface platform.

3. Evaluate the fully submerged drilling concept, with no riser pipe to the surface and platform heave, as an alternative. Factor the system cost of kick detection and control into evaluation of alternatives.

END PRODUCT: Devices and procedures to control downhole pressure.

BENEFIT: Fewer OCS oil well blowouts.

SCHEDULE: 1 year

BUDGET $100,000

PRIORITY:

Oil and Gas

1-50d DEEP WATER PLATFORM MOORS

OBJECTIVE: Develop deep water mooring systems for holding floating platforms.

PLAN OF ACTION: The sequence of steps would include:

1. Examine current state of the art.

2. Prepare plan for government co-sponsorship of needed development with industry.

3. Build and test equipment.

4. Disseminate results.

END PRODUCT: Design manual for deep water platform moors.

BENEFIT: Capability of using existing platform designs in deeper outer continental shelf waters.

SCHEDULE: 5 years

BUDGET: $7 million

PRIORITY:

Oil and Gas

1-51 DEVELOPMENT OF SATURATED DIVING SYSTEMS FOR SERVICING OF DEEPWATER PRODUCTION EQUIPMENT

OBJECTIVE: To extend diving time on sea floor in deep water and to improve diving environment for more efficient operations.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate and evaluate all national and international programs in this field.

2. Determine medical requirements (both physical and psychological) for sustained operation in deep water.

3. Investigate personal equipment and skills required.

4. Simulate deepwater environment in laboratory to study effects of deep water on diving personnel.

5. Integrate above into a development program for design and eventual construction of prototype system.

END PRODUCT: Improved saturated diving system for deepwater work.

BENEFIT: Extension of diving time and improved working environment.

SCHEDULE: 3 years

BUDGET: $1 million

PRIORITY:

1-52 FLIPPABLE BARGE

OBJECTIVE: Transfer through the air-sea interface of heavy work packages such as submersibles, diving chambers, subsea work stations and sea floor instrumentation modules by present methods is severely limited by sea conditions. This project would permit the transfer of heavy payloads through the air-sea interface safely and economically in rough sea conditions.

PLAN OF ACTION: The sequence of steps would include:

1. Establish feasible capability requirements through dicussions with governmental and industrial activities, and technology state of the art review.

2. Develop design of versatile, adaptable seagoing platform for payload submergence, operation and recovery, including basic vehicle, system controls and monitors, and special payload subsystems.

3. Construct and test prototype system in phases, starting with basic vehicle and its controls, followed by subysystems for handling and operating special payloads.

4. Conduct total system demonstration and evaluation.

5. Prepare specifications for commercial construction.

END PRODUCT: A seagoing system for safe and economical transport, submergence operation and recovery of heavy work packages.

BENEFIT: First, this system would make undersea operations possible in sea conditons which are presently prohibitive, thus reducing down time. Second, this system would greatly reduce the hazards and expense associated with current methods for air-sea interface transfers.

SCHEDULE: First year--system definition, system design and drawings; second year--construct platform and controls, design special payload subsystems; third year--conduct sea test, construct, install and test subsystems; and fourth year--conduct full systems test, and prepare specifications.

BUDGET: First year--$350,000; second year--$1,000,000; third year--$600,000; fourth year--$300,000; total $2 million.

PRIORITY:

Oil and Gas

1-53 STUDY TO PROVIDE IMPROVED METHODS FOR UNDERWATER INSPECTION OF FIXED OFFSHORE STRUCTURES

OBJECTIVE: To upgrade systems for underwater inspection.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate current systems and categorize in terms of visual, diving, instrumentation, remote, or other parameters.

2. Evaluate use of miniature submarines.

3. Detail the type and nature of inspection criteria, e.g. damage to structural members - percent metal gouged, cracked welds, deflected members, damaged coatings, excessive organic growth, deteriorated concrete, etc.

4. Investigate optimum system for inspection and automatic recording.

5. Evaluate use of television for underwater inspection.

6. Investigate and evaluate lighting systems used underwater.

7. Evaluate potential for providing built-in inspection chambers on vulnerable parts of offshore structures.

8. Compile report integrating above factors and indicating where further specific development efforts are required.

END PRODUCT: Compendium of current and projected state-of-the-art of underwater inspection.

BENEFIT: Improved inspection procedures.

SCHEDULE: 2 years

BUDGET: $150,000

PRIORITY:

Oil and Gas

1-54 EVALUATION OF SURVEYING TECHNIQUES FOR OFFSHORE CONSTRUCTION AND RECOMMENDATIONS FOR IMPROVEMENT

OBJECTIVE: Evaluation of modern survey methods used in offshore locations with emphasis on navigation and positioning by electronic means.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate the state-of-the-art of modern survey methods and their applicability for offshore industry.

2. Investigate recent advances in navigation and positioning particularly by electronic and satellite means.

3. Investigate the future of global positioning by electronic and satellite means.

4. Evaluate all methods and recommend field testing program.

5. Implement program and monitor results.

6. Recommend most appropriate techniques and systems and future required development work.

END PRODUCT: Evaluation and recommendation of suitable methods applicable to the offshore industry of navigation and positioning by electronic means.

BENEFIT: Increased knowledge of modern surveying techniques as they can be applied to navigation and positioning of offshore structures far away from land masses.

SCHEDULE: 1 year

BUDGET: $100,000

PRIORITY:

OIL AND GAS

MATERIALS, CORROSION AND FOULING CONTROL

OIL AND GAS PANEL

Materials, Corrosion and Fouling Control

1-55 Development of Improved Procedures, Techniques and Materials for Corrosion Control of Offshore Platforms and Pipelines
1-56 Development of Environmentally Safe and Acceptable Materials and Methods for Control of Pier Fouling and Boring Organisms
1-57 Develop Rules for Cathodic Corrosion Protection Systems
1-58 Long Term Behavior of Materials in the Air Sea Interface
1-59 Improved Protective Coatings for Ocean Structures
1-60 Investigation of Methods, Materials and Systems for Control of Marine Parasite and Predator Incursions
1-61 Improved Cost/Effectiveness of Metallic Alloys in the Marine Environment
1-62 Evaluation of Computerizing Various Material Testing Techniques (X-Ray, Ultra-sonic, etc.) for Use in Offshore Construction Projects

Oil and Gas

1-55 DEVELOPMENT OF IMPROVED PROCEDURES, TECHNIQUES AND MATERIALS FOR CORROSION CONTROL OF OFFSHORE PLATFORMS AND PIPELINES

OBJECTIVE: Evaluation of current and future techniques and materials for corrosion control of platforms and piping placed in sea water environments.

PLAN OF ACTION: The sequence of steps would include:

1. Discussion of scope of corrosion damage to pipelines, platforms and production equipment.

2. Evaluation of current methods and procedures of corrosion inspection of platform and pipelines.

3. Investigation of current and proposed mitigation techniques for corrosion control.

4. Preparation of comprehensive corrosion control program for use in future installations.

5. Recommendations on new approaches and concepts that should be tested to control corrosion.

END PRODUCT: Improved corrosion control methods and procedures.

BENEFIT: Maintenance cost reductions in preventing and controlling corrosion at sea.

SCHEDULE: 5 years

BUDGET: $300,000

PRIORITY:

1-56 DEVELOPMENT OF ENVIRONMENTALLY SAFE AND ACCEPTABLE MATERIALS AND METHODS FOR CONTROL OF PIER FOULING AND BORING ORGANISMS

OBJECTIVE: To limit fouling and prevent premature destruction of piers by various organisms.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate present control materials, methods, and systems and evaluate effectiveness

2. Literature search and interviews with all interested parties -- port authorities, military, academia, chemical companies, etc. -- to learn of current R & D and proposed approaches.

3. Study processes by which fouling and boring occurs and the sea environment conducive to growth of causal organisms

4. Evaluate concept of changing sea environment physically, chemically, or biologically vis-a-vis use of coatings immune to these organisms

5. Determine most feasible approach and initiate one or more field programs for testing of concepts

END PRODUCT: Environmentally safe method for pier maintenance.

BENEFIT: Cost reduction in maintenance and need for only replacement of pier structures.

SCHEDULE: 2 years

BUDGET: $125,000

PRIORITY:

Oil and Gas

I-57 DEVELOP RULES FOR CATHODIC CORROSION PROTECTION SYSTEMS

OBJECTIVE: To develop rules which will permit the design of cathodic protection systems effectively limiting corrosion to prescribed allowances.

PLAN OF ACTION: Work with American Bureau of Shipping to catalogue existing guidelines and operational experience and formulate specific rules for cathodic protection of external surfaces exposed to sea water and internal surfaces such as drill water and ballast tanks.

END PRODUCT: Rules for the design of cathodic protection systems.

BENEFIT: Reduced steel corrosion.

SCHEDULE: 2 years

BUDGET: $200,000

PRIORITY:

1-58 LONG TERM BEHAVIOR OF MATERIALS IN THE AIR SEA INTERFACE

OBJECTIVE: To define the long term behavior of materials necessary for large ocean structures.

PLAN OF ACTION: The sequence of steps would include:

1. Survey world laboratories for ocean structure materials use and behavior.

2. Coordinate within industry, government and academia long term material properties in ocean environment.

3. Test materials where insufficient data is available.

END PRODUCT: Catalogue of the long term behavior of ocean materials.

BENEFIT: Improved ocean structures long term performance.

SCHEDULE: Equal effort over a three year program.

BUDGET: $200,000/year

PRIORITY:

1-59 IMPROVED PROTECTIVE COATINGS FOR OCEAN STRUCTURES

OBJECTIVE: To develop durable ocean structure protective coatings that prevent fouling. In addition, cost/effective coatings which will significantly reduce permeability of water can significantly improve floating ocean structure technology and should be developed.

PLAN OF ACTION: The synthetic chemical products industry should be focused on this particular problem and encouraged to perform a range of analyses and empirical studies leading to the development of the desired new protective coatings. Such encouragement might be accomplished through the issuance of program solicitations or RFP's or might less formally be achieved by letting it be known that an appropriate government agency is willing to subsidize research into new materials that may lead to the objectives of this program element. It would be necessary to form a competent proposal review group so that, by and large, only the most attractive proposals would receiving funding.

END PRODUCT: Improved protective coating materials with improved cost/ effectiveness to be marketed by the inventors(s).

BENEFIT: The removal of yet another roadblock to commercial ocean development.

SCHEDULE: 3 years

BUDGET: $200,000 per year

PRIORITY:

1-60 INVESTIGATION OF METHODS, MATERIALS AND SYSTEMS FOR CONTROL OF MARINE PARASITE AND PREDATOR INCURSIONS

OBJECTIVE: To determine the processes by which such incursions occur and recommend methods of control.

PLAN OF ACTION: The sequence of steps would include:

1. Study historical incursions, economic damage, control methods employed, and results.

2. Investigate previous laboratory studies and research in this area to determine natural processes and evaluate means of control.

3. Plan R & D programs for laboratory and field testing of materials and methods considering U.S. coastal water conditions.

4. Monitor results and recommend appropriate techniques and further development.

END PRODUCT: Recommended materials and methods to control parasite and predator incursions.

BENEFIT: Reduction of economic losses to fishermen, resort areas, and the general public.

SCHEDULE: 3 years

BUDGET: $350,000

PRIORITY:

1-59 IMPROVED PROTECTIVE COATINGS FOR OCEAN STRUCTURES

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SCHEDULE: 3 years

BUDGET: $200,000 per year

PRIORITY:

1-60 INVESTIGATION OF METHODS, MATERIALS AND SYSTEMS FOR CONTROL OF MARINE PARASITE AND PREDATOR INCURSIONS

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3. Plan R & D programs for laboratory and field testing of materials and methods considering U.S. coastal water conditions.

4. Monitor results and recommend appropriate techniques and further development.

END PRODUCT: Recommended materials and methods to control parasite and predator incursions.

BENEFIT: Reduction of economic losses to fishermen, resort areas, and the general public.

SCHEDULE: 3 years

BUDGET: $350,000

PRIORITY:

Oil and Gas

1-61 IMPROVED COST/EFFECTIVENESS OF METALLIC ALLOYS IN THE MARINE ENVIRONMENT

OBJECTIVE: To improve the cost/effectiveness of metal alloys used as construction materials in the marine environment. In this context, the lowering of costs through the use of readily available and less expensive alloy constituents, improving the strength and anti-fouling performance, as well as the workability, are all important.

PLAN OF ACTION: This most appropriately should be filled in by persons adequately conversant with the metallurgy R & D industry.

END PRODUCT: New materials or formulas therefor which would enable and promote less expensive and more effective offshore structures.

BENEFIT: Partial removal, as a minimum, of a current inhibition to commercial ocean development.

SCHEDULE: 5 years

BUDGET: $5 million

PRIORITY:

1-62 EVALUATION OF COMPUTERIZING VARIOUS MATERIAL TESTING TECHNIQUES (X-RAY, ULTRA-SONIC, ETC.) FOR USE IN OFFSHORE CONSTRUCTION PROJECTS

OBJECTIVE: To accelerate testing operations and provide a means of furnishing more accurate retrievable data.

PLAN OF ACTION: The sequence of steps would include:

1. Inventory of offshore construction projects and practices requiring testing, e.g. submarine pipelaying, platform connections, etc.

2. Comprehensive description of testing procedures, identification of all types of defects sought and delineation of acceptance ranges for each material and application.

3. Prepare computer program for adaptation.

4. Implement to a specific project, monitor, and prepare final program.

END PRODUCT: Computer program for materials testing by type of material and end construction use.

BENEFIT: More accurate data accumulation and reduction in potential construction mishaps.

SCHEDULE: 1 year

BUDGET: $75,000

PRIORITY:

Oil and Gas

ARCTIC DEVELOPMENTS

OIL AND GAS PANEL

Arctic Developments

1-63 Arctic Bulk Shipping System (Surface)
1-64 Arctic Offshore Structure Technology
1-65 Analysis of Methanol Phase Change Plant
1-66 Arctic Methanol Transport Concept Evaluation
1-67 Extend the Season for Drilling Operations in Arctic Waters
1-68 Sea Access to Beaufort Sea
1-69 Analysis of Underwater Methanol Plant
1-70 Sea Floor Benchmarks and Sub-Bottom Benchmarks for Use in the Shear Ice Zone
1-71 Ship Transits Through the Arctic Ice Pack an Experimental Data Gathering Program
1-72 Small Bore Tunnelling for Pipelines Through Arctic Shore Fast Ice Zone
1-73 Shear Ice Zone Logistic Transport Vehicle
1-74 Establish a Civilian Under Ice OCS Communications Network and Traffic Control System in the Arctic Under a Joint U.S./Canadian Program
1-75 Development of Standardized Design Criteria for Construction and Emplacement of Artificial Arctic Islands
1-76 Arctic Submarine Methanol Tanker System Design
1-77 Arctic Methanol Pipeline and Ship System Definition
1-78 Large ACV's for Arctic Transportation
1-79 Tanker Submarine
1-80 Advanced High Speed Tunnelling Technology for Building OCS Underground Drilling Chambers Under Arctic Shore Fast and Shear Ice Zones
1-81 Water Reinjection in Arctic OCS Petroleum Fields
1-82 Under Ice Oil Spill Cleanup System
1-83 Development of Equipment and Systems to Deflect Icebergs from Fixed Offshore Platforms
1-84 Improvement of Deepwater Drilling Techniques in Arctic Waters
1-85 Arctic Marine Transportation and Ship Design
1-86 Arctic Submarine Route Survey
1-87 Arctic Submarine Port Facility
1-88 Ice Engineering
1-89 Shorefast and Shear Ice Zone Pipeline Laying System
1-90 Establish a Non-Military Under Ice Navigation Reference System for Use in the Arctic Under a Joint U.S./Canadian Program
1-91 Under Ice Salvage System
1-92 Pollution Monitoring and Alerting
1-93 Ocean Pollution Reduction from OCS Petroleum Operations
1-94 Tanker Spill Prevention
1-95 Capture and Collection of Upward Floating Petroleum from Bottom Mounted Drilling and Production Systems
1-96 Submarine Tanker Ballast Sea Water Undersea Processing to Remove Trace Amounts of Oil

1-63 ARCTIC BULK SHIPPING SYSTEM (SURFACE)

OBJECTIVE: To develop the necessary technology for the U.S. development of petroleum and mineral shipping from arctic sources to U.S. destinations.

PLAN OF ACTION: The sequence of steps would include:

1. Develop ship and terminal technology of speed power in ice, design of propellers for ice service, hull structures, hull design, air cushion support vehicles, and data for design criteria, materials and methods, construction and operation in mooring and docking of arctic marine terminals.

2. Environment information necessary for vehicle and terminal design.

3. Design baseline arctic bulk shipping system (ship and loading terminal)

   a. natural gas carrier
   b. crude oil tanker
   c. coal
   d. hard minerals

4. Simulate the technical and economic operation of system in an arctic environment (mathematical model).

END PRODUCT: Baseline design of arctic shipping systems.

BENEFIT: Provide a baseline for technical, economic, and operational assessment of shipping systems required for development of U.S. arctic resources.

SCHEDULE: Equal effort over a three year period.

BUDGET: First year--$150,000; second year--$300,000; third year--$200,000.

PRIORITY:

1-64 ARCTIC OFFSHORE STRUCTURE TECHNOLOGY

OBJECTIVE: To develop arctic offshore structure technology necessary for terminals, and resource exploitation and exploitation equipment.

PLAN OF ACTION: The sequence of steps would include:

1. Design and develop the arctic technology for

   a. offshore structure configuration and shape
   b. construction material
   c. structure mooring
   d. construction methods and transport to site.

2. Catalog environmental data for vehicle and terminal design and operation for key resource areas' potential shipping lanes.

3. Test the above technology in laboratory environment measuring ice terminal interactions and ice forces on structures.

4. Simulate the operation of structures in arctic environment.

END PRODUCT: Design criteria for arctic offshore structures.

BENEFIT: Reduce the technical, operational and economic risk of future arctic resource development.

SCHEDULE: Equal effort over a three year program.

BUDGET: $300,000/year

PRIORITY:

1-65 ANALYSIS OF METHANOL PHASE CHANGE PLANT

OBJECTIVE: To describe the recommended methanol production system for Arctic on-land operations. The description would include a preliminary design, a procedure for emplacing, a suggested construction method and an estimate of the schedule, research and development costs, capital cost and operating costs involved in bringing the plant to production.

PLAN OF ACTION: The task will be concerned with the design, description, schedule and costs of a land based plant. The plant is envisioned to be of conventional design, constructed on a barge somewhere in the lower 48, floated on the North Slope, emplaced and started up.

1. Design conventional methanol plant on a shallow barge.

2. Barge assembly site evaluation.

3. Barge transport from assembly to emplacement point.

4. Development of a plan and schedule for plant construction and installation.

END PRODUCT: The output will be a report describing the land based methanol plant and appropriate visual materials for presentation. The report will contain design details, schedule and location recommendations and cost data. The presentation visuals will contain a precis of the important results of this part of the study.

BENEFIT: To define the shoreside facilities necessary to bring Arctic gas to U.S. energy demand markets.

SCHEDULE: 6 months

BUDGET: $50,000

PRIORITY:

1-66 ARCTIC METHANOL TRANSPORT CONCEPT EVALUATION

OBJECTIVE: To evaluate the methanol transport concept as a system. The areas of concern are: alternative products to methanol, economic analysis, environmental impacts, risk (technical and economic), implementation, the methanol market demand.

PLAN OF ACTION: The approach of this task will be to collect the information generated by the other task efforts, correlate it and determine:

1. Is the methanol production and transport concept technically and economically viable - as a business proposition?

2. How does the methanol production and transportation approach compare to other methods of gas handling?

3. What are the steps and procedures involved in making the methanol system work?

END PRODUCT: The output of this task will be a report on the methanol system. The report will describe system economics, environmental impacts, alternatives to methanol, plans for implementation. In addition, this task will be responsible for aggregating and summarizing the significant results from the other task.

An executive summary in visual-nomative form will also be prepared illuminating the highlights of the systems study.

a. Assessment of economic viability.
b. Assessment of probable environmental impacts.
c. Assessment of technical, political and business risk.
d. Assessment of alternate products of Arctic NG for transport.
e. Evaluate technical and economic pace of undersea production.
f. Methanol market survey.

BENEFIT: Enable the U.S. to explore a possible low cost means of moving Arctic gas to U.S. market.

SCHEDULE: 5 months

BUDGET: $150,000

PRIORITY:

i.

1-67 EXTEND THE SEASON FOR DRILLING OPERATIONS IN ARCTIC WATERS

OBJECTIVE: To extend the season for drilling operations in waters where ice and bad weather limitations restrict operations to several months a year.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate the state of art of dynamic positioning, propulsion and platform configuration from the point of view of maintaining drilling operations in bad weather.

2. With the cooperation of operators, develop new concepts for drilling platforms which will enable extended operation. Consideration is to be given to both above and below water operations.

3. Develop economic criteria balancing increased platform construction and operational costs with increased productivity.

END PRODUCT: A drilling platform which will allow continued operation in adverse weather.

BENEFIT: Improved productivity for drilling operations in areas presently limited by ice and bad weather.

SCHEDULE: 2 years

BUDGET: $75,000 per year

PRIORITY:

Oil and Gas

1-68 SEA ACCESS TO BEAUFORT SEA

OBJECTIVE: To determine the best means of providing an assured sea route to the Beaufort Sea around Point Barrow.

PLAN OF ACTION: Analysis and evaluation of alternative courses of action:

1. Dredged canal

2. Offshore berms to ground pressure ridges

3. Offshore artificial ice build-up to ground ice pack

4. Ice-breaking ships and barges.

END PRODUCT: An economical and positive means of supplying activities and developments in the Arctic Ocean.

BENEFIT: Orderly, economical, and safe development of Arctic Ocean resources.

SCHEDULE: 1 year

BUDGET: $250,000

PRIORITY:

1-69 ANALYSIS OF UNDERWATER METHANOL PLANT

OBJECTIVE: To describe a conceptual design for an undersea methanol plant. The conceptual design will include an engineering analysis of the requirements, a proposed design, a suggested development program and an estimate of the research, capital and operating costs of the conceptual design.

PLAN OF ACTION: This task will take basic environmental parameters, e.g., a water depth pressure of 600 feet, "typical" input natural gas flows and design a methanol production system appropriate to the conditions. This conceptual design will be evaluated for costs and development requirements. The gas input flow rate will be (nominally) 100 million cubic feet per day for this concept design.

1. Analyze the requirements of an undersea methanol plant and derive a concept design.

2. Design pressure hull appropriate to the plant.

3. Define undersea plant schedule, cost, logistics.

4. An evaluation of the R&D steps required to define the technological inadequacies.

END PRODUCT: The output will be a report on the technical and economic feasibility of the concept design, with a definition of a reasonable development schedule.

BENEFIT: Develop an economical method to tap offshore Arctic gas.

SCHEDULE: 4 months

BUDGET: $100,000

PRIORITY:

1-70 SEA FLOOR BENCHMARKS AND SUB-BOTTOM BENCHMARKS FOR USE IN THE SHEAR ICE ZONE

OBJECTIVE: Develop a technical solution to the problem of offshore bottom benchmarking of lease area boundaries. The devices must also be survivable in shear ice zone areas and yet readily interrogated and relocated.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate the existing active acoustic transponder art for applicability to bottom mounted markers.

2. Evaluate passive acoustic corner reflectors both for use in the water and as buried subsoil low frequency acoustic markers.

3. Design, build and test markers and acoustic interrogator equipment in a cooperative program with industry, BLM, USGS and NOAA.

4. Disseminate data on the operation of devices, their design and cost aspects.

END PRODUCT: Body of data on practical bottom mounted and sub-bottom long life markers for OCS lease benchmarking and shut-in well marking.

BENEFIT: Improved knowledge and fewer disputes as to location of OCS lease areas, shut-in wells, etc.

SCHEDULE: 3 years

BUDGET: $300,000

PRIORITY:

1-71 SHIP TRANSITS THROUGH THE ARCTIC ICE PACK
AN EXPERIMENTAL DATA GATHERING PROGRAM

OBJECTIVE: To generate data on the ice forces that must be effectively withstood for ice transiting ships and platforms operating at the surface in the Arctic.

PLAN OF ACTION: The sequence of steps would include:

1. To use the Coast Guard icebreaker POLAR STAR for the experiment.

2. Instrument the ship to determine ice resistance, ice compression, hull deformation, etc.

3. Perform the experiment at two different times of the year to produce representative data.

4. Publish and disseminate data to the industry.

5. Compare data with that generated by the MANHATTAN icebreaking tanker runs.

END PRODUCT: Body of data on ice forces on ships in transit through a variety of sea ice conditions.

BENEFIT: Better understanding of the economics factors involved in planned operations in the ice.

SCHEDULE: 2 years

BUDGET: $1 million

PRIORITY:

1-72 SMALL BORE TUNNELLING FOR PIPELINES THROUGH ARCTIC SHORE FAST ICE ZONE

OBJECTIVE: To develop a high speed tunnelling capability for pipeline diameter tunnels through the permafrost under the shore fast ice along the Arctic OCS coastline. The technique is applicable to surf zones on other coastlines once developed.

PLAN OF ACTION: The sequence of steps would include:

1. Review the state of knowledge in tunnelling through permafrost.

2. Review the state of technology in high speed tunnelling.

3. Prepare a plan for and implement a program to design, develop and test a high speed tunnelling system for use in permafrost. Seek NSF RANN co-sponsorship program.

4. Disseminate data on results achieved. Encourage the application of the technology developed.

END PRODUCT: Body of design data on small diameter pipeline tunnelling system for use in OCS Arctic permafrost conditions.

BENEFIT: Lower cost OCS pipelining to shore through the permafrost shore fast ice zone.

SCHEDULE: 1/2 year

BUDGET: $25,000

PRIORITY:

1-73 SHEAR ICE ZONE LOGISTIC TRANSPORT VEHICLE

OBJECTIVE: Participate in the development of an ice cover transiting logistics vehicle capable of working in the shear ice zone, and in open water, polynias and leads when the ice breaks up.

PLAN OF ACTION: The sequence of steps would include:

1. Review prior work on this problem including ARPA ACV program.

2. Participate in the further development of a suitable multimode transport vehicle having significantly greater payload than a helicopter.

3. Determine best means for providing federal co-sponsorship of effort to develop suitable vehicle.

END PRODUCT: A design for a proven vehicle system having significant payload capabilities for shear zone logistic support functions.

BENEFIT: Practical logistic support of shear zone petroleum development systems.

SCHEDULE: 1 year

BUDGET: $100,000

PRIORITY:

1-74 ESTABLISH A CIVILIAN UNDER ICE OCS COMMUNICATIONS NETWORK AND TRAFFIC CONTROL SYSTEM IN THE ARCTIC UNDER A JOINT U.S./CANADIAN PROGRAM

OBJECTIVE: To establish a reliable and safe undersea OCS communications and traffic control system for use in OCS petroleum development in Arctic under ice conditions.

PLAN OF ACTION: The sequence of steps would include:

1. Review existing data on technical characteristics of such under ice communications systems.

2. Evaluate the cost, lead time and facility acquisition issues for the command and control centers.

3. Review MarAd maritime COMSAT satellite communications system for applicability to augment undersea portions of the system.

4. Plan for and arrange joint U.S./Canadian program including an evaluation of the adaptability of the Canadian "Aluette" communication satellite system.

5. Plan needed U.S. support and establish industry tie in.

END PRODUCT: A reliable Arctic civilian undersea communications system.

BENEFIT: Lower cost and more reliable Arctic OCS operations.

SCHEDULE: 1 year

BUDGET: $200,000

PRIORITY:

1-75 DEVELOPMENT OF STANDARDIZED DESIGN CRITERIA FOR CONSTRUCTION AND EMPLACEMENT OF ARTIFICIAL ARCTIC ISLANDS

OBJECTIVE: To provide design criteria for artificial Arctic island creation.

PLAN OF ACTION: The sequence of steps would include:

1. Determine construction materials required and source and ready availability of same.

2. Analyze each material in terms of qualities for Arctic use -- strength, low temperature characteristics, fatigue, impact, additives and protective coatings needed, etc.

3. Specify proportional dimensional and shape characteristics to withstand environmental forces--wind, waves, icebergs, etc.

4. Investigate type of construction equipment necessary.

5. Evaluate past performance of islands emplaced to date and current development programs in terms of design characteristics.

6. Evaluate established monitoring programs to obtain data on wind, wave, current, ice, snow, termperature, earthquake, and other factors and forces at selected Arctic locations.

7. Integrate above items into a comprehensive design criteria handbook to provide guidelines for construction and emplacement of artificial Arctic islands; also indicate aspects when future work is required.

END PRODUCT: Design criteria handbook.

BENEFIT: Improvement in Arctic operation.

SCHEDULE: 1 1/2 years

BUDGET: $150,000

PRIORITY:

I-76 ARCTIC SUBMARINE METHANOL TANKER SYSTEM DESIGN

OBJECTIVE: To conduct an analysis of the compatibility of the submarine oil tanker designed in a recent MarAd study to transport methanol (or methyl fuel). To reconsider the development schedule defined in the previous study. To estimate such changes as may be needed and costs associated with them.

PLAN OF ACTION: The basic design and environmental data developed in the submarine tanker study will be examined to determine whether changes would be necessary if the subtanker fleet were to carry full loads of methanol. Transshipment to conventional tankers of smaller deadweight capable of entering existing east coast ports will be reviewed in concert with Arctic Methanol Pipeline and Ship System Definition. The changes will be evaluated for cost. In addition, the subtanker development schedule will be examined to determine whether the recommended schedule may need to be changed.

1. Analysis of loading terminal compatibility.

2. Methanol submarine baseline design.

3. Design trade off analysis.

4. Methanol submarine development schedule, costs and research or development required.

END PRODUCT: The output will be a final report of the results of this task and a summary in visual-narrative form of the important conclusions. Specifically, the report will describe all changes in the original subtanker design made necessary by the methanol transportation requirement. A report of the costs of these changes and the schedule reevaluation will be included.

BENEFIT: Enable U.S. to develop technology to improve transport system for moving Arctic gas to U.S. markets.

SCHEDULE: 9 months

BUDGET: $250,000

PRIORITY:

1-77 ARCTIC METHANOL PIPELINE AND SHIP SYSTEM DEFINITION

OBJECTIVE: To develop a complete description of the logistics, cost and organization of the transportation system needed in Stage 1 (before availability of the submarine tanker fleet).

PLAN OF ACTION: Various levels of methanol throughput will be conjectured and appropriate logistics networks will be posited to deliver the throughput. The logistical elements will be evaluated for cost, probability of availability and compatibility.

The Alyeska pipeline will be considered in detail and assessment made of the technical, legal, organization and cost problems involved in using this pipeline on a time shared basis for methanol throughput.

1. Assessment of technical, legal, and organizational compatibility of methanol to Alyeska pipeline system.

2. Definition of the shipping fleet.

3. Definition of the special requirements of a methanol Arctic storage, handling and loading and offloading facility.

4. Definition of system operational requirements.

END PRODUCT: The output will be a report describing the logistic network for Stage 1 for various throughputs of methanol. The report will also contain transport cost estimates and a recommended organizational structure for the network.

BENEFIT: Enable the U.S. to develop a low cost means of shipping Arctic gas to U.S. markets.

SCHEDULE: 6 months

BUDGET: $100,000

PRIORITY:

1-78 LARGE ACV'S FOR ARCTIC TRANSPORTATION

OBJECTIVE: To determine the feasibility of the use of large ACV's for Arctic offshore transportation.

PLAN OF ACTION: Carry out prototype design including realistic mission profile to ascertain the technical and economic feasibility of the use of large, i.e. 4,000 to 8,000 ton, ACV's for use in the Arctic (and Antarctic) offshore, studying both towed and self-propelled ACV's. If milestone review is positive then proceed with detailed design, construction, and testing of first unit.

END PRODUCT: An operational analysis of large cargo capacity ACV's and an appraisal of their capability to provide transportation in the Arctic.

BENEFIT: The possibility of a year-round arctic transportation capability that costs a fraction of currently limited-season capabilities.

SCHEDULE: First year - preliminary engineering, design and feasibility, and decision; Second year - final design; Third year - fabrication; Fourth year - test and intial operation.

BUDGET: First year - $1,000,000; Second year - $3,000,000; Third year - $40,000,000; Fourth year - $10,000,000.

PRIORITY:

1-79 TANKER SUBMARINE

OBJECTIVE: To develop an economic alternative to pipe line or ice-breaking surface tanker to bring Arctic oil to the East Coast.

PLAN OF ACTION: The sequence of steps would include:

1. Prepare the detailed design of a submarine tanker based on conceptual studies prepared for MarAd.

2. Develop, build and test a prototype vessel.

END PRODUCT: A primary element of an ice free Arctic transport system.

BENEFIT: Economic transport of Arctic oil to the East Coast.

SCHEDULE: Three years - develop, design and test; Five years - 1st Unit engr., const., test and evaluate.

BUDGET: Develop, design and test - $130,000,000; 1st unit engr., const., test and evaluate - $430,000,000.

PRIORITY:

1-80 ADVANCED HIGH SPEED TUNNELLING TECHNOLOGY FOR BUILDING OCS UNDERGROUND DRILLING CHAMBERS UNDER ARCTIC SHORE FAST AND SHEAR ICE ZONES

OBJECTIVE: To develop a low cost, high advance speed, means of tunnelling in permafrost offshore in the Arctic. Apply to the building of tunnels from land under the ocean in shorefast ice and shear ice zones.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate the state of the technical art in tunnelling.

2. Determine whether significant tunnelling breakthroughs would provide economically attractive solutions to the Arctic permafrost region underlying the shorefast and shear ice zones.

3. Prepare a program plan in cooperation with other agencies with tunnelling needs including DOT and BuMines.

4. Build and test hardware in permafrost and disseminate results to industry.

END PRODUCT: Body of data on advance tunnelling rechniques in permafrost.

BENEFIT: Improved access to OCS petroleum resources.

SCHEDULE: 5 years

BUDGET: $2,000,000

PRIORITY:

1-81 WATER REINJECTION IN ARCTIC OCS PETROLEUM FIELDS

OBJECTIVE: Examine the feasibility of using the ballast sea water back-hauled by a submarine tanker fleet to reinject into the Arctic OCS petroleum field as petroleum products are taken out.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate the feasibility of reinjection of oily ballast water into the field as opposed to the need for ballast water processing and cleaning.

2. Examine the recently completed MarAd sponsored submarine tanker study for background.

3. Establish a program to demonstrate the feasibility.

4. Disseminate data to the industry.

END PRODUCT: Body of design data.

BENEFIT: Eliminates the need for submerged oily water processing facility.

SCHEDULE: 2 years

BUDGET: $500,000

PRIORITY:

Oil and Gas

1-82 UNDER ICE OIL SPILL CLEANUP SYSTEM

OBJECTIVE: To develop, in conjunction with Arctic under ice drilling and production system, the associated supporting system that would be capable for handling the cleanup of an under ice oil spill.

PLAN OF ACTION: The sequence of steps would include:

1. Review current studies on nature of under ice test spills, potentials for spills, cleanup means and fate and effect studies.

2. Design, develop and test in the Arctic a variation on the logistic and/or tanker submarine which is the spill cleanup submarine system.

3. Disseminate results of tests to industry and encourage industry to build and operate such a system similar to current cooperative program of support to an offshore fire fighting semisubmersible design.

END PRODUCT: Body of knowledge on a practical under ice spill cleanup system.

BENEFIT: Less ecological damage potential from a possible under ice oil spill. Improved public acceptance of OCS under ice petroleum development activity.

SCHEDULE: 3 years

BUDGET: $5,000,000

PRIORITY:

Oil and Gas

1-83 DEVELOPMENT OF EQUIPMENT AND SYSTEMS TO DEFLECT ICEBERGS FROM FIXED OFFSHORE PLATFORMS

OBJECTIVE: To prevent damage to offshore platforms in Arctic waters.

PLAN OF ACTION: The sequence of steps would include:

1. Inventory current and proposed Arctic seas platforms.

2. Evaluate equipment and systems currently in use.

3. Analyze historical cases of platform failure resulting from iceberg impact.

4. Determine scope of forces generated by iceberg impact: magnitude, direction, duration, seasonal occurrence.

5. Evaluate effectiveness of ice-breaking equipment currently available and proposed.

6. Initiate model studies of most feasible approach, evaluate, and implement prototype test.

END PRODUCT: Improved system for iceberg deflection.

BENEFIT: Provide for safer operations in Arctic waters.

SCHEDULE: Three years

BUDGET: $250,000

PRIORITY:

1-84

IMPROVEMENT OF DEEPWATER DRILLING TECHNIQUES IN ARCTIC WATERS

OBJECTIVE: To optimize drilling rates and drilling movements on year-round arctic operations.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate all known and proposed drilling tehchniques - rotary, turbodrilling, etc. - and select most suitable Arctic conditions.

2. Investigate metals and materials - drill stem, casing, BOP's, packing seals, etc. - and select most suitable for Arctic environment.

3. Inventory various mobile rigs and support craft and recommend most efficient for open water and ice conditions.

4. Evaluate drilling muds, cements, and other down-hole chemicals and recommend most suitable ones.

5. Compile list of waterfront facilities suitable for base support for Arctic waters.

END PRODUCT: Development of overall system to optimize Arctic water drilling.

BENEFIT: Improvement of drilling operations in frigid environments.

SCHEDULE: 2 years

BUDGET: $200,000

PRIORITY:

1-85 ARCTIC MARINE TRANSPORTATION AND SHIP DESIGN

OBJECTIVE: To develop an Arctic Marine Transportation System to transport crude oil, natural gas and minerals from Alaska's North Slope and contiguous offshore coastline to U.S. markets.

To open the Northwest Passage (joint US/Canada venture) as a year round international trade route and become a catalyst to open resources of far northern Alaska and Canada to the world.

PLAN OF ACTION: Conduct feasibility and design studies for Arctic Marine Transportation System as follows:

1. Trade routes from Prudhoe Bay

   a. Northwest Passage to U.S. East Coast
   b. Bering Strait to U.S. West Coast

2. Preliminary Ship Design (Fossil and Nuclear Fueled)

   a. Icebreakers - 80,000 - 120,000 SHP
   b. Ice-Strengthened Commercial Ships
      Crude Oil Carrier - 250,000 DWT
      LNG Carrier - 165 M3
      Bulk Carrier - 150,000 DWT
   c. Submarine Tankers (Nuclear)
   d. Semi-Submersible Tankers (Nuclear)
   e. Loading Terminal Facility

END PRODUCT: A practical and economical Arctic Marine Transportation System that will foster the development of energy resources in that part of the world.

BENEFIT: The political, economic and technological status of the U.S. as a leading Arctic power will be assumed in addition to promoting international exchange in polar marine science, Arctic data, conservation of Arctic resources, protection of the fragile Arctic ecology and pollution avoidance.

The opening of the Northwest Passage as a year round international trade route will benefit all nations in world trade.

Other technological benefits include:

(1) Advanced Icebreaker Design
(2) Ice-Strengthened Commercial Ship Design
(3) Advanced Ship Structure Design Criteria

(4) Multiple High Strength Propeller, Rudder and Shafting Design
(5) Special High Strength Steel and Welding Criteria
(6) Nuclear Propulsion
(7) Terminal Loading Facility Development
(8) Oil, Gas and Mineral Extraction Development

SCHEDULE: System operational within ten years based on oil and gas production and mining operations.

BUDGET: Unknown.

PRIORITY:

1-86 ARCTIC SUBMARINE ROUTE SURVEY

OBJECTIVE: To determine the oceanographic and bathymetric characteristics of potential Arctic shipping lanes for submarine navigation; and to establish the requirements and potential for navigational aids.

PLAN OF ACTION: The sequence of steps would include:

1. Design the survey
2. Procure necessary instrumentation
3. Assemble survey staff
4. Obtain and outfit "bailed" Navy SSN
5. Conduct survey

END PRODUCT: A thorough understanding of Arctic Ocean transport routes from the North Slope of Alaska to the East Coast of the U.S.

BENEFIT: An all U.S.-controlled or international waters transport route from Alaska.

SCHEDULE: Item (1)-(4) 1 year
Item (5) 1 year

BUDGET: Items (1)-(4) $2 million
Item (5) $12.5 million

PRIORITY:

1-87 ARCTIC SUBMARINE PORT FACILITY

OBJECTIVE: To provide a submerged port for the transfer of petroleum cargoes to tanker submarines in the Arctic.

PLAN OF ACTION: Prepare detailed designs, area surveys, and cost estimates for the construction of a submerged port facility off the North Slope of Alaska.

Construct a submerged port facility off the North Slope of Alaska.

END PRODUCT: The land link for a completely ice free transport system from Alaska to the East Coast of the U.S.

BENEFIT: An all U.S.-controlled or international waters transport route from Alaska.

SCHEDULE:	Item (1)	3 years
	Item (2)	5 years

BUDGET:	Item (1)	$ 150 million
	Item (2)	$ 2000 million

PRIORITY:

1-88

ICE ENGINEERING

OBJECTIVE: Develop concepts and criteria for exploration and production of fossil fuels in ice conditions.

PLAN OF ACTION: The first step is to develop engineering data for design of structures and vehicles to operate under ice conditions ranging from full ice coverage, plate ice, ice flows and iceberg conditions. The next phase should develop concepts for exploratory and production drilling techniques, well completion including platform structures and subsea systems, pipelaying and transport to a processing station, and the necessary support vehicle and activities.

END PRODUCT: Engineering criteria for design of systems and structures in ice conditions and demonstrated production capability.

BENEFIT: Safe recovery of resources under ice conditions ranging from marginal ice and iceberg flow areas to full ice cover.

SCHEDULE: 1-3 years — Develop engineering data and component/subsystem development.

3-6 years — System demonstration.

BUDGET: Estimate - $ 25 million for development
Estimate - $150 million for system demonstration

PRIORITY:

1-89 SHOREFAST AND SHEAR ICE ZONE PIPELINE LAYING SYSTEM

OBJECTIVE: Develop a pipelaying system capable of installing trenched-in pipelines through the shore fast and shear ice zones in the Arctic.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate existing studies for pipelay barges, pipepulling techniques and other approaches.

2. Prepare a plan to cooperatively build and test a system with an industry consortium.

3. Build and test system.

4. Disseminate results to industry.

5. Encourage building of commercial system through use of MarAd financial incentives.

END PRODUCT: Body of engineering data on shore fast and shear ice zone pipelaying technology.

BENEFIT: Accelerated access to OCS petroleum by making land-side processing accessable to Arctic offshore fields production output.

SCHEDULE: 10 years

BUDGET: $30 million

PRIORITY:

1-90 ESTABLISH A NON-MILITARY UNDER ICE NAVIGATION REFERENCE SYSTEM FOR USE IN THE ARCTIC UNDER A JOINT U.S./CANADIAN PROGRAM

OBJECTIVE: To enable reliable and unambiguous lease area marking, drilling system positioning, logistic and petroleum transport platforms navigation in the Arctic under ice environment.

PLAN OF ACTION: The sequence of steps would include:

1. Review existing data on technical characteristics of such under ice navigation systems.

2. Evaluate the cost, lead time and facility acquisition issues for the navigation reference system establishment and maintenance.

3. Plan for and arrange joint U.S./Canadian program.

4. Plan needed U.S. support and establish industry tie in.

5. Establish working agreements between ERDA, NOAA and USCG.

END PRODUCT: A reliable, high accuracy non-military under ice navigation reference system.

BENEFIT: Precise knowledge of location of operations and support system elements under ice.

SCHEDULE: 1 year

BUDGET: $200,000.

PRIORITY:

Oil and Gas

1-91 UNDER ICE SALVAGE SYSTEM

OBJECTIVE: To evaluate the number and type of salvage systems that would be required to support under ice OCS petroleum development accidents. Sponsor the building of one such system with OCS petroleum developers.

PLAN OF ACTION: The sequence of steps would include:

1. Determine nature of probable accidents.

2. Design and develop a suitable salvage capability to be used with a logistic support submarine if appropriate.

3. Co-sponsor with industry the building and deployment of one salvage system.

END PRODUCT: Operational salvage system for Arctic under ice OCS areas.

BENEFIT: Reduced insurance cost to builders due to reduced loss probability.

SCHEDULE: 10 years

BUDGET: $20 million

PRIORITY:

Oil and Gas

1-92 POLLUTION MONITORING AND ALERTING

OBJECTIVE: To approach the potential OCS pollution issue in the most positive way to minimize spill possibilities through good design and operational practice, continuous monitoring and rapid alerting.

PLAN OF ACTION: The sequence of steps would include:

1. Review responsibilities of various federal agencies for pollution monitoring and alerting in the OCS zone.

2. Develop a cooperative industry/government plan for pollution monitoring in the OCS zone which considers the responsibilities of the various federal agencies and the capabilities and responsibilities of the petroleum industry operators.

3. Develop a plan to foster the transfer of technological information between industry and government to insure that pollution minimizing technology is incorporated in offshore hardware design.

4. Establish a positive mechanism to insure the compatibility of OCS zone antipollution undertakings with this country's IMCO centered international efforts to minimize ocean pollution.

END PRODUCT: Finite planning for pollution monitoring and alerting in the U.S. OCS zone.

BENEFIT: Preservation of the natural resources of the oceans, foreign and domestic. More receptive national attitude toward the commercial development of the U.S. OCS.

SCHEDULE: 1 year

BUDGET: $150,000

PRIORITY:

Oil and Gas

1-93 OCEAN POLLUTION REDUCTION FROM OCS PETROLEUM OPERATIONS

OBJECTIVE: Develop advanced handling and storage systems for drilling muds, drill cuttings, sewage, production water, oil slops, and bilges to minimize ocean contamination.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate current procedures for handling wastes.

2. Determine the state of the art in advanced handling storage and disposal of wastes.

3. Determine the costs associated with mandating the use of advanced waste handling systems.

END PRODUCT: Rules and regulations based on practical and economic control means for waste products.

BENEFIT: Better public understanding of the responsible approach being taken to OCS petroleum operation waste handling.

SCHEDULE: 1 year

BUDGET: $50,000

PRIORITY:

1-94 TANKER SPILL PREVENTION

OBJECTIVE: Design and develop a tanker cargo gelling system to protect against petroleum spills from supertanker strandings and collisions.

PLAN OF ACTION: Develop a petroleum gelling system to locally contain petroleum spills as follows:

1. Feasibility study to select candidate gelling agents and systems optimizing gel effectiveness (introduction and removal), and minimizing cost.

2. Laboratory gel candidate demonstration and evaluation.

3. Design develop and demonstrate prototype gelling system.

END PRODUCT: A system for introducing a gelling agent to etroleum tanker cargos which can be adapted to existing tankers at acceptable cost/benefit ratio.

BENEFIT: Minimize the government, and public concern with this type maritime disaster and reduce clean up and insurance costs.

SCHEDULE: It is estimated that the first prototype could be developed and demonstrated in two years.

BUDGET:

	MONTHS	COST
1. Gel Candidate/System Selection	6	$ 200,000
2. Gel Candidate Demonstration	6	$ 300,000
3. Prototype Gelling System Demonstration	12	$ 1 million

PRIORITY:

1-95 CAPTURE AND COLLECTION OF UPWARD FLOATING PETROLEUM FROM BOTTOM MOUNTED DRILLING AND PRODUCTION SYSTEMS

OBJECTIVE: To develop a capture and collection system technology for oil spills from bottom oriented drilling and production systems. In concept a device similar to a circus tent over the operating site could collect the floating oil which is then pumped into a tank.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate the types and densities of crude oils and determine percentage of probable capture of lighter-than-water fractions.

2. Evaluate means for containing heavier-than-water fractions on the bottom.

3. Design build and test hardware in a cooperative program with industry and EPA.

4. Publish and disseminate results. Encourage use of system.

END PRODUCT: Body of data on proven designs for capturing potential spills from bottom oriented drilling and production systems.

BENEFIT: Less potential for ocean pollution because bottom released oil spills never reach ocean surface and spread.

SCHEDULE: 7 years

BUDGET: $20 million

PRIORITY:

1-96 SUBMARINE TANKER BALLAST SEA WATER UNDERSEA PROCESSING TO REMOVE TRACE AMOUNTS OF OIL

OBJECTIVE: To determine the best means under the hydrostatic pressure of the sea, to remove oily water from the ballast.

PLAN OF ACTION: The sequence of steps would include:

1. Review Mar Ad studies on submarine tanker system.

2. Prepare a plan to develop and test a submerged oily ballast water processing system.

3. Build and test equipment.

4. Prepare and disseminate results to industry.

END PRODUCT: Body of design and tradeoff data for undersea separation equipment system.

