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Report to Rep. Jack Brooks, Chairman, House Committee on Government Operations; by Robert F. Keller, Acting Comptroller General.

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The Maritime Administration needs to identify and demonstrate specific benefits that exceed the Government's costs for continuing the satellite communications services offered shippers. The continuing development of maritime satellite communications-related technology by the Maritime Administration is questionable because this technology is now available commercially. Findings/Conclusions: Many shipping companies have stated that the costs for procuring, installing, and operating shipboard satellite communications equipment are too high for them to independently finance these operations, especially since it has not been demonstrated that the potential benefits of satellite communications and related data processing could offset these costs. Recommendations: The Secretary of Commerce should direct the Assistant Secretary for Maritime Affairs to: undertake a cost-benefit analysis of the satellite program to determine the value to the U.S. shipping industry of using the satellite communications and the available fleet management computer programs; demonstrate these benefits to the shipping industry if they can be shown to offset the equivalent commercial or Government costs for these services; correct promptly management deficiencies with emphasis on the development of and adherence to a master plan and requisite management controls and the method by which the Kings Point Center's functions can be turned over to private industry; and terminate the satellite program unless the first two recommendations can be fully achieved. (Author/SC)

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# REPORT TO THE HOUSE COMMITTEE ON GOVERNMENT OPERATIONS

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12/19/77*

## BY THE COMPTROLLER GENERAL OF THE UNITED STATES



### Maritime Administration's Satellite Communications Program: Is It Still Needed?

The Maritime Administration needs to identify and demonstrate specific benefits that exceed the Government's costs for continuing the Maritime satellite communications program.

Maritime should terminate the satellite program in early 1978 unless (1) a meaningful cost-benefit analysis is accomplished and (2) the program's benefits are then demonstrated to the U.S. shipping industry. If the program is continued or reoriented, Maritime should improve its management of the program significantly.



COMPTROLLER GENERAL OF THE UNITED STATES  
WASHINGTON, D.C. 20548

B-186100

The Honorable Jack Brooks, Chairman  
Committee on Government Operations  
House of Representatives

Dear Mr. Chairman:

This report, prepared in response to your March 8, 1976, request and subsequent meetings held with your Office, discusses the management and value of the Maritime Administration's Maritime Satellite Program. We are also enclosing copies (only to you) of our decision and letters concerning the related protest against the contract awarded to Computer Sciences Corporation for operation of Maritime's Fleet Management tests.

We recommend that the Maritime Administration terminate the satellite program in early 1978 unless it (1) undertakes a cost-benefit analysis of the program to determine its value to the U.S. shipping industry and (2) demonstrates any identified benefits of the program to the same industry. We also recommend, in the event the above is done and the satellite program is continued, that the Maritime Administration correct numerous management deficiencies, which are described in our report.

This report contains recommendations to the Secretary of Commerce on pages 27 and 28. As you know, section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the House Committee on Government Operations and the Senate Committee on Governmental Affairs not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report. We will be in touch with your office in the near future to arrange for release of the report so that the requirements of section 236 can be set in motion.

Sincerely yours,

  
Acting Comptroller General  
of the United States

COMPTROLLER GENERAL'S  
REPORT TO THE HOUSE COMMITTEE  
ON GOVERNMENT OPERATIONS

MARITIME ADMINISTRATION'S  
SATELLITE COMMUNICATIONS  
PROGRAM: IS IT STILL NEEDED?

D I G E S T

GAO questions the continuing development of maritime satellite communications-related technology by the Maritime Administration because this technology is available commercially. (See p. 1.)

For several years Maritime has been developing satellite communications and related computer techniques using its communications and computer center at Kings Point, New York, as the base for these experiments. (See pp. 8 and 13.)

A commercial maritime satellite communications system became available in mid-1976 to the world shipping community. Its owners offered the same range of communications services as did the Maritime Administration. Twenty-two foreign-flag and 10 U.S.-flag ships have been using the system, including 6 U.S. ships for which the costs were being paid by Maritime. Maritime satellites now cover the Atlantic, Pacific, and Indian Oceans. Maritime's program covers mainly the Atlantic. (See pp. 11, 15 and 16.)

Officials from 14 shipping companies told GAO that the costs for procuring, installing, and operating shipboard satellite communications equipment are too high for them to independently finance these operations, especially since it has not been demonstrated that the potential benefits of satellite communications and related data processing could offset these costs. Officials from 12 companies not participating in Maritime's program said that present methods of communications and present navigation techniques are more than adequate for shipping operations and they could not justify changes to the new methods because of the costs. (See p. 9.)

Maritime continues to provide, largely at Government expense, satellite communications services also offered by private industry. (See pp. 16 and 18.) Moreover, it has not, either by cost-benefit studies or test demonstrations, established benefits of its satellite communications and computer services which would offset their costs. (See p. 8.)

This duplication of satellite communications services no longer appears essential. Unless Maritime can demonstrate cost-benefits to the users of its computer services, the satellite program should be terminated. (See p. 18.)

Maritime's three program development contracts are cost-reimbursable arrangements. (See p. 3.) Dollar expenditures have exceeded the funding originally intended. (See p. 19.) Maritime has not taken the management measures required to insure that its program can proceed in an efficient, economical manner. Specifically, it should have an overall satellite program plan and prescribed management controls. (See pp. 19 and 26.)

GAO concludes, and recommends that the Secretary of Commerce direct the Assistant Secretary for Maritime Affairs to:

- Undertake a cost-benefit analysis of the satellite program to determine the value to the U.S. shipping industry of using the satellite communications and the available fleet management computer programs; benefits should be compared with commercial or Government costs for the services.
- Demonstrate these benefits to the shipping industry, if they can be shown to offset the equivalent commercial or Government costs for these services.
- Correct promptly the management deficiencies discussed in this report; emphasis

should be placed upon the development of and adherence to a master plan and requisite management controls, and the method by which the Kings Point Center's functions, if proven cost effective, can be turned over to private industry.

--Terminate the satellite program unless the first two recommendations can be fully achieved. (See pp. 27 and 28.)

The Maritime Administration agreed with most GAO recommendations and stated that definite actions are in progress to carry them out. It disagreed with the recommendation to terminate the program. (See pp. 28 and 29.)

The conditional nature of the recommendation to terminate the program presents Maritime with the opportunity to determine whether the program's present direction and costs are justified, provided this is done by the end of 1977. (See pp. 29 and 31.)

The Congress should review the results of the program's "fourth phase"--a determination of program costs and benefits by the end of 1977--in conjunction with its consideration of research and development funding requested by the agency for fiscal year 1979. (See p. 31.)

The Maritime Administration questions GAO's conclusion that satellite communications cost more than conventional high-frequency communications for shipboard use. GAO's survey of high-frequency costs compared to shipboard maritime satellite equipment shows Maritime's cost assumptions to be inaccurate and reinforces the conviction that maritime satellite communications are more expensive than conventional communications. (See p. 30, and app. III, p. 35.)

The Maritime Administration disagrees that it has performed no cost-benefit analysis since the first phase of the satellite program. GAO found that one cost-benefit

analysis was drafted in 1975, but due to its lack of specific benefits, was not acknowledged by the shipping companies nor incorporated into the program. (See p. 31 and app. III, p. 35.)

The Maritime Administration also disagrees that it provides services that duplicate those of private industry. In GAO's opinion, every communications function being processed through the Center and then through the commercial system, can be provided directly through the system (except the data processing functions for which the value is to be determined). (See p. 29 and app. III, p. 37.)

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#### ABBREVIATIONS

AII	Applied Information Industries
ATS	Applications Technology Satellite
CDS	Construction Differential Subsidy
CPFF	cost plus fixed fee
CSC	Computer Sciences Corporation
DOD	Department of Defense
FLTSATCOM	Fleet Satellite Communications
GAO	General Accounting Office
INMARSAT	International Maritime Satellite
MARAD	Maritime Administration
MARISAT	maritime satellite
MMS	Marine Management Systems
NASA	National Aeronautics and Space Administration
R&D	research and development
SSB-HF	single side band--high frequency

## CHAPTER 1

### INTRODUCTION

At the request of Congressman Jack Brooks, Chairman of the House Committee on Government Operations, we initiated a review of the award by the Maritime Administration (MARAD) of a cost-reimbursable-type contract to Computer Sciences Corporation (CSC) for operating MARAD's Fleet Management Tests, Maritime Satellite Program, phase IV. The contract award was also the subject of a protest to GAO by an unsuccessful offeror, Marine Management Systems, Inc. (MMS).

