

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

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**Mike Parulis (for) Thomas Cook**

**&**

**Ricky Milnarik**

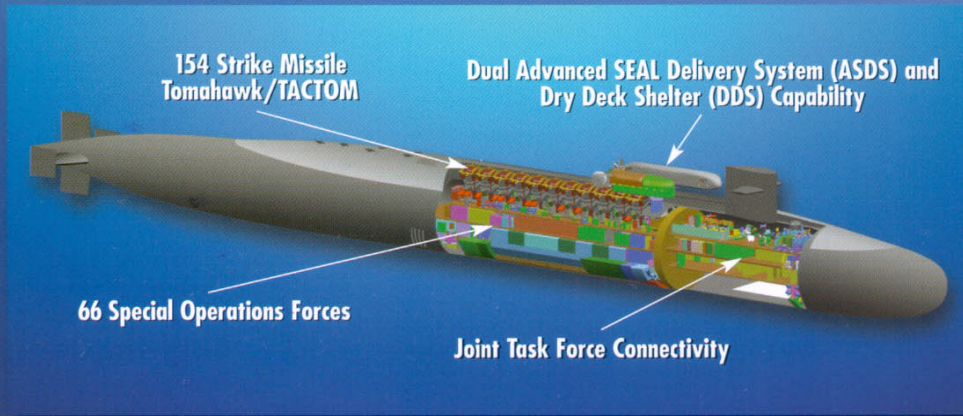
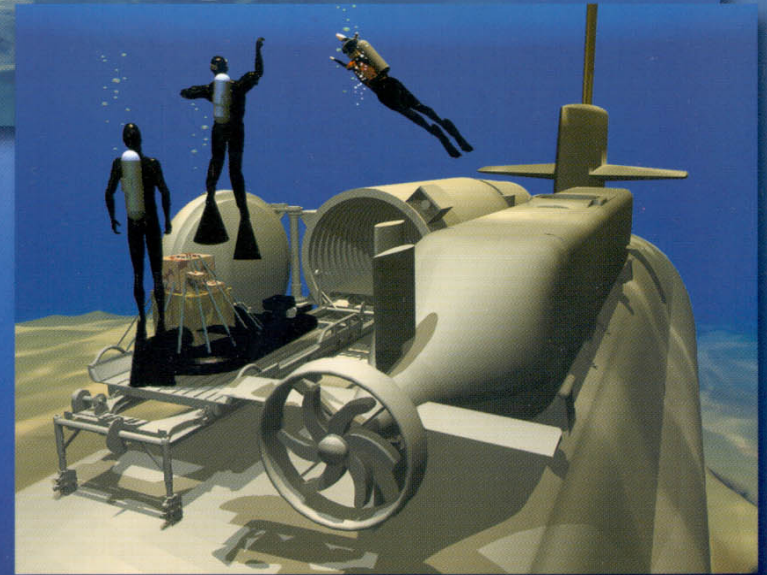
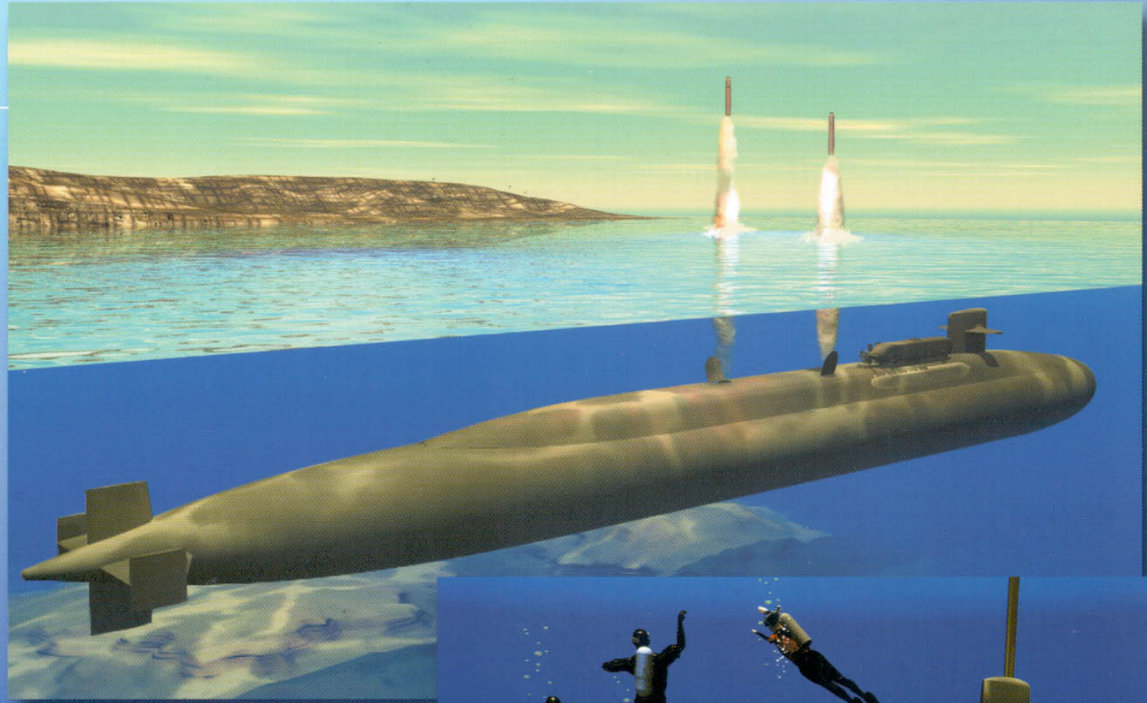