BENEFIT: Lower cost OCS petroleum development.

SCHEDULE: 5 years

BUDGET: $2 million

PRIORITY:

Oil and Gas

ENVIRONMENTAL AND DESIGN DATA

OIL AND GAS PANEL

Environmental and Design Data

1-97 Remote Sea Floor Inspection System

1-98 Common Surface Platform for Baseline OCS Environmental Surveys as Well as Seismic and Route/Site Surveys for Petroleum Development

1-99 Development of Sensitive Geophysical Instrumentation to Identify Near-Surface Geologic Features of the Ocean Floor

1-100 Compilation and Development of Safety and Environmental Procedures and Measures for Deepwater Exploratory and Development Drilling

1-101 Surface Independent Seismic and Oceanographic Survey System

1-102 Development of Equipment and Methods for Sea Floor Surface Detection of Presence of Hydrocarbons Prior to Drilling

1-103 Long-Range Study of the Adaption of Marine Organisms to Oil Exposure

1-97 REMOTE SEA FLOOR INSPECTION SYSTEM

OBJECTIVE: To enable State and Federal regulation of the growing exploitation of sea bed resources, provide the capability to inspect the sea floor environment, and to monitor operations there to the extent necessary to enforce statutes.

PLAN OF ACTION: The sequence of steps would include:

1. Establish feasible capability requirements through discussions with cognizant State and Federal agencies, and technology state of the art review.

2. Develop design of versatile, adaptable sea floor inspection system, including basic vehicle, system controls, sensor subsystems, and data transmission, display and analysis subsystems.

3. Construct and test prototype system in phases, starting with basic vehicle and its controls, followed by sensor and test subsystems, data handling and display subsystems, and finally with data analysis subsystem.

4. Conduct total system evaluation.

5. Prepare specifications for commercial construction of follow-on systems.

6. Conduct exploratory operations in concert with cognizant agencies.

END PRODUCT: A transportable sea floor survey, inspection and sampling system capable of being operated to 6000 meters depth from ships of opportunity.

BENEFIT: First, this system would provide information needed to formulate reasonable laws and regulations concerning activities on the sea floor, and to monitor and inspect the actions of parties, both foreign and domestic, who conduct such activities.

Second, advance state-of-the-art in technology for sea floor work and data-gathering systems.

SCHEDULE: Review technology - 9 months; design - 2 years; fabricate - 15 months; test and evaluate 15 months; total project - 4 1/2 years.

BUDGET: Review technology - $45,000; design - $185,000; fabricate - $1.5 million; test and evaluate - $450,000; total project - $2.18 million.

PRIORITY:

1-98 COMMON SURFACE PLATFORM FOR BASELINE OCS ENVIRONMENTAL SURVEYS AS WELL AS SEISMIC AND ROUTE/SITE SURVEYS FOR PETROLEUM DEVELOPMENT

OBJECTIVE: To determine the extent to which OCS petroleum development can be accelerated by an aggressive federal co-sponsorship of OCS survey craft.

PLAN OF ACTION: Based on the Coastal Zone Management Act of 1972 and the mandated requirement for OCS baseline environmental surveys prior to OCS petroleum development, examine the extent to which new and better OCS baseline environmental surveying platforms can perform collateral duties as seismic and route or site survey platforms as a second duty. Evaluate currently used platforms and their limitations. Determine suitable approach for federal co-sponsorship of new survey platforms.

END PRODUCT: More platforms to produce more survey data faster.

BENEFIT: Faster access to OCS petroleum resources in currently poorly surveyed OCS areas.

SCHEDULE: 1/4 year

BUDGET: $10,000

PRIORITY:

Oil and Gas

1-99 DEVELOPMENT OF SENSITIVE GEOPHYSICAL INSTRUMENTATION TO IDENTIFY NEAR-SURFACE GEOLOGIC FEATURES OF THE OCEAN FLOOR

OBJECTIVE: Development of geophysical equipment suitable for identification of near-surface geologic features of the ocean floor without resorting to conventional boring and sampling techniques.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate the state of the art of geophysical investigations from the point of view of near-surface applicability.

2. Discussion of new equipment and techniques that may be applicable to near surface investigations.

3. Initiate testing programs to evaluate most appropriate instrumentation systems.

4. Recommendations for further development work.

END PRODUCT: Geophysical instrumentation applicable for near surface investigations without use of boring or sampling equipment.

BENEFIT: Obtaining of valuable data on sea floor geology and soil conditions.

SCHEDULE: 3 years

BUDGET: $300,00

PRIORITY:

1-100 COMPILATION AND DEVELOPMENT OF SAFETY AND ENVIRONMENTAL PROCEDURES AND MEASURES FOR DEEPWATER EXPLORATORY AND DEVELOPMENT DRILLING

OBJECTIVE: Protection of environment and personnel in deepwater operations.

PLAN OF ACTION: The sequence of steps would include:

1. Compile lists of safety and environmental procedures currently in use on board mobile rigs, supply vessels, etc. engaged in deepwater operations.

2. Compile directory of applicable mandatory safety and environmental regulations required by Federal, state, and international laws.

3. Indicate knowledge gaps and where new regulations ought to be required.

4. Determine scope of training and education programs for various personnel classes.

5. Evaluate current safety and environmental equipment required and indicate new types of equipment to be developed.

6. Establish minimum personal safety and environmental requirements for various equipment categories.

7. Evaluate and incorporate search and rescue programs.

8. Investigate and recommend "fail-safe" safety and environmental procedures for all operational phases.

9. Evaluate and recommend instrumentation required to monitor and control failures affecting personal safety and the environment.

10. Establish procedures for medical treatment and evacuation including preparation of onshore medical facilities register.

11. Establish procedures for controlling failures to minimize environmental damage.

END PRODUCT: Comprehensive directory of safety and environmental procedures and guidelines for deepwater operations.

BENEFIT: Protection of personnel and ocean environment.

SCHEDULE: 1 year

BUDGET: $150,000

PRIORITY:

Oil and Gas

1-101 SURFACE INDEPENDENT SEISMIC AND OCEANOGRAPHIC SURVEY SYSTEM

OBJECTIVE: To obtain, on a bailment from the Navy an early vintage SSN nuclear submarine for adaptation into an Arctic seismic survey and oceanographic survey platform. To provide survey service to Arctic under ice petroleum development community.

PLAN OF ACTION: The sequence of steps would include:

Platform

1. Review prior studies and/or buy from industry, as appropriate.

2. Co-sponsor development of needed survey hardware and crew training with MarAd and NOAA, and deployment cost for the survey-adapted SSN.

3. Participate in the operational planning and disseminate data to industry.

4. Evaluate possible joint U.S./Canadian effort to survey in Canadian Arctic waters as a follow-on activity.

Sensor Development

1. Evaluate present seismic techniques and limitations.

2. Review under ice noise levels and spectrum.

3. Design, develop and demonstrate advanced seismic survey system in the lab for a group of participating organizations including industry.

4. Deploy on a submarine to Arctic for under ice tests and then operational seismic data gathering.

5. Interpret and publish results to participating organizations.

6. Evaluate joint U.S./Canadian program to get added data on Canadian areas of Arctic.

Data Taking Capability

1. Develop means of making deep corings rapidly through ice cover and from submarine survey platforms to permit accurate delineation of soil depth and extension from shore of undersea permafrost conditions and undersea pingoes (ice wedges).

2. Review present coring systems capabilities.

3. Adapt equipment for use submerged from submersible craft and/or submarines.

4. Make long term geotechnical studies of the soil to determine stability of soils for undersea civil engineering facilities such as docks and terminals for submarine tankers.

END PRODUCT: Body of engineering knowledge and highly qualified seismic data on Arctic OCS soil geotechnical properties to provide design limits.

Body of seismic and oceanographic route and area surveys under the Arctic ice, confirming extent of under ice petroleum resources and their accessability.

BENEFIT: Lower cost OCS petroleum development systems because of tighter engineering designs. Accelerated access to Arctic under ice OCS petroleum resources.

SCHEDULE: 5 years

BUDGET: $20 million

PRIORITY:

Oil and Gas

1-102 DEVELOPMENT OF EQUIPMENT AND METHODS FOR SEA FLOOR SURFACE DETECTION OF PRESENCE OF HYDROCARBONS PRIOR TO DRILLING

OBJECTIVE: To develop techniques that would indicate presence or lack of oil and gas in order to provide more cost-effective drilling.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate and evaluate known and experimental geophysical, geochemical and other methods (biological, satellite sensing, etc.) for hydrocarbon detection -both onshore and offshore.

2. Initiate test program to evaluate most promising approaches.

3. Recommend most appropriate system and additional development work required.

END PRODUCT: Methodology for detection of hydrocarbons on the sea floor prior to drilling.

SCHEDULE: 3 years

BUDGET: $500,000

PRIORITY:

1-103 LONG-RANGE STUDY OF THE ADAPTATION OF MARINE ORGANISMS TO OIL EXPOSURE

OBJECTIVE: To determine the biological processes by which marine biota adapt or adjust to exposure to oil.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate data on natural seepages and historical spills by type of crude oil and petroleum product to determine changes including those of a genetic nature.

2. Plan laboratory R&D programs for long-range continuing studies of common U.S. marine fauna and flora that would be exposed to oil.

3. Monitor results and indicate processes of adaptation.

END PRODUCT: Processes of marine organism adaptation.

BENEFIT: Increase in knowledge of organism behavior, changes and adjustment to oil spills.

SCHEDULE: 5 years

BUDGET: $250,000

PRIORITY:

Oil and Gas

POLICY AND TRENDS

OIL AND GAS PANEL

Policy and Trends

1-104 Impact-On-Navigation Analysis
1-105 Planning for Uses of Abandoned Offshore Oil and Gas Platforms
1-106 Offshore Platform Alternate Collateral Uses
1-107 Increase in the Potential and Frequency of Major Marine Accidents
1-108 Military Threat Analysis
1-109 Terrorist/Criminal Threat Analysis
1-110 New Dis-Incentive Legislation
1-111 Evaluation of Tender - Assisted Rigs vs. Drill Ships for Deepwater Drilling

1-104 IMPACT-ON-NAVIGATION ANALYSIS

OBJECTIVE: Determine the extent and type of marine traffic navigation impact caused by greatly expanded OCS petroleum operations.

PLAN OF ACTION: The sequence of steps would include:

1. Examine the types of marine traffic that will be impacted.

2. Evaluate need to maintain or move traffic lanes, fishing areas, dump sites, military test ranges.

3. Evaluate needs for submerged petroleum operations and need to mark same to prevent interference.

4. Analyze "200 mile economic zone" Law-of-the-Sea aspects.

END PRODUCT:

1. Report with findings and recommendations.

2. Periodic update of results of applying approach.

3. Recommendations on new navigation techniques.

BENEFIT: Orderly development of more petroleum resources offshore in addition to other uses of the same ocean areas.

SCHEDULE: 1/2 year

BUDGET: $20,000

PRIORITY:

I-105 PLANNING FOR USES OF ABANDONED OFFSHORE OIL AND GAS PLATFORMS

OBJECTIVE: To develop uses for abandoned offshore oil and gas recovery platforms, particularly man-made islands.

PLAN OF ACTION: Establish characteristics and condition of typical offshore platforms at abandonment.

Explore potential uses as a function of size, location and condition of platforms upon availability.

Compile results in suitable planning document.

END PRODUCT: Planning base for utilization of abandoned platforms.

BENEFIT: Recovery of installation costs or oil and gas production facilities.

SCHEDULE: 1/2 year

BUDGET: $25,000

PRIORITY:

1-106 OFFSHORE PLATFORM ALTERNATE COLLATERAL USES

OBJECTIVE: To determine if structures primarily intended for OCS oil and gas recovery could be advantageously used for other purposes.

PLAN OF ACTION: The sequence of steps would include:

1. List potential alternate uses such as offshore cargo terminals, fisheries base, coastal patrol and rescue operations base, navigational aids, etc.

2. Determine compatability of primary and secondary uses.

END PRODUCT: Report presenting possible alternative uses including economic effects.

BENEFIT: Economic benefit and possible increased socio-economic acceptability to installation of offshore recovery equipment in such areas as Atlantic mid-latitudes.

SCHEDULE: 1/2 year

BUDGET: $25,000

PRIORITY:

Oil and Gas

1-107 INCREASE IN THE POTENTIAL AND FREQUENCY OF MAJOR MARINE ACCIDENTS

OBJECTIVE: To identify and assess the problems created by more traffic, hazardous and exotic cargoes carried in larger and faster ships, major growth in numbers and size of offshore rigs and structures.

PLAN OF ACTION: The sequence of steps would include:

1. Study present and future trends of marine activity.

2. Forecast frequency and scope of salvage incidents on a realistic or worst case basis.

3. Critically evaluate the ability of the professional private salvage industry, possible industry cooperative endeavors, underwater and insurance syndicate efforts, government facilities and combinations thereof to meet future demands.

4. Determine whether, and if so, who should provide overall coordination or management to national response capability.

END PRODUCT: The need, crossing many different interests, will likely dictate government coordination, legislation, subsidy and/or even direct management of the national efforts. Means to achieve this end will be recommended.

BENEFIT: Realistic indentification of a problem that individual industries are unlikely to admit the presence of; formulation of a plan to address the problem; the generation of a professional response capability to meet the need.

SCHEDULE: Six to eighteen months.

BUDGET: $200,000 - $500,000

PRIORITY:

Oil and Gas

1-108 MILITARY THREAT ANALYSIS

OBJECTIVE: To determine the number, type, and frequency of detrimental military actions against U.S. OCS petroleum platforms and facilities.

Define the protection and early warning systems needed.

PLAN OF ACTION: The sequence of steps would include:

1. Define the threats.

2. Evaluate the threat model.

3. Define the roles of Industry, and government.

4. Evaluate early warning capability.

5. Evaluate defense weapon possibilities and/or patrol craft approaches.

6. Evaluate graceful failure mode designs, rescue systems.

END PRODUCT: Two documents will be produced. Threat analysis and operational reaction approach will be Navy classified, need-to-know only.

Unclassified volume will cover general conclusions.

BENEFIT: Better understanding by Industry, government and foreign powers of U.S. approach to this problem.

Better engineering design of platforms with graceful failure modes.

SCHEDULE: 1 year

BUDGET: $50,000

PRIORITY:

Oil and Gas

1-109 TERRORIST/CRIMINAL THREAT ANALYSIS

OBJECTIVE: To determine the number, type and frequency of detrimental terrorist actions against U.S. OCS petroleum platforms and facilities.

Define the protection and early warning systems needed.

PLAN OF ACTION: The sequence of steps would include:

1. Define the threat.

2. Evaluate the capabilities of the terrorist groups.

3. Define the roles of industry and government.

4. Define the role of FBI and Justice Department in prosecutions.

5. Evaluate the early warning capabilities.

6. Evaluate the defense weapons, capture of terrorists, use of patrol craft, etc.

7. Evaluate graceful failure mode designs and rescue systems.

END PRODUCT:

1. Two documents will be produced. Threat analysis and operational reaction approach will be Navy classified.

2. Unclassified volume will contain general conclusions.

BENEFIT: Better understanding by industry, government and public press of U.S. approach to this problem. Better engineering design of platforms with graceful failure modes.

SCHEDULE: 1 year

BUDGET: $50,000

PRIORITY:

Oil and Gas

1-110 NEW DIS-INCENTIVE LEGISLATION

OBJECTIVE: To examine the range of possible forms of negative, dis-incentive legislation which might be used to accelerate or delay the pace of OCS petroleum development.

PLAN OF ACTION: The sequence of steps would include:

1. Examine prior instances where legislation has been counter productive.

2. Examine the probable types of legislation that could be introduced and develop strategies for arguing against punitive legislation.

3. This examination should encompass the following legislative areas:

- Regulatory
- Punitive Taxation
- Personnel Benefits
- Safety
- Government Production
- Government Exploration
- Platform Protection Costs
- Platform Salvage and Marking
- Anti Pollution
- Design Codes
- International Treaties
- Leasing Controls
- Sabotage Laws
- Wage and Price Controls
- Contingent Lease Arrangements
- Petroleum Conservation Restrictions

END PRODUCT: A plan to minimize the impact of negative legislation. Data and analysis information for use in Congress when discussing effect of contemplated legislation.

BENEFIT: Minimum disruption of an accelerated OCS petroleum development program.

SCHEDULE: 1 year

BUDGET: $500,000

PRIORITY:

1-111 EVALUATION OF TENDER - ASSISTED RIGS VS. DRILL SHIPS FOR DEEPWATER DRILLING.

OBJECTIVE: To determine most cost-effective vessel modes for deepwater drilling.

PLAN OF ACTION:

1. Establish costs and effectiveness of drillship drilling in deepwater, capital costs, operating cost, logistics costs, etc.

2. Investigate storage capacity and costs for equipment, materials, drill string, etc. of tender-assisted vs. drill ships.

3. Establish costs and effectiveness of tender - assisted rigs including start-up time for drilling, initial costs, labor and logistics costs for supply vessels.

4. Provide cost comparison and effectiveness for both systems.

END PRODUCT: Recommendations as to most cost effective vessel utilization.

BENEFIT: Assist exploration and reduce costs of deepwater drilling.

SCHEDULE: 1 year.

BUDGET: $125,000.

PRIORITY:

OIL AND GAS

GENERAL

OIL AND GAS PANEL

General

1-112 Rescue/Salvage Equipment and Personnel Data Bank
1-113 Personnel Acquisition and Selection
1-114 OCS Nuclear Power Supply Requirements Definition
1-115 Oil/Sea Water Miscibility Under Ocean Depth Pressures
1-116 Personnel Retention and Incentives
1-117 Training Facilities - Officers
1-118 Training Facilities - Crew
1-119 Investigation of the Methods of Avoiding Energy Losses Between Production Offshore and Manufacturing Onshore
1-120 Intermediate Self-Propelled ACV's for Lightering Inter-Modal Transporters
1-121 Certification and Licensing
1-122 Short Voyage OCS Petroleum Field Gathering Submarine Tanker
1-123 Nuclear Power Supply Refueling in OCS Development Applications
1-124 Comprehensive Study of Application of Plate Tectonics to Oil and Gas Accumulation in Present Continental Margins
1-125 Comprehensive Study of Application of Plate Tectonics Theory to Ore Localization in Defining and Identifying New Areas for Mineral Exploration
1-126 Interactions of Surface Transport of Petroleum Products and Sea Bird Populations in the Western North Atlantic.

1-112 RESCUE/SALVAGE EQUIPMENT AND PERSONNEL DATA BANK

OBJECTIVE: To provide quick recovery of information on all forms of equipment, floating plant, and qualified salvage personnel available for use in an emergency.

PLAN OF ACTION: Catalog in readily recoverable form, probably on a computer,

complexes, and qualified personnel in ocean engineering, salvage, diving, hazardous materials, etc.

END PRODUCT: Readily available access to information on military and civilian facilities and personnel capable of a quick response to marine emergency which is beyond the capability or jurisdiction of the Coast Guard, Navy, or other emergency response agencies.

BENEFIT: Indeterminate but could be substantial in dollar savings in event of stranding of loaded tanker or in saving lives where large quantities of hazardous materials are involved.

SCHEDULE: One year or less depending on priority applied to project.

BUDGET: Range $75,000 to $500,000 dependent on method and format adopted. Annual operating cost should be under $30,000.

PRIORITY:

1-113 PERSONNEL ACQUISITION AND SELECTION

OBJECTIVE: To prepare a plan to accelerate the availability of appropriately motivated people needed to crew the increasing numbers of OCS petroleum development platforms and facilities.

PLAN OF ACTION:

1. Determine the nature of the current acquisition problem.

2. Examine current procedures for enlisted and officer personnel in OCS platforms.

3. Examine current procedures for U.S. Maritime ship manning for applicability of acquisition process. Include examination of union operated schools for high school level candidates as an entry point to system, e.g. Harry Lundeberg School.

END PRODUCT: A plan for better identification of personnel availability and skills and a register of qualified personnel.

BENEFIT: Adequate numbers of people entering the system pipeline early enough for training.

SCHEDULE: 1/2 year.

BUDGET: $20,000.

PRIORITY:

1-114 OCS NUCLEAR POWER SUPPLY REQUIREMENTS DEFINITION

OBJECTIVE: Assess the requirements of OCS power sources as to size, surface, subsurface, accessible, inaccessible, MTBF, MTTR, logistic support and crew.

PLAN OF ACTION:

1. Survey platform requirements.

2. Translate platform requirements into powerplant requirements.

3. Survey candidate current OCS power supplies.

4. Define size ranges appropriate to nuclear.

END PRODUCT: Definition of the current OCS power supply requirements as to scope and specifications (for nuclear).

BENEFIT: Accelerated nuclear power source development for OCS applications.

SCHEDULE: Six (6) months.

BUDGET: $50,000 - $200,000.

PRIORITY:

1-115 OIL/SEA WATER MISCIBILITY UNDER OCEAN DEPTH PRESSURES

OBJECTIVE: To examine the extent to which the mixing of oil and seawater is minimized under the depth pressures prevalent in the OCS. Environmentally benign OCS operations could be the result.

PLAN OF ACTION:

1. Evaluate industry experience with submerged oil storage tanks with oil/sea water interfaces always under sea pressure and without exposure to air or sloshing.

2. Design and experiment to obtain independent government data.

3. Fund and carry out experiment at suitable lab with pressure test facilities, high accuracy sensors for determining extent of mixing.

4. Vary the type of crude, temp., seawater salinity and temp., pressure, tank filling rate.

END PRODUCT: Body of technical data.

BENEFIT:

1. Government-owned data to permit evaluation of proposals for fully submerged petroleum operations.

2. Environmentally benign systems may be possible.

SCHEDULE: A 2 year program of testing is involved.

BUDGET: $500,000.

PRIORITY:

Oil and Gas

1-116 PERSONNEL RETENTION AND INCENTIVES

OBJECTIVE: Prepare a plan for maximizing the retention of trained personnel.

PLAN OF ACTION:

1. Examine current incentive programs in other fields as well as the current OCS industry approach.

2. Consider the following factors:

   (a) Tropical - Gulf of Mexico retention and incentives.
   (b) Northern and Arctic surface platform incentives.
   (c) Incentives needed for operating personnel on submerged systems.
   (d) Incentives needed to facilitate male/female crews and other non convential arrangements.

END PRODUCT: A plan which will be used for costing the probable personnel cost aspects of advanced OCS petroleum systems. Included will be data on salary, adders, bonuses, retirement benefits, health and accident benefits, etc.

BENEFIT: Better understanding on the part of the public of implications of accelerated OCS petroleum development.

SCHEDULE: 1/4 year.

BUDGET: $10,000.

PRIORITY:

1-117 TRAINING FACILITIES - OFFICERS

OBJECTIVE: To determine the need for new facilities and applicability of existing training facilities.

PLAN OF ACTION:

1. Evaluate Industry facilities for applicability.

2. Evaluate National Maritime Academy as a basis for greatly expanded officer training for OCS platforms.

3. Evaluate need for equivalent of state marine schools or an expanded program of this type.

4. Consider the use of an ROTC type of program in other colleges.

END PRODUCT: Plans to expand the availability of trained manpower to operate increased numbers of OCS petroleum platforms.

BENEFIT: More crews means more platforms means more oil. Present status is one of acute lack of trained personnel.

SCHEDULE: 1/4 year.

BUDGET: $10,000.

PRIORITY:

1-118 TRAINING FACILITIES - CREW

OBJECTIVE: To determine the best method to use in greatly expanding the supply of trained crew members for more OCS petroleum development platforms and systems.

PLAN OF ACTION:

1. Examine current industry training approaches for crews.

2. Evaluate applicability of crew training for the maritime trades, including union run schools.

3. Evaluate the means to upgrade personnel in the system to officer grades as a result of retraining and qualification testing.

4. Evaluate means to train Alaska natives for Alaska OCS crew positions.

END PRODUCT: Plans to expand the availability of trained crew members for increased numbers of OCS petroleum platforms.

BENEFIT: More properly trained personnel. Present status shows an acute lack of trained personnel.

SCHEDULE: 1/4 year.

BUDGET: $10,000.

PRIORITY:

1-119 INVESTIGATION OF THE METHODS OF AVOIDING ENERGY LOSSES BETWEEN PRODUCTION OFFSHORE AND MANUFACTURING ONSHORE

OBJECTIVE: To conserve energy losses.

PLAN OF ACTION:

1. Detail present production of offshore oil and gas.
2. Determine energy losses offshore and causes, e.g. flared gas, well-head pressure loss not used for energy generation, vapor loss feasibly recoverable, friction loss on poorly maintained pipelines.
3. Investigate gas flared in-process plants and other losses.
4. Investigate vapor losses from storage tanks, etc.
5. Estimate loss due to distance of process plants from source.
6. Evaluate overall losses, determine best currently available technology to minimize same, and indicate areas where further development would be required.

END PRODUCT: Program for minimizing energy losses.

BENEFIT: Conservation of energy.

SCHEDULE: 1 year.

BUDGET: $100,000.

PRIORITY:

1-120 INTERMEDIATE SELF-PROPELLED ACV'S FOR LIGHTERING INTER-MODAL TRANSPORTERS

OBJECTIVE: To determine the feasibility of self-propelled intermediate sized ACV's for use as intermodal lighters/cargo transfer units.

PLAN OF ACTION: Complete prototype design of a "modular family" of intermediate sized self-propelled ACV's, with payloads of 100 to 750 tons and assess the technical and economic feasibility of these units as cargo carriers/lighters in areas where adequate port facilities do not exist or current cargo movement does not warrant extensive investment in port developments. Such areas might be those requiring emergency supplies (drought areas, flooded areas, etc.), one-shot construction programs for industrial production (refinery for example which doesn't require extensive terminal facilities for end use operation), etc.

END PRODUCT: Design of a "modular family" of intermediate air cushion transporters with construction of at least two prototypes for field demonstration and use.

BENEFITS: Such ACV's would allow sea lifting supplies to an area like Punta Arenas, Chile, to assist in oil spill containment and clean-up -- as was recently required, but hardly warrants a large cargo terminal complex.

SCHEDULE:	1st year Preliminary Engineering Design and Decision	2nd year Design & Construction of Units	3rd year Test & Deploy
BUDGET:	$.75 Million	$8 Million	$3 Million

PRIORITY:

1-121

CERTIFICATION AND LICENSING

OBJECTIVE: To determine the approach to be used for OCS platform officers and crew certification and licensing and to determine the nature of the federal participation.

PLAN OF ACTION:

1. Evaluate present OCS petroleum industry personnel certification and licensing procedures, and possible future IMCO type international requirements.

2. Evaluate present maritime trades approaches to licensing personnel and applicability to (federal) program.

3. Evaluate special needs for undersea diver certification and biomedical qualification procedures.

4. Prepare budget and staff plan for federal certification program.

END PRODUCT: Plan for federal program. Definition of interfaces between government, industry and profession of licensed personnel.

BENEFIT: Personnel in operating system whose responsibility and accountability is standardized and made a mark of professional attainment.

SCHEDULE: 1/2 year.

BUDGET: $15,000.

PRIORITY:

I-122 SHORT VOYAGE OCS PETROLEUM FIELD GATHERING SUBMARINE TANKER

OBJECTIVE: To design and develop a relatively small gathering submarine tanker capable of taking petroleum products from OCS wells to near land terminals in OCS areas such as the Gulf of Alaska where pipelines are too long to be practical. I.E. 200-300 miles.

PLAN OF ACTION:

1. Evaluate performance requirements and determine whether a non-nuclear submarine tanker can be built with needed endurance.

2. Build and test pilot model submarine.

3. Perform tests with pilot model of undersea terminal.

4. Disseminate results to industry.

5. Facilitate through MarAd financial incentive program, the implementation of operational commercial gathering submarine tankers.

END PRODUCT: Body of data on proven submarine tanker design for gathering oil in OCS regions relatively close to land.

BENEFIT: Scattered undersea oil wells can be produced once a gathering system is demonstrated.

SCHEDULE: 10 years.

BUDGET: $50 Million.

PRIORITY:

1-123 NUCLEAR POWER SUPPLY REFUELING IN OCS DEVELOPMENT APPLICATIONS

OBJECTIVE: To determine refueling procedure and requirements for nuclear power supplies in OCS development applications.

PLAN OF ACTION:

1. Determine refueling requirements of OCS nuclear power supplies.

2. Contrast in-place refueling to on-shore refueling.

3. Determine most advantageous refueling schedule and procedure.

END PRODUCT: Refueling procedure for OCS nuclear power supplies.

BENEFIT: Efficient operation of OCS development projects.

SCHEDULE: Six (6) months.

BUDGET: $100,000 - $250,000.

PRIORITY:

Oil and Gas

1-124 COMPREHENSIVE STUDY OF APPLICATION OF PLATE TECTONICS TO OIL AND GAS ACCUMULATION IN PRESENT CONTINENTAL MARGINS

OBJECTIVE: To provide a sound geologic framework for future offshore hydrocarbon exploratory activities.

PLAN OF ACTION: The sequence of steps would include:

1. Conduct comprehensive literature search of domestic and foreign work dealing with relation of plate tectonics to stratigraphic and structural controls of oil and oil containment.

2. Relate and integrate geologic controls in present-day onshore and offshore fields to plate tectonics.

3. Formulate basic exploratory concepts derived from above relationships to pinpoint potential hither to unexplored onshore and offshore areas.

END PRODUCT: Report providing a guide for future oil and gas exploration.

BENEFIT: Increased knowledge of geologic controls affecting oil and gas accumulation.

SCHEDULE: Two years

BUDGET: $100,000

PRIORITY:

1-125 COMPREHENSIVE STUDY OF APPLICATION OF PLATE TECTONICS THEORY TO ORE LOCALIZATION IN DEFINING AND IDENTIFYING NEW AREAS FOR MINERAL EXPLORATION

OBJECTIVE: To provide a sound geologic framework for future exploration of mineral deposits.

PLAN OF ACTION: The sequence of steps would include:

1. Conduct comprehensive research of domestic and foreign work dealing with relation of plate tectonics to location of present areas of hydrothermal activity, continental trenches and subduction zones, and known ore deposits, both continental and marine.

2. Relate and integrate geologic controls within the framework of plate tectonics theory.

3. Formulate basic concepts derived from above relationships to pinpoint potential hitherto unexplored offshore and onshore sites of mineralization.

END PRODUCT: Report providing a guide for future hard-rock mineral exploration.

BENEFIT: Increased knowledge of geologic controls affecting ore localization.

SCHEDULE: Two years

BUDGET: $100,000

PRIORITY:

1-126 INTERACTIONS OF SURFACE TRANSPORT OF PETROLEUM PRODUCTS AND SEA BIRD POPULATIONS IN THE WESTERN NORTH ATLANTIC

OBJECTIVE: To determine the most critical times and areas of breeding and wintering of populations of marine waterfowl along the east coast of the United States, so as to be able to minimize any detrimental effects of surface transport of petroleum products.

PLAN OF ACTION:

1. Chose a sampling area (such as the Gulf of Maine).
2. Coordinate with current efforts to monitor breeding bird populations and wintering waterfowl populations there.
3. Determine critical breeding periods for key species.
4. Determine critical feeding areas for key species.

END PRODUCT: A series of distribution patterns of breeding and wintering populations of waterfowl in the Gulf of Maine, that could be used to guage the possible environmental impacts that would have to be considered in routing of tankers in the area.

BENEFIT: The New England sea duck population supports a considerable amount of hunting in the fall and early winter; the financial benefits of this resource in the local economy is substantial in many areas. In a less tangible way, many species of seabirds are represented as breeding birds in the United States only on the basis of their nesting in literally a handful of islets along the Maine Coast; they are clearly susceptible to becoming lost as native birds if sufficient damage to their habitat occurred.

SCHEDULE: Probably a 3-year project, depending upon the sampling area chosen, and the manpower available. Compiling known breeding grounds of key species would constitute one milestone. Developing an understanding of the chronology of their use of these breeding grounds would be another. Development of maps depicting the relative intensity of dependence upon particular times and places would be third milestone of the project.

BUDGET: Estimated at approx. $50,000/year for 3 years.

PRIORITY:

HARD
MINERALS

HARD MINERALS PANEL

Hard Minerals

2-1 IMPROVED EXPLORATION TECHNIQUES FOR DEEP OCEAN MINERAL DEPOSITS

OBJECTIVE: To develop a low cost, rugged and sophisticated method for rapidly exploring the ocean bottom for mineral deposits.

PLAN OF ACTION: In order to make the mining of deep ocean mineral deposits economic, it is necessary to develop the technology for ocean exploration to a mine efficient state. Present techniques such as precision bathymetry, reconnaissance seismic and free-fall sampling are either too slow or not sensitive enough.

The purpose of this study is to explore the state of art of ocean exploration and to develop new concepts for rapid, low cost yet sophisticated techniques for ocean exploration. These concepts are to be evaluated using an acceptable criteria and the technology development necessary in each case is to be defined and planned.

END PRODUCT: New concepts for improved deep ocean exploration.

BENEFIT: More efficient and positive identification of deep ocean mineral deposits.

SCHEDULE: 2 years

BUDGET: $300,000

PRIORITY:

2-2 RARE METALS FROM THE CONTINENTAL SHELF

OBJECTIVE: Gold, platinum, and diamonds, as well as heavy metals such as titanium and tin are known to be concentrated in river beds and along beaches in some areas of the world. Many of the concentrations, called "placer deposits," were formed when sea level was lower and now are submerged under 92 meters (300 ft.) or less of ocean. The objectives of this program element are: to appraise the regions of likely occurrence and then delineate target areas for detailed sampling; and, to identify the technologic barriers to their economic and environmentally - sound exploitation.

PLAN OF ACTION: Regions of interest will be identified, then specific target areas in one or more regions will be investigated by means of close-grid acoustic sub-bottom profiling surveys augmented by core drilling. The oceanographic environment in each target area will be studied with respect to design criteria for mining systems as well as environment constraints on the system.

END PRODUCT: Definitely a clearer picture of domestic resource potential will emerge; hopefully, the Nation's mineral resource base will be expanded as well.

BENEFIT: The need to depend on imports will be better clarified and, hopefully, reduced. If so, new industries will develop and the balance - of - payments will improve.

SCHEDULE: A five year project is proposed; one year for regional appraisal followed by three years of field work at target areas coincident with technology evaluation, and one year for final analysis of findings.

BUDGET: Year #1 - $ 200,000
Year #2 - $1,000,000
Year #3 - $1,000,000
Year #4 - $1,000,000
Year #5 - $ 500,000

PRIORITY:

2-3 RARE METALS FROM SEAWATER

OBJECTIVE: To determine the feasibility, both economic and environmental, of recovering rare metals which occur in near-trace quantities from seawater.

PLAN OF ACTION: Distillation of fresh water from seawater produces a concentrated brine from which the recovery of significant quantities of rare metals may be gained as suitable technology is developed within acceptable economic limits. The expected concentrations of metals, chemical, electrical, and mechanical means by which they might be extracted and the environmental impact such extraction might impose will next be determined.

END PRODUCT: Assessment of the potential of residual brine to produce rare metals.

BENEFIT: Increasing the natural resource base of the United States, expanding an existing industry, and reducing dependencies on imports from foreign sources.

SCHEDULE: A five-year program is proposed, the first year to be spent in technology assessment and developing a program plan; the remaining four years in implementing the plan.

BUDGET: First year, $150,000; ensuing years to be determined during the first year's work.

PRIORITY:

2-4 AN EXHAUSTIVE MINERAL AND BIOLOGICAL SURVEY OF THE U.S. CONTINENTAL SHELVES

OBJECTIVE: To make a complete inventory and assessment of the mineral and biological resources that are available to the U.S. on its continental shelves.

PLAN OF ACTION: The sequence of steps would include:

1. Establish assessment categories, criteria and model parameters.

2. Develop inventorying instrumentation.

3. Conduct field surveys.

4. Analyze data and develop projection models.

5. Prepare inventory lists and short and long range resource projections.

END PRODUCT: Complete resource inventory of the U.S. Continental Shelves, and models for use in resource utilization and planning.

BENEFIT: Established baseline for resource control and development planning.

SCHEDULE:

1st year - Develop operations plan, define parameters for measurement, start assessment instrumentation development.
2nd year - Instrumentation development and field testing.
3rd year - Commence Continental Shelf survey
4th - 10th year - Continental Shelf survey and development of Continental Shelf resource atlas.

BUDGET:

1st year - $600,000
2nd year - $4 million (not counting ship time)
3rd - 10th year - $1 million/year (not counting ship time)
Total - $12 million (not counting ship time)

PRIORITY:

2-5 SEA-GOING CUTTERHEAD DREDGE

OBJECTIVE: To develop a conceptual design of a sea-going cutterhead hydraulic suction dredge capable of working efficiently in 2 meter (about 6 ft) waves and being structurally and hydromechanically sound to withstand 5 meter (about 15 ft) waves, with a capacity of 2500 cubic yards per hours.

PLAN OF ACTION: Cutterhead dredges are normally designed for operation in calm waters of rivers and estuaries. Their stability in currents is principally determined by the mooring characteristics. Operations of such dredges in waves over 0.6 meters (2 ft) in height becomes inefficient and the operation is ineffective in waves over 1 meter (3 ft) in height and may cause serious damage to trunions and, or ladder. The study will be directed to investigate new concepts in dredge design permitting it to operate safely and efficiently in 2 meter (6 ft) waves. To achieve required stability twin semi-submersible, catamaran hulls and other designs will be considered. The various concepts will be evaluated on the basis of their effectiveness, flexibility, initial and operational costs.

END PRODUCT: New design concepts for cutterhead dredges capable of operating offshore in moderate waves.

BENEFIT: Greater productivity for dredge production and greater on-the-job record. Specifically:

1. Increase on-the-job time from 30 to 90 percent
2. Decrease unit costs of dredging offshore
3. Decrease the chance of dredge sinking during a storm.

SCHEDULE:

Year 1

1. Name concepts and alternative design ideas.
2. Select three most promising concepts for detailed study.
3. Design model study.

Year 2

1. Conduct small-scale model studies of selected conceptual designs.
2. Modify designs to increase ship's stability in waves.

Year 3

1. Build a 1/4 model of the prototype vessel.
2. Test vessel's performance in waves.

BUDGET:

Year 1 - $100,000
Year 2 - $200,000
Year 3 - $750,000

PRIORITY:

2-6 MANGANESE NODULE EXTRACTION PROCEDURES

OBJECTIVE: To stimulate ocean mining for hard minerals.

PLAN OF ACTION: Development efforts in the recovery of manganese nodules from the ocean floor have moved forward under commercial stimulus in the civilian sector. Commercial development planning has proceeded on the basis of projected harvesting techniques and at least one preferred extraction technique for recovery of the base metals. The latter area lends itself best to laboratory exploration of processes and techniques and is a source of stimulation for the commercial development of the oceans.

1. Review current techniques for the extraction of nickel, copper and cobalt from the manganese nodules. The proprietary nature of commercial processes will introduce difficulty in the establishment of such a data base, however, outline process approach information should be available even if details are not.

2. Analyze techniques on basis of chemical and physical processes and cost effectiveness of one against the other for each metallic extraction.

3. Determine promising new approaches and for each, outline a laboratory experimental series aimed at proving its feasibility and commercial applicability.

END PRODUCT: Information base upon which to plan for developments of more effective extraction processes.

BENEFIT: Stimulate recovery of hard mineral ocean resources.

SCHEDULE: 2 years.

BUDGET: $150,000.

PRIORITY:

2-7 DEEP OCEAN ENVIRONMENTAL TEST FACILITY

OBJECTIVE: To stimulate deep ocean industry.

PLAN OF ACTION: Although a number of hyperbaric facilities exist in this country, they are relatively small and unsuited for large scale simulations of the ocean environment. There is a need for a suitable U.S. facility in which large scale commercial test, development efforts and evaluations of materials, instruments, devices and operational techniques can be conducted under simulated deep ocean conditions. Such a facility could be modeled after that presently in being at Japan's Marine Technology Center north of Yokosuka.

1. Assemble a compilation of desired research, test, development and evaluation capabilities that a deep ocean test facility should provide to support the necessary technological needs of the oil and gas, mining and other deep ocean industries.

2. Prepare an outline design and associated costing and implementation schedule for a facility to provide the capabilities previously defined.

END PRODUCT: Preliminary design data upon which to base planning and budget requests for a deep ocean test facility.

BENEFIT: Would lead to acceleration of deep ocean technology and associated stimulation of commercial oceans development.

SCHEDULE: 1 year

BUDGET: $150,000

PRIORITY:

2-8 MINERAL GENESIS

OBJECTIVE: To expand the knowledge base with regard to ocean mineral origin.

PLAN OF ACTION: Successful exploitation of deep ocean mineral resources depends in good measure on the degree of understanding of the mechanisms of formation and deposit. Although considerable geological data exists with regard to terrestrial mineral deposits, the inaccessability of deep ocean deposits has inhibited efforts to expand this data base in the marine environment. A basic research program aimed at marine mineral origin and the mechanics of their deposit and concentration seems a requisite to successful ocean development.

1. For a discrete number of economically and strategically interesting minerals, such as nickel, manganese, and cobalt, establish a background compendium of past geological research efforts and results.

2. Analyze the research background of each material with the twofold objective of identifying gaps in the knowledge spectrum and determining those elements of the basic research which might be affected or influenced by a marine vice terrestrial environment.

3. On the basis of the background analysis, layout a basic research program aimed at broadening understanding of marine mineral formation genesis and the mechanisms of deposit and concentration. The breadth of the program should cover those mineral elements of strategic and economical interest to the United States.

4. Implement the program on an annual sustaining basis.

END PRODUCT: An ongoing program providing a continuing augmentation of our knowledge with regard to the oceans and its resources.

BENEFIT: Stimulate commercial development of the oceans and demonstrate United States determination to optimize its utilization of the oceans within its economic sphere of influence.

SCHEDULE: Initial research - one year; continuing research.

BUDGET: First year - $1 million

PRIORITY:

2-9 BOTTOM MAPPING OF DEEP OCEAN BASINS

OBJECTIVE: To stimulate deep ocean industry through improved techniques for bottom mapping.

PLAN OF ACTION: Through the years considerable knowledge of the topography and character of the nations harbors and estuaries has been accumulated. Similar information with regard to the deep ocean basins of the world is not available and its accumulation as a stimulus to ocean development is indicated. As a prelude to the accumulation and presentation of such information, improved equipments and techniques for rapid wide area bottom surveys must be developed.

1. For each of the six areas listed below, review the state of the art capability. Establish desirable criteria for advancing the existing technique and define the technology which must be developed to accomplish improved capability. For each area, layout a development plan which will include schedules and budget.

a. Remote surveying capability to acquire information on bottom sediment dispersal patterns and currents.

b. Metal assaying devices to perform on site and provide continuous or averaged readouts.

c. Improved methods for precision positioning at the sea surface, mid-column depth and on the bottom.

d. An improved capability to determine soil properties on the continental shelf and on the deep ocean floors.

e. Improved means for coring and mineral sampling and evaluation.

f. Automatic capability to provide reconnaissance scale bathymetric, geophysical and geological maps.

END PRODUCT: A detailed accomplishment planning matrix whose orderly and systematic implementation will lead to an improved capability to characterize the deep ocean basins.

BENEFIT: Facilitate implementation of a program to acquire more definitive knowledge of the deep ocean environment.

SCHEDULE: 1 year

BUDGET: $50,000

PRIORITY:

2-10 DEVELOPMENT OF SULFUR AS A CONSTRUCTION MATERIAL

OBJECTIVE: To stimulate the commercial recovery of sulfur from the ocean areas by broadening its marketability.

PLAN OF ACTION: The National Research Council of Canada has been exploring the utilization of sulfur in such forms as sulfur concrete in competition with cement, as a waterproofing agent, and in combination with asphalt as a road surfacing agent. Broadening sulfur's utilization beyond its present use as an acid base would stimulate its production and sale.

1. Review the work of the Canadian National Research Council and other sulfur utilization projects as reported in the literature.

2. Select one or more promising initiatives and develop project plans aimed at demonstrating practicability and degree of cost-effectiveness.

3. Implement planning on one or more projects as feasible.

END PRODUCT: Potential new uses for an ocean based element resource.

BENEFIT: Contribute to improved commercial development of the oceans.

SCHEDULE: Two years.

BUDGET: Review and planning $50,000; Project $150,000.

PRIORITY:

Hard Minerals

2-11 AIR POLLUTION CONTROL IMPACT ON OFFSHORE SULFUR PRODUCTION

OBJECTIVE: To reassess the importance of offshore sulfur production in the light of potential new sulfur sources.

PLAN OF ACTION: Pending air pollution control regulations aimed at utilization of sulfur free oil and coal fuels has the potential to realign the existing Frasch Gulf sulfur production and its closely associated southern markets. The resulting terrestrially deployed sulfur sources would effectively remove the production of that commodity as a consideration in commercial oceans development.

1. Investigate the feasibility of using the by-product sulfur from oil and coal burning purification processes as a substitute for current commercial sulfur sources.

2. Explore the projected time frame for such a development in relation to the current capital investment in Gulf sulfur and estimates of its depletion.

END PRODUCT: Studied information upon which to base development planning.

BENEFIT: More effective oceans development planning.

SCHEDULE: One half year.

BUDGET: $15,000.

PRIORITY:

2-12 IMPROVED SULFUR TRANSPORTATION

OBJECTIVE: To facilitate the offshore production of sulfur by improving its transportability.

PLAN OF ACTION: Since approximately 90 percent of all sulfur currently mined is converted to sulfuric acid as a sale product, it may be economically feasible to produce the end product at the mining platform and ship it as a finished product instead of liquid sulfur. The potential for increasing numbers of energy sources in offshore siting would be an added incentive.

1. Explore the merits of sulfur transfer in the concentrated sulfuric acid form vice liquid state. Safety, handling ease, volumes involved and net cost effects of the two modes need to be explored. Accessibility of existing mining sites to ready marine transportation may also be a factor as well as the location of the consumer market in regard to marine and interfacing shipping modes.

END PRODUCT: Studied information upon which to base development planning.

BENEFIT: More effective oceans development planning.

SCHEDULE: One half year.

BUDGET: $15,000

PRIORITY:

2-13 NEW USES FOR COBALT

OBJECTIVE: To ascertain what benefits might be derived from a large new supply of cobalt as a result of ocean mining.

PLAN OF ACTION: Of the four recoverable metallic elements of mananese nodules, cobalt is the least utilized. Broadening the marketability of cobalt would be an added stimulus to nodule recovery.

1. Review the current industrial uses of cobalt and the important chemical properties and characteristics associated with each utilization.

2. On the basis of the uses/characteristics matrix, predict potential additional utilization areas, within various price ranges.

3. Develop a laboratory experiment or demonstration procedure aimed at substantiating the viability of the predicted new cobalt uses.

END PRODUCT: Report of predicted new cobalt uses.

BENEFIT: Facilitate solution to possible problem of surplus production of cobalt as a result of manganese nodule mining.

SCHEDULE: One year.

BUDGET: $50,000.

PRIORITY:

2-14 USE OF FERROMANGANESE RESIDUE IN STEEL MAKING

OBJECTIVE: To stimulate ocean mining for hard minerals.

PLAN OF ACTION: After the extraction of nickel, copper and cobalt from the manganese nodules, the remaining ferromangenese residual may be of sufficient purity to be utilized as a low grade additive in the steel making industry. Such utilization would only be possible if the residue did not contain metal trace elements detrimental to the steel or if undesirable residuals could be cost effectively removed.

1. Procure or generate ferromanganese residue samples from as many varied geographical locations as are readily obtainable. The proprietary nature of ongoing commercial developments will impact this undertaking however nodule samples have been recovered by other than the principle commercial developers and extraction processes on a laboratory scale are available.

2. Conduct standard laboratory qualitative and quantitative analysis of the residues to determine compositions.

3. Analyze compositions with regard to metallurgical impact on the steel making process.

END PRODUCT: Analytical information upon which to base judgements as to the suitability of process residue for use in steel making.

BENEFIT: Improve the profitability of manganese nodule mining and stimulate its commercial development.

SCHEDULE: One year

BUDGET: $200,000

PRIORITY:

2-15 EVALUATE AND INVESTIGATE ALTERNATIVE ENVIRONMENTALLY SAFE METHODS FOR DISPOSAL OF TAILINGS FROM MANGANESE NODULE REFINERY OPERATIONS

OBJECTIVE: To establish criteria for disposal of tailings.

