Anatomy of an Award Winning Safety Program: A Case Study of the SSGN OHIO Class Conversion Safety Program

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&

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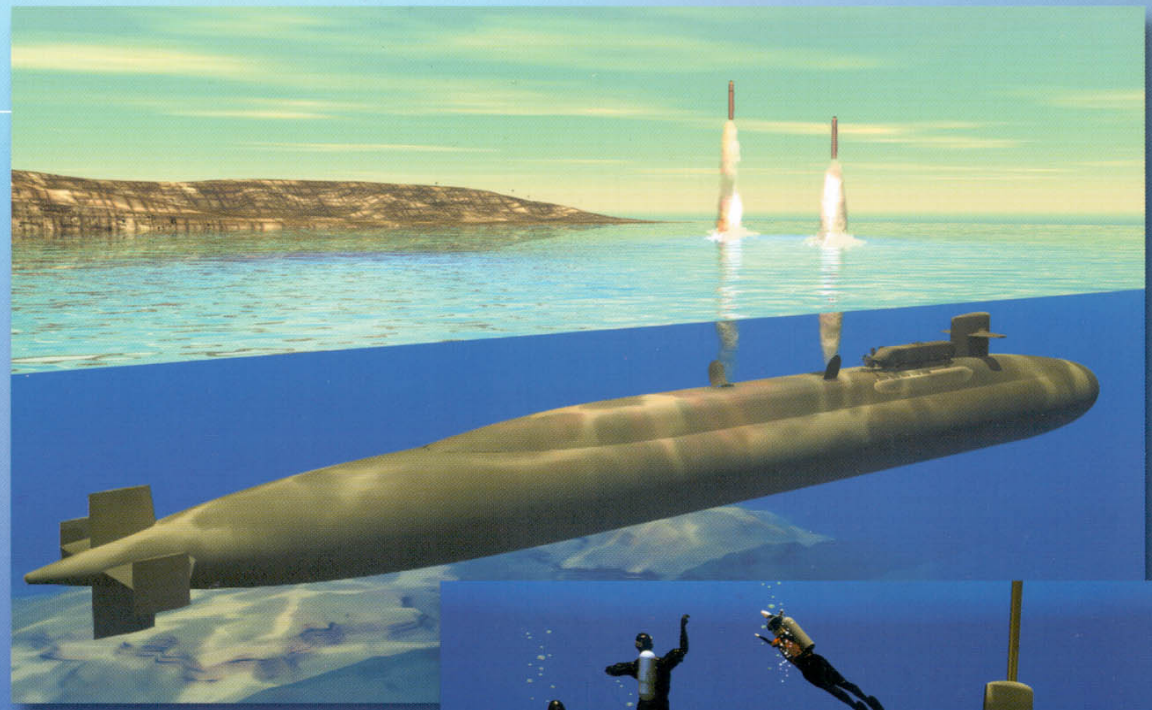
NAVAL SEA SYSTEMS COMMAND

