NSSN — New Attack Submarine

U.S. Navy's "Paper Submarine" Undergoes Exhaustive Early Operational Assessment

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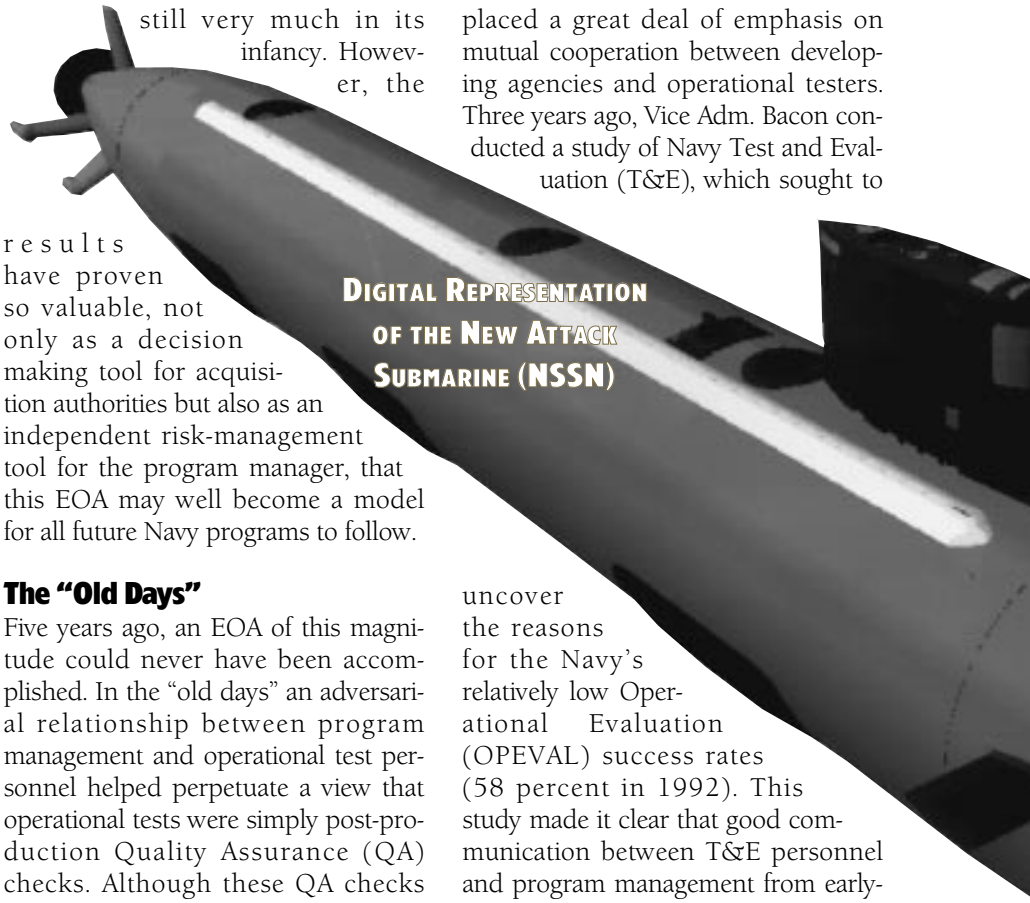
The New Attack Submarine will be the Navy's undersea weapon of choice for the 21st Century. With unsurpassed quieting, state-of-the-art computer technology, and precision targeting capability, the NSSN will be the most advanced weapons delivery system in the world. But today, what will eventually become a formidable, 7,500-ton warfighting machine, is simply a vast collection of plans, diagrams, and schematics, which occupy filing cabinets and computer disks at selected locations around the country.

Getting Started

In one sense, however, the New Attack Submarine has already been to sea and operated in a wartime environment. In the spring of 1995, without ever leaving the drawing board, or more accurately, the drawing board's digital database equivalent, this "paper submarine" underwent an exhaustive Early Operational Assessment (EOA) by the Navy's Operational Test and Evaluation Force (OPTEVFOR).

The EOA of the New Attack Submarine (NSSN), which was completed in just 10 weeks, was the first of its kind for the Navy. Never before had such a thorough EOA been conducted for a large program so early in a project's development. Critics questioned the worth of assessing a program that was still very much in its infancy. However, the results have proven so valuable, not only as a decision making tool for acquisition authorities but also as an independent risk-management tool for the program manager, that this EOA may well become a model for all future Navy programs to follow.



