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Report to Sen. Charles H. Percy; by Richard W. Gutmann, Director, Procurement and Systems Acquisition Div.

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In most cases, the end product of a Maritime Administration research and development contract is a report. Some of these are used internally by the Maritime Administration, but most are distributed to the shipping and related industries. Further distribution is achieved through the Department of Commerce's National Technical Information Service. In March 1977, GAO reported that the agency did not have formal procedures for evaluating complete contracts and the results obtained. The agency has since required a final evaluation to be submitted to the Assistant Administrator for Commercial Development. Because the requirement for these evaluation reports is new for fiscal year 1977 contracts, no comments have been made on their effectiveness. In the absence of formal evaluations of contracts awarded in fiscal year 1975, information was obtained on the acceptability of their end products from agency officials. Comments were obtained on 15 completed contracts, and information was obtained on the status of 11 contracts still in process at September 30, 1977 (Author/SW)

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UNITED STATES
GENERAL ACCOUNTING OFFICE

The Maritime Administration's Evaluation Of The End Products Of Research And Development Contracts With Private, Profitmaking Firms

In most cases the end product of a Maritime Administration research and development contract is a report. Some of these are used internally by Maritime but most are distributed to the shipping and related industries. Further distribution is achieved through the Department of Commerce's National Technical Information Service.

In March 1977, GAO reported that Maritime did not have formal procedures for evaluating completed contracts and the results obtained. Maritime has since required a final evaluation to be submitted to the Assistant Administrator for Commercial Development.

Because these evaluation reports are newly required, GAO is not commenting on their effectiveness.

PSAD-78-4

JANUARY 27, 1978

UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

PROCUREMENT AND SYSTEMS
ACQUISITION DIVISION

B-164912

The Honorable Charles H. Percy
United States Senate

Dear Senator Percy:

This is our second response to your June 7, 1977, letter, requesting that we follow up certain areas of our report, "Federal Agencies' Contracting for Research and Development in the Private, Profitmaking Sector" (PSAD-77-66, Mar. 24, 1977).

One such area is related to agency evaluations of end products for research and development contracts. Because only a few contracts were complete at the time of our prior review, you asked that we return to the agencies and determine the end product's current status for each completed contract; any evaluation, circulation, or other action taken on the end product; and any further use intended by the Agency.

In subsequent discussions with your office, we agreed to furnish the information as it became available. Our first report, dated October 31, 1977, covered the Environmental Protection Agency. Information on Department of Transportation contracts will be reported to you in the near future. This report summarizes contract information obtained at the Maritime Administration.

For our March 1977 report, we reviewed 26 contracts (each costing over $100,000) awarded by Maritime in fiscal year 1975. Three contracts had been completed at that time; an additional 12 contracts had been completed as of September 30, 1977. Fifteen of these contracts are cost and 11 are fixed-price contracts.

In most cases a report is the end product of a Maritime research and development contract. Some reports are used internally by Maritime but most are distributed to the shipping and related industries. The reports are further distributed by the Department of Commerce's National Technical Information Service.

In March 1977 we reported that Maritime did not have formal procedures for evaluating completed contracts. Maritime has since initiated a requirement for a final evaluation to supplement its periodic progress reviews held during the contract period. Upon completion of a contract, the Director of the research and development office that managed the project is to submit a report to the Assistant Administrator for Commercial Development. The report is to evaluate the contract's execution and results and is to give suggestions on the report's distribution, the next work phase to be implemented, and the product's use. Because the requirement for these evaluation reports is new for fiscal year 1977 contracts, we are not commenting on their effectiveness.

In the absence of formal evaluations of contracts awarded in fiscal year 1975, we obtained information on the acceptability of their end products from responsible Agency officials. A summary of the comments on Maritime's 15 completed contracts is contained in appendix I. Appendix II gives the status of the 11 contracts still in process at September 30, 1977.

As discussed with you, we did not obtain written Agency comments. The matters covered in the report, however, were discussed with Agency officials, and their comments were included when appropriate.