**GENERAL DYNAMICS**  
Electric Boat

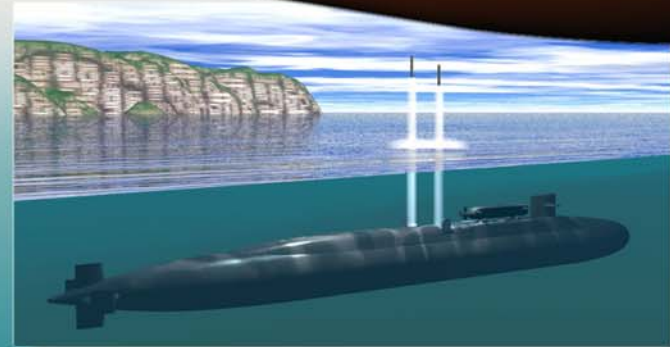
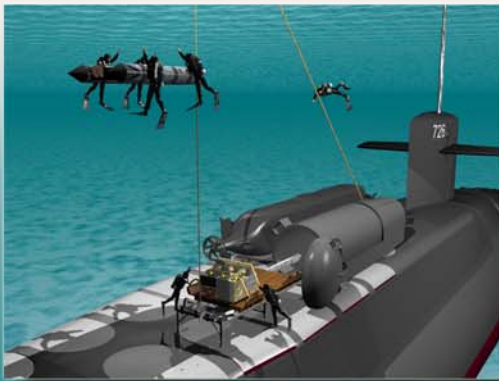
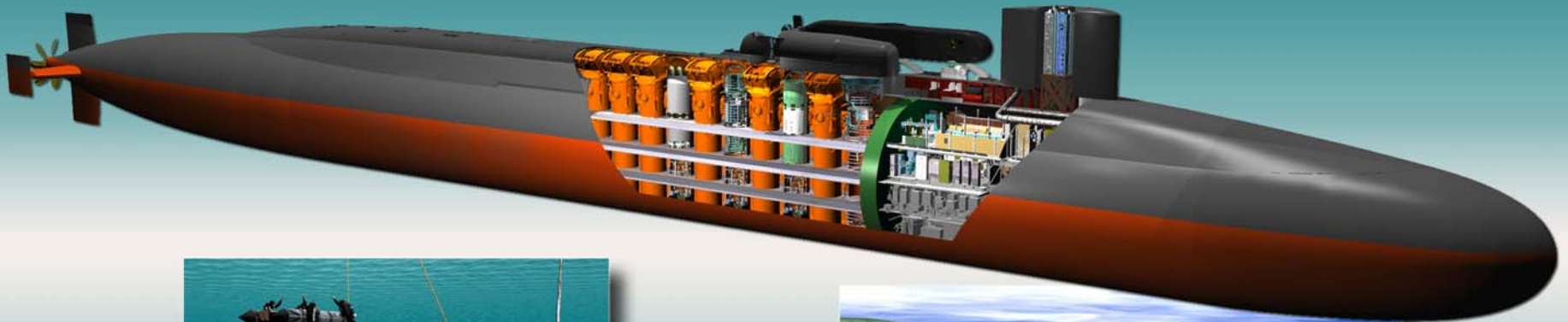
# SSGN

