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SEASAT-A is an ocean dynamics satellite scheduled for launch in 1978 with sensors to measure winds, waves, ocean currents, sea temperatures, ice coverage, and atmospheric and water vapor. Findings/Conclusions: The National Aeronautics and Space Administration (NASA) has experienced cost, schedule, and performance difficulties with the SEASAT-A because of technical problems and an estimated \$5 million increase in the cost of the launch vehicle. NASA did not identify and report to the Congress at least \$12.3 million in SEASAT-A project-related costs. No organization outside the Government has committed any money to the project. Government agencies that plan to use the data, especially the National Oceanic and Atmospheric Administration, have experienced difficulty in obtaining the required funds. Without definite monetary commitments from potential users of SEASAT-A data, the Federal Government would be justified in not pursuing an operational SEASAT program planned in 1985. An economic assessment study conducted for the operational program (1985 to 2000) overstated projected benefits. SEASAT-A will not be launched until 1978 and engineering validation of sensors' performance and geophysical validation of data will take several years. Recommendations: The Administrator of NASA should: formalize agreements with potential users of SEASAT-A data, particularly the National Oceanic and Atmospheric Administration, to insure their necessary contributions of resources to the project before expanding the program beyond the project stage; identify on the project status report all costs, cost increases, and important schedule and performance data and submit the report to each committee of the Congress having oversight and appropriations responsibility over NASA; demonstrate that SEASAT-A data can achieve its stated scientific objectives before expanding the program beyond the project phase; and develop all costs identifiable with an operational

SEASAT system. (Author/SW)

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REPORT TO THE CONGRESS



BY THE COMPTROLLER GENERAL
OF THE UNITED STATES

The SEASAT-A Project: Where It Stands Today

National Aeronautics and Space Administration
National Oceanic and Atmospheric Administration

GAO recommends that the Congress and NASA take several actions before the experimental SEASAT-A project is expanded to an operational program.

The SEASAT-A spacecraft, scheduled for launch in 1978, will measure ice fields, winds, waves, ocean currents, sea temperatures, and atmospheric water vapor. NASA's January 1977 project cost estimate of \$80.5 million excludes \$12.3 million of related costs. The cost estimate is continuing to be reviewed by NASA.

Although there has been considerable user interest and participation in the development of the project, no organization outside the Government has committed funds for the use of SEASAT data.

SEPTEMBER 16, 1977



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

B-183134

To the President of the Senate and the
Speaker of the House of Representatives

This is our second report on the National Aeronautics and Space Administration's SEASAT-A project. It discusses SEASAT-A's cost and status, issues pertaining to funding problems experienced by the user agencies, and noncommitment of funds by organizations outside the Federal Government. It also discusses the speculative nature of an economic assessment study of a SEASAT system planned for operation during 1985 to 2000.

We made this review as part of our continuing effort to inform the Congress of the status of major system acquisitions and to assist it in exercising its legislative and review functions.

We made our review pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

We are sending copies of this report to the Director, Office of Management and Budget; the Administrator, National Aeronautics and Space Administration; and the Administrator, National Oceanic and Atmospheric Administration.

A handwritten signature in black ink that reads "James B. Steats".

Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

THE SEASAT-A PROJECT:
WHERE IT STANDS TODAY
National Aeronautics and
Space Administration
National Oceanic and
Atmospheric Administration

D I G E S T

The SEASAT-A project proposes to place a spacecraft in orbit in 1978 with sensors to measure ice fields, winds, waves, ocean currents, sea temperatures, and atmospheric water vapor. The National Aeronautics and Space Administration (NASA) project is very diverse and complex. Several Government agencies, nonprofit organizations, and commercial enterprises are expected to participate.

NASA justified the project to the Congress on the basis that other organizations would be relied on to provide staffpower and money to use the satellite data. NASA currently has its January cost estimate of SEASAT-A--\$80.5 million--under review due to recent development problems and scope changes.

NASA is experiencing cost, schedule, and performance difficulties with the SEASAT-A because of many technical problems and an estimated \$5.0 million increase in the cost of the launch vehicle. (See pp. 6, 9, and 10.) NASA also did not identify and report to the Congress at least \$12.3 million in SEASAT-A project-related costs. (See p. 7.)

Although there has been considerable user interest and participation in the project's development, no organization outside the Government has committed any money. Government agencies that plan to use the data, especially the National Oceanic and Atmospheric Administration--the primary potential user--are experiencing difficulty in obtaining the required funds. Without definite monetary commitments from potential users of SEASAT-A data, the Federal Government would be justified in not pursuing an operational SEASAT program planned in 1985. (See p. 12.)

Meanwhile, the Congress should be provided complete information not only on the project's merits, but also on its costs. During authorization and appropriations deliberations, NASA should point out to the Congress the speculative nature of anticipated benefits derived from using unvalidated assumptions and generalizations and the inadequately developed costs of an operational SEASAT program.

An economic assessment study conducted for the operational SEASAT program (1985 to 2000) overstated projected benefits. SEASAT-A will not be launched until 1978 and engineering validation of sensors' performance and geophysical validation of SEASAT-A data will take several years to evaluate.

Part of the study made projections based on data of a particular industry in a foreign country. GAO believes it is erroneous to assume that all data in a given industry in a given country will show the same characteristics in the same industry throughout the world. Further, the study fails to consider uncertainties, such as the rate of development and substantial investments required for each of the users before SEASAT data can be used, or to explore adequately the costs of an operational program through the year 2000.

RECOMMENDATIONS

The NASA Administrator should

- formalize agreements with potential users of SEASAT-A data, particularly the National Oceanic and Atmospheric Administration, to insure their necessary contributions of resources to the SEASAT-A project before expanding the program beyond the SEASAT-A project stage (see p. 19),
- identify on the SEASAT-A project status report all costs, cost increases, and important schedule and performance data and submit the report to each committee of the Congress having oversight and appropriations responsibility over NASA (see p. 11),
- demonstrate that SEASAT-A data can achieve its stated scientific objectives before

expanding the SEASAT program beyond the SEASAT-A project phase (see p. 19), and

--develop all costs identifiable with an operational SEASAT system. (See p. 25.)

In view of the funding problems being experienced by the user agencies, the Congress should require NASA to keep it advised of funds contributed by other organizations and periodically provide it with the status of user agreements. (See p. 20.)

Since the costs for an operational SEASAT system have not been adequately explored, the Congress should ask NASA to furnish it with a cost/benefit analysis based on realistic cost estimates of an operational SEASAT system and periodically update such estimates for consideration during deliberations for any follow-on satellite in the SEASAT program. (See p. 25.)

NASA COMMENTS

NASA did not address GAO's recommendation on obtaining formalized agreements with potential users of SEASAT-A data before expanding the program beyond the SEASAT-A phase.

In commenting on GAO's other recommendations, NASA stated that it

--has provided the total project costs in its SEASAT-A project status reports that conform to NASA policy as to what should be included (see p. 10),

--does not intend to recommend any future commitment to an operational system until the uses of the SEASAT-A data are proven to be of sufficient value to merit such a recommendation (see pp. 19 and 20), and

--is continuing evaluations of costs and investments required to exploit an operational system and awaits SEASAT-A experience for more detailed analysis. (See p. 24.)

GAO believes that all costs directly identified with the project, including civil service personnel and any other fixed costs, should be summarized on the project status report to show fully the total economic impact of a project and to have all the necessary information in one place to assist the Congress in fulfilling its oversight and appropriation responsibilities.

OTHER COMMENTS

The National Oceanic and Atmospheric Administration had no major disagreement with GAO's recommendations. However, the National Oceanic and Atmospheric Administration feels it cannot formalize agreements with NASA until SEASAT-A's project funding level has been approved.

Since the National Oceanic and Atmospheric Administration is experiencing difficulty in obtaining the necessary funding for SEASAT-A, its priority for an operational SEASAT system may need reevaluation.

Comments by NASA and the National Oceanic and Atmospheric Administration are discussed in the report as appropriate and included as appendixes III and IV.

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ABBREVIATIONS

DOD	Department of Defense
GAO	General Accounting Office
JPL	Jet Propulsion Laboratory
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
SAMSC	Space and Missile Systems Organization

CHAPTER 1

INTRODUCTION

The SEASAT program was defined in 1972 as a part of the National Aeronautics and Space Administration's (NASA's) Earth and Ocean Physics Application program. It began in spring 1973 when governmental, institutional, and commercial users of ocean dynamics data met to discuss measurement requirements. The SEASAT-A project, initiated by NASA in fiscal year 1975, is the first step in developing and demonstrating a global ocean dynamics monitoring system using remote space sensing technology to provide information on the oceans.