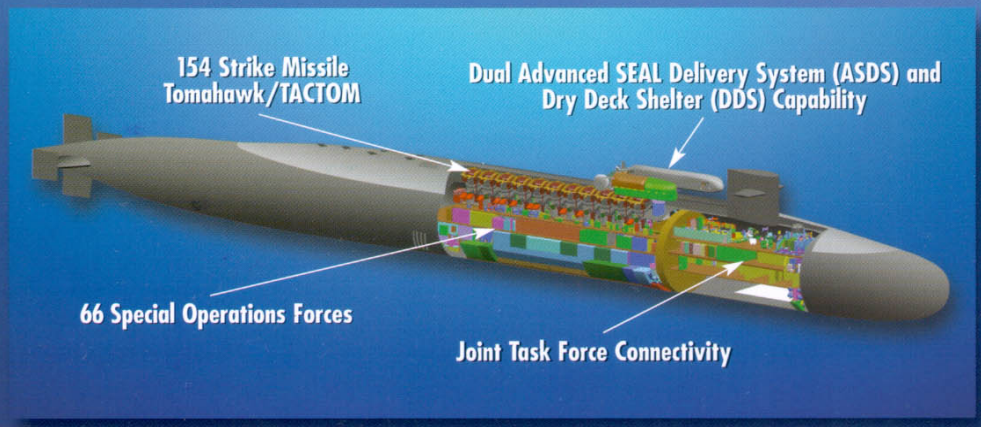
GENERAL DYNAMICS
Electric Boat

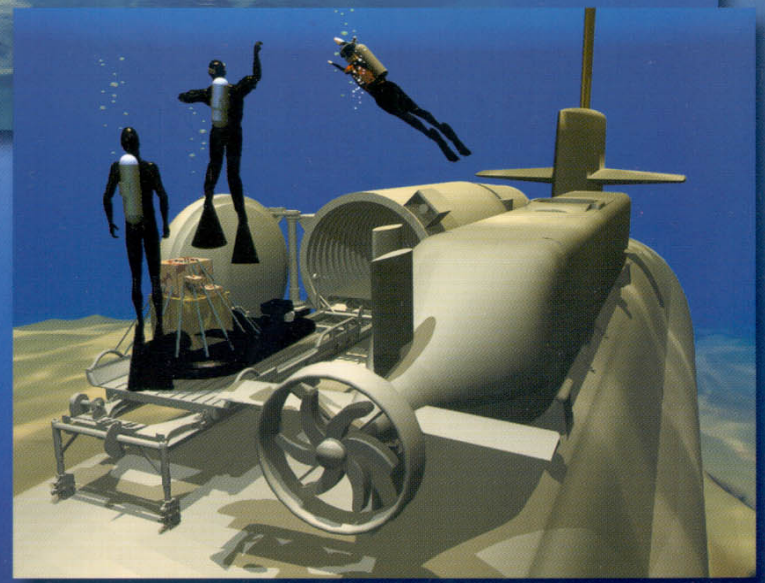
SSGN

Ship Characteristics

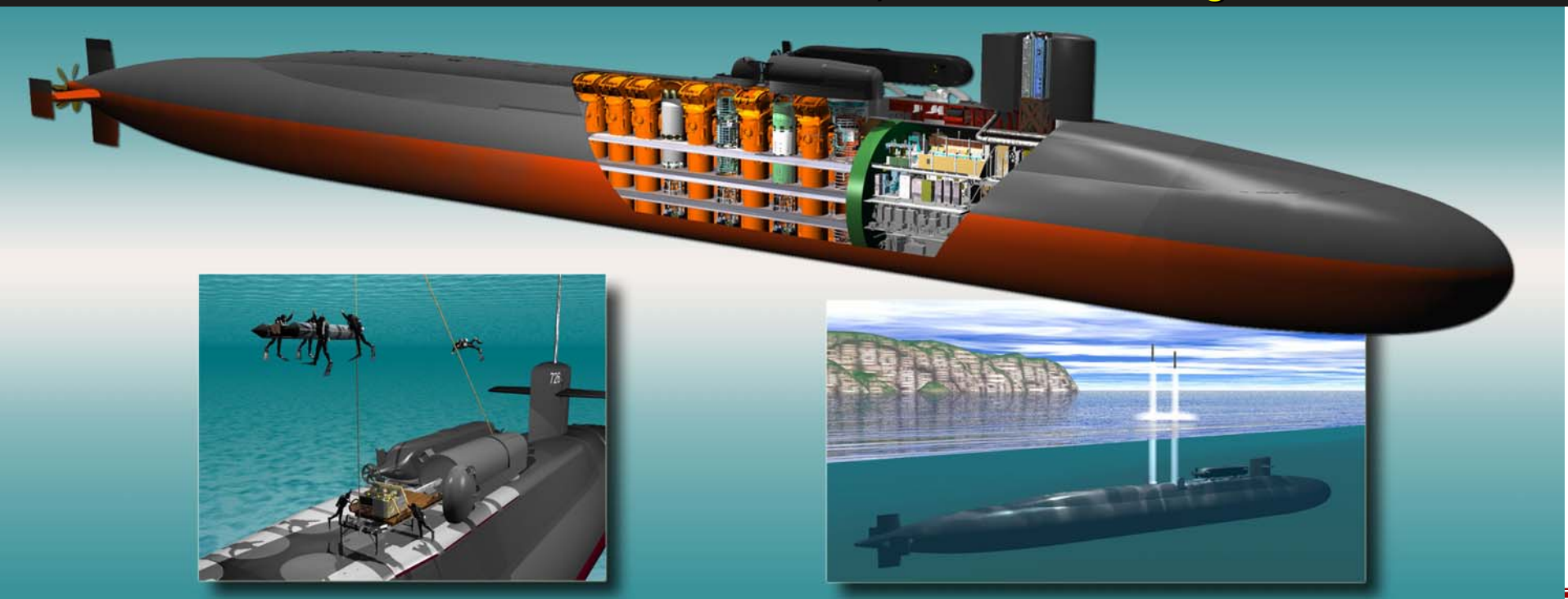
Length	560 ft
No. of SOF Personnel	66 to 102
No. of VLS Missiles	Up to 154
DDS/ASDS Capability	Dual
Speed	20+ knots







- 154 TOMAHAWK Missiles
- 66 Special Operations Forces (SOF) for more than 60 Days
- 2 Dry Deck Shelter / Advanced SEAL Delivery System
- 8 Modular SOF Storage Canisters
- Battle Management Center:
- Joint Connectivity and Organic Command & Control Capability
- Communications suite has double the antennas of an SSN
- SOF Habitability & Training Facilities
- SEASUB – Lock-In/Lock-Out, Ordnance Package