Our work was performed at Maritime Administration Headquarters, Washington, D.C.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of the report. At that time we will send copies to interested parties and make copies available to others on request.

Sincerely yours,

R. W. Gutmann
Director

APPENDIX I

COMPLETED MARITIME RESEARCH AND DEVELOPMENT CONTRACTS

Contract 5-37045

On February 6, 1975, a cost-plus-fixed-fee contract was awarded to NUS Corporation. It was completed on September 17, 1975, having increased in cost from $147,088 to $148,969.

The end product of the contract was a master program schedule to be used for Maritime's nuclear ship program. The master program schedule, supported by a detailed description of milestone events, provides a coordinated plan to identify paths of design and construction and the responsibilities of each participant--including Maritime, the shipyard, nuclear equipment suppliers, shipowners, the naval architect, and regulatory agencies.

Originally, the program schedule was intended primarily for internal use by Maritime. However, Maritime officials said that it was made available and used by a nuclear system supplier and a proposed shipbuilding contractor on the nuclear merchant ship program. It has also been used as a model for program planning by other managers within Maritime.

Contract 5-38000

Exxon Research and Engineering Company was awarded a cost-shared contract on May 14, 1975. The contractor and Maritime each provided $108,000 for a pollution abatement study on various environmental aspects of oil cargo tank operations.

The results appeared in five reports, the last dated June 1976. Initial distribution of the reports was made to the major oil companies; subsequent distribution was made through the National Technical Information Service (NTIS).

The study results include:

--Washing crude oil cargo tanks with crude oil gives the greatest benefit to the environment by reducing the residue. A subsequent washing with water reduces pollution further. The crude oil washed free from tank insides by oil washing, which would have been lost during water washing, is recovered as deliverable cargo and results in economic benefits to the industry.

--Several sludge removal techniques were found to be impractical and expensive, but one concept increased sludge removal efficiency by a factor of four over present methods.

--The ocean survey for hydrocarbons produced baseline data on existing ocean conditions for measuring the effectiveness of future long-term improvements in pollution control methods.

--After washing the cargo tanks, oil is the only significant pollutant in the waste water holding tanks and no special shoreside treatment is required.

Contract 5-38014

On March 13, 1975, a firm-fixed-price contract for $96,187 was awarded to Combustion Engineering, Inc. A modification to include fuel oil testing increased the contract to $113,568.

The work represented the first phase of a two-phase project to identify and define criteria considered to be important to the design and operation of marine boilers. Statistically and historically, the least reliable piece of equipment aboard a merchant ship has been the marine boiler.

The final report on the contract, "Improved Marine Boiler Reliability," was issued in April 1976. The report investigates marine boiler design factors related to the reliability of the steam generating system.

In June 1976 a seminar was held to brief ship operators on the study's results. Also in June 1976 Combustion Engineering, Inc., received a new contract to perform phase two of the project, which is to concentrate on obtaining shipboard inservice data on the criteria identified in phase one.

The April 1976 report was disseminated by Maritime, the contractor, and NTIS. Maritime officials said that the data has been used by the California Air Resources Board (in proposing environmental emission standards on U.S. flag vessels in port) and by industry (for upgrading requirements for boiler tube materials).

Contract 5-38019

On June 24, 1975, a $138,638 cost-plus-fixed-fee contract was awarded to John J. McMullen Associates, Inc. The work was to provide Maritime with directions and strategies for the development of cargo-handling systems for U.S. flag cargo operators in the 1980s.

The study recognized that the basic trend of all general cargo systems was to reduce handling by introducing unitized methods. Since the unitized method to be used would depend on the commodity's characteristics, the study examined groups of commodities moving in major trade routes and alternative methods of handling these cargoes. Additionally, 18 cargo-handling systems were selected to illustrate present levels of technology, and these were evaluated against various criteria.

While the study is complete, the final report had not been distributed at the time of our review because volume I (an executive summary) was being revised by the contractor. The other two volumes were complete; one analyzed the U.S. general cargo trade and the other covered advanced cargo-handling system concepts. According to Maritime officials, once the executive summary has been received and the report is distributed to the U.S. flag carriers, Maritime expects that innovations in cargo handling will be introduced into different trade routes.

