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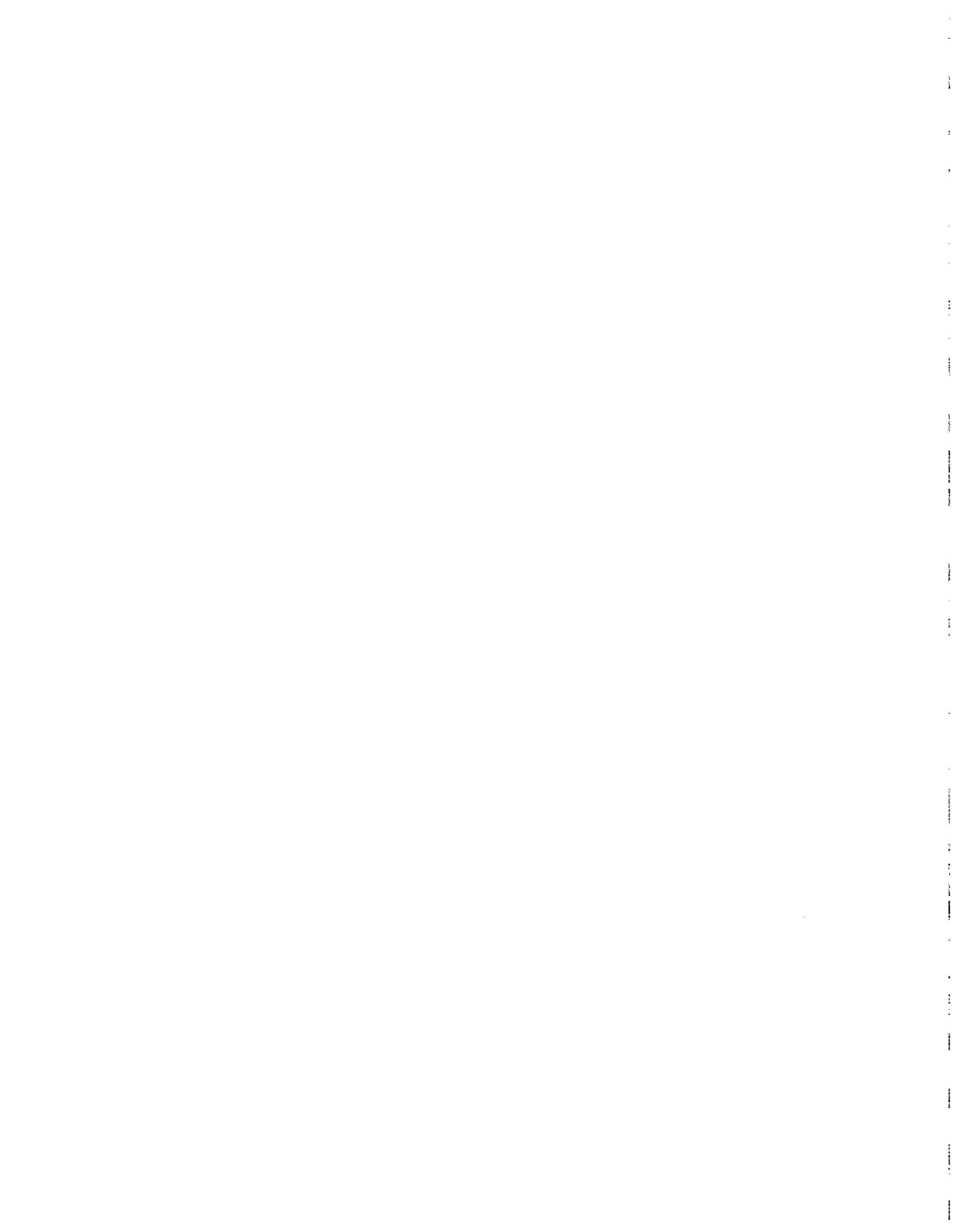
Briefing Report to the Chairman,
Legislation and National Security
Subcommittee, Committee on
Government Operations, House of
Representatives

May 1991

SUBMARINE COMBAT SYSTEM

Status of Selected Technical Risks in the BSY-2 Development







United States
General Accounting Office
Washington, D.C. 20548

Information Management and
Technology Division

B-243941

May 24, 1991

The Honorable John Conyers, Jr.
Chairman, Subcommittee on Legislation
and National Security
Committee on Government Operations
House of Representatives

Dear Mr. Chairman:

At your request, we obtained information on specific hardware and software development risks for the Navy's AN/BSY-2 combat system (BSY-2). The BSY-2 combat system is being designed to detect, classify, track, and launch weapons against targets for the Navy's new SSN-21 SEAWOLF nuclear attack submarine. The BSY-2 is planned to (1) enable the submarine to detect and locate targets faster, (2) allow operators to perform multiple tasks and address multiple targets concurrently, and (3) ultimately reduce the time between detecting a threat and launching weapons. The cost for the first BSY-2 system is estimated at \$280 million—15 percent of the estimated \$1.9 billion cost for the first SEAWOLF.