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SSGN Conversion

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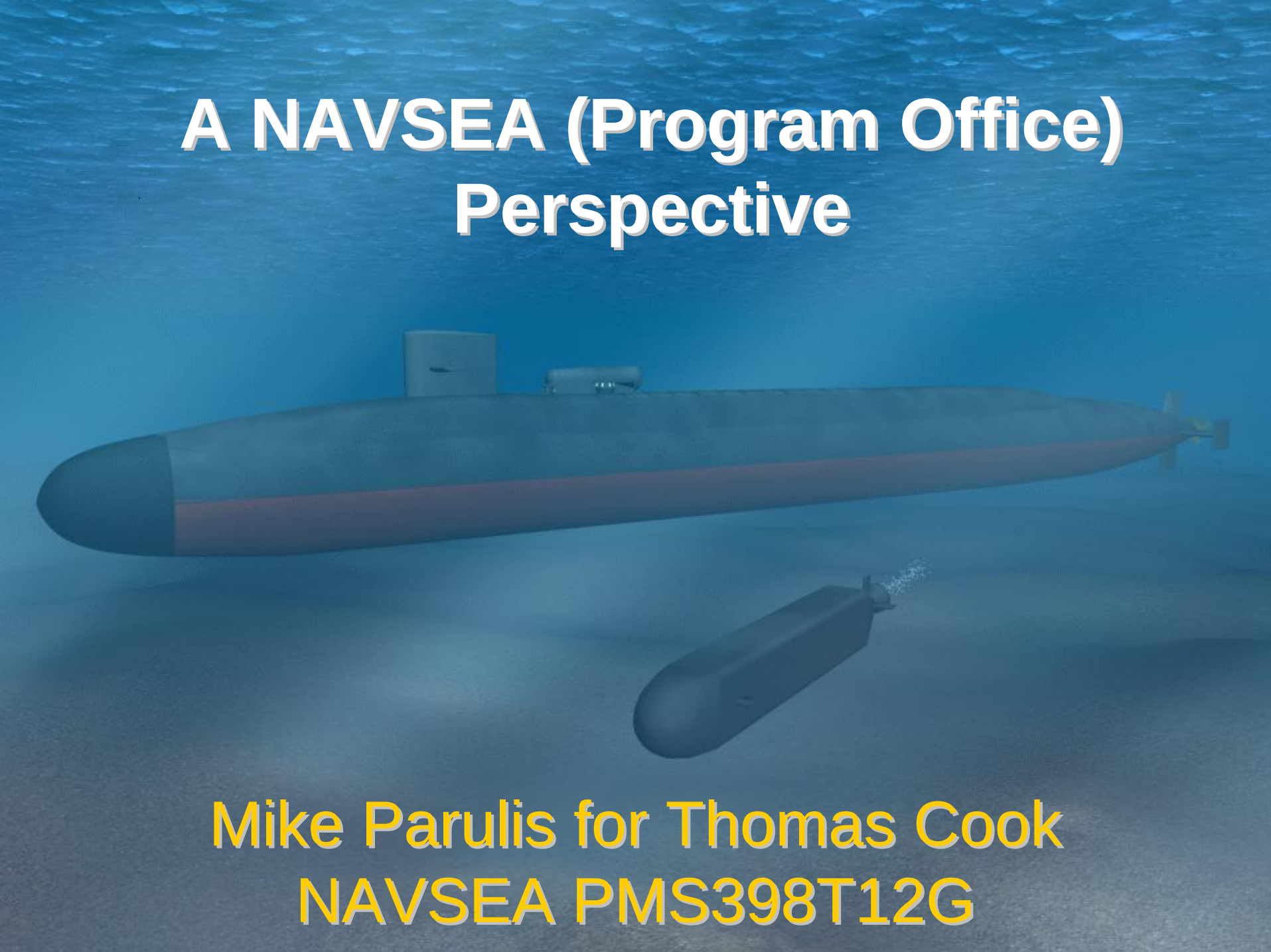
A NAVSEA (Program Office) Perspective