The second phase may be a prototype operational system, SEASAT-B, and the final phase is planned to be a fully operational SEASAT system consisting of three or more satellites to be launched by 1985. The fully operational system would use not only a number of satellites, but also data buoys, aircraft flights, and other data sources connected by a data distribution system.

SEASAT-A PROJECT DESCRIPTION

SEASAT-A is an ocean dynamics satellite scheduled for launch in 1978 to measure winds, waves, ocean currents, sea temperatures, ice coverage, and atmospheric and water vapor. NASA has characterized SEASAT-A as an experimental and feasibility mission with objectives of

- demonstrating techniques for global monitoring of oceanographic phenomena and features,
- providing oceanographic data, and
- determining key features of an operational ocean dynamics monitoring system.

NASA plans to achieve these objectives by operating a set of five sensors in a SEASAT-A spacecraft at an 800-kilometer altitude. The sensors and the measurements that each will perform follow.

<u>Sensor</u>	<u>Measurements</u>
Radar altimeter	Wave height Sea surface topography Geoid (shape of the Earth)
Radar scatterometer	Wind speed and direction near the ocean surface
Synthetic aperture radar	Surface wave and current patterns Ice fields Coastline and ocean interaction
Visible and infrared radiometer	Ocean surface patterns Ocean surface temperature
Scanning multifrequency microwave radiometer	Surface wind velocity All-weather sea surface temperature Atmospheric water content Ice coverage

The spacecraft will complete 14-1/2 orbits a day from 72 degrees North latitude to 72 degrees South latitude, spanning almost all the oceans of the world.

The sensors will cover different swath widths up to about 1,000 kilometers and, except for the synthetic aperture radar, will achieve 95-percent coverage of the Earth's ocean surface every 36 hours.

The data gathered by the sensors will be assembled through a command and control center at Goddard Space Flight Center. The data will then be converted into geophysical quantities, such as wind speed and wave heights, and disseminated daily to research scientists. NASA officials told us that they will give this data to the National Oceanic and Atmospheric Administration (NOAA), which will use and subsequently archive and distribute it.

NASA will provide, in near real time, algorithms (mathematical expressions) and support engineering data to the Navy's Fleet Numeric Weather Central, Monterey, Calif., where it will be processed and used in twice daily global weather and sea state predictions. The Weather Central output also will be provided to NOAA for use and further distribution to others.

USERS OF OCEANOGRAPHIC DATA

NASA justified the project to the Congress partly on the basis that user organizations would provide scientific

and technical staffpower and funds in return for using the satellite data. The "user" community--agencies and non-profit organizations which are potential users of SEASAT-A data--became involved in planning the project in early 1973. NASA established an Ocean Dynamics Advisory Subcommittee in September 1975 to advise NASA on the SEASAT-A project and to become involved with user agency activities in analyzing surface truth data ^{1/} and with investigations involving science and applications. However, this subcommittee was abolished on April 15, 1977. A list of participating organizations is shown in appendix I.

PROJECT MANAGEMENT

NASA's Office of Applications is responsible for overall management of the SEASAT-A project and the Jet Propulsion Laboratory (JPL), Pasadena, California, for day-to-day project management and implementation. Wallops Flight Center, Langley Research Center, and Goddard Space Flight Center are assisting JPL in acquiring the satellite's sensor instruments. The Office of Tracking and Data Acquisition and Goddard Space Flight Center will provide tracking support and data acquisition. The launch vehicle office of the Office of Space Flight will be responsible for launch vehicle support. (See app. II for a more definitive summary of responsibilities and funding sources.)

EXPERIMENT TEAMS

To provide a competent, objective assessment of the geophysical performance of the SEASAT-A instruments and the potential utility of the data collected by the satellite to marine science and technology, NASA established, for each of the sensors, a team of scientists whose principal research interests include both remote sensing and oceanic research. These teams will provide guidance in sensor development, mission and data system design, algorithm definition, and planning stages. They also will conduct a preliminary analysis of the early flight data and provide an interim evaluation of instrument performance and the reliability and accuracy of the geophysical data collected.

NASA expects an interim evaluation and validation of data to be completed within 4 months after launch, before general release to other researchers. The experiment teams will conduct continued, indepth evaluations in parallel with research by all interested scientists, all supported by their

^{1/}Collecting onsite data on wind and sea surface conditions.

own institutions or grants from various U.S. agencies. In-depth case studies aimed at providing an assessment of the utility and applicability of the SEASAT-A data to a number of clearly defined problems or research areas will follow.

SCOPE OF REVIEW

Our review was performed during the period June through December 1976 primarily at NASA headquarters, Washington, D.C., and at JPL. The information presented herein was obtained by reviewing project plans, reports, correspondence, and other documents and by discussions with NASA and JPL personnel. We also met with representatives of Econ, Inc., who performed a cost/benefit study of the SEASAT program, and officials of the user community, particularly NOAA, the Department of Defense (DOD), the U.S. Geological Survey, and the Coast Guard.

CHAPTER 2

PROJECT STATUS

Major development and procurement activities for the SEASAT-A mission were initiated in fiscal year 1976 with the selection of a contractor to provide an Agena spacecraft, sensor module, satellite system integration, and launch and mission operations support.

Work has been completed on the final SEASAT-A design and on the physical interface between the spacecraft and the sensors. The manufacturing and testing of each of the SEASAT-A sensors and the satellite spacecraft are scheduled to be completed in fiscal year 1977. Integration of sensors into a sensor module attached to the spacecraft is expected to begin in 1977 and should continue through early 1978 in preparation for a May 1978 launch.

COST

NASA originally estimated that SEASAT-A's cost would be \$58.2 million but increased the estimate to \$74.7 million in July 1975. NASA again increased the estimate to \$80.5 million in January 1977 due to increases in the estimated launch cost. NASA currently has the total project cost estimate under review, pending resolution of recent development problems. This estimate excludes costs of about \$12.3 million directly related to the SEASAT-A effort, but which NASA does not consider project-related. (See p. 7.)

The total project cost as reported by NASA in the January 1977 project status report is \$80.5 million. The major cost increase is attributed to the modification of the nose cone configuration on the launch vehicle.

SEASAT-A Estimated Cost at Completion (note a)

	NASA SEASAT-A operating plan <u>July 1975</u>	JPL estimate <u>Oct. 1976</u>	NASA SEASAT-A project status report <u>Jan. 1977</u>
	----- (millions) -----		
NASA Office of Applications:			
Project management	\$ 5.47	\$ 5.47	\$ 5.47
Reserves (note b)	4.21	3.10	3.10
Satellite system	34.25	34.22	34.22
Sensor development and support	-	0.28	0.28
Sensors:			
Altimeter	4.60	4.63	4.63
Synthetic aperture radar	4.60	5.48	5.48
Scatterometer	4.04	4.97	4.97
Scanning multifrequency microwave radiometer	2.50	1.95	1.95
Visual and infrared radiometer	0.50	0.40	0.40
Mission operations	5.53	5.20	5.20
Integrating receiver/processor	<u> -</u>	<u> -</u>	<u> 0.80</u>
Total	65.70	65.70	66.50
NASA Office of Space Flight (launch cost including vehicle)	5.00	5.00	<u>c/10.00</u>
NASA Office of Tracking and data acquisition:			
Tracking and data acquisition	<u> 4.00</u>	<u> 4.00</u>	<u> 4.00</u>
Total	<u>\$74.70</u>	<u>\$74.70</u>	<u>\$80.50</u>

a/Real year dollars. 1/ Fiscal year 1974 base dollars were escalated at 7 percent.

b/As of September 30 1976, \$1.11 million of a total \$4.21 million in reserves had been allocated.

c/\$5.0 million increase for launch costs was reported in NASA's January 1977 Project Status Report.

1/Real year dollars means that projected inflation through project completion is included in the estimate.

Costs not included in NASA's SEASAT-A project cost estimate

NASA's project cost estimates exclude about \$12.3 million in SEASAT-A efforts, shown in the following table, which have an impact on the SEASAT-A portion of the NASA budget. The related programs' cost estimates were provided by the NASA SEASAT program manager.