Contract 5-38022

Newport News Shipbuilding and Dry Dock Company was awarded a $418,078 cost-plus-fixed-fee contract on April 21, 1975, to engineer, design, and produce specifications for a nuclear-powered ultralarge crude oil carrier.

This contract followed approximately 18 months of conceptual design on very large crude carriers by a naval architectural firm. The earlier studies showed a definite economic incentive for applying nuclear propulsion to large crude carriers.

The Newport News Company developed preliminary plans and specifications for a nuclear-powered ultralarge carriers; performed safety analyses; developed a preliminary quality assurance program; developed a ship construction schedule; and defined the division of supply responsibilities between the shipyard and reactor supplier.

A subsequent modification increased the contract cost to $539,981 (no increase in fee) and incorporated a new task to develop the conceptual design of a nuclear powered icebreaking tanker.

Project results were published in a several-volume report that was usable for study purposes only and not for construction. Maritime said that it has made copies available to various industrial firms (including interested oil companies) to assist them in assessing the role of nuclear propulsion in ocean transportation of crude oil. The report is also available at NTIS.

Contract 5-38023

Hydronautics, Inc., was awarded a $48,451 firm-fixed-price contract on May 12, 1975, to develop a computer-based capability for sequencing the load and discharge movements of containers between a ship and terminals in accordance with a predetermined loading strategy. A modification increased the contract to $105,364. The scope of work was expanded to include demonstration of the containership loading program developed under the basic contract.

A February 1977 report describes a system of computer programs designed to aid the cargo-loading supervisor and marine terminal personnel in performing pre-stow planning and subsequent generation of sequential loading and unloading instructions for containerships or vessels. The report was distributed to 15 U.S. flag liner operators such as the United States Lines and Prudential Lines. It was also distributed to the American Institute of Merchant Shipping, American Maritime Association, and regional offices of the Maritime Administration. The programs have been made available on a worldwide computer network accessible from ports in the continental United States and many maritime nations.

Contract 5-38024

BDM Corporation was awarded a firm-fixed-price contract on June 24, 1975, in the amount of $164,892 for a technology assessment of newly developing offshore industry (offshore oil and gas, offshore energy production, undersea mining, 200-mile-limit fishing, and municipal services) and the effect on the traditional maritime industry. Phase I of this study (the report was delivered Nov. 1975) identified a rapidly growing offshore industry with a strong need for Federal leadership in offshore technological development.

This led directly to the establishment of the National Planning Conference on Commercial Development of the Oceans, which was held in June 1976.

A contract modification in the amount of $61,463 was awarded to BDM for technical support services to conduct the National Planning Conference, which was jointly sponsored by Maritime and other Government agencies. It brought together a group of 145 senior representatives from Government, industry, academia, and public interest groups to chart a work plan for the Nation's future ocean development. According to Maritime officials, this conference has had a major effect on the progress of offshore technology research.

A modification in the amount of $58,401 was added to the contract to permit the preparation of a comprehensive analysis of the supply and demand for offshore oil and gas rigs and support craft. The report from this study points out a near-term softness in the rig and support craft markets followed by sustained rapid growth, and the results have been used to justify Maritime continuing to insure the mortgage of offshore equipment under Title XI of the Merchant Marine Act.

The study also identified a need for low-cost platforms for offshore industry support. This led to the award of a separate contract of $149,042 to ETA Engineers of Houston, Texas, in May 1976, for a study of alternative offshore industry uses of surplus oil tankers. This study is still underway, but is expected to identify new opportunities for the conversion of vessels that are no longer economic in their original missions.

Contract 5-38032

Prairie Shipping, Inc. was awarded a $150,000 firm-fixed-price contract on June 26, 1975, to study the feasibility of developing a very large ship capable of carrying a wide spectrum of cargo from the Great Lakes through the St. Lawrence Seaway to the North Atlantic.

The report (dated Aug. 1975) documents the engineering and design data developed to determine the technical feasibility of the multipurpose ship concept. It also documents alternative design features that might further increase ship performance and/or decrease ship cost.