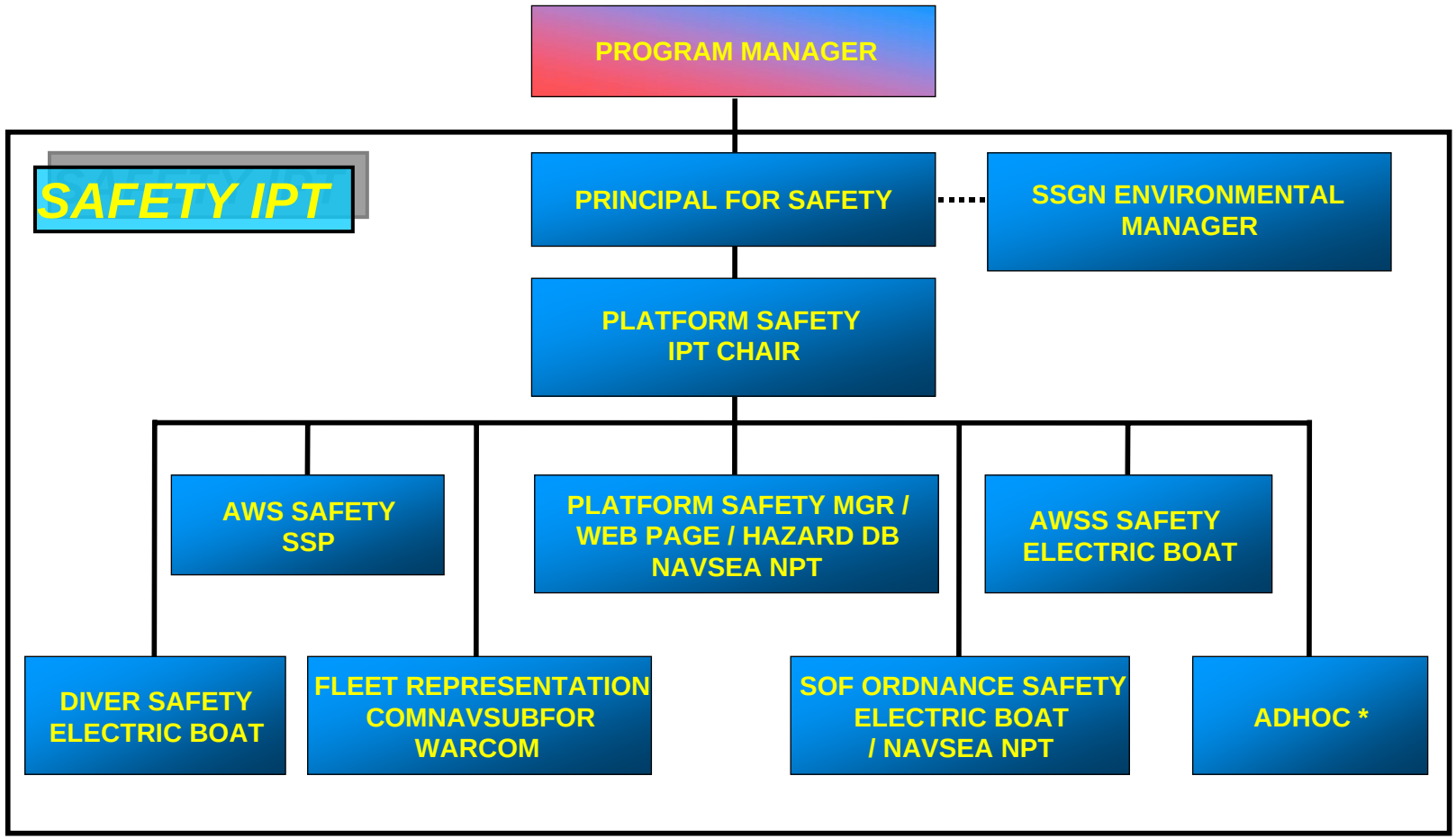


Mike Parulis for Thomas Cook
NAVSEA PMS398T12G

Introduction

NAVSEA assembled multi-disciplinary teams that developed and implemented ESOH management programs whose goals were to incorporate life cycle ESOH compliance into design and construction

SSGN Conversion ESOH



* *ADHOC* - **Participants as necessary (i.e., NOSSA / WSESRB, Legacy, Shipboard Shock, Packaging, Handling and Transportation)**

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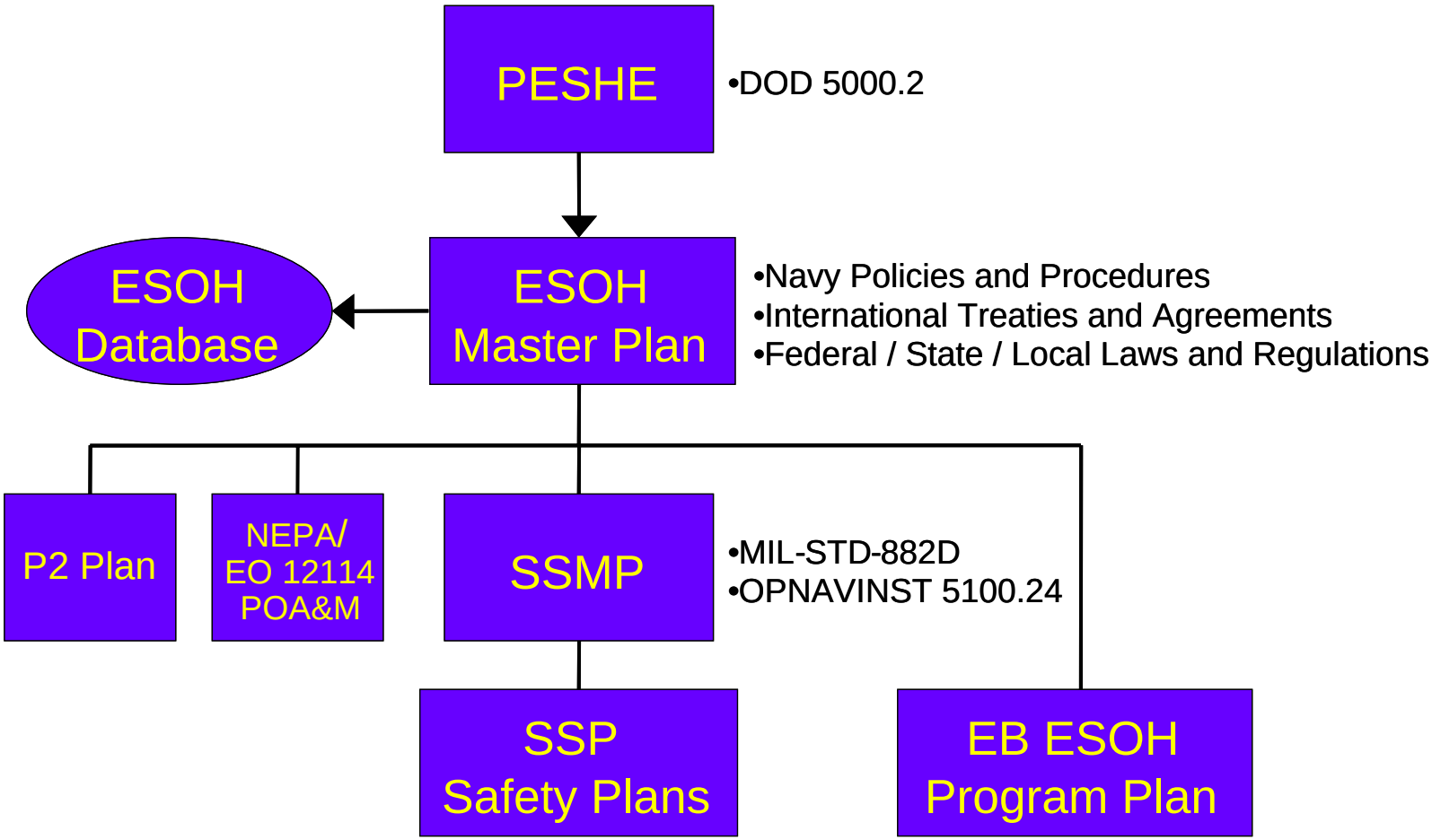
SSGN Conversion ESOH