DIGITAL REPRESENTATION OF THE NEW ATTACK SUBMARINE (NSSN)

The "Old Days"

Five years ago, an EOA of this magnitude could never have been accomplished. In the "old days" an adversarial relationship between program management and operational test personnel helped perpetuate a view that operational tests were simply post-production Quality Assurance (QA) checks. Although these QA checks could be effective, they were not very efficient because they were performed at the end of program development. On some programs, problems would be discovered requiring further development and delay in fielding the new system.

Recently, however, in the spirit of acquisition streamlining, the Navy has placed a great deal of emphasis on mutual cooperation between developing agencies and operational testers. Three years ago, Vice Adm. Bacon conducted a study of Navy Test and Evaluation (T&E), which sought to uncover the reasons for the Navy's relatively low Operational Evaluation (OPEVAL) success rates (58 percent in 1992). This study made it clear that good communication between T&E personnel and program management from early-on gave programs a head start toward undergoing a successful OPEVAL. To this end, EOAs are an excellent way for operational testers to provide essential information to system developing activities, which can greatly improve chances for a successful OPEVAL.

Adding Value — How Early is Too Early?

The task of conducting the NSSN EOA in a scant 10 weeks fell to Capt. William M. Espinosa, USN, head of

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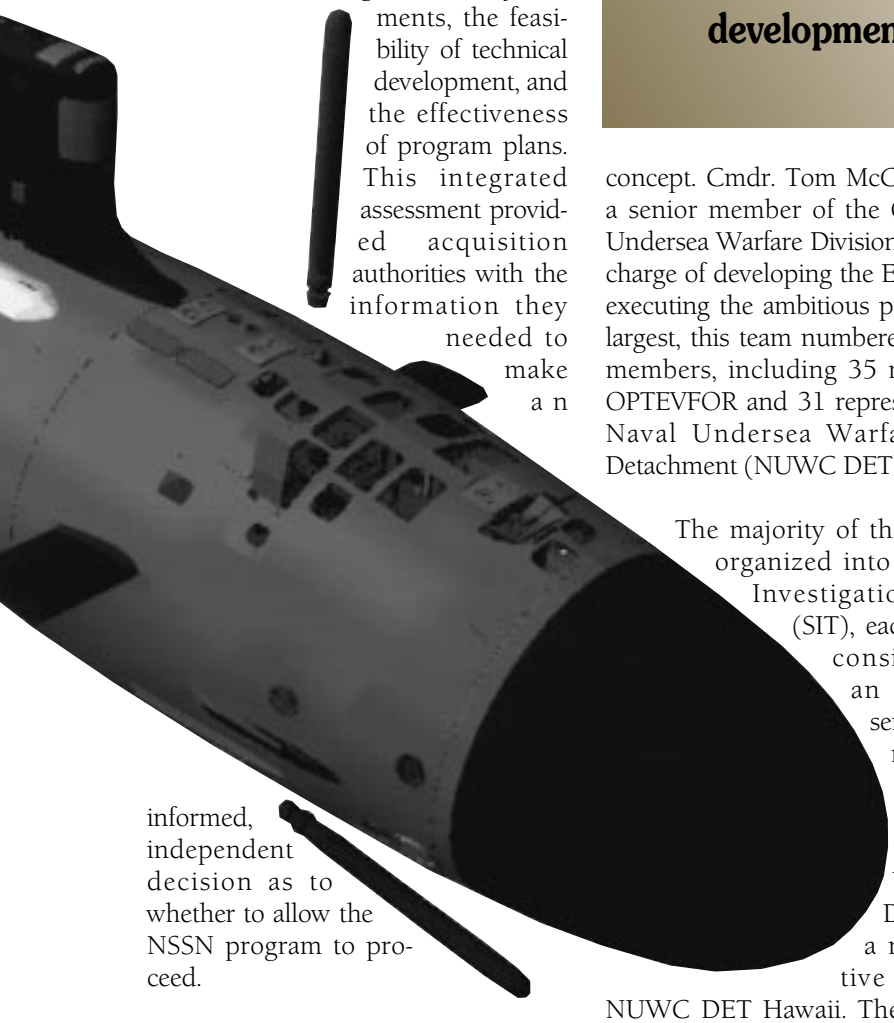
OPTEVFOR's Undersea Warfare Division. His first task was to decide what to look at and how to organize the evaluation effort. How could OPTEVFOR add value to a development process that hadn't yet completed the detailed design stage? Without detailed designs, how could we make a determination of potential operational effectiveness?