During our preliminary inquiry into the protested award, we observed and questioned MARAD's continuing involvement in the development of maritime satellite communications-related technology, since this technology is now developed and marketed on a commercial basis. The MARISAT 1<sup>1</sup> is a commercially owned maritime communications satellite system that is presently offering a full range of communications services between shore offices and ships at sea. Reportedly, 32 <sup>2</sup>/ U.S. and foreign flag vessels are using these services. With the concurrence of the Committee staff, we expanded the review to include an evaluation of MARAD's program.

As part of our review, and also as originally requested, we examined the protested award to CSC. However, this part of our review disclosed no significant information in addition to that reported in the Comptroller General's decision (B-185860) dated September 14, 1976, and in the Comptroller General's letters dated December 10, 1976, to the Secretary of Commerce and to the attorney for MMS.

### RATIONALE FOR DIRECTION OF MARITIME R&D

The Merchant Marine Act of 1936 (49 Stat. 1985), as amended, provides MARAD with the responsibility for fostering the development and maintenance of an American merchant marine sufficient to meet the needs of the national security and of the domestic and foreign commerce of the United States.

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<sup>1</sup>/This is the title used by the COMSAT General Corporation and its partners for the maritime communications satellite venture.

<sup>2</sup>/This number has increased to 51 since mid-1976, the time of our review.

The 1970 amendment to the legislation (Public Law 91-469), authorizes MARAD to subsidize and help rebuild a 300-ship U.S. merchant fleet. The 300 ships are to be built by 1980. MARAD is also authorized to subsidize the operation of eligible American-flag merchant ships to help offset the cost of paying seamen's wages, which are high compared to other nations' maritime wages.

MARAD interprets the legislation as authority to undertake programs that will increase the efficiency, economy, and effectiveness of the American Merchant Marine's operations, and elevate its competitive position within the international shipping market. Also, as one of the bases for its present direction of research and development (R&D) effort, MARAD cites the President's message of October 23, 1969, which states: "We will enlarge and redirect the maritime research and development activities of the Federal Government. Greater emphasis will be placed on practical applications of technological advances and on the coordination of Federal programs with those of industry." This message has been interpreted as a Presidential objective by MARAD and is also used as justification for the present R&D program direction.

MARAD's stated goal for the R&D program is to make the U.S. merchant fleet more competitive through application of technological advances. The R&D program is also expected to help shipping companies become more self-sufficient, and to eventually rely less on Government subsidies. Thus, MARAD states that a measurement of the success of its R&D performance is a reduction in the amount of operating and construction subsidies required by U.S. companies.

#### MARITIME SATELLITE PROGRAM

The satellite program <sup>1/</sup> is an R&D program sponsored by MARAD's Office of Commercial Development. Appendix I (p. 32) shows the Office's organizational structure and each research and development program it is presently sponsoring. The Assistant Administrator for Commercial Development is the principal official responsible for MARAD's R&D. He reports directly to the Deputy Assistant Secretary for Maritime Affairs.

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<sup>1/</sup> During the past years, MARAD has applied different titles to this program. This report uses the term "satellite program" to encompass all titles used by MARAD in the past.

MARAD's initial work in satellite communications started in 1969. Since that time, MARAD's satellite-related projects have cost over \$10.5 million. Future satellite-related costs have been estimated by MARAD to be about \$5.3 million through fiscal year 1980. Although no costs have been projected beyond 1980, MARAD documentation shows more development planned in this area through 1990.

A program manager from MARAD's Office of Advanced Ship Operations (see app. I, p. 32) directs the satellite program's elements. At the time of our review, MARAD had four major contracts 1/ to perform the elements. The following table shows the satellite program's existing contracts, contractors, estimated costs per contract, and period of performance.

<u>Contract</u>	<u>Contractor</u>	<u>Estimated costs</u>	<u>Period of contract (months)</u>	<u>Concluding</u>
Fleet management services	CSC	\$ 416,052	23	12/77
Engineering and technical support	Magnavox Corporation	640,253	30	12/77
Engineering services	Mitre Corporation	149,713	13	12/77
Satellite terminals	Comsat General Corporation	<u>162,400</u>	23	not definitized
		<u>\$1,368,418</u>		

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1/Three cost-reimbursable development contracts and one lease arrangement for satellite terminals.

The stated objectives of MARAD's satellite program are:

- To extend to ships the quality, real-time communications services now provided between locations ashore.
- To make continuous, accurate ship location information available for use by both ship and shore stations.
- To enable U.S. companies to use new ship management techniques that exploit aerospace technology.
- To increase operating efficiency through management techniques which expand use of the technologies mentioned above.

The actual purpose of the present satellite program is to conduct several fleet management experiments between a Maritime Coordination Center and participating ships at sea, utilizing the MARISAT communications link.

#### Maritime Coordination Center

The Center, located at the U.S. Merchant Marine Academy, Kings Point, New York, is an experimental computer/satellite communications processing facility built for MARAD in 1972. The Center is the central facility for operating and coordinating each of MARAD's fleet management tests. These tests are a series of satellite-communications and computer-processing experiments being conducted by CSC and the Magnavox Corporation, which are designed to determine both the value and the feasibility of using the Center's shore-based computer to aid ship operations in such areas as navigation, fuel economy, and reduced maintenance costs.

The following satellite communications services can be provided between shipping companies (or other shore points) and ships at sea.

- Telex (Teletype)
- Digital and analog facsimile
- Voice
- Medium- and high-speed digital data transmissions

Appendix II (see p. 33) shows the schematic representation of the present commercial satellite system and the MARAD

Center's connection. The routing of communications via the MARAD Center offers no communications services not already commercially available but, as can be seen, adds an additional link between the participating shipping companies and ships at sea. It appears that this additional link could increase end-to-end transmission time.

In addition to its communication switching function, the MARAD Center is providing two categories of computer-processing experiments which are being conducted between the Center and the ships participating in MARAD's program. MARAD calls these experiments the fleet management tests.

### Fleet management tests

The first fleet management test category is concerned with the communications of operations data between the ships and their respective shore offices, such as ship performance (position, speed, course, estimated time of arrival), engine room data (boiler steam pressure, engine RPM), payroll data, ship stores and spare parts requisitions, and cargo manifest data. A minicomputer at the Center receives and assists with formatting the data, stores it in memory files, processes it where required, and forwards it to either the ships (via the MARISAT communications link) or to their shore offices (via the conventional communications lines). The data is transmitted in either raw, digital form or in the forms of teletype and facsimile reports.

The second category of tests involves the Center's collection and transmission of Government service data to the ships (via the MARISAT link), such as weather forecasts, notices to mariner reports, and vessel emergency reports.

### Global fleet management

To place the satellite program in proper perspective with MARAD's total R&D effort, an explanation of MARAD's overall fleet management concept would be pertinent at this point.

The Office of Advanced Ship Operations is attempting to attain as a major goal by 1980, a U.S. fleet management network that will direct at least 300 American-flag vessels worldwide. This concept was conceived by MARAD as the means of improving the competitive position of the U.S. merchant fleet. According to MARAD, global fleet management is the

process of optimizing the productivity and safety of the ocean transport of cargo, using to the best economic advantage all available capital, procedural and personnel resources on a global basis for the U.S. merchant fleet. To achieve this goal, which is in essence an integrated U.S. merchant marine transportation-management network, MARAD has been developing techniques that involve the use of advanced communications and management control systems such as satellites and computers.

Three R&D programs comprise the elements of the Global Fleet Management program: (1) competitive shipping, (2) advanced ship control, and (3) advanced communications and navigation. <sup>1</sup>/ MARAD plans to integrate these elements by 1978 and to have a global fleet management system by the early 1980s.

In the competitive shipping program, MARAD has developed and is promoting the use by shipping companies, of a computer-based Shipping Operations Information System, which is expected to afford the companies computerized management systems to more effectively handle shore- and ship-based operations. In the Advanced Ship Control program, MARAD expects to develop high levels of automation aboard ships in such areas as machinery operations, bridge, and cargo-handling functions. Subsequently, these two elements are to be integrated with the results of the Advanced Communications and Navigation element. Altogether, the three elements are expected by MARAD to tie all U.S. merchant shipping companies and their ships together, into an integrated American fleet management system, with the ships and logistics operations controlled by each of the companies; and to coordinate them through one common facility, the Maritime Coordination Center.