SSGN Conversion ESOH

- MIL-STD-882D requirement
  - Allows flexibility
    - Multiple Government Agencies
    - Prime Shipbuilder Contractor
    - Several other Contractors
  - Each organization has own safety plan
    - All are in accordance with program office plan
    - Each organization plan is tailored for specific "way of doing business"

SSGN Conversion ESOH

- Integrated Product Team (IPT) Process
  - Not exactly an IPT process, but encompasses the open communication
    - Open expression of ideas (safety and process)
    - Members encouraged to voice concerns
    - Seeks consensus on programmatic issues and processes
  - Buy-In by the program office, Principal for Safety,and the individual (contractor or government) identifying the Hazard
    - Identification – at least three signatures
    - Acceptance – at least four signatures

SSGN Conversion ESOH

- Performance based Specification instead of detailed requirements
  - As Principal for Safety
    - Insist on end-results
      - Hazards/Impacts identified openly (i.e., don't suppress)
      - Hazards/Impacts mitigated in a consistent manner
        - » Each organization follows the same MIL-STD-882 logic for severity and probability (Initial & Final)
    - Do not dictate manner to reach end-results
      - Analyses conducted by each organization as per their processes

NAVSEA Summary

- Program Support
  - Continuous funding
  - Adequate safety manning
- Safety IPT Independence
- Contributing organizations staffed by experience safety engineers
  - Strategic Systems Programs (e.g., TRIDENT)
  - Naval Undersea Warfare Center
  - Naval Air Systems Command
  - Electric Boat Corporation
  - Numerous Sub-Contractors

A Contractors Perspective

Ricky Milnarik
Electric Boat Engineering Specialist

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Electric Boat Corporation

Electric Boat has been building submarines for the U. S. Navy for over 100 years.

In 1900 Electric Boat delivered the U. S. Navy's first submarine, the USS Holland.

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Integrated Product and Process Development (IPPD)

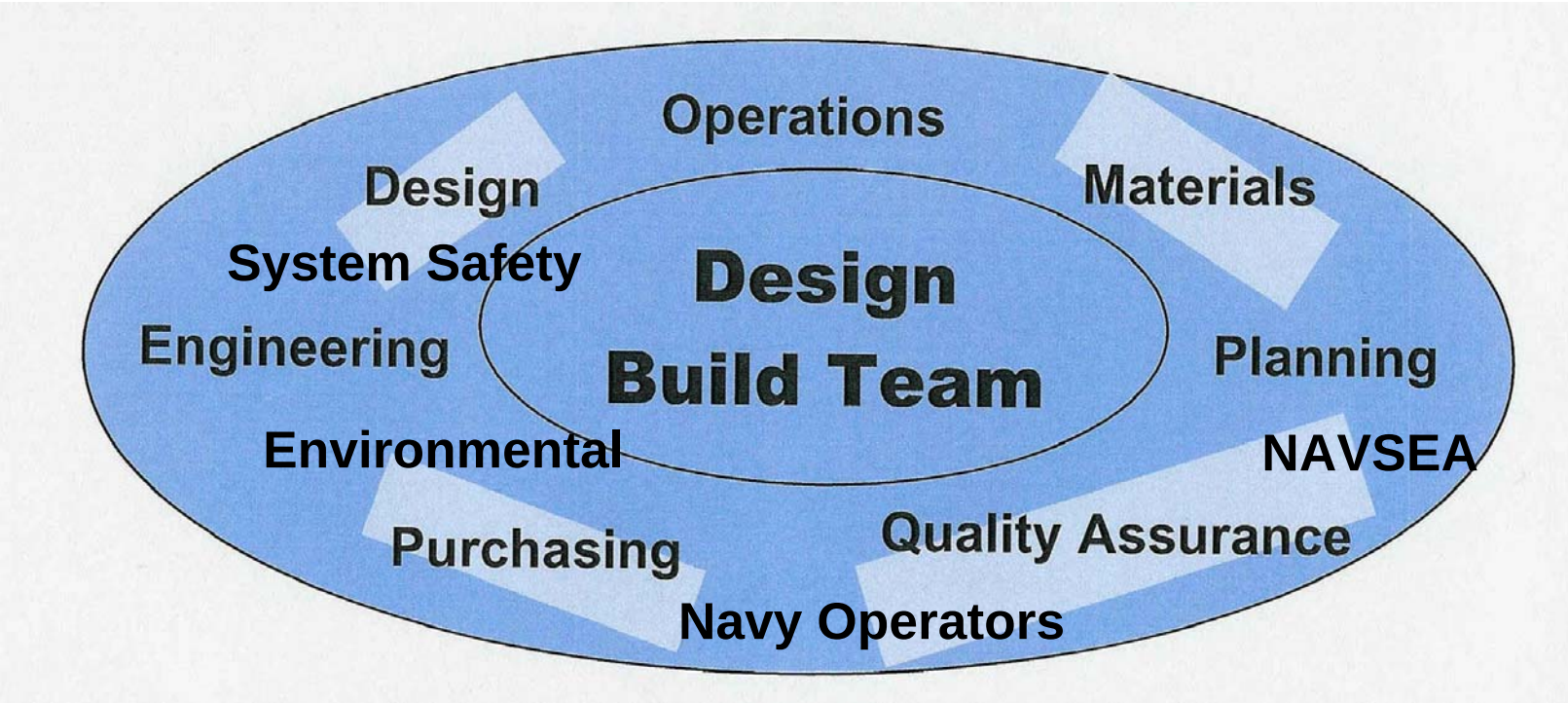
- First used at Electric Boat extensively on the VIRGINIA Class Submarine program in 1994
- Before the IPPD process, a serial approach to submarine design-to-construction was taken.
- The dynamics of the IPPD process is made possible through the use of the Computer Aided Three-Dimensional Interactive Application (CATIA) software design tool to develop electronic mockups.