While these particular ships have not been built because of a lack of financing for a high-cost system in unproven

trade, according to Maritime officials the successful technical solution of this unique ship design has advanced the body of knowledge in these areas and has resulted in innovative structural and cargo-handling concepts. The report has been used internally by Maritime and by the contractor. The Maritime's Great Lakes Region has made special efforts to make the results of this work known through presentations to forums such as the Great Lakes Commission, the Great Lakes Task Force, and the International Associates of Great Lakes Port Authorities.

Contract 5-38034

On June 24, 1975, Peat, Marwick, Mitchell and Company was awarded a $132,814 firm-fixed-price contract to develop a financial information and reporting system for the maritime industry. The system, known as the Financial Information and Retrieval System (FIRST), will provide the Maritime Administration with an automated system to facilitate the analysis and evaluation of the financial and operational position of the U.S. maritime liner industry and of the individual firms within that industry that receive an operating differential subsidy.

A March 1976 report, "FIRST System Design," described the detailed design of the subsystems required to perform the functions of FIRST. There was no outside distribution of the report because FIRST is to be used internally by Maritime. However, financial information from FIRST will be made available to U.S. flag liner operators such as the United States Lines, American Export Lines, and Prudential Lines when the system becomes operational around March 1978.

Contract 5-38036

J.J. Henry Company, Inc. was awarded a cost-plus-fixed-fee contract on June 30, 1975, in the amount of $151,225 to investigate the feasibility of developing a standardized stern capable of being mass produced to reduce ship construction time and cost.

Based on the evaluation performed, the study found the standardized stern concept to be technically sound and economically feasible. Three basic ship stern sections were developed to satisfy the requirements of approximately 79 percent of the U.S. merchant fleet requirements over the next three decades.

Four reports were received and delivered to U.S. shipbuilders, especially the smaller shipyards such as Kelso Marine, Inc., Tacoma Boat-building Company, etc. The results will be presented to a national forum of naval architects and marine engineers. Two of the reports were available to the public through NTIS.

Contract 5-38042

On June 30, 1975, Pyramid Marine, Inc. was awarded a firm-fixed-price contract for $144,739 to develop and test a prototype shipboard maintenance and repair system.

Based on input from ship operators, a basic system design was developed and a diesel plant prototype system was produced and installed on board a dry-bulk carrier for a 1-year at-sea evaluation. A final report on the contract, entitled "Shipboard Maintenance Repair System, Basic System Design and Diesel Plant Prototype," was completed in August 1977 and discusses progress toward development of a shipboard maintenance and repair system to meet industry needs and Coast Guard requirements. Conclusions and recommendations are tentative; data collection and analysis are to continue with final conclusions and recommendations to be provided in a subsequent report under another contract.

The report was furnished to about 25 participating shipping companies and can be obtained from NTIS. A seminar is planned to inform all segments of the industry of the results of the evaluation of the prototype system.

Contract 5-38045

Raytheon Company was awarded a firm-fixed-price contract for $133,000 on June 30, 1975, to provide system definition for an unmanned ship machinery area. The effort is part of the Machinery Control System Program, whose long-term objective is to develop a control system for the safe, reliable, and economic operation of a periodically unattended maritime steam plant. Microprocessors offer the potential for providing improvements in reliability, easier maintainability, flexibility in accommodating variations in ship systems, and reduction in control system space and weight.

The report (1) defines a direct digital control system (using microprocessors) to control a marine boiler and (2) provides a cost analysis showing the machinery control system to be a cost-effective approach to engine room automation.

According to Maritime officials, the report had a selected distribution because of its highly technical information and the cost-sharing involvement of the industry team members. Copies were provided to Maritime, the American President Lines, and Raytheon for use in further development of the Machinery Control System concept.

Contract 5-38060

In order to discharge its responsibilities under the Merchant Marine Act of 1936, Maritime said that it was required to construct an econometric model to forecast U.S. foreign trade in tonnage as well as value for all ocean-borne commodities except crude petroleum, petroleum products, and bulk agricultural commodities.