Related Programs and Cost
Items Supporting SEASAT-A

	<u>Amount</u> (millions)
Surface Truth Programs	\$ 3.00
Data Analysis Programs	2.00
Cost for Conducting Announcement of Opportunity Program (no estimate de- veloped by NASA)	-
Economic Verification Experiments	0.32
Data Utility Studies	0.65
Cost/Benefit Studies	0.33
Advanced SEASAT Studies Group	0.80
Civil Service Support Costs	4.70
Synthetic Aperture Radar Enable/Disable Function	<u>0.50</u>
Total	a/ <u>\$12.30</u>

a/Excludes development cost of NASA Standard Transponder and tape recorder since these units are provided as Government-furnished equipment to SEASAT-A and other NASA projects.

Related programs supporting the SEASAT-A project are as follows.

Surface Truth Programs--NASA's present funding estimate is \$3 million for fiscal years 1976-79. JPL project management officials have, however, requested over \$5 million. These programs involve the use of aircraft, both before and after launch, to collect data on actual wind and sea surface conditions. This data will be used by the experimental teams to develop and refine algorithms which convert sensor output into geophysical units and to conduct their geophysical evaluation tasks.

Data Analysis Programs--Project management estimates these programs will cost between \$2 million and \$6 million for fiscal years 1978 and 1979, respectively. The programs involve engineering validation of the sensors' performance and geophysical validation. They will compare sensor data with the surface truth programs data base.

Cost for Conducting Announcement of Opportunity Program--No funding estimate is available. The Announcement of Opportunity Program is an effort to demonstrate use of SEASAT data by the academic community and research-oriented companies. This will be accomplished by soliciting, evaluating, and funding research proposals. The program is planned to be a coordinated effort in 1977 by NASA, NOAA, the National Science Foundation, DOD, the U.S. Geological Survey, and the Coast Guard to solicit proposals from the academic community to perform research on applications of SEASAT data to enable users to develop "data analysis" techniques for their own particular end uses. After evaluation of the proposals, NASA expects to provide limited funding, and hopes other agencies, primarily NOAA, will pay for the research proposals.

Economic Verification Experiments--Funding is estimated at \$320,000 for fiscal years 1976-78. NASA contracted with Econ, Inc., to develop experiments to demonstrate the usefulness of SEASAT-A data to industry. Current efforts are aimed at having five or six sample experiments ready by launch date to interest private companies and encourage them to pledge funding support. No private funding had been pledged at the time of our review; however, we were informed by JPL officials that several companies, primarily those in the fishing industry, were extremely interested.

Data Utility Studies--Funding is estimated by NASA at \$650,000 for fiscal years 1976-79. The density of coverage of data from meteorological satellites does not now fit into weather forecasting models. Because many potential SEASAT-A benefits are weather-oriented, data utility studies are aimed at developing models to account for the interaction between the sea and the atmosphere so that the SEASAT-A satellite data can be used in forecasting models. The studies are taking place at JPL and the Goddard Institute for Space Science. The Fleet Numeric Weather Central is providing some computer support to these activities.

Cost/Benefit Studies--In fiscal years 1974 and 1975 NASA spent approximately \$325,000 for two cost/benefit studies of an operational SEASAT system. (See ch. 4.) The cost/benefit studies were performed by a private company, Econ, Inc., with the help of Battelle Laboratories and JPL.

Advanced SEASAT Studies Group--Funding is estimated at \$800,000 for fiscal years 1976-78. JPL is conducting feasibility studies to define the next SEASAT project and future SEASAT systems. Products of the study will include the development of a satellite and sensor catalog and the collection of information on users' needs in relation to a follow-on effort within the total SEASAT program.

Civil Service Support Costs--Civil Service support at Goddard Space Flight Center, Langley Research Center, and Wallops Flight Center total 109 direct staff years over the project life at an estimated cost of \$4.7 million.

Synthetic Aperture Radar Enable/Disable Function--The cost of adding this capability to the spacecraft is estimated by JPL at about \$500,000. It will insure positive command and control over its activation. NASA plans to show it as a line item in the NASA budget separate from the SEASAT-A portion of its budget.

PERFORMANCE

SEASAT-A is the first satellite to have three active sensors (altimeter, synthetic aperture radar, and scatterometer) and two passive sensors (scanning multifrequency microwave radiometer and visual infrared radiometer) operating in space at one time. How well these sensors will work together and whether simultaneous operation will cause interference among them are not yet known. In October 1976 the first critical tests of each sensor's antenna were conducted individually and simultaneously. Preliminary results of interference measurements between the antennas showed the measurements were within the limits specified in the test plan. An exception involved a higher than predicted level of interference between the antenna of the altimeter and scanning multifrequency microwave radiometer; however, the deviation was not considered high enough to cause any problems. The simultaneous testing of the five sensors began in mid-1977.

Project officials stated that the only current problem that could possibly result in a decrease in performance involved the synthetic aperture radar. This is an extremely complex and new instrument, untested for civilian applications. It is considered an experimental device with limited operational potential for SEASAT-A. Thus, how it will operate in space is uncertain. In its present state of development, the synthetic aperture radar is experiencing difficulty in achieving its specified antenna performance, which could reduce its coverage. The actual effect will not be known until after launch although, according to project

officials, specified coverage might still be achieved despite reduced performance. Antenna redesign efforts are underway and management hopes to achieve the specified performance before the time of launch.

Numerous deficiencies in the NASA standard tape recorder is now a matter of extreme concern to project officials. Problems with tape tracking, tape speed control, packaging design, production practices, and cleanliness standards have been identified by NASA during a product assurance audit of the contractor. The qualification test model remains seriously behind schedule. NASA is considering optional solutions to these problems, including alternate tape recorder sources.

SCHEDULE

Although project officials described the schedule as "tight, leaving no room for any major problems," they believe the May 1978 launch date will be met. They stated that the problems to date are usual and routine for this type of project, and they expect to solve them without any major impact on the SEASAT-A schedule or performance.

AGENCY COMMENTS AND OUR EVALUATION

NASA believes the costs it has provided in its project status reports conform to its policy as to what should be included. It added that the costs we have shown represent those for general oceanographic research programs, future systems and mission studies, and multipurpose devices. The costs we identified are SEASAT-A project related. It is our view that to show fully the total economic impact of a project it is necessary to summarize all costs which are directly identifiable with the project. By consolidating all project-related costs on a single document, the Congress will have all the necessary information in one place for fulfilling its oversight and appropriation responsibilities.

CONCLUSION AND RECOMMENDATION

Although no insurmountable problems affecting SEASAT-A were evidenced at the time of our review, several situations may influence the project's success. It is probable that the cost estimates will be exceeded as a result of the launch vehicle changes, and at least \$12.3 million of directly related SEASAT-A project costs were not summarized and reported to the Congress as project related. Therefore, because of the problems relative to cost, schedule, performance, the criticality of system (antennas, sensors, and spacecraft)

tests scheduled for fiscal year 1977, and numerous deficiencies in the NASA standard tape recorder, the Congress should periodically be provided updated information on these matters by the NASA Administrator. This can be accomplished by including such data in the SEASAT-A semi-annual project status report. See our report "Improved Reporting Needed on National Aeronautics and Space Administration Projects" (PSAD-77-54, January 27, 1977).

We therefore recommend that the NASA Administrator include in the SEASAT-A project status report all project-related costs as well as schedule and performance data which may have an impact on the project. These reports should be submitted to each of the committees of the Congress having oversight and appropriation responsibilities over NASA. These reports are currently submitted only to the Senate Appropriations Subcommittee on HUD--Independent Agencies.

CHAPTER 3

SEASAT DATA USERS

The SEASAT-A project is dedicated to users of oceanographic data. NASA is developing the technology for data reduction techniques while other organizations are expected to provide the staffpower and money to make use of the validated satellite data.

Although there has been considerable user interest and participation in the development of SEASAT, no organization outside the Government has committed funding for the use of SEASAT-A data. Furthermore, the Government agencies that plan to use SEASAT-A data are experiencing difficulty in obtaining the funds required to participate. The lack of a commitment by the user community with the exception of NOAA appears to be the weakest link in the SEASAT-A project. Without definite monetary commitments from potential users of SEASAT-A data, the Federal Government would be justified in not pursuing an operational SEASAT system.

The Announcement of Opportunity Program (see p. 8) is among NASA's efforts to develop and demonstrate uses for SEASAT-A data. NASA apparently believes that once uses are developed and benefits shown, potential beneficiaries will be willing to invest the funds necessary to use the data. A preliminary objective of the SEASAT-A project was to demonstrate economic and social benefits of user agency projects, but this objective was not included when NASA formally defined SEASAT-A project objectives.