#### SCOPE OF REVIEW

During our review we examined pertinent background information, legislation, agency correspondence, and contractor files. We interviewed key officials and other personnel at the Office of Administrative Services and Procurement, Department of Commerce; the Office of Audit, Department of Commerce; the Maritime Administration, Washington, D.C.,

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<sup>1</sup>/The Maritime Satellite Program is the major portion of this element.

and the Maritime Coordination Center at Kings Point, Long Island, New York; several merchant shipping companies; Computer Sciences Corporation, Falls Church, Virginia; Marine Management Systems, Inc., Stamford, Connecticut; the Magnavox Corporation, Silver Spring, Maryland, and Torrance, California; and Comsat General Corporation, Washington, D.C. We also discussed the program with officials of the American Institute of Merchant Shipping, the Radio Officers' Union, the U.S. Coast Guard, the U.S. National Weather Service, and the Defense Mapping Agency.



## CHAPTER 2

### SATELLITE PROGRAM BENEFITS

#### HAVE NOT BEEN ESTABLISHED

The Maritime Satellite Program appears to have been initiated as the result of a 7-month study contracted in November 1970, with Applied Information Industries, Inc. (AII), of Moorestown, New Jersey. The study postulated that potential dollar savings of about \$120,000 to \$470,000 per year for each ship would be achieved if between 300 and 2,000 ships used the combination of maritime satellite communications and a MARAD-developed satellite communications coordination and computer center. 1/

#### COST-BENEFIT STUDIES NOT MADE

The AII study urged the establishment of an experimental center which would measure, rather than estimate, the benefits to ship operations of satellite communications and computer technology. MARAD proceeded with this suggestion and awarded another contract to AII for the design and implementation of the center and the follow-on communications experiments. The center was completed in March 1973 and work under AII's contract cost just over \$4.8 million.

Despite the completion of AII's contract and several additional contracts and numerous experiments since that time, MARAD, up to the end of our review, had neither developed cost/benefit studies, nor had it measured the benefits commensurate with the costs for potential users of the satellite program. In short, the savings postulated by the AII study have not been confirmed. Although six vessels are now participating in the program, MARAD is paying for most of the associated costs.

#### LACK OF APPARENT USER BENEFITS INHIBITED INTEREST IN PROGRAM

During our review we interviewed 20 key officials of 15 U.S. merchant shipping and 3 U.S. oil companies involved in the ocean transport of goods. Included were the four merchant shipping companies and the two U.S. oil companies

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1/Presently called the Maritime Coordination Center.

participating in MARAD's program. We discussed each company's potential for using satellite communications equipment and attempted to determine the officials' overall knowledge of MARAD's satellite program. We found from these interviews and examination of MARAD documentation that, of the 18 U.S. companies contacted, only 3 U.S. oil companies 1/ and the 4 merchant shipping companies being funded by MARAD's program expressed any immediate interest in either using satellite communications or participating in the fleet management, data processing aspects of the satellite program.

More specifically, officials from 14 different shipping companies told us that the costs for procuring, installing, and operating shipboard satellite communications equipment were too high for them to independently fund these operations, especially since it had not been demonstrated to them that the potential benefits of satellite communications and the related data processing use could offset these high costs. These officials included two of those involved in the MARAD program. Also, 12 of the same officials from companies not participating in the program told us that their present methods of communications and their present navigation techniques were more than adequate for shipping operations, and that they could not justify the costs for changes to the new methods. For example, most of these companies own and operate shipboard, single side-band high-frequency (SSB-HF) radio equipment. According to these officials, this equipment is capable of ocean coverage and affords them adequate communications with their ships. The officials also stated that navigational equipment being used aboard ship had, for some time, afforded the ships' officers with more than adequate course information. Consequently, they felt there was no need to automatically transmit or receive navigation data via satellite--one of the functions proposed in MARAD's program.

One other point was made by these officials, which seems to have a significant impact on their decision not to use satellite equipment at present. Those companies planning to build new ships in the near future can defer procuring satellite communications equipment, in order to allow the Government to help fund the venture. For example, when these companies build new ships, if the construction is eligible for Government subsidization, MARAD construction

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1/One oil company not funded by MARAD.

differential subsidy (CDS) will be used to fund the ship's construction. According to several of these officials (and supported by MARAD documentation), CDS funding could include a major portion of the costs for procurement and installation of satellite communications equipment for that ship. According to MARAD, CDS funding will include any shipboard communications system that has a total cost of between \$100,000-125,000. Therefore, since MARAD could eventually fund the procurement of satellite communications equipment for new U.S.-registered merchant ships, the ships' owners deem it cost effective to delay this procurement. In the meantime, present shipboard communications methods are thought to be adequate.

Our analysis of satellite communications versus existing shipboard communications methods shows that the costs for procuring and operating satellite equipment are much higher than for communications equipment presently in use. The following schedule compares the costs of marine mobile message services (SSB-HF) costs versus the costs for MARISAT communications services.

	Costs	
	<u>Marine mobile message service</u>	<u>MARISAT services</u>
Shipboard hardware		
Lease (monthly)	\$ -	\$1,275
Purchase	6,000	51,750
Telex (note a)	3 per minute (3 minute minimum)	6 per minute (bulk rate-- \$4 per minute over 200 minimum usage)
Telephone	5 per minute	10 per minute
Message (note b)	.33 per word	.35 per full-rate word

a/Teletype or immediate machine-to-machine record communications.

b/Cablegram or telegram.

It is obvious from this cost comparison that, except for the first minute's Telex services, the marine communications services presently in use are less expensive than similar services offered by MARISAT. Also, since the typical Telex traffic described by the shipping companies averages more than 3 minutes in length, the 1 minute comparison between MARISAT and conventional Telex has no major significance.

We should point out that of the 32 vessels using the MARISAT service, 22 foreign-flag vessels and 4 U.S.-flag vessels are paying these satellite communications costs independent of MARAD funding. One U.S.-flag vessel, the "ARCO Prudhoe Bay," is owned by the Atlantic Richfield Oil Company and, according to a company official, his management has expressed an interest in participating in and being funded by MARAD's satellite program. He feels that the 24-hour communications with his company's ships at sea will greatly benefit his company and the U.S. merchant fleet.

Of the other three U.S.-flag vessels using MARISAT, two are operating under Government contract and the other is foreign owned.

MARAD-supplied documentation shows that satellite program officials were aware of the relatively high cost of satellite communications at least 1 year before the satellite's availability. Nevertheless, MARAD might have promoted wider participation in the satellite program had it been able to demonstrate the potential benefits of satellite communications and related data processing techniques to the shipping companies.

#### SUMMARY

The six U.S. shipping companies now participating in the MARAD satellite program seem interested in the benefits of satellite communications and the data processing services offered by the program. These services, however, are being funded largely by MARAD.

Fourteen different U.S. shipping companies saw no evidence of benefits that would offset the higher costs of satellite communications, and 12 felt that existing (HF radio) communications were adequate. Some companies agreed that, if ship construction subsidies would help defray the costs of satellite terminals for new ships, the potential benefits of satellite communications might be attractive. Nevertheless, 22 foreign-flag and 4 U.S.-flag vessels are

using the MARISAT communications satellite and paying for its costs independent of any MARAD funding. Apparently, these companies expect to benefit from the service.

MARAD should proceed promptly to establish whether benefits associated with the satellite program are commensurate with its costs. If so, it should be demonstrated to the U.S. shipping industry. This is equally important to MARAD's future program planning, since it will apparently be called upon to subsidize the more costly advanced satellite communications technology, if employed.

## CHAPTER 3

### NEED FOR MARAD'S SATELLITE

#### PROGRAM IS IN SERIOUS QUESTION

In 1969 MARAD identified communications satellites and computers as the best U.S. technologies available to solve maritime shipping problems. Reliable communications between shipping companies and their ships at sea and the utilization of computer techniques to facilitate shipping management were assessed by MARAD as specific requirements for improving U.S. shipping operations. Therefore, in 1970 MARAD established the satellite and the Shipping Operations Information System programs to (1) develop reliable satellite communications between ships at sea and their owners and (2) to develop comprehensive, computer-based data processing techniques to improve the responsiveness of management and control of ship or fleet operations. It should be noted that, by this time, the NASA Applications Technology Satellites had demonstrated the practicality of satellite communications employing relatively small, mobile communications terminals and they were available for MARAD testing.

When MARAD initiated the satellite program by contracting to AII, two requirements were identified that would have to be developed to implement a successful maritime, satellite-aided communications system.

1. A marine data center to integrate and disseminate all important performance and safety information affecting maritime operations. The center would provide continuously available and reliable communications via high-altitude satellite to each ship and ship operator.
2. A compact, shipboard communications terminal operating in consonance with the marine data center and with available communications satellites.

Therefore, in March 1972 MARAD awarded a second contract (sole source) to AII for the development of an experimental Maritime coordination center to be located at the Merchant Marine Academy, Kings Point, New York. Officials, however, contemplated eventually turning the center's functions over to private industry when MARAD's objectives were attained. In addition to developing the center, AII was required to develop shipboard satellite communications

terminals that would operate with available NASA satellites and to perform communications experiments between selected ships at sea and the Center.