PLAN OF ACTION

1. Investigate types of tailings generated
2. Establish criteria for disposal on land and sea taking into consideration the following factors:

   (a) Environment
   (b) Social
   (c) Economic
   (d) Legal

3. Investigate feasibility of using tailings for landfill, or as source of raw material for aggregate or other industrial uses, taking into consideration the environmental and economic impacts.

END PRODUCT: Environmentally safe method for disposal of tailings.

BENEFIT: Minimization of environmental impact of tailings disposal

SCHEDULE: 2 Years

BUDGET: First year $500,000 Second year $500,000

2-16 OCEAN BOTTOM SURVEY SYSTEMS

OBJECTIVE: Develop a submarine device to conduct subsea surveys with great accuracy and low costs.

PLAN OF ACTION: The sequence of steps would include:

1. Development of Specifications.
2. Design and develop suitable system.
3. Conduct tests of system components.
4. Design prototype vehicle/device.
5. Fabricate prototype.
6. Conduct test and evaluation of prototype.

END PRODUCT: A survey device which can map and survey the ocean bottoms with great accuracy and low costs.

BENEFIT: Allows accurate locations of boundaries and prevents time lost in attempting to locate particular sites.

SCHEDULE: Program duration would be 3 years. Milestones:

1. System development
2. Component test reports
3. Prototype fabrication
4. Test results.

BUDGET: First year - $500,000; second year-$2 million; third year-$4 million.

PRIORITY:

2-17 REMOTELY OPERATED GEOLOGICAL SUBMARINE DEVICE FOR OCEAN BOTTOM SAMPLING

OBJECTIVE: Develop a means of taking multiple surface and sub-surface bottom samples in water depths up to 6,000 meters with high degree of location accuracy.

PLAN OF ACTION: System development; system component testing; prototype design, fabrication and tests.

1. Design and develop suitable system.
2. Conduct tests of system components.
3. Design prototype vehicle/device
4. Fabricate prototype
5. Conduct test and evaluation of prototype.

END PRODUCT: A remotely operated sub-sea geologists' aid.

BENEFIT: Automated remote survey on minerals and ore deposits on ocean bottom areas.

SCHEDULE: Program duration would be 3 years. Milestones:

1. System development
2. Component test reports
3. Prototype fabrication
4. Test results

BUDGET: First year - $ 500,000; second year - $1,500,000
third year - $3,000,000

PRIORITY:

2-18 DEVELOPMENT AND UTILIZATION OF UNDERSEA VEHICLES IN ARTIC SEAS

OBJECTIVE: Develop plan for an Arctic Ocean engineering program to adapt current technology to military and civilian needs.

PLAN OF ACTION: Navy and NOAA conduct a joint study to prepare a program plan for technology development suitable for mutual needs. The Naval Undersea Center could conduct the R&D effort with NOAA participating in a supporting role.

END PRODUCT: Program plan.

BENEFIT: Provide early identification of needs and problems in this vital area of exploration for resources yet without suitable equipment and systems to survey, assess and recover them.

SCHEDULE: One year study to develop a program plan followed by R&D.

BUDGET: $100,000 for first year with recommendations for ensuing years made part of the program plan.

PRIORITY:

2-19 MARINE SAND AND GRAVEL RESOURCES

OBJECTIVE: To assess the marine sand and gravel deposits available to U.S. industry and develop efficient and economical means for their recovery.

PLAN OF ACTION: In Great Britain, recovery of sand and gravel from marine deposits has frequently proven more economical than shoreside recovery. Presumably, this could also be true in the United States. To the extent that concrete is used increasingly in offshore and nearshore structures, recovery of the sand and gravel constituents from marine deposits may prove even more economical because of the transportation factor.

There are three major components of this action plan. The first is the assessment of marine sand and gravel deposits available to U.S. industry through offshore surveys and sampling activities. The second is the development of suitable technology to support a marine recovery industry. The third is the assessment of the environmental impacts such activities may have on the marine environment, both at the immediate site of extraction and in surrounding areas. Each of these three thrusts could be focused in different institutional research and development teams.

END PRODUCT: An assessment of marine sand and gravel resources as a stimulus to additional ocean industry which can serve the cause of commercial ocean development.

BENEFIT: Bring about reduced costs in commercial ocean development and increase availability of important materials.

SCHEDULE: Five years, the first three years to be spent in survey, design, and environmental impact assessment; the following two years to be spent in initiating the first large-scale recovery projects.

BUDGET: $300,000 for the first year; following budgets to be determined during the first year.

PRIORITY:

Hard Minerals

2-20 MANGANESE NODULE INDUSTRY

OBJECTIVE: Examine institutional constraints affecting the establishment and expansion of a manganese nodule industry.

PLAN OF ACTION:

1. Study alternative measures to provide security of tenure.

   (a) Domestic legislation
   (b) Law of the Sea Treaty

2. In the event of a Treaty study the means by which it could be put into effect.

   (a) Provisional application
   (b) Implementing domestic legislation

3. Tax treatment vis a vis a Treaty requires clarification particularly with references to the question of how payments to the authority will be treated by U.S. Treasury.

END PRODUCT: A viable manganese nodule industry

BENEFIT: Increasing independence from foreign sources; improved balance of payments, and increased availability of metallic raw materials.

SCHEDULE: Six months

BUDGET: $100,000

PRIORITY:

2-21 THE USE OF MANGANESE

OBJECTIVE: To determine a broad range of uses for manganese which could simultaneously reduce the nation's dependence on other materials and also increase the potential profitability of ferromanganese nodule recovery and refinement.

PLAN OF ACTION: Study the following:

1. New uses for manganese metal
2. New uses for manganese alloys
3. Potential uses for manganese compounds for catalytic purposes
4. Use of manganese for demetallizing
5. Use of manganese as an anti-knock compound in gasoline

END PRODUCT: A reduced dependence on the importation of other metals and an expanded ferromanganese nodule recovery, refinement and employment industry in the U.S.

BENEFIT: New business based on availability of new sources of manganese.

SCHEDULE: Five years

BUDGET: $500,000

PRIORITY:

2-22 DEVELOPMENT OF ON-BOARD MARINE MINERAL ASSAY EQUIPMENT

OBJECTIVE: To develop equipment that will assay samples on-board the survey ship and thereby expedite exploratory activities.

PLAN OF ACTION: The sequence of steps would include:

1. Review available data and equipment used in full-scale assay laboratories.

2. Determine parameters for on-board assaying equipment.

3. Design prototype unit and evaluate on land.

4. Install on-board survey ship, run field trials, monitor results, and institute necessary changes.

END PRODUCT: A ship-board assay laboratory capable of conducting all tests (as on land).

BENEFIT: Would provide for immediate analysis thereby enabling expeditious modifications of the exploration survey or core drilling.

SCHEDULE: Two years

BUDGET: $250,000

PRIORITY:

Hard Minerals

2-23 DESIGN LONG-DISTANCE PIPELINE SYSTEMS FOR OCEAN DREDGES

OBJECTIVE: To initiate the development of new designs and techniques to allow for the construction of long-distance pipelines for discharge of materials from offshore mining and dredging sites.

PLAN OF ACTION: The sequence of steps would include:

1. Review the current state-of-the-art of dredge pipelines from literature searches and interviews with dredge operators; also state-of-the-art of land-based material lines (e.g., coal slurries).

2. Determine necessary design characteristics for long-distance pipelines.

3. Evaluate the potential use of varying materials, such as aluminum and flexible synthetics, as well as pumping systems, fluid additives, pipe configuration, etc.

4. Prepare a design of a long-distance pipeline incorporating desired features.

END PRODUCT: New long-distance material pipeline design.

BENEFIT: Result is increased productivity on offshore dredging and mining operations.

SCHEDULE: One year

BUDGET: $150,000

PRIORITY:

Hard Minerals

2-24 PREPARATION OF ENVIRONMENTAL GUIDELINES FOR OCS HARD-ROCK MINING OPERATIONS

OBJECTIVE: To establish at an early date definitive environmental guidelines required for the issuance of OCS mineral leases.

PLAN OF ACTION: The sequence of steps would include:

1. Examine all available data and present OCS hard-rock operations in U.S. (e.g., Florida and Alaska).

2. Evaluate proposed marine mining schemes for potential environmental impact and re-evaluate previously issued guidelines.

3. Prepare draft environmental guidelines using the best available technology currently applicable, including recommendations on the scope of continuing environmental monitoring that will be required.

4. Prepare draft lease regulations that would encourage OCS mining activity yet provide for reasonable amortization of environmental equipment.

END PRODUCT: Handbook of environmental regulations and guidelines governing OCS mining operations.

BENEFIT: Encourage offshore mining consistent with reduction in environmental risks.

SCHEDULE: Eighteen months

BUDGET: $75,000

PRIORITY:

2-25 IMPLEMENTATION OF PROTOTYPE ENVIRONMENTALLY - SAFE MARINE MINING OPERATIONS FOR SAND AND GRAVEL

OBJECTIVE: Determine the baseline environmental conditions in one area of commercial interest, monitor a prototype commercial-scale mining operation, document changes in the benthos and in the pelagic ecosystem during mining as well as following mining, and then develop environmental standards and guidelines for use in formulating operating regulations.

PLAN OF ACTION: Regions of interest are already defined. The test area will be identified through consultation between industry and government. Baseline conditions will be measured for one year. Heavily-monitored commercial scale mining for up to one year will follow. Recovery of the water column and benthos will be documented, then environmental standards and guidelines prepared.

END PRODUCT: Development of facts concerning the environmental effects of marine sand and gravel mining.

BENEFIT: Regulations would be prepared, based on factual information, whereby mining could occur off metropolitan areas in need of construction aggregate for urban construction projects. Use of offshore sources would minimize (onshore) truck haulage from "beyond suburbia" to downtown construction sites.

SCHEDULE: A four year project is proposed; the test area will be selected during the first year, monitoring of a prototype mining operation will occur during the second year, with post-mining studies occurring in the third and fourth years along with the final analysis of findings.

BUDGET: Year #1 - $ 500.000
Year #2 - $1,000,000
Year #3 - $1,000,000
Year #4 - $ 500,000

PRIORITY:

2-26 DEVELOPMENT OF INCENTIVES FOR MARINE MINING

OBJECTIVE: To establish means of promoting OCS hard rock mineral activity and new and improved design of systems, equipment, and vessels to be used for mineral exploitation of the OCS.

PLAN OF ACTION: The sequence of steps would include:

1. Review the present U.S. OCS mineral (hard rock) leasing program
2. Review the offshore hard rock mineral leasing programs of other countries.
3. Evaluate and recommend changes in U.S. leasing program to encourage hard rock mineral exploration and development.
4. Propose a series of plans encompassing subsidies, grants, R&D funds, etc. for design and development of new and improved equipment.
5. Propose a plan whereby industry can advise government as to what R&D efforts and services the government should undertake.
6. Evaluate the wherewithal and methods for providing government aid to the hard rock marine mining industry. 9direct subsidies, changes in tax structure, varying royalty payments, etc.)

END PRODUCT: Overview of Federal incentives for fostering hard rock mineral mining.

BENEFIT: Aid the development of marine hard rock mineral exploitation.

SCHEDULE: One year

BUDGET: $ 100,000

PRIORITY:

Hard Minerals

2-27 ENVIRONMENTAL IMPACT OF U. S. DEEP OCEAN MINING FOR MANGANESE NODULES

OBJECTIVE: To develop close collaboration between the government, the marine mining industry, and other interested groups through a joint program to develop environmentally safe deep ocean mining.

PLAN OF ACTION: The sequence of steps would include:

1. Determine environmental baseline conditions in selected representative deep ocean manganese nodule mining sites.

2. Develop predictive models of environmental changes.

3. Establish preliminary environmental guidelines for deep ocean mining of manganese nodules.

4. Monitor effects on the marine environment of industrial testing of manganese nodule mining equipment.

5. Document changes induced in the ecosystems by deep ocean mining testing.

6. Test and refine predictive environmental models.

7. Recommend changes if necessary in mining methods and equipment.

8. Finalize guidelines

9. Prepare an adequate Environmental Impact Statement for manganese nodule mining.

10. Formulate environmental criteria and regulations for manganese nodule mining.

END PRODUCT: An objective evaluation of the environmental impacts caused by deep ocean mining of manganese nodules and a set of proposed environmental criteria and regulations to minimize resulting effects.

BENEFIT: Provide for commercial exploitation of needed mineral resources in the deep ocean with minimal environmental damage.

SCHEDULE: Three years

BUDGET: $ 6,000,000

PRIORITY:

2-28 A FLOATING PROTOTYPE METAL EXTRACTION AND PROCESSING SYSTEM

OBJECTIVE: To develop, construct and deploy a prototype marine metal extraction and processing plant which could provide nickel, cobalt and copper for industrial users.

PLAN OF ACTION:

Phase 1 System Analysis

1. Establish the metal requirements for industrial consumption.
2. Establish technical and economic feasibility of floating plant.
3. Project needed technical development.
4. Analyze sociological and economic impacts and benefits.
5. Develop preliminary environmental and energy impact assessments.
6. Establish fiscal policies and implementation schedules.

Phase 2 Prototype Development

1. Design and construct appropriate scale models of system.
2. Design and test links with existing metal distribution networks.
3. Establish personnel training requirements and programs.
4. Establish construction costs and schedules.

Phase 3 Deployment

1. Implement construction of marine metal extraction and processing plant and associated equipment.
2. Modify existing distribution network for acceptance of seabased metals.
3. Implement construction of land facilities.

END PRODUCT: To develop, construct and deploy a prototype metal extraction and processing plant for industrial use.

BENEFIT: A demonstrated capability of an alternative method of nickel, cobalt and copper extraction and processing that is low cost, highly efficient and environmentally sound.

SCHEDULE:

BUDGET:

PRIORITY:

2-29

OCEANOGRAPHIC AND METEOROLOGICAL INFORMATION FOR U.S. COMMERCIAL DEVELOPMENT OF THE OCEANS

OBJECTIVE: Almost all activities in or on the ocean are affected by the state of the environment. Insufficient information on the present condition of the environment and its predicted future states is currently available. This program element contains required steps to provide an adequate environmental information program on an engineering basis for most United States Ocean interests.

PLAN OF ACTION:

1. Define required data coverage for ocean areas including satellite data, ship observations, buoy observations, island observations, observations from fixed platforms, and observations from other sources.
2. Define the frequencies of observations to be made, the type of information required and engineering accuracy of each measurement.
3. Define the location and number of conventional surface observations, subsurface ocean observations, satellite observations and special types of observations such as spectral sea height and long term record stations which are required.
4. Define a communications system which will collect these observations routinely in a period of a few hours.
5. Determine the model characteristics which will permit the prediction of environmental elements on realistic grid and time spacings.
6. State the computer capability required to make these analyses and predictions.
7. Describe methods by which analyzed and predicted information can be delivered to any U.S. users in engineering terms.

END PRODUCT: The end product shall be a Government provided service of environmental information for all U.S. ocean interests.

BENEFIT: In connection with the Seasat program NASA has identified an annual cost of the order of one billion dollars per year as the total effect of the environment on U.S. ocean activities excluding the Department of Defense. An adequate information system can result conservatively in reducing these penalties by one-four to one-half.

SCHEDULE: Efforts described under Plan of Action can be obtained from a three or four year program with the following milestones.

2-29 (Continued)

First year: State objectives and detail the plan of action. Develop automatic weather stations for ocean sites and platforms and automatic communication equipment to take oceanographic observations with satellite data collection. Open a project office whose mission will be to increase the taking of the required observations and their timely collection.

Second Year: Begin a detailed synoptic analysis of the ocean, air-ocean boundary layer and subsurface structure on a routine basis world-wide in scope. Develop a prediction model to integrate with an appropriate model for the free atmosphere.

Third Year: Begin predictions on a routine basis and begin to develop user interfaces.

BUDGET:

First year: 50 Million
Second year: 150 Million
Third year: 200 Million
Subsequent costs after development: 100 Million/year

PRIORITY:

2-30 INVESTIGATION OF STRUCTURAL MATERIALS

OBJECTIVE: To improve systems components to support total systems for commercial deep ocean mining operations with respect to:

1. Fatigue life of material in sea water, and fracture mechanics of materials exposed to sea water and other corrosive media at high stress levels.

2. The effect of residual stresses due to welding.

PLAN OF ACTION: With regard to materials and structures for marine mining applications, the federal government and industry will conduct a comprehensive materials testing program to evaluate selected materials and characteristics of those materials, accomplish the program by 1978, and publish a report for public use. Testing will be carried out by independent laboratories and the program will concentrate on:

1. Materials: Steels, titanium, aluminum

2. Form of Test Specimens: weldments, forgings, sheet, and plate

3. Evaluation parameters: near stress levels, stress ration, S/N curve (where S/N = stress level/number of cycles) on air and water, and stress concentration factors.

END PRODUCT: More reliable systems for deep ocean mining.

BENEFIT: Better capability for the development of marine mineral resources by U.S. firms. Improved safety of operations.

SCHEDULE: Two years

BUDGET: First Year $500,000
Second Year $500,000

PRIORITY:

2-31 COMPONENT AND SYSTEMS RELIABILITY

OBJECTIVE: To improve component and systems reliability

PLAN OF ACTION: With regard to component and systems reliability, an organization to form standards will be set up, utilizing the expertise of both government and industry. (Compare the Scandinavia Det Norske Veritas) Components that are common to several engineering problems such as pressure compensation will be standardized. Others that require custom design will be required to follow standardized development guidelines, and acceptance testing criteria. Based on the comprehensive materials testing program, guidelines will be established for determining structural design criteria of deep ocean systems.

END PRODUCT: More reliable systems for deep ocean mining operations.

BENEFIT: Better capability for the development of deep ocean mineral resources by U.S. firms. Improved safety of operations.

SCHEDULE: Four years

BUDGET: $3,500,000

PRIORITY:

2-32 DESIGN AND DEVELOPMENT OF AN ELECTRIC MOTOR FOR SUBSEA USE

OBJECTIVE: Provide 200 SHP - 1500 SHP light weight compact electric motor capable of operating at rated load for 6-8 months continuously. This motor should be pressure compensated and capable of operating for extended periods of time at 20,000 foot depths.

PLAN OF ACTION: Award conceptual design contracts to two or three competent research facilities that have a high degree of technology and experience in this particular area. Of the three conceptual designs, a review board should select a design or combination of the three designs that will provide the best overall system. The next phase of the program should be a detail system resulting in system specification that could go out for competitive bidding.

END PRODUCT: The end product of this program should be an electric motor rated at 200- 1500 SHP with a minimum operating voltage of 7500 V that has demonstrated its capabilities in 20,000 feet of water. Along with the delivery of the hardware should be a complete report outlining system design, development, procurement and testing results.

BENEFIT: This type of equipment has use in the offshore oil patch, deep sea drilling, ocean mining, remote underwater work stations and military applications.

SCHEDULE: This program should commence in the first quater of 1976 and be completed including testing in the third to fourth quarter of 1978.

BUDGET: The cost of this program including breadboarding, delivery of prototype and testing will be 1-1/4 - 1-1/2 million. This number is based on 1975 dollar figures and has no inflation allowance for the 2 year program schedule.

PRIORITY:

2-33 DESIGN AND DEVELOPMENT OF A CLOSED CYCLE POWER GENERATOR SYSTEM FOR SUBSEA USE

OBJECTIVE: Provide 1000 KW - 2000 KW power source capable of operating at rated load for 1 to 4 months continuously with refueling capability. The power source should be capable of operating for extended periods of time at 20,000 foot depths.

PLAN OF ACTION: Award conceptual design contracts to two or three competent research facilities that have a high degree of technology and experience in this particular area. Of the three conceptual designs, a review board should select a design of combination of the three designs that will provide the best overall system. The next phase of the program should be a detail system design resulting in system specification that could go out for competitive bidding.

END PRODUCT: The end product of this program should be one complete closed cycle power source rated at 1000 KW - 2000 KW that has demonstrated its capabilities in 20,000 feet of water. Along with the delivery of the hardware should be a complete report outlining system design, development, procurement and testing results.

BENEFIT: This type of equipment has use in the offshore oil patch, deep sea drilling, ocean mining and military applications.

SCHEDULE: This program should commence in the first quarter of 1976 and be completed including testing in the third to fourth quarter of 1979. A program of this magnitude and complexity will have severe difficulties if schedule compression is tried.

BUDGET: The cost of this program including breadboarding, delivery of prototype and testing will be 30-35 million. This number is based on 1975 dollar figures and has no inflation allowance for the 3-1/2 year program schedule.

PRIORITY:

2-34 DESIGN AND DEVELOPMENT OF HIGH POWER SEMICONDUCTOR SWITCH GEAR FOR SUBSEA USE

OBJECTIVE: Provide high power semiconductor switch gear for underwater power system. This switch gear should be capable of operating at rated load 1000 KW - 2000 KW for 10-12 months continuously without failure. This equipment should have automatic sense circuits for protection against overvoltage, overloads and shorts.

PLAN OF ACTION: Award conceptual design contracts to two or three competent research facilities that have a high degree of technological knowledge and experience in this particular area. Of the three conceptual designs, a review board should select a design or combination of the three designs that will provide the best overall system. The next phase of the program should be a detail system resulting in system specification that could go out for competitive bidding.

END PRODUCT: The end product of this program should be a complete solid state gear system rated at 1000 KW - 2000 KW that has demonstrated its capabilities in 20,000 feet of water. Along with the delivery of the hardware should be a complete report outlining system design, development, procurement and testing results.

BENEFIT: This type of equipment has use in the offshore oil patch, deep sea drilling, ocean mining, remote underwater work stations and military applications.

SCHEDULE: This program should commence in the first quarter of 1976 and be completed, including testing, in the third to fourth quarter of 1978. A program of this magnitude and complexity will have severe difficulties if schedule compression is tried.

BUDGET: The cost of this program including breadboarding, delivery of prototype and testing will be 8 - 10 million. This number is based on 1975 dollar figures and has no inflation allowance for the 2-year program schedule.

PRIORITY:

LIVING RESOURCES

LIVING RESOURCES

INCREASING FISH PRODUCTION

LIVING RESOURCES PANEL

INCREASING FISH PRODUCTION

3-1 Improved Methods of Living Marine Resources Management
3-2 Economic Incentives for Marine Fisheries
3-3 Stimulate Fish Harvesting Productivity
3-4 Improved Fish Locations and School Concentration Techniques
3-5 Improved Commercial Fishing Technology
3-6 Floating Food Processing Complex
3-7 Fishery Strategy and Engineering Research For Conservation of Northwest Atlantic Fisheries
3-8 Multi-Use Harvesting Vessel
3-9 Development of Processing Methods for Underutilized Fishery Resources
3-10 Multi-species Fish Preservation Systems Aboard Vessels in the Northeast Pacific
3-11 Development of A U.S. Fish Block Industry
3-12 Useful Microorganism From the Sea
3-13 Recovery of Shrimp Fishery Incidental Catch
3-14 Unmanned Fishing Systems
3-15 Control of Fish Stocks
3-16 Survey of Fish Holding Conditions Aboard Vessels
3-17 Developing Fisheries for Underutilized Fishes in the Eastern Gulf of Mexico
3-18 Industry - Government Ventures on Alaskan Surf Clam
3-19 Investigations on the Biology and Fisheries of Baitfishes in Florida
3-20 Determine Abundance and Seasonal Distribution of Scombroid Fish Stocks
3-21 Coastal Pelajic Fishery Development
3-22 Hydrogenated Fish Oils As An Energy Source In Milk Replacers
3-23 Development of Bottomfish Fishery In the Gulf of Mexico
3-24 Extension of Known Raw Material Resources
3-25 Study of Per Capita Consumption of Fish In the U.S.
3-26 Application of Alternative Technology In the Shrimp Fisheries
3-27 Application of Alternative Technology In the Spiny Lobster Fishery
3-28 Improving Fish Production At Sea
3-29 Development of Increased Knowledge Concerning Histamine and Histamine-Like Substances
3-30 Dynamics of Great Lakes Fisheries

3-1 IMPROVED METHODS OF LIVING MARINE RESOURCES MANAGEMENT

OBJECTIVE: The concepts of maximum sustainable yield and optimum sustainable yield are altogether overly simplistic. A great deal of evidence strongly suggests that marine populations undergo natural fluctuations in numbers and that they may be extremely sensitive to fluctuations in environmental conditions beyond human control. Moreover, secondary effects of human activities may produce significant responses in population dynamics of living marine resources. It is, then, necessary to understand the essential parameters dictating marine populations and the dynamics of their interactions.

PLAN OF ACTION: Initially, an exemplary four trophic level example in an easily defined body of water should be selected and submitted to intensive systems analysis including dynamic modeling by the most capable people available. Once this initiating activity results in a firm understanding of the dynamics of the exemplary system, attempts should be made to broaden the methods to larger and more complex marine ecosystems. NORFISH at the University of Washington is an initial example of the type of project suggested here. However, the work will require more funding and a broader base of able people.

END PRODUCT: Guidelines and rules for the management of living marine resources.

BENEFIT: Sustainable yields which, though possibly fluctuating, will be the maximum possible to obtain without disturbing the balance of the ecosystem involved.

SCHEDULE: This probably will be an ongoing project for several decades.

BUDGET: $1 million for the first year, gradually increasing to about $5 million per year.

PRIORITY:

3-2 ECONOMIC INCENTIVES FOR MARINE FISHERIES

OBJECTIVE: Probably the single most important cause of the decline of the U.S. marine fisheries lies in the nonreliability of supply and market demand and thus the nonreliability of the income individual operators can expect. When coupled with the relatively high salaries potential fishermen can earn in other endeavors in this country today, it is not difficult to understand why more and more individuals turn away from the hard life at sea to a more comfortable life ashore. In the long run, this is deleterious to the country's best interests in that it is resulting in the death of one component of our industrial base and adversely affecting the balance of trade. The objective of this program element is to establish effective economic incentives which, along with improved technology, will foster the expansion of the U.S. fishing industry.

PLAN OF ACTION: A competent group, which may be a single institution or a team, should be selected to study the problem thoroughly and develop a feasible plan for a series of economic incentives which can result in the expansion of the U.S. fishing industry.

END PRODUCT: An expanded U.S. fishing industry.

BENEFIT: Improved internal economic structure and improved balance of trade position.

SCHEDULE: Suggest 2 years for the development of the plan mentioned above.

BUDGET: $500,000 for the first two years.

PRIORITY:

3-3 STIMULATE FISH HARVESTING PRODUCTIVITY

OBJECTIVE: To stimulate the U. S. Commercial fisheries industry by improving its productivity.

PLAN OF ACTION: The incursion of foreign fishing fleets in the coastal zones adjacent to U. S. shores has introduced a quantum gap between the productivity of the U. S. fleet and its foreign competitors. Economies of scale and onsite processing have in the main obsoleted the harvesting techniques of the domestic fishing fleet. With the prospective establishment of a large protected U. S. economic zone, the opportunity to improve the productivity of the U. S. fleet should not be lost.

1. Explore the comparable capabilities of the present U. S. domestic fishing fleet and its typical foreign competitors.

2. Single out those elements of the U. S. vessel design or equipment design in which technological improvement is required. Emphasis should be placed on reduction of capital and labor intensive aspects.

3. Determine the availability of existing technology which can be directly applied to improved productivity.

4. Outline specific areas where technology must be developed.

END PRODUCT: A planned framework within which governmental or industry funding can be applied to promote a systematic plan for updating U. S. commercial fishing fleet.

BENEFIT: Maximize U. S. return on living resources in the anticipated expanded new economic coastal zone.

SCHEDULE: Single year effort.

BUDGET: $25,000.

PRIORITY:

3-4 DEVELOPMENT OF IMPROVED INSTRUMENTATION AND SYSTEMS FOR LOCATING SCHOOLS OF FISH AND CONCENTRATING SPARSELY DISTRIBUTED STOCK FOR MORE ECONOMICAL HARVESTING.

OBJECTIVE: To increase harvesting of fish.

PLAN OF ACTION:

1. Investigate present-day and proposed instrumentation and system for fish locating.

2. Investigate instrumentation and techniques used in other industries, e.g. side-scan sonar, reflection, etc. and evaluate potential for technology transfer.

3. Investigate and evaluate baiting and lure techniques that can be used to concentrate widely scattered fish schools.

4. Recommend feasible approaches and initiate pilot programs for fish locating and concentrating.

END PRODUCT: New techniques for locating and concentrating fish stocks.

BENEFIT: Increase in efficiency of fish harvesting.

SCHEDULE: Two years

BUDGET: $125,000

PRIORITY:

3-5 IMPROVED COMMERCIAL FISHING TECHNOLOGY

OBJECTIVE: The National Marine Fisheries Service has an ongoing program to assist the U.S. fishing industry in broadening the resource base and in improving its technology. Nevertheless, U.S. offshore fishing technology remains far behind that of Japan and the Soviet Union. In addition, our fisheries industry is steadily declining while those of other nations are steadily expanding, with the result that we continue to import more and more of the fish we consume. The United States does not have a single cannery ship in operation, while the other countries named have many. While the existence of this situation may be attributed more to differences in economic incentives than to the availability of technology, it cannot be denied that a superior technology would, of itself, be an economic incentive to expansion of the U.S. offshore fishing industry.

PLAN OF ACTION: Refine the focus of the present NMFS efforts and broaden the scope. Set priorities for improving traditional fishing technology, as well as priorities for the harvesting of nontraditional living resources. Provide supplemented funding to NMFS to pursue this program consistent with the quality and coherency of the plans NMFS can submit.

END PRODUCT: An expanded U.S. marine fisheries industry.

BENEFIT: An expansion of the economic base that marine fisheries can provide and an improved balance of trade position for the U.S.

SCHEDULE: This would be an ongoing program for at least a decade and possibly two.

BUDGET: Suggest $200,000 to be applied to the NMFS budget to develop a coherent plan of action for five years during the first year.

PRIORITY:

3-6 A FLOATING FOOD PROCESSING COMPLEX

OBJECTIVE: To develop, construct and deploy a prototype mariculture, fishing and seaweed processing complex.

PLAN OF ACTION:

Phase I System Analysis

1. Establish existing and project needed marine food processing capability.
2. Define technical developments.
3. Establish links with existing industrial facilities.
4. Determine engineering and economic feasibility of seabased complex.
5. Develop preliminary environmental and energy impact assessments.
6. Develop fiscal policy and implementation program.

Phase II Prototype Development

1. Design, construct and test scale models of complex.
2. Establish operating envelope of complex.
3. Design terminals and links with existing shore-based facilities.
4. Establish personnel training programs.
5. Establish construction schedules and costs.

Phase III Deployment

1. Implement construction of marine food processing facility and associated support equipment.
2. Implement construction of shore facilities.

END PRODUCT: To deploy a prototype marine-based food processing facility which will be environmentally sound.

BENEFIT: A demonstrated capability of an at sea, low cost, highly efficient marine food processing complex.

3-6

SCHEDULE:

BUDGET:

PRIORITY:

3-7 FISHERY STRATEGY & ENGINEERING RESEARCH FOR CONSERVATION OF NORTHWEST ATLANTIC FISHERIES

<u>OBJECTIVE:</u> Develop and implement a program to provide technical and strategic options for minimizing the impact of fishing activities on non-target marine resource species in the Western North Atlantic. By-catch and discard problems are major difficulties for fisheries management in the Northwest Atlantic. Development of more selective fishing gear and methods are needed to simplify and increase the effectiveness of management strategies under extended jurisdiction.

<u>PLAN OF ACTION:</u> The current over-exploited state of the living marine resources of the Northwest Atlantic off the United States New England and Mid-Atlantic Coasts requires that we move to more controlled and selective fishing operations to rebuild depleted stocks. This program element will conduct detailed studies of various technical, distributional and strategic aspects of the mixed fishery (by-catch or discard) problem, and propose technical and strategic options for reducing mortality on non-target species. More detailed analyses will be made of existing groundfish survey (MARMAP Survey II) data, as well as foreign and domestic commerical fisheries statistics. Special observer surveys will be conducted on board both domestic and foreign commercial fishing vessels to upgrade statistical information on mixed or by-catches and discards. Particular attention will be paid to documenting non-reported mortality of juveniles of non-target species.

Studies will be made of the relative selectivity of existing commercial gear and engineering work undertaken to provide modifications leading to greater selectivity.

Seasonal distributional data on adults and juveniles of important resource species will be analyzed and mapped with great detail, and alternate fishing strategies leading to reduced mortality on non-target species will be developed, proposed and tested.

<u>END PRODUCT:</u> The expected end product will be gear modifications, and fishing strategies or practices that will result in reduction of mortality on non-target species. This, in turn, will lead to better management options which will be implemented through Regional Fishery Management Council regulations.

<u>BENEFIT:</u> More effective management, more rapid and certain recovery of depleted stocks, more efficient and stable fisheries, and an overall increase in the economic yield from the fisheries of the Northwest Atlantic (particularly the domestic fisheries) will result from the studies and implementation of resulting new technology and fishery strategies.

SCHEDULE:

BUDGET:

PRIORITY:

3-8 MULTI-USE HARVESTING VESSEL

OBJECTIVE: Design fishing vessels for maximum use - historically a vessel today is a lobster boat, a halibut boat, a shrimp boat, etc. -- a one specie vessel. We need boats equipped to do several types of fishing and maximize per unit effort of catch and reduce seasonal fluctuations.

PLAN OF ACTION: Design and construct a new class of catch vessel that is capable of working three types or more fishery resources. Gear development to reach various types of resources should be the research and development effort applied here.

END PRODUCT: A more efficient vessel that can be used for additional fishing days. Increase total tonnage landed and capitalize on the potential that would fall to the U.S. under the 200 mile curtain.

BENEFIT: Increased supplies of domestic caught seafood and greater return per unit of catch effort.

SCHEDULE: Three years.

BUDGET: $900,000.

PRIORITY:

3-9

DEVELOPMENT OF PROCESSING METHODS FOR UNDERUTILIZED FISHERY RESOURCES

OBJECTIVE: To provide manufacturing techniques that would make underutilized fishery products acceptable to the consumer.

PLAN OF ACTION:

1. Determine the economically available species.

2. Conduct a consumer survey to gain insight into possible consumer reaction and product usage. This would refer both to the housewife as well as institutions.

3. Prepare the seafood in an appropriate manner in the laboratory.

4. After testing, develop production techniques.

END PRODUCT: Utilization of additional species.

BENEFIT: Savings to consumer, profit to producer and raw material availability.

SCHEDULE: Two years.

BUDGET: $150,000

PRIORITY:

3-10 MULTI-SPECIES FISH PRESERVATION SYSTEMS ABOARD VESSELS IN THE NORTHEAST PACIFIC

OBJECTIVE: To increase productivity and broaden the production capabilities of fishing vessels in the Northeast Pacific by developing and testing multi-purpose systems for handling, chilling, preserving, and freezing underutilized species of fish and shellfish.

END PRODUCT: Recommendations, demonstrations, pilot models, and full-scale installations will be the results from development of systems for multi-species preservation depending on the area, species, and established characteristics of the fishing vessels. Systems will include solutions to specific handling and sorting problems for the fish species, recommendations for conversion of existing vessels, evaluation of operation and maintenance problems, and suggestions for adaptation of preservation techniques to smaller vessels as appears advisable for efficient utilization of existing vessels. Target species proposed for consideration include Alaska pollock, Pacific hake, jack mackerel, anchovy, squid, and herring.

BENEFIT: Benefits include the demonstration of technical and economic feasibility of improved multi-purpose fish preservation systems aboard vessel and their application to harvest and utilization of underutilized fishery resources.

SCHEDULE: Five years.

Milestones will be the specific solutions and unit developments of a preservation system, e.g., handling system for sorting and chilling Alaska pollock, a mechanized system for heading and gutting pollock and freezing in blocks aboard vessel, application of a spray brine chilling procedure for hake and mackerel, and a system for unitized handling and chilling anchovy at sea and for mechanical cleaning (heading, gutting, and washing) ashore.

BUDGET: $1,000,000

PRIORITY:

3-11 DEVELOPMENT OF A U.S. FISH BLOCK INDUSTRY

OBJECTIVE: Develop, design and build a prototype fish block processing plant capable of producing both whole, minced and mixed specie fish blocks.

The U.S. does not have fish block plant production capability at present, we are totally dependent on imports.

PLAN OF ACTION: Contract a food plant construction company to design and build a model operating plant to demonstrate this technology - plant eventually to be commercially sold to processing industry.

END PRODUCT: End total dependence on foreign imports for fish blocks, build new U.S. industry, use of additional domestic raw material and provide more jobs.

BENEFIT: Add additional processing capability to the U.S. industry, increase employment and be in a better position to use fish catch within the U.S. 200 mile limit.

SCHEDULE: Two years from design to final construction and one year as a pilot demonstration unit.

BUDGET: $1,250,000

PRIORITY:

3-12 USEFUL MICROORGANISMS FROM THE SEA

OBJECTIVE: To identify microorganisms in marine environments which have potential industrial or food utility.

PLAN OF ACTION:

1. Seek and identify microorganisms which possess unusually active enzyme systems for breakdown of waste materials.

2. Seek and identify microrganisms with ability to grow in marine environments on low quality substrates to produce biomass of a composition suitable for use as animal or human food.

3. Seek microrganisms which have particular enzymatic or synthetic capabilities useful in industrial processing.

4. Establish optimum conditions for growth and desired activity of the identified microorganisms, either in situ or in artificial culture.

PRODUCT: Useful microorganisms.

BENEFIT: Improved utilization technology, possible new food source, enhancement of marine environment.

SCHEDULE: One to five years.

BUDGET: $150,000 - $1,000,000

PRIORITY:

3-13 RECOVERY OF SHRIMP FISHERY INCIDENTAL CATCH

OBJECTIVE: To recover valuable fish protein presently lost.

PLAN OF ACTION:

1. Develop mechanical sorting systems for use on board the vessel.

2. Develop simple one pass beheading and eviscerating instrument - need not yield high recovery.

3. Utilize deboning machine to produce minced flesh product from headed, eviscerated product.

4. Develop system for stabilizing minced fish.

5. Test complete operation on medium sized shrimp trawler.

END PRODUCT: Usable system for recovery of shrimp by-catch.

BENEFIT: Increased fish production with little increase in energy expenditure and improvement in economic condition of shrimp fishermen.

SCHEDULE: Two years.

BUDGET: $500,000*

PRIORITY:

*Note: The value of fish presently dumped is probably in excess of $10,000,000 per year.

3-14

UNMANNED FISHING SYTEMS

OBJECTIVE: To develop energy-efficient unmanned fishing systems.

PLAN OF ACTION: In general, the plan would be to design and test large free floating or anchored raft or trap systems which would attract, concentrate, and corral fish which are normally dispersed. The fish would be held alive until the traps could be emptied by a collector vessel. Great selectivity could be applied to taking of fish for final processing at this stage to ensure proper management of the stocks and excellent quality raw material.

1. Assemble information on behavior, attractants, etc.

2. Construct experimental systems for test fishing by e.g. light attraction at night.

3. If successful, expand system - with appropriate navigational and other controls - to pilot size to evaluate commercial utility.

END PRODUCT: Unmanned energy-efficient fishing sytems.

BENEFITS: Make dispersed fish species available for harvest. Reduce manpower problems and possibly fishing costs.

SCHEDULE: Five years.

BUDGET: $2,500,000

PRIORITY:

3-15 CONTROL OF FISH STOCKS

OBJECTIVE: To enhance desirable species and improve productivity.

PLAN OF ACTION: Fisheries management is presently based (except for anadromous fish) on conservation. This is self-defeating, since fishing *per se* upsets natural balances. We should be seeking to control and enhance stocks, rather than simply preserving them. This requires a bold new look at living resource utilization and development of new technology.

1. Select accessible ocean area with well-defined but limited commercially desirable species.

2. Determine boundaries of movement of species and feeding habits.

3. Determine competing species and ensure they are not essential to survival of desirable species.

4. Deliberately remove or greatly reduce competing species.

5. Establish perimeter watch of defined area and fence out or eliminate intruding competitors or predators.

6. Seek to enhance food sources for the desirable species.

7. Develop improved monitoring and husbandry techniques.

END PRODUCT: Ultimately development of stock rearing and husbandry processes for marine fish species.

BENEFIT: Assured and stable supply of fish.

SCHEDULE: 7-15 years.

BUDGET: $10 - 50 million

PRIORITY:

3- 16 SURVEY OF FISH HOLDING CONDITIONS ABOARD VESSELS

OBJECTIVE: Practical and operable sanitation program for vessels.

PLAN OF ACTION: Survey statistical sample of vessels in major U.S. fisheries and assess the hygenic conditions of holding fish for human consumption.

END PRODUCT: Basic information would be available describing the current hygienic conditions for holding fish for human consumption.

BENEFIT: Fleets that exhibit regular problems of landing poor quality products can be improved. Consistent quality fish would be landed and sold for a better price thereby improving the economic return to fishermen.

SCHEDULE: 2-3 years.

BUDGET: $350,000

PRIORITY:

3-17 DEVELOPING FISHERIES FOR UNDERUTILIZED FISHES IN THE EASTERN GULF OF MEXICO

OBJECTIVE: Several species of clupeid and carangid fishes suitable for reduction fisheries are abundant in the Eastern Gulf. Biomass estimates have been obtained for some clupeid species, but abundance of most species still is unknown. Resource assessment surveys should be directed at estimating abundance and distribution, determining availability and catchability, and estimating the potential sustainable yield to a fishery.

PLAN OF ACTION: Ichthyoplankton surveys have proved useful in the past to estimate clupeid abundance in the Eastern Gulf and should be continued as a good fishery-independent technique to assess the unexploited fishery resources. In addition, well designed trawling surveys and, possibly, acoustic surveys should be implemented to give further information on seasonal abundance and distribution of the stocks. Lastly, a commercial feasibility program should be carried out to determine if the stocks can be exploited economically. This last aspect is especially necessary for stocks that are present 50 to 150 km offshore in the Eastern Gulf.

END PRODUCT: Valuable new fisheries could be developed in the Gulf of Mexico to supplement the menhaden fishery. A knowledge of stock size and yield potential could be used for management purposes before significant exploitation occurred.

BENEFIT: Economic benefit to develop new significant fisheries. The knowledge obtained on the biology of these stocks will be important in determining their role in the shelf ecosystem and the possible effects on the stocks due to human activity, such as that involved in development of an offshore petroleum industry.

SCHEDULE: A four year effort would be required to accomplish the objectives of the program. Three years would be necessary to assess resources. Commercial feasibility could be determined during years 3 and 4. In year 4 estimates will be made of maximum sustainable yield and potential for fishing, based on stock availability.

BUDGET: A total budget of about $954,000 over four years could accomplish project goals. Research vessel costs at $3,000 per day (194 days in year 1 through 3) total $582,000, which is 61 percent of the total budget.

PRIORITY:

3-18 INDUSTRY-GOVERNMENT VENTURE ON ALASKAN SURF CLAM (SPISULA ALASKANA)

OBJECTIVES: Impetus for this proposal stems from the recent and dramatic decline of the Atlantic surf clam fishery and a commensurate interest by the industry in developing a fishery on the closely related surf clams of the Bering Sea.

PLAN OF ACTION: Action should be implemented in four steps:

(1) Initiation of an Industry-Government Steering Committee to develop guidelines of research particulars including research vessel capabilities, dredging gear survey areas and financing of the venture (preliminary meetings have already been held at the industry's request).

(2) Collection of samples in the Bering Sea during April and May 1976 to test for the presence of paralythic shellfish poisoning (PSP), and marketing and technological studies.

(3) Exploratory surveys of selected Bering Sea waters, gear modification studies, production fishing trials and additional marketing and technological studies during the spring-summer of 1977.

(4) Additional surveys as required to promote development of the fishery (1978-1979). Throughout this fishery development program, one additional objective would be to monitor incidental catches of non-target species and measure the impact of this fishery on the environment and living resources which are dependent upon clam species.

END PRODUCT: Assuming good resource availability, the expected outcome would be development of a clam fishery which might produce conservatively 50 million pounds of meat annually for a market which has a strong demand for a raw material (clam meats) in short supply.

BENEFIT: Successful development would result in a fishery with an ex-vessel value of 30 million dollars annually, extension of the fishing season for West Coast king crab vessels which are now tied up in between king crab seasons, and employment opportunities for many East Coast clam vessels and crews which are currently idle or not able to find full employment.

SCHEDULE: Project activities should cover four years. Completion of each "action phase" would be a project milestone and decision point.

BUDGET:	First Year:	$ 5,000 Each Year	Marketing sample collections as part of ongoing Bering Sea MARMAP surveys.
	Second Year:	$250,000 Each Year	Vessel charter and related costs for 80-day exploratory fishing and production fishing trials.
	Third and Fourth Years:	$250,000 Each Year	Expansion and refinement of efforts initiated in second year together with other aspects of Bering Sea clam fishery development as identified by joint Industry-Government Steering Committee.

Total: $755,000

PRIORITY:

3-19 INVESTIGATIONS ON THE BIOLOGY AND FISHERIES OF BAITFISHES IN FLORIDA

OBJECTIVE: A commercial fishery for baitfishes is important in Florida. Some species that are exploited include ballyhoo, silver mullet, sardines of at least three species, and round shad.. These fisheries are of concern to recreational fishermen who demand bait, yet worry that exploitation of such fishes damages the food supply of gamefishes. The baitfish and their fisheries should be investigated to determine their potential for exploitation and the important of these species in Florida marine ecosystems.

PLAN OF ACTION: The fishery should be investigated. Catches, effort, areas and trends should be determined. The distribution and abundance of the stocks can be outlined and a knowledge of age, growth, mortality, and maturity of the various species must be obtained. Potential annual yields of the species to a fully developed fishery could then be predicted.

END PRODUCT: The potential of the baitfish stocks to be exploited without endangering them or harming recreational fishing will be determined. Management measures, if needed, can be recommended.

BENEFIT: Benefits would be obtained by both commercial and recreational fishermen. Commercial fishermen will benefit from information on yield potential and trends in the fishery. Recreational anglers will benefit from effective management measures that ensure continued supplies of bait, while maintaining stock sizes at high enough levels to serve as food for gamefishes.

SCHEDULE: The proposed program would require four years to complete. In the first year the fishery and its participants would be studied. Catches and effort would be monitored over the entire four year period. Biological studies would be carried out in the first three years. Stock size and yield potentials could be obtained in year four. Recommendations regarding management needs would be provided at the end of year four.

BUDGET: $244,000

PRIORITY:

3- 20 DETERMINE ABUNDANCE AND SEASONAL DISTRIBUTION OF SCOMBROID FISH STOCKS

OBJECTIVES: Determine the abundance, seasonal distribution, composition, and related environmental factors of the scombroid (tuna and mackerel) fish stocks in the Gulf of Mexico.

PLAN OF ACTION: A survey and fishery development project is recommended which calls for a two-pronged approach: (a) Charter of a fishing vessel to conduct trolling and live bait pole fishing, and (b) provide remote sensing support through aircraft charter for resource and environmental assessment.

END PRODUCT: The rationale for this exercise is that these fishes can be profitably harvested by conventional trolling and jackpole methods as used in the West Coast albacore fishery. Local shrimp vessels, with a minimum of conversion, can be adapted for such a fishery. Development of such a fishery would alleviate the pressure on the shrimp stocks; and would serve as an alternate source of income during poor shrimp fishing seasons.

BENEFIT: Tuna and petfood industry members have expressed keen interest in the development of a fishery for scombroid stocks. Its development would satisfy the private sector and increase fish production. Since the project should be jointly funded and managed by NMFS and industry, a working cooperative atmosphere would be realized. It is believed that the scombroid resource could support an annual harvest of at least 40,000 tons worth $16,000,000. The market also exists.

SCHEDULE: A two-year project is anticipated. At the end of the first year a preliminary assessment and prediction report will be available. The second year, quarterly progress will evolve into concrete estimates, regarding availability and capture techniques.

BUDGET: First year $188,500. Should stock abundance projections reach the desired level to test commercial purse seine operations, increased funding is needed to charter commercial tuna seiner at a cost of $105,000 in the second year.

Total cost $482,500.

PRIORITY:

3- 21 COASTAL PELAGIC FISHERY DEVELOPMENT

OBJECTIVE: Overall increase utilization of Southeast Region's (N.C. to TX, P.R.&V.I.) coastal pelagic stocks. Specifically, conduct resource survey to stimulate investment for developing new fishery based on underutilized species.

PLAN OF ACTION:

Phase I Contact industry to determine requirements of potential investors. Determine distribution, behavior, size and species composition. Determine approximate commercial catch rates. Estimate unit production and processing costs. Collect market intelligence.