AGREEMENTS

We said in our February 25, 1976, SEASAT report (PSAD-76-76) that there were no formal agreements between NASA and user organizations as to staffpower and funds to be committed to the project. As of August 1977 the situation remains unchanged with the exception of two agreements with DOD which are discussed on page 14.

NOAA

NOAA expects to be the primary user of SEASAT data. Its participation in the SEASAT-A project includes:

- Science and application experiments, including the Announcement of Opportunity.

- Financial support of about \$10 million during fiscal years 1977-1980.
- Distribution of all SEASAT-A data to interested users.
- Storage of SEASAT-A data products.
- Near real-time data distribution of data from the Fleet Numeric Weather Central.

NOAA's goals include developing and operating a national system to monitor and predict weather and environmental conditions for protecting life and property and to increase the efficiency and productivity of Government, industry, and the individual. NOAA recognizes that SEASAT-A is the first space system that addresses all these needs in oceanic areas; NOAA's current operational satellites address these problems over land areas.

To determine what it might receive from SEASAT-A, NOAA completed, in June 1976, a special Program Development Plan, which delineates a program of measurements and evaluation that should be undertaken. According to the program plan, NOAA's objectives are to:

- Establish those environmental measures and acquisition techniques which can be obtained efficiently and economically from an operational system.
- Determine the geoid to the accuracy needed to serve as a reference point for the sea surface topography.
- Continue to improve the understanding of the complex dynamic behavior of the ocean and sea air interface.
- Contribute environmental data to major ongoing international, national, and NOAA programs.

NOAA's plan focuses on two primary aspects--research for basic understanding of satellite-acquired ocean data and an operational demonstration for assessing the real economic benefit that NOAA should anticipate from the SEASAT project.

NOAA is developing a detailed experimental plan to support the Program Development Plan based on anticipated appropriations from the Congress. The experimental plan may eliminate some of the programs proposed in the Program Development Plan because of lack of funds. In addition, the Environmental Data Services and the National Weather Service (both part of NOAA) are planning for the storage of SEASAT-A data and its distribution to the user community.

Although relying on NOAA for an important part of the SEASAT program, NASA has not signed a formal agreement with NOAA to make certain that responsibilities of each agency are clearly defined. NOAA officials stated that a Memorandum of Understanding could not be signed with NASA until NOAA knows what funding levels will be approved for the fiscal year 1978 budget. However, it expects the Memorandum of Understanding to be signed with NASA during calendar year 1977.

NOAA's difficulty in obtaining funding for its planned SEASAT-A efforts and the impact it will have on the project are matters of concern to NASA and NOAA. For example, NOAA requested \$730,000 for fiscal year 1976 but the House and Senate conferees deleted the amount from the final appropriation bill. They stated they would not object if the effort were carried out with existing funds. Subsequently, NOAA reprogramed \$500,000 of available fiscal year 1976 funds to support the SEASAT project. In fiscal year 1977, NOAA requested \$963,000 from the U.S. Department of Commerce; however, only \$470,000 was approved. We were advised by the NOAA SEASAT program manager that the agency requested \$2.47 million in 1978 and plans to request \$3.67 million in each of the next 3 years (1979, 1980, and 1981).

According to the NOAA program manager, NOAA's participation in SEASAT-A could be curtailed if the requested funds are not obtained, thus diminishing the scope of the entire SEASAT program.

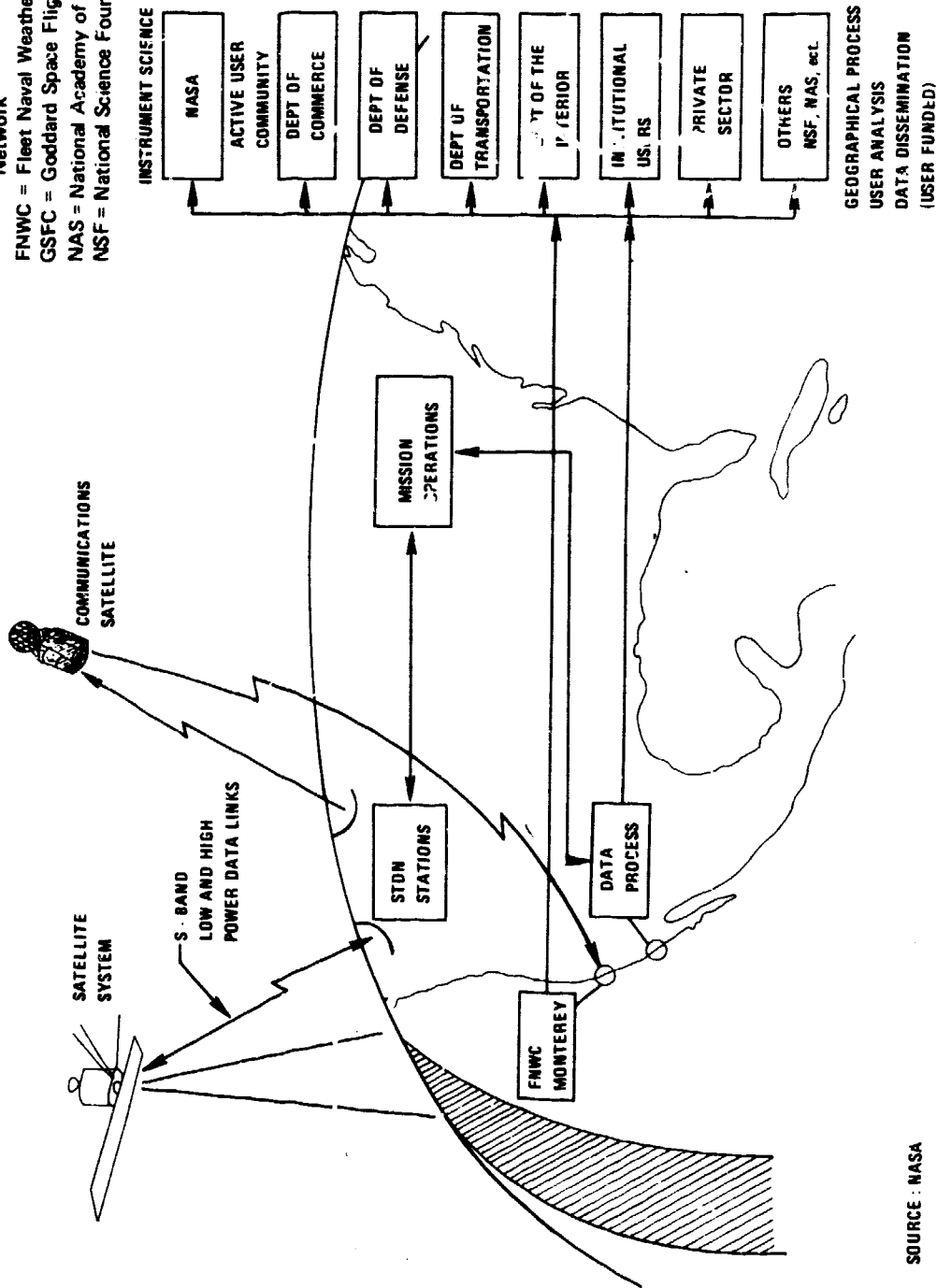
DOD

NASA and DOD have signed two agreements concerning DOD's participation in SEASAT. The first agreement, signed in July 1976, requires the Navy to implement a real time data processing facility to process raw SEASAT-A data and supply supporting oceanographic and atmospheric data as shown in the Ocean Data Distribution Plan. (See p. 15.) DOD stated that they will fund approximately \$3.0 million through fiscal year 1977.

Under the second agreement, signed in June 1977, DOD will provide a doppler beacon costing about \$38,000 to obtain precision tracking data for use by the Defense Mapping Agency. The Defense Mapping Agency will receive tracking information directly from SEASAT-A and will correlate data from the beacon and the altimeter (sensor) in order to refine estimates of the Earth's shape.

SEASAT-A OCEAN DATA DISTRIBUTION PLAN

Abbreviations
 STDN = Satellite Tracking Data Network
 FNWC = Fleet Naval Weather Central
 GSFC = Goddard Space Flight Center
 NAS = National Academy of Sciences
 NSF = National Science Foundation



SOURCE : NASA

United States Coast Guard

The United States Coast Guard's participation in SEASAT-A includes (1) tests already completed to demonstrate the ability to identify fishing fleet and ice fields and (2) potential applications of the SEASAT-A data to the 200 mile-jurisdiction control, the International Ice Patrol, and the Arctic Ice Patrol.

The Coast Guard is establishing a SEASAT working group but has not executed any formal agreements with NASA on the SEASAT program.

