
Appendixes

Summary of the R&D Program of the Maritime Administration (MarAd), Department of Transportation

Overview*

MarAd's research program grew out of the program office for the nuclear ship SAVANNAH of the late 1950s and early 1960s. The program pursued a variety of small projects and worked with the Navy on surface effect ships until 1970 when it was enlarged and redirected. The emphasis then shifted to cooperative work with industry to solve the near-term problems that plagued shipbuilders and operators,

In the past year or two emphasis is once again shifting. Administration policy is to have industry assume more responsibility for its near-term problems while government concentrates its efforts on the longer term basic research. Corresponding to this policy, MarAd's research budget gradually has been reduced. In the 1970s, funding peaked at \$25 million per year, after which budget cutting took its toll. The FY 1984 and 1985 budget are \$11.4 million and \$9.9 million respectively. Accordingly, MarAd has been trimming some of its programs. Work will continue in certain applied research areas but it will involve broad-based projects which apply to many or all companies, and these areas will be turned over to industry whenever that becomes possible.

With the limited funds available, high priority projects will be undertaken in shipbuilding, ship operations, and port technology. First priority will be policy or defense-related issues. Second priority will be fundamental research. Third priority will be applied research that can be useful to a broad range of shipyards, operators, or ports.

Government/industry cost sharing is a key element in certain of the MarAd R&D programs. During fiscal year 1982, MarAd committed \$9.6 million to R&D projects. Industry contributed an additional \$4.5 million (FY 82 Annual Report, chapter 6). Joseph A. Seelinger, assistant to MarAd's Research Advisor, estimates that the industry contributed \$5 million to \$7 million in 1983. The actual amount the industry contributed, however, is difficult to estimate because in-

dustry often makes in-kind contributions of labor, facilities, or technical assistance rather than cash.

MarAd also has cost-sharing and cost-reimbursed arrangements with the U.S. Navy and the U.S. Coast Guard. In 1983, MarAd obligated \$25 million of research and development funds. Of this amount, \$15.5 million, including a one-time amount of \$5.3 million for funding of USCG icebreaker operations, was directly appropriated to MarAd, while \$9.5 million was contributed or reimbursed by other agencies, primarily the Navy.

The MarAd R&D program was recently reorganized. Formerly, an Associate Administrator had sole responsibility for research and development. The Associate Administrator's supervisory responsibilities encompassed: 1) the Office of Advanced Ship Development, which included the shipbuilding and ship machinery programs; 2) the Office of Advanced Ship Operations, which included the programs of fleet management, cargo handling, and ship performance and safety; and 3) the Office of Maritime Technology, which included the hydrodynamics, university research, marine science, advanced ship systems, and ship structures programs.

With the recent reorganization, the R&D office was merged with the MarAd Operations office and is now under the Associate Administrator for Shipbuilding Operations and Research. The major organizational change was to combine the Offices of Advanced Ship Development and the Office of Maritime Technology in the Office of Advanced Ship Development and Technology.

Within MarAd, the managers at the program level (e.g., shipbuilding, ship machinery, etc.) are largely responsible for the organization and the conduct of individual programs. This results in a great deal of variation in how these various programs are operated and how they interact with the industry. In a few programs, such as the Shipbuilding, Fleet Management and Cargo-Handling Programs, formal relationships have been established between the programs and the industry. These arrangements may dictate specific procedures for soliciting input from the industry and for carrying out joint research projects. Other programs have less formal mechanisms for coordinating with the

*The material in this appendix was taken from various published and unpublished MarAd sources then reviewed by Dr. Zelvin Levine, Senior Advisor for R&D, February 1, 1985.

industry but still have an active relationship with the private sector. Overall, it is a policy of MarAd to conduct most projects on a cost-sharing basis; projects that are not conducted on this basis are required to justify their actions.

Current MarAd Program Elements

Shipbuilding Research

A large percentage of MarAd R&D funds are devoted to the National Shipbuilding Research Program (NSRP). The projects conducted under this program are jointly sponsored by MarAd and industry; this joint participation is widely thought to be the primary reason this program has been so successful. J. E. DeMartini of the Bath Shipyard writes: "The National Shipbuilding Research Program has grown into an effective vehicle for the conduct of industry-wide research and development programs that have made substantial contributions to increasing the productivity of our industry." (DeMartini, 1982.)