Phase 2 Describe seasonal variation in availability. Identify fishing methods most likely to succeed. Give first approximation of stock magnitude.

Phase 3 Develop experimental fishing methods, e.g., light attraction. Identify cost efficient fishing tactics and optimum size commercial vessel for maximized net earnings. Refine stock magnitude estimates. Identify institutional environment constraints responsible for expensive end products.

END PRODUCT: Several viable commercial fisheries created. Implementation accomplished via day and night aerial surveys using aerial and low-light television cameras. Two charter vessels using purse seine, mid-water trawl, and gill nets to fish with aircraft.

BENEFITS: Strengthen fishing industry. Attract additional investment capital. Produce protein. Increase employment. Additional value realized, ex-vessel, $10,000 to $100,000/year. Additionally tonnage utilized 25,000 to 250,000 tons.

SCHEDULE: Three years. Milestone - Species inventory and approximate commercial catch rates for each. Identify optimum size vessel. First approximation of stock size.

BUDGET: $1,260,000

PRIORITY:

3- 22 HYDROGENATED FISH OILS AS AN ENERGY SOURCE IN MILK REPLACERS

OBJECTIVES: Industrial fishery products/by-products, in general, have excellent, and in some cases unique nutritional properties, and can play significant roles in animal diets. One of the most promising new uses for fish protein and oil in animal nutrition is in the compounding of suitable milk-replacer products. Therefore the objective is to conduct the necessary work required to evaluate the nutritional/ economic potential of hydrogenated fish oils as alternate energy sources in milk replacer formulations fed to neo-natal animals.

PLAN OF ACTION: Limited research has shown that up to 26% hydrogenated menhaden oil (iodine #, 80) can be incorporated with dry milk solids into free-flowing powders and yield comparable results to whole milk (30% milk fat on a dry basis), when fed to calves more in-depth studies are needed in this area before a market can be developed for the use of fish oils in milk replacers. At first, limited calf feeding studies will be conducted to determine optimum levels of oil incorporation and degree of hydrogenation. Upon selection of optimum levels, a large scale calf feeding study will be conducted to compare the nutritive values of hydrogenated fish oils to other energy sources currently used in milk replacers. Organoleptic evaluations will also be carried out at the termination of the feeding study. Economic/cost-projection considerations will also be determined.

END PRODUCT: Upon completion of this work, it is expected that we will have demonstrated the significant economic potential as well as nutritional benefits to be derived from the use of hydrogenated fish oils in milk-replacer formulations. Such work will benefit not only the industrial fishery industry (via new market outlets) but also animal feeders and milk-replacer manufacturers.

BENEFIT: If all milk replacers presently produced in the U.S. contained an average of 15% added hydrogenated fish oil there would be a market for over 18,000 tons of fish oil. This potential market would represent nearly 20% of the U.S. fishing industry's annual fish oil production.

SCHEDULE: The proposed work will require not less than three years. Two years needed for preliminary/small scale calf feeding studies to evaluate the use of fish oils hydrogenated to various degrees in milk replacer formulations. [M] Selection of optimum level of oil hydrogenation and incorporation. One and one-half years to complete large-scale calf feeding study with selected oils from preliminary work. [M] Complete evaluation of fish oils and milk replacer rations, with recommendations to industry.

BUDGET:: Total: $27,000; 1st Year $2,000, 2nd Year $5,000, 3rd Year $20,000
Contract Feeding Study

PRIORITY:

3-23 DEVELOPMENT OF BOTTOMFISH FISHERY IN THE GULF OF MEXICO

OBJECTIVE: To expand utilization of the bottomfish resources (trawl fishery) to near optimum utilization.

PLAN OF ACTION: A multi-discipline, multi-interest (industry, state and federal government and universities) effort is to be coordinated by the National Marine Fisheries Service, NOAA compatible with a National Fishery Plan and a National Fishery Development Plan. Projects are to be planned jointly with applicable elements, concentrating on specific existing constraints to the development project but attending to all necessary phases - resource assessment harvesting vessels and gear, handling, preservation, processing, packaging, storage, economics, marketing and distribution. An industry steering committee is to be jointly financed by government and industry to conduct development activities not within the purview of the government. States and universities are to be encouraged to contribute to coordinated efforts. Alternative projects are to be evaluated and selection based on greatest commercial results for least cost, time and greatest probability of success.

END PRODUCT: New and expanded bottomfish industry producing more and diversified food and industial products from the under-utilized bottomfish-croaker, spot, seatrout, porgy and others. Since bottomfish are all trawl caught and mostly as mixed species it is difficult to treat on a specie basis. A fishery approach is indicated. Approximately 120 million pounds are currently harvested whereas the estimated potential is at least one billion pounds.

BENEFIT: A processed value in excess of 500 million dollars per year is estimated as the potential of the bottomfish alone. About ten times the present production value.

SCHEDULE: Dependent upon effort allotted but no less than 15 years.

BUDGET: Industrial capital investment required will be large and will depend upon the usual availability and attraction. R&D costs under $30 million total.

PRIORITY:

3- 24 EXTENSION OF KNOWN RAW MATERIAL RESOURCES

OBJECTIVE: The availability of known ground fish resources provides the data sufficient for the conclusion that the industry is now entering an era of resource constraint. This resource constraint will be reflected in continuously rising raw material costs and hence higher prices to the consumer for fish and seafood products. The objective therefore is to increase the availability of raw material generated by the U.S. based "catching" operations.

PLAN OF ACTION: The fish and seafood industry in the U.S. and elsewhere in the world is one which wastes a large amount of raw material during processing from the "round" to finished goods state.

There is need for the development of improved technology to recover these waste products in a form that is considered palatable by consumers. Work is therefore needed on both (a) improved meat extraction techniques and (b) the further processing of such extracted meats so that they are made palatable.

The sequence of actions in such a program would be:

1. Assessment of the major locations for raw material in the U.S. that would be "reworked."

2. A definition of the inadequacies of current extraction techniques and also the inadequacies of the extracted raw material in its current finished state.

3. A program to develop more effective extraction equipment and to develop rework techniques to improve the palatability of the extracted raw material.

The other area of wasted resources relates to the "trash" fish currently available in the southern water of the U.S. At this point in time, such fish are caught by shrimp fishermen and are thrown back overboard because there is no commercial market for such species. This raw material could be used as the basis for a U.S.-based minced fish oepration. Such an action would then reduce the industry's need to import minced fish from other areas of the world.

The scheduled events for such a program would be as follows:

1. An assessment of the "trash fish" stocks in the southern areas of the U.S. and evaluation of the equipment and catch costs associated with landing such species.

2. An evaluation of the economics of converting such fish to minced fish blocks and the investment required for production facilities in the U.S. for processing such raw materials.

END PRODUCT: The expected outcome of such activities would be to generate raw materials that can be used to "stretch" the current resources available to the fish and seafood industry in the U.S.

BENEFIT: It is not possible to quantify at this stage the financial benefits from the above activities on increasing resource availability. It can be said, however, that at minimum, these actions would act to stabilize raw material costs in the industry and certainly if the industry generates more of its own resources within the U.S., would be of advantage to the U.S. balance of payment situation.

There is an additional benefit in the sense that such technology can be sold to other countries which would benefit U.S. exports and also would amplify the world's total availability of fish and seafoods.

SCHEDULE: Three years from initial evaluation to the final development of technology capable of exploiting the above resources. The significant activities would be a six month "cost/benefit" analysis and then a further 2 1/2 - 3 years in developing the extraction/processing technology.

BUDGET: It is assumed that it would probably cost somewhere in the region of $40,000 to complete an effective cost benefit analysis. The development of the technology to extract these resources would probably be at least $250,000.

PRIORITY:

3-25 STUDY OF PER CAPITA CONSUMPTION OF FISH IN U.S.

OBJECTIVE: To understand why the per capita consumption of fish and shellfish is relatively stagnant at less than 12 pounds while that of land animals is large and continues to grow (for example, that of beef is about ten times that of fish).

PLAN OF ACTION: Solution to the problem may be obtained by a properly designed survey to be conducted by expert analysts using techniques like those used in the Gallup polls and by interpretation of the data. To determine the accuracy of the data interpretation, pilot experiments (using proper statistical design) can be conducted.

END PRODUCT: This study would identify reasons for a relatively stagnant and undesirably low per capita consumption of fish and shellfish and it would provide the mechanism for increasing it.

BENEFIT: Provided that the per capita consumption is increased, benefits would accrue to the consumer because it would improve the nutritional and medical aspects of his diet, mainly by reducing the intake of saturated fats. A long-term benefit would also accrue to the consumer because fish and shellfish are more efficient converts of feed and we can already see a growing trend in the competition for feeds that we have customarily squandered to grow land animals from which we get our meats. Related to more efficient conversion, of course, is the savings in energy that is consumed in the production of feed. Since energy is a critical requirement in food production, we cannot start too soon in taking steps to conserve it.

SCHEDULE:

Initial Survey	about 1 year
Data analysis, interpretation and make-up surveys	1 year
Pilot experiments to test accuracy of data interpretation	2 years
Transfer of technique to private sector and analysis of cost/benefit ratio of project	1 year

BUDGET:

1st Year	$ 30,000
2nd Year	50,000
3rd Year	100,000
4th Year	100,000
5th Year	50,000

PRIORITY:

3-26 THE APPLICATION OF ALTERNATIVE TECHNOLOGY IN THE SHRIMP FISHERIES

OBJECTIVE: It is now generally recognized that shrimp typically occur in patches and are not uniformly distributed on the shrimp grounds. These patches are often long and relatively narrow, as the shrimp tend to concentrate within regions of preferred temperature, salinity, dissolved oxygen, or bottom sediment type. As means are not currently available for detecting bottom shrimp with sonar, and because of the inadequacies of the try net, much trawling is being done, and fuel wasted, traversing relatively barren areas. Typically, a vessel will fish three to eight hours before recovering the trawls, and presumably much of that time and fuel are wasted on barren ground.

The objective of the proposed project would be to greatly increase the efficiency of shrimp trawlers by providing a means for finding shrimp and delineating the areas of relative abundance, and for monitoring the density of shrimp during the trawling operation. In addition, bottom temperature and sediment information, also of value to the shrimp fishermen, could be provided by the proposed shrimp detector system. By confining their fishing to areas of relatively high shrimp density and favorable bottom conditions, it appears likely that smaller, lower powered shrimp trawlers towing smaller trawls, and consuming much less fuel, could exceed the catch rate of larger vessels.

PLAN OF ACTION: Preliminary tests have already shown that this method of detecting shrimp is practical. The prototype shrimp detector, now partially constructed, would be completed and field tested. The cost effectiveness of the shrimp detector would be evaluated through a series of trials aboard a commercial shrimp trawler. A technical report would be prepared.

END PRODUCT: If the cost effectiveness evaluation is favorable, a manufacturer would be sought to produce a commercial version of the shrimp detector. A research version of the shrimp detector (with temperature, salinity, dissolved oxygen, and sediment classification sensors) would be constructed on a separate research project to study the seasonal distribution of shrimp off a typical estuarine system as related to the measured environmental factors.

BENEFIT: A significant reduction in fuel cost for shrimp trawlers would be expected because vessel size, power, and net size could be scaled down while maintaining the same, or higher, catch rate. A better understanding of the environmental factors controlling the distribution of shrimp will eventually provide a prediction capability which should further increase the efficiency of the total fishing effort.

3- THE APPLICATION OF ALTERNATIVE TECHNOLOGY IN THE SHRIMP FISHERIES (continued)

SCHEDULE: One year.

BUDGET: Estimated $36,000.

PRIORITY:

3-27 THE APPLICATION OF ALTERNATIVE TECHNOLOGY IN THE SPINY LOBSTER FISHERY

OBJECTIVE: (A) The spiny lobster fishery of Florida (and some other U.S. trap fisheries as well) suffers from a low catch per unit effort caused by high fuel and labor costs and by the frequent loss of catch and traps to poachers. Recently the problem of trap loss has increased greatly, and the theft of entire lines of traps has become a common occurrence. Temporary buoy concealment is probably the most practical approach for protecting trap gear, and we have developed an expendable delayed float release for the purpose (Richard, 1971). Although the D.F.R. was tested and found suitable for tropical and sub-tropical waters, it was too expensive ($0.15 each). Subsequently, a low cost configuration of the D.F.R. has been designed which is suitable for automated production. The development and testing of the new D.F.R., and its evaluation in terms of cost effectiveness in the South Florida lobster fishery, is the first objective of this proposed project.

(B) Generally, lobsters and crabs are caught with traps towhich they are attracted by the odor of a bait. Manufactured baits are sometimes used because they have the important advantage of not requiring refrigeration before use. Unfortunately, after baits are immersed in water, the attractive odor substances leach out rapidly and therefore the effectiveness of baited traps extends for only a relatively short period after the trap is set. As a consequence, much of the effort and expense of trap fishing involves the frequent renewal of bait. Generally, rebaiting is necessary long before an adequate catch has accumulated and it has been recognized, therefore, that if bait renewal can be effected without the expenditure of labor and boat operating time, the actual catch per unit effort of the fishery can be significantly increased. A second objective, therefore, of the proposed project is to develop and test a delayed bait dispenser (D.B.D.) and to evaluate its use, in terms of cost effectiveness, in the South Florida lobster fishery.

PLAN OF ACTION: After sample quantities of the prototype D.F.R. and D.B.D. are constructed and tested, relatively large numbers would be produced, and the practicality of their use (in terms of cost effectiveness) would be evaluated in a commercial fishing operation.

3-27 THE APPLICATION OF ALTERNATIVE TECHNOLOGY IN THE SPINY LOBSTER FISHERY (Continued)

END PRODUCT:

1. A method and device for protecting lobster, crab, and fish traps from theft or poaching.

2. A method and device for the delayed re-baiting of lobster and crab traps to effect substantial savings in fuel and labor costs.

BENEFIT:

1. In the South Florida lobster fishery, the D.F.R. should provide protection from the loss of traps and catch which has been identified in Sea Grant reports as the most serious problem in the fishery (Seaman and Aska, 1974; and Craig, 1973).

2. It is expected that a major increase in catch per unit effort can be realized from the use of the D.B.D. by sequentially rebaiting lobster traps (e.g., three times) without additional expenditure of boat time, fuel, or labor. Each of these two proposed devices (1 and 2) increases the practicality of the other.

SCHEDULE: One year.

BUDGET: Estimated $24,000.

PRIORITY:

3-28 IMPROVING FISH PRODUCTION AT SEA

TITLE: Multi-Species Fish Preservation Systems Aboard Vessel in the Northeast Pacific

OBJECTIVE: To increase productivity and broaden the production capabilities of fishing vessels in the Northeast Pacific by developing and testing multi-purpose systems for handling, chilling, preserving, and freezing underutilized species of fish and shellfish.

END PRODUCT: Recommendations, demonstrations, pilot models, and full-scale installations will be the results from development of systems for multi-species preservation depending on the area, species, and established characteristics of the fishing vessels. Systems will include solutions to specific handling and sorting problems for the fish species, recommendations for conversion of existing vessels, evaluation of operation and maintenance problems, and suggestions for adaptation of preservation techniques to smaller vessels as appears advisable for efficient utilization of existing vessels. Target species proposed for consideration include Alaska pollock, Pacific hake, jack mackerel, anchovy, squid, and herring.

BENEFIT: Benefits include the demonstration of technical and economic feasibility of improved multi-purpose fish preservation systems aboard vessel and their application to harvest and utilization of underutilized fishery resources.

SCHEDULE: Five years.

Milestones will be the specific solutions and unit developments of a preservation system, e.g., handling system for sorting and chilling Alaska pollock, a mechanized system for heading and gutting pollock and freezing in blocks aboard vessel, application of a spray brine chilling procedure for hake and mackerel, and a system for unitized handling and chilling anchovy at sea and for mechanical cleaning (heading, gutting, and washing) ashore.

BUDGET: Annual budgets will be broken down by either the preservation elements such as chilling or freezing characteristics of a particular species or by the mechanical development needed such as a means of mechanized sorting and chilling of small pollock.

A budget of $100,000 per element per year with a minimum of two problem elements per year for five years; $1,000,000 for the five year budget.

PRIORITY:

3-29 DEVELOPMENT OF INCREASED KNOWLEDGE CONCERNING HISTAMINE AND HISTAMINE-LIKE SUBSTANCES

OBJECTIVE: To provide information necessary to establish both good commercial practices as well as regulatory agency compliance guidelines.

PLAN OF ACTION:

(1) Evaluate work presently underway in certain universities and other facilities.

(2) Examine additional programs now being developed.

(3) Determine whether further new studies should be conducted.

(4) Monitor above programs and report to all interested parties.

END PRODUCT: Closer liaison between researchers and government agencies.

BENEFIT: More efficient commercial fishery operation with resultant lower cost for consumer plus increased public health safety.

SCHEDULE: 2 years

BUDGET: $25,000

PRIORITY:

3-30 DYNAMICS OF GREAT LAKES FISHERIES

OBJECTIVE: During the past 50 years, dramatic changes have occurred in the fish populations of the upper Great Lakes. Salmon, smelt, alewife, and sea lamprey have been introduced or have invaded the upper Great Lakes and at the same time enormous changes have occurred in the populations of native species such as lake whitefish, lake herring, lake trout, and chubs. These changes have had a disastrous impact on the commercial fisheries and commercial fishermen of the Great Lakes.

A few fishery scientists have attempted, with considerable success, to explain the changes that have occurred in the fish populations of the Great Lakes, but there has been little effort to apply fishery models for the purpose of understanding and management of the Great Lakes fisheries.

The objectives of this study are to apply fishery models to describe changes that have occurred and are now occurring in the major fisheries of the upper Great Lakes, to apply fishery models for stock assessment, and to apply fishery models for management of the Great Lakes fisheries.

PLAN OF ACTION: As a first step, the large quantity of data on catch and effort for lake whitefish, lake trout, lake herring, and chubs has been transferred to computer cards and a surplus production model has been applied. These fish are of major importance in the upper Great Lakes. This approach has been successful and has enabled a rapid assessment of the relation between equilibrium yield and fishing effort for this fisheries.

To confirm the results obtained with the surplus production model and to obtain additional information for optimum exploitation of the fisheries, it is now proposed that dynamic pool models be applied to the lake whitefish and lake trout populations. Ricker (1975) discusses dynamic pool model in some detail. Data for application of the dynamic pool models are available in the published literature and in State of Michigan Department of Natural Resources Technical Reports.

Application of dynamic pool models requires biological data that is available for only a few areas of the upper Great Lakes. However, dynamic pool models are not dependent on historical data to the extent that surplus production models are, and dynamic pool models, therefore, will be especially useful for assessment of the lake trout populations.

Dynamic pool models are applied to determine yield per recruit as a function of fishing effort and to determine the relation among age at recruitment, yield, and fishing mortality. As the dynamic pool model is based on different data than the surplus production model, it provides a second and independent assessment of the optimum yield.

END PRODUCT: The results will be applied by Federal and State fishery scientists and administrators for management of the Great Lakes Fisheries.

BENEFIT: Greater understanding of Great Lake Fisheries and better stock management.

SCHEDULE:

BUDGET:

PRIORITY:

LIVING RESOURCES

HABITAT

LIVING RESOURCES PANEL

HABITAT

3-31 An Exhaustive Mineral and Biological Survey of the U.S. Continental Shelf (Also Hard Minerals Panel)

3-32 Investigation of Ocean Upwelling Process and Means of Commercial Utilization

3-33 Feasibility of Transplanting Fish Stocks Out of Their Native Habitat, e.g., Introduction of Salmon into the Nutrient-Rich Southern Ocean

3-34 Investigation of the Physiological Constraints of Unit Fish Stocks Movement

3-35 Application of Satellite Telemetry to Follow and Determine Migrating Fish Patterns

3-36 Consequences of Energy Related Activities On Marine Fish and Shellfish (Thermal Additions, Ozone, Chlorine)

3-37 Fishery Diaster Monitoring And Prediction System Development

3-38 Microconstituents and Environmental Impacts Considerations

3-39 Effects of Ocean Outfalls on the Prevalence of Tumors and Other Noninfections and Infections Dieases of Marine Fish and Shellfish

3-40 Environmental Impact In the Coastal Zone of the Southeastern U.S. - Follow-up Studies

3-41 Polychlorobiphenyls (PCB's) In Marine Fish

3-42 Effects On Marine Fish and Shellfish of Biologic and Abiologic Controls Utilized in Agriculture

3- 31 AN EXHAUSTIVE MINERAL AND BIOLOGICAL SURVEY OF THE U. S. CONTINENTAL SHELVES

OBJECTIVE: To make a complete inventory and assessment of the mineral and biological resources that are available to the U. S. on its continental shelves.

PLAN OF ACTION:

1. Establish assessment categories, criteria and model parameters.

2. Develop inventorying instrumentation.

3. Conduct field surveys.

4. Analyze data and develop projection models.

5. Prepare inventory lists and short and long range resource projections.

END PRODUCT: Complete resource inventory of the U. S. Continental Shelves, and models for use in resource utilization and planning.

BENEFIT: Established baseline for resource control and development planning.

SCHEDULE: 1st year: Develop operations plan, define parameters for measurement, start assessment instrumentation development.
2nd year: Instrumentation development and field testing.
3rd year: Commence Con Shelf Survey
4th - 10th year: Con Shelf Survey and development of Con Shelf Resource Atlas.

BUDGET: 1st year: $600,000.
2nd year: $4,000,000 (not counting ship time)
3rd - 10th year: $1,000,000/year (not counting ship time)
Total: $12,600,000 (not counting ship time).

PRIORITY:

3-32 INVESTIGATION OF OCEAN UPWELLING PROCESS AND MEANS OF COMMERCIAL UTILIZATION.

OBJECTIVE: To determine the physical and biological dynamics of ocean upwelling and its influence on population growth.

PLAN OF ACTION:

1. Investigate the relationship worldwide between ocean upwelling sites, marine population, and fish harvesting.

2. Investigate and determine the physical and biological processes of upwelling and its timing, variability, and influence on marine life.

3. Recommend systems to monitor upwellings and ultimately to increase fish catches.

END PRODUCT: Recommended methods and approaches for increased fish catches from areas of ocean upwelling.

BENEFIT: Increased economic benefits to commercial and sport fishermen.

SCHEDULE: 3 years.

BUDGET: $200,000.

PRIORITY:

3-33 INVESTIGATION OF THE FEASIBILITY OF TRANSPLANTING FISH STOCKS OUT OF THEIR NATIVE HABITAT INTO OTHER AREAS (e.g. INTRODUCTION OF SALMON INTO THE NUTRIENT-RICH, WHALE-DEPLETED SOUTHERN OCEANS).

OBJECTIVE : To increase available fish supply.

PLAN OF ACTION:

1. Inventory location, life-cycle, feeding habits, spawing cycle, and other biological factors of selected fish types suitable for transplanting.

2. Recommend fish varieties suitable for program.

3. Initiate laboratory - model test to determine applicability of concept and monitor results.

4. Initiate pilot program with selected stocks and locations and monitor results.

END PRODUCT: Creation of new fish stocks in nutrient-rich areas.

BENEFIT: Increase in available fish supply.

SCHEDULE: 3 years.

BUDGET: $250,000.

PRIORITY :

3-34 INVESTIGATION OF THE PHYSIOLOGICAL CONSTRAINTS OF UNIT FISH STOCK MOVEMENT

OBJECTIVE: To determine the physiological factors that influence the migration of fish.

PLAN OF ACTION: The sequence of steps would include:

1. Review current state-of-the-art on both U.S. and foreign work performed in this area of interest.

2. Evaluate the known physiological parameters and the scope of influence.

3. Establish the framework for field experiments.

4. Set up controlled field experiments with one or more selected fish stocks and monitor results.

END PRODUCT: Increased knowledge about fish movements.

BENEFIT: Aid in determining the rationale for fish movements which will lead to increased catches.

SCHEDULE: Four years

BUDGET: $250,000

PRIORITY:

3-35 APPLICATION OF SATELLITE TELEMETRY TO FOLLOW AND DETERMINE MIGRATING FISH PATTERNS

OBJECTIVE: To learn fish migration patterns as an end to increased harvesting.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate current satellite telemetry programs (landsat and others) to determine applicability, resolution, tracking capability, and results thus far obtained.

2. Evaluate need for tagging of stock and methods of accomplishing same.

3. Establish parameters for a fish tracking program - quantities involved, routes and patterns, etc.

4. Institute pilot program to check fish migration patterns and verify by means of ground confirmation.

END PRODUCT: Development of more reliable method of following fish schools.

BENEFIT: Aid in location of fish and increase in yields.

SCHEDULE: Three years

BUDGET: $200,000

PRIORITY:

3-36 THE CONSEQUENCE OF ENERGY-RELATED ACTIVITIES - THERMAL ADDITIONS, OZONE, CHLORINE - ON MARINE FISH AND SHELLFISH

OBJECTIVE: Heated effluents from power generating stations can be used for aquaculture purposes. Unfortunately, chemicals used to control fouling are present in the effluents and could preclude use of thermal discharges. The objective is to determine the impacts of heated effluents and oxidants (chlorine, ozone) or other chemical and irradiation discharges on fish and shellfish inhabiting sites adjacent to estuarine and offshore power plants.

PLAN OF ACTION: Fish and shellfish held in cages or trays will be exposed to power plant effluents bimonthly. Histopathological examination of fixed tissues will be made to determine pathological changes induced by the environment. Control animals exposed in adjacent, unaltered areas will also be examined. Free living fish and shellfish and thermally impacted and unimpacted areas will be sampled monthly to determine temperature-related disease incidence.

END PRODUCT: Documentation of the toxic effects (or lack thereof) of oxidants used as anti-fouling agents in the marine environment. Documentation of the effects of heated effluents on the incidence of diseases in fish and shellfish.

BENEFIT: The data generated would be of benefit to those concerned with making decisions on power plant siting and choice of alternative biocides in existing and proposed plants.

SCHEDULE: The experimental phase would take two years and compilation of results an additional year.

BUDGET:
Year 1: $100,000
Year 2: $106,000
Year 3: $110,000

PRIORITY:

3- 37

FISHERY DISASTER MONITORING AND PREDICTION SYSTEM DEVELOPMENT

OBJECTIVE: The objective of this project is to develop and demonstrate a monitoring and prediction capability to assess the effects of natural disasters (e.g., floods and hurricanes) on coastal fishery resources.

PLAN OF ACTION: The prototype system would be limited to coverage of the Mississippi and Louisiana coasts; four commercially important species (shrimp, menhaden, oysters and croaker); acute rather than chronic effects; environmental parameters that can be remotely sensed (temperature, salinity and silt); and participation by agencies located at NSTL (NMFS, NWS, NASA, COE, USGS, and F&WS). Major activities in project development include:

(1) Identify critical estuaries and periods of habitation by critical resources.

(2) Establish environmental tolerances as a function of resource, area and season.

(3) Develop river forecast models for discharge volume and flow rate, silt load, and temperature.

(4) Develop estuarine circulation models for silt disposition, salinity and temperature patterns as a function of river discharge.

(5) Define and implement remote sensing, data acquisition, and environmental and biological sampling programs, and integrate and verify river forecast and estuarine circulation models based on acquired data.

(6) Provide fishery disaster forecasts through verified model outputs.

END PRODUCT: The expected outcome of this project is for a fishery disaster forecast model which would aid in fishery management both at the state and national levels by providing advance knowledge and predictions of impending environmental conditions and disasters.

BENEFITS: Specific benefits may include: an aid to flood control management decisions (e.g., should flood water from the Mississippi River be diverted to Lake Pontchartrain); an input for determining economic relief activity requirements; an input for strategic planning of fishing operations; and an aid to state regulatory functions such as determining fishing seasons.

SCHEDULE: Duration of the project would be for a total of three years with the major effort occurring during the second year of the project.

BUDGET:

Calendar Year	Cost
1	$100,000
2	$200,000
3	$100,000

PRIORITY:

3- 38

EFFECT OF THE ENVIRONMENT IN ACCUMULATION OF UNDESIRABLE INORGANIC MICROCONSTITUENTS IN FISH AND SHELLFISH

OBJECTIVE: To determine the specific factors in the marine environment that affect the accumulation, chemical form, and distribution of inorganic microconstituents of public health significance (e.g., Hg, Pb, As, Cd) in the muscle and organs of particular fish species.

PLAN OF ACTION: Initially a screening study and literature search is needed to select and assign research priorities to target species, microconstituents, and areas of concern. For example, a study of the wide variance of the mercury level in halibut from fishing areas off the Washington Coast to the Bering Sea might be selected. A sample plan is to be established for the microconstituent occurrence in relation to the species, water and bottom samples, and organisms in the food chain. Methodology and rationale are to be established for microconstituent determinations in specific tissues, and organs of the target species and the organic and inorganic components in the environment. Methods and possible significance of physiological or pathological examination of the target species should be considered and included in the particular species/microconstituent study as appears appropriate and feasible. In later phases or with several aspecies with suitable life cycle, live-holding studies under controlled environment and microconstituent levels should be incorporated as a supporting investigation to demonstrate specific species/microconstituent relationships or metabolic effects.

END PRODUCT: Expected outcome will be information on the environmental factors and biological response in fish species of commercial importance to the occurrence and distribution of inorganic microconstituents of public health significance. It is probable that guidelines for monitoring indicator species, either the target species or an associated food chain organism, for potential problems with specific microconstituents can be developed from this basic information.

BENEFIT: First, to better utilize fishery resources fully for commercial or recreational uses with adequate knowledge to assure product safety to the consumer. Second, to provide as seems appropriate further guides for selective fishery management of fish stocks or environments affected by microconstituents of public health concern.

SCHEDULE: Long term studies are needed and program outlines should consider 5 to 10 years for planning. Indicated species/microconstituent studies will require from 1 to 3 years. Milestones will include reports on methodology, analytical findings, and environmental relationships of species and particular microconstituents.

BUDGET: In-house investigations at $100,000 per year plus an additional $100,000 per year for contractual support research and consultant studies (e.g., in physiological response studies).

PRIORITY:

3-39 THE EFFECTS OF OCEAN OUTFALLS ON THE PREVALENCE OF TUMORS AND OTHER NONINFECTIOUS AND INFECTIOUS DISEASES OF MARINE FISH AND SHELLFISH

OBJECTIVE: Tumors, hemorrhagic lesions, gross lesions and skeletal abnormalities are found in increasing numbers in ocean outfalls. From an esthetic and public relations point of view, as well as to gain knowledge on the affects these conditions have on population structures, we plan to determine the prevalence of tumors and other noninfectious and infectious diseases in marine fish and shellfish inhabiting specific coastal areas receiving domestic and industrial wastes.

PLAN OF ACTION: Groundfish surveys will be conducted in coastal waters representing a spectrum of degraded environments. In conjunction with the surveys, disease prevalence in fish and shellfish will be determined. Vessel acquisition or charters will be necessary.

END PRODUCT: The product of the research will be a documentation of the impact of disease on economically valuable marine fish and shellfish resources. The data acquired will make it possible to estimate the economic losses consequent to the degradation of productive coastal ecosystems.

BENEFIT: The value of the research lies in its ability to determine conclusively whether the degradation of coastal environments has profound effect on recruitment, growth, and longevity of marine fish and shellfish.

SCHEDULE: The project will be conducted during a 4-year period in which the following milestones will occur:

- Year 1 - Collation and analysis of gross lesions observed in field surveys.
- Year 2 - Collation and analysis of microscopic observations.
- Year 3 - Description of pathologies encountered in fish and shellfish and preparation of manuals. Description of new infectious disease entities encountered.
- Year 4 - Submission of final report and preparation of papers to be published.

BUDGET: Vessel construction or charters or purchase - \$250,000

1st Year	\$128,000
2nd Year	\$130,000
3rd Year	\$140,000
4th Year	\$145,000

PRIORITY:

3-40 ENVIRONMENTAL IMPACT IN THE COASTAL ZONE OF THE SOUTHEASTERN U.S. - FOLLOW-UP STUDIES

OBJECTIVE: To conduct short-term quick response and follow-up research on the effects of environmental impacts in estuaries and coastal waters of the southeastern U.S.

PLAN OF ACTION: Estuarine and coastal waters in the southeastern U.S. are being subjected to increased pressure for environmental modification to meet the growing needs of industry. Many of these modifications are related to energy development and production and consist of construction of:

(1) Electrical generating stations,

(2) Shore bases to service offshore facilities for extraction, production and transportation of energy related materials, and

(3) Pipelines to transport oil.

Because many of the present and proposed impacted areas also provide critical habitat for fisheries, a research team is needed to conduct intensive follow-up studies in selected impacted areas to determine effects of these modifications on fisheries production. In particular, this project would be concerned with:

(1) Impact of dredge operations in estuaries and coastal waters of the Carolinas and Georgia, and

(2) Evaluation of the role of high marshes in estuarine productivity and the impact of ditching and filling of these marshes.

END PRODUCT: Evaluation of the effects of environmental alterations on fisheries productivity requires a thorough understanding of the response of all components of any particular ecosystem to these alterations. Results of specific follow-up studies will then be considered in future decisions where protection of fisheries habitat is concerned.

BENEFIT: Benefits derived from this proposed research would be in the form of direct assistance to agencies involved in habitat protection in the southeastern U.S. In addition, it is anticipated that benefits will take the form of the development of new techniques useful in assessing fisheries habitat degradation which will be applicable to many impacted marine areas within the U.S.

SCHEDULE: This project will require 5 years of concentrated research in selected impacted areas and milestones will be in the form of additional information as to the effects of environmental alteration on fisheries production.

BUDGET: 1st Year - $130,000; 2nd, 3rd, 4th, and 5th Years - $95,000/year.

PRIORITY:

3- 41 POLYCHLOROBIPHENYLS (PCB'S) IN MARINE FISH

OBJECTIVE: To better define the extent of PCB contamination in marine fish and fishery products.

PLAN OF ACTION: To quantitatively determine, through chemical (chromatographic) analysis, levels of PCB's and their metabolites in selected key species from the S.E. Atlantic and Gulf of Mexico. Fish of prime commercial and recreational importance will be analyzed with reference to size, sex and site of collection.

END PRODUCT: A comprehensive data base on the occurrence and distribution of PCB's in fish, including shellfish and fishery products, taken from a major sector of U.S. coastal waters. Data and interpretive reports will be given wide distribution.

BENEFITS: The establishment of a dynamic information base providing a means to:

(1) Draw meaningful conclusions on the occurrence and persistence of PCB contamination in marine fish,

(2) Aid in the assessment of biochemical effects and biological consequences of PCB pollution of the ocean.

In the short term, in those cases where it can be clearly demonstrated that no public health hazard exists, fears will be allayed, with a consequent positive impact on both industry and consumer confidence.

SCHEDULE: Project length of 4 years, with analytical work terminating at the end of the 3rd year. Interim data reports will be issued on completion of 1st and 2nd years. Final data report and interpretive reports will be prepared during course of final year.

BUDGET:

Year:	1	2	3	4
MY/K$	3.5/130	3.5/90	3.5/90	3.0/60

PRIORITY:

3-42 THE EFFECTS ON MARINE FISH AND SHELLFISH OF BIOLOGIC AND ABIOLOGIC CONTROLS UTILIZED IN AGRICULTURE

OBJECTIVE: Several new agricultural chemicals and more recently live or attenuated microbial agents (viruses and bacteria) are in use or soon will be used to control populations of insect pests, snails, etc. We know virtually nothing of how these agents affect "non-target" aquatic species such as fish and shellfish. We plan to determine the chronic pathological effects of bacteria, viruses, and chemical pesticides on populations of marine fish and shellfish.

PLAN OF ACTION: With the cooperation of FDA and USDA to:

(1) Perform controlled chronic exposures in the laboratory of selected fish, mollusks, and crustaceans to chemical pesticides;

(2) Determine body burdens of pesticides through chemical analysis of tissues of experimental animals exposed to chemical-pesticides;

(3) Through exposure and inoculation, determine effects of viruses and spore-forming bacteria proposed for biological control on key species of estuarine and coastal fish and shellfish;

(4) Survey selected natural populations for effects of the biotic and abiotic agents through histopathology, chemical analysis, and microbiological analysis.

Compare results with those obtained by experimental means.

END PRODUCT: Understanding of the pathological changes caused by the various agents in shellfish and fish, so that estimates can be made of damage the agents cause to food chain animals and commercially utilized species.

BENEFIT: The ability to predict the effect on populations of fish and shellfish if exposure to the agents occurs or, in the case of many chemical substances, continues to occur. A knowledge of what body burdens of abiotic agents may occur in animals used as human food.

SCHEDULE: Over a period of 5 years to:

(1) Perform chronic exposures to selected pesticides and inoculation and exposure to selected biotic agents;

(2) Survey on a continuing basis certain natural populations known to be a risk;

(3) Survey populations undergoing unusual exposure to pesticides or mortalities known or suspected to be caused by biotic or abiotic agents.

After each test exposure or inoculation, determination of the pathological consequences to the test animals of exposure to the chemical or biotic agent.

BUDGET:

PRIORITY:

LIVING RESOURCES

IMPLICATIONS OF EXTENDED JURISDICTION

LIVING RESOURCES PANEL

IMPLICATIONS OF EXTENDED JURISDICTION

3-43	Fisheries Resource Analysis: Shrimp and Associated Estuary - Dependent, Demersal Species
3-44	Soci-Economic Study of Commercial And Recreational Users of Louisiana Shrimp Resources As it May Relate To Future Entry Programs
3-45	Prototype Industry - State - Federal Data Management Systems
3-46	Economic Impact Study of Foreign Caught Fish Landings

3-43 FISHERIES RESOURCE ANALYSIS: SHRIMP AND ASSOCIATED ESTUARY-DEPENDENT, DEMERSAL SPECIES, GULF OF MEXICO

OBJECTIVE: Over 90% of the shellfish and finfish catch of the Gulf of Mexico is made up of shrimp and associated estuary-dependent, demersal species. Because most of these species are short-lived and exhibit pronounced fluctuations in year class success, wise utilization and management of these fishery resources requires monitoring and prediction of abundance, distribution and growth of oceanic and estuarine life stages of these species and associated environmental variables (e.g., temperature, salinity, stream discharge, Ekman transport, etc.). In addition, such activities provide a means by which the impacts of natural and man-caused environmental changes on these living resources can be assessed.

The objective of this program is to develop a system capable of assessing these living resources, associated fisheries, and their oceanic and estuarine environments in the Gulf of Mexico for the purpose of determining levels and types of use necessary to maximize benefits from these resources.

PLAN OF ACTION: The program will involve:

(1) MARMAP II (groundfish) surveys in estuarine and oceanic environments,

(2) MARMAP I (ichthyoplankton) surveys in estuarine and oceanic environments,

(3) Associated projects to monitor estuarine and oceanic environmental variables,

(4) Development of an associated data management and analysis system to process data from items (1-3), and

(5) Development of mathematical models to explain the relationships among yield from these resources, effects of related fisheries, and effects of environmental fluctuations and trends, and to predict the impacts of alternative management strategies.

END PRODUCTS: Outputs will be:

(1) Biological and environmental data files,

(2) Data summaries,

(3) Results of statistical analyses, and

(4) Explanatory and predictive mathematical models.

BENEFIT: This program would provide a major portion of the information base needed to guide decisions regarding utilization and management of shrimp resources and associated demersal, estuary-dependent fishery resources, regulation of users of these resources and regulation of man's effect on the oceanic and estuarine environments related to these resources.

Primary recipients of these benefits will include Gulf fisheries industries, the Gulf States Marine Fisheries Commission, the NMFS Southeast Regional Fisheries Management Council, State conservation agencies and other state and federal (e.g., Environmental Protection Agency, Energy Resource Development Administration, U.S. Army Corps of Engineers, Bureau of Land Management, Fish and Wildlife Service, etc.) agencies.

SCHEDULE: The monitoring aspects of the program are a continuing activity. Development of mathematical models and statistical analyses leading to this development will require five years. Thereafter, existing models will need to be modified as needed in response to changes in the fisheries and trends of change in the resources and their environment.

BUDGET: Millions of dollars

	Calendar Year				
	First	Second	Third	Fourth	Fifth
Monitoring	11.5	11.5	11.5	11.5	11.5
Analysis and Modeling	0.5	0.5	0.5	0.5	0.1
TOTAL	12.0	12.0	12.0	12.0	11.6

PRIORITY:

3-44 SOCIO-ECONOMIC STUDY OF COMMERCIAL AND RECREATIONAL USERS OF LOUISIANA SHRIMP RESOURCES AS IT MAY RELATE TO FUTURE LIMITED ENTRY PROGRAMS

OBJECTIVE: The valuable Louisiana shrimp resource is harvested by a diverse commercial and recreational fisheries. Quantitative information on identity, economic and recreational dependence, and harvest by the various users is necessary for evaluating current management decisions and possible future limited entry programs.

PLAN OF ACTION: Questionnaire survey to determine numbers of recreational shrimpers, fishing areas, techniques, and catch statistics, all in relation to commercial shrimping activity.

END PRODUCT: Assessment of role of recreational shrimping activity in relation to the total fishery guidelines for licensing, setting harvest limits, establishing nursery sanctuaries.

BENEFIT: Development of improved management strategies.

SCHEDULE: One season questionnaire survey data and analysis, one season for follow-up interviews with state officials, legislators, etc.

BUDGET: $20,000/year for two years.

PRIORITY:

3-45

PROTOTYPE INDUSTRY-STATE-FEDERAL DATA MANAGEMENT SYSTEM

OBJECTIVE: The objective of this project is to design, develop, implement, and evaluate an integrated Industry-State-Federal Data Management System for fishery resources.

PLAN OF ACTION: The initial step for project implementation will be to enter into a cooperative program with selected state agencies and private industries directly involved with living marine resources. Ideally, this should involve two or more states and two or more industry groups or associations (e.g., National Fish Meal and Oil Association). Data and output requirements will be specified. Data not readily available for insertion into the system will be identified and efforts will be made to acquire them from program participants. Software routines will be prepared for data analysis and display (e.g., contour plots and tabulations) and computer terminals will be located in key areas to accept data inputs and provide outputs on a time-shared basis. Complete software documentation will accompany each terminal so that users with minimum training (provided by the program) can operate the system. After the system has been functional for one year, a benefit analysis will be performed based primarily on use.

END PRODUCT: A prototype data management system designed to provide resource managers and industry with various outputs reflecting past, current, and projected status of stocks based on the most recent inputs.

BENEFIT: The primary benefit will be the availability of living marine resource data and the capability to assess the data and obtain outputs which reflect the status of the resources.

SCHEDULE: The schedule for this activity will be for a three-year period with the first two years devoted to design and development and the third year for test and evaluation of the system.

BUDGET:

Calendar Year	Cost
1	$ 50,000
2	$200,000
3	$100,000

PRIORITY:

3-46

ECONOMIC IMPACT STUDY OF FOREIGN CAUGHT FISH LANDINGS

OBJECTIVE: Determine the economic impact of allowing fish caught by foreign vessels to be landed in the United States for further processing by U.S. processors and labor; objective of operation would be to provide market for U.S. fishermen in products not now harvested.

PLAN OF ACTION: Hire a qualified economics research firm to conduct the study with assigned areas of investigation to include: benefits to community in which plant would be located, the likelihood of U.S. boats entering new fishery if processing market were in place, competitiveness of U.S. fleet.

END PRODUCT: Study report; proposed legislation if results are favorable.

BENEFIT: If feasible, starting point for U.S. fleet entrance into new fishery.

SCHEDULE: One Year

BUDGET:

PRIORITY:

LIVING RESOURCES

IMPROVING PROCESSING AND MARKETING OF FISHERY PRODUCTS

LIVING RESOURCES PANEL

IMPROVING PROCESSING AND MARKETING OF FISHERY PRODUCTS

3-47 BROADEN CONSUMER FOOD FISH ACCEPTANCE

OBJECTIVE: To stimulate the U. S. commercial fisheries industry by broadening the spectrum of food fish species acceptable to the domestic consumer.

PLAN OF ACTION: It is estimated that potentially available supplies of food fish are greatly in excess of current world demand and that species currently neglected by U. S. consumers approximately equal the annual U. S. catch. Broadening of consumer acceptance would stimulate the commercial fishing industry.

1. Characterize present U. S. domestic consumer market and delineate cost effective areas into which it could be expanded.

2. Survey typical domestic consumers with a view toward defining buying habits and ascertaining reason for relatively narrow spectrum of acceptable food species.

3. Generate marketing improvement or other approaches to broadening acceptability based on results and analysis of current consumer actions.

END PRODUCT: A basic strategy for stimulating consumer demand which could be implemented by government or private enterprise.

BENEFIT: Increase the U. S. commercial fishing presence in the new economic coastal zone and act to counter the current trend toward higher food fish imports.

SCHEDULE: Single year effort.

BUDGET: $75,000

PRIORITY:

3-48 DEVISE METHODS FOR IDENTIFYING TOXIC FISH AND DEVELOP COMMERCIAL FISH AND SHELLFISH DETOXIFICATION PROCESSES

OBJECTIVE: Fish intoxications have increased in the U.S. in recent years. Increased world protein demand has encouraged fishing in areas of known toxic fish incidence. Good and simple procedures for identification of toxic fish (Scombroid and Ciguatera poisons particularly) are not available nor are processing techniques designed to eliminate toxicity. Moreover, large quantities of shellfish, particularly in Alaska, are unavailable for harvest for human food because of endemic or periodic toxicity due to the so-called red tide toxin (saxitoxin). The size, distribution, and value of the resource makes self-cleansing (depuration) techniques impracticable. A new chemical analysis for saxitoxin facilitates processing research.

(1) Develop a simple test for use on board ship or on shore to rapidly and easily identify toxic fish.

(2) Evaluate effectiveness of current processing methods to detoxify toxic fish and shellfish.

(3) Evaluate modifications of current processing methods.

(4) Investigate novel processing methods for detoxification.

END PRODUCT: Methods for the identification of toxic fish. Processing method or methods which will yield detoxified product from contaminated fish and shellfish.

BENEFIT: Development of new industry in areas of endemic toxicity. Increased food from the sea. Reduction of health hazard.

SCHEDULE: (1) 3 years: methods for identifying toxic fish
(2) 2-3 years: Processing methods

BUDGET: (1) $250,000
(2) $300,000

PRIORITY:

3-49 QUALITY ASSESSMENT SURVEY

OBJECTIVE: Quality assessment study of major fishery products available to consumers at the retail level.

PLAN OF ACTION: Nationally collected samples will be analyzed from three aspects:

(1) Sensory and physical evaluation for compliance with current voluntary and/or mandatory standards for quality, identity, workmanship, decomposition, fill of container, net weight, quantity of seafood component, etc.

(2) Microbiological quality analysis for product wholesomeness and hygiene, including:

(a) Total plate counts,

(b) Coliforms,

(c) *Escherichia coli*,

(d) *Salmonella*/Shigella,

(e) Erysipelothrix,

(f) Anisakid nemotodes,

(g) Faecal *Streptococcus*,

(h) Filth (rodent hairs, etc.), and

(i) Insect fragments.

(3) Chemical analysis for compounds indicating product degradation, such as:

trimethylamine,
dimethylamine,
thiobarbituric acid,
extractable protein nitrogen.

END PRODUCT: Results of the quality studies will provide hard baseline data reflecting current quality, safety, and wholesomeness of seafoods available to consumers.

The baseline quality data will:

(1) Identify the seafoods that reflect highly variable quality available to consumers;

(2) Provide data to establish minimum acceptable quality level standards;

(3) Provide data to stratify product quality levels;

(4) Provide data needed in considering microbiological guidelines appropriate and attainable through good industry processing practices;

(5) Provide possible objective chemical tests for quality that would be useful in routine inspection activities.

BENEFIT: Consumers benefit by establishing minimum quality levels - unsuitable quality products are eliminated from market place. Consumers can purchase products of a specified and labeled quality based upon grade standards.

Industry benefits by having modern, uniform, precise standards. With such standards, competition in the marketplace must be based upon factors other than serious compromises in product quality. Imports as well as domestic products would have to comply with minimum quality standards.

U.S. regulatory agencies and those in source countries producing seafoods for the U.S. market would have a more rational, objective, and technically sound basis for auditing or monitoring compliance with such standards.

SCHEDULE: 2 years

BUDGET:	Sensory and physical evaluations	$100,000
	Microbiological analysis	300,000
	Chemical analysis	115,000
		$515,000

PRIORITY:

3-50 COASTAL SMALL BUSINESS CO-OP DEVELOPMENT

OBJECTIVE: A basic scheme for coastal - small businessmen - co-ops should be designed, built and actually tested. The pressure of increased federal regulation on the seafood industry is heavy and will likely continue. Coastal small seafood business has been a very individual effort with limited capital availability. The scheme outlined below would allow each his individuality yet enable them to meet the latest in OSHA, FDA, USDC, EPA type requirements.