In conjunction with NASA and the National Marine Fisheries Service, the Coast Guard provided manpower, aircraft, and helicopters to conduct surface truth programs (see p. 7) at Georges Bank, Massachusetts, and in Alaska. These efforts are documented in Coast Guard test plans entitled "Fisheries Imaging Radar Surveillance--Georges Bank (March 1976)" and "Fisheries Imaging Radar Surveillance--Alaska (April 1976)."

The Coast Guard recently completed ice mapping tests over the Great Lakes Region using the Environmental Research Institute of Michigan's synthetic aperture radar on a C-141 aircraft. Analysis of these tests showed that the synthetic aperture radar provided much better resolution of images than the side looking radar the Coast Guard now uses for mapping.

In fiscal year 1977 the Coast Guard will direct its efforts toward reducing the surface truth program results to algorithms to determine if it is feasible to use the synthetic aperture radar for classifying types of foreign fishing fleets. Agency officials said they would be interested in using the unclassified synthetic aperture radar data when SEASAT becomes operational.

The Coast Guard has not provided funds specifically for SEASAT-A, but it anticipates having to do so in fiscal years 1978 and 1979 to use SEASAT-A data.

United States Geological Survey

The United States Geological Survey is expected to

--process synthetic aperture radar image tapes into film products at the Earth Resources Observation System Data Center and

--store synthetic aperture radar data.

In addition, at least seven agency offices are interested in using SEASAT-A data for such scientific projects as analysis of marine resources and coastal processes, updating geological maps, monitoring strip and ocean mining activities, and applying data to the Alaskan permafrost problem. The U.S. Geological Survey has spent about \$200,000 in personnel costs on the SEASAT-A project. The Department of the Interior denied the agency's request for \$1.8 million to be used in fiscal year 1978.

Canadian participation

Canadian Government scientists have provided NASA with several studies on potential applications of SEASAT-A data and have participated in the SEASAT synthetic aperture radar experiment team. The Canadian Government has also recently approved a program which looks to the utilization of existing funds to provide for direct reception processing and analysis of SEASAT data at St. John's, Newfoundland.

At the April 4, 1977, meeting of the Ocean Dynamics Advisory Committee, a representative of the Canadian SEASAT project announced that his government has approved an \$8 million program to process data from the synthetic aperture radar and to conduct a wide variety of research programs on ocean conditions and ice forecasting off the east and west coasts of Canada, in the Arctic Circle, and the Great Lakes. However, we were not able to verify the accuracy of the financial allocation of the Canadian Government.

Academic users

The academic community has participated only in the Ocean Dynamics Advisory Subcommittee and in the experiment teams. The community's participation is dependent upon outside financial support. Thus, part of the reasoning behind the conduct of the Announcement of Opportunity Program is to provide funding to this group to research and develop uses for SEASAT-A data.

Commercial users

The private sector has not provided any funding. NASA officials stated that several companies are interested in SEASAT-A data and that the Economic Verification Experiments (discussed in ch. 2) are being designed to obtain their involvement.

FOLLOW-ON SEASAT SYSTEMS

NASA, NOAA, and DOD have initiated follow-on SEASAT studies to determine feasible alternatives for proceeding from the currently funded SEASAT-A project to an operational ocean monitoring system. NOAA and DOD are conducting studies on the need for oceanographic data which might be provided by an operational system. NASA is consolidating these studies and conducting systems analysis studies to define alternatives. A user needs assessment and a satellite and sensor catalog (handbooks delineating existing capabilities and future low-cost opportunities) will be the basic tools for defining these alternatives.

The user needs assessment was identified as a logical step in the definition of follow-on SEASAT activities. JPL made the assessment between February and July 1976 when it identified and contacted about 40 potential SEASAT user organizations.

Several options were described as SEASAT follow-on possibilities:

- Option I (SEASAT-B) would be launched as a duplicate backup should SEASAT-A fail, or it could be launched with minor technical improvements.
- Option II would be a modest improvement of the SEASAT-A and SEASAT-B payloads with the possible addition of one or more new measurement capabilities. This option would be planned as a three-satellite system, replaced every 3 years, with the design updated every 6 years to accommodate technology advances.
- Option III would be a major update of the SEASAT-A and SEASAT-B payloads, based on new instrument developments. This option contemplates a six-satellite operational system, replaced every 3 years, and updated every 6 years.

JPL plans to continue the assessment in order to identify more potential users and their needs.

CONCLUSIONS AND RECOMMENDATIONS

The SEASAT program was developed with the assistance of the "user" community, i.e., agencies and nonprofit organizations that are the intended users of SEASAT-A data. NASA intended to rely on extensive funding by many participating Federal agencies; however, the funding has not materialized.

NOAA, which is expected to be the primary Federal agency user of SEASAT data, is experiencing problems in obtaining funds through the budget process and has not formalized an agreement with NASA concerning its proposed contribution of resources to the project. Without definite monetary commitments from potential users of SEASAT-A data, the Federal Government would be justified in not pursuing an operational SEASAT program.

NASA does not believe it is possible to have formal agreements from user agencies before a research and development project begins. We believe, however, that prior formalized agreements with Government agencies concerning their participation in SEASAT-A were possible and warranted because NASA justified the project to the Congress on the basis that other organizations would be relied on to provide staffpower and money to use the satellite data. We further believe that such agreements would have provided reasonable assurance that the SEASAT-A project would be adequately supported.

Although we believe NASA's planning efforts for the follow-on SEASAT program are warranted, the justification for the SEASAT program becomes a vulnerable issue without commitment of resources by the potential users of SEASAT data.

We recommend, therefore, that before expanding the SEASAT program beyond the SEASAT-A project stage, the NASA Administrator formalize agreements with potential users, particularly NOAA, to insure their necessary contributions of resources. While NASA addressed the subject of formalizing agreements, it did so only in the context of agreements prior to project approval. It did not respond to our recommendation that agreements be formalized before going beyond SEASAT-A.

NOAA feels it cannot formalize agreements with NASA until SEASAT-A's project funding level has been approved. We believe that since NOAA is experiencing difficulty in obtaining the necessary funding for its planned SEASAT-A effort, its priority for an operational SEASAT system may need reevaluation.

We also recommend that the NASA Administrator demonstrate that SEASAT-A data can achieve its stated scientific objectives (discussed in ch. 1) and definite uses and benefits of SEASAT-A data, before expanding the SEASAT program beyond the SEASAT-A project phase. NASA advised us that it does not intend to recommend any future commitment to

an operational system until the uses of SEASAT-A data are proven to be of sufficient value to merit such a recommendation.

RECOMMENDATIONS TO THE CONGRESS

In view of the funding problems being experienced by the potential user agencies, the Congress should require NASA to (1) keep it advised of funds contributed by other organizations and (2) periodically provide it with the status of user agreements.

CHAPTER 4

SEASAT PROGRAM COST/BENEFIT ANALYSIS

NASA contracted for an operational SEASAT system economic assessment in October 1974 and for a follow-on study in August 1975. The studies, which cost \$325,000, showed that cumulative potential benefits ranging from \$859 million to \$2,709 million can be obtained by using data on improved ocean condition and weather forecasts from an operational SEASAT system during the period 1985 to 2000. The studies were premised upon the system becoming operational in 1985 and benefits were discounted 10 percent to arrive at a present value in 1970 dollars. The cost of operating a SEASAT system through the year 2000 was estimated at \$272 million (1975 dollars at a 10-percent discount rate).

A separate study was made for each major industry or sector considered likely to benefit from SEASAT data. These were ocean fishing, marine transportation, offshore oil and natural gas, and arctic operations. We chose the ocean fishing industry case study for analysis because the potential benefits that could accrue to the industry as shown in the study were the most impressive, ranging from \$274 million to \$1,432 million on a worldwide basis. Translated in terms of percentages, the benefits to the fishing industry range from 34- to 53-percent higher than the other three industries. According to the study, the potential benefits that could accrue to the U.S. fishing industry range from \$30 million to \$157 million during the same time frame.

To determine benefits to the fishing industry, the study considered the results of a Canadian Ocean Fishing Industry Study. Benefits for both the United States and worldwide fishing industries for the years 1985-2000 were then projected on the basis of information on Canada. The extrapolation was accomplished using various assumptions on projected yields, consumption, species availability, and relative prices. This methodology is known as generalization.

A number of assumptions appear to be questionable and therefore cast doubt on the validity of the potential U.S. and worldwide benefits. Some key assumptions used in the Canadian study are:

- Canada can increase its share of the catch two- or threefold only if the foreign share is reduced commensurately.