More specifically, AII was required to:

- Define and implement a Marine Data Coordination Center at the Merchant Marine Academy, Kings Point.
- Provide an earth station at the center for access to NASA Communications Applications Technology Satellites (ATS).
- Design and develop 10 shipboard satellite communications terminals for MARAD.
- Provide program support and operate a 5-month, on-air experiment of satellite communications between 10 ships at sea and the center, utilizing NASA's ATS 1, 3, and 5.

This contract was awarded to AII for about \$2.9 million, it was modified six times, and another contract was added; the resulting cost to the Government was about \$4.8 million.

In documents dated March and October 1972, MARAD proposed the development of an expanded or a worldwide maritime satellite communications system, consisting of three coordination centers--one located on the east coast, one on the west coast, and one overseas. Each would provide the system with the capability of communicating via any available (NASA) satellites, and between ships located in the Atlantic and Pacific Oceans and their respective shore offices. In essence, MARAD was proposing to develop a dedicated maritime communications system capable of processing marine data through any available communications satellite. At that time, a dedicated commercial maritime satellite system was not under development.

Specific capabilities of the center were to be:

- Developing and transmitting communications and navigational signals to any available communications satellite(s) for broadcast to addressed ships.
- Acting as a communications center for ship/shore/ship transmission of any required data.

It was also to be capable of receiving various other types of service information and of processing and disseminating this information to selected ships, such as

- sea traffic direction advice,
- search and rescue information,
- local environmental conditions,
- weather data,
- ship distress,
- private and company business information, and
- time-shared computer services.

MARAD's specific requirement for the maritime satellite communications system was that it be capable of transmitting (and receiving) teletype, voice, facsimile, and digital information between the shore offices and ships.

It is important to note that during the early 1970s the only communications satellites available for Merchant Marine experiments or use were the ATS satellites owned by NASA. In these circumstances, it was appropriate for MARAD to have taken the initiative in arranging for and facilitating (via the Center) their experimental use by shipping companies and their ships. These circumstances were destined to change, however.

#### DEDICATED MARITIME SATELLITE COMMUNICATIONS SYSTEM NOW AVAILABLE COMMERCIALY

In early 1973 the COMSAT General Corporation entered the commercial maritime communications satellite business with a system called MARISAT. This move was prompted, in part, by a Navy contract of March 1973 to lease certain channels from the satellites for 2 years with options for additional services. Subsequently, three U.S. international record communications carriers 1/ joined in the venture.

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1/Western Union International, RCA Globcom, and ITT Worldcom.



(These latter companies have, for years, provided commercial high-frequency radio services for ships at sea.)

After some delays, on July 9 and August 15, 1976, the Atlantic- and Pacific-based MARISAT satellites were made available for commercial use. <sup>1/</sup> According to the satellite owners, MARISAT is a dedicated maritime satellite communications system capable of selectively broadcasting to ships at sea and also of receiving Telex, voice, digital and analog facsimile, and medium- and high-speed digital data transmissions. The MARISAT system is also capable of selectively broadcasting to specific ships, or groups of ships, such information as weather or hydrographic and navigational information. This can be provided directly to the MARISAT communications facility by the U.S. National Weather Service, the Defense Mapping Agency, and the U.S. Coast Guard. The MARISAT system can be used to relay general messages to ships of a specific line, to ships of specific nationalities, or those ships sailing in a specific, geographical area. If necessary, all ships in such groups could simultaneously receive the service messages transmitted by the MARISAT earth station(s). Also, emergency distress signals received from a shipboard communications terminal would receive priority over all other traffic. The point here is that the MARISAT system presently has all the capabilities originally contemplated for MARAD's coordinated system except for the fleet management, data processing services whose value (as we pointed out earlier) has not been adequately assessed by MARAD to date.

Shipboard terminals now offered  
as off-the-shelf commercial items

One other area of development--shipboard satellite terminals--was established by MARAD as a requirement for the original satellite program but since that time has been developed commercially. However, as we point out in chapter 4 (see pp. 24 and 25), terminal development was being conducted by MARAD during the time of our review.

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<sup>1/</sup>A third satellite was placed over the Indian Ocean for Navy use.

Comsat General Corporation presently offers, for lease or purchase, shipboard satellite communications terminals. The lease price for each terminal is \$1,275 per month for a 5-year lease, and the purchase price for a terminal is \$51,750. A one-time installation charge of \$3,000 per terminal is required in addition to the lease price. The terminals are compatible with the MARISAT system and provide the following information exchange capabilities.

--Telex (teletype).

--Voice.

--Digital and analog facsimile.

--Medium- or high-speed data transmissions.

RCA Globcom and Western Union International, two of the other MARISAT owners, also offer shipboard satellite terminals with capabilities similar to Comsat's. So far, as we pointed out earlier, 32 ships have been equipped with MARISAT terminals--22 foreign-flag vessels, 6 leased by MARAD, and 4 by other U.S. companies. The ships are linked--via earth stations located at Southbury, Connecticut, and Santa Paula, California, and via normal terrestrial (land-line) communications--to their respective shore offices and also to one another, if required.

VALUE OF MARAD'S COMPUTER SERVICES  
NOT SUBSTANTIATED

Although the satellite communications services provided by MARAD's satellite program are now fully available commercially, the fleet management, data processing hardware and software programs portion of the MARAD-provided services are not. However, MARAD has made no relevant cost-benefit studies, nor have they been able to demonstrate the value of these services to the shipping industry.

Other than the six U.S. companies now participating in the MARAD program (largely at Government expense), no other U.S. companies contacted, including those who are independently leasing MARISAT communications services, seem interested in the computer services.

The provision of Government service data to ships, such as weather forecasts, notices to mariners, and vessel emergency reports using computer-aided store/forward

or digital facsimile message techniques, could just as readily be done by agencies furnishing such data directly to the MARISAT communications facility rather than duplicating these services via the MARAD center.

Finally, should MARAD demonstrate the benefits of providing data through the Center, a plan should be formulated to turn the Center's functions over to private industry, as originally contemplated.

#### SUMMARY

MARAD's satellite program and the operation of its center are adding no value to the communications services which are now commercially available. This part of the program (i.e., processing service messages, voice and Telex traffic, etc.) appears duplicative of services provided by private industry. Also, the value of the computer services provided by MARAD have not, in our opinion, been clearly established.

Since 4 U.S. and 22 foreign flag ships are paying the costs for commercial satellite communications independent of MARAD's program, these services alone may be beneficial to the shipowners. However, since six U.S. shipping companies are receiving comparable communications services together with the additional computer services, provided largely at MARAD's expense, we question whether the computer services portion would prove cost beneficial to the shipping companies if the MARAD funding were to be withdrawn.

MARAD's role in duplicating the satellite communications services now available from industry no longer appears essential. Therefore, unless MARAD can demonstrate cost-benefits to the users of its computer services, devoid of Governmental funding, we believe the satellite program should be terminated.

## CHAPTER 4

### NEED FOR BETTER PROGRAM MANAGEMENT

#### IF SATELLITE-RELATED

#### DEVELOPMENT IS TO BE CONTINUED

Apart from questions as to the effectiveness of or need for the satellite program, MARAD should have implemented management measures to insure that the maritime satellite program could proceed in an efficient, economical manner. The program's expenditures have greatly exceeded the funding originally intended by MARAD. We believe this excess could have been avoided, to some extent, had these management measures been implemented.

The satellite program's total contract costs, to the time of our review, have been about \$10.5 million; but, for the level of program development that had been attained, available documentation shows that MARAD had intended to spend only about \$3 million.

We believe that, should the program be permitted to proceed based on MARAD's identification of specific benefits for the U.S. merchant fleet and commensurate with its costs, management measures, such as program planning and control, should be implemented.

#### PROGRAM PLAN NEEDED

In our review of MARAD's R&D program documents, we could find no overall satellite program plan. The formulation and use of a written program plan is a basic requirement for proper management control, and MARAD should have met this requirement before either awarding satellite program contracts or continuing the program's activities.

The satellite program manager told us that, because of the high degree of technical complexity involved in this program and because of such contingencies as the delays in the availability of the MARISAT satellites and the delays in obtaining shipping companies' requirements for the satellite program tests, he did not formulate a program plan. Also, he felt that since the satellite program was reviewed each year during MARAD's annual budget justification cycle, MARAD management had adequate opportunity to assess the program's performance.

We believe that MARAD has had ample opportunity to organize the program's technical requirements and the shipping companies' requirements and to develop a comprehensive plan for the satellite program. In our opinion, the failure to do so is attributable to MARAD's not following sound management practices and not emphasizing the need for such a plan.