PLAN OF ACTION: Design and construct a model co-op structure and demonstrate its cost effectiveness, economy of scale and ability to be modern, clean, efficient and competitive.

END PRODUCT: To encourage small fishing and processing business to invest in similar concepts. After demonstration unit has proved its goals, it would be sold to small business interests.

BENEFIT: To assist small seafood related business in meeting federal regulatory requirements and to keep that sector of the U.S. economy alive.

SCHEDULE: Plant design and construction - 1-1/2 years; lease and demonstrate - 1-1/2 years.

BUDGET: $5,000,000

PRIORITY:

3-51 MECHANIZED FISH STORAGE AND UNLOADING

OBJECTIVE: Mechanize fish storage and unloading on large vessels to aid quality improvement and handling of final products. Time is important in terms of money, fish decomposition and vessel turn-around. More efficient systems are needed. This study could also include a new model for harbor facilities to accommodate such vessels and shore-based receiving equipment - i.e., refrigerated containerized carriers.

PLAN OF ACTION: Research and develop the system described above with a plan for prototype testing under actual conditions.

END PRODUCT: A quicker more efficient way to unload fish, less labor intensive, and with greater attention to quality production.

BENEFIT: Savings in time, energy and vessel turn-around.

SCHEDULE: Three years

BUDGET: $750,000

PRIORITY:

3-52 IDENTIFY TECHNOLOGIES CAPABLE OF UPGRADING THE USES AND VALUE OF INDUSTRIAL FISH

OBJECTIVE: Upgrade the uses and value of industrial fish.

PLAN OF ACTION:

(1) Survey the alternative opportunities presently or potentially available for converting industrial species such as menhaden or anchovy to fishery products suitable for direct human consumption. This includes identifying the technological, regulatory, economic and marketing needs for each case. Estimate time and cost of development and probability of success.

(2) Select the approaches most likely to succeed, and outline specific programs to develop the required technology, cost and market data and to institute regulatory changes needed to provide a basis for industry investment.

(3) Implement the selected programs on a joint government industry basis.

END PRODUCT: A comprehensive framework of sound technological, cost and market information on one or more fishery processes which will provide a basis for industry to upgrade industrial or low value food fisheries.

BENEFITS:

(1) Will increase the supply of protein food directly available to the consumer from the ocean.

(2) Will improve the efficient use of national and international resources.

(3) Will provide a more valuable use of industrial fish.

(4) Will provide a backstop position for the reduction industry against cheap competitive food proteins (single cell, soy, etc.).

(5) Can benefit developing countries now converting fish to fish meal.

SCHEDULE: Initial survey by expert group - 6 months. Development action schedule cannot be predicted exactly, but expected to take 2-4 years.

BUDGET: Depends on number of sub-projects undertaken. Initial survey - $60,000. Development $250,000 product-approach/year. This includes Government/industry costs.

PRIORITY:

3-53 PROBLEMS ASSOCIATED WITH THE PRESENCE OF NEMATODES IN SURF CLAMS AND CALICO SCALLOPS

OBJECTIVE: The surf clam industry is confronted with a major potential problem related to F.D.A. and consumer acceptance of worm-infested clams. Determine prevalence and geographical distribution of nematodes and other parasites in surf clams. Utilize new data to assist seafood industry in modifying processing methods for clam meats to assume product acceptability.

PLAN OF ACTION: Quantitative determinations on numbers of parasites per clam must be made with regard to geographic distribution. Parasites must be identified by specialists in order to assure that none are potentially harmful to humans. Parasites recovered from clams must be used in laboratory animals infection experiments. Finally, economically feasible technology must be developed to free clam meats from biotic contaminants and reduce foreign particles to levels accepted by the Food and Drug Administration. Vessel acquisition and capture gear would be helpful but not critical -- charters could substitute.

END PRODUCT: A beforehand knowledge of harvestable areas of the sea which yield clams with minimal or maximal parasite burdens.

BENEFIT: Clam producers should be able to estimate the amount of processing that is required in order to produce acceptable products. Areas of low parasite loads would require less additional quality control than areas of high parasite load. Animal tests would measure the public health hazard of clam parasites, or the lack of a hazard.

SCHEDULE: Three years. Map parasite distribution from north to south, and from nearshore to offshore (2 years). Analyze seasonal differences in parasite burdens (2 years). Make specific parasite identifications and complete animals tests (3 years).

BUDGET:

1st Year	$131,000
2nd Year	$ 99,000
3rd Year	$108,000
4th Year	$111,000
5th Year	---

Vessel Construction - $250,000

PRIORITY:

3-54 REDUCTION OF PRESENT ENERGY DEPENDENCY - VESSELS

OBJECTIVE: Reduce the energy dependent requirements of search, harvest and protection of the catch. Develop new systems that will use less energy but remain efficient - vessel and gear design, other fuel power sources, and engine re-design.

PLAN OF ACTION: Research and develop alternate sources of energy for vessel power.

END PRODUCT: New systems that use cheaper fuels or alternative approaches to energy.

BENEFIT: Cost savings to boat owners, easing of total dependence on present fuels, possible lower cost of landed food.

SCHEDULE: Five years

BUDGET: $1,500,000

PRIORITY:

3-55 REVITALIZATION OF OUR DOMESTIC OYSTER INDUSTRY

OBJECTIVE: To develop a cooperative comprehensive, 5-year concerted effort between industry, states, academic and Federal researchers, economists and marketing personnel to revitalize our domestic oyster industry.

PLAN OF ACTION: NMFS/NOAA will have the lead responsibility for formulating and coordinating a 5-year cooperative research/assistance program employing Federal, state, industry, and academic funding and personnel.

In the first year, a preliminary survey will be conducted to document the oyster industry and its technical and economic capabilities as related to problems of: resource availability, shellfish safety, diminishing markets, operational changes needed to develop new products, improve sanitation, and comply with an array of new and anticipated Federal legislation including environmental protection, packaging and labeling, and product and plant inspections. The survey will delineate the need for indepth studies, research and assistance indicating funding requirements for resolution.

A Master Plan identifying priority needs will be developed jointly, in the second year, with industry, states, other Federal agencies, and academic parties. The Master Plan will be presented for modification/endorsement at national and regional public hearings. The plan will identify:

(1) Needs,

(2) Ongoing activities,

(3) A consensus of joint priorities with corresponding funds and support, and

(4) Joint responsibilities to promote a systematic resolution of the oyster industry's problems.

Federal funds will be used to coordinate and integrate findings and establish a dissemination network to include all users. Direct federal contractual assistance will be provided in critical areas not adequately addressed by other participants.

A National Oyster Advisory Panel will be established to monitor progress, changing needs, and review cooperative research proposals so as to maximize continued efforts to improve the oyster industry.

END PRODUCT: A systematic, cooperatively funded plan of action will emerge to improve and maintain our oyster industry. An information dissemination network and National Oyster Advisory Panel will assure continued integrated progress and maximize overall efforts.

BENEFIT: Oysters are an important traditional food resource and are processed in more plants than any other seafood. The industry, composed of many small independent processors, is not equipped to resolve or even delineate all of the factors contributing to the present crisis. This cooperative 5-year program will revitalize the oyster industry which is not only important in terms of retail sales, but also supports watermen and plant personnel in coastal areas, boat manufacturing, and other related trades.

SCHEDULE: 5 years

BUDGET:	Year 1	Year 2	Year 3	Year 4	Year 5
	$350,000	$850,000	$185,000	$185,000	$185,000

PRIORITY:

3-56

ORGANIZING AND OPERATING FISHERY INSURANCE COOPERATIVES

OBJECTIVE: The U.S. fishing industry has experienced sharply rising insurance costs especially costs of protection and indemnity (P & I) insurance. Much of this increase has stemmed from the litigation of cases and resulting high court settlements. A legislative bill has been developed and introduced in Congress which would provide a schedule of payments to be made to fishermen or their dependents in cases of injury and death. However, whether or not the bill is passed into law, insurance costs for commercial fishing vessels may be reduced through self insurance of the mutual company type which is organized and operated by fishermen themselves.

The objective of this proposal is to develop a model cooperative (mutual) insurance organization for fishermen and to assist them in organizing and operating insurance cooperatives. Self insurance tends to reduce insurance costs because of the direct relationship between claims settlements and insurance costs and the associated safety performance of the vessel and its crew members. While this approach to the commercial fishing vessel insurance problem treats the symptoms rather than the primary cause of the problem, it can be effective in correcting some of the secondary causes of high insurance costs and is probably the second best solution to the problem; the primary cause being case litigation.

PLAN OF ACTION:

(1) Develop a model fishery insurance cooperative using those now functioning as prototypes.

(2) Increase the awareness of fisheries to the potentials of an insurance cooperative and to methods of organizing and operating fishery cooperatives. This will be accomplished with a publication and fisheries briefings.

(3) Assist fisheries in organizing and in operating insurance cooperatives.

END PRODUCT: Greater control of vessel insurance costs by vessel owners with the strong prospect of lower insurance costs than otherwise would exist.

BENEFITS: Lower vessel insurance costs are possible when a fishery adopts self insurance. This being the ultimate benefit sought.

SCHEDULE:

(1) Develop a model cooperative insurance organization.

(2) Publish and brief U.S. fisheries on the organization and benefits, next six months.

(3) Assist fisheries in organizing and operating a fishery insurance cooperative (continuous).

BUDGET: 1st Year $10,000
2nd Year $30,000

PRIORITY:

3-57 UNDERLYING CAUSES OF LIPID RANCIDITY IN FISH MUSCLE (CROAKER)

OBJECTIVES: To study the biological mechanisms, enzymatic, organo-metalic, etc., that stimulates lipolytic autolysis in fish muscle, especially in the fish that contain a high percentage of fat in the muscle and harvested from warm waters.

PLAN OF ACTION: In order to be able to handle and process fish, so it will maintain the best possible quality, it is necessary to understand the biological reactions that contribute to rancidity.

(1) Seasonal variations - to determine at what time of the year the species is in optimum physical condition.

(2) Geographical variation - to determine what affect the food in the environs has on composition.

(3) Study the variation and changes in the degree of saturation of the fatty acids.

(4) Study the mineral composition, especially the microelements that are inclined to spark the rate of oxidation.

(5) Isolate the enzymes that are involved in the oxidative reactions.

(6) Determine how the fish can be handled or processed to overcome the cause of deterioration.

END PRODUCT: It will provide a basis upon which the method of processing can be based on the lipid composition in order to obtain a fish product with prime quality.

BENEFIT: Economically, it will provide a basis upon which the price of raw material can be determined. Also, it will improve the quality of the fish sold to the consumer. It will improve consumer confidence in fishery products.

SCHEDULE: Two years are needed to complete the research work and about 6 months to summarize and write up the report of the findings.

BUDGET: $200,000 for contracts
$ 75,000 for each of the 2 years
$ 50,000 to write up the report of the findings.

PRIORITY:

3-58 FISHERY RESOURCES FOR THE FUTURE INCLUDING UNDERUTILIZED RESOURCES

OBJECTIVE: To develop and test specific production and market systems for utilizing little known and underdeveloped fishery resources of the Northeast Pacific for food.

PLAN OF ACTION: A steering committee will be formed to prepare plans and undertake specific developments for testing, harvesting, processing, and marketing of food products and/or ingredients from selected species not now utilized fully by the U.S. for food production. Produce recommendations and proposed process systems for development will be screened by the committee. Production tests will include technological and economic feasibility and will be limited to small-scale or pilot plant tests unless industry facilities are available for commercial production tests. Products will include processed, precooked convenience foods such as breaded products, fish cakes, salted and smoked specialty foods, canned specialties, and reformed or extruded products and processed food ingredients and meat extenders for use in processed meats, sausages, spreads, luncheon meats, and precooked entrees.

END PRODUCT: Conceptual product and system demonstrations and published reports of each system-species development including technical and economic data on process, yields, equipment, problems, alternatives, costs, and recommendations for industry consideration will be derived.

BENEFIT: System-species developments with commercial potential will be clearly identified and will provide the needed basic information for industry application as resource allocations under extended jurisdiction are assigned for domestic development. Intangible benefits will include determinations of the acceptability of products from otherwise little-known species and their potential for increasing the domestic per capita consumption of fishery products.

SCHEDULE: Five years. Each system development contract will be planned for two years. About three to five such developments should be selected and implemented during five years.

BUDGET: 1st Year - $200,000
2nd to 5th Year - $250,000 each year for a total of $1,000,000
Total budget - $1,200,000

PRIORITY:

3- 59 TARIFFS AND NONTARIFF BARRIERS TO TRADE IN FISH AND FISHERY PRODUCTS

OBJECTIVE:

1. To identify both U.S. and foreign tariff and nontariff barriers to international trade in fish and fishery products.

2. To develop a position with justification for each U.S. tariff and nontariff barrier to U.S. imports of fishery products.

3. To identify concessions which the U.S. fisheries want negotiators to obtain from foreign governments. These should include not only tariffs and nontariff barriers to foreign market access for fishery products but also fish resources and other yet unidentified concessions.

PLAN OF ACTION: The socio-economic impact of alterations in various trade barriers should be developed for each TSUS item and for each nontariff barrier. Consideration should be given to the impact on fishermen, fish wholesalers, fish processors, importers, the regional economy, national food supply, and the balance of trade. Proper emphasis should be given to the fisheries resources of the U.S., short run food needs, long run food needs and world politics.

Develop concessions wanted by U.S. fisheries in conjunction with members of the U.S. fishery industry. Delineate the effect that each concession would have on U.S. fishery exports, development, employment, incomes, and the regional and national economics.

END PRODUCT: The position on each TSUS item and nontariff barrier will be applied in trade negotiations now underway in Geneva. Concessions will be sought in current negotiations. A stronger international trade posture for U.S. fisheries and for U.S. consumers is the intended outcome.

BENEFITS: Positions taken and information developed will help determine the well being of U.S. fisheries and consumers following the current round of multilateral trade negotiations. The lack of clear positions and strong supporting data could have a very adverse impact on some of the U.S. fisheries which now enjoy substantial market protection. This is because tariffs are likely to be reduced by 50 percent or more and only a very convincing argument will prevent this.

SCHEDULE: This must be accomplished prior to September 1, 1976, to be applicable in current negotiations.

BUDGET: Total project cost about $35,000.

PRIORITY:

3- 60 FOOD FISH DATA BANK

OBJECTIVE: Develop a comprehensive Food Fish Data Bank to provide a central information point for all species important to commercial or recreational fishermen. Update existing publications and develop new publications to meet constituent information needs.

PLAN OF ACTION: A researcher will collect date from NMFS labs and other sources. The data will be organized to provide ready access to specific types of information such as nutrition or the latest processing techniques.

(1) To enlist the cooperation and meet the needs of all concerned NMFS elements, a planning committee will be formed. The committee will provide guidance on the amount of detail to be included in the species files. For highly technical or detailed information, the file would refer to the original source. The committee will determine what type of information or which species should be given highest priority.

(2) The researcher would travel to the various labs, compile the information, and report periodically to the committee. These reports would comment on the availability of desired information and relay field staff input about the types of information needed by their constituents. The committee could then determine if priorities should be changed or additional data obtained.

(3) When sufficient information is organized, the committee would determine what types of updated or new publications are needed and decide priorities. The researcher would then make arrangements for development of the publications.

END PRODUCTS: A single, comprehensive data file would provide a ready reference source for future information needs. The existing "Food Fish Facts" (which provide information on life history, habitat, fishing methods, distribution, and use of 48 food fish species) would be updated and expanded to include more species and additional information such as nutrition. This publication provides information to a broad range of constituents. Publications would be developed from the Data Bank which will meet the needs of specific constituents: An example would be a handbook for recreational fishermen on how to convert their catch into nutritious, tasty meals.

BENEFIT: The Data Bank will provide a single source for NMFS personnel to begin research for publications. If the file itself does not provide sufficient detail, it will contain references to additional data sources. This will enable NMFS to respond quickly to urgent needs for information.

SCHEDULE: The project would be complete in approximately one and a half years. Then, it would be part of the regular mission of the National Fishery Education Center to update the Data Bank with new information, particularly data on underutilized species.

BUDGET:

	1976 (3 mo.)	1977	1978 (3 mo.)
Committee travel*	$ 600	$ 1,200	$ 0
Researcher travel	1,600	4,800	1,000
Contract for writing**	0	3,000	2,000
Printing	0	5,000	4,000
	$2,200	$14,000	$7,000

* This amount would be reduced if committee meetings could be combined with other meetings.

** This amount would be reduced if the writing was done by NMFS personnel.

PRIORITY:

3-61 IDENTIFICATION AND ELIMINATION OF POTENTIAL PATHOGENS IN SEAFOOD AND FISHERY PRODUCTS

OBJECTIVE: Cancers, viruses, and bacteria of human and presumed non-human origin have been found in fish and shellfish of the U.S. We know nothing of the range of infectivity of these diseases including their ability to infect man. We plan to safeguard the public health against potential pathogens in raw and processed marine fish and shellfish through programs of biological research, food technology and fishery management.

PLAN OF ACTION: Like other highly perishable animal-derived foods, fish and fishery products can serve as active or passive vehicles for transmission of hazardous enteric diseases, including salmonellosis, vibriosis, staphylococcus, enteritis, botulism and hepatitis. Parasites and viruses other than hepatitis also pose potential hazards. It is proposed that a research group and laboratory be established within NMFS to assay the extent of hazard from infectious agents in fish and fishery products, to define and characterize such agents, and develop methods to prevent, eliminate, or abate these hazards and prolong shelf life.

END PRODUCT: The end products will be certified safe, wholesome, dependable foods which consumers will accept with confidence and without hesitation.

BENEFIT: A federally-guaranteed imprimatur of public health safety and quality will enhance value, consumer acceptance, and benefit both the public and the fisheries industry.

SCHEDULE: This proposal is for a continuing project with unpredictable milestones.

BUDGET:

1st Year	$365,000
2nd Year	$321,000
3rd Year	$332,000
4th Year	$345,000
5th Year	$352,000

PRIORITY:

3-62

MARKET RESEARCH

OBJECTIVE: Initiate major 5-year National Market research program to provide industry and appropriate government agencies with information on consumption, consumption trends, elasticity and cross-elasticity of demand and other pertinent market information.

PLAN OF ACTION: Envisioned is a coordinated and cooperative market research effort on the part of about five Sea Grant Universities strategically located throughout the U.S., i.e., Southwest, Northwest, Midwest, Northeast, and Southeast. NMFS could serve as National Coordinator of program or could be done by one of the Sea Grant Universities.

END PRODUCT: Market information to better enable industry to improve marketing strategies. Will better enable industry to take advantage of extended fisheries jurisdiction.

BENEFIT: Will enhance industry production, processing and marketing capabilities. Also, will provide better baseline data for microconstituent guidelines that are established by regulatory agencies.

SCHEDULE: Five-year project. Semi-annual progress reports containing results of studies.

BUDGET: $1.5 million each year for five years.

PRIORITY:

3-63 QUARANTINE AND INSPECTION SERVICE FOR MARINE FISH AND SHELLFISH

OBJECTIVE: Negotiations with some countries are now in progress to permit entry into the U.S. of live, fresh killed or insufficiently processed eggs, larvae, juvenile and adult marine shellfish and finfish species. We plan to protect coastal U.S. waters against the possible introduction of infectious (contagious) diseases and noxious pests and predators that will severely reduce domestic marine fish and shellfish resources.

PLAN OF ACTION:

(1) Establish guidelines for the screening of foreign and domestic fish and shellfish resources for infectious and noninfectious disease;

(2) To develop techniques to determine the viability of disease agents subjected to standard processing procedures;

(3) Develop susceptible model systems to determine pathogenicity of infectious agents;

(4) Construction of laboratory wings and effluent disposal systems on the east, west and Gulf coasts.

END PRODUCT: Certified disease-free imported fishery products and protein of natural resources.

BENEFITS: Protect marine fish and shellfish resources from the introduction of diseases and other undesirable organisms.

SCHEDULE:

(1) Develop protocols for the inspection and quarantine of marine products on three U.S. coasts prior to their importation into United States (1 year);

(2) Develop techniques to determine the viability of disease agents subjected to standard processing procedures (5 years);

(3) Develop susceptible model systems to determine pathogenicity of infectious agents (5 years);

BUDGET:	1st Year	$381,000
	2nd Year	$348,000
	3rd Year	$640,000
	4th Year	$670,000
	5th Year	$936,000

PRIORITY:

LIVING RESOURCES

AQUACULTURE/MARICULTURE

LIVING RESOURCES PANEL

AQUACULTURE/MARICULTURE

3-64 Mariculture Integration With Platform Buffer Zone
3-65 Mariculture Stimulation Through Market Broadening
3-66 Use of Heated Water from Nearshore Power Plants to Accelerate Mariculture Output
3-67 Pilot Mariculture Bed To Use Ocean Thermal Ammonia Plant-Ship Cold Water Nutrients to Produce Shellfish and Lobsters
3-68 Feasibility Study of Using Treated Sewage Effluents as a Nutrient Source For Fish
3-69 Investigation of Accelerating Fish and Shellfish Maturation In the Presence of Warm Water and Use of Special Diets
3-70 Evaluation of U.S. Brackish Waters as Future Areas for Fish Pond Culture
3-71 Aquaculture and Diseases of Marine Fish and Shellfish
3-72 Aquaculture of Low Cost Fishes
3-73 Bio-Conversion of Energy and Animal Waste Recycling Through Aquaculture
3-74 Enhancement of Coastal Fisheries For Pandalid Shrimp Through Aquaculture
3-75 Marine Culture of Pacific Salmonids For Enhancement of Recreational Fisheries in Puget Sound
3-76 Examination of the Nutrative Capacity of Bio-deteriogenic Fungi For Commercially Valuable Shrimp
3-77 A Search For Genetically Controlled Economically Important Traits In the Malaysian Prawn, (Macrobrachium Rosenbergii)
3-78 Use of Fishery Wasts As Aquaculture Feeds
3-79 Application of Alternative Technology In Commercial Shrimp Culture
3-80 Increased Aquaculture Productivity
3-81 Marine Biogenic Energy Sources

3-64 MARICULTURE INTEGRATION WITH PLATFORM BUFFER ZONES

OBJECTIVE: To stimulate U. S. mariculture industry by investigating its compatibility with projected offshore operations.

PLAN OF ACTION: With the anticipated erection of offshore platforms for utilization in offshore industry, it is thought that regulatory requirements for safe operation, safe navigation and other considerations will provide for designated buffer zones about each platform. These required zones could well provide sea space for mariculture activities which might be effectively monitored from the adjacent platforms.

1. Conduct a feasibility study which will explore the practicality of using the void or buffer zone sea spaces about offshore platforms for mariculture purposes. Considerations would include segregation of the species from the open sea, disease control, nutrition variants, compatibility of the mariculture with various platform operations, and the utilization of the platforms for monitoring and control of the mariculture.

2. If supported by study results, design a scaled pilot project, or series thereof, which will demonstrate in nature the feasibilities explored in the study.

3. Design, deploy and test the most promising mariculture project in an operating offshore environment.

END PRODUCT: A proven mariculture undertaking whose deployment is compatible with anticipated expanded offshore operations in coastal U. S. waters.

BENEFITS: Source of additional food supplies and productive means for replenishment of living resources of the oceans.

SCHEDULE: Feasibility 1 year; pilot projects 2 years; full scale project test 3 years.

BUDGET: First year, $50,000; Second-Third years, $300,000 total; Final 3 years, $1 million.

PRIORITY:

3-65 MARICULTURE STIMULATION THROUGH MARKET BROADENING

OBJECTIVE: To stimulate the botanical aspects of U. S. mariculture industry by seeking new applications for algae and its components.

PLAN OF ACTION: Algae derivitives are mainly used as gelling and stabilizing elements in pharmaceuticals, dairy and some nonfood products. Potential uses based on algae's bioactive properties, nutritive values and as a source of noncolloidal alcohol remain to be exploited. If demand can be stimulated, the problems of labor intensive harvesting and extraction, as well as anticipated refining problems, can then be researched.

1. Review the current use of algae derivitives and catalogue past research on potential alternate uses.

2. Develop a component program of basic and applied research which will pursue a multi-path effort to generate new knowledge with regard to algae and its derivitives. The program should be elementally structured so as to be responsive to varied annual funding levels and shifting annual priorities.

END PRODUCT: A systematic research plan for exploring the botanical potential of the living resources of the U. S. coastal oceans.

BENEFIT: Provide a continuing focal point for U. S. activity with regard to living resources commercial development of the oceans and serve as a stimulus for U. S. mariculture undertakings.

SCHEDULE: Continuing multi-year.

BUDGET: First year $200,000, succeeding $1,000,000.

PRIORITY:

3-66 INVESTIGATION OF LONG-TERM DEMONSTRATION PROJECT TO ACCELERATE PRODUCTION OF COMMERCIAL SHELLFISH IN AND AROUND THE HEATED WATERS OF ONSHORE POWER PLANTS

OBJECTIVE: To increase supply of captive shellfish for harvesting.

PLAN OF ACTION:

1. Inventory potential U.S. locations where this type of project can be established and determine environmental conditions for each, e.g., tidal variation, salinity, temperature gradient, degree of contamination, etc.

2. Select one or more suitable sites.

3. Evaluate pilot plans now in operation or abandoned and evaluate results.

4. Establish one or more pilot programs for one or more shellfish types and maintain continual monitoring.

5. Determine commercial applicability and feasibility.

END PRODUCT: Use of thermal outfall from power plants for practical, commercial utilization.

BENEFIT: Increase in shellfish supply.

SCHEDULE: Five years.

BUDGET: $250,000

PRIORITY:

3-67 PILOT MARICULTURE BED TO USE OCEAN THERMAL AMMONIA PLANT-SHIP COLD WATER NUTRIENTS TO PRODUCE SHELLFISH AND LOBSTERS

OBJECTIVE: To attach a pilot size mariculture bed to an ocean thermal pilot plant-ship and demonstrate the commercial benefits attainable.

PLAN OF ACTION: The work will proceed in two phases. In Phase I, a composite engineering design will be made of a mariculture bed for use of cold water discharge for controlled production of a limited number of shellfish and lobster. The method of attachment, seakeeping, survivability and operating requirements of the pilot bed will be defined. The expected production and method of cold water transfer from the pilot plant-ship to the pilot bed will be selected. An economic analysis will be completed. (A Columbia University of New York, Lamont-Doherty Geological Observatory paper based on operation of a demonstration installation in St. Croix has estimated that a shellfish and lobster by-product of $516 million per year could be obtained from the cold water effluent of a 100 MW plant-ship). In Phase II, construction, deployment, attachment, start-up and 1-2 years operation of the pilot bed will be completed.

END PRODUCT: A demonstrated capability of mariculture by-product production from an ocean thermal ammonia pilot plant-ship. An economic analysis of the costs and commercial value of mariculture by-product from plant-ships of commercial size.

BENEFIT: The commercial viability of the ocean thermal plant-ship producing energy-intensive products will be enhanced.

SCHEDULE: Three years. Complete in two phases. Phase I - 1 year, Phase II - 2 years.

BUDGET: Phase I - $100,000; Phase II - $1,000,000 (accurate estimate after Phase I)

PRIORITY:

3-68 FEASIBILITY STUDY OF USING TREATED SEWAGE EFFLUENT AS A NUTRIENT SOURCE FOR FISH

<u>OBJECTIVE</u>: To recycle nutrients that would otherwise be discarded and to provide a new food source for fish to accelerate growth.

<u>PLAN OF ACTION</u>: The sequence of steps would include:

1. Review state-of-the-art both here and abroad.

2. Determine nutrient quality of effluent from sewage plants and evaluate suitability for selected fish and shellfish.

3. Set up laboratory experiment and monitor results.

4. Implement pilot operation at appropriate field site and monitor results.

<u>END PRODUCT</u>: Development of new food source for fish to spur growth.

<u>BENEFIT</u>: Increased fish supply.

<u>SCHEDULE</u>: Three years

<u>BUDGET</u>: $250,000

<u>PRIORITY</u>:

3-69 INVESTIGATION OF ACCELERATING FISH AND SHELLFISH MATURATION IN THE PRESENCE OF WARM WATER AND USE OF SPECIAL DIETS

OBJECTIVE: To speed the raising and harvesting of edible marine commercial fish and shellfish.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate U.S. and foreign pilot projects and other studies related to this field including physical conditions, species, additive nutrients, etc.

2. Evaluate potential sites in the U.S. where warm water from power plants and industrial facilities is available and the type of marine organisms that can be raised.

3. Select one (1) representative site for shellfish and one (1) representative site for commercial fish species and determine technical and economic feasibility.

4. If feasible, design a system and methodology of operation for a pilot operation at each representative site.

5. Implement pilot projects and monitor results.

END PRODUCT: Development of techniques to accelerate growth of fish and shellfish.

BENEFIT: Increase in food supply.

SCHEDULE: Three years

BUDGET: $1.5 million

PRIORITY:

3-70 EVALUATION OF U.S. BRACKISH WATERS AS FUTURE AREAS FOR FISH POND CULTURE

OBJECTIVE: To determine if brackish waters are suitable as a new resource base for the development of fish stocks.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate both U.S. and foreign areas where brackish waters are impounded, stocked, and cultivated in terms of physical conditions, species, economics, labor, marketability, etc.

2. Evaluate those areas of the U.S. where fish pond culture in brackish waters would be adaptable.

3. Using several representative areas, determine the technical and economic feasibility.

4. If feasible, prepare a design plan for a pilot project on the most appropriate site.

5. Implement pilot project and monitor results.

END PRODUCT: Pilot project that will indicate the appropriateness of adapting fish pond culture to U.S. brackish waters.

BENEFIT: Development of additional food sources.

SCHEDULE: Three years

BUDGET: $1 million

PRIORITY:

3-71 AQUACULTURE AND DISEASES OF MARINE FISH AND SHELLFISH

OBJECTIVE: To conduct bibliographic and applied research on the diseases of intensively cultured marine fish and shellfish.

PLAN OF ACTION: Bibliographic research will be conducted to assemble a complete and up-to-date compilation of the diseases of marine fish and shellfish amenable to aquaculture. Based on an identification and prioritization of disease related problems, research will be initiated on the infectious and neoplastic diseases of fish and shellfish.

END PRODUCT: An initial product of the research will be a documentation of the diseases limiting the intensive culture of marine fish and shellfish. Applied research on the more significant diseases will improve the technical feasibility of aquaculture. Presently, disease is an almost universal limiting factor in aquaculture of selected marine and shellfish.

BENEFIT: The utility of the research is based on its ability to significantly improve methodologies for successful aquaculture of marine fish and shellfish.

SCHEDULE: The project will be conducted during a five-year period in which the following milestones will occur:

Year 1 - Assemble bibliography on diseases of marine shellfish.
Year 2 - Assemble bibliography on diseases of marine fish.
Year 3 - Initiate disease research on a selected species of fish and shellfish.
Year 5 - Publish results of studies.

BUDGET:

1st Year	$218,000
2nd Year	$200,000
3rd Year	$241,000
4th Year	$270,000
5th Year	$255,000

PRIORITY:

3-72 AQUACULTURE OF LOW COST FISHES

OBJECTIVE: Although aquaculture in the U.S. has largely concentrated on species in high demand and limited supply, it is not restricted to high-valued species. The development of warm water fish culture utilizing low-cost species (carp, buffalo fish, tilapia, mullet, etc.) that will produce maximum protein returns at the least cost has much appeal. These species feed primarily on plants or detritus, and raised in monoculture or polyculture systems, yield high production levels per acre per year.

The objective of this proposal is to culture, process and market low-cost species (generally of poor acceptance to U.S. consumers) into processed products in which convenience, food value, standardized quality, and price are more important than the name of the species. Recent developments in the field of fish processing technology have made it practicable to use a wide variety of species not accepted as prime food fish. Methods are now available for production of high-quality fish blocks from mechanically separated minced flesh of one or more species.

PLAN OF ACTION: Initially, wild stocks should be utilized. However, if the operations are successful, wild stocks would be quickly reduced to uneconomic levels, and aquaculture would be needed to produce a reliable, year-round supply of the raw product. The plan, which should run a minimum of five years, would include the following sequences:

(1) Assessment of natural stocks (carp, buffalo fish, mullet, etc.) Utilize natural stocks which can be obtained at low cost for development of processing industry and a market for minced fish products, recognizing that natural supplies of some of these species are quite limited.

(2) From a survey of available knowledge (state-of-art survey), determine which species of fish suitable for aquaculture could be expected to produce protein at the lowest cost.

(3) Develop techniques for pond culture of selected fish and brackish water species directed towards improving efficiency of traditional pond culture methods to minimize production costs.

(4) Develop techniques for high density culture and determine economic feasibility.

END PRODUCT: Production of high yields of low-cost fishes to be used in processed fishery and protein extender products.

BENEFITS: Provide to the U.S. consumer (with export potential), a year-round available supply of low-cost, high value protein.

SCHEDULE: Five year program --

Year 1 - Resource assessment of wild stocks -- market development
Years 1 & 2 - Literature search and determination of species suitable for aquaculture
Years 3 - 5 - Development of improved techniques for pond culture
Years 4 - 5 - Development of high density culture techniques

BUDGET: Years 1 & 2 - $300,000 - $400,000
Years 3, 4 & 5 - $500,000 - $600,000

3-73 BIO-CONVERSION OF ENERGY AND ANIMAL WASTE RECYCLING THROUGH AQUACULTURE

OBJECTIVE: To develop the technology for the economical mass production of commercially valuable marine algae utilizing wastes from animal husbandry.

At present, marine cultural systems parallel to agronomy do not exist. There is, nevertheless, a potential for the production of marine plants of economic value utilizing seawater, solar energy and wastes from animal husbandry. Some species of the red, green and blue-green algae are well suited for forced growth under semi-controlled conditions and for automated harvesting. This research offers the possibility of a new source of plant materials for use in industry, livestock feeds, methane production, aquaculture feeds, and human food. Factors which contribute to the attractiveness of this proposal are:

(1) The competing uses and consequent demand for fresh water indicate we should begin using seawater in plant production,

(2) Waste recycling methods offer an economical source of nutrients, and

(3) This approach offers an additional means of utilizing solar energy.

The potential for extremely rapid growth of algae under optimum conditions makes production of immense quantities of plant material per unit area conceivable.

PLAN OF ACTION: As much of the preliminary algal culture research has been done, laboratory research will be limited to maintenance of stock cultures of species used, preliminary analysis of nutrient requirements when required, and chemical analysis of water. During the first year, design and construction of the outdoor facility will be completed while small-scale comparison of algal species is conducted in existing facilities. During the second year, necessary modifications or additions to the "algal farm" will be made and eight species (2 blue-green, 2 green and 4 red) will be selected for use on the basis of productivity, value, and compatibility with year-round operation of the farm.

The farm will consist of a series of shallow concrete tanks designed to facilitate harvesting with a tractor. Each tank will be provided with seawater delivery and drain systems, waste dilution tanks, covers to reduce contamination and air delivery systems. Tanks will be sufficiently large to permit pilot scale commercial evaluation following development of techniques. Two waste sources will be used, chicken manure and an effluent from high-density shrimp culture.

Economic data will be collected along with input from the engineer and biologists to determine the potential for production on a seasonal basis with the eight species under various conditions of flow rates, density, nutrient levels, aeration and harvesting rates.

Industrial cooperation will be encouraged throughout, and especially as quantities of algal material are available for experimental use. Various uses of the algae will be explored with industry and the effects of various environmental conditions on the quality and characteristics of algae will be determined. Algae will be tested as food for cultured marine fish, as commercial sources of carrageenan and other industrial products and as feed supplements for livestock.

END PRODUCT: Techniques for commercial scale production of 8 species of macroalgae and economic costs of production.

BENEFIT: Methods of producing new raw materials using wastes, sunlight and seawater will be developed. The economic feasibility of this production will be determined. If economically attractive, the technology could lead to a new industry.

SCHEDULE: This project will be completed during the 5-year period. At the end of the period, a decision will be made concerning the value of additional specialized research projects to commercial implementation of economically attractive practices.

BUDGET:	Year 1	Year 2	Year 3	Year 4	Year 5
	$770,000	$650,000	$450,000	$440,000	$440,000

PRIORITY:

3-74 ENHANCEMENT OF COASTAL FISHERIES FOR PANDALID SHRIMPS THROUGH AQUACULTURE

OBJECTIVE: Evaluate the contribution of hatchery reared post-larval prawns to the prawn fishery of Hood Canal, Washington. Develop wire-coded tagging techniques for the identification of hatchery reared spot prawn.

PLAN OF ACTION:

(1) Develop a rapid internal tagging technique using the Bergman-Jefferts coded wire tag. Test the effect of the internal tag on growth, survival and tag retention in laboratory reared spot prawns, Pandalus platyceros.

(2) Mass culture one million post larval spot prawns at the NMFS Aquaculture Field Station at Manchester, Washington.

(3) Evaluate the contribution of tagged shrimp released to public shrimp beds in Dabob Bay using appropriate sampling gear.

END PRODUCT: Development of culture techniques for the spot prawn, Pandalus platyceros. Development of an internal wire tag for crustaceans. Economic evaluation of pilot-scale mass culture of the spot prawn. Evaluation of large-scale releases of experimental animals to public shrimp beds.

BENEFIT: A model for future crustacean enhancement-rehabilitation programs using laboratory reared juveniles seed stock.

SCHEDULE: Studies will be cooperative State-Federal projects between NMFS, Washington Department of Fisheries and the University of Washington. The proposed program would have a 5-year duration.

BUDGET:

	Cost (In Thousands)
1977	45.5
1978	67.4
1979	85.7
1980	101.2
1981	54.2

PRIORITY:

3-75 MARINE CULTURE OF PACIFIC SALMONIDS FOR ENHANCEMENT OF RECREATIONAL FISHERIES IN PUGET SOUND

OBJECTIVE: Rehabilitation of Pacific salmon and trout in Puget Sound through the use of marine culture systems. This is a cooperative State-Federal program to investigate:

(1) The impact on the recreational fishery of manipulating size, time, and stocks of delayed and extended reared salmon released from net pens, and

(2) To develop low cost brood stock techniques to enable management agencies to "totally culture" endangered or unique stocks of salmon and trout.

PLAN OF ACTION: The sport fishery in Puget Sound has not responded to the large increase in production of salmon by hatcheries. The numbers of chinook and coho released from and returning to local hatcheries have increased dramatically yet the sport catch has continued to decline. This paradox comes from the tendency of hatchery salmon to leave the Sound while they are feeding and vulnerable to hook-and-line fishing. An evaluation of contribution of coho from Puget Sound hatcheries in recent years using coded wire tags and fin marks to identify the fish and coast-wide catch sampling showed that most of the adult coho residents in Puget Sound were wild fish, and that the hatchery stocks had migrated to the north and west to be caught principally by Canadian trollers along the west coast of Vancouver Island.

Studies with coho and chinook salmon have indicated that hatchery fish, held beyond the usual release time in net pens or at hatcheries, are many more times likely to stay within Puget Sound than to go to the ocean. Puget Sound sport catches of "delayed" fish are up to 60 times greater than normal hatchery released fish. Catches of the "delayed" fish are also significantly higher in the coastal troll and Puget Sound gill net fisheries.

The fish used in this program would be salmon and trout stocks provided by the Washington Departments of Fisheries and Game. They would be transferred as fingerlings to pens floating in salt water at the NMFS Maricultural Experiment Station at Manchester where the experiments would be conducted. All released fish will be adipose fin-marked and uniquely tagged with Bergman-Jefferts coded wire head tags. Tag recovery for released fish would be carried out on Puget Sound and over a broad marine area from northern California to Alaska under the existing WDF Hatchery Contribution Program with cooperation from other State, Federal, and Canadian fishery agencies.

Program elements are designed to:

(1) Determine the rate of return to the central Puget Sound sport fishery of serially-released, accelerated 0-age coho salmon (NMFS-WDF).

(2) Determine the rate of return to the central Puget Sound sport fishery of three genetic stocks of fall chinook reared and serially released from net pens (NMFS-WDF).

(3) Examine the feasibility of production rearing of odd-year pink salmon in saltwater pens for impact release in southern Puget Sound. Establish runs of even-year pink salmon adapted to the Puget Sound environment (NMFS-WDF).

(4) Develop brood stock techniques for the maintenance of endangered stocks of chinook salmon (NMFS-WDF).

(5) Develop net-pen reared broodstock of sea-run cutthroat from fish native to the Puget Sound basin that have a reduced tendency to residualize in freshwater. Determine if delayed saltwater releases of the progeny will establish saltwater residency (NMFS-WDF).

END PRODUCT: A major benefit produced by the program will be the use of extended saltwater rearing as a major tool for enhancing the Puget Sound sport fisheries by the Washington State Departments of Fisheries and Game.

Research information resulting from the studies will have both immediate and long-range benefits. Occurring in the metropolitan center of Washington and affecting the State's most seriously declining fishery, the program could do much to enhance public confidence in fisheries science and management, as well as both Federal and State government.

If successful, these experiments will become the forerunners of continuing large-scale releases by the State management agencies. The ultimate goal will be to assure the increased survival of species of Pacific salmon and trout, not only for the multitudes of sportsmen but also for the sustained support of this State's commercial fleet.

BENEFIT: Benefit will be derived from increased catch of salmon and trout. Application of techniques developed will result in an estimated 25% increase in sport catch, worth 5 million dollars.

SCHEDULE: All studies will be cooperative -- State-Federal projects between NMFS and Washington Department of Fisheries or Washington Department of Game. The proposed program would have a six-year duration, beginning in 1977 and extending through 1982.

BUDGET:

	Cost (In Thousands)
1977	188.7
1978	213.2
1979	154.4
1980	108.0
1981	80.6
1982	66.3

PRIORITY:

3-76 EXAMINATION OF THE NUTRITIVE CAPACITY OF BIODETERIOGENIC FUNGI FOR COMMERCIALLY VALUABLE SHRIMP

OBJECTIVE: To take steps in the direction of reducing the feed costs of the mariculture of shrimp and perhaps other valuable marine animals.

PLAN OF ACTION: A portion of the diet of shrimp in nature is made up of the tissue of fungi within decaying bits of plants. Fungi are capable of converting highly refractile plant-derived waste material (e.g., paper) into their own nutritious biomass. We wish to determine what fraction of the many known biodeteriogenic fungal species can serve as food sources for commercially valuable shrimp. We will obtain these fungi and systematically screen them for nutritive capacity in model aquacultural systems. This will pave the way for development of inexpensive, simulated natural feeds.

END PRODUCT: Information which will serve to indicate the means by which feed for shrimp and other commercially valuable detritivores can be produced from inexpensive agricultural or industrial wastes.

BENEFIT: The value lies in the furthering of practical knowledge of the nutritional demands of commercial shrimp, which could lead to reduction of feed costs in shrimp mariculture, and thereby to its profitability.

SCHEDULE: At this time, the project has been suspended for about nine months. During the three years of its tenure, our experimental work indicated to us the feasibility of the concept of natural food analogues and pointed out the directions in which further work ought to move. The following publication describes the work: Newell, S.Y. and J.W. Fell. 1975. Preliminary experimentation in the development of natural food analogues for culture of detritivorous shrimp. Univ. Miami Sea Grant Tech. Bull. 30. 115 pp. In two more years time, we will be able to generate firm information regarding the range in capacity of biodeteriogenic fungi to support growth of shrimp.

BUDGET: (Direct Costs)	1st Year	-	$25,000
	2nd Year	-	28,000
	TOTAL	-	$53,000

PRIORITY:

3-77

A SEARCH FOR GENETICALLY CONTROLLED ECONOMICALLY IMPORTANT TRAITS IN THE MALAYSIAN PRAWN, MACROBRACHIUM ROSENBERGII

OBJECTIVE: Species with a wide geographical distribution are usually composed of intraspecific races called "ecotypes" distinguished from each other by genetically controlled physiological and reproductive adaptations that have evolved in response to regional environmental and community structural differences.

The wide geographical distribution of native Macrobrachium rosenbergii, a species of considerable national and international aquacultural interest, suggests that ecotypes of Macrobrachium rosenbergii exist and that they may be characterized by adaptations that would give greater production and cost reduction than stocks presently cultured.

Most, if not all, of these stocks in the United States are derived from animals provided by Takuji Fujimura of the Anuenue Fisheries Research Center (AFRC) in Hawaii. Fujimura originally imported about two dozen animals (records are absent as to the exact number) to Hawaii from Penang, Malaysia, as founder stock to the "Anuenue stock". The main reason for importing Penang animals was that they were available. No attempt was made over the years to introduce new stock from Penang or anywhere else. At the very least, 12 animals from one stream in Malaysia is a very biased sample of the gene pool of Macrobrachium rosenbergii. Therefore, it is important to import stocks from throughout the range of distribution of M. rosenbergii and assess their production capabilities, especially regarding growth rate under temperate conditions and reduced larval development time. The objective is, therefore:

(1) To identify areas in the natural distribution of Macrobrachium rosenbergii which have conditions amenable to the evolution of an ecotype adapted to greater production or cost reduction during hatchery and pond operations.

(2) To obtain M. rosenbergii from areas selected under (1).

(3) To maintain breeding stocks of animals obtained under (1) and stocks of the Anuenue variety.

(4) To institute a breeding and larval rearing program using animals from stocks given under (3).

(5) To assess the larval development characteristics, growth rate, stocks obtained under (3) and morphometric characteristics.

(6) To pinpoint the best genetic stock for extensive and intensive aquaculture.

PLAN OF ACTION:

General

Live animals have to be collected from areas throughout the range. Likewise, morphometric data will be obtained. A breeding and grow-out program will be instituted using the live animals. An extensive statistical analysis will be conducted on data obtained from both live and dead animals. Larval rearing, holding and grow-out tank complexes will have to be installed.

Sequence of Action

Activity	Year
(1) Plan collecting expedition	01
(2) Plan physical plant	01
(3) Construct physical plant	01
(4) Begin collecting expedition	02
(5) Ship animals to experimental facility	02
(6) Begin grow-out of young collected animals	02
(7) Standardize ages of breeding stock	02
(8) Begin breeding experiments	02
(9) Begin grow-out experiments	03
(10) Analyze results	03

END PRODUCT: The expected outcome of this program will be the identification and/or construction of a genetic stock that has:

(1) A reduced larval development time,

(2) An increased growth rate under extensive culture in subtropical environments,

(3) An increased growth rate under extensive culture conditions in temperate areas (this involves a decreased morality during "overwintering"),

(4) An increased growth rate under intensive culture,

(5) An increased food conversion efficiency under both extensive and intensive culture, and

(6) The "best" morphometric (body) characteristics which may include:

(a) Optimal head/tail length ratio

(b) Optimal weight/length ratio

(c) Optimal length tail girth ratio

BENEFIT: The major benefits to using different ecotypes for culture will include:

(1) Decreased hatchery operation costs because of increased "turnover" time in the larval cycle.

(2) Increased (extensive) pond production because of better foster growth rate and/or better food conversion.

(3) Increased (intensive) tank production because of foster growth rate and/or food conversion.

(4) Increased extensive and intensive production because of more uniform growth rate.

SCHEDULE: Project length: 5 years
Significant milestones: Year 03 - Identification of ecotypes with reduced larval development time and increased growth rate.

BUDGET:

	Year 01	Year 02	Year 03	Year 04	Year 05
Capital cost	200K	---	---	---	---
Operating cost	60K	60K	70K	80K	90K
	260K	60K	70K	80K	90K

PRIORITY:

3-78 USE OF FISHERY WASTES AS AQUACULTURE FEEDS

OBJECTIVE: Tons of fishery wastes are discarded daily either at sea, through sewer systems or trucked to dumps. Types of wastes discarded, for example, include such products as surf clam bellies, the entire scallop except for the muscle, all fish innards, heads, etc., and shells from crab and shrimp plus associated meat. At the same time, aquaculture feeds depend upon the Peruvian anchovy as its main component. A recent decline in this fish stock resulted in drastic price increases for feeds along with shortages. The objective of this proposal is to survey the amounts of wastes now being discarded, pick several that are in greatest quantities, then determine if they can be developed into usable feeds thus reducing our needs for import types.

PLAN OF ACTION: A total inventory of seafood wastes will be made. Several of these will be selected, formulations using these as a base will be made and then tested on several aquaculture species. The test diets will be compared with those presently being used.

END PRODUCT: The utilization of seafood wastes as feeds for aquaculture species.