On June 30, 1975, ECON, Inc. was awarded a firm-fixed-price contract for $102,844 to develop a trade forecasting model to produce 5-year U.S. foreign trade forecasts to assist industry in developing its marketing and shipbuilding plans. ECON then selected the trade and economic data bases from the major trading countries of the world and developed an econometric model. These data bases were implemented on computer files and the output is accesible through the Trade Econometric Management Information System (TEMIS).

TEMIS has been used by the Division of Economic and Operational Analyses of Maritime in responding to requests from its Regional Offices. Other Government agencies such as the Institute for Water Resources (IWR), the Department of Transportation, and the U.S. Coast Guard are considering using TEMIS in fulfilling their forecasting objectives. Currently, Maritime is working with IWR to further improve TEMIS to fulfill the objectives of the Corps of Engineers.

Contract 5-38074

Hydronautics, Inc. was awarded a firm-fixed-price $255,000 contract on June 13, 1975. The contractor conducted tests of maneuvering responses and power requirements for bulk vessels in shallow water. Four modifications of a computer program increased the contract to $295,250. The completion date was June 15, 1977.

Two reports resulted from the contract. One report, "Shallow Water Maneuverability Characteristics of MarAd Systematic Series for Full-Form Merchant Ships," gives data

obtained by testing models of bulk vessels in shallow water. The second report, "Development of Means for Rapid Retrieval of Hull Form Geometry and Performance Data for the MarAd Standard Series," details a computer program that can be used to develop the geometry and draw the lines of any size Maritime standard series bulk carrier design.

Distribution of these reports is presently being reviewed by Maritime officials with the aim of restricting the data to United States use only, in order to give U.S. interests an advantage over foreign competition.

Contract 5-38075

Delta Steamship Lines, Inc., was awarded a cost-shared contract on June 30, 1975, for $210,448, the Government's and the contractor's share each being $105,224. The project was to invite shipping interests to participate with Maritime in investigating, evaluating, and implementing a domestic waterborne feeder system. The study analyzed the feasibility of barge feeders servicing Atlantic, Gulf, Great Lakes, and inland waterway systems. It was completed on December 31, 1975.

Operators had expressed interest in this study because interchanging barges within a worldwide network would reduce barge inventories for each operator and substantially reduce barge building costs. In addition, it would be beneficial if operators could restrict their calls to one coast, enabling the vessel to increase the number of its annual voyages.

The project was planned as a two-phase effort. The second phase was to include the engineering design and implementation phase if the results of the first phase were positive. However, operators' lack of interest caused cancellation of further effort.

APPENDIX II

LIST OF MARITIME CONTRACTS STILL IN PROCESS AS OF SEPTEMBER 30, 1977

Contract no.	Contractor	Estimated completion	Comments
5-37039	Magnavox Research Laboratories	Mid-1978	Under Phase IV of the Maritime Satellite Program, the contractor was awarded a $436,195 cost-plus-fixed-fee contract in June 1975 for engineering and technical support services. The contract has been modified to extend the period of performance 1 year--to December 31, 1977. The contract amount has been increased to $640,253. It is expected that completion will be further delayed until mid-1978. The contractor provides data for evaluation of such satellite system applications as transmitting weather, navigation, and routing information.
5-37043	Prudential Lines, Inc.	12/31/77	The contract was awarded in April 1975 in the amount of $381,120, to be shared equally between the contractor and the Government. Modifications have increased the value to $566,087, shared equally by the contractor and Maritime. The contractor is to prepare a computer-based management and control system for U.S. flag

Contract no.	Contractor	Estimated completion	Comments
			carriers. The system uses a voyage simulator to enable management to project the profitability of various courses of action relating to individual vessel and voyage deployments and to examine the financial effect of changes to that voyage before their occurrence. One contract modification added a requirement to develop a uniform cargo-handling and port expense reporting and analysis system for the industry.
5-38003	Grumman Data Systems Corp.	10/31/77	This cost-plus-fixed-fee contract increased from $1,049,964 to $2,312,572 when the period of performance was extended 1 year. The contractor provides management and operation services for the Computer Aided Operations Research Facility (CAORF) at the National Maritime Research Center, Kings Point, New York. CAORF simulates vessel operations in port or at-sea environments and accurately reproduces the response of a ship to the actions of its crew and to the marine environment. CAORF permits studies and experimentation in situations infeasible for actual shipboard testing.