- Fish can be harvested optimally.
- SEASAT sensors would provide data as expected.
- Countries would cooperate in accordance with international fishing agreements and sea law mandates.
- Fishing fleet improvements would be achieved.
- Fishing operational efficiency will be improved from 1 percent to 4 percent but the study methodology assumed a 1- to 4-percent improvement in maximum sustainable yield which is different from operational efficiency.

Concerning the above assumptions, the methodology

- used requires optimal fish population estimates, yet existing models are unable to provide such information and
- assumes an estimated 1- to 4-percent improvement in the fish production in both the United States and the world, but does not consider the improvement in each nation's fishing fleet that would have to be achieved independent of SEASAT before proposed operational efficiency would occur as a result of SEASAT.

Further, with regard to the assumptions, there is no assurance that the Canadian share of the catch will increase to the same extent as the foreign share decreases, the improvement in fishing operational efficiency and improvement in maximum sustainable yield are not the same, and the conditions needed to achieve the maximum fish yield are not yet understood.

Another assumption expects offshore fisheries to be expanded using ice-strengthened and freezer trawlers, yet the United States does not process fish on any of its vessels. Most U.S. fishermen/vessel owners are small, independent operators--more than 90 percent of them employ less than five people. Large scale fleet ownership is minimal.

The National Commission on Productivity, in its report on productivity in the fishing industry 1/, pointed out that the industry's fragmented nature leaves little opportunity for capital accumulation and, therefore, even if a reasonable chance for a fair return did exist, few industry members could make the investments necessary to develop new fisheries. 2/ Fragmentation also makes it difficult to achieve coordination among industry members. (See our report "The U.S. Fishing Industry--Present Condition and Future of Marine Fisheries, vol. I and II, CED-76-130 and CED-76-130A, Dec. 23, 1976.)

Furthermore, potential benefits are predicated on better weather forecasting to reduce human and property losses; however, adverse weather accounted for only a small percentage of total accidents occurring between 1969-1974. The study also assumed that the fish population can be harvested optimally, yet remote sensing capability is not effective below the sea surface, so that very little assistance can be expected in locating fish and therefore assigning fishing vessels to productive areas.

CONCLUSIONS

We believe the study conducted for the operational SEASAT program (1985-2000) overstated projected benefits. NOAA and U.S. Geological Survey officials told us that they would not comment on the cost/benefit study on the operational SEASAT program because the experimental SEASAT-A will not be launched until 1978 and that engineering validation of sensors' performance and geophysical validation of SEASAT-A data will take several years to evaluate.

1/"Potential for Increasing Productivity in the Seafood Industry," revised draft, May 15, 1973.

2/The U.S. fishing industry is subject to high costs for vessels, nets and netting, and insurance. U.S. fishing vessels cost up to 30-percent more than foreign-built vessels. U.S. fisherman, pursuant to law, must land fish in U.S. ports with U.S.-built vessels. Import duties on fishing nets and netting material can be as high as 50 percent. According to the U.S. Coast Guard 1974 registry of fishing vessels, the average age of U.S. fishing vessels was about 22 years, which is considered old by the National Marine Fisheries Service. Only 7 percent of the vessels have radar on board and very few vessels have available electronic gear on board.

We also believe it is erroneous to assume that all data in a given industry in a given country will show the same characteristics in the same industry throughout the world. Further, the study fails to (1) consider the uncertainty as to the rate of development and substantial investments that will be required for each of the users before SEASAT data can be used and (2) adequately explore the costs of an operational SEASAT program through the year 2000.

Substantial investments will also be required before users are able to acquire ground handling equipment and facilities to process, disseminate, or utilize the information produced from SEASAT data. Operating cost, life expectancy of the spacecrafts, and technological obsolescence are all cost elements that should have been considered in depth. Investments and operating costs could easily amount to hundreds of millions of dollars in excess of the study estimate over a 15- to 20-year period. NASA states it is continuing evaluations of costs and investments required to exploit an operational system and awaits SEASAT-A experience for more detailed analysis.

NASA believes that a broad spectrum of industry users stands ready to invest their own time and money to test study results using SEASAT-A data. However, we were not able to verify the amount of resources, if any, commercial users have contributed or will contribute toward using SEASAT-A data. Further, we believe that until and unless the NASA Administrator demonstrates (1) the engineering validation of sensor performance, (2) the geophysical validation of SEASAT-A data, and (3) the usefulness of SEASAT-A to the user community in terms of benefits, commercial users of SEASAT-A data will not invest their resources. As noted in chapter 3, NASA said it would not recommend a commitment to an operational system until the uses of SEASAT-A data are proven to be of sufficient value to merit such a recommendation.

We believe that the Congress should be provided complete information not only on the project's merits, but also on the project's cost. This has been a matter of continuing concern to us as expressed in numerous reports on NASA activities. Until this goal is achieved, NASA should, during authorization and appropriations deliberations, point out to the Congress the speculative nature of benefits derived from using unvalidated assumptions and generalizations and the inadequately developed costs of an operational SEASAT program.

RECOMMENDATION TO NASA

We recommend, therefore, that the NASA Administrator adequately develop all costs identifiable with an operational SEASAT system.

RECOMMENDATIONS TO THE CONGRESS

Since the cost of an operational SEASAT program has not been adequately explored, the Congress should require NASA to provide it with a cost/benefit analysis based on realistic cost estimates of an operational SEASAT system and to periodically update such estimates for consideration during deliberations for any follow-on satellite in the SEASAT program.

OCEAN DYNAMICS ADVISORY SUBCOMMITTEE

The SEASAT-A requirements evolved through the active formalized participation of the interested user community in the Ocean Dynamics Advisory Subcommittee. The user community has been drawn from:

Government

Department of Commerce
National Oceanic and Atmospheric Administration
Maritime Administration

Department of Defense
Director of Defense Research and Engineering
Naval Research Laboratory
Defense Mapping Agency
Naval Weapons Center
Fleet Numerical Weather Central
Naval Oceanographic Office
Coastal Engineering Research Center
Corps of Engineers

Other agencies

The Department of the Interior
U.S. Geological Survey
The Department of Transportation
U.S. Coast Guard
Atomic Energy Commission
Environmental Protection Agency
National Science Foundation
National Aeronautics and Space Administration
National Academy of Sciences
National Academy of Engineering

Institutions

Smithsonian Astrophysical Observatory
Woods Hole Oceanographic Institution
Scripps Institution of Oceanography/University
of California
University Institute of Oceanography/City College
of New York
Battelle Institute

Private sector

American Institute of Merchant Shipping
American Petroleum Institute
Sea Use Council

SEASAT-A PROJECT RESPONSIBILITIES

<u>Center agency</u>	<u>Responsibility</u>	<u>Funding source</u>
OA and JPL (note a)	SAR ground data processor	OA and JPL
DOD/DMA (note b)	Doppler beacon and antenna	DOD
GSFC (note c)	Mission operations	<u>d</u> /OTDA
GSFC	JMMR electronic piece-parts	<u>e</u> /OA
GSFC	VIRR	OA
GSFC/JPL	SMMR and antenna	OA
JPL	SAR electronics	OA
LARC (note f)	Scatterometer and antennas	OA
SAO (note g)	LASER tracking network and operations	OA
USAF/SAMSO/LERC (note h)	Launch vehicle	<u>i</u> /OSF
WFC (note j)	Altimeter and antenna	OA
WFC	Subsystem support from Applied Physics Lab SAR data link LASER reflector ring Engineering support	OA

a/Office of Applications (NASA)

b/Defense Mapping Agency

c/Goddard Space Flight Center

d/Office of Tracking and Data Acquisition (NASA)

e/Office of Applications (NASA)

f/Langley Research Center

g/Smithsonian Astrophysical Observatory

h/Lewis Research Center

i/Office of Space Flight (NASA)

j/Wallops Flight Center

NASA

National Aeronautics and
Space Administration

Washington, D.C.
20546

Reply to Airmail **W**

MAY 9 1977

Mr. R. W. Gutmann
Director
Procurement and Systems
Acquisition Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Gutmann:

We appreciate the opportunity to review the GAO draft report entitled, "Status and Issues Regarding the Seasat-A Project", which was transmitted with your letter, dated March 30, 1977.

The detailed NASA comments are enclosed, together with a copy of NASA's recent letter to OMB which terminated the Ocean Dynamics Advisory Subcommittee among other things. That letter and several of the enclosed detailed comments are provided to help make the subject report more current.