As agreed with your office, we determined the status of three technical risk areas identified as critical by the Institute for Defense Analyses (IDA) in its January 1990 report,¹ and the actions the Navy has taken to mitigate them. Specifically, we examined the Enhanced Modular Signal Processor (EMSP), the database management system, and the computer network. We provided the results of our review in a formal briefing to your office in April 1991. Subsequently, we agreed to prepare this report containing the charts used in the briefing (see app. I). These charts describe the (1) IDA-reported risks, (2) potential impacts identified by IDA, (3) IDA recommendations, and (4) current status of the risks and Navy actions to address them.

Results in Brief

Most of the risks identified by IDA concerning (1) the immaturity of the EMSP and its inability to meet timing requirements; (2) incomplete database management design; and (3) potentially lengthy network reconfiguration times, still exist. According to IDA, if left unresolved, these risks could significantly impair system development through

¹Assessment of the Development Program for the AN/BSY-2 Submarine Combat System, Institute for Defense Analyses, January 1990.

increased costs, schedule delays, and degraded system performance. IDA recommended specific actions to mitigate these risks. However, the Navy has not implemented 5 of 6 IDA recommendations.

Background

In 1989, IDA analyzed the development program for the BSY-2 combat system² and identified critical technical risks in the development of the three BSY-2 components. These three components will perform critical functions within the BSY-2 combat system, and any problems experienced may affect the operation of the entire combat system and the submarine itself. EMSP processes data from most of the submarine's sensors for transfer to other computer processors and operator displays where analysis, such as determining the speed, location, and direction of a target or multiple targets, is performed. EMSP is being newly developed, and will be provided to the BSY-2 contractor as government-furnished equipment. Its first operational use is planned for BSY-2.

EMSP and other system data will be maintained in a database management system. The database management system will need to store voluminous navigation and target data for use in analyzing targets and launching weapons. For example, data received by the submarine's multiple sensors is integrated into the database and used by operators to detect, classify, and track targets.

Data will be transferred throughout the BSY-2 combat system by an advanced computer network being developed by the contractor. The network will interconnect almost 100 processors and will need to meet stringent throughput and timing requirements in order to achieve all planned BSY-2 capabilities.

As agreed with your office, we did not obtain official comments on a draft of this report. We did, however, discuss this information with agency officials and have incorporated their comments where appropriate.

We performed our work in accordance with generally accepted government auditing standards between October 1990 and March 1991. We

²This analysis was done at the request of the Office of the Deputy Director of Defense Research and Engineering.

interviewed IDA officials responsible for analyzing the BSY-2 development program, and Navy and contractor officials responsible for developing BSY-2 and EMSP, including the BSY-2 and EMSP program offices and General Electric offices in Syracuse, New York, and Moorestown, New Jersey. In addition, we analyzed the IDA report and numerous BSY-2 documents, such as the Software Development Plan, architecture modeling reports, the Master Test and Evaluation Plan, and various Navy and Defense policies and regulations. While we analyzed the status of the IDA-reported risks, we did not assess the validity of the specific IDA recommendations.

As your office requested, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the date of this letter. At that time, we will send copies to the Secretary of Defense; the Secretary of the Navy; the Chairmen, Senate and House Committees on Appropriations; the Chairmen, Senate and House Committees on Armed Services; and the Director, Office of Management and Budget. We will also send copies to other interested parties, and will make copies available upon request.

Should you have any questions about this report, please contact me at (202) 275-4649. Major contributors are listed in appendix II.

Sincerely yours,



Samuel W. Bowlin
Director, Defense and Security
Information Systems

Contents

Letter	1
Appendix I Briefing Charts	6
Appendix II Major Contributors to This Report	36

Abbreviations

EMSP	Enhanced Modular Signal Processor
GAO	General Accounting Office
IDA	Institute for Defense Analyses
IMTEC	Information Management and Technology Division

Briefing Charts

**GAO Three Areas of Risk Reported by the
Institute for Defense Analyses (IDA)**

**Enhanced Modular Signal Processor
(EMSP)**

Database Management System

Computer Network

GAO EMSP Risks

Immature signal processor

Timing requirements

Different versions of EMSP

GAO EMSP Risks
Immature Signal Processor

IDA-reported risks:

- Immature EMSP may experience operational problems not discovered in laboratory testing
- Automated software development tools are lacking

GAO EMSP Risks
Immature Signal Processor

Potential impact identified by IDA:

- Unanticipated bugs may cause delays in developing EMSP and interfacing software components
- Additional staff needed to develop software

GAO EMSP Risks
Immature Signal Processor

IDA recommendation:

Navy should develop a comprehensive management plan addressing EMSP risks

GAO EMSP Risks
Immature Signal Processor

Status:

Navy has not developed a comprehensive management plan addressing EMSP risks

- EMSP is still under development
- Navy's original risk mitigation plan called for obtaining initial experience with EMSP on other Navy systems, however, BSY-2 is now first user of EMSP

GAO EMSP Risks
Immature Signal Processor

Status:

- BSY-2 contractor not responsible for addressing EMSP risks since it is being developed by another contractor for many Navy programs and provided to BSY-2 as government-furnished equipment

Navy must ensure BSY-2 requirements are met

GAO EMSP Risks
Immature Signal Processor

Status:

- Contractor is experiencing problems using immature software development tools to debug software, and is expecting delays

GAO EMSP Risks
Timing Requirements

IDA-reported risk:

EMSP 86-second start-up time
does not meet BSY-2 20-second
requirement

Potential impact identified by IDA:

EMSP may prevent the entire BSY-2
combat system from meeting timing
requirements

GAO EMSP Risks
Timing Requirements

IDA recommendations:

- Navy and contractor should monitor modification efforts underway to reduce the EMSP start-up time
- Navy should evaluate and report the impact on SEAWOLF mission effectiveness if timing requirements are relaxed

GAO EMSP Risks
Timing Requirements

Status:

- Navy and contractor are monitoring modifications made to reduce the EMSP start-up time
- Navy has not evaluated and reported the impact of not meeting EMSP requirements on SEAWOLF mission effectiveness

GAO EMSP Risks
Timing Requirements

Status:

- Software modifications have improved EMSP start-up time to 40 seconds--still too slow to meet BSY-2 start-up requirement
- Navy officials now state that the start-up requirement may be waived

GAO **EMSP Risks**
Two Versions of EMSP

IDA-reported risk:

Navy plans to transition to a more advanced EMSP version when it becomes available

GAO EMSP Risks
Two Versions of EMSP

Potential impact identified by IDA:

- Significant costs for retrofitting earlier systems with advanced versions, and for recoding software
- Logistic support may be limited since first three BSY-2 systems are planned to be the only users of the initial EMSP version

GAO EMSP Risks
Two Versions of EMSP

IDA recommendation:

Navy should obtain an independent assessment of BSY-2 EMSP transition plans

GAO **EMSP Risks**
Two Versions of EMSP

Status:

Navy has not obtained an independent assessment of proposed transition plans

- Navy lacks an approved EMSP Transition Plan
- Navy decision on when and how to transition BSY-2 program from initial to advanced version has not been made

GAO Database Management Risk

IDA-reported risk:

Database management approach not fully defined

GAO Database Management Risk

Potential impact identified by IDA:

- Coding delays of software components
- Degraded overall system performance if selected system does not meet real-time requirements

GAO Database Management Risk

IDA recommendation:

Navy should obtain a detailed, critical review of the contractor's data management approach, including an assessment of the performance requirements and the ability of the system to meet them

GAO Database Management Risk

Status:

Navy has not conducted a detailed, critical review of the contractor's data management approach

- Contractor has developed a two-pronged approach to manage the system data:

(1) commercial system to store, compare, and retrieve some data

GAO Database Management Risk

Status:

(2) contractor-developed data management methods to more quickly store and retrieve other data

- Contractor has not decided which approach to use for some combat system functions

GAO Database Management Risk

Status:

- Contractor is determining type and amount of data to be stored in various databases

GAO Network Risks

Network throughput

Network reconfiguration time

GAO Network Risks
Network Throughput

IDA-reported risk:

Required network throughput may not be achievable

Potential impact identified by IDA:

Network may need to be redesigned to meet throughput requirements; schedule delays may result

GAO Network Risks
Network Throughput

IDA recommendation:

Navy should obtain an independent assessment of the adequacy of network prototyping

GAO Network Risks
Network Throughput

Status:

Navy has not obtained an independent assessment of the adequacy of network prototyping

- Network prototyping indicates the BSY-2 network design will meet throughput requirements

GAO Network Risks
Network Reconfiguration Time

IDA-reported risk:

- Reconfiguration times that appear adequate on the prototype network may be excessive on the actual production network
- Long reconfiguration times needed to reestablish the network after a failure may result in excessive "down-time" and impair operators' use of the system

GAO Network Risks
Network Reconfiguration Time

Potential impact identified by IDA:

Network may need to be redesigned
to achieve required performance;
schedule delays may result

GAO Network Risks
Network Reconfiguration Time

IDA recommendation:

Navy should obtain an independent assessment of the adequacy of network prototyping

GAO Network Risks
Network Reconfiguration Time

Status:

Navy has not obtained an independent assessment of the adequacy of network prototyping

- Reconfiguration has not been demonstrated on the prototype network, but contractor is modeling reconfiguration and plans prototype demonstration in the future

Major Contributors to This Report

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