Integrated Product and Process Development (IPPD)

- Methodology consists of activity-based product management and concurrent engineering Design Build Teams (DBTs).
- Team assignments are structured in accordance with program development and manufacturing needs.

Design / Build Teams

A typical DBT makeup is shown below

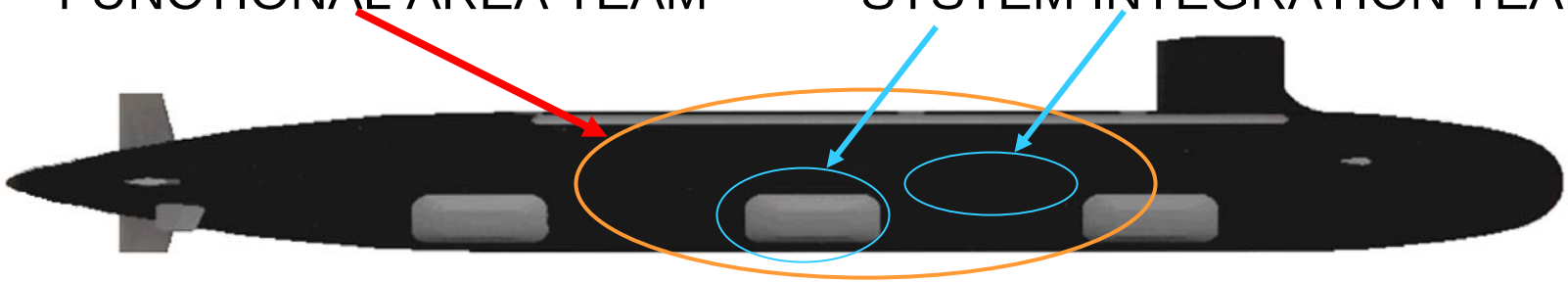


Design / Build Teams

DBT functional managers / technical leaders have direct management and control of their specific functional areas.

FUNCTIONAL AREA TEAM

SYSTEM INTEGRATION TEAMS



Before SSGN !

- Prior to SSGN, System Safety Engineering and Environmental Engineering groups at Electric Boat were not merged into a single Environmental, Safety, and Occupational Health (ESOH) group.
- System Safety and Environmental Engineering were separate parallel processes.
- System Safety and Environmental engineers were in separate locations 7 miles apart.

Before SSGN !

In support of the VIRGINIA Class IPPD process:

- System Safety Engineering conducted traditional MIL-STD-882 hazard analysis reports on identified ship systems.
- Environmental Engineering conducted Design/Build Environmental Analyses (DBEA) on identified ship systems.

SEPARATE PARALLEL PROCESSES

Before SSGN !

- System Safety Engineering identified potential hazards.
- Environmental Engineering identified potential environmental impacts.

SEPARATE PARALLEL PROCESSES

Before SSGN !

- System Safety Engineering tracked hazards in an Hazard Tracking List database.
- Environmental Engineering tracked environmental impacts in a DBEA database.

SEPARATE PARALLEL PROCESSES

SSGN Conversion

- In 2001 the SSGN Conversion Program provided an opportunity to eliminate duplication and integrate System Safety and Environmental Engineering into an effective ESOH group
- Leveraging off the lessons learned from the VIRGINIA (SSN 774) Class Submarine Safety and Environmental programs, the SSGN Conversion program allowed Electric Boat to implement an ESOH program per DODI 5000.2

SSGN Conversion ESOH

A single integrated ESOH Program Plan was developed. Key features included:

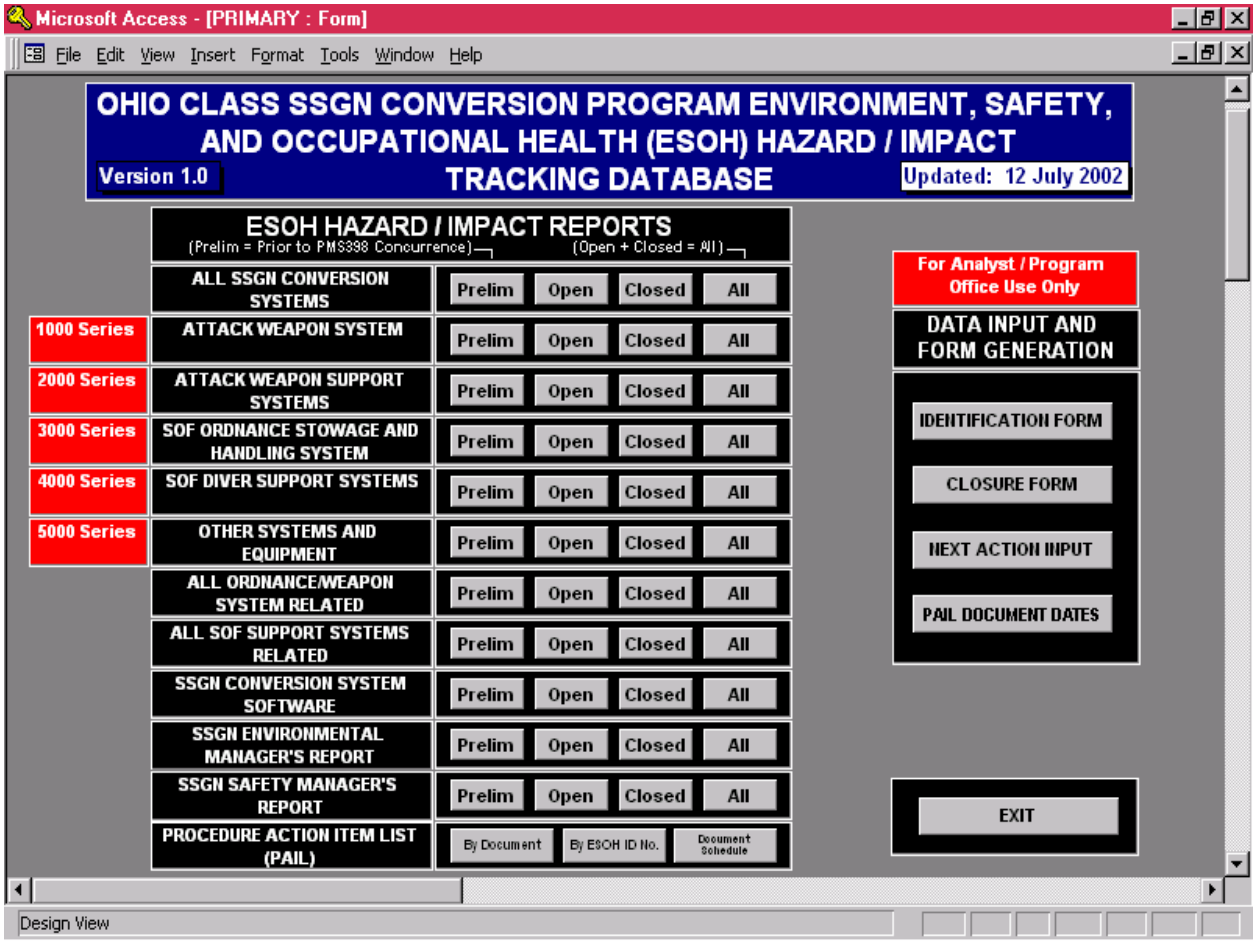
- Making ESOH the responsibility of the DBT.
- Integrating experienced Safety & Environmental engineers into DBTs.
- Define the ESOH hazard analyses for all Electric Boat SSGN Conversion cognizant systems.
- Establish an audit trail of identified ESOH issues (safety hazards/environmental impacts).

SSGN Conversion ESOH

Key features included continued:

- The system safety engineering group was co-located with the environmental engineering group.
- An ESOH Program Integrator was assigned to the program.
- A single report format that would satisfy the needs of both a DBEA and MIL-STD-882 hazard analysis was developed.
- An integrated database was developed to track both system safety hazards and environmental impacts.