For example, we found that in 1973 the Commerce Department's Office of Audit completed a survey of the programs under MARAD's Office of Research and Development (now called the Office of Commercial Development). The auditors' report, dated March 20, 1973, cited MARAD's lack of written guidelines for planning R&D programs and recommended that MARAD issue instructions for preparing and periodically updating R&D planning documents. In response, MARAD R&D officials stated that the recommendation would be followed and that written instructions for program planning would be formulated. However, MARAD has not complied with that recommendation.

In the absence of its own formal program-planning criteria, MARAD's Office of Commercial Development could have profited by the guidelines used by other departments in such matters. For example, Department of Defense Directives 5000.1 and 5000.2 1/ provide explicit guidance for the planning and management of major defense acquisitions.

Application of these directives in their entirety would be inappropriate for the much smaller MARAD program. However, the planning and management principles should apply, as would the procedures applicable to more modest programs.

These principles have been more recently enunciated in the Office of Management and Budget Circular No. A-109, dated April 5, 1976, which now requires among other things, that agencies:

"Maintain a capability to: Predict, review, assess, negotiate and monitor costs for system development, engineering, design, demonstration,

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1/DOD Directive 5000.1 issued July 13, 1971, and DOD Directive 5000.2 issued January 21, 1975; both revised January 18, 1977.

test. \* \* \* Assess acquisition cost, schedule and performance experience against predictions, and provide such assessments for consideration by the agency head at key decision points. Make new assessments where significant costs, schedule or performance variances occur."

Obviously, this cannot be accomplished without a time-phased plan with clearly identified milestones for measurement of progress and control. The following examples illustrate the type of program deficiencies which we believe could have been avoided if MARAD had employed such sound management principles.

Work called for under initial phase IV contract not completed

On January 27, 1975, MARAD awarded a cost-plus-fixed-fee (CPFF) contract (modification) to Marine Management Systems, Inc. for the follow-on or fourth phase of fleet management testing of the Maritime Satellite Program. The modification was made to MARAD's (then) existing CPFF contract with MMS for the satellite program's third phase. The duration of the new contract, as revised, was 12 months, to January 1976, and the estimated costs for the new level of effort proposed were \$300,000.

Under the terms of MARAD's modification, MMS was to perform four major tasks.

1. Develop and implement a plan for augmenting the center's present (third phase) hardware and software configuration for the fourth phase of operations. This task was to take about 6 months and 38 percent of the contract's total level of effort.
2. Operate the center during phase four tests and coordinate the tests with participating shipping companies. MMS' proposed level of effort for this task was about 50 percent of the contracted resources, to be utilized over a 9 month period.
3. Evaluate and report on the results of phase four testing. This task was to take about 8 percent of MMS' resources and would be completed during the last 4 months of the contract period.

4. Provide overall contract management for phase four. MMS proposed that this task take about 4 percent of its resources.

Although MARAD contemplated that this contract might be eventually extended for an additional period of testing, the \$300,000 was considered to be an adequate estimate for the above mentioned tasks.

On February 5, 1976, MARAD awarded another CPFF contract for "Fleet Management Tests, Maritime Satellite Program Phase Four," to Computer Sciences Corporation. This contract's duration was to be 23 months, and its total estimated cost to the Government was to be \$416,052.

Under the terms of this contract, CSC had five major tasks.

1. Operate the center during phase four testing. This task was estimated to take about 55 percent of CSC's total effort.
2. Provide technical assistance to the shipping companies in developing phase four tests. CSC's proposed level of effort for this task was about 20 percent.
3. Further develop the center, including an examination of the potential services that the Center could offer, both commercially and to the Government. This task was to take about 6 percent of CSC's total effort.
4. Coordinate the dissemination of results of the test program to participants. CSC estimated about 16 percent of the total resources for this task.
5. Assume overall management of the contract and analyze and report on the test results. CSC's estimate was about 2 percent of the total for this task.

Our review of the circumstances concerning the phase four MMS and CSC contracts shows that (1) MMS did not complete its contracted tasks, although it was only required to concentrate its resources on about 40 percent of the contract's total level of effort (as shown below), (2) MARAD failed to assess MMS' ineffective contract performance until it was too late and, (3) as a result, MMS was reimbursed for the total estimated cost of its contract. In addition, CSC

is required to complete those tasks not completed during the MMS contract.

For example, the Atlantic-based MARISAT was not made available for commercial use until July 9, 1976. So, for the duration of MMS' phase four contract, or from January 1975 to April 1976, <sup>1/</sup> MMS could not perform those tasks that were MARISAT-dependent. Our analysis of the MMS contract activities shows that the operation of tasks 2, 3, and part of task 4 were MARISAT-dependent. Therefore, about 60 percent of MMS' proposed level of effort could not be performed without the satellite. Consequently, the anticipated costs related to the MARISAT-dependent tasks (about 40 percent of the contract's level of effort), which could not be completed by MMS, were about \$180,000.

Since the satellite did not become available for commercial use during its contract period, MMS could concentrate its manpower resources on those tasks not requiring the satellite, such as test plan development and, more significantly, on the design and development of the center's phase four software. MMS did not complete these tasks.

In a memorandum dated January 6, 1976, MMS reported to MARAD's satellite program manager that all of its required software development for the fleet management reports and its development of test plans would be completed during the week of January 19, 1976. On January 30, 1976, MARAD modified the MMS contract to extend its period, without additional cost, to March 15, 1976, to allow MMS to continue debugging and documenting the software developed under the contract. On April 5, 1976, MARAD again extended the contract to allow MMS until April 20 of that year to complete its software development.

Although the contract extensions were made to accommodate MMS, not all of the software tasks were completed at the termination of MMS' contract. As an example, in a MARAD memorandum dated March 11, 1976, the satellite program manager recommended to the Department of Commerce Procurement Division that the task of developing the center's software for input and transmission of service reports (weather, notice to mariners, etc.) to ships should be canceled since it could not be completed within the remaining

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<sup>1/</sup>MARAD extended the MMS contract to April 20, 1976.



contract period. This software was important to MARAD's program because the center's processing of service information was one of the two major Fleet Management Test categories.

Although the contracted tasks were not completed, MMS was reimbursed the total estimated \$300,000 based on its vouchers for those services that were performed.

The satellite program manager stated that he was unaware of MMS' improper performance until early January 1976 when the contract was nearly completed. In a January 27, 1976, memorandum to the Department of Commerce Procurement Division, the program manager stated that, under MMS' contract, a rather substantial overrun of the tasks occurred that amounted to over 100 percent. He also stated that "MARAD was able to accommodate the additional expense, because of the delay of the MARISAT launch." He also indicated that MMS was usually late with delivery of monthly program status reports, and for that reason he was not able to detect these problems sooner. It appears that it was January 1976 before MARAD's program manager became aware of the shortfall in MMS' performance under this contract--too late to effectively control it.

The second phase four contract was then competitively awarded to CSC. This contract included all of the tasks not yet accomplished in the previous contract with MMS. Moreover, the unfavorable conditions that existed during the MMS performance period (i.e., lack of an overall program plan and demonstrated benefits) continued during the CSC contract and at the time of our review.

Communications hardware development  
contract requires more stringent specifications

On June 27, 1975, MARAD awarded a CPFF contract to the Magnavox Corporation, essentially to design and provide hardware needed for the satellite program. This hardware development was to include the modification of 10 satellite terminal systems, 2 of which had been used with the NASA satellites, to make them work in a different frequency band allocated for the commercial MARISAT satellites. In addition, Magnavox was to provide modems 1/ and interface electronics

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1/Modems are used to interface with data processing devices and to convert data to a form compatible for sending and receiving on transmission facilities such as satellite voice communications channels.

for use with the 10 terminals. They were also to test and maintain all equipment involved.

In June 1976, MARAD modified its Magnavox contract, increasing its value from about \$436,000 to \$640,000. Under this contract modification Magnavox was to furnish four MARISAT-compatible terminals of its own design and install these together with six MARISAT terminals, which MARAD had leased from Comsat General, on ships designated by MARAD. Additionally, they were to continue their delivery and test of special modems. Work on modifying the original satellite terminals was canceled.

We found that the specific amounts and types of special communications modems to be provided and experimented with under the basic Magnavox contract were deleted in favor of no specific amount or types, in the contract modification. However, the estimated cost allotted by MARAD for providing the unspecific modems and their experimentation was almost doubled. MARAD's documentation that accompanied and justified the contract modification stated that the modification was made because the satellite program's requirements had been more specifically defined, but the action taken in the modification appeared to contradict the justification.