The answers to these questions were manifested in a unique, integrated approach to the NSSN EOA. Rather than focusing exclusively on design, this EOA addressed all aspects of the project: development, design, requirements, technology, and management. The results not only provided an assessment of the early system designs, but also validated the program requirements, the feasibility of technical development, and the effectiveness of program plans. This integrated assessment provided acquisition authorities with the information they needed to make an informed, independent decision as to whether to allow the NSSN program to proceed.



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A Team Effort

The EOA effort was organized using the Integrated Product Team (IPT) concept. Cmdr. Tom McCarthy, USN, a senior member of the OPTEVFOR Undersea Warfare Division, was put in charge of developing the EOA IPT and executing the ambitious project. At its largest, this team numbered nearly 70 members, including 35 members of OPTEVFOR and 31 representatives of Naval Undersea Warfare Center Detachment (NUWC DET) Hawaii.

The majority of the team was organized into 16 System Investigation Teams (SIT), each of which consisted of an officer or senior enlisted member of OPTEVFOR's Undersea Warfare Division and a representative from NUWC DET Hawaii. The numerous Critical Operational Issues (COI) that were applicable to the NSSN program were divided up among the SITs so that each two-man team could concentrate on a relatively small slice of the pie. The remaining members of the team were assigned support roles, including editing, analysis, and information coordination.

A Senior Advisory Committee (SAC), led by Espinosa, was created to provide oversight and guidance to the team as the EOA progressed. This committee consisted exclusively of senior, post-command captains, from all warfare areas, and their civilian counterparts both at OPTEVFOR and NUWC DET Hawaii. With their broad spectrum of warfare specialties and their vast experience in both the fleet and the T&E world, the SAC infused a great deal of insight and maturity into the EOA process while still empowering individual SIT members to make judgments and recommendations.

Interagency Cooperation

With most systems only in the early design phase, and with work being conducted in laboratories and test sites all over the country, the amount of information that had to be gathered for the EOA was staggering. The superb cooperation of the program office was absolutely essential for gathering this information and completing the EOA on time. In this regard, the program office was very much a part of the Operational Test and Evaluation (OT&E) IPT, providing in-house information as well as interfacing with various laboratories and contractors on a daily basis.

Where highly specialized expertise was needed, such as estimates of the state of technology available in the future, experts were called upon from academia. The team worked with the National Science Foundation's (NSF) Engineering and Advanced Technology Division as well as the Maritime Systems Office of the Advanced Research Projects Agency (ARPA) to resolve highly technical issues and to obtain independent expert opinions. The outstanding support from NSF and ARPA provided valuable insight

PICTURED: SEVERAL MEMBERS OF OPTEVFOR'S NSSN EOA TEAM, NORFOLK, VIRGINIA, 1995.

into the advanced technology being planned for the NSSN. Future collaborative efforts with these agencies should be considered for any significant OT&E effort involving leading-edge technology.

A Four-phased Approach

The procedures for conducting the EOA were developed in coordination with the Department of Defense Director, Operational Test and Evaluation (DOT&E). A four-phased approach was decided upon. In Phase I, the investigation phase, the SITs gathered high-level information on the systems which affected their COIs, establishing the necessary contacts at the program office, developmental test sites, and other appropriate agencies. At the end of Phase I, they briefed the results of their investigations to the SAC. These briefs, which were conducted over a three-day period at a Video Teleconferencing (VTC) facility, allowed the SAC members at OPTEVFOR and NUWC DET Hawaii to fully interact with SIT team members. The use of a VTC facility, which saved precious time and scarce travel funds, is a valuable resource for any IPT whose team members are scattered over a wide area.

During Phase II, the SAC reviewed the SITs' inputs in depth, validating the Phase I findings and providing feedback and guidance to the investigation teams. The principal purpose of this phase was to decide where to target the Phase III evaluation for the greatest payoff.

Phase III consisted of an in-depth review of each COI by the SITs, focusing especially on systems that the SAC (in phase II) viewed as potentially the highest risk. During this phase, members of the team arranged various meetings with program management and laboratory personnel, including on-site visits to test facilities, in order to answer unresolved issues from previous phases. Another series of VTC briefings was given to the SAC at the end of Phase III.