We will be glad to discuss the NASA comments with you or members of your staff if you desire.

Sincerely,

Kenneth R. Chapman
Kenneth R. Chapman
Assistant Administrator
DOD and Interagency Affairs

Enclosures: a/s

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
COMMENTS ON THE GAO DRAFT REPORT
ENTITLED "STATUS AND ISSUES REGARDING
THE SEASAT-A PROJECT"

General Comments:

To help make the report more current, we are enclosing a copy of a recent letter from NASA to the Office of Management and Budget abolishing the Ocean Dynamics Advisory Subcommittee, among other things. This letter is pertinent to the information appearing in Appendix I of the draft report.

In addition, we suggest that the following changes in the segments of the digest and text of the report to which they pertain be made.

Specific Comments:

Page i, paragraph 2: To provide current information, this paragraph should be revised as follows:

"NASA's estimate of the Seasat-A was \$80.5 million, according to the Project Status Report, dated January 31, 1977. NASA now has the Seasat-A cost estimate under review due to additional development problems and changes in scope encountered in recent months. In its justification of the project to Congress, NASA stated that other organizations would be relied on to provide manpower and money to use the satellite data." [See GAO note 1, p. 36.]

Page i, paragraph 3 and page 21: The Department of Defense and the National Oceanic and Atmospheric Administration have been, and are, committing resources to the Seasat-A Program. The Navy's Fleet Numerical Weather Central will receive and process "real time" data from Seasat-A and a Memorandum of Agreement to this effect was signed by NASA and the DOD in 1976. NOAA has developed a "Program Development Plan for Seasat-A Research and Applications."

In both references (pages 1 and 21), delete the sentence beginning "Without definite monetary commitments from" The proposed statement is not germane, since NASA does not intend to recommend any future commitment to an operational system until the uses of the Seasat-A data are proven to be of sufficient value to merit such a recommendation. [See GAO note 1, p. 36.]

Page 11, paragraph 2 and pages 22 and 32: NASA does not agree that it is possible to have formal agreement and committed funding from user agencies prior to initiation of an R&D project within NASA. The funding lead times are different in that an analysis agency can request funding three or four years later than the project agency. NASA would generally concur with this observation for an operational project. [See GAO note 1, p. 36.]

Page 11, paragraph 3: The first proposed finding should be revised to: ". . . is experiencing tight cost, schedule, and performance problems and an estimated \$5.2 million increase in the cost of the launch vehicle (see pp. 9, 15, and 18)." [See GAO note 1, p. 36.]

And in this connection, footnote C on page 8 should be revised to: "An increase of \$5.2 million in launch cost was estimated by NASA in the Project Status Report, dated January 31, 1977." [See GAO note 1, p. 36.]

Page 11, paragraph 3 and pages 9, 10, and 15: NASA does not agree that the \$15.8 million of estimated costs cited on these pages of the report should be part of NASA's project cost estimate. Some items are part of a general oceanographic research program, some are future systems and mission studies, and others like NAVSTAR are multi-purpose devices. [See GAO note 1, p. 36.]

Page 11, paragraph 3 and pages 38 and 39: NASA does not agree that the economic assessment study substantially overstated the program's benefits. One of the purposes of the Seasat-A project is to test these potential benefits. Working closely with Seasat users the study considered benefit areas in depth and then derated benefit areas substantially in

realization that it might be difficult to achieve full benefits. A broad spectrum of industry users stands ready to invest their own time and money to test study results using Seasat-A data. The evaluations of cost and investments required to exploit an operational system are continuing and await the Seasat-A experience for more detailed analysis. [See GAO note 1, p. 36.]

Page iii and page 19: In connection with the recommendation on the data to be included in the Seasat-A project status report, the NASA position remains the same as it was reported in the GAO report (PSAD 77-54), cited on page 19 of the draft report. We have provided total project costs that conform to NASA policy as to what should be included, i.e., the project itself, the launch vehicle, and additional identifiable facilities, and tracking support.

[See GAO note 1, p. 36.]

Page 2, paragraph 1: The third Seasat-A objective should be corrected to read:

" . . . determining key features of an operational ocean dynamics monitoring system."

[See GAO note 1, p. 36.]

Page 3, paragraph 1: This sentence should be revised to read:

"The sensors will cover different swath widths up to about 1,000 kilometers and, except for the synthetic aperture radar, will achieve 95 percent coverage of the Earth's ocean surface every 36 hours." [See GAO note 1, p. 36.]

Page 3, paragraph 3: The paragraph beginning "NASA also envisions . . ." should be revised. DOD has formally requested NASA to support FNWC and NASA and DOD have signed an agreement to that effect. [See GAO note 1, p. 36.]

Page 7, paragraph 2: Revise the first sentence to begin, "Work has been completed on the final Seasat-A design . . ."

[See GAO note 1, p. 36.]

Page 7 paragraph 3: Replace the last sentence with the following:

"NASA increased the estimate to \$80.5 million in January 1977, due to increases in the estimated launch cost. NASA currently has the total project cost estimate under review, pending resolution of recent development problems." [See GAO note 1, p. 36.]

[See GAO note 2, p. 36.]

Pages 9 through 13: As discussed below, NASA does not agree with the GAO's attribution to Seasat-A of the \$15.8 million of "related programs and cost items" on page 10. It should also be noted that several of the cost estimates for specific items are unofficial and clearly speculative; other items are now moot, such as the NAVSTAR operating cost for Seasat-A.

The specific items raised cover a wide and varying spectrum of activities, as follows. Several items such as Surface Truth Programs, Data Analysis Programs, and Data Utility Studies do, in fact, contribute to Seasat-A. However, they are keyed to the longer term Ocean Condition Monitoring and Forecasting R&D program which provides the foundation on which future applications are based.

The Cost/Benefit Studies aided considerably in Seasat-A program alternative decisions; however, the basic purposes were (1) to address the long term desirability and economics of an operational Seasat system, and (2) to provide a benefit thesis which could be tested early in the Seasat development cycle to demonstrate the true benefits of an operational system. The Economic Verification Experiments are, in fact, the next step in the operational system benefits assessment and, as such, are not actually a part of Seasat-A. The Advanced Seasat Study Group is a term that GAO associates with follow-on activities subsequent to Seasat-A.

The Synthetic Aperture Radar Enable/Disable Function is a special capability of the Seasat-A system which was included at the specific request of DOD; the cost of this special capability will be reflected in the update of the Seasat-A project cost estimates.

As noted by GAO in its report on NASA project cost reporting dated July 25, 1975, costs identifiable with projects should "show the total economic impact each project has on the overall NASA budget." In the case of Civil Service support costs, these relatively fixed costs are not sensitive to the inclusion or exclusion of Seasat in the NASA budget, and therefore should not be shown as project-related cost. [See GAO note 1, p. 36.]

[See GAO note 2, p. 36.]

Page 14, Development Cost of Standard NASA Transponder and Tape Recorder. This paragraph and the footnote (a) of the table on page 10 are misleading, inasmuch as Seasat-A is merely a user of standard hardware being developed for a number of NASA projects. This paragraph and footnote (a) on page 10 should be deleted. [See GAO note 1, p. 36.]

[See GAO note 2, p. 36.]

Page 25, paragraph 2: ~~The NASA Seasat program manager does not agree that this statement is an accurate representation of what he said. Rather, his recollection is that he said the full attainment of the objectives of the Seasat-A program would be jeopardized if there were no NOAA participation. The hypothetical situation of no NOAA participation has, in itself, no factual basis and should not be alluded to.~~ [See GAO note 1, p. 36.]

Page 29, Canadian Participation: The paragraph on Canadian participation errs in two respects. (1) Over the past three years NASA has regularly consulted with senior officials of Canada's Department of Energy, Mines and Resources on the status of the Seasat-A program, on Canadian studies for the program, and on possible arrangements for Canadian participation. (2) Canadian officials have taken formal action to provide for participation in the Seasat program.

We recommend the draft GAO report be revised to read as follows:

"Canadian Participation

Canada has provided NASA with several studies on potential applications of Seasat-A data and has participated in the Seasat Synthetic Aperture Radar experiment team. The Canadian Government has also recently approved a program which looks to the utilization of existing funds to provide for direct reception (at St. John's Newfoundland), processing, and analysis of Seasat data."

[See GAO note 1, p. 36.]

Page 30, Commercial Users: The sentence, "The private sector has not provided any funding ...", should be revised to "The private sector has not publicly indicated how much, if any, money it intends to expend utilizing Seasat-A data."

[See GAO note 1, below.]