## 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



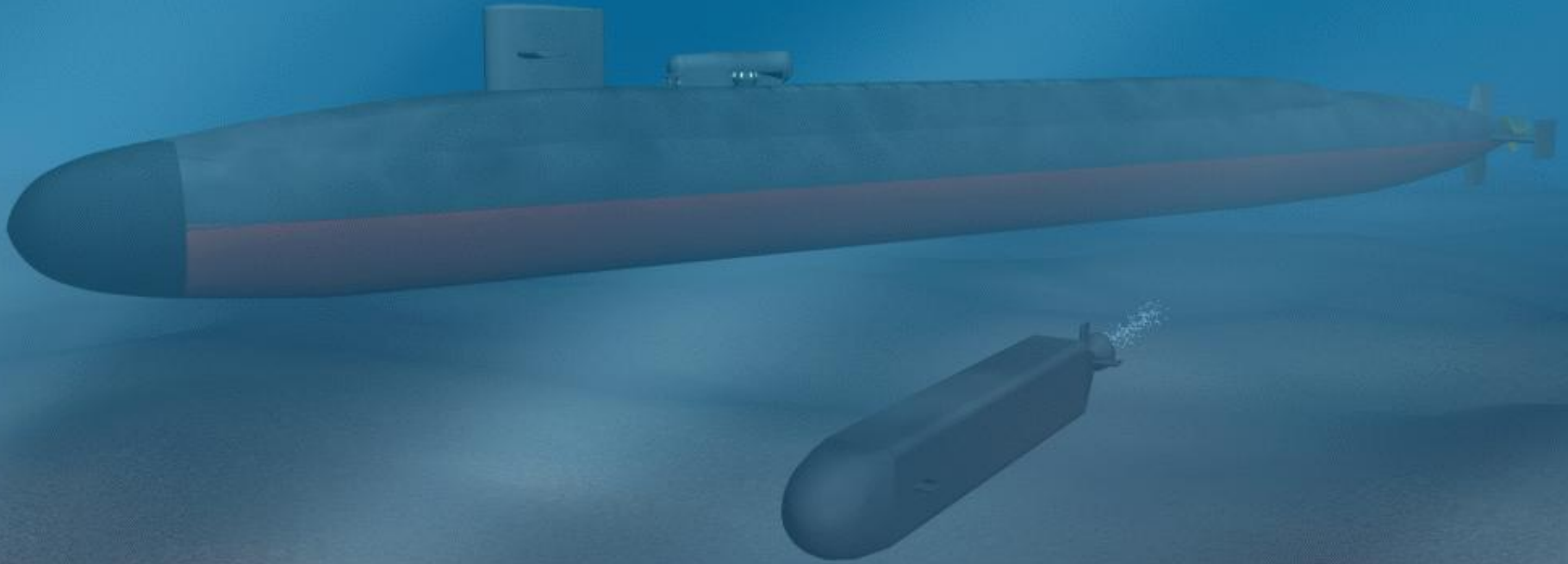
**GENERAL DYNAMICS**  
Electric Boat

# SSGN Conversion

Parallel conversion at Puget Sound Naval Shipyard & Norfolk Naval Shipyard