For example, in the basic contract's task 4, MARAD had provided about \$152,000 for the development and experimentation of nine special communications modems (3 for data, 3 for analog and digital facsimile and 3 for voice communications). The contractor was also to install the modems and to develop electronics equipment as interfaces between the modems and satellite terminals being provided under task 1. In the modification, however, the number and types of special modems to be provided under task 4 were specified "as approved" in the "deliverables" clause instead of the specific number "nine" as they were in the basic contract. Also, MARAD provided \$280,000, or an additional \$128,000, for the modified task 4.

We questioned the satellite program manager about the rationale for deleting the specific number and types of special modems in favor of no specific number and types in the modification and for almost doubling the estimated funding for this task. We also asked him to explain why this action was taken, especially in light of MARAD's written justification for the additional funding, which stated that the satellite program's requirements had been more specifically defined.

The program manager told us that the lack of specific types and numbers of modems allows him more leeway in managing the communications aspects of the program. He can decide what modems should be developed during the course of the program. He also said that the program's requirements are more specifically defined and, for that reason, he will be able to make more specific decisions on what should be developed during the course of the program.

This shows again, in our view, the need for definite planning and management control that should be a pre-requisite for cost estimating, funding, and procurement actions.

MARAD should not proceed with any continued or new satellite/computer related developments unless formal specific planning and management controls are employed such as those from applicable portions of DOD Directive 5000.1, 5000.2 and Office of Management and Budget Circular No. A-109.

#### SUMMARY

The satellite program should be continued only if MARAD can resolve the issues and questions raised in earlier chapters. If these matters are resolved in a timely manner and the program is continued, the management weaknesses noted in this chapter, specifically, the lack of a master plan and prescribed management controls, demand prompt and effective remedies.

## CHAPTER 5

### CONCLUSIONS, RECOMMENDATIONS, AGENCY COMMENTS AND OUR EVALUATION AND MATTERS FOR CONSIDERATION BY THE CONGRESS

#### CONCLUSIONS

The continued need for the MARAD satellite program is questionable because:

- It is doubtful that the program can attain its objectives unless MARAD can demonstrate to the U.S. shipping industry, and for its own purposes, the benefits of the program commensurate with its costs.
- The communications services provided by the program, although warranted in earlier years, duplicate those now available from private industry.
- The value of the computer services provided by the program has not been established. Their benefits, in excess of their costs, need to be shown.

Satellite communications cost considerably more than conventional HF radio, and many U.S. shipowners see no advantages to using satellites. However, 22 foreign flag and 4 U.S. flag ships are now using the commercial MARISAT system, independent of the 6 ships in MARAD's program. It appears that these ships, or their owners, expect to benefit by using satellite communications services.

Apart from the questionable merits of the satellite program, MARAD has not exercised prudent management of the program's objectives, activities, and costs.

#### RECOMMENDATIONS

We recommend that the Secretary of Commerce direct the Assistant Secretary for Maritime Affairs to:

- Undertake a cost-benefit analysis of its satellite program to determine the value to the U.S. shipping industry of (1) using the MARAD-provided satellite communications and (2) using the available fleet

management computer programs. Benefits should be compared with the commercial or Government costs (respectively) for these services.

- Demonstrate these benefits to the U.S. shipping industry, if they can be shown to offset the equivalent commercial or Government costs for these services.
- Correct promptly the management deficiencies discussed in this report, if the program is continued or reoriented. Particular emphasis should be placed upon the development of and adherence to a master plan and requisite management controls and the method by which the center's functions, if proven cost effective, can be turned over to private industry.
- Terminate the satellite program unless the first two recommendations can be fully implemented in a timely manner.

#### AGENCY COMMENTS AND OUR EVALUATION

MARAD generally concurred with most of our recommendations and stated that definite actions are in progress to carry them out. (See app. III, p. 37.) <sup>1/</sup> MARAD did not agree, however, with our recommendation to terminate the satellite program unless its specific benefits can be identified and clearly demonstrated, in a timely manner, for the U.S. shipping industry.

MARAD feels that our recommendation to terminate the program seems premature because (1) the combined Shipping Operations Information System and satellite programs may eventually realize compound benefits, (2) continued Navy funding for the commercial MARISAT is not assured, (3) the United States should continue to prepare for its participation in the proposed, commercial international maritime satellite (INMARSAT) venture, (4) MARAD desires to help U.S. shipping companies to learn to fully utilize satellite communications and (5) the Maritime Coordination Center's potential benefits have not been fully explored.

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<sup>1/</sup>Twenty-five pages of detailed data provided as appendixes to MARAD's comments are not included.

In our opinion, the conditional nature of our recommendation to terminate the program affords MARAD the opportunity to study these five points and to determine whether or not these are adequate requirements to cost justify continuing the program's present direction of effort.

The question of continued Navy support for MARISAT is still open. Although the Navy has three FLTSATCOM satellites in production, the Congress' refusal to allow funds in fiscal year 1978 for two more satellites will likely increase the Navy's dependency upon MARISAT. If FLTSATCOM gets no more funding, the Navy might be obliged to seek a successor to MARISAT for the early 1980s.

Concerning point three, the United States has become a participant in the planning for an international (commercial) maritime satellite system (INMARSAT) scheduled for operation in the mid-1980s. The INMARSAT system will not be directly related to MARISAT, although the two systems could be technically similar. For example, INMARSAT satellites are expected to be positioned over the Atlantic, Pacific, and Indian Oceans to provide transoceanic communications between ships and sea and shore offices.

Although it is conceivable that MARISAT could be the forerunner of the international system, the INMARSAT's specific technical requirements have not been defined, and the participating countries have not delegated the INMARSAT's management responsibilities to any commercial entity. The point we are making here is INMARSAT and MARISAT are two unique systems, which are not specifically related to one another. MARAD's present satellite program is concerned mainly with the utilization of the MARISAT communications system. Once INMARSAT's requirements are known, MARAD should then determine if and how its R&D resources should be allocated for the international program.

MARAD disagrees that it provides services which duplicate those of private industry, since the MARISAT owners are not charging space segment communications costs to the six companies in MARAD's program. As we pointed out earlier, however, MARAD's Center processes service messages that can be transmitted directly to ships via the MARISAT system. This action obviously duplicates activities that could be served on a commercial basis. In addition, every communications function being processed through the Center (except the questionable data processing services for which the value is to be determined) can be provided directly through the commercial system, without, in our opinion, the need for coordinating it through an additional dedicated maritime processing center.

As one other point, MARAD disagrees with our view, and with several shipping companies' points of view, that conventional shipboard communications costs less than MARISAT communications. Specifically, MARAD disagrees that a typical, shipboard HF equipment configuration (new) costs less than MARISAT shipboard equipment. MARAD supports its view by reference to a study performed by the COMSAT General Corporation, one of the MARISAT co-owners, which analyzes the relative costs for HF and maritime satellite, shipboard communications.

The significant point we can make concerning this study is that one of its critical assumptions is inaccurate. COMSAT General assumes that a typical, shipboard HF configuration costs \$70,000 <sup>1/</sup>, which indeed, is more expensive than MARISAT equipment, which costs about \$52,000. However, we discussed the costs of typical HF equipment with two major suppliers of marine communications equipment (in addition to the several shipping company officials with whom we discussed the same issue). Both vendors pointed out that it is common knowledge in the shipping industry that satellite communications costs more than conventional communications presently being used. Also, between the two vendors, they suggested a range of costs for marine HF radio equipment (depending upon the degree of sophistication and redundancy desired) between \$4,000 and \$35,000, with a typical or adequate installation without Government subsidy costing about \$6,000. However, it is plausible that shipping companies could elect to install the more sophisticated, expensive HF communications equipment should the Government subsidize a significant portion of their costs. Nevertheless, since MARISAT equipment costs \$52,000 and HF equipment typically costs between \$4,000 and \$35,000, it seems clear that costs of shipboard equipment for satellite communications are significantly more than those for HF communications.

Also, a recent study performed by the Exxon Corporation compared the actual costs of MARISAT and marine HF. The study results show marine HF equipment and operating costs to be less costly than MARISAT costs.

In addition to the issue of MARISAT versus HF costs, MARAD contends that satellite communications services are of a higher quality than HF services now being provided, and if U.S. flag companies are to capitalize on this advanced technology they must be encouraged to use it.

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<sup>1/</sup>These costs were included as detailed support data in appendix B of MARAD's comments on our draft report. The detailed support data was omitted from our report.

It is difficult for us to reconcile this point with the fact that MARAD's Office of Commercial Development is also sponsoring a 2-year R&D program to improve the quality of conventional HF communications services for the U.S. shipping community. It seems that if this effort is successful, it will tend to deter rather than promote the use of satellite services.