Finally, during Phase IV, the SAC reviewed in detail the results provided by each SIT. Each investigation team drafted an input for the final report, addressing their assigned COIs, and submitted it electronically to an editing and collating team. Once all the inputs were consolidated and edited, the smooth final report was produced.

Clarifying Requirements

The stated purpose of this EOA was to provide an independent assessment of the NSSN program to support a milestone II decision to proceed. A threefold method was used to achieve this goal: assessing whether the design met the requirements, determining the technical risk of developing new technology systems, and assessing the adequacy of the program plans. From the beginning, however, it became apparent that another goal would have to be accomplished in order to conduct the EOA. This task was to clarify the program requirements.

U.S. Navy photo

At first glance, the requirements seemed well defined; however, on closer inspection several requirements parameters were open to various interpretations over a range of values, rather than being specifically nailed down. A requirements clarification team was formed and worked for a week to remove all uncertainty from the requirements. This team produced an "Operational Requirements Document (ORD) Clarification" to ensure that the developing agency and operational testers interpreted requirements the same way.

This was important because the first step of the EOA was to compare the proposed design for each NSSN system with the requirements stated in the ORD. The "ORD Clarification," once agreed upon by OPTEVFOR, the program sponsor, and the program manager, became an extremely useful tool during the EOA: a clear, concise statement of the requirements that was still flexible enough to be updated as necessary. In fact, OPTEVFOR found the "ORD Clarification" so helpful that the concept is recommended for all programs.

Determining Risk

Having compared the intended designs to the requirements, team members next looked at the level of new technology that was involved with each system under development. Each system was assigned a degree of technical risk, depending on the perceived difficulty of developing the necessary technology and the amount of time available to do so. Risk levels were color coded into green, yellow, or red in order to create an easy-to-read format, free of excess verbiage, that decision makers could absorb at a glance.

Finally, the team addressed the program plans for the various systems and evaluated them in terms of risk. Investigators reviewed the program manager's risk mitigation plans and considered the amount of lead time available as well as the amount of work that had already been completed. From this information, the SIT made a judgment, validated by the SAC, as to whether the program plan was adequate for the risk involved. For the NSSN program, almost all program plans were found to be adequate, but for the most challenging areas, a recommendation was made for continued management attention as well as additional OPTEVFOR assessment points as the development proceeds.

The NSSN EOA was a landmark achievement for the Navy, and it exemplified the type of cooperation between the Office of the Secretary of Defense, program sponsors, program managers, and operational testers that is necessary to make streamlined acquisitions a reality.

Information — the Future Is Online

The key to performing an EOA of this magnitude is being able to access an enormous amount of information in a short amount of time. Of approximately $700K that was spent on the NSSN EOA, well over half of it went to paying salaries and overhead for the retrieval of information. Although online services allowed us to tap into the T&E network database, we found that the majority of the information we needed still had to be retrieved manually, at considerable expense. This was primarily due to the lack of Wide Area Network (WAN) connectivity to automated program resources.

Navy systems commands and program offices, NSSN in particular, are currently automating all of their information. They have found this to be a very cost-effective means of data management, and the Navy OT&E community could also realize huge benefits by tapping into these networks. For instance, the NSSN EOA could have been produced cheaper, faster, and better had we been interconnected to both the classified and unclassified databases in existence for the NSSN. As OT&E dollars diminish in the future, the use of WANs and automated data retrieval will be an important resource for the OT&E community, and these initiatives should be funded now.

Summary

The NSSN EOA was a landmark achievement for the Navy, and it exemplified the type of cooperation between the Office of the Secretary of Defense, program sponsors, program managers, and operational testers that is necessary to make streamlined acquisitions a reality. By using an integrated approach to this EOA, which went far beyond a design assessment, we were able to add value to the development process and support a major milestone decision. We demonstrated that the IPT approach is extremely effective for conducting large-scale EOAs by producing a high-quality product for one of the most complex programs in an unprecedented 10 weeks. Finally, we developed an ORD Clarification that may help future programs operate more efficiently, saving time and money, and producing better products for the fleet.

During recent briefings of the NSSN EOA, both the program manager and the resource sponsor expressed their appreciation and satisfaction with the report. The Honorable Philip E. Coyle III, DOT&E, said of it, "Clearly the best EOA we have seen from any Service." After such an enthusiastic response, more EOAs of this nature are sure to follow.