NSRP coordinates R&D activities through the Society of Naval Architects and Marine Engineers (SNAME). SNAME helps to disseminate the results of R&D projects to their members. In addition, the Ship Production Committee of SNAME has formulated a five-year R&D plan. According to M. Lee Rice, President of the Shipbuilders Council of America, the shipbuilding industry generally views NSRP as a successful program.

Ship Machinery

Before the oil embargo of 1973, the Ship Machinery Program concentrated on lower cost engines and lower manning. After the embargo, fuel efficiency became its main thrust although work continues on lowering capital and maintenance costs. All work in coming years will be on longer range projects: fundamental work will be conducted on the diesel engines, alternate fuels, and fluidized bed combustion. The near-term work on energy conservation and steamship retrofits will be left to industry.

In FY 1985 the first phase of a project on ceramic coatings for diesel components will be completed. These coatings, which were originally developed for gas turbine blades, can be applied to diesel internals and allow higher operating temperatures, and thereby attain greater efficiency and raise tolerance to lower grades of fuel. In cooperation with the U.S. Coast Guard, the problem of spontaneous combustion of coal aboard ship will be studied.

In FY 1986, further work on diesel efficiency will be conducted including the application of the Navy's

RACER system (Rankine Cycle Energy Recovery) to diesel waste heat recovery. In both 1985 and 1986, work will continue on the use of alternate fuels, such as coal-in-water slurries, and on a cooperative project with industry to adapt the new concept of fluidized bed combustion to ships.

Cargo Handling

The Cargo-Handling Cooperative Program (CHCP) is an arrangement between MarAd and six U.S. carriers for conducting cooperative R&D on cargo handling. The program was initiated in 1981, with projects actually beginning in 1983. The program operates through an executive committee composed of representatives of the carriers and MarAd. The committee meets two to four times a year to discuss common interests and to plan future projects. These projects are then conducted by contractors recommended by the MarAd program administrator and approved by the executive committee. The carriers themselves do not conduct R&D projects as do the shipyards associated with the Ship Production Committee; however, one of the member carriers takes the lead in monitoring each of the projects. Results of the projects are disseminated through monthly reports written and distributed by the MarAd program administrator. The CHCP was budgeted at \$500,000 for FY 1984. Additionally, the CHCP is being funded by the Navy to conduct research relevant to both military and civilian needs.

In 1985, work on a computerized simulation model of container terminal operations will continue. The carriers use this model to determine the impacts of changes in operational methods and vessel scheduling. Another project is determining how changes in cargo handling might capture some additional cargo for container carriers. Bar code identification equipment is being tested to determine its ability to function in the marine environment. There is a continuing effort to assess the technologies used in other industries for their application to marine cargo handling.

Future projects will include a test of low frequency microwave identification systems, improved communications between yard equipment and a central control station, automatic storage and retrieval of containers in the container yard, automated interchange transactions, testing of automated guided vehicles, and laser disc storage of documentation.

Computer-Assisted Operations Research Facility (CAORF)

This facility simulates a ship's bridge as well as ports or channels and their associated traffic and is used to investigate and test alternative operating procedures.

Cost-shared projects are carried out with U.S. Coast Guard, U.S. Navy, Corps of Engineers, port authorities, and shipping companies to test the effect of variables in their operations—changes in turning basins, positioning of buoys, changes in training procedures, etc.

In FY 1985 and 1986, CAORF will continue to work on a wide variety of navigational problems, many for other parties on a reimbursable basis. One project which will continue into FY 1985 is a reimbursable project for the Panama Canal Commission. The Corps of Engineers will continue to be a heavy user of CAORF in connection with several dredging projects, including Hampton Roads, Mobile, and New York. Individual port authorities will also be funding projects at the facility. MarAd will conduct its own work at CAORF on safety-related projects such as improved navigational and training procedures.

Fleet Management

The Fleet Management Program has established a formal mechanism—the Cooperative Industry Research Program—for soliciting ideas and establishing cost-shared projects with the industry. Under this program, a Request for Proposal is issued annually to over 800 firms. The program then funds the best proposals among those submitted.