In any event, we should point out that our report does not purposely imply that one particular communications service is more beneficial than the other. As we mentioned on page 9, several shipping companies we contacted during our review felt that the additional cost for satellite communications over the use of conventional services was not justified by the amount of improvement gained. We do question the added value of MARAD's satellite program, since the commercial satellite communication system is completely operational.

MARAD disagrees that it has performed no cost-benefit analysis since the first phase of the satellite program. We found, however, that one cost-benefit analysis was drafted by MMS in 1975, but due to its lack of specific benefits, was not acknowledged by the shipping companies nor incorporated into the program.

In light of our comments, therefore, it is still questionable whether MARAD can identify any specific benefits of satellite communications use that offset the equivalent commercial or Government costs for these services.

Finally, MARAD says that the objectives of its current phase IV contract with Computer Sciences Corporation are to:

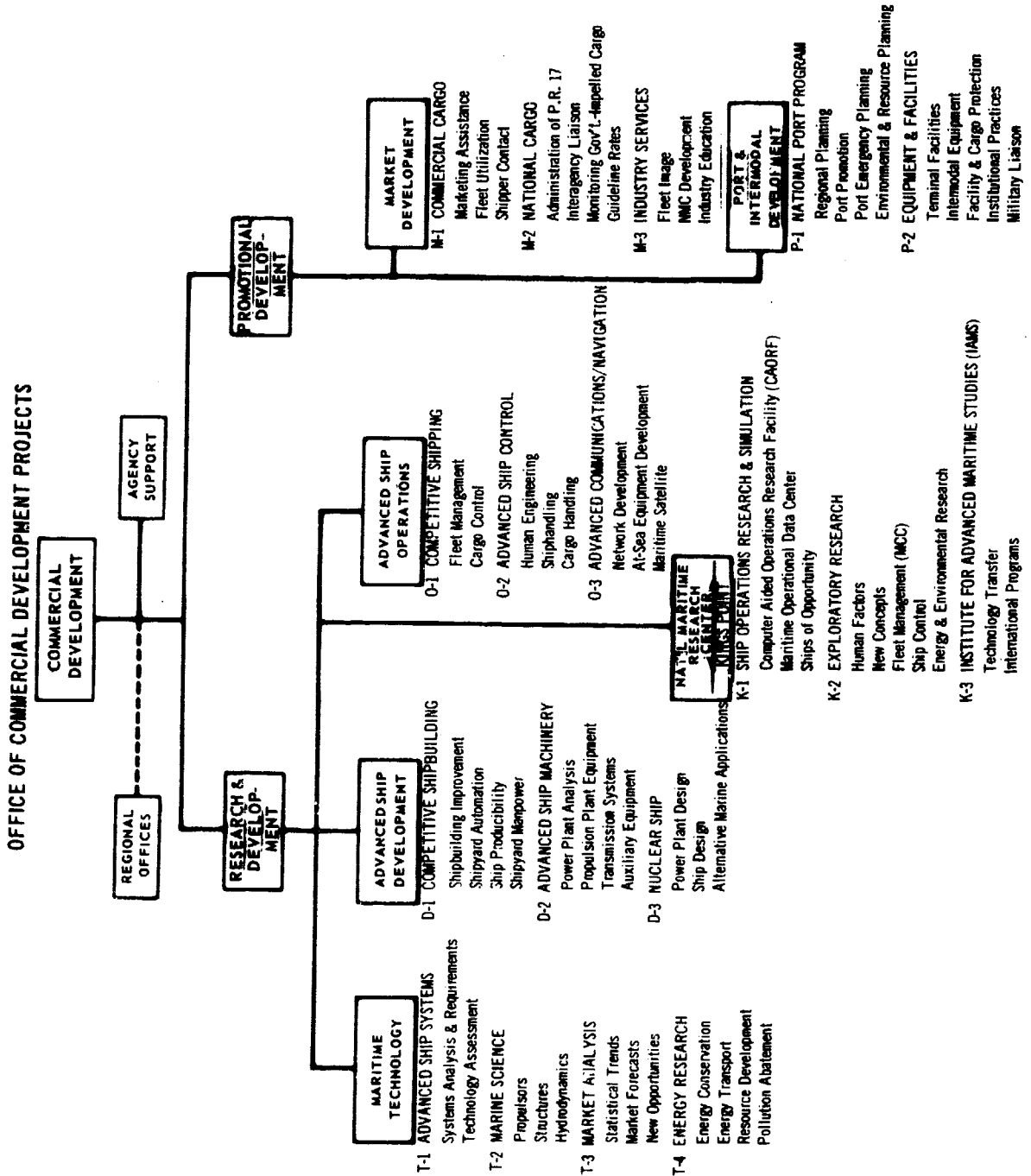
- permit an evaluation of the benefit of satellite communications applications by U.S. shipping companies, and
- evaluate the potential services which the Maritime Coordination Center will offer and their cost-benefits.

These actions should be completed in a timely manner. If, in fact, MARAD's objectives are met at the conclusion of phase IV (due by end of 1977), then continuation of the program--with management improvements--may be of value. Conversely, if they are not met, the program should be terminated in early 1978.

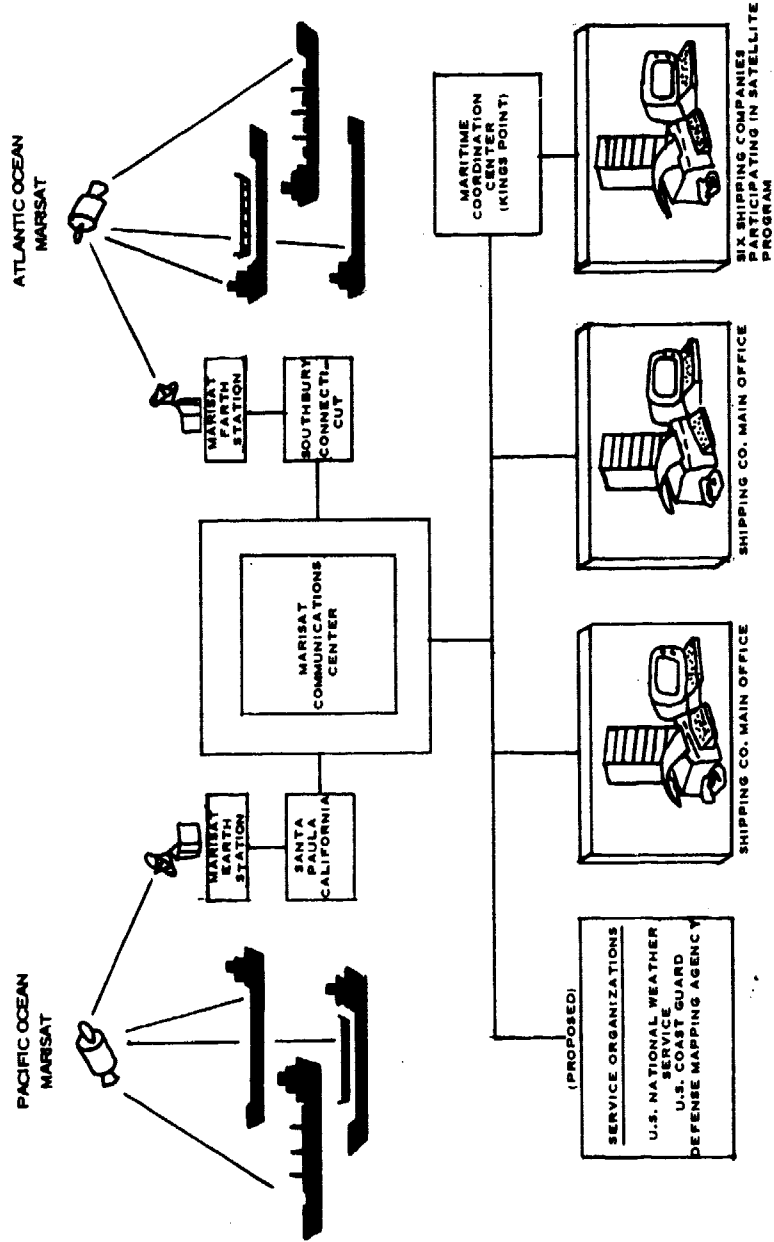
#### MATTERS FOR CONSIDERATION BY THE CONGRESS

The Congress should review the results of MARAD's fourth phase (due by the end of 1977) in conjunction with its consideration of any R&D funding requested by the agency for fiscal year 1979.