BENEFIT: More profits for seafood processors. Less costs for aquaculture feeds. Less dependence on imports for feed formulations.

SCHEDULE: Five-Year Program: Year 1 - Inventory
Year 2 & 3 - Formulation
Year 3 & 4 - Testing

BUDGET: Year 1 - $50,000
Year 2 - $100,000
Year 3 - $100,000
Year 4 - $75,000
Year 5 - $75,000

PRIORITY:

3-79 THE APPLICATION OF ALTERNATIVE TECHNOLOGY IN COMMERCIAL SHRIMP CULTURE

OBJECTIVE: At the present time, the practicality of shrimp culture as a profitable business has not yet been established. The success of the industry will ultimately depend on improvements in growth rate and food conversion efficiency. Towards this end, species selection and nutrition requirements have been given much attention. Although the importance of optimizing feeding rates at various stages of growth has been recognized, there has been no method available for determining shrimp population or the size distribution of shrimp in the grow-out ponds. Pond census information is particularly critical during the last month before harvest because underfeeding or overfeeding must both be avoided. Other counting problems exist in the metering of large numbers of post larvae from the hatchery tanks, and also in the transferral of juveniles from the nursery ponds to the grow-out ponds. Additionally, optimum pond populations and feeding rates might be maintained more readily if the size distribution of a shrimp crop can be kept uniform. Improved size uniformity would also greatly simplify harvesting and processing problems. For example, it might be beneficial in terms of growth rate and/or eventual size uniformity to extract and retain only the "healthiest" fraction (e.g., 10%) from a crop of post larvae from the hatchery.

In view of the foregoing, some objectives of the proposed project include:

(1) An ultrasonic Doppler shrimp detector would be constructed and evaluated as a means for counting shrimp in grow out ponds. Preliminary tests have shown that this proposed counting technique is practical even for burrowed shrimp, and it has the additional capability of providing size distribution information.

(2) A high speed separator (based on a suitable behavioral response to a stimulus) would be developed for selecting out a uniformly responsive (and presumably most viable) segment from a hatchery or nursery pond population for continued grow out. Using the separator, a controlled test would be conducted to determine if the selected group grows faster or maintains a narrower size distribution compared to a control group.

(3) Certain behavioral responses of shrimp to various stimuli would be investigated as a possible approach to a new harvesting method.

(4) Some possible high speed counting techniques for post larvae and juvenile shrimp would be considered.

END PRODUCT: A method and apparatus will be provided for counting shrimp in grow out ponds so that optimum feeding rates can be maintained. A fast separator for extracting a most desirable fraction from a population of post larvae or juveniles should provide a more uniform size distribution when the retained segment is eventually harvested. It is possible also that an improved average growth rate might be realized for the retained group.

BENEFIT: Accurate population counts, particularly during the final phase of growth, will make it possible to optimize feeding rates and improve the total food conversion efficiency. Harvest size predictions would be greatly facilitated. Rapid separation techniques for post larvae or juveniles could result in a more uniform size distribution in the final pond population thus simplifying harvesting problems and processing.

SCHEDULE: One year

BUDGET: Estimated $30,000

PRIORITY:

3- 80 INCREASED AQUACULTURE PRODUCTIVITY

OBJECTIVE: To examine the biological and ecological factors by which one might hope to stimulate and manage a larger productivity of useful species, or of collection of useful species.

PLAN OF ACTION: Examine the various questions involved in improving the potential yield of fish or other seafood in semi-controlled or uncontrolled conditions in bays, sounds, or the open ocean and examine the possibilities involved in feeding, fertilizing, genetics and reproductive control, predator control, disease control, artificial upwelling, etc., in the search for useful and interesting cases. This examination of the scientific factors will be coupled with some examination of the technologies and kinds of engineering required to carry out such a program, as well as examining problems of regulations, law, investment incentive, and economic and social arrangements that might make such stimulation of fisheries practical. This departs from most previous work in aquaculture because it proposes to examine the cases in which there is incomplete control of the situation. There have been some experiments of this type, but none to our knowledge have examined the broad range of non-scientific factors involved, as well as the direct biological questions. If initial examination of the problem shows it to be reasonable, we would hope eventually to proceed through stages of analysis of what is known, theoretical analysis, and the examination of possible cases, to actual pilot work. As an initial hypothesis, lobster in the open sea and bottom flat fish would be considered, as well as extensions of the conventional farming of bi-valves.

END PRODUCT: Greater understanding of the biological, ecological, and technological applications in the growth of marine organisms.

BENEFIT: Improved yields of fish and shellfish; increased food production.

SCHEDULE:

BUDGET:

PRIORITY:

3-81 MARINE BIOGENIC ENERGY SOURCES

OBJECTIVE: Many marine biological activities produce energy in storable forms. For example, the growth of kelp can produce combustible materials; metabolism and growth of certain phytoplankton produce hydrogen directly, and the anaerobic activity of certain bacteria on organic wastes produces methane. Moreover, other biological activities may produce components that might be synthesized into synthetic fuels. At present, this is a moderately known realm which may well bear further investigation. The objective of this program element is to focus a portion of the nation's scientific and technological resources on pursuing these investigations further until the energy conversion potential of marine biological processes can be adequately assessed and, where appropriate, developed.

PLAN OF ACTION:

Phase I would demonstrate the technical feasibility and investigate the economic feasibility of all concerned technologies between now and 1978-80.

Phase II would prove the concept with two 1000-acre farms in the 1983-1985 time period.

Phase III would demonstrate the commercial practicality of the concept with an operating 100,000-acre farm system by the 1989-1992 time period.

END PRODUCT: Potentially new sources of renewable energy.

BENEFIT: Potentially, additional energy independence and improved balance of trade position.

SCHEDULE AND BUDGETS:

Phase I: to finish by 1978-1980 at a total estimated cost of $5 to $30 million.

Phase II: to finish by 1983-1985 at a total estimated cost of $50 to $100 million.

Phase III: to finish by 1989-1992 at a total estimated cost of $2 to $4 billion.

PRIORITY:

OCEAN
SITING

Ocean Siting

ENERGY SOURCES

OCEAN SITING PANEL

ENERGY SOURCES

4-1 Ocean Thermal Energy Conversion Feasibility
4-2 Energy From Ocean Waves and Currents
4-3 A Floating Solar Power Plant
4-4 Offshore Geothermal Power Plant
4-5 Offshore Wind Power Plants
4-6 Offshore Geothermal Power Plant
4-7 Ocean Thermal Energy Conversion (OTEC)
4-8 Floating Nuclear Power Plants

4-1 OCEAN THERMAL ENERGY CONVERSION FEASIBILITY

OBJECTIVE: To determine the technical and economic feasibility of ocean thermal energy conversion at the earliest possible date.

PLAN OF ACTION: ERDA already has an ocean thermal energy conversion (OTEC) program underway. Funding for fiscal 1976 is reported to be $6 million. At present the program is characterized by multiple studies at multiple institutions. Many respected individuals in the OTEC community feel that the time for a concerted effort to achieve a pilot capability is now. This will require an expanded budget and increased program management strength within the ERDA organization.

END PRODUCT: Potentially, a new and massive energy resource for the country.

BENEFIT: Independence from foreign oil supplies and improved position in the world balance of trade; not to say insurance of survival beyond the limits of world fossil fuel reserved.

SCHEDULE: Six years to achieve a pilot plant capability which will determine the economic and technical feasibility of OTEC.

BUDGET: $11 million for the first year; with further budgets to be determined as the project proceeds. Very likely, the budget for this total project will exceed $300 or 400 million.

PRIORITY:

4-2

ENERGY FROM OCEAN WAVES AND CURRENTS

OBJECTIVE: To determine the energy potential of ocean waves and currents, the most likely sites in the oceans for utilizing such energy, the most effective devices for extracting such energy, and the most appropriate uses of whatever energy may be available.

PLAN OF ACTION: At the moment, it seems most likely that ocean waves and currents, at best, will provide auxiliary sources of power for offshore industry and thereby reduce the reliance of such industries on other sources of power. The literature abounds with proposals for energy extraction devices employing ocean waves and currents. These require unbiased and objective evaluations and further design development before their potential can be assessed. Moreover, the amount of energy theoretically available in various parts of the oceans over extended time periods is as yet unknown. The federal government should be tasked to continue pursuing the potential of these energy extraction devices. The program should maintain objectivity and coherency and be adequately funded. The appropriate federal agency should be encouraged to submit a coherent plan for proceeding with the evaluation and potential development of these energy sources.

END PRODUCT: Additional sources of economically competitive energy in some circumstances at some locations.

BENEFIT: Improved economic position for some offshore industries based on non-polluting sources of energy.

SCHEDULE: Continuing.

BUDGET: $50,000 for the first year to develop a program plan; subsequent budget to be $200,000/year.

PRIORITY:

Ocean Siting

4-3

A FLOATING SOLAR POWER PLANT

OBJECTIVE: To develop, construct and deploy a marine-based prototype solar power plant which could provide supplemental electric power or packaged fuel for a major metropolitan area or primary power for less populated regions of the United States.

PLAN OF ACTION:

Phase 1 System Analysis

1. Establish the power requirements for proposed sites.

2. Establish technical feasibility of a solar plant.

3. Project needed technical development.

4. Analyze sociological and economic impacts and benefits of land-based system vs. seabased system.

5. Develop preliminary environmental and energy impact assessments of landbased vs. seabased.

6. Establish fiscal policies and implementation schedules.

Phase 2 Prototype Development

1. Design and construct appropriate scale models of system.

2. Design and test links with existing power networks.

3. Establish personnel training requirements and programs.

4. Establish construction costs and schedules.

Phase 3 Deployment

1. Implement construction of marine power plant, underwater transmission cable and mooring buoy.

2. Modify existing power network for acceptance of additional power load and prepackaged fuel.

3. Implement construction of land facilities.

4-3

END PRODUCT: To develop, construct and deploy a prototype marine-based solar power plant for urban and/or suburban use.

BENEFIT: A demonstrated capability of an alternative energy source that is ecologically and environmentally sound.

SCHEDULE: Initial work to begin immediately; overall schedule to be determined.

BUDGET: $150,000 for the first phase of investigation and program planning. Subsequent budget to be determined.

PRIORITY:

4-4 OFFSHORE GEOTHERMAL POWER PLANT

OBJECTIVE: Establish the technical and economic feasibility of offshore geothermal energy production of electrical energy.

PLAN OF ACTION:

a. prepare heat maps of candidate offshore sites
b. conduct engineering systems studies
c. develop drilling and completion technology
d. develop legal and environmental aspects

END PRODUCT:

a. selection of suitable sites
b. specifications and preliminary design of offshore geothermal plant

BENEFIT:

a. mitigate environmental constraints
b. achieve high electrical generating efficiencies due to ready supply of cooling water

SCHEDULE: First year: Feasibility Study

BUDGET: First year: $1 million

PRIORITY:

4-5 OFFSHORE WIND POWER PLANTS

OBJECTIVE: Establish the feasibility of large scale offshore wind power plants for generating electricity

PLAN OF ACTION:

a. establish the wind profiles of key sites
b. develop concepts for offshore structures
c. establish energy storage/delivery mode trade-offs

END PRODUCT: Preliminary design and specifications for design and construction of prototype offshore wind power plant.

BENEFIT: Offshore wind is more steady and of higher velocity than that found on shore, and could provide another developable resource.

SCHEDULE: First year: Feasibility Studies

BUDGET: First year: $1 million

PRIORITY:

4-6 OFFSHORE GEOTHERMAL POWER PLANT

OBJECTIVE: Design and develop a power plant which utilizes offshore geothermal wells as an energy source and deep ocean waters as bottoming cycle rejected heat sink.

PLAN OF ACTION: Basic platform energy conversion systems designs have been established by TRW and others. The next step is to conduct a study of submerged geothermal well drilling, completion and workover technologies.

END PRODUCT: Off-shore platforms producing 50 MW of power.

BENEFIT: Alleviate environmental pollution and reduce fossil energy demand for power production.

SCHEDULE: It is estimated that the first prototype offshore platform could be deployed in five years.

BUDGET:

	MONTHS	COST
Conceptual Design Drilling and Completion	6	$400,000
Develop and Demonstrate Offshore Geothermal Well Drilling	12	$ 2 Million
Prototype Platform Design, Construction, and Test	40	$30 Million

PRIORITY:

4-7 OCEAN THERMAL ENERGY CONVERSION (OTEC)

OBJECTIVE: To develop commercially viable thermal energy conversion systems which can supply a substantial fraction of the nation's electric power needs and also provide a high technology product for export.

PLAN OF ACTION:

1. A better grasp of the cost breakdown of complete OTEC Systems is needed. Additional generalized cost optimization studies should be made, as well as specific cost reduction studies of major plant components such as the cold water intake pipe, D.C. cables to shore, turbines for the open cycle system, heat exchange systems, etc. Component cost studies will require some technology development and demonstration.

2. Detail designs of several complete cost optimized OTEC Systems incorporating specific site and use constraints should be made. Open cycle and closed cycle systems should be compared and sensitivity of all designs to changes in component costs determined.

3. Engineering development to minimize component costs should proceed, including new technology and adaptation of existing technology to the OTEC Systems. In this area, long term behaviour of construction materials in the ocean is of great concern. Corrosion and fouling studies of aluminum and steel are especially important and inexpensive methods for extending the life of common steels by use of inert coatings and cathodic protection should be developed and/or evaluated for OTEC application.

4. Consolidation and extension of oceanographic data pertinent to OTEC system performance, environmental impact and safety. Immediate studies of the Gulf Stream should be made to determine temperature and velocity characteristics as functions of time. Meanders and their influence on OTEC platform positioning and powering require study and the impact of mixing cold and warm layers on the climate of Europe should be estimated. Worldwide locations of suitable OTEC plant sites in relation to foreign and at-the-site evergy uses should be determined for use in OTEC plant market projections.

5. In order to verify performance and firm up costing, pilot model construction and testing at sea should be carried out for the most promising designs. Projected costs, performance and environmental impact would be the primary deciding factors. Because OTEC plants lend themselves to modular design, full scale modules should be deployed following component testing ashore when possible.

6. Design, construct, and place in operation at least one full scale demonstration O.T.E.C. plant capable of being the prototype for production run of commercially viable O.T.E.C. Systems.

7. Investigate and provide a choice of solutions for institutional restraints or capitalization problems. Guarantees or insurance of O.T.E.C. Systems against economic warfare, i.e., programmed oil price reductions, are clearly in the national interest for O.T.E.C. and other solar systems which are initially economically competitive.

END PRODUCT: A prototype power plant operating in the ocean and delivering power to the shore for sufficiently long time and with high enough reliability as to encourage the building of commercial power plants by private enterprise.

BENEFIT: In the Gulf Stream of the eastern United States alone, a limit of about 1.5 million megawatts of electrical power could be obtained using O.T.E.C. Systems. Equivalent fossil fuel plants would consume 60 million barrels of oil per day, thus a very substantial portion of the nation's energy requirements for the year 2000 could be met. Furthermore, sales of this high technology product abroad could ease the world's energy crisis and provide for increased balance of trade. Industrial floating islands in the ocean's doldrums using O.T.E.C. Systems could also provide for increased production of fertilizers, aluminum, magnesium, and other energy intensive products.

SCHEDULE: It is estimated that this project will take about 10 years to complete. Major tasks, milestone dates are as follows:

First Two Years

System design optimization studies to produce cost estimates, trade-offs, identify uncertainties and define site characteristics.

Next Two Years

Design and development work to provide firm cost and design information on heat engine, electrical transmission, platform, etc. Pilot plant designs.

Fifth and Sixth Years

Pilot plant construction and deployment.

Seventh Year

Pilot plant tests and prototype plant design.

Eighth to Tenth Years

Prototype plant construction and deployment. Prototype plant test start.

BUDGET: The estimated cost of this program by annual year is:

First year	$ 9 Million
Second year	9 Million
Third year	20 Million
Fourth year	50 Million
Fifth year	50 Million
Sixth year	10 Million
Seventh year	50 Million
Eighth year	100 Million
Ninth year	100 Million
Tenth year	100 Million

PRIORITY:

Ocean Siting

4-8 FLOATING NUCLEAR POWER PLANTS

OBJECTIVE: To partially reduce the United States' dependence on foreign fuels by the use of Floating Nuclear Power Plants located off the coasts, in bays, rivers, artificial basins, and in other proposed maritime developments both in and beyond the presently defined territorial waters.

Achieving several sub-objectives will result in the meeting of this overall objective for the Floating Nuclear Power Plant Program. The attached program element sheets provide Plans of Action and End Products specifically related to each of the sub-objectives they cite.

Program Element Title	Schedule	Budget	Priority
4-8a Site Inventory	2 years	$150,000	
4-8b Technology Improvements	10 years	$10 Million	
4-8c FNP Complex Analysis	2 years	$300,000	
4-8d Regulation Analysis	1 year	$100,000	
4-8e Financial Incentives	1 year	$100,000	

4-8a

OBJECTIVE: To provide an inventory of suitable FNP sites that can be systematically used to meet load growth in U.S. coastal regions.

PLAN OF ACTION: Develop a comprehensive Floating Nuclear Plant location plan, that will designate areas suited for FNP siting with respect to energy demand, physical siting characteristics, needs of individual utilities, population/industrial centers, etc. Include investigations of siting FNPs with other offshore developments such as artificial offshore industrial islands. It is important to note that the selection of suitable sites is a relatively straight forward task using scientific and engineering data in a structured decision making process. The issues which are difficult to resolve are those which involve Federal, State, and local prelicensing and preapproval of sites for inclusion into an inventory.

END PRODUCT: A comprehensive listing of suitable FNP sites that can be used on a schedule developed to make optimal use of the FNP manufacturing schedule and the load growth in various coastal regions. As load grows in various areas an FNP in the assembly process can be selected and mated to a site selected from the inventory and prepared in time for plant delivery.

BENEFIT: The benefit realized from this program is the time savings involved in site construction and licensing of multiple sites in advance of their critical need, the orderly increase of power production capacity with load increases and the assurance that suitable sites exist in areas where load growth is expected.

4-8b

OBJECTIVE: To improve existing FNP site related technology in areas related to the plant.

PLAN OF ACTION: Development and testing of new breakwater designs and materials; investigate materials' sources and economics of the designs. Develop submarine cable that can handle higher voltages with lesser losses and/or is easier to install and maintain. Investigate new means of power transmission and means of reducing losses in long transmission runs. Develop and test new mooring system designs that meet needs of high seismic areas and accommodate other severe natural phenomena.

END PRODUCT AND BENEFIT: New equipment and structures designs that provide increased efficiency in the use of materials, manpower and time both in the site development process and in the delivery of the power produced by the FNP. An additional benefit is the increased siting potential provided by better isolation from seismic shock.

4-8c

OBJECTIVE: To determine what combination of industrial, marine and FNP facilities can be developed and what benefits they may have over individual facilities of each type.

Investigate the combination of FNP complexes with other industrial facilities either offshore on existing or artificial islands, or onshore. This should include FNP nuclear energy centers (with nuclear fuel fabrication and reprocessing facilities at the same site) as well as other industrial facilities such as desalinization plants, mineral processing centers or manufacturing complexes, etc.

END PRODUCT: The result of this program should be a determination of the technical and economic feasibility and practicality of an FNP combination with other industrial facilities. In addition, conceptual designs of such facilities should be completed.

BENEFIT: A practical assessment of the synergistic effects of combining facilities.

4-8d

OBJECTIVE: To determine what regulatory and legal requirements and policies would restrict such developments and suggest appropriate changes to those requirements.

PLAN OF ACTION: Investigate what regulations exist that would restrict development of any of the feasible and practical combinations of facilities studied and developed in other phases of the FNP program, and develop means of changing them. To be included are means of decreasing delays in plant and site licensing, siting beyond the 3 mile limit, regulatory overlaps, etc.

END PRODUCT AND BENEFIT: The result of this program must be a smoothly operating regulatory blueprint that directs and allows efficient site selection, designation, development and use without unwarranted "red tape" delays.

4-8e

OBJECTIVE: To prevent financial limitations of individual electric utilities from hindering orderly FNP siting program implementation.

PLAN OF ACTION: Develop methods to provide financial aid to offshore industry, including the electric utilities in whose territories the designed sites are located. This should include a thorough investigation of those changes required to extend the effectivity of Mar Ad Title XI mortgage insurance.

END PRODUCT AND BENEFIT: The plan can aid in utility growth to meet load growth while maintaining financial stability and will allow overall capacity growth to develop in accordance with a regional master plan.

OVERALL PROGRAM BENEFIT: The benefit of the program is a specific and meaningful plan to (1) reduce dependence on foreign (and domestic) oil, and fossil fuels in general, (2) provide an optimal use of the ocean resources available and (3) provide optimum environmental, social and economic tradeoffs so that power needs can be met with the least environmental impact and the efficient use of resources including time, money and people.

The project should start immediately. It will be necessary to properly coordinate this with studies already being performed along with other maritime and power industry programs. Successful completion of the program is largely dependent on development of a national energy policy. It is estimated that the study would require extensive coordination with maritime programs, individual utility and industry programs and government policies. For this reason, it is difficult to establish either a meaningful schedule or budget at this time.

Ocean Siting

APPLICATIONS

OCEAN SITING PANEL

APPLICATIONS

4-9 Offshore Metals Extraction Plant
4-10 Material Storage on Ocean Floor
4-11 Recovery of Deuterium from Seawater
4-12 Recovery of Hydrogen from Seawater
4-13 Synthetic Fuels from the Marine Environment
4-14 A Floating Coal-Fired Power Plant
4-15 Sea-Based Coal Fired Power Plant Design and Test
4-16 Ammonia Production Offshore
4-17 Development of Reliable, Economical and Fail-Safe Power Sources for Remote Ocean Stations
4-18 Generation of Electrolytic Hydrogen Utilizing Ocean Thermal Energy
4-19 Ocean Thermal Energy Point-to-Point Delivery Ship for Ammonia

4-9 OFFSHORE METALS EXTRACTION PLANT

OBJECTIVE: Develop an offshore plant utilizing ocean energy sources to extract rare metals dissolved in the oceans.

PLAN OF ACTION: Design study to determine quantities of ocean water which can be processed, energy required and volumes of metals extractable. Develop pilot plant to demonstrate economics.

END PRODUCT: System concepts for rare metal extraction from the ocean.

BENEFIT: Expansion of reservoir of metal resources.

SCHEDULE: Program duration would be 4 years. Milestones: (1) conceptual design report; (2) pilot plant design; (3) pilot plant construction; (4) test results.

BUDGET: First year - $250,000; second year - $1 million; third year - $5 million; fourth year - $2 million.

PRIORITY

4-10 MATERIAL STORAGE ON OCEAN FLOOR

OBJECTIVE: Determine feasibility of using the lower ocean floor as a storage area for materials or bulk resources.

PLAN OF ACTION: Conduct feasibility study on candidate materials; then conduct pilot tests to determine rates of corrosion, oxidation, dissolution and changes in properties while in deep ocean storage zones.

END PRODUCT: List of candidate materials or resources which may be safely stored for long periods in the relatively inert, cold lower ocean depths.

BENEFIT: If successful, a large storage area will become available for select materials or resources. (Available storage volumes of hundreds of cubic miles.)

SCHEDULE: Total project duration is 36 months. Milestones (1) analytic feasibility; (2) pilot test results.

BUDGET: First year - $150,000; second year - $500,000; third year - $750,000.

PRIORITY:

4-11 RECOVERY OF DEUTERIUM FROM SEAWATER

OBJECTIVE: To achieve efficient technology for extracting deuterium from seawater and its importance will depend upon the success achieved with controlling the deuterium-deuterium fusion reaction. Beyond this, the value of deuterium extraction will depend upon the public and environmental safety with which the deuterium-deuterium fusion reaction can be controlled, as well as general public acceptance of this form of energy production.

PLAN OF ACTION: The National Academy of Sciences Committee on Resources and Man, in 1969, reported that the extraction of 1% of the supply of deuterium in the world's oceans would supply approximately 500,000 times the amount of energy in the world's original supply of fossil fuels. The ultimate accuracy of this assessment, of course, depends on the thermodynamic efficiency with which the deuterium-deuterium fusion process might be brought under control, as well as the efficiency with which deuterium can be extracted from seawater.

Methods for extracting deuterium from seawater exist presently. These should be reviewed at a low level of effort and attempts made to analytically improve their efficiency. Should it appear likely that control of the D-D fusion reaction should be imminent, pilot extraction studies should be initiated. To the extent that controlled fusion from the deuterium-deuterium process shows promise of becoming a major component of U.S. energy production, pilot deuterium extraction techniques should gradually be expanded into operating commercial processes. It is not clear that the Federal government need plan any particular role in this program element. It seems likely that enterprising commercial firms, once convinced of the likelihood of commercial fusion power production will leap into the gap on their own funds.

END PRODUCT: Commercial processes for extracting deuterium from seawater that are both energy efficient and cost effective.

BENEFITS: Potential energy independence for the United States.

SCHEDULE: To be determined by the degree of success or the rate of progress made with bringing the deuterium-deuterium reaction under control.

BUDGET: Unknown.

PRIORITY:

4-12 RECOVERY OF HYDROGEN FROM SEAWATER

OBJECTIVE: To assess the potential for direct electrolysis of seawater and if this appears infeasible, to determine the most energy efficient and cost effective means of distilling seawater and subsequent electrolysis of the distilled production of hydrogen.

PLAN OF ACTION: Many of the potential offshore natural energy conversion systems produce electrical or thermal energy, but will require some form in which energy can be stored and transported. At the moment, electrolytic production of hydrogen from water appears to be one of the more attractive of the available processes. One or two small-scale experiments with electrolysis of seawater have been conducted. At the moment, several technical difficulties cause pessimism concerning the direct electrolysis of seawater.

Further and better funded experiments involving electrolysis of seawater appear to be in order. We need to understand more about the production of gases such as chlorine at the electrodes and we need to better understand the electrochemical dynamics at the electrodes themselves. Should it become apparent that direct electrolysis of seawater is an unattractive approach, then system designs for first distilling the water and then electrolyzing it to produce hydrogen, based on existing technology and extensions thereof, would be in order.

END PRODUCT: The technology for hydrogen production at sea.

BENEFIT: The achievement of a storable transportable fuel to be associated with natural energy conversion systems such as OTEC, direct solar radiation, geothermal energy, etc.

SCHEDULE: Alternate approaches by multiple institutions for the electrolysis of seawater should be funded at modest scales during the next three to five years. Simultaneously, a modest-scale analytical design study of low-energy distillation and subsequent electrolysis of seawater should be begun within the next few years.

BUDGET: $1 million per year.

PRIORITY:

4-13 SYNTHETIC FUELS FROM THE MARINE ENVIRONMENT

OBJECTIVE: Most of the more attractive approaches for producing energy in the marine environment produce electricity or heat. Neither of these forms is particularly storable or transportable. If we are to produce energy offshore and transport it to shoreside uses, a synthetic fuel of some sort will be needed. Hydrogen, hydrazine, other ammonia compounds, and hydrocarbon compounds have been proposed. We have no adequate assessment of which of these approaches may be the more attractive for certain conditions and locations. The objective of this program element is to resolve these unknowns.

PLAN OF ACTION: The appropriate federal agency should be encouraged and funded to pursue development of a program aimed at achieving these objectives. Presumably, the program would involve assessing the availability of constituents, as well as the existing technology and further developing technology for synthesizing appropriate constituents into synthetic fuels.

END PRODUCT: Synthetic fuels for the storage and transmission of energy produced from marine energy resources.

BENEFIT: The added utility of marine energy sources throughout the nation.

SCHEDULE: 3 years

BUDGET: $200,000 per year

PRIORITY:

4-14 A FLOATING COAL-FIRED POWER PLANT

OBJECTIVE: To develop, construct and deploy a marine power plant which will provide supplemental electric power for a major metropolitan area or primary power for less populated regions of the United States.

PLAN OF ACTION:

Phase 1 System Analysis

1. Establish the power requirements for proposed sites.

2. Establish technical feasibility of a floating coal-fired plant.

3. Project needed technical development.

4. Analyze sociological and economic impacts and benefits of land-based system vs. seabased system.

5. Develop preliminary environmental and energy impact assessments of landbased vs. seabased.

6. Establish fiscal policies and implementation schedules.

Phase 2 Prototype Development

1. Design and construct appropriate scale models of system.

2. Design and test links with existing power networks.

3. Establish personnel training requirements and programs.

4. Establish construction costs and schedules.

Phase 3 Deployment

1. Implement construction of marine power plant, underwater transmission cable and mooring buoy.

2. Modify existing power network for acceptance of additional power load.

3. Implement construction of land facilities.

END PRODUCT: To develop, construct and deploy a prototype marine-based coal-fired power plant for urban and/or suburban use.

BENEFIT: A demonstrated capability of a low cost, highly efficient coal-fired power plant that is ecologically and environmentally sound.

SCHEDULE:

BUDGET:

PRIORITY:

4-15 SEA-BASED COAL FIRED POWER PLANT DESIGN AND TEST

OBJECTIVE: Design and construct a fleet of sea-based power stations.

PLAN OF ACTION: A very brief preliminary feasibility study has been completed. An in-depth study needs to be accomplished to further define the design, power plant components, method of power transfer, environmental impact, economic trade-offs and marketability of such a power plant.

If this study proves the concept to be viable and economically desirable, the next step would be a detailed design effort culminating in specifications to a contract level of detail so that bidding could be requested. This would be followed by the construction and deployment of a prototype plant.

END PRODUCT: A fleet of sea-based coal fired power plants in the intermediate, 400 MW range, fueled by a coal/water slurry. These plants would be deployed 4 - 12 miles at sea, near load centers, supported by tankers and supplying power via an underwater cable to the beach.

BENEFIT: Alleviate siting and cooling water problems associated with land based power stations while promoting the use of coal.

SCHEDULE: It is estimated that the first prototype could be deployed within five years from contract go-ahead for conceptual design, assuming no program interruptions and a normal level of effort and funding.

BUDGET:	Conceptual Design	8 - 10 months	$300,000
	Detailed Design & Critical Component Testing	18 months	$20-25 million
	Systems Integration & Deployment of Prototype	24 - 30 months	$250 million

PRIORITY:

4-16 AMMONIA PRODUCTION OFFSHORE

OBJECTIVE: Design and develop offshore production of ammonia for agricultural shore markets.

PLAN OF ACTION: Brief preliminary feasibility studies indicate the economic feasibility of two approaches to manufacturing ammonia offshore as follows:

1. Floating Platform - Utilization of electrical energy produced by OTEC or sea-based coal fired power plants to produce ammonia by converter synthesis from electrolytic hydrogen and air separation processes.

2. Fixed Platform - Utilization of gas feedstocks from offshore production platform and wells to produce ammonia by steam reforming natural gas to yield hydrogen, combustion exhaustion of air to yield nitrogen and ammonia converter synthesis.

In-depth studies need to be accomplished to further define the design, economic trade-offs and marketability of such ammonia manufacturing facilities.

If these studies prove the concepts to be economically desirable, the next step would be design, development and demonstration of scaled prototype processes.

END PRODUCT: Offshore fixed platforms, 100 miles off Gulf Coast in 300 feet of water, manufacturing 600 to 2,000 tons of ammonia per day using gas feedstocks in offshore fields. Offshore floating platform, any ocean or depth, manufacturing 400 to 800 tons of ammonia per day utilizing electrical energy from OTEC.

BENEFIT: Alleviates the impact of pending shortages of on-shore natural gas supplies with respect to ammonia production. Off-shore gas field utilization eliminates need for expensive pipelines to shore and offers reduced cost potential since FPC has no jurisdiction over resultant field prices.

SCHEDULE: It is estimated that the first scaled (10 ton/day) prototype plants could be developed and demonstrated in three to four years.

BUDGET:

	Fixed Platform Months	Fixed Platform Cost	Floating Platform Months	Floating Platform Cost
Conceptual Design and Feasibility Study	6	$200,000	8	$400,000
Design and Construction Based Prototype	24	$6 Million	36	$12 Million
Prototype Demonstration	6	$500,000	12	$1 Million

PRIORITY:

4-17

DEVELOPMENT OF RELIABLE, ECONOMICAL AND FAIL-SAFE POWER SOURCES FOR REMOTE OCEAN STATIONS

OBJECTIVE: To provide a more cost-effective power source for remote ocean stations.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate and evaluate historical programs and new proposals including nuclear power, solar cells, ocean currents, winds, etc.

2. Recommend most feasible approach and initiate test program using currently available off-the-shelf technology that requires no or only minor modifications.

3. Implement field test and monitor results.

END PRODUCT: Use of more reliable, maintenance-free power source.

BENEFIT: Provide continual power for remote stations.

SCHEDULE: Three years

BUDGET: $225,000

PRIORITY:

Ocean Siting

4-18 GENERATION OF ELECTROLYTIC HYDROGEN UTILIZING OCEAN THERMAL ENERGY

OBJECTIVE: To optimize, integrate, and deliver a pilot plant sized (about ten megawatt) shipboard hydrogen plant.

PLAN OF ACTION: The technology to generate tons per day of hydrogen by the electrolysis of water exists. However, a shipboard plant that utilizes ocean thermal energy to produce the hydrogen feedstock for an ammonia synthesis plant has not been designed before. Modification of current land based plants to an ocean environment will be necessary. Optimization of these hydrogen plants to maximize hydrogen output from a reasonably sized facility with the smallest possible operating and capital costs must be accomplished.

An optimization study of a shipboard electrolysis facility will be started and an optimum hydrogen plant type, configuration and operating characteristics identified. Integration of this plant into the total shipboard ammonia synthesis plant will be accomplished during the design phase of the program. Engineering drawings will be prepared and approved.

A modular approach will allow maximum flexibility and provide definite milestones during the construction phase of the program. Construction of an appropriate module or modules will begin after drawing approval. The modules will be equipped with appropriate auxiliaries to minimize space and capital costs. An instrumentation package will provide automatic control and document the operating history of the plant.

END PRODUCT: An optimization study, design and engineering package, and a 5-10 megawatt (electrical) modular plant that produces gas at minimum system cost will be delivered.

BENEFIT: The delivery of the plant outlined above will firmly establish the costs associated with the manufacture, installation and operation and will demonstrate the reliability of electrolytic hydrogen generating plant in conjunction with ocean thermal energy.

SCHEDULE: The optimizations study and design phase will be seven months from start. Construction of pilot plant will be fourteen months. Total project will run for twenty three months.

BUDGET:

	2nd Plant Costs	
	5 MW	10 MW
Optimization Study	$ 25,000	$ 25,000
Design	$ 134,000	$ 134,000
Plant Construction	$1,000,000-	$1,750,000

PRIORITY:

4-19 OCEAN THERMAL ENERGY POINT-TO-POINT DELIVERY SHIP FOR AMMONIA

OBJECTIVE: To analyze the requirement and cost advantages of point-to-point ammonia delivery ships specifically equipped or designed and built for ocean thermal ammonia plant-ship support.

PLAN OF ACTION: Using the demonstration-sized ocean thermal plant-ship and extrapolating to commercial size, analyze the requirement for U.S. flag ships to provide point-to-point delivery from the tropical site to selected ports. Develop the specific fleet size and timing required. Prepare specifications for the ships required and a proposed shipbuilding program to provide them on a timely basis.

END PRODUCT: A study on which to base decisions for U.S. shipbuilding and national policy relative to ocean thermal ammonia plant support.

BENEFIT: Adequate and least cost shipping available for U.S. strategic needs. Independence of foreign flag shipping for vital U.S. agricultural chemicals.

SCHEDULE: 10 - 12 months

BUDGET: $150,000

PRIORITY:

Ocean Siting

CONCRETE AND OTHER STEEL SUBSTITUTES

OCEAN SITING PANEL

Concrete and Other Steel Substitutes

4-20 U.S. Offshore Concrete Construction Industry
4-21 Prestressed Concrete Buoyancy
4-22 Capacity of High Strength Concrete Under Deep Submergence
4-23 Structural Design of Prestressed Concrete Structures
4-24 LNG Containment in Prestressed Concrete Platforms
4-25 Improved Concretes for Marine Structures
4-26 Behavior of Aluminum in Sea Water
4-27 Evaluation of Concrete Gravity Structures for Deepwater Storage and Production Platforms in Environmentally Hostile Waters

4-20 U.S. OFFSHORE CONCRETE CONSTRUCTION INDUSTRY

OBJECTIVE: To develop a U.S. offshore concrete construction industry capable of meeting future offshore structure requirements in petroleum, gas, offshore industries, and natural resource exploitation such as mining.

PLAN OF ACTION: The sequence of steps would include:

1. Survey the present worldwide offshore concrete experience.

2. Establish design principles and structural configuration suitable for U.S. production and industry requirements.

3. Develop the U.S. production techniques.

4. Define U.S. capability to produce large offshore concrete structures

   - Manpower and skills
   - Facilities
   - Insurance
   - Regulatory
   - Transport to site

5. Design a series of concrete U.S. offshore floating structures

   - Storage terminal
   - Offshore power plant
   - Petroleum production terminal
   - Transport vehicle
   - Arctic ocean drilling structures

6. Economic comparison with alternative materials and production techniques.

7. Development of new materials, i.e., polymer concretes.

8. Conduct accelerated ocean behavior tests for material strength, motions, life, and maintenance and repair.

END PRODUCT: Determination of the direction the offshore concrete construction within the U.S. should take.

BENEFIT: Potential development of a U.S. offshore construction capability that is necessary for U.S. ocean resource exploitation structure that has long life, low cost, short construction period, and low energy consumption.

SCHEDULE: Items 1 through 6 will be conducted in one year as Phase I and items 7 and 2 started in the first year and continued into the second.

BUDGET: Phase I - $500,000; Phase II - $500,000/year

PRIORITY:

4-21 PRESTRESSED CONCRETE BUOYANCY

OBJECTIVES: To determine the buoyancy changes in concrete due to water absorption.

PLAN OF ACTION: The sequence of steps would include:

1. Define concrete density.

2. Design and conduct experiments to determine rate of water absorption of concrete at varying water pressures.

3. Relate to concrete density and buoyancy.

4. Recommend methods to increase density to reduce absorption.

END PRODUCT: Concrete design information.

BENEFITS: Prestressed concrete structures properly designed for expected water absorption will result in safer and/or lighter and less expensive structures.

SCHEDULE: 1 year

BUDGET: $100,000

PRIORITY:

4-22 CAPACITY OF HIGH STRENGTH CONCRETE UNDER DEEP SUBMERGENCE

OBJECTIVE: To enable more rational, safe, and economical design of concrete sea structures.

PLAN OF ACTION: Experimental determination of the capacity of concrete under high hydrostatic head, for the following load combinations:

Fatigue: Cyclic loading; moment plus shear, corresponding to wave history.

Shear: With combined moment and axial load.

Thermal: Both hot (oil) and cold (LNG) accompanied by environmentally-imposed loads.

Impact: Collision and dropped object.

Implosion: Different configurations typical of offshore structures.

Above to be accompanied by analytical studies.

END PRODUCT: Rational design criteria.

BENEFIT: Greater safety, economy, better understanding of service and ultimate behavior.

SCHEDULE: Complete in 2 years.

BUDGET: First year - $1,000,000; second year - $1,000,000; third year - $250,000.

PRIORITY:

4-23 STRUCTURAL DESIGN OF PRESTRESSED CONCRETE STRUCTURES

OBJECTIVE: Development of more efficient concrete structural concepts, departing from conventional ship forms/shapes.

PLAN OF ACTION: The sequence of steps would include:

1. Develop computer programs for finite element analysis of new concrete hull features and design details.

2. Develop large scale (not less than 1/4 to 1/3) test program for evaluating new structural (e.g. honeycomb) and termal insulation (e.g. 3D) concepts, including fatigue testing and thermal shock evaluation for carriage of cryogenic liquids.

END PRODUCT: Will help in providing rationale to ABS and USCG for classifying concrete ships and floating platforms.

BENEFIT: Will give designer greater freedom in use of space and shell form.

SCHEDULE: 1st year - Program Definition
2nd year - Computer Program Testing
3rd year - Computer Program Testing
4th year - Computer Program Testing
5th year - Computer Program Testing

BUDGET: 1st year - $300,000
2nd year - $500,000
3rd year - $1.0 Million
4th year - $1.0 Million
5th year - $1.0 Million

PRIORITY:

4-24 LNG CONTAINMENT IN PRESTRESSED CONCRETE PLATFORMS

OBJECTIVE: To qualify prestressed concrete as a primary and secondary boundary for the containment of cryogenic liquids in floating platforms.

PLAN OF ACTION: The sequence of steps would include:

1. Develop a data bank and test criteria.

2. Design a test program and computer model.

3. Execute test program and improve computer model.

4. Modify test program.

5. Iterate tests and computer modelling until benefits are exhausted.

6. Submit report to USCG for concurrence.

END PRODUCT: Criteria and data for designing prestressed concrete as a primary and secondary boundary for the containment of cryogenic liquids such as LNG in floating platforms.

BENEFIT: More efficient and safe designs for prestressed concrete floating platforms to contain cryogenic liquids.

SCHEDULE: One year.

BUDGET: $360,000

PRIORITY:

4-25 IMPROVED CONCRETES FOR MARINE STRUCTURES

OBJECTIVE: To develop concrete technology in the direction of massive marine structures. This may include the development of new admixtures which will decrease permeability and increase strength-to-wieght ratios, as well as new concrete-forming techniques which increase the strength and reduce the construction costs of such structures.

PLAN OF ACTION: A two-pronged approach is proposed. Both are essentially empirical. The first should begin with small-scale empirical work focused on the testing of alternate concrete mixtures under various conditions of pressure and static and dynamic stress loadings. The second thrust should begin analytically with the design and analysis of typical cross-sections and joints for ocean structures and gradually move into testing of alternate forms with different concrete mixtures under a broad range of pressure and static and dynamic loadings.

END PRODUCT: Improved materials and forming techniques which will enable and promote the development of large long-lived ocean structures.

BENEFIT: The cost and long leadtimes for the construction of very large ocean structures is a major roadblock to expanding their employment and to seaward advancement in general. This program element, to the extent it is successful, will remove that roadblock.

SCHEDULE: This would be an ongoing R&D program over several decades. Major milestones for the first decade should be established.

BUDGET: $100,000 for the first year.

PRIORITY:

4-26 BEHAVIOR OF ALUMINUM IN SEA WATER

OBJECTIVE: To determine the rates of corrosion, pitting and biofouling of aluminum in sea water flow.

PLAN OF ACTION: Plan and conduct tests of aluminum tubes and/or plates in sea water flow of varying temperature and flow rates to determine rate and extent of pitting, corrosion and biofouling. Aluminum types are to be chosen as most appropriate for heat exchanger use.

END PRODUCT: Performance data.

BENEFIT: Determination of adequacy and limits of aluminum for use in sea water heat exchangers.

SCHEDULE: 5 years.

BUDGET: $750,000

PRIORITY:

4-27 EVALUATION OF CONCRETE GRAVITY STRUCTURES FOR DEEPWATER STORAGE AND PRODUCTION PLATFORMS IN ENVIRONMENTALLY HOSTILE WATERS

OBJECTIVE: To evaluate the use of concrete gravity structures for deepwater storage and production platforms in areas with severe weather and environmental conditions.

PLAN OF ACTION: The sequence of steps would include:

1. Determine the different types of behavior of cellular raft structures resting on the seabed.

2. Evaluate the massive magnitude of thrust and moment due to environmental forces that these structures are subjected to.

3. Study the expected overall and relative movements of these structures and the seabed and stress situation of the components.

4. Evaluate the stability of the structure-and-seabed relationship.

END PRODUCT: A study of the suitability of concrete gravity structures for offshore storage and production platforms.

BENEFIT: To provide greater awareness of the problems and benefits of using large gravity concrete structures for offshore deepwater storage and production platforms.

SCHEDULE: 1 year

BUDGET: $100,000

PRIORITY:

Ocean Siting

DESIGN

OCEAN SITING PANEL

Design

4-30 Cold Water Pipe for OTEC Plant-Ship
4-31 Mobile Fabrication Plant for Giant Concrete Structures to be Erected at Deepwater Sites (Feasibility Study)
4-32 Evaluation of Low Natural Frequency as a Motion Control on Floating Platforms
4-33 OTEC Cold Water Pipe Platform Connection
4-34 Modular Anchoring Submersible System
4-35 Deepwater Moorings for Massive Floating Structures
4-36 Advanced Cable Laying
4-37 Integrated Oceanographic Research Package
4-38 Large Ocean Platform Positioning System
4-39 High Voltage Undersea Transmission Systems
4-40 Development of Design Criteria For Submerged Oil Storage System
4-41 Development of Design Criteria for Hurricane Damage Prevention
4-42 Evaluation of Various Structural Concepts Which Limit the Necessity of Using Expensive Construction Equipment
4-43 Development of Design Criteria to Prevent or Minimize Earthquake Damage to Offshore Structures, Pipelines, Subsea Completions, Etc.
4-44 Offshore Structures Responses to Natural Extremes
4-45 Deep Ocean Structural and Hydrogynamic Test Laboratory
4-46 Wave Induced Ship Strain Data
4-47 Calculation of Motions and Forces in Single Point Mooring Systems
4-48 Ship Motion Theory Applied to Various Forms of Offshore Platforms

4-30 COLD WATER PIPE FOR OTEC PLANT-SHIP

OBJECTIVE: To establish engineering design, and define optimum methods of construction, delivery to site, and attachment of the cold water pipe for a full-scale OTEC plant-ship.

PLAN OF ACTION: Trade off studies will be made of materials and methods of fabrication to determine an optimum design for a minimum cost cold water pipe for use in the tropical oceans where maximum currents less than 1 kt will be encountered. Structural and fabrication tests will be performed on suitable scale elements of the tailpipe system to comfirm its full-scale operational performance.

BENEFIT: The program will ensure timely availability of an optimized minimum cost cold water pipe for the OTEC plant-ship.

SCHEDULE: 2 years

BUDGET:

Engineering design	$ 250,000
Structural tests	$ 250,000
Fabrication tests	$1,000,000

PRIORITY:

4-31 MOBILE FABRICATION PLANT FOR GIANT CONCRETE STRUCTURES TO BE ERECTED AT DEEPWATER SITES (FEASIBILITY STUDY)

OBJECTIVE: To assure the economic feasibility of future offshore mining oil or gas producing facilities, or ocean thermal power plants by reducing the cost and time needed to build giant concrete tanks, pressure vessels, or structures within fair weather periods at sea.

PLAN OF ACTION: The sequence of steps would include:

1. Review current fabrication problems at deepwater sites to establish economic significance of factors which now inhibit offshore construction in concrete.

2. Design a seagoing barge with dynamic positioning capability which has at least 1,000 linear feet of clear work area, fitted with cranes and mechanical equipment for efficient continuous pouring of concrete, mechanized placement of pre-tensioned reenforcing materials, as well as for placing and stripping of forms, and which has a means to safely launch and position the finished products or sub assemblies.

3. Design a self propelled support vessel to provide all necessary support services and accommodations.

4. Develop in conjunction with a consortium of prospective users a means of long term financing for successive usage on a competitive job-by-job basis.

5. Demonstrate on paper how the system could be applied to specific recent offshore construction.

END PRODUCT: Plans, specifications, draft operating agreements and financing plans with functional comparison for potential application.

BENEFIT: Reduced total cost through ability to shorten work period to fit within a single fair weather period.

SCHEDULE: Industry seminar to define major problems, 1 month
Conceptual design, 12 months
Review seminar, 1 month
Working agreements and implementation plan, 10 months
Total of 24 months

BUDGET: First year - $300,000; second year - $200,000

PRIORITY:

4-32 EVALUATION OF LOW NATURAL FREQUENCY AS A MOTION CONTROL ON FLOATING PLATFORMS

OBJECTIVE: To evaluate the effectiveness of low natural frequency design as a motion control on floating platforms.

PLAN OF ACTION: Several platform designs including Tuned Sphere and cylindrical platforms such as the one proposed by TRW for OTEC design for very low natural frequencies of motion as a motion control. When excited by the higher frequencies of the sea, the response is very slight.

Make a rigorous evaluation of this principle, which seems to work, to give evidence of the probabilities that the system can be excited by wave combinations (such as slow regular swells) in sea conditions under which such a system might be deployed.

END PRODUCT: Evaluation of theory.

BENEFIT: Improved confidence in the use of this theory for design.

SCHEDULE: 1 year

BUDGET: $100,000

PRIORITY:

Ocean Siting

4-33 OTEC COLD WATER PIPE PLATFORM CONNECTION

OBJECTIVE: To determine the proper design for the connection of the cold water pipe to the OTEC platform.