ESOH Hazard / Impact Database



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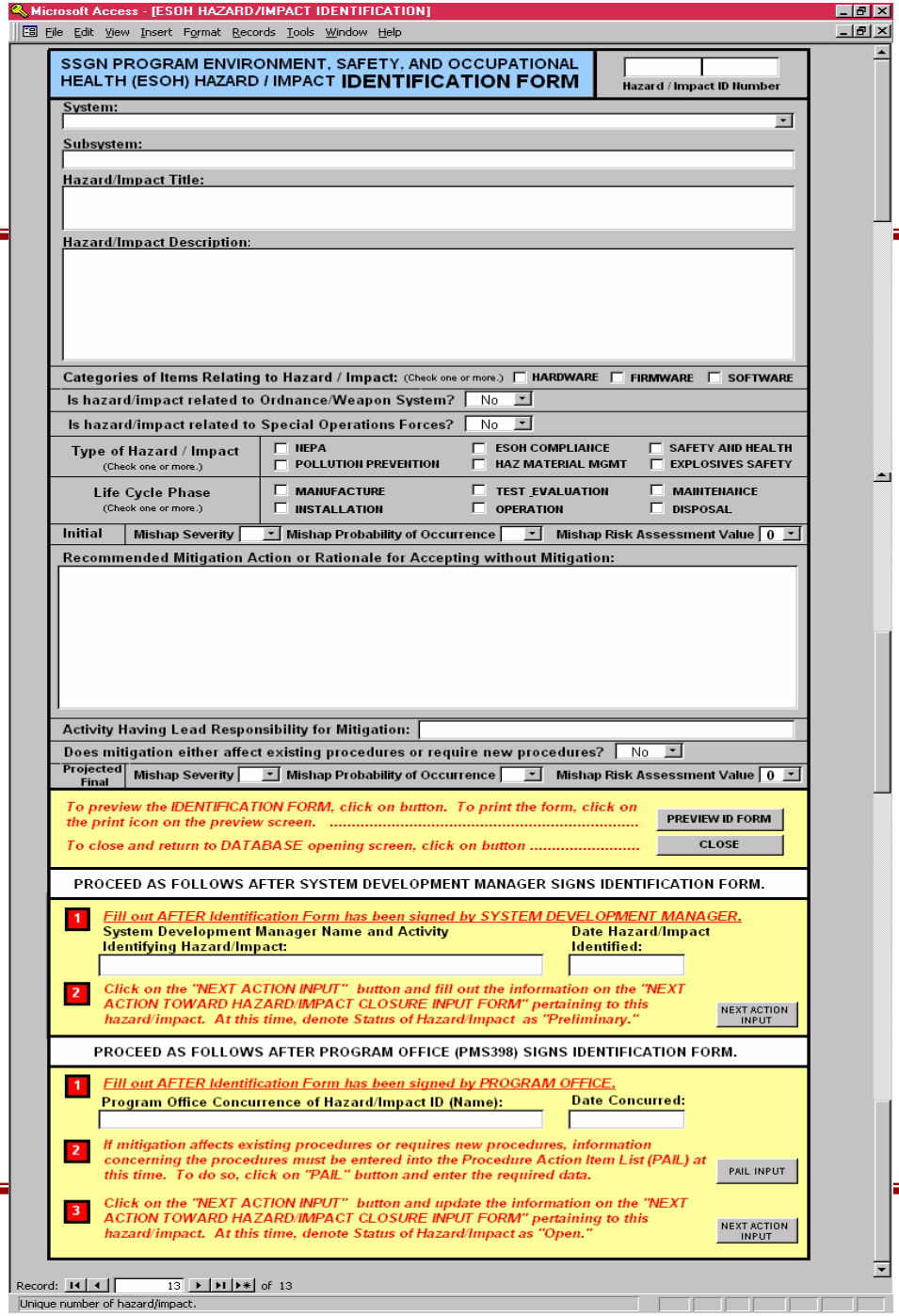
ESOH Hazard / Impact Database

The hazard / impact database is capable of accepting both system safety hazards and environmental impacts on a single unique Hazard/Impact Identification Form.

ESOH Hazard/Impact Identification Form



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ESOH Hazard / Impact Database

The hazard / impact database can generate and print:

- ESOH Hazard/Impact Identification Forms
- ESOH Hazard/Impact Closure Forms
- ESOH Hazard/Impact Status Reports
- ESOH Program Progress Reports

Additionally, the database has the capability of generating customized reports that satisfy the needs of both the system safety and environmental communities.

Success Recognized

DoN 2006 Special Recognition for Excellence in Safety in the Field of Acquisition

"The program emphasizes the integration of safety and environmental engineers into the design/build teams to add the element of objectivity into hazard analyses. This team exemplifies the benefits of the early integration of safety concerns into the acquisition process."

THE SECRETARY OF THE NAVY
WASHINGTON, D.C. 20350-1000

September 6, 2006

MEMORANDUM FOR PROGRAM MANAGER, USS OHIO CLASS SSGN PROGRAM

SUBJECT: Special Recognition for Excellence in Safety in the field of Acquisition

The Department of the Navy 2006 Special Recognition for Excellence in Safety in the Field of Acquisition is presented to the USS OHIO CLASS SSGN Program (PMS398) in recognition of its accomplishments as a leader in promoting acquisition excellence through effective risk management processes and hazard recognition and correction.

In calendar year 2005, the OHIO Class Environmental, Safety, and Occupational Health (ESOH) System Safety Integrated Product Team, including participants from Naval Undersea Warfare Center, Newport Division; General Dynamics, Electric Boat Corporation; and Strategic Systems Programs distinguished itself by providing early identification, elimination, and effective control of system safety hazards and environmental impacts associated with the SSGN Conversion Program.

In 2005 the team closed four Weapons Systems Explosive Safety Review Board (WSERB) findings and completed sixteen analyses and reports in support of a time-compressed program that will provide exceptional capability to the Fleet. In recognition of their exemplary performance the team was nominated for the prestigious David Packard Excellence in Acquisition Award in the category of supporting Secretary of Defense goals, including safety. Accomplishments include:

- Making Safety the responsibility of the design/build teams to ensure application of cognizant engineering expertise;
- Integrating experienced safety and environmental engineers into the design/build teams to add the element of objectivity into hazard analyses;
- Defining applicable safety hazards and environmental impacts and defining and the methods of elimination or mitigation used for resolution; and
- Incorporating SSBN experienced engineers into the design/build teams to identify and resolve any existing safety issues and to implement methods of mitigation in the design and manufacturing of the SSGN.

The USS OHIO CLASS SSGN Program established itself as a leader in making safety an integral part of its organizational culture, and its accomplishments are in keeping with the Department of the Navy's goals and objectives for professional excellence.

Congratulations on a job well done!

Donald C. Winter

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