Contract no.	Contractor	Estimated completion	Comments
5-38021	RCA Global Communications, Inc.	12/31/77	The cost-shared contract is for $202,940, increased by modification from $172,998. The Government's share is now $113,207; the contractor's share remained at $89,733. The contract provides for the lease and maintenance of communication equipment installed on U.S.-flag vessels. The contractor's tests and demonstrations are intended to facilitate commercial use of new techniques in ship-to-shore communications, including error-correcting teleprinters for record communication.
5-38037	Moore-McCormack Bulk Transport, Inc.	12/31/77	The cost-shared contract is for $145,470, increased by modification from $123,470. The Government's share is $116,600. The effort is part of Phase IV (the experimental and economic validation phase) of the Maritime Satellite Program. The contractor is to provide a shipboard computer system and an automated navigation capability. Also, the contractor is to provide tests and evaluations of the automatic transmission of data between the ship at sea and a monitoring or controlling facility ashore.

Contract no.	Contractor	Estimated completion	Comments
5-38040	Lykes Brothers Steamship Co. Inc.	1/31/78	The total estimated cost of this cost-shared contract has increased from $661,000 to $928,106. The Government's share is $519,739; the contractor's share is $408,367. The contractor is to develop, implement, and evaluate an equipment control system to provide management with timely information on the status and location of barge and container equipment and accessories utilized in domestic and international marine transportation.
5-38046	Pacific Far East Line, Inc.	12/31/77	This fixed-price contract has increased from $350,000 to $700,000. The total project cost is $1,200,000; the Government's share is $500,000. The contractor is to develop an automated cost information reporting system for IBM equipment designed around and based upon a system developed by Maritime. The objective of the contract is to (1) provide the contractor and other carriers in the industry with the ability to analyze cost data in accordance with Maritime-prescribed guidelines on a regular and continuing basis and (2) serve as a foundation for an integrated information system needed for management to critically analyze day-to-day operations and assist in reaching valid and timely decisions.

APPENDIX II

Contract no.	Contractor	Estimated completion	Comments
5-38047	Comsat General Corp.	12/31/77	The firm-fixed-price contract for $116,400 covers 18 months of leasing costs and maintenance of 6 ship satellite terminals for the Maritime Satellite Program. Shippers are bearing the costs of terminal installation and the last six months' lease costs of the 2-year evalution program. The terminals are being used by shipping companies to evaluate the concept and economic viability of the experimental Maritime Coordination Center. It is expected that company experience with improved information interchange through the satellite system will encourage management to use these advanced communication techniques.
5-33048	Sperry Rand Corp.	11/15/77	Under a $360,000 cost reimbursement contract, the contractor is conducting the third phase of an effort responding to a National Transportation Safety Board recommendation for development of a ship transponder. The contractor is to test at sea and demonstrate the Marine Radar Interrogator Transponder, a device for use in radar systems. Some of its applications are collision avoidance, vessel identification,

Contract no.	Contractor	Estimated completion	Comments
			information interchange, and aids-to-navigation beacons.
5-38051	Waterway Communications Systems, Inc.	9/30/78	This cost-shared contract is for $997,088, with the Government's share $500,000 and the contractor's $497,088. The contractor is to develop an inland waterway communications system. The system will consist of eight or nine remote-coast stations, landlines for communications with tow boats and company offices, and automated ship equipment. Federal Communication Commission regulatory delays will require extending the contract about 9 months.
5-38071	Avondale Shipyards, Inc.	2/8/78	This cost-shared contract has been modified once, increasing the cost from $102,156 to $417,156. The contractor is to prepare a handbook for improving surface preparation and coating of ship tanks and closed areas during ship construction; catalog existing power hand tools for surface preparation; and perform related research projects.