Appendix II - The following changes should be made:

1. The funding source and center/agency responsibility for the SAR ground data processor will be OA and JPL, respectively.
2. "SMMR parts" should be revised to "SMMR electronic piece-parts."
3. Reference 5/ should be associated with "SAO."
4. The "note", in parenthesis, of footnote 1/ should be deleted in view of the above NASA comments on Canadian participation. [See GAO note 1, below.]

Appendix III - Revisions should be made to show:

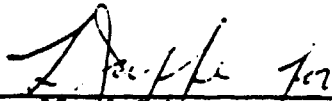
ADMINISTRATOR:

Alan M. Lovelace (Acting)	May 1977	Present
James C. Fletcher	April 1971	April 1977

ASSOCIATE ADMINISTRATOR/COMPTROLLER

William E. Lilly a/	Feb. 1967	Present
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[See GAO note 1, below.]



 Bradford Johnston
 Associate Administrator
 for Applications

5/9/77

 Date

GAO note:

1. Page references in this appendix refer to the draft report and do not necessarily agree with the page numbers in final report.
2. Portions of this letter have been deleted because they are no longer relevant to the matters discussed in this report.



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

9 MAY 1977

Mr. William L. Martino
Assistant Director, Community and
Economic Development Division
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Martino:

This is in reply to your letter of April 1, 1977,
requesting comments on the draft report entitled
"Status and Issues Regarding The SEASAT-A Project."

We have reviewed the enclosed comments of the
Administrator, National Oceanic and Atmospheric
Administration, and believe they are responsive
to the matters discussed in the report.

Sincerely,

A handwritten signature in cursive script, appearing to read "Elsa A. Porter".

Elsa A. Porter
Assistant Secretary
for Administration

Enclosure





UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
 Rockville, Md. 20852
 EM2

April 1977

Mr. William L. Martino
 Assistant Director
 Community and Economic Development Division
 General Accounting Office
 Washington, D.C. 20548

Dear Mr. Martino:

We have reviewed the March 1977 draft report "Status and Issues Regarding the SEASAT-A Project" and find no major disagreement with the recommendations made in the report draft. One area of concern is the recommendation that NASA have formalized agreements with participating Government agencies. While we agree with this recommendation, NOAA cannot sign such an agreement until we know what funding levels will be approved for our SEASAT program.

We would also like to point out that the Canadian government has made a tentative commitment of substantial funds for their SEASAT program.

The enclosed list indicates a number of items in the report that are unclear and our suggested changes.

We appreciate this opportunity to review this draft report. Please advise me if you require any further information.

Sincerely,


 Robert M. White
 Administrator

Enclosure



NOAA Comments on March 1977 Draft Report:
 "Status and Issues Regarding the SEASAT-A Project"

<u>Item</u>	<u>Comment</u>
1. Page 11, 2nd line on page	Change "NASA" to "the Federal Government" to remove any implication that NASA would be the agency to pursue an operational SEASAT program. [See GAO note p. 41.]
2. Page 1, 2nd paragraph	While the paragraph is correct, a system of three or more satellites is just one possible configuration for an operational system. There are other concepts that are equally possible--one or two satellites, or some amalgamation of SEASAT sensors with the post-TIROS-N sensors. NASA, NOAA, and DOD are looking at the functions an operational system might be expected to perform in the 1980-85 time frame. Thus SEASAT-B could be designed to be the transition to an as yet undefined operational system. [See GAO note p. 41.]
3. Page 12, 2nd sentence, 2nd paragraph, <u>Data Utility Studies</u>	Sentence is incorrect as stated. We suggest it be replaced with the following: "The density of coverage of data from meteorological satellites does not fit into existing weather forecasting models. For example, the satellite data may have resolutions of 50km and the model grids are 300-400km, so that the models are the limiting factor. Additionally, the satellite data is asynoptic." [See GAO note p. 41.]
4. Page 12, 3d sentence, 2nd paragraph	SEASAT should be inserted as follows: "...so that <u>SEASAT</u> satellite data can be used in forecasting models." [See GAO note p. 41.]
5. Page 21, 3d sentence, 2nd paragraph	Change sentence to read "The lack of a full commitment by the user community appears to be the weakest link in the SEASAT-A Project." since NOAA, as a prime potential user, has committed considerable resources to the SEASAT program. [See GAO note p. 41.]
6. Page 21, 4th sentence, 2nd paragraph	Change "NASA" to "the Federal Government". See item 1 above. [See GAO note p. 41.]

7. Page 23, 4th line from top of page
Add to end of sentence "in oceanic areas" since NOAA's current operational satellites address these problems over land areas.
[See GAO note p. 41.]
8. Page 23, 7th & 8th line from top of page
Phrase should be added to make sentence read "...delineates a program of measurement and evaluation that should be undertaken."
[See GAO note p. 41.]
9. Page 24, 1st full sentence on page
Phrase should be added so sentence reads as follows: "NOAA is developing a detailed experimental plan to support the Program Development Plan based on anticipated appropriations from the Congress." The following sentence should also be added: "The experiment plan may eliminate some of the programs proposed in the Program Development Plan because of lack of resources." [See GAO note p. 41.]
10. Page 24, 2nd sentence, 2nd paragraph
Phrase should be added so that sentence reads as follows: "NOAA officials stated that a Memorandum of Understanding could not be signed until NOAA was able to commit to certain programs based on the availability of resources requested in the FY 78 budget but that a memorandum is expected to be signed with NASA during calendar year 1977."
[See GAO note p. 41.]
11. Page 25, 1st sentence
While the amounts quoted were correct at the time the draft was prepared, NOAA has since requested \$2.47M in 1978 and plans to request \$3.67M in 1979, 1980, and 1981.
[See GAO note p. 41.]
12. Page 29, last paragraph, titled Canadian Participation
Statements in this paragraph were probably factual at the time the draft was prepared but are incorrect now. It could be updated with the following footnote: "At the April 4, 1977, meeting of the Ocean Dynamics Advisory Committee, a representative of the Canadian SEASAT Project announced that his government had approved, subject to the resolution of some problems related to data sensitivity, an eight million dollar program to process data from the Synthetic Aperture Radar and to conduct a wide variety of research programs on ocean conditions and ice forecasting off the east and west coasts of Canada, in the Arctic Circle, and the Great Lakes."
[See GAO note p. 41.]

13. Page 30, paragraph titled Academic Users
- The following should be added to this paragraph: "This AO program support for SEASAT-A investigations would be in addition to such funds as would normally be available from the Office of Naval Research and the National Science Foundation for research in oceanographic or meteorological research which could be conducted or enhanced by using SEASAT-A data." [See GAO note below.]
14. Page 30, paragraph titled Follow-on SEASAT Systems
- Paragraph should be changed to read as follows: "NASA, NOAA and DOD have initiated follow-on SEASAT studies to determine feasible alternatives of proceeding from the currently funded SEASAT-A project to an operational ocean monitoring system. NOAA and DOD are conducting studies of the need for oceanographic data which might be provided by an operational system. NASA is consolidating these studies and conducting systems analysis studies to define alternatives. A user needs assessment..." [See GAO note below.]
15. Page 32, 1st paragraph
- See item 5 above. NOAA has received partial funding for their SEASAT program. [See GAO note below.]
16. Page 32, 11th line
- "NASA" should be changed to "the Federal Government". See item 1 above. [See GAO note below.]
17. Page 41 (also Appendix I of "Contents," page 4, and page 30)
- Title and reference in first paragraph to Oceanology Advisory Subcommittee should be changed to Ocean Dynamics Advisory Subcommittee since the proposed name change has not taken place. [See GAO note below.]

GAO note: Page references in this appendix refer to the draft report and do not necessarily agree with the page numbers in final report.

PRINCIPAL OFFICIALS OF THE
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
RESPONSIBLE FOR ACTIVITIES
DISCUSSED IN THIS REPORT

	<u>Tenure of office</u>	
	<u>From</u>	<u>To</u>
ADMINISTRATOR:		
Robert A. Frosch	June 1977	Present
Alan M. Lovelace (acting)	May 1977	June 1977
James C. Fletcher	Apr. 1971	May 1977
DEPUTY ADMINISTRATOR:		
Alan M. Lovelace	June 1976	Present
George M. Low	Dec. 1969	June 1976
ASSOCIATE ADMINISTRATOR/ COMPTROLLER:		
William E. Lilly (note a)	Feb. 1967	Present

a/Position established in December 1972. Before that date the Comptroller function was part of the Office of the Associate Administrator for Organization and Management.