**CONFIGURATION OF MARITIME COORDINATION CENTER  
WITH MARITIME SATELLITE SYSTEM**





UNITED STATES DEPARTMENT OF COMMERCE  
The Assistant Secretary for Maritime Affairs  
Washington, D.C. 20230

JUL 22, 1977

Mr. Henry Eschwege  
Director, Community and Economic  
Development Division  
U.S. General Accounting Office  
Washington, D.C. 20548

Dear Mr. Eschwege:

The Secretary of Commerce has requested me to comment on your draft report entitled "The Maritime Satellite Program; Is It Still Needed?" (GAO Code 941096.)

The report has been carefully reviewed by our staff. As written, it demonstrates a significant grasp of a highly complex and dynamic program. Its delineation of certain areas where deficiencies appear to exist is very beneficial to the Department of Commerce and the Maritime Administration, in their efforts to maintain a high level of quality in their programs. There are, however, certain errors of fact in this report. Perhaps more seriously, there appear to be misunderstandings of the intent and scope of the current program phase that should be corrected.

Dwelling as it does on the central question of whether the program should continue in the future, perhaps it is understandable that the report does not discuss the success of the program to date. However, I believe it is appropriate to point out the Maritime Administration Satellite (MARSAT) program has contributed significantly to the development of a major maritime communications capability which should benefit the safety and efficiency of operation of ships of the U.S. Merchant Marine. The MARSAT program as conceived in 1969-1970 envisioned an international satellite communications system to meet maritime requirements by 1980. The fact that a commercial U.S. maritime satellite (MARISAT) communications service was created and made available in 1976--four years ahead of the original target date--is a significant achievement and worthy of note. At last count, and after only this short period, 51 vessels and mobile platforms (including 23 U.S. users) have installed MARISAT terminals. The MarAd program has made important contributions to those successes.

The question, however, is "Is it still needed?" Rather than to attempt to comment in detail on the report, it is more productive to address the sense of the six major recommendations summarized on pages ii and iii, and to refer to matters of detail in the context of those recommendations. Each of these recommendations is addressed below.



1. The Maritime Administration concurs in the recommendation and in fact has anticipated the need to "undertake a cost/benefit analysis of its satellite program --". As discussed in Appendix A, "Cost/Benefits of Satellite Communications," a series of cost/benefit studies were conducted during Phases I-III. (See GAO Note 2 below.) The following abstracts from Contract No. 6-38012 indicate the relevant work now being performed under Phase IV by Computer Sciences Corporation:

"1.0 Objectives - The objectives of this effort are to:

---  
 Provide a technical and economic base of valid data to permit an adequate evaluation of the potential benefits of satellite communication applications by U.S. shipping companies.  
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3.3 Task 3 Maritime Coordination Development Center

--- During Phase IV, tests will be conducted that are intended to realistically allow evaluation of new satellite-supported communication procedures on ship management. In addition, an analysis of the potential services and value of the MCC (See GAO Note 3 below.) is required. This task will examine potential services that an MCC will offer; both commercial and government. Benefits and costs for such services will be projected."

With regard to costs, the report as presently written, can be misinterpreted. The table and supporting language on page 13 of the report indicate that "the costs for procuring and operating satellite equipment are significantly higher than the costs incurred by shipping companies for presently utilized communications equipment." The data used does not reflect comparable services by marine mobile message service and MARISAT, nor does it accurately reflect total communications costs. Appendix B covers these matters in some detail and concludes that MARISAT TELEX for low-volume users and MARISAT voice channels for high-volume users are less expensive than HF services. (See GAO Note 2 below.)

2. We also concur in the recommendation to "demonstrate these benefits to the U.S. shipping industry ---". In fact, this is the major thrust of Phase IV. The U.S. maritime industry is a very conservative community and tends to judge benefits and costs on the basis of experience rather than studies. While commercial satellite communications services are now available, as are some fleet management services, it is unlikely that an industry concerned with many other serious problems will readily adopt such services rapidly and widely without some Government leadership.

In an earlier paragraph, it was noted that 23 terminals have been installed on U.S. vessels or platforms. During the same time there have been 28 foreign installations. Out of 14 pending orders, 4 are for U.S. flag

installations and the other 10 are foreign, even though U.S. users have significant advantages in both installation costs and user charges. It seems clear that if U.S. flag companies are to capitalize on this advanced technology, they must be encouraged and assisted in learning to use it. Our present program is designed to provide such assistance.

3. Chapter 4 of the GAO report, "Need for Better Management, etc.," states that the Satellite program was lacking in program planning and control and that formal guidelines for planning and related management tools would improve the program. Our honest assessment of this statement and internal review of the program lead us to the same conclusion although we may disagree with the GAO in certain specific areas.

First of all, the direction of a satellite communication program is an undertaking of great technical complexity and is inherently subject to uncertainties in schedule and performance because of the potential problems with equipment, booster launch and operation. Therefore, any satellite program plan cannot be so rigidly planned that schedule changes, etc., cannot be accommodated. The structure of a workable plan for the satellite communications area should be arranged to handle such contingencies by means of periodic review and revision.

The Advanced Communications and Navigation program has already allocated manpower and funds for the specific purpose of developing a comprehensive program planning and review document which will be used as a primary management tool for the continued direction of the satellite program. This document will also address the manner in which the Maritime Coordination Center's functions can be turned over to private industry, exercising due care that the interests of the user community are adequately protected. We believe that this action both anticipates and complies with the substance of the GAO recommendations in this area.

4. The recommendation to terminate the satellite program unless certain conditions are met seems premature. Even if not fully quantified in the near future, the potential compound benefits for U.S. flag shipping from the Shipping Operations Information System and Maritime Satellite programs should not be discounted. Furthermore, while the United States now has a clear lead in satellite communications, it is based to a considerable degree on U.S. Navy support. Such continued Navy participation is not assured. Accordingly, preparations for U.S. participation in INMARSAT must continue. It also follows that emphasis on helping U.S. flag companies to learn to fully utilize satellite communications to improve their competitive position must continue.

The MCC plays an important part in this process. While it does not provide a communication capability per se, it provides an information interchange function between ships, shipping companies and Government agencies (National Weather Service, U.S. Coast Guard, Defense Mapping Agency, and the Maritime Administration). Neither the economic, safety nor security aspects of this function have been fully explored and evaluated. Such evaluation will take several years to complete, and operation as a profitable commercial venture may well be further away.

5. The recommendation that the Congress should consider whether further funding should be made is properly conditioned upon the demonstration of the program's value. In the executive budget process, review of further funding is accomplished within the Maritime Administration, the Department of Commerce, and the Office of Management and Budget.

The report makes reference to some growth of the program costs. It is equally important to point out that the program has saved substantial amounts of Government funds. The original program plan was dependent upon NASA providing a dedicated satellite at the following estimated costs:

Revised ATS-3 satellite and L-Band	
Transponder (ATS-Y1 - October 1971)	\$ 4.4M
Thor Delta Launch System	6.1M
NASA Facilities, Management, etc., (2 years)	2.0M
Total	<u>\$12.5M</u>

Not only was the above amount saved by the Government by the development of the MARISAT capability, but a more realistic "operational" system was made available.

6. The question of "whether the Government (MarAd) should provide communications services (at Government cost) which duplicate those of private industry" seems to be based on a misunderstanding. Communications services are provided commercially by the MARISAT consortium--not MarAd. No-cost service is provided under bilateral agreements between MarAd and members of the consortium for use by shipping companies in specific Fleet Management Tests. Hence the MarAd services use, rather than duplicate, those of private industry. As a matter of general policy, it is our intention to make maximum use of the capabilities of private industry in carrying out our responsibilities.

In summary, we are of the opinion that the Maritime Satellite program in the past has made commendable contributions to the development and implementation of a major technological innovation in maritime communications. While the equipment development phase is now essentially complete, a major task still remains, that of developing and demonstrating the value of Fleet Management activities made possible by this new capability. It is the purpose of the ongoing program to carry out that task, making use of commercially available communications.

While disputing some of the details of the draft report, we are in agreement with most of the recommendations, and definite actions are in progress to carry them out. With regard to the recommendations concerning termination of the program, we feel that such recommendations, while conditional, may raise false doubts about the future and potential benefits of satellite communications. Such doubts would likely inhibit their use, to the detriment

of the U.S. flag carriers in a commercial sense and to the national objectives which the Maritime Administration seeks to achieve.

Thank you for the opportunity to respond to this interesting report.

Sincerely,



ROBERT J. BLACKWELL  
Assistant Secretary  
for Maritime Affairs

- GAO NOTES:
1. Page references in this appendix may not correspond to pages of this report.
  2. Twenty-five pages of detailed data provided as appendixes are not included in this report.
  3. The MCC is MARAD's Maritime Coordination Center.