PLAN OF ACTION: In the design of the thermal energy conversion plant, one of the critical problems will be the connection of the large diameter cold water pipe to the platform. Highest stresses are expected in this area.

Further work is necessary to determine the magnitude of these dynamic stresses and to engineer a structure to withstand the expected stresses.

END PRODUCT: A design for a cold water pipe/platform connection.

SCHEDULE: 1 year

BUDGET: $100,000

PRIORITY:

4-34 MODULAR ANCHORING SUBMERSIBLE SYSTEM

OBJECTIVE: To provide for a very deep mooring system to be used with the various ocean energy extraction platforms (i.e., ocean thermal energy conversion, etc.).

PLAN OF ACTION: The Modular Anchoring Submersible System (MASS) may be composed of 3 or more cylindrical pods approximately 24 feet in diameter. These pods are set vertically on 125 foot centers (minimum) with appropriate trussing. The pods are the primary modules of MASS in that they contain the buoyancy/ballast and positioning devices (for controlled decent), act as the main brace for the anchor linkage, and serve as the stowage for the mooring line winches.

The MASS concept has not been tested in model scale as yet. The basic components are not of radical design thus reducing both development time and expenses. The model design analysis must be completed to finalize the configuration.

Preliminary calculations reveal that MASS would be able to support the various proposed energy platforms. Construction of 1/75 scale and final 1/4 scale models are necessary for the extensive testing required to accommodate the various loading aspects prior to the fabrication of the full scale prototype.

END PRODUCT: The final prototype MASS would be available for assignment as required.

BENEFIT: There is a current and well documented need for energy extraction from the oceans (current, thermal gradient, etc.). The aforementioned platforms will be located in deep water and therefore the mooring will be of prime concern. By use of the controlled descent/positioning, the critical moor may be completed. Repositioning may be accomplished by activation of the buoyancy/positioning components.

SCHEDULE:

First year	Design 1/75 scale for model and complete testing Design 1/4 scale model Construct 1/4 scale
Second year	Complete 1/4 scale model and at-sea testing Begin design of full scale prototype
Third year	Complete design full scale prototype and begin construction
Fourth year	Complete prototype construction and conduct at-sea tests.

BUDGET: First year - \$240,000; second year - \$270,000; third year - \$950,000; fourth year - \$2.1 million; total - \$3.56 million.

PRIORITY:

4-35

DEEPWATER MOORINGS FOR MASSIVE FLOATING STRUCTURES

OBJECTIVE: To determine the feasibility and cost/effectiveness of passive mooring systems for extended (50-100 years) service in keeping massive floating structures on station. To compare such systems with their alternative: dynamic positioning.

PLAN OF ACTION: The work would entail several simultaneous thrusts. The first would involve achieving materials having near-neutral buoyancy and improved strength. It is most likely that the development of new synthetics which can be manufactured on mass scales at reasonable prices will be in order. Another thrust relates to the assessment of materials vulnerability to encroachment by marine organisms, fatigue and embrittlement in the dynamics of the marine environment. Yet another relates to the construction, assembly, and deployment of anchors and of whole anchoring systems. It would be valuable to develop specifications for a modeling and testing environment (laboratory, model definition) which could verify properties and behavior of deep-water mooring systems without the great costs of full scale testing. It is suggested that a single Federal agency should act as a coordinating office offering incentives and direct support which would encourage industry to develop the necessary components of long-lived deepwater anchoring systems in pursuit of expanded future markets.

END PRODUCT: A technology for long-term deepwater anchoring systems which removes one of the roadblocks to national commercial ocean development.

BENEFIT: A new component of the national commercial ocean development industry.

SCHEDULE: At least a decade of R&D must be expected under this program element. First year, lead federal agency should be identified, funded, and charged with the responsibility of developing a coherent program and an associated budget.

BUDGET: Funding on the order of $100,000 for first year; subsequent years' funding to be determined after its first study period.

PRIORITY:

4-36 ADVANCED CABLE LAYING

OBJECTIVE: Establish new deep ocean cable laying techniques that extend the state-of-the-art.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate concepts for deployment.

2. Study new cable designs.

3. Modify test vessels to do laying.

4. Fabricate cable.

5. Test deployment concepts.

END PRODUCT: Cable design and laying procedures for deep ocean.

BENEFIT: New methods of accurate laying; less strength member oriented cable construction permitting greater capacity.

SCHEDULE: First year - design and fabrication; second year - testing.

BUDGET: First year - \$5 million; second year - \$5 million.

PRIORITY:

4-37 INTEGRATED OCEANOGRAPHIC RESEARCH PACKAGE

OBJECTIVE: Improve efficiency of oceanographic research techniques by lowering a multi-instrument package by a pipe string instead of a cable for long-term observation.

PLAN OF ACTION: The sequence of steps would include:

1. Develop multi-instrument package in cooperation with scientific community.

2. Modify existing drill ship.

3. Test concept.

END PRODUCT: More efficient oceanographic research method for obtaining a large quantity of time-related data over a long period for the many disciplines involved.

BENEFIT: Accelerated results of oceanographic research.

SCHEDULE: First year - develop instrument package; second year - modify vessel, testing.

BUDGET: First year - $2 million; second year - $10 million.

PRIORITY:

4-38 LARGE OCEAN PLATFORM POSITIONING SYSTEM

OBJECTIVE: Assess compatability/performance of positioning systems for maintaining large ocean platforms on station.

PLAN OF ACTION: The development of the most effective positioning systems postulated for large ocean platforms (e.g., moorings, water jets, propellers) should proceed immediately in order to meet projected needs for such applications as OTEC and sea-based coal power plants. The first phase should be a detailed performance analysis and systems trade-off study involving economics, platform type, and environment. Hardware development and test of the most generally applicable systems should then proceed.

END PRODUCT: Recommended positioning systems for the various projected applications and detailed performance data for designing such systems.

BENEFIT: Demonstrates feasibility of concept and provides design data for large ocean platform development.

SCHEDULE: The first phase of the study involving performance analysis and systems studies should be performed over two years. The development and test of hardware should take place during the following two years.

BUDGET: Performance analysis and trade-off studies - $1-2 million; hardware development and test - $2-5 million.

PRIORITY:

4-39 HIGH VOLTAGE UNDERSEA TRANSMISSION SYSTEMS

OBJECTIVE: To advance undersea power transmission technology concurrent with sea-based energy production and utilization developments.

PLAN OF ACTION: Remote ocean platform concepts are being developed or considered which will produce or utilize high voltage electrical energy, e.g., OTEC, sea-based coal fired power plants, offshore ammonia production, submerged oil production systems. However, the general state-of-the-art is notably deficient in the vital synergetic area of undersea power transmission, i.e., undersea cables, in-line connectors and articulated calbe/floating platform coupling.

An in-depth study needs to be accomplished to define generic development requirements and schedules for two types of transmission systems identified as follows:

1. Offshore energy utilization - 50 to 300 MW, 10 to 30 miles offshore, 1977 to 1980 need dates.

2. Offshore energy production - 400 to 800 MW, 50 to 200 miles offshore, 1980 to 1985 need dates.

The next step is advanced technology R&D of generic components and subsystems.

END PRODUCT: Developed and demonstrated generic prototypes of undersea transmission components synergetically supporting remote ocean platform developments.

BENEFIT: A comprehensive generic program development of high voltage undersea transmission components and subsystems will provide the required technology at least cost in the shortest time frame.

SCHEDULE: It is estimated that the first prototypes for energy utilization concepts could be deployed in two years and for energy production in three years.

BUDGET:

	Energy Utilization		Energy Production	
	Months	Cost	Months	Cost
Conceptual Design	3	$ 60,000	6	$ 100,000
Detailed Design and Critical Component Testing	12	$ 400,000	18	$ 600,000
Prototype Testing	6-12	$1 million	12-24	$3 million

PRIORITY:

4-40 DEVELOPMENT OF DESIGN CRITERIA FOR SUBMERGED OIL STORAGE SYSTEM

OBJECTIVE: To provide design engineers and contractors with criteria for design and installation of submerged oil storage systems.

PLAN OF ACTION: The sequence of steps would include:

1. Categorize locations for emplacement - by climatic condition, water depth, and other environmental factors.

2. Define criteria for investigation of foundation conditions, deflection, differential settlement, necessity for piling, retaining subsoil, addition of skirts, etc.

3. Define allowable stresses for different construction materials - steel, aluminum, concrete, etc.

4. Define and identify required materials tests for tension, compression, fatigue, cyclic loadings, etc.

5. Define requirements for protective coatings paints, cathodic protection, sacrificial anodes, etc.

6. Define means of providing aids to navigation - audible and visual.

7. Define groupings for different categories of products to be stored by physical and chemical properties.

8. Define allowable and safe systems for filling and displacing product, location of discharge and inlet nozzles, rates of filling and discharge, size of the inlets, reinforcing necessary etc.

9. Define requirements for fire protection.

10. Develop criteria for spill prevention and control.

11. Define requirements for instrumentation - manual, automatic, remote, etc.

12. Define criteria for using tanks as structure for mooring and loading or offloading of product.

13. Define requirements for model testing before building or installing prototypes.

END PRODUCT: Report on development of design criteria for submerged oil storage systems.

BENEFIT: Design and instruction guidelines for industry.

SCHEDULE: 1 year

BUDGET: $250,000

PRIORITY:

4-41

DEVELOPMENT OF DESIGN CRITERIA FOR HURRICANE DAMAGE PREVENTION

OBJECTIVE: To prevent and/or mitigate hurricane damage.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate historical records of hurricanes and categorize by location, duration, wind velocity, direction, and accompanying phenomena.

2. Evaluate forecasting and tracking methods.

3. Determine and establish recommended design criteria for withstanding hurricane forces and related impacts structurally, mechanically, electrically, etc., also instrumentation and communication requirements.

4. Recommend material properties for design incorporation.

5. Recommend communication equipment for early warning.

6. Recommend methods for securing material and equipment on offshore platforms, rigs, etc.

7. Recommend auxiliary standby equipment, emergency lighting, fire protection apparatus, etc.

8. Incorporate above into a design criteria handbook.

END PRODUCT: Comprehensive handbook design criteria for hurricane damage prevention.

BENEFIT: Improve operations in hurricane areas and reduce loss of life and property.

SCHEDULE: 1 year

BUDGET: $100,000

PRIORITY:

4-42 EVALUATION OF VARIOUS STRUCTURAL CONCEPTS WHICH LIMIT THE NECESSITY OF USING EXPENSIVE CONSTRUCTION EQUIPMENT

OBJECTIVE: To economically evaluate alternatives to eliminate the use of expensive construction equipment on offshore construction.

PLAN OF ACTION: The sequence of steps would include:

1. Survey of installation with a record of economical equipment and on-site construction cost.

2. Evaluate prefabrication and floating-in construction concepts as they relate to offshore construction practice.

3. Recommend future uses and concepts which may be applicable to the offshore industry and which will eliminate the use of expensive construction equipment.

END PRODUCT: An understanding of concepts and ideas applicable to offshore construction which will substantially reduce equipment requirements during the construction phase.

BENEFIT: More economical facilities for use in the offshore industry using prefabrication techniques and floating concepts.

SCHEDULE: 1 year

BUDGET: $100,000

PRIORITY:

4-43 DEVELOPMENT OF DESIGN CRITERIA TO PREVENT OR MINIMIZE EARTHQUAKE DAMAGE TO OFFSHORE STRUCTURES, PIPELINES, SUBSEA COMPLETIONS, ETC.

OBJECTIVE: To prevent or minimize damage to offshore structures from earthquakes.

PLAN OF ACTION: The sequence of steps would include:

1. Classification of ocean locations in terms of earthquake probability and severity.

2. Determination of allowable increase in design stresses due to earthquake forces and indication of structural areas most prone to damage.

3. Establishment of current quality and details of connections for common construction systems - pipe to pipe, structural section to structural section, steel reinforcement connections, etc.

4. Preparation of dynamic analysis of foundation requirements for various types of sea floor soils conditions.

5. Providing of recommended design guidelines on prevention of vibration effects due to earthquakes.

6. Evaluation and recommendation of design parameters to offset earthquake-accompanying phenomena - tsunamis, increased winds, etc.

7. Evaluation and recommendation of design criteria for piping connections, connections of other resistant members to fixed, stiff platforms, etc. subjected to earthquake motion.

8. Recommendation of instrumentation for automatic shut-in of wells, pipelines, and other operations.

9. Preparation of design parameters and criteria handbook for use by design engineers, contractors, and operating personnel.

END PRODUCT: Guidelines reflecting latest state-of-the-art for designing and construction of offshore structures relatively immune to earthquake damage.

BENEFIT: Safer and more reliable earthquake zone offshore operations.

SCHEDULE: 2 years

BUDGET: $225,000

PRIORITY:

4-44 OFFSHORE STRUCTURES RESPONSES TO NATURAL EXTREMES

OBJECTIVE: To determine the responses of very large ocean structures to--seismic shock; hurricane sized wave loadings.

PLAN OF ACTION: The sequence of steps would include:

1. Survey present world information on ocean structure response to natural extremes.

2. Map the natural extremes for future U.S. offshore developments.

3. Define and categorize ocean structures to be in ocean areas.

4. Test ocean structures to natural extremes--mathematical model; physical test.

5. Publish report.

END PRODUCT: Design criteria of ocean structures to natural extremes.

BENEFIT: Greater acceptance of ocean structures to long life in marine environment.

SCHEDULE: Equal effort over a three year period.

BUDGET: $100,000/year

PRIORITY:

4-45 DEEP OCEAN STRUCTURAL AND HYDRODYNAMIC TEST LABORATORY

OBJECTIVE: To develop a U.S. capability to commercially test and define deep ocean structures.

PLAN OF ACTION: The sequence of steps would include:

1. Worldwide survey of present deep ocean test facilities--facilities; programs; economics.

2. Define U.S. programs to employ the facility for five years.

3. Design the test facility.

4. Develop the financial plan to build and operate.

5. Define the facility operation--staff; utilization.

END PRODUCT: U.S. deep ocean test laboratory.

BENEFIT: Retain in the U.S. the basic technology for deep ocean structures development.

SCHEDULE: Equal effort over a two year project.

BUDGET: $200,000 cost share with industry and government.

PRIORITY:

4-46 WAVE INDUCED SHIP STRAIN DATA

OBJECTIVE: Improvement in ship (and platform) design and safety, plus ship routing, depends in appreciable degree on more complete knowledge of wave induced ship strain. There is pressing need to expand programs to obtain worldwide data on wave induced ship (and platform) strain.

PLAN OF ACTION: Review present programs relative to generation wave induced ship (and platform) strain data. Develop a plan for increased government/industry cooperation in assembling performance data. Institute selected ship (and platform) monitoring program.

END PRODUCT: Improved ship and platform design and ship routing.

BENEFIT: A reduction in loss of life and loss and damage to ships and platforms.

SCHEDULE: Develop and carry out expanded programs for gathering wave induced ship strain data over four year period.

BUDGET: $1.0 to 3.0 million per year.

PRIORITY:

4-47 CALCULATION OF MOTIONS AND FORCES IN SINGLE POINT MOORING SYSTEMS

OBJECTIVE: To develop theoretical capability to calculate motions and forces for single point mooring systems.

PLAN OF ACTION: Under certain conditions with ship head-on to waves, it is possible to calculate the mean wave drifting force in regular waves from strip theory. In the general case with waves coming from arbitrary directions, calculations based on three-dimensional potential theory may be used. These methods have not included the effect of low-frequency wave drifting forces usually obtained from model tests. Thus the theoretical methods are not yet fully developed to yield the consistent results necessary for design purposes.

Develop the theoretical capability to predict SPM motions and forces taking low-frequency wave drifting forces into account. Conduct model tests as necessary to validate the theory and prepare a computer design program utilizing the theory.

END PRODUCT: A computerized theoretical technique for predicting motions and forces for SPM.

BENEFIT: Safer and better design SPM system.

SCHEDULE: 3 years

BUDGET: $300,000

PRIORITY:

4-48 SHIP MOTION THEORY APPLIED TO VARIOUS TYPES OF OFFSHORE PLATFORMS

OBJECTIVE: To extend the use of existing ship motion computer programs to ship type offshore platforms.

PLAN OF ACTION: Available programs for determing ship motions and wave-induced structural loads for conventional ships also has a large degree of applicability to many vessels used in offshore operations. This project will extend the existing program in order to have a useful prediction capability for various offshore platforms that are generally shiplike forms. Effects of mooring will also be included.

END PRODUCT: Extend computer design program for motions and structural loads for shiplike offshore platforms.

BENEFITS: Greater ability to control critical motions during design. Ability to design safer structures.

SCHEDULE: 1 year

BUDGET: $100,000

PRIORITY:

Ocean Siting

POLICY, TRENDS, AND GENERAL

OCEAN SITING PANEL

POLICY, TRENDS, AND GENERAL

4-49 Offshore Energy Utilization Processes
4-50 Nautical Chart and Geodesy Requirements
4-51 Protection of Maritime Property
4-52 Conceptual Development of an Environmentally Acceptable Offshore Oil Production and Refining System for the U.S. Atlantic Coast
4-53 Mathematical Prediction (Deterministic and Statistical)
4-54 Offshore Platforms for Industry: Public or Private Ownership?
4-55 Identification of Ocean Platform Location Parameters
4-56 Legal Implications of Offshore Structures
4-57 Environmental Impact Statement for Offshore Fossil Fuel Power Stations
4-58 Economic Data Base and Analytic Methodology
4-59 Environmental Data Gathering for New OCS Areas
4-60 Long Range Study to Determine the Degree of Contamination Ocean Water Can Tolerate
4-61 Development of Improved Methods of Tsunamis Forecasting (Bottom Turbulence Generated Sea Waves)
4-62 A National (International) Seamount Station
4-63 Cost/Benefit Analysis of Tidal Power Production
4-64 Feasibility of Near-Shore Dredge Spoils Disposal

Ocean Siting

4-49 OFFSHORE ENERGY UTILIZATION PROCESSES

OBJECTIVE: To develop effective technology for on site utilization of energy in order to extract and process marine resources of the seabed and sea water.

PLAN OF ACTION: The sequence of steps would include:

1. Define energy needs of extraction and process industries.

2. Define offshore on site energy supply technology alternatives.

3. Develop an energy supply system suitable for common offshore industries in various power ranges.

4. Define the market potential of developed system.

END PRODUCT: Design of a suitable offshore on site energy supply system.

BENEFIT: Low capital and operating cost/higher reliability offshore energy supply system through common design, construction and operating support.

SCHEDULE: Effort over a three year period.

BUDGET: First year - $500,000; second year - $1 million; third year - $1 million.

PRIORITY:

4-50 NAUTICAL CHART AND GEODESY REQUIREMENTS

OBJECTIVE: Define in realistic terms the needs for nautical charts related to economic exploitation of the oceans and the characteristics of the chart or product that best meets that need.

PLAN OF ACTION: The sequence of steps would include:

1. Determine specific product and area requirement for nautical charts and related products to meet the needs of current ocean operations.

2. Project requirements into future and establish a recommended priority of requirements.

3. Establish continuing procedures for civil ocean operator to state requirement for charts and related products.

END PRODUCT: A consolidated statement of nautical chart and related product requirements for the civil user that is:

a. current
b. updateable
c. based on specific and realistically projected needs
d. in recommended priority order.

BENEFIT: Establish a base upon which to produce a national hydrographic plan and policy statement. Provide direction for product design and development to support other than surface marine transportation requirements of the public sector. Would place support for economic development of the oceans in a more realistically competitive position to receive federal funds.

SCHEDULE: Initial effort complete in one year with a continuing update action assigned to a federal agency.

BUDGET: $50,000 first year. Continuing costs by federal agency assigned.

PRIORITY:

4-51 PROTECTION OF MARITIME PROPERTY

OBJECTIVE: To reduce the practical possibility of real or threatened attack by criminal, political terrorist or lunatic fringe elements of extremist groups on offshore rigs, structures and ocean bottom facilities.

PLAN OF ACTION: The sequence of steps would include:

1. Study the present and future trends of marine activity.

2. Project and evaluate the potential for sabotage, anonymous or overt attack or harassment, or threats of such, by unfriendly governments or extremist groups.

3. Evaluate private and governmental capability and needs in order to counter these possible threats.

END PRODUCT: Evaluation of the threat will assist industry and government to focus on the need so that appropriate security will be provided on a continuous basis and contingency plans to counter specific threats can be developed.

BENEFIT: With private and governmental facilities prepared to cope with provocative or politically sensitive attacks or harassments, they will avoid being forced or threatened into taking untenable positions or making choices regarding valuable property, national prestige or human life.

SCHEDULE: Four to six months

BUDGET: \$50,000 - \$100,000

PRIORITY:

Ocean Siting

4-52 CONCEPTUAL DEVELOPMENT OF AN ENVIRONMENTALLY ACCEPTABLE OFFSHORE OIL PRODUCTION AND REFINING SYSTEM FOR THE U.S. ATLANTIC COAST

OBJECTIVE: To meet north and mid Atlantic demand for oil products in an economical fashion within guidelines established by the federal government.

PLAN OF ACTION: The sequence of steps would include:

1. Establish a target rate of production and pattern of distribution for the year 2000 assuming all refining could be done offshore.

2. Establish a list of the specific refinery processes and storage points which would be needed, and the geometric pattern in which each could be most easily compressed to be contained within a free floating or pilemounted structure designed to withstand maximum 100 year storm conditions. Compare pile mounted surface platforms with partially or full submerged configurations on the basis of cost at 100', 200' and 600' depths when the cost of connecting pipelines are considered.

3. Given the output for the most satisfactory design suited to each depth class. Calculate the total plant required by 2000 to handle the production targets established in (1) above.

4. Develop the storage and distribution system required, utilizing either pipeline or surface tankers or both, utilizing an all-weather pipeline to ship transfer system assuming specially designed dedicated tankers.

5. Prepare a draft environmental impact statement for the system as a whole with comparison to conventional shore-side refineries and terminals of equal total capacity.

END PRODUCT: A plan for development of an offshore oil production and refining system.

BENEFIT: A significant constraint to future rise in crude oil prices by developing an alternative which would lessen U.S. dependency on mid east oil.

SCHEDULE: Establish production and distribution targets, 8 months; conceptual design, 12 months; environmental impact statement, 10 months; total of 30 months.

BUDGET: Contractual Dollars

First year	$200,000	
Second year	$200,000	Total $500,000
Third year	$100,000	

PRIORITY:

4-53 MATHEMATICAL PREDICTION (DETERMINISTIC AND STATISTICAL)

OBJECTIVE: To develop an environmental prediction capability relative to a wide range of ocean activities.

PLAN OF ACTION: The sequence of steps would include:

1. Review present status of Mathematical Modeling (Ocean oriented).

2. Review present status of Mathematical Modeling (Estuarine oriented).

3. Combine deterministic and statistical techniques - developing a handbook approach.

4. Generate a computational facility capable of providing assistance with techniques of processing ocean oriented data with ecological systems prediction.

5. Develop capability to predict environmental state from observable oceanographic, estuarine, meteorological and climatological parameters.

END PRODUCT: A review and compilation of available techniques for environmental prediction and the development of a facility which could provide a prediction capability with techniques, software and physical services.

BENEFIT: A mathematical facility would be provided which would produce predictive information for operations, planning and management decisions.

SCHEDULE: Three year program.

BUDGET: Total program cost is estimated at less that $1 million.

PRIORITY:

4-54 OFFSHORE PLATFORMS FOR INDUSTRY: PUBLIC OR PRIVATE OWNERSHIP?

OBJECTIVE: To evaluate the advantages and disadvantages of public versus private ownership and operation of proposed offshore ocean platforms and artificial islands for use by private industry.

PLAN OF ACTION:

1. Study case histories of several large existing projects, such as TVA, airports, nuclear power plants and COMSAT, to evaluate the advantages and disadvantages of various degrees of private/public ownership and operation.

2. Relate results of (1) to the special circumstances of offshore ocean structures for industrial use.

3. Model various offshore infrastructure configurations to test the hypotheses of (2).

END PRODUCT: Recommendations for optimum organization types to build and operate offshore ocean platforms or artificial islands.

BENEFIT: The type of analysis described herein is essential to ensure success in obtaining the necessary permits for construction of ocean platforms. It will also help in optimizing construction costs and timetables, and minimizing long-range operational problems.

SCHEDULE: Fifteen months.

BUDGET: Total cost is estimated to be $60,000.

PRIORITY:

Ocean Siting

4-55 IDENTIFICATION OF OCEAN PLATFORM LOCATION PARAMETERS

OBJECTIVE: To identify and evaluate critical physical location parameters for offshore ocean structures, such as platforms and artificial islands, intended for use as heavy industry sites, and other types, such as thermal differential energy centers, floating cities, etc.

PLAN OF ACTION: The sequence of steps would include:

1. Establish significant design requirements for an ocean platform to accommodate heavy industry, such as: size, water depth, type of construction, demand factors influencing location, distance from shore and others.

2. Extract from the literature all available data concerning ocean and shoreline processes.

3. Relate information from (1) and (2) to the various types of ocean structures under consideration in order to optimize physical location of a structure for minimum physical impact on the existing environment.

END PRODUCT: A set of parameters and location-sensitive modifiers to help guide decision-making on optimal locations for offshore ocean structures such as: platforms, artificial islands, thermal differential energy centers and others.

BENEFIT: The information developed in this study should provide guidelines which will minimize the long-range physical impact of man-made ocean structures on the existing physical environment.

SCHEDULE: 18-24 calendar months.

BUDGET: $150,000.

PRIORITY:

4-56 LEGAL IMPLICATIONS OF OFFSHORE STRUCTURES

OBJECTIVE: To attempt to define the types of legislation and other affirmative actions required on the part of the federal and state governments to permit the construction and operation of offshore structures to be used for non-extractive purposes.

PLAN OF ACTION: This project will require systematic, in-depth review of international, federal, state and local laws which possibly affect the construction, operation and/or removal of offshore structures used in activities other than for the extraction of mineral resources. The examination of the existing legal framework should be done first on a generic basis--that is, to see how present laws apply to all offshore structures. Then, various scenarios involving structures located at differing distances from shore, as well as structures intended for various functions, should be studied to identify the weaknesses, gaps and overlaps contained in the present legal and jurisdictional matrix. Finally, a package of model legislation should be drawn up for use as a reference material packet to be made available to the political subdivisions likely to be impacted by offshore structure development.

END PRODUCT: Model legislation recommendations.

BENEFIT: Provides an orderly framework for future legislative, institutional and regulatory changes needed to permit the construction and operation of offshore structures.

SCHEDULE: 18 to 24 months

BUDGET: $45,000 - $55,000, the first year and about $30,000 the second year, for a total of $75,000 - $85,000.

PRIORITY:

4-57 ENVIRONMENTAL IMPACT STATEMENT FOR OFFSHORE FOSSIL FUEL POWER STATIONS

OBJECTIVE: Establish the effects of the presence of floating offshore fossil fuel power stations on the environment.

PLAN OF ACTION: The sequence of steps would include:

1. Perform study to identify characteristics and parameters of a floating offshore power station which utilizes fossil fuels, including:

   a. Plant installation at site
   b. Logistics of transferring power from plant to shoreside users
   c. Logistics of transferring coal or oil/coal slurries to power plant
   d. Operational considerations for stack emissions, hull cleaning, and ash disposal.

2. Assess impact on environment, including:

   a. Operations
   b. Material, system, or operational failures
   c. Natural disasters.

END PRODUCT: A statement of environmental hazards, safeguards, and impact of both normal operations and credible failures associated.

BENEFIT: This action is required prior to initiation of operations of the subject offshore power stations.

SCHEDULE: Study should take nine months plus an added three months for hearings and responses to questions.

BUDGET: Estimated cost is $120,000.

PRIORITY:

4-58 ECONOMIC DATA BASE AND ANALYTIC METHODOLOGY

OBJECTIVE: To provide a body of data and a proven methodology within the federal establishment to permit rapid determination of cost, economics and national level net economic benefit of various projects.

PLAN OF ACTION: The sequence of steps would include:

1. Collect cost information.

2. Perform a national level net economic benefit study of the technical difficulty (R&D cost), operational difficulty, petroleum resource payoff, environmental impact and political impact or landside technology assessment of choosing one OCS area over other for aggressive exploitation.

3. Examine the tradeoffs at the national level considering the following study conditions:

a. Gulf of Mexico is not technology limited, or politically opposed, but future petroleum payoff is less promising.
b. Gulf of Alaska is technically expensive, partly opposed politically because of potential environmental problems, but prolific for petroleum and fairly close to markets.

4. Perform economic analysis of cost effectiveness of nuclear power for OCS development.

END PRODUCT: Common data base of economic information and analytical techniques upon which to make improved developmental judgments relative to OCS.

BENEFIT: More cognizant and perceptive federal program management. Rapid response to queries from Congress and others.

SCHEDULE: 1 year

BUDGET: $900,000

PRIORITY:

Ocean Siting

4-59 ENVIRONMENTAL DATA GATHERING FOR NEW OCS AREAS

OBJECTIVE: To develop a coordinated government/industry program to gather environmental data on OCS areas where ocean surface operations will occur.

PLAN OF ACTION: The sequence of steps would include:

1. OCS operations are environmentally limited at this time. A graphic example is the North Sea area. A federally led program to get more OCS environmental data as quickly as possible will assist in accelerating OCS petroleum development in areas where surface access is possible. Considering the needs of scientific research, environmental monitoring and equipment design, determine the number of different types of environmental parameters to be measured, the accuracy, the temporal frequency of measurement and special distribution of measurement required.

2. This analysis should consider three distinct areas where:

   a. Environmental parameters are needed and presently available.
   b. Environmental parameters are needed and are presently of limited availability.
   c. Environmental parameters are or will in future be needed but for which there is no available data or systems to take the data.

3. For each of the areas analyzed, develop a detailed plan for acquiring the necessary environmental data to accommodate the needs of the users of the OCS. Funding, manning, and scheduling efforts should be a part of the developed planning as well as delineation of the implementation responsibility between industry and government. The plan as developed should cover both surface and sub-surface operation.

END PRODUCT: A plan for OCS environmental data taking for scientific research tasks such as baseline surveys, for the development of cost effective industry euqipment designs and operating procedures, and for evaluation of environmental impact and associated requirements.

BENEFIT: Better understanding of OCS environment will accelerate development of its resources.

SCHEDULE: 1/2 year

BUDGET: $30,000

PRIORITY:

4-60 LONG RANGE STUDY TO DETERMINE THE DEGREE OF CONTAMINATION OCEAN WATERS CAN TOLERATE

OBJECTIVE: To determine extent of contamination oceans can withstand and the self-healing processes by which the oceans adjust to offshore disposal of materials.

PLAN OF ACTION: The sequence of steps would include:

1. Investigation of historical records and literature to determine present contaminants level, decomposition of materials, effect of currents and pressure, etc.

2. Evaluate domestic and foreign sites in terms of biotic accommodation to various contamination levels, e.g., natural oil seeps off California, mouths of large contaminated rivers, etc.

3. Conduct laboratory tests to duplicate historical findings and determine process of accommodation.

4. Conduct field tests in open sea water conditions.

5. Monitor lab and field program over long term period.

END PRODUCT: Advancement of knowledge about the ocean environment as a site for continued waste material disposal.

BENEFIT: Preservation of ocean environment within known limitation.

SCHEDULE: 5 years

BUDGET: $1 million

PRIORITY:

4-61 DEVELOPMENT OF IMPROVED METHODS OF TSUNAMIS FORECASTING (BOTTOM TURBULENCE GENERATED SEA WAVES)

OBJECTIVE: To upgrade the present methods of tsunamis forecasting.

PLAN OF ACTION: The sequence of steps would include:

1. The effects of tsunamis on offshore platforms and structures.

2. Evaluate present methods of tsunamis forecasting.

3. Evaluate the effects of increased warning time.

4. Proposed improvements in tsunamis forecasting (and their effect on design and warning time), and recommendations for prototype testing.

5. Implementation of one or more test programs and monitoring.

END PRODUCT: Improved reliable tsunamic forecasting system.

BENEFIT: Reduction in loss of life and property.

SCHEDULE: 3 years

BUDGET: $100,000

PRIORITY:

4-62 A NATIONAL (INTERNATIONAL) SEAMOUNT STATION

OBJECTIVE: To establish and operate a national (international) seamount station as a laboratory type facility for oceanographic studies and ocean engineering developments of all types. (As proposed by the Stratton Commission.)

PLAN OF ACTION: To continue and accelerate the development of Cobb Seamount Station to meet the need for a national (international) seamount station.

END PRODUCT: A viable open ocean laboratory type facility on a seamount administered to provide basic facilities for oceanographic studies and ocean engineering developments.

BENEFIT: Accelerated development of our knowledge of ocean processes and ocean engineering techniques and design.

SCHEDULE: Four years - continue development of Cobb Seamount Station; specifically, the installation of facilities.

BUDGET: $1.0 to 2.0 million per year.

PRIORITY:

4-63 COST/BENEFIT ANALYSIS OF TIDAL POWER PRODUCTION

OBJECTIVE: To stimulate commercial development of the oceans by exploiting its energy production potential.

PLAN OF ACTION: Over the years numerous studies have been undertaken to explore the feasibility of harnessing tidal activity to produce power in appropriate U.S. locations. The power transmission problems associated with the remoteness of these locations in relation to the user markets and the prior low price of energy source fuels generally mitigated against such projects. Improvements in electrical power transmission capability and the current rising costs of fossil fuels may alter the economics to create a faborable investment incentive.

1. Perform a literature search to trace the history of prior U.S. efforts in the area of tidal power generation.

2. Select the most promising plan based on prior economic analysis and state of the art technology capability.

3. Reassess the proposal in the light of current technology and the present and projected cost of terrestrial power generation.

END PRODUCT: An updated planning document upon which to base feasibility judgments with regard to tidal power generation.

BENEFIT: A thrust toward U.S. energy self-sufficiency and a stimulus to commercial development of energy demanding ocean industries.

SCHEDULE: 1/2 year

BUDGET: $15,000

PRIORITY:

4-64

FEASIBILITY OF NEAR-SHORE DREDGE SPOILS DISPOSAL

OBJECTIVE: To investigate the scientific and economic feasibility of near-shore dredge spoils disposal (a) on land and (b) by ocean dumping, especially in craters produced by sand and gravel mining.

Presently, numerous near-shore dredging operations either have been completed or are in the planning stage. Requirements of deep-draft vessels, new construction, and various other factors indicate that this will be a continuing activity. In each case, biological, chemical, and physical characterizations of the dredge spoils are required prior to disposal. Despite considerable evidence to indicate that higher than normal concentrations of potential pollutants (both metals and organics) are not released to the water column in large amounts during ocean dumping, there is always concern about the effects of such dredge spoils on bottom dwelling organisms. Consequently, land disposal is frequently proposed. However, we know very little about the long-term pollutional potential for saline dredge spoils subjected to weathering and leaching by rainwater containing significant amounts of acid (especially in highly industrialized areas).

PLAN OF ACTION: The study of land disposal of dredge spoils could be pursued via small field studies and in model laboratory investigations. Field studies should be established in "typical" areas considered to be good candidate locations for disposal. Baseline studies of the area prior to disposal should include chemical and biological characterization of ground water and soil coupled with general geologic and hydrologic descriptions. Spoils should be intensively characterized by chemical, biological, and physical measurements. After application of spoils, changes in these parameters should be monitored within the spoils and beneath the spoils in the dump site and surrounding area. The quality of rainwater would be monitored, especially with respect to acid content. Oxidation of spoils particles and changes in concentration and speciation of pollutants (such as heavy metals) should be compared along a depth profile in the spoils.

In conjunction with field trials, model laboratory studies would be conducted in chambers designed to simulate a variety of field conditions. It is not possible to fully simulate field conditions, but the flexibility in manipulating variables coupled with ease of sample collection make this approach useful in arriving at general relationships.

Study of the feasibility of using sand and gravel mining craters for disposal of dredge spoils depends on the availability of such sites. If research on the environmental impacts of sand and gravel mining is re-established, it is suggested that a study of the feasibility of disposal of near-shore spoils be incorporated.

END PRODUCT: The outcome of a research program incorporating all of the elements described above would be the evolution of criteria to aid in the selection of sites for near-shore dredge spoils disposal. An obvious implication is that test methods for characterizing spoils with respect to significant factors in their pollution potential would be developed (present test methods such as the "standard elutriate test" are grossly inadequate). Some important characteristics determining the suitability of land sites would be identified, thereby enabling more reliable site selection.

BENEFIT: There is presently a great deal of test work done prior to selection of sites for spoils disposal. However, much of this test work produces data that we cannot objectively interpret; and, therefore, site selection is still more art than science. This program should add to the scientific objectivity of this process.

SCHEDULE:

BUDGET:

PRIORITY:

<u>OCEAN SITING</u>

MISCELLANEOUS

OCEAN SITING PANEL

MISCELLANEOUS

4-200 A Floating Petrochemical Processing Complex
4-201 A Floating Natural Gas Refinery and Storage Facility
4-202 A Floating Oil Power Plant
4-203 Towage of Large Floating Structures

4-200 A FLOATING PETROCHEMICAL PROCESSING COMPLEX

OBJECTIVE: To develop, construct and deploy a prototype floating, marine-based petrochemical complex for the United States.

PLAN OF ACTION:

Phase 1 System Analysis

1. Establish existing and projected needed petrochemical plant capacity.

2. Determine engineering and economic feasibility of seabased complex.

3. Define technical development.

4. Establish links with existing support networks.

5. Develop preliminary environmental, pollution and energy impact assessments.

Phase 2 Prototype Development

1. Design, construct and test scale models of complex.

2. Establish operating envelope of complex.

3. Design terminals and links with existing shore-based facilities.

4. Establish personnel training programs.

5. Establish construction shcedules and costs.

Phase 3 Deployment

1. Implement construction of marine petrochemical complex and associate support equipment.

2. Implement construction of shore facilities.

END PRODUCT: To deploy a prototype, marine-based petrochemical processing complex that is environmentally sound and will maintain established emission pollution standards.

BENEFIT: A demonstrated capability of a low cost, highly efficient petrochemical processing complex which is ecologically sound.

4-200

<u>SCHEDULE</u>:

<u>BUDGET</u>:

<u>PRIORITY</u>:

Ocean Siting

4-201 A FLOATING NATURAL GAS REFINERY AND STORAGE FACILITY

OBJECTIVE: To develop construct and deploy a prototype marine-based natural gas refining and storage complex.

PLAN OF ACTION:

Phase 1 System Analysis

1. Project needed natural gas refining and storage capacity for major population and industrial areas of the United States.
2. Determine engineering feasibility of marine complex.
3. Define technical developments.
4. Establish links with existing storage and transfer facilities.
5. Develop preliminary environmental, pollution and energy impact assessments.
6. Develop fiscal policy.
7. Develop implementation program.

Phase 2 Prototype Development

1. Design, construct and test scale models of complex.
2. Establish operating envelope of complex.
3. Design terminals and links with existing shore-based facilities.
4. Establish personnel training programs.
5. Establish construction schedules and costs.

Phase 3 Deployment

1. Implement construction of marine natural gas refinery and storage facility and associated support equipment.
2. Implement construction of shore facilities and transfer terminals.

4-201

END PRODUCT: Deploy a prototype, marine-based natural gas refining and storage facility which will maintain established emission pollution standards.

BENEFIT: A demonstrated capability of a low cost, highly efficient natural gas refining complex which is ecologically sound.

SCHEDULE:

BUDGET:

PRIORITY:

4-202

A FLOATING OIL POWER PLANT

OBJECTIVE: To develop, construct and deploy a marine oil power plant which will provide supplemental electric power for a major metropolitan area or primary power for less populated regions of the United States.

PLAN OF ACTION:

Phase 1 System Analysis

1. Establish the power requirements for proposed sites.

2. Establish technical feasibility of a floating oil-fired plant.

3. Project needed technical development.

4. Analyze sociological and economic impacts and benefits of land-based systems vs. seabased system.

5. Develop preliminary environmental and energy impact assessments of landbased vs. seabased.

6. Establish fiscal policies and implementation schedules.

Phase 2 Prototype Development

1. Design and construct appropriate scale models of system.

2. Design and test links with existing power networks.

3. Establish personnel training requirements and programs.

4. Establish construction costs and schedules.

Phase 3 Deployment

1. Implement construction of marine power plant, underwater transmission cable and mooring buoy.

2. Modify exisitng power network for acceptance of additional power load.

3. Implement construction of land facilities.

4-202

END PRODUCT: To develop, construct and deploy a prototype marine-based oil power plant for urban and/or suburban use.

BENEFIT: A demonstrated capability of a low cost, highly efficient oil power plant that is ecologically and environmentally sound.

SCHEDULE:

BUDGET:

PRIORITY:

4-203 TOWAGE OF LARGE FLOATING STRUCTURES

OBJECTIVE: To determine problems in towing large floating structures such as industrial islands. To develop techniques which will allow for more economic, safer and more efficient towing of such structures.

PLAN OF ACTION: The areas that this effort would cover would be:

1. Cable and rope configuration and strength
2. Tugboat arrangements
3. Sea condition and towing
4. Ballasting techniques and stability
5. Horsepower requirements
6. Manpower requirements
7. Maneuverability

For each of these areas standardized methodologies will be sought and where necessary testing will be developed by which unusual cases could quickly be studied when they arrive.

END PRODUCT: A comprehensive manual in towing and towing techniques of large structures which can be updated as new techniques are developed.

BENEFIT: Training related to towing as well as standards could be more widely available; costing of an expensive component in ocean siting could be more easily estimated. Better design of platforms, tugboats and mooring systems may emerge.

SCHEDULE: Initial work should take no more than 2 years.

BUDGET: $200,000

PRIORITY:

MUNICIPAL
SERVICES

MUNICIPAL SERVICES

TRANSPORTATION AND FACILITY APPLICATIONS

MUNICIPAL SERVICES PANEL

TRANSPORTATION AND FACILITY APPLICATIONS

5-1 High Performance Surface Craft to Support Offshore Facilities
5-2 Mobile Transfer and Test Systems for Installing U.S. Built Industrial Facilities Overseas (Feasibility Study)
5-3 Vehicular Design Concept for Underwater Transportation
5-4 Assessment of Utilization and Potential of Undersea Vehicles in Development of The Ocean and Its Resources
5-5 Development of High Efficiency Ocean Transport
5-6 Composite Commuter and Cargo Waterborne Transportation Systems
5-7 All Weather Floating Offshore Transshipment Terminal
5-8 Submerged Structure Power Sources
5-9 Floating Offshore Industrial Community
5-10 National Marine Parks System
5-11 Offshore Service Facility
5-12 Feasibility of Man-Made Islands Offshore
5-13 A Floating Desalinization Plant
5-14 Offshore Marine Community
5-15 A Man-Made Offshore Island Industrial Community
5-16 Deep Ocean Nuclear Waste Disposal
5-17 Chemical Agent Waste Disposal
5-18 Development of Underwater Habitat
5-19 Evaluation of Burning at Sea of Chemical and Other Wastes
5-20 A Floating Waste Disposal System for a Major Urban Region
5-21 Commercial Waste Management
5-22 Deep Water Terminals
5-200 An Inter-Island Ferry System
5-201 A Floating United Nations International Conference Complex
5-202 A Floating Business and Communications Center
5-203 Coastal Wave Climate Stations

Municipal Services

5-1 HIGH PERFORMANCE SURFACE CRAFT TO SUPPORT OFFSHORE FACILITIES

OBJECTIVE: To develop one or more types of high performance surface craft, with the requisite speed, range and payload capabilities to provide efficient service to facilities located 200 miles or more offshore.

PLAN OF ACTION: A four-phase program to adapt existing technology in high speed marine vehicles to the specific needs of selected offshore support applications:

Phase I: Systems Requirements Analysis and Definition

Phase II: Preliminary Design and System Integration Study

Phase III: Contract Design, Detailed Design and Manufacture of Selected Craft

Phase IV: Test and Evaluation

END PRODUCT: A tested design(s) of cost effective, high performance surface craft to support offshore facilities requiring high speed for transportation of high value cargo and personnel. This output will be implemented by craft manufacturers through sales to industries involved in development of offshore facilities.

BENEFIT: The value of speed is high, in offshore support. Operating personnel are paid on a portal-to-portal basis from the time they leave the shore base; hence, transit time influences the proportion of their time spent on the job. Similarly, if a shutdown occurs on the offshore facility and delays ensue due to lack of repair materials, the loss of revenue is considerable. While conventionally designed surface craft and helicopters will continue to perform many of the supporting services required by offshore installations, time and distance factors increasingly demand improved surface transportation, with requisite range, speed, payload and seakeeping characteristics. This program will assure offshore industries that plans to operate distant facilities (200-500 miles offshore) can be supported effectively.

SCHEDULE AND BUDGET:
Phase I: 12 months, $200,000.
Phase II: 9 months, $1.5-2 million.
Phase III: 30 months, $10.0-15 million.
Phase IV: 9 months, $1.0-2 million.

PRIORITY:

5-2 MOBILE TRANSFER AND TEST SYSTEMS FOR INSTALLING U.S. BUILT INDUSTRIAL FACILITIES OVERSEAS (FEASIBILITY STUDY)

OBJECTIVE: To expand the export of U.S. technology and major heavy industrial plant equipment to developing nations overseas.

PLAN OF ACTION:

1. Enable U.S. contractors to develop a significant advantage in competing for construction of refineries, petro-chemical plants, power plants, port facilities etc. by designing and determining costs for a shoal draft seagoing barge, or group of such barges with (1) large storage and assembly areas and heavy duty ramps, (2) heavy lift rough terrain dollies, (3) all related handling, assembly and test equipment, as required to transferring deck-loaded major sub-assemblies to final installed position and of providing the necessary support operations for acceptance tests.

2. Develop, in conjunction with a consortium of prospective users, a means of long term financing for successive usage on a competitive, job-by-job basis by member firms.

3. Demonstrate on paper how the system could be applied to appropriate recent heavy construction projects, and calculate the differences in costs and completion time.

END PRODUCT · Plans, specifications, draft operating agreements and financing plans with functional comparison for potential applications.

BENEFIT: Reduced total costs as result of (1) being able to handle larger sub-assemblies in order to do more work at the manufacturers plant in lieu of costly test and assembly work in the field overseas, (2) more favorable financing as result of higher equipment utilization over a longer period, (3) reduced terminal delay.

SCHEDULE:

1. Industry seminar to define major problems, 1 month.
2. Conceptual design, 9 months.
3. Review Seminar, 1 month.
4. Drafting of operating agreements, and implementing and financing plan, 10 months.

BUDGET:

First year - $250,000; Second year - $150,000; Third year $50,000; Total $450,000.

PRIORITY:

Municipal Services

5-3 VEHICULAR DESIGN CONCEPT FOR UNDERWATER TRANSPORTATION

OBJECTIVE: Future underwater exploration must be supported by various means of transportation for human and cargo. Requirements of individual missions are likely to dictate radical departures from conventional submarine designs. Feasibility studies and pre-design analysis are to be carried out for vehicles with various applications.

PLAN OF ACTION: Investigations are to be branched out along three main avenues: namely, vehicles for the transport of humans, vehicles for the transport of cargo and semi-mobile storage units. The latter would serve as buffers for a long but finite duration. On the other hand, the first category must include appropriate life supporting systems. Parameters to be determined include shapes, sizes, range of depth, optimal operating speed, means to attain structural strength for deep submergence, possible use of sandwich construction and composites. To provide answers to such a series of questions, a sequence of problems in solid and fluid mechanics and problems of stability and control must be posed, formulated and solved.

END PRODUCT: Rational design concepts usable by designers and manufacturers of submerged vehicles for human and cargo transportation.

BENEFIT: A line of safe and efficient means of transportation of human and cargo may be developed, based on the findings of this project.

SCHEDULE: 5 years.

BUDGET: $150,000/year.

PRIORITY:

5-4 ASSESSMENT OF UTILIZATION AND POTENTIAL OF UNDERSEA VEHICLES IN DEVELOPMENT OF THE OCEAN AND ITS RESOURCES

OBJECTIVE: To assess and make recommendations relative to industry-institutions and government roles in the utilization of undersea vehicles.

PLAN OF ACTION: NOAA, through its MUS&T Office conduct a study through survey and workshop methods. MUS&T has compiled and reported on similar surveys entitled "Manned Undersea Activities of the Federal Agencies and Utilization of Manned Undersea Research Submersibles and Habitats" 1972 and 1974 reports. MTS Undersea Vehicle Committee can assist in this study.