# A NAVSEA (Program Office) Perspective



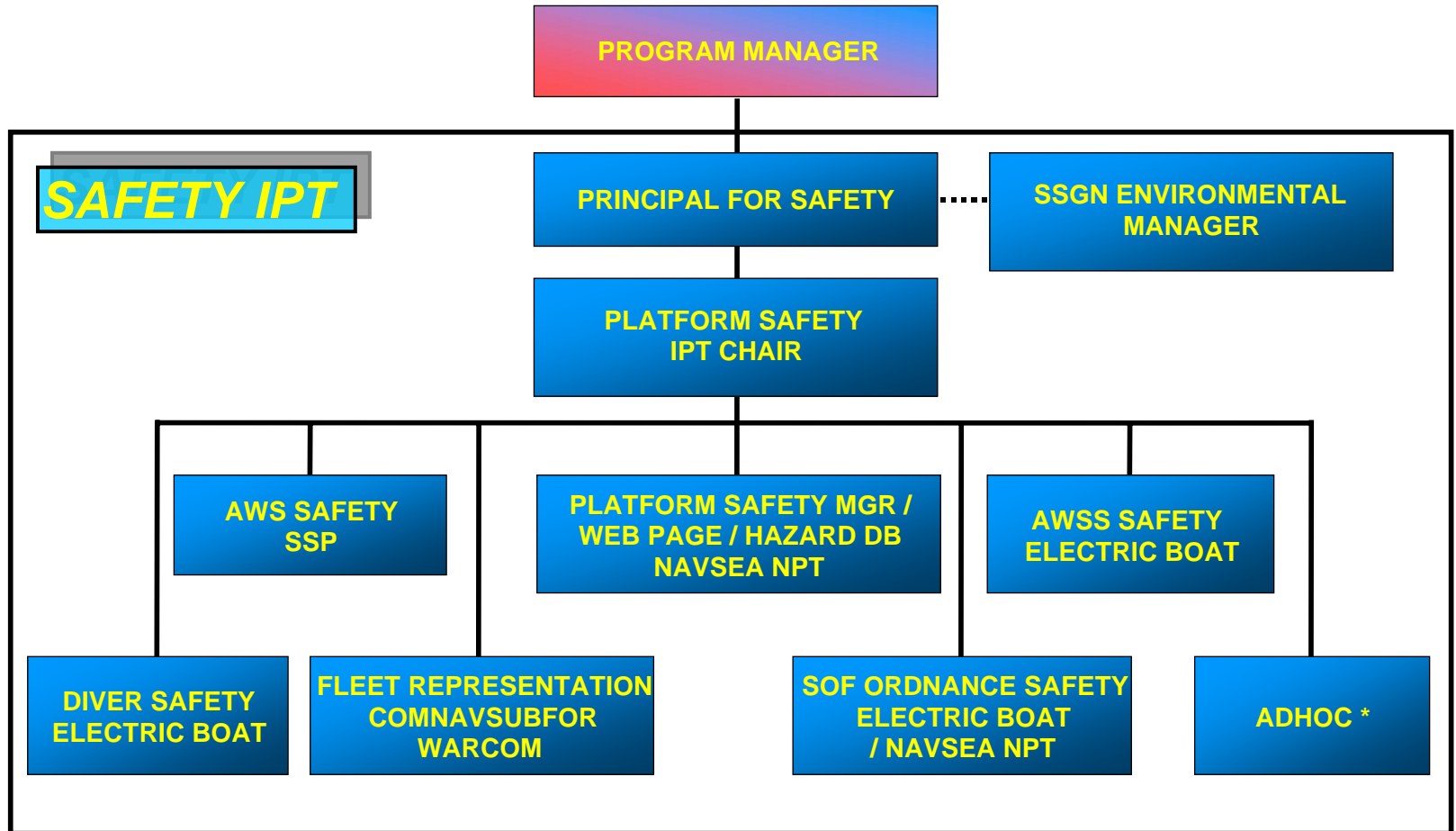
Mike Parulis for Thomas Cook  
NAVSEA PMS398T12G

# Introduction

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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