MarAd has been working with the ship operating industry on information technology since the early 1970s. Various computer modules were developed but problems arose on the transferability of these modules from one company to the next. A new approach is to work with groups of companies through trade associations and to structure the output so that it is as widely usable as possible. This work has been merged with a former program on ship communications. Work on near-term computer/communications applications is being phased out as recently developed modules are being implemented, and as industry takes a larger role in developing new ones that may be required. A new generation of technology is being investigated to see how it can be applied profitably to ships and shipping.

Emphasis in 1985 and 1986 will be on long-term, high-risk projects which will be formulated during a technology forecasting project initiated in FY 1984. These projects will use technologies that are not yet fully developed, but are currently in the basic research phase of R&D. Projects will be undertaken to provide a useful product within 5 to 10 years. Although of a lesser priority, work will continue in the Cooperative Industry Research Program, which provides for 50/50 cost sharing with industry on near-term projects to implement existing state-of-the-art technology. Continua-

tion of these near-term projects is thought by MarAd to be essential to maintaining a spirit of cooperation with industry.

Ship Performance and Safety

This program addresses several areas of ship operations not covered elsewhere. Among these are effective manning, maintenance and repair, and hull and propeller coatings. Projects are usually conducted in cooperation with industry and/or labor. They are aimed at reducing fuel consumption, reducing the hazards aboard ship, or analyzing motivational aspects of seafaring to improve productivity and retain skilled seafarers in the work force. There has been an increasing emphasis in this program on making better use of the human resources of the industry. The biggest effort in coming years will be on effective manning of ships. In cooperation with shipowners and unions, shipboard experiments will determine the safest and most economical crew levels. Hull and propeller coatings will continue to be an important area of research in an effort to increase propulsive efficiency and reduce maintenance.

Advanced Ship Systems

This program is designed as the industry's bridge to tomorrow's shipping systems. The maritime industry is not organizationally or financially equipped to do long-range research and development. Under present circumstances limited resources are directed at near-term survival. The probability of success in any given Advanced Ship Project is small compared to that of the other programs, and the successes may come in directions other than those originally intended.

For FY 1985 and FY 1986, an initiative is planned on "competitive ships of the future." This would be an R&D joint venture, involving both government and industry, to develop prototype ship designs which incorporate the latest technology. The goal would be a series of ships which could be competitive in many world freight markets. While this project has been approved in the budget, the project has not yet been given the go-ahead to begin.

In addition, technology development for ice transiting ships will continue. Also, the study of powering needs in various ice conditions will continue. This will require additional full-scale tests of polar class icebreakers in cooperation with the U.S. Coast Guard.

Marine Science

Just as there is very little work on advanced concepts by the industry, there is little or no fundamen-

tal research on hydrodynamics, structures, and propellers. In addition, because of the nature of this research, relatively few projects are cost-shared by industry. Other government agencies such as the U.S. Navy and U.S. Coast Guard as well as the American Bureau of Shipping share in this work, especially through the Ship Structures Committee. Wherever possible, the agencies work together to solve common problems. MarAd, however, must take the sole initiative in problems peculiar to the merchant fleet, such as the maneuvering of tankers in shallow water or the resistance of vessels with very high block coefficients. Research will continue in the following areas: 1) improving ship maneuvering performance, 2) propulsion efficiency, and 3) ship structural safety through the interagency Ship Structure Committee.

Market Analysis

The small amount of research conducted by this program is directed at a number of areas. Specific mar-

ket opportunities are assessed, such as heavy lift cargo, perishable cargo, or shipments to developing nations. Market information is produced, such as monthly performance printouts and Canadian diversion reports. Planning is carried out on new market strategy models and forecasts of trade. In addition, U.S. and international policies are evaluated for their affect on U. S.-flag carriage. Industry has taken part in this program by recommending research projects.

In FY 1985 and 1986, this program will emphasize research on possible barriers to U.S.-flag vessels in world markets. The impact of international maritime policies also will be assessed and responses will be recommended.

Table A-1.—MarAd R&D Program Funding, Fiscal Years 1969-76
(dollars in thousands)

	Contract awards by final year							
	1969	1970	1971	1972	1973	1974	1975	1976
Prior year carryover					\$ 900.6	\$ 492.4	\$ 1930	\$ 7680
Appropriation					24,000.0	24,000.0	22,432.0	19,768.0
Total available					24,900.6	24,492.4	22,625.0	20,536.0
Obligations:	\$9,471.0	\$11,584.0	\$23,435.0	\$22,864.4	24,408.2	24,299.4	22,138.9	19,164.1
Advanced ship development	\$ 129.0	\$ 1,319.0	\$ 5911.8	\$ 4,193.2	\$ 7,018.7	\$9,314.7	\$6,572.2	\$ 7,433.1
Advanced ship operations	217.0	4,293.0	7,521.0	9,021.6	10,623.3	8,434.4	9,677.3	3,272.8
Maritime technology	500.0	385.0	2,190.2	6,120.6	2,361.2	1,626.6	2,343.3	3,656.6
NMRC/CAORF	0.0	0.0	0.0	1,936.6	3,595.8	3,384.6	2,221.9	3,127.9
NS Savannah/nuclear	3,973.0	3,389.0	5,334.0	0.0	0.0	666.8	882.9	568.2
JSESPO	3,332.0	1,500.0	500.0	0.0	0.0	0.0	0.0	0.0
Agency support	369.0	698.0	310.0	1,068.5	809.2	872.3	525.0	318.5
Market development	0.0	0.0	481.0	^a	^a	^a	39.3	300.6
Port & intermodal	0.0	0.0	308.0	^b	^b	^b	^b	486.4
Other	951.0	0.0	879.0	523.9	0.0	0.0	(123.0)	0.0

^aIncluded in advanced ship development

^bIncluded in advanced ship operations

NOTE: Numbers are ballpark since recoupments from prior years are not entered in a consistent fashion

Table A-2.—MarAd R&D Program Funding, Fiscal Years 1976-85
(dollars in thousands)

	Contract awards by fiscal year									
	Transfer quarter	1977	1978	1979	1980	1981	1982	1983	1984	1985 (estimated)
Prior year carryover	\$1,371.8	\$2,270.4	\$2,595.7	\$1,910.0 2,670.4	\$2,701.0	\$1,102.5	\$1,507.0	\$ 636.0	\$ 908.0	\$2,919.0
Appropriation	4,000.0	18,500.0	18,325.0	17,500.0	16,300.0	13,800.0	8,481.0	15,300.0	11,385.0	9,900.0
Total available	5,371.8	20,770.4	20,920.7	22,080.4	19,001.0	14,902.5	9,988.0	15,936.0	12,293.0	12,819.0
Obligations:	\$3,101.3	\$18,174.6	\$19,030.2	\$19,362.8	\$18,007.0	\$13,738.0	\$9,668.0	\$15,330.0	\$10,500.0	\$13,790.0
Advanced ship development	574.0	5,973.6	5,735.7	4,860.7	5,179.0	4,409.0	2,808.0	3,670.0	2,666.0	3,365.0
Advanced ship operations	774.6	1,882.2	1,922.3	2,476.0	2,673.0	2,274.0	1,569.0	2,166.0	1,332.0	4,164.0
Maritime technology	742.1	3,624.3	4,889.7	5,111.3	4,159.0	2,852.0	1,181.0	1,244.0	2,731.0	1,818.0
NMRC/CAORF	837.0	5,080.5	4,850.6	6,568.4	5,802.0	3,534.0	3,666.0	2,933.0	3,478.0	3,547.0
NS Savannah/nuclear	87.0	107.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
J S E S P O	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agency support.	8.6	2055	175.6	346.4	194.0	669.0	444.0	617.0	2930	0.0
Market development	^a	^a	^a	^a	^a	^b	^b	^b	^b	450.0
Port & intermodal	780	1,301.2	1,456.3	^c	^c	^b	^b	^b	^b	446.0
O t h e r	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4,7000	0.0	0.0

^aIncluded in advanced ship development

^bIncluded in agency support

^cIncluded in advanced ship operations

VOTE Numbers are ballpark since recoupments from prior years are not entered in a consistent fashion