END PRODUCT: A report on the study.

BENEFIT: Better planning for and utilization of undersea vehicles and maintaining a cadre of scientific and technical personnel experienced with their capabilities. More efficient and productive application of undersea vehicles commensurate with mission needs.

SCHEDULE: One year.

BUDGET: $40,000.

PRIORITY:

5-6 DEVELOPMENT OF HIGH EFFICIENCY OCEAN TRANSPORT

OBJECTIVE: Provide a clear path to a viable United States merchant marine industry which is capable of competing without subsidy with all other nations. Develop the complete body of legal and technological advance needed to produce such a high-efficiency system, and demonstrate the new approach on a practical scale.

PLAN OF ACTION: Use modern problem solving and system analysis techniques to define area where successful solution to economic, management, and technologic aspects of goal have a common solution. Develop indicated transport systems, draw up needed legislation or operating procedures, and select a favorable system for prototype demonstration. Implement demonstration.

END PRODUCT: A demonstrated new ocean transport system which can compete world-wide.

BENEFIT: Improved balance of payments, improved national image, lessened dependence on foreign flag ships for U.S. necessities. Greater war-time transport readiness.

SCHEDULE:

Problem solving and definition:	2 years.
Technology development:	6 years.
Demonstration:	3 years.

BUDGET: $102 Million.

PRIORITY:

5-6 COMPOSITE COMMUTER AND CARGO WATERBORNE TRANSPORTATION SYSTEMS

OBJECTIVE: To develop, construct, and display marine commuter and cargo transportation systems for major metropolitan areas of the United States.

PLAN OF ACTION:

Phase 1 System Analysis:

(1) Establish the existing and projected commuter and cargo requirements for major metropolitan areas.

(2) Establish existing waterway and vehicle capabilities.

(3) Project vehicle, waterway and facilities technical development.

(4) Define links to existing transportation networks.

(5) Analyze sociological and economic impacts and benefits.

(6) Preliminary environmental and energy impact assessment.

(7) Develop a fiscal policy.

(8) Develop an implementation program.

Phase 2 Prototype Development:

(1) Design and construct vehicle models.

(2) Design and model waterway development.

(3) Design terminals and links with existing transportation networks.

(4) Establish personal training programs.

(5) Construct, test, and evaluate full scale prototype vehicles.

(6) Establish construction schedules and costs.

Phase 3 Deployment:

(1) Order and construct vehicles.

(2) Modify existing waterways.

(3) Construct needed waterways.

(4) Build terminals.

END PRODUCT: To develop, construct and deploy a composite commuter marine end cargo transportation systems.

BENEFIT: Low cost and highly efficient mass and cargo transportation systems with the capability of meeting future transportation requirements.

SCHEDULE:

BUDGET:

PRIORITY:

Municipal Services

5-7 ALL WEATHER FLOATING OFFSHORE TRANSSHIPMENT TERMINAL

OBJECTIVE: To design for the U.S. east coast an all weather floating offshore oil and gas transshipment terminal.

PLAN OF ACTION:

1. Evaluate offshore transshipment terminal concept.

2. Evaluate terminal ship/terminal/ship or barge interaction in offshore conditions.

3. Preliminary Design of transshipment terminal including docking, mooring, ship/ship cargo transfer system.

4. Evaluate operation in all weather conditions.

END PRODUCT: Design of all weather offshore transshipment terminal.

BENEFIT: Provide the technology for the low cost, flexible, ecologically sound transshipment terminal for future oil and gas shipments from ocean floor or import.

SCHEDULE: 18 months.

BUDGET: Year 1 - $150,000.
Year 2 - $ 50,000.

PRIORITY:

5-8 SUBMERGED STRUCTURE POWER SOURCES

OBJECTIVE: To develop economical power sources for fully submerged structures.

PLAN OF ACTION:

1. Review power sources suitable for submerged structures.

2. Conduct systems analysis studies of alternatives.

3. Define future offshore submerged structure power requirements, divide requirements into market categories.

4. Design power source for high priority markets.

5. Develop and test power source of high technology system from above.

END PRODUCT: Economical power source for fully submerged structures.

BENEFIT: Allow offshore structures to become completely independent of shore or surface for deep ocean activities.

SCHEDULE: Five year program.

BUDGET: Total program cost is estimated at $5 million.

PRIORITY:

5-9 FLOATING OFFSHORE INDUSTRIAL COMMUNITY

OBJECTIVE: To develop a floating offshore urban/industrial complex off the west coast of the continental U.S. This would be a sister project to the manmade island initiative for the east coast. Its purpose: to extend the work to floating complexes in deeper water.

PLAN OF ACTION: Begin by employing the work of the offshore petroleum industry, NUC's MOBS work, Hawaii's Floating City program, and others as the initiating points for competitive (phase I) design analyses. The first step in this process would be to employ the findings of the University of Delaware and the Ecofisk City development along with other information as the takeoff points for competitive designs by competent industrial and academic teams for offshore island complexes. The results of this phase I competition would include not only designs themselves (which would include the industrial and urban components that would make up the island community), but also analyses of the economics, environmental impact, sociology, and social psychology questions, and legal and political issues. From two to four phase I competitions might be funded at approximately one-half million dollars each. Following this phase I competition, the designs or some combination of two or more of the designs might be chosen as the first national initiative. This would then be funded and implemented over a 4- to 8-year period and studied as an operating entity over the ensuing several years. If the approach proves viable, similar complexes very likely would be initiated by state and private capital long before this first initiative had lived its useful life.

END PRODUCT: A new and potentially more efficient form of urban/industrial complex, solid data for employment in the design of later such complexes, and improved insights into the dynamics, efficiencies, and economics of urban/industrial complexes in general.

BENEFIT: Improved effectiveness of urban/industrial complexes and improved balance of trade position for the United States.

SCHEDULE: Approximately 2 years for the phase I competitive designs.

BUDGET: One to two million dollars for the first year.

PRIORITY:

5-10 NATIONAL MARINE PARKS SYSTEM

OBJECTIVE: To expand the marine park system in order to achieve popular understanding of the oceans and improve recreational resources.

PLAN OF ACTION: The few national marine parks developed to date have been highly successful. Such parks, on an expanded scale, can serve two important functions. First, they provide critical recreational facilities near areas of high population density. Second, they can serve to focus national attention on the potential of the oceanic realm for human recreational and commercial activities and on its sensitivity to human activities. Only with such first-hand understanding at the grassroots level is a national commercial ocean development program likely to gain the momentum it requires. Needed first is a clear definition of the types and numbers of marine parks appropriate to various regions of the United States. Following that, an incremental development plan involving state and private capital, as well as Federal subsidy, appears in order. It is clear that such plans should be made components of states' coastal zone management plans. However, it is unlikely that this will be done adequately unless the Federal government encourages states to focus on the parks issue, as well as other important issues.

END PRODUCT: A greatly expanded national marine park system.

BENEFIT: Improved popular understanding of the marine environment and its potential for the nation, as well as greatly expanded recreational facilities.

SCHEDULE: Marine parks system plan within the first three years. Development schedule to be determined at a later date.

BUDGET: Approximately 41.5 million a year for the first two years.

PRIORITY:

5-11

OFFSHORE SERVICE FACILITY

OBJECTIVE: To build a large, multi-use, integrated port facility situated in the northern Gulf of Mexico, central to the offshore industry in that area. The facility will be designed to offer all services required by any offshore industry. Current use of crew boats and helicopters is not satisfactory for operations reaching beyond certain limits, i.e., 100 miles.

PLAN OF ACTION:

1. Site location -- a central site or several sites must be chosen which will satisfy the present and projected offshore activity.

2. Terminal design -- to include major docking facilities, airport, housing, recreation facilities, marinas, hovercraft port, heliport, communications, solar energy facility, wind energy conversion system, desalination plant, aquaculture center, storage facilities, etc.

3. Total design -- a. Component, or module, design
   b. Placement of modules.

4. Initiate construction -- third year.

END PRODUCT: The end product will be an "ocean" city, where complete services for the maritime industry are provided. It will be a proving ground for industrial and government joint enterprise. The city will be as self sufficient as possible, and populated with families who will live here as they would on land. A "new" mode of transportation, large hovercrafts, or air-cushioned vehicles, will be incorporated, providing service to New Orleans, the Louisiana coast and East Texas coast. Optimum utilization of Gulf resources will be realized, and the nations ability to work in the oceans enhanced.

BENEFIT: We will provide the nation with a complete technology, and industry with a new challenge. The present offshore industry will be economically serviced; new transportation (new to the Gulf) will be used; waste management and energy conversion systems will be developed, and new structural designs, which will withstand hurricane forces will be developed. This venture will require a total integration of industry finance, and governments.

SCHEDULE: Site(s) and terminal, or city design can be completed in 3 years.

BUDGET: 3 years: planning, design, etc. - $700,000.

PRIORITY:

5-12 FEASIBILITY OF MAN-MADE ISLANDS OFFSHORE

OBJECTIVE: To evaluate the feasibility of constructing man-made islands offshore using solid waste and dredged materials.

PLAN OF ACTION:

1. Identify the solid waste materials that could be used in construction of offshore islands to supplement the dredged materials.

2. Evaluate the increase in stability of the island under construction through the use of solid waste.

3. Evaluate the stability and erosion characteristics of an island constructed of a combination of solid waste and conventional dredged material.

END PRODUCT: Suggest the use of certain suitable solid waste material for construction of offshore islands.

BENEFIT: Large volumes of solid waste are generated each day in most areas. Some of these materials can find beneficial use as material for construction of offshore islands.

SCHEDULE: Year 1

1. Identification of solid waste materials which can be used.

2. Selection of solid waste material that can be best used with dredged material.

3. Evaluate with the aid of an ocean engineering model the stability and erosion characteristics of an island.

Year 2

1. Construct a 100-foot diameter pilot island using waste material and dredged material.

BUDGET: First year - $60,000; Second year - $350,000.

PRIORITY:

5-13 A FLOATING DESALINIZATION PLANT

OBJECTIVE: To develop, construct and deploy a prototype desalinization plant which could provide supplemental freshwater for a major metropolitan area or for large scale applications to municipal, industrial, and agricultural needs.

PLAN OF ACTION:

Phase 1 System Analysis

(1) Project the freshwater requirements for proposed sites.

(2) Establish technical and economic feasibility of desalinization.

(3) Project needed technical development.

(4) Analyze sociological and economic impacts and benefits.

(5) Develop preliminary environmental and energy impact assessments.

(6) Establish fiscal policies and implementation schedules.

Phase 2 Prototype Development

(1) Design and construct appropriate scale models of system.

(2) Design and test links with existing power networks.

(3) Establish personnel training requirements and programs.

(4) Establish construction costs and schedules.

Phase 3 Deployment

(1) Implement construction of marine desalinization plant and associated equipment.

(2) Modify existing freshwater network for acceptance of additional water.

(3) Implement construction of land facilities.

END PRODUCT: To develop, construct and deploy a prototype marine desalinization plant for urban and/or suburban use.

BENEFIT: A demonstrated capability of an alternative freshwater source that is ecologically and environmentally sound.

SCHEDULE: Phase 1: 2 Years
Phase 2: 4 Years
Phase 3: 6 Years

BUDGET: $17 million

PRIORITY:

5-14 OFFSHORE MARINE COMMUNITY

OBJECTIVE: To define U.S. capability to develop an offshore marine community.

PLAN OF ACTION:

A. Technical Analysis

(1) Economic, socio/political analysis
(2) Structure design
(3) Legal status
(4) Urban design
(5) Model test
(6) Scale prototype test
(7) Logistics support vehicle required
- cargo
- passenger

(8) Mooring or positioning systems
(9) Power plant design

B. Financial Analysis of Community Development
C. Ecological Analysis
- Present and future requirements

D. Define specific proposals for seaward advancement
E. Develop Large Seaward Advancement Experiment
- selection
- economic analysis
- financial analysis
- ecological analysis
- social/political analysis
- government program definition
- social variations
- communications

END PRODUCT: Technical, ecological and operational feasibility of the U.S. going forward with an offshore marine community project.

BENEFIT: Enlarge the options available to the U.S. in its future community and offshore developments.

SCHEDULE: The project will be conducted over a two year period.

BUDGET: The total cost will be $650,000.

PRIORITY:

5-15 A MAN-MADE OFFSHORE ISLAND INDUSTRIAL COMMUNITY

OBJECTIVE: To develop a man-made offshore island industrial community on the continental shelf of the east coast of the United States. This would serve as a national initiative similar to, but much smaller and less costly than, the NASA space program and also as the first controlled national experiment in an offshore urban/industrial community. As such, it should significantly increase our understanding of such systems and lead to a future determination of where and how they can further the commercial development of the oceans available to the nation.

PLAN OF ACTION: The first step in this process would be to employ the findings of the University of Delaware and the Ecofisk City development along with other information as the takeoff points for competitive designs by competent industrial and academic teams for offshore island complexes. The results of this phase I competition would include not only designs themselves (which would include the industrial and urban components that would make up the island community), but also analyses of the economics, environmental impact, sociology, and social psychology questions, and legal and political issues. From two to four phase I competitions might be funded at approximately one-half million dollars each. Following this phase I competition, the designs or some combination of two or more of the designs might be chosen as the first national initiative. This would then be funded and implemented over a 4- to 8-year period and studied as an operating entity over the ensuing several years. If the approach proves viable, similar complexes very likely would be initiated by state and private capital long before this first initiative had lived its useful life.

END PRODUCT: A new and potentially more efficient form of urban/industrial complex, solid data for employment in the design of later such complexes, and improved insights into the dynamics, efficiencies, and economics of urban/industrial complexes in general.

BENEFIT: Improved effectiveness of urban/industrial complexes and improved balance of trade position for the United States.

SCHEDULE: Approximately 2 years for the phase I competitive designs.

BUDGET: One to two million dollars for the first year, and for ensuing years to be determined after the end of the phase I competition.

PRIORITY:

5-16 DEEP OCEAN NUCLEAR WASTE DISPOSAL

OBJECTIVE: Develop nuclear waste disposal sites in the deep ocean seabed and implant numerous high level radioactive canisters for permanent storage.

PLAN OF ACTION

1. Conduct scientific biologic, geologic and oceanographic investigations of possible disposal sites.

2. Conduct conceptual engineering studies on canister emplacement.

3. Conduct engineering studies and develop the construction, emplacement, monitoring, retrieval and ship handling equipment and materials.

4. Construct a prototype disposal site, emplace simulated canisters and monitor long life effects.

5. Complete necessary production site technical, safety and economic evaluations.

6. Construct and/or modify production site equipment, facilities and support vessels.

7. Start production disposal of radioactive canisters in deep seabed.

END PRODUCT: A secure and safe disposal solution for the U.S. and possibly international nuclear waste products.

BENEFIT: Disposal would be in an area very remote from population centers and with limited susceptibility to natural or man-made environmental factors. A very high degree of exclusion and containment can be provided.

SCHEDULE:

YEAR	1	2	3	4	5
	Scientific Investigation & Concept Studies	Initiate Development Program	Development Program	Development Program	Construct Prototype Site

BUDGET:

YEAR	1	2	3	4	5
	$1 Million	$10 Million	$50 Million	$70 Million	$70 Million

PRIORITY:

5-17 CHEMICAL AGENT WASTE DISPOSAL

OBJECTIVE: To provide the optimum solution for the disposal of the Army's hazardous residues which result from demilitarization of chemical warfare agents.

PLAN OF ACTION:

1. Perform a feasibility study on burial of the residues underneath the ocean bottom.

2. Design and fabricate hardware necessary to accomplish the burial including ship modifications.

3. Demonstrate the method with inert material.

4. Bury the actual material.

END PRODUCT: Successful disposal of the hazardous residues. At present an acceptable method has not yet been established.

BENEFIT : The problem of how to dispose of these materials will be solved.

SCHEDULE:

YEAR	1	2	3	4	5
	Feasibility Study	Design	Fabricate	Fabricate	Demonstrate And Bury*

BUDGET:

YEAR	1	2	3	4	5
	$100,000	$3 Million	$5 Million	$10 Million	$50 Million

*Figures assume drilling a hole and pumping the residue down.

PRIORITY:

5-18

DEVELOPMENT OF UNDERWATER HABITAT

OBJECTIVE: Structural analysis and development leading to the determination of optimal design of underwater habitat.

PLAN OF ACTION: This project should begin with an extensive effort in the feasibility evaluation of the optimization of configuration of deep submerged structures suitable for human living under predetermined tasks. The problems to be resolved in the second phase of research and development include:

1. Structural response to static and dynamic loads, regular and random, of the various proposed structural shapes.

2. Fluid-solid interaction and its influences on structural integrity, stability and acoustic properties.

3. Material and form of construction - concrete vs. metallic or non metallic substances, modular vs. unitary formation, monocoque vs. composites.

4. Computational capability tailored for the preceding specific needs.

A third phase of research is expected in need of following up the preliminary phases in dealing with specific problems which arise, such as stress concentration elimination, fracture and fatigue and their arrest, etc.

END PRODUCT: Underwater habitat of various scales suitable for seabed research, mining and other tasks related to ocean floor colonization.

BENEFIT: Underwater colonies play important roles in future sea floor exploration and resource harvesting. They may also serve as primary processing sites for extracted minerals as well as research stations for oceanographic sciences.

SCHEDULE: 10 years.

BUDGET: $1 Million/year.

PRIORITY:

5-19 EVALUATION OF BURNING AT SEA OF CHEMICAL AND OTHER WASTES

OBJECTIVE: A discussion of the present use and limitations upon burning at sea of industrial and other wastes.

PLAN OF ACTION: The sequence of steps would include:

1. Discussion of the present use of burning-at-sea of specific chemicals and other wastes.

2. Evaluation of environmental hazards and effects of burning-at-sea, disposal of residue, and air pollutant dispersal.

3. Investigation of alternatives to proposed use of burning at sea.

4. Recommendations regarding future use of burning-at-sea of selected chemicals and other specific wastes.

END PRODUCT: Evaluation of burning-at-sea as a potential technique for disposing of certain chemicals.

BENEFIT: Cost effective method of disposing of otherwise difficult-to-dispose-of chemical and other specific wastes.

SCHEDULE: 1 year

BUDGET: $75,000

PRIORITY:

5-20 A FLOATING WASTE DISPOSAL SYSTEM FOR A MAJOR URBAN REGION

OBJECTIVE: To develop, construct and deploy a floating, prototype marine liquid and solid waste disposal complex that can meet the offshore ocean environmental requirements.

PLAN OF ACTION:

Phase 1 System Analysis

(1) Project needed waste disposal capacity for major urban areas of the United States.

(2) Determine engineering and economic feasibility of sea-based complex.

(3) Define technical development.

(4) Establish links with existing land-based facilities.

(5) Develop environmental, pollution and energy impact assessments.

(6) Develop fiscal policy and implementation program.

Phase 2 Prototype Development

(1) Design, construct and test scale models of complex.

(2) Establish operating envelope of complex.

(3) Design terminals and links with existing shore-based facilities.

(4) Establish personnel training programs.

(5) Establish construction schedules and costs.

Phase 3 Deployment

(1) Implement construction of marine waste disposal system and associated support equipment.

(2) Implement construction of shore facilities.

END PRODUCT: To deploy a prototype marine-based liquid and solid waste disposal complex that is environmentally sound.

BENEFIT: A demonstrated capability of a low cost, highly efficient waste disposal system which is ecologically sound.

SCHEDULE:

BUDGET:

PRIORITY:

5-21

COMMERCIAL WASTE MANAGEMENT

OBJECTIVE: To use the oceans in an economical and environmentally acceptable manner for commercial waste disposal. The problem is that the quantities of waste are tremendous and increasing yearly and that land disposal is becoming increasingly more restrictive and difficult.

PLAN OF ACTION: The sequence of steps would include:

1. Determine specifically and quantitatively the types, amounts, and locations of the liquid and solid wastes produced from all sources in the United States.

2. Determine the present methods, facilities and costs for disposing of these wastes, including the types and amounts which do not receive adequate disposal.

3. Project the data for a five-year period.

4. Determine the types, quantities, and location of those wastes that can be acceptably incinerated at sea (this may require defining acceptability and the technological or other steps necessary to achieve acceptability).

5. Design, build, and operate incinerator ships.

6. Determine the technical and ecological feasibility of near shore, shallow burial of wastes (as by dredging channels, depositing wastes, and covering the channels).

7. Design, build and operate dredge/burial ships.

8. Determine the ecological feasibility of depositing hazardous wastes in the ocean under sufficiently dilute conditions.

9. Determine the economic feasibility of using the oceans as part of an integrated land-sea transportation network for pick-up and delivery of wastes to specially operated land disposal sites.

10. Consider the feasibility of constructing floating conversion/recycle plants to convert hazardous wastes to either non-hazardous or useable products.

11. Design, build and operate floating conversion/recycle plants.

END PRODUCT: The expected outcome is a series of ships for disposal of waste at sea.

BENEFIT: Solution to the waste disposal problem which is becoming increasingly more severe.

SCHEDULE:	YEAR	1	2	3	4	5
		Study	Design	Build	Build	Operate

BUDGET:	YEAR	1	2	3	4	5
		$10 Mil.	$20 Mil.	$200 Mil.	$200 Mil.	$100 Mil.

PRIORITY:

*The budget refers to Government expenditures and will vary based on the number and type of ships and/or plants and the extent to which these are economically self-supporting.

5-22 DEEP WATER TERMINALS

OBJECTIVE: Study the economic aspects of increased ship berthing ability permitted with deep water terminals. Determine prospective sites for terminals as justified by economics. Indicate the necessary supporting system development - rail, highway, etc.

PLAN OF ACTION: Study the present and projected trade patterns of commodities shipped in bulk. Determine the transportation cost per DWT and its effect on U.S. trade position. Determine the raw economic advantages to be gained through shipment in larger, deep draft vessels. Determine the economic impact of a shift in present trade patterns. Study possible sites for development of those deep water terminals considered essential for the economic health of the U.S. Determine the cost of development of those sites selected including the necessary supporting systems. Prepare the necessary environmental impact statements for the proposed sites.

END PRODUCT: A blue print of the future terminal network necessary for bulk commodity trading.

BENEFIT: This study will enable the formulation of a national policy which will ensure the economic well being of the U.S. bulk commodity trade.

SCHEDULE: 3 years

BUDGET: $200,000

PRIORITY:

5-200 AN INTER-ISLAND FERRY SYSTEM

OBJECTIVE: To develop, construct and deploy a marine transportation system for the major islands of the United States and Trust Territories.

PLAN OF ACTION:

Phase 1 System Analysis

(1) Establish the existing and projected transportation requirements for the major islands.

(2) Establish existing waterway and vehicle capability and characteristics.

(3) Project vehicle and facilities technical development.

(4) Define links to existing transportation networks.

(5) Analyze sociological and economic impacts and benefits on the islands.

(6) Preliminary environmental and energy impact assessment.

(7) Develop a fiscal policy.

(8) Develop an implementation program.

Phase 2 Prototype Development

(1) Design and construct vehicle models.

(2) Design and model waterway modifications.

(3) Design terminals and links with existing transportation networks.

(4) Establish personnel training programs.

(5) Construct, test and evaluate full scale prototype vehicles.

(6) Establish construction schedules and costs.

Phase 3 Deployment

(1) Order and construct vehicles.

(2) Modify existing waterways.

(3) Build terminals.

END PRODUCT: To develop, construct and deploy an inter-island ferry system for the major islands of the United States and Trust Territories.

BENEFIT: Low cost and highly efficient inter-island transportation system with the capability of meeting existing and future transportation requirements.

SCHEDULE:

BUDGET:

PRIORITY:

5-201 A FLOATING UNITED NATIONS INTERNATIONAL CONFERENCE COMPLEX

OBJECTIVE: To develop, construct and deploy an international conference center.

PLAN OF ACTION:

Phase 1 System Analysis

(1) Establish the requirements for proposed center.

(2) Establish technical feasibility.

(3) Project needed technical development.

(4) Analyze sociological and economic impacts and benefits.

(5) Develop preliminary environmental and energy impact assessments.

(6) Establish fiscal policies and implementation schedules.

Phase 2 Prototype Development

(1) Design and construct appropriate scale models of system.

(2) Design and test links with existing power networks.

(3) Establish personnel training requirements and programs.

(4) Establish construction costs and schedules.

Phase 3 Deployment

(1) Implement construction of marine-based United Nations International Conference complex.

(2) Modify existing shore support facilities.

(3) Implement construction of new land facilities.

END PRODUCT: To develop, construct and deploy a United Nations International Conference Center.

BENEFIT: A capability of having a neutral site for a United Nations international conference which is ecologically and environmentally sound.

SCHEDULE:

BUDGET:

PRIORITY:

5-202 A FLOATING BUSINESS AND COMMUNICATIONS CENTER

OBJECTIVE: To develop, construct and deploy a prototype business and communications center which could provide supplemental space for a major metropolitan area or primary space for less populated regions of the United States.

PLAN OF ACTION:

Phase 1 System Analysis

(1) Establish the business and communications requirements for proposed sites.

(2) Establish technical and economic feasibility.

(3) Project needed technical development.

(4) Analyze sociological and economic impacts and benefits.

(5) Develop preliminary environmental and energy impact assessments.

(6) Establish fiscal policies and implementation schedules.

Phase 2 Prototype Development

(1) Design and construct appropriate scale models of system.

(2) Design and test links with existing power networks.

(3) Establish personnel training requirements and programs.

(4) Establish construction costs and schedules.

Phase 3 Deployment

(1) Implement construction of marine business and communications center and associated equipment.

(2) Modify existing land-based networks.

(3) Implement construction of land facilities.

END PRODUCT: To develop, construct and deploy a prototype business and communications center for urban and/or suburban use.

BENEFIT: A demonstrated capability of an alternative business and communications center that is low cost, highly efficient and ecologically and environmentally sound.

SCHEDULE:

BUDGET:

PRIORITY:

5-203 COASTAL WAVE CLIMATE STATIONS

OBJECTIVE: A network of permanent coastal wave climate stations along the U.S. Coast similar to the weather station, and being able to record not only the local free surface agitation, but also the directional wave spectrum. Establish standard methods of analysis and presentation in view of compiling a coastal wave climate atlas.

PLAN OF ACTION:

(1) Conduct feasibility study

(2) Install experimental station

(3) Development of coastal wave climate atlas.

END PRODUCT: A coastal wave climate atlas.

BENEFIT: This corresponding expense will be the most valuable investment which could be done for the future generations in the thrust of our society seawards.

SCHEDULE: A three-year investigation for feasibility study, installation of experimental station, development of data analysis methodology, and presentation of atlas form.

BUDGET: One million dollars per year.

PRIORITY:

MUNICIPAL SERVICES

ENVIRONMENT AND DATA

MUNICIPAL SERVICES PANEL

Environment and Data

5-23 Data Management
5-24 Regional Marine Resource Data Centers
5-25 Automated Environmental Reporting From Remote Locations and Ships
5-26 Identification and Evaluation of Industries Whose Requirements For Water Make it Attractive and Economically Feasible to Locate Offshore

5-23 DATA MANAGEMENT

OBJECTIVE: Develop a system and facility to properly manage, store, and distribute ocean and estuarine data and information.

PLAN OF ACTION: The sequence of steps would include:

1. Continue efforts within NOAA, EPA, AND NODC activities.

2. Bring together near shore/estuarine data under one cover facility.

3. Organize all data and information (historic, present, and future) under one facility.

4. Review and update software capabilities as applicable to data and information.

5. Provide realistic data access, software assistance and information retrieval.

END PRODUCT: A rational depository of information, data, software and assistance.

BENEFIT: It will allow manager, decision maker, planners, and researchers to obtain data, software information and assistance from a single source with the knowledge that all available information has been located.

SCHEDULE: 5 year program

BUDGET: Total program cost is estimated at $15 million.

PRIORITY:

5-24 REGIONAL MARINE RESOURCE DATA CENTERS

OBJECTIVE: To develop regional marine resource data centers to meet the need for such data on a regional basis for planning development of coastal and ocean resources and for drafting and evaluating environmental impact statements.

PLAN OF ACTION: To encourage NOAA to implement its legal responsibility to carry out the "collection and transmission of marine intelligence" by sponsoring establishment of regional marine resource data centers.

END PRODUCT: An ability to provide, on a regional basis, data relative to coastal and ocean resources, and oceanographic and atmospheric parameters, pertinent to marine resource development.

BENEFIT: A greater availability of data needed for planning with a reduction in overall cost.

SCHEDULE: First two years - Establish a prototype regional data center.
Second two years - Develop additional regional data centers and their capability.

BUDGET: $0.5 to 2.0 million per year.

PRIORITY:

5-25 AUTOMATED ENVIRONMENTAL REPORTING FROM REMOTE LOCATIONS AND SHIPS

OBJECTIVE: To expand the network for reporting of environmental parameters from ocean areas. Automation of environmental monitoring and reporting from remote locations ashore and ships is required (in addition to buoys).

PLAN OF ACTION: To develop and deploy instrument packages for automated environmental monitoring and reporting of atmoshpheric and oceanographic parameters from remote locations in marine areas and from ships.

END PRODUCT: A needed increase in inputs of synoptic reports of marine environmental parameters as a basis for enhanced marine advisories and forecasts.

BENEFIT: A reduction in loss of life and damage and loss to shipping, commercial fishing craft and mariculture projects, offshore petroleum and mining operations, pleasure boats, and in coastal areas; plus increased efficiency in ship routing and fisheries operations.

SCHEDULE: First three years - Develop and initiate deployment of automated environmental monitoring and reporting packages.
Next two years - Continue deployment of instrument packages.

BUDGET: $1.0 to 3.0 million per year.

PRIORITY:

Municipal Services

5-26 IDENTIFICATION AND EVALUATION OF INDUSTRIES WHOSE REQUIREMENTS FOR WATER MAKE IT ATTRACTIVE AND ECONOMICALLY FEASIBLE TO LOCATE OFFSHORE

OBJECTIVE: The sequence of steps would include:

1. Inventory existing industries - refineries, power plants, paper mills etc. - whose water requirements, capital intensity, and low labor force needs provide motivation for offshore siting.

2. Preparation of cost estimate of relocating existing plants offshore or establishing new offshore plants.

3. Determine energy requirements and possible integration of offshore gas and oil development with offshore industry siting.

4. Evaluate environmental benefits/risks and cost effectiveness vis-a-vis onshore plants.

END PRODUCT: Report on advantages/disadvantages of relocating large water - consuming industries to offshore sites.

BENEFITS: Environmental - and cost effective dispersion of selected industries.

SCHEDULE: 1 year

BUDGET: $125,000

PRIORITY:

MUNICIPAL SERVICES

POLICY, TRENDS, AND GENERAL

MUNICIPAL SERVICES PANEL

POLICY, TRENDS, AND GENERAL

5-27 Onshore Socio-Economic Effects of Multi-Purpose Offshore Industrial-Port Islands and Platforms
5-28 Encouraging the Safe Use of Scuba Diving
5-29 Regional (Federal-State) Marine Resource Councils
5-30 "The Development of a Safe and Reliable Deep Ocean Waste Disposal Policy, Practice and Atlas of Sites"
5-31 Sailing Ship Technology & Economics
5-32 Determination of Feasibility of the Use of Obsolete Vessels for Creating Artificial Reefs as Habitat for Sport and Commercial Fish, Breakwaters, Artificial Islands, and Other Uses
5-33 Development of Improved Floating Breakwater
5-34 The Sociology of Offshore Industry and Urban/Industrial Complexes
5-35 Legal and Political Implications of Offshore Industry and Urban/Industrial Complexes
5-36 Establish an Under Ice Search and Rescue System
5-37 Environmental Ramifications of Offshore Industries and Urban/Industrial Complexes
5-38 Collision Preventive Measures/Equipment
5-39 Investigation of Improved Blasting Techniques and Materials for Trenching, Removing Obstructions, Harbor Construction, Etc.
5-40 Analysis of Relationship Between Historic Dredge Spoil Disposal Sites and Wetlands
5-41 Feasibility of Raising Commercial Sponges in Water Fertilized with Domestic Sewage

5-27 ONSHORE SOCIO-ECONOMIC EFFECTS OF MULTI-PURPOSE OFFSHORE INDUSTRIAL-PORT ISLANDS AND PLATFORMS

OBJECTIVE: To assess the potential changes in the social and economic infrastructure of onshore areas adjacent to proposed ocean platform sites.

PLAN OF ACTION: The sequence of steps would include:

1. Estimate the short-term and permanent onshore support facilities required in connection with offshore ocean platforms and artificial islands.

2. Project the short-term and long-range changes in the onshore social infrastructure (schools, public safety, transportation, housing, etc.) of areas adjacent to proposed platform and island sites.

3. Estimate the short-term and long-range economic changes likely attributable to the construction and operation of offshore platforms and/or islands for industrial plants.

END PRODUCT: This project should result in a set of recommendations outlining the steps that should be taken in the areas of long-range planning, new legislation and institutional changes to ameliorate the potential impacts.

BENEFIT: Will help in avoiding or minimizing the "boom-town" type of impact possible from a major offshore development project.

SCHEDULE: 18 to 36 months

BUDGET: Estimated cost $75,000-$125,000

PRIORITY:

5-28 ENCOURAGING THE SAFE USE OF SCUBA DIVING

OBJECTIVE: To establish guidelines and organizational patterns which will encourage the safe use of civilian scuba diving for commercial and recreational purposes.

PLAN OF ACTION: To encourage broader leadership by NOAA's Manned Underseas Program in establishing national and regional patterns to promote safe use of civilian commercial and recreational scuba diving.

END PRODUCT: An expanded capability for underwater work in support of scientific and commercial development of coastal and ocean resources.

BENEFIT: Greater ability to operate underwater coupled with a reduction in loss of life.

SCHEDULE: Two years - Establish NOAA oversight of regional scuba diving programs.

BUDGET: $0.5 to 1.5 million per year.

PRIORITY:

5-29 REGIONAL (FEDERAL-STATE) MARINE RESOURCE COUNCILS

OBJECTIVE: To encourage formation and use of regional, Federal-State marine resource councils to assess marine problems and encourage marine resource development.

PLAN OF ACTION: To provide a legislative basis for federal leadership and oversight by encouraging the formation and utilization of regional marine resource councils.

END PRODUCT: A nationwide structure of regional Federal-State groupings to review, assess, recommend, and coordinate the development of coastal and ocean resources.

BENEFIT: Enhanced regional marine resource development planning.

SCHEDULE: Three years - Establish regional marine resource councils

BUDGET: $0.3 to 1.0 million per year

PRIORITY:

5-30 "THE DEVELOPMENT OF A SAFE AND RELIABLE DEEP OCEAN WASTE DISPOSAL POLICY, PRACTICE AND ATLAS OF SITES"

OBJECTIVE: To provide the U.S. with a safe and practical alternative to the collection of toxic and radio active wastes on land.

PLAN OF ACTION: The sequence of steps would include:

1. Determine all critical physical parameters.

2. Develop instruments and techniques to measure critical parameters.

3. Carryout studies of alternative waste packaging and dumping techniques.

4. Survey abyssal plains for best dump site locations.

5. Develop regulatory mechanism to insure compliance by government and industry.

END PRODUCT: Complete documentation and justification to support legislation covering new ocean waste disposal law.

BENEFIT: Increased safety and decreased cost (possibly) of dangerous waste disposal.

SCHEDULE:

1st year:	Parametric studies and instrumentation development
2nd year:	Design studies for waste packaging, begin ocean site survey
3rd year:	Ocean site survey, disposal test program
4th year:	Data analysis and regulatory policy development
5th year:	Legislative recommendations, bill preparation and testimony

BUDGET:

1st year:	$600,000
2nd year:	500,000 (not counting ship time)
3rd year:	500,000 (not counting ship time)
4th year:	200,000
5th year:	200,000
Total	$2.Million(not counting ship time)

PRIORITY:

5-31 SAILING SHIP TECHNOLOGY & ECONOMICS

OBJECTIVE: To determine economic potential of modern commercial sailing ships.

PLAN OF ACTION: The sequence of steps would include:

1. Determine operational capabilities and characteristics of a series of sailing ships to meet various trades (tour ship, inter-island general cargo, low value ocean cargo, etc.) assuming best potential sail aerodynamics.

2. Conduct economic studies in comparison with comparable engine powered ships to determine where sail power might have equal or greater economic advantage.

END PRODUCT: Ships with an alternative power source to fossil or nuclear fuels.

BENEFIT: A broader choice of energy supply for ship propulsion.

SCHEDULE:	Ship conceptual design	1 year
	Economic trade-off studies	4 months

BUDGET:	Ship conceptual design	$200,000
	Economic trade-off studies	$ 50,000

PRIORITY:

5-32 DETERMINATION OF FEASIBILITY OF THE USE OF OSBOLETE VESSELS FOR CREATING ARTIFICIAL REEFS AS HABITAT FOR SPORT AND COMMERCIAL FISH, BREAKWATERS, ARTIFICIAL ISLANDS, AND OTHER USES

OBJECTIVE: To provide more effective and utilitarian application of obsolete vessels.

PLAN OF ACTION: The sequence of steps would include:

1. Study existing offshore platforms and other structures as magnet for marine fauna.

2. Conduct pilot program of stocking areas adjacent to offshore structures and study effects and results.

3. Compile and analyze inventory of obsolete ships and those ships scheduled for obsolescence.

4. Select vessel types by preferred application (reef, breakwater, or island, etc.), geographic location, environmental forces involved, and other parameters.

5. Establish prototype programs based on data developed.

END PRODUCT: Elimination of esthetic eyesores of beached and derelict vessels and providing a useful and practical application.

BENEFIT: Improvement of recreational and commercial fishing and shipping activities.

SCHEDULE: 3 years

BUDGET: $1. million

PRIORITY:

5-33 DEVELOPMENT OF IMPROVED FLOATING BREAKWATER

OBJECTIVE: To extend construction season and to optimize efficiency of operations.

PLAN OF ACTION: The sequence of steps would include:

1. Investigate most effective floating breakwater concepts developed to date - military, construction and marine use.

2. Evaluate practicality of using obsolete vessels as breakwaters.

3. Select type of construction projects which would benefit from use of a floating breakwater.

4. Evaluate feasibility of using floating breakwater for other purposes - storage, personnel accommodations, offloading, etc.

5. Initiate pilot scheme and monitor same.

END PRODUCT: Development of practical floating breakwater to assist offshore construction.

BENEFIT: More cost effective construction practices.

SCHEDULE: 5 years

BUDGET: $2. million

PRIORITY:

5-34 THE SOCIOLOGY OF OFFSHORE INDUSTRY AND URBAN/INDUSTRIAL COMPLEXES

OBJECTIVE To develop a sound understanding of the sociological and social psychology factors which influence the effectiveness and viability of offshore industry and offshore industrial complexes.

PLAN OF ACTION: Engage a competent firm or academic institution to identify those parameters that most probably interact to constitute the sociological climate affecting the performance of offshore complexes. This institution should also lay out a plan whereby appropriate capabilities and pools of knowledge can be developed at private professional firms and appropriate academic institutions. An existing government agency should act as the lead agency in encouraging research related to this subject. Included in the long-range program should be development guidelines and checklists which may be used in the design of offshore complexes.

END PRODUCT: A long range plan for identifying and examining sociological impacts resulting from offshore complexes and a set guidelines for such development.

BENEFIT: The capability to evaluate the sociological implications of proposed offshore complexes in such a manner as to maximize their effectiveness and attractiveness.

SCHEDULE: 2 years

BUDGET: $250,000

PRIORITY:

5-35 LEGAL AND POLITICAL IMPLICATIONS OF OFFSHORE INDUSTRY AND URBAN/INDUSTRIAL COMPLEXES

OBJECTIVE: To assess the problems which urban/industrial complexes offshore will pose for states, national and international legal systems, and to assess political ramifications in order to provide guidelines for states and national legislative action and for U.S. positions in international negotiations.

PLAN OF ACTION: There are at least three major facets to this program. The first is concerned with states' legal structures, the second with national enabling and regulatory legislation, and the third with international commitments and agreements. Each would become an ongoing project for one or more suitable organizations with a Federal agency monitoring and coordinating the activities and developments.

END PRODUCT: A coherent set of guidelines for revising and developing states and national legislation as well as for guiding international negotiations.

BENEFIT: Removal of legal and political roadblocks and constraints to national commercial ocean development.

SCHEDULE: This must be viewed as the initiation of an essentially ongoing program. Three thrusts would be pursued simultaneously over several years.

BUDGET: $300,000 for the first year

PRIORITY:

5-36 ESTABLISH AN UNDER ICE SEARCH AND RESCUE SYSTEM

OBJECTIVE: To reduce the risk or perceived risk to under ice OCS petroleum operators and personnel as a means of encouraging increased Arctic OCS petroleum development.

PLAN OF ACTION: The sequence of steps would include:

1. Evaluate need for search and rescue system in terms of number of accidents, number of rescue platforms, standards for rescue mating hatches on all undersea vehicles, range, speed and size of rescue platforms, etc.

2. If an under ice logistic submarine can perform all the needed rescue missions should the Federal Government partly sponsor the development of rescue-capable logistic and support submarines?

3. Evaluate cost effectiveness of governmental versus private sector manning of developed rescue craft.

END PRODUCT: A plan of action.

BENEFIT: Less costly, safer and more reliable OCS Arctic petroleum development.

SCHEDULE: 1/4 year

BUDGET: $15,000

PRIORITY:

5-37 ENVIRONMENTAL RAMIFICATIONS OF OFFSHORE INDUSTRIES AND URBAN/INDUSTRIAL COMPLEXES

OBJECTIVE: To amass a body of knowledge as a guide to the design of ocean industries and the regulation of effluents into the oceans from all human activities.

PLAN OF ACTION: The oceans undoubtedly have a far greater ability to metabolize wastes than either land or air, not only because of their volume, but because the oceans are four dimensional in that their three spatial dimensions are mixed over time. However, for this same reason, global pollution of the oceans through overintroduction of wastes is a significant danger. We must learn which wastes the oceans can metabolize and at what rate and under what conditions. We must also learn which wastes are simply innocuous and which can be beneficial. Only in this way can we assure that our discharges into the oceans will have only desirable or acceptable effects.

First, discharges from industrial activities should be cataloged and characterized. Second, the effects of these discharges in saline waters from the chemical and biological dynamics of the marine ecosystem should become the subject of multiple research programs at multiple institutions. Third, we must advance our knowledge of the circulation of the earth's oceans and of such parameters as chemical combination, biological uptake, settling, and flocculation rates of various substances under the range of conditions to be found throughout the world's oceans. Ultimately, we must synthesize this knowledge base into a quantitative dynamic model of circulation, advection, convection, and chemical and biological metabolism in the world's oceans which will allow us to predict with reasonable certainty the fates of proposed discharges at specified locations and in specified volumes.

END PRODUCT: The capability described above.

BENEFIT: Simultaneous protection of the world's oceans against irreversible damage and utilization of the ocean's capabilities to metabolize the wastes produced by human activities, innocuously or beneficially.

SCHEDULE: 10 years

BUDGET: $1.5 million for the first year and 5 million per year for the remaining nine.

PRIORITY:

5-38 COLLISION PREVENTIVE MEASURES/EQUIPMENT

OBJECTIVE: To develop procedures and equipments which will minimize probability of general traffic colliding with outer continental shelf oil and gas recovery installations.

PLAN OF ACTION: The sequence of steps would include:

1. Study records and determine causes of past collisions.

2. Postulate positions of recovery equipment installations on outer continental shelf.

3. Generate concepts for equipment and methods for preventing future collisions based on probable installation sites and their positions relative to normal traffic lanes.

4. Evaluate concepts.

END PRODUCT: Regulations and systems designed to deal with equipment installations and traffic procedures.

BENEFIT: Reduction of losses resulting from collision.

SCHEDULE: 1 year

BUDGET: $50,000

PRIORITY:

Municipal Services

5-39 INVESTIGATION OF IMPROVED BLASTING TECHNIQUES AND MATERIALS FOR TRENCHING, REMOVING OBSTRUCTIONS, HARBOR CONSTRUCTION, ETC.

OBJECTIVE: To improve blasting techniques and materials

PLAN OF ACTION: The sequence of steps would include:

1. Inventory existing offshore blasting materials and methods

2. Evaluate and categorize offshore rock and seafloor conditions--hardness, friability, density, etc.

3. Evaluate on-land blasting materials and methods in terms of offshore applicability

4. Investigate suitability of directional blasting

5. Investigate methods for disposal of blasted material to assure that it does not fall back into excavated trench

6. Recommend development work to be carried out on new materials, methods, and concepts for offshore blasting

END PRODUCT: Proposals for new offshore blasting techniques

BENEFIT: Improved construction efficiency

SCHEDULE: 1 year

BUDGET: $100,000

PRIORITY:

5-40 ANALYSIS OF RELATIONSHIP BETWEEN HISTORIC DREDGE SPOIL DISPOSAL SITES AND WETLANDS

OBJECTIVE: To determine if dredge spoil sites can be historically translated into productive wetlands.

PLAN OF ACTION: The sequence of steps would include:

1. Obtain historical records, maps, and other documents indicating the location of former near-shore dredge spoil disposal sites.

2. Obtain photographs or other documentation indicating the status of the site prior to disposal.

3. Obtain photographs, maps, etc., of the site as it exists at the present time and compare with original condition.

4. Integrate all data on all sites and compare pre-disposal vs. post-disposal conditions in terms of adaptation, productivity, and feasibility for large scale implementation.

END PRODUCT: Report to indicate a "new" approach to dredge spoil disposal.

BENEFIT: Provide method for recycling dredge spoil for productive use.

SCHEDULE: Eighteen months

BUDGET: $80,000

PRIORITY:

5- 41 FEASIBILITY OF RAISING COMMERCIAL SPONGES IN WATER FERTILIZED WITH DOMESTIC SEWAGE

OBJECTIVES: To raise commercial sponges (wool, *Hippiospongia lachne* and yellow, *Spongia barbara*) under conditions of controlled fertilization using domestic sewage after treatment. More specifically to determine if the growth and survival rates of sponges are increased in enriched waters as compared to controls in natural waters. To determine if nutrient removal by sponges is large enough to substantially reduce eutrophication of natural waters. To gain knowledge applicable to husbandry of sponges for commercial ventures.

PLAN OF ACTION: Treated sewage will be transported from Virginia Key (Dade County) treatment plant to the Rosenstiel School of Marine and Atmospheric Science campus (about 2 miles distance) for experimentation. Covered tanks will be used for the experiment to prevent heavy seasonal rainfall from reducing salinities and killing sponges as is possible in open ponds. Several tanks will be used; a control with no nutrient added; and one tank for each of the two species of sponges with added effluent-plankton mixture. Tanks will be stocked with sponge cuttings obtained from large sponges collected in nature. These cuttings will be attached to pieces of concrete in the manner used on sponge farms (Storr, 1964). Before being metered into the tanks, the sewage and amount of phytoplankton will be tested to determine the nutrient levels of SiO_3, NO_2, NO_3, and plankton. At regular time intervals, nutrient tests will be repeated to determine the amounts removed after cropping by the sponges. The rates of growth will be determined at regular intervals by measuring the increase in volume of the sponges (Smith, 1973). The balance between the amount of nutrients and the quantity of plankton necessary for good growth of the sponges will be determined. Obviously, the highest levels of effluents producing the greatest growth of sponges will be the most desirable from the standpoint of preventing eutrophication.

END PRODUCT: The results of the proposed research have the potential for significant improvement of the quality of water in inshore areas frequently the habitat of juvenile commercial fishes and forage fishes. The feasibility of raising commercial sponges in natural waters will be demonstrated thereby providing opportunities for employment of displaced fishermen. Savings in sewage disposal to coastal communities will accrue due to reduced treatment costs. This has application to cities of the U.S. mainland as well as our Caribbean and Pacific possessions.

BENEFIT: Cost savings of $2000 per day could benefit just the municipalities of southeastern Florida on the assumption that sponge culture in sewage effluent would reduce costs by $0.01 per 1000-gallons (McGuire and Lee, 1973, cited ocean-outfall discharge as 201 million gallons per days from Rivera Beach through Key West). Until sponge growth and mortality rates and amounts of nutrient removal from sewage have been determined, we cannot calculate dollar benefits accurately. Aesthetic values of the inshore waters also would be increased by the improved water quality.

SCHEDULE: We estimate this to be a 2-3 year project. The first year, techniques will be evaluated, modified, and experience will be gained in maintaining optimum phytoplankton populations for sponges.

BUDGET: Year 1: $56,300
Year 2: $62,500

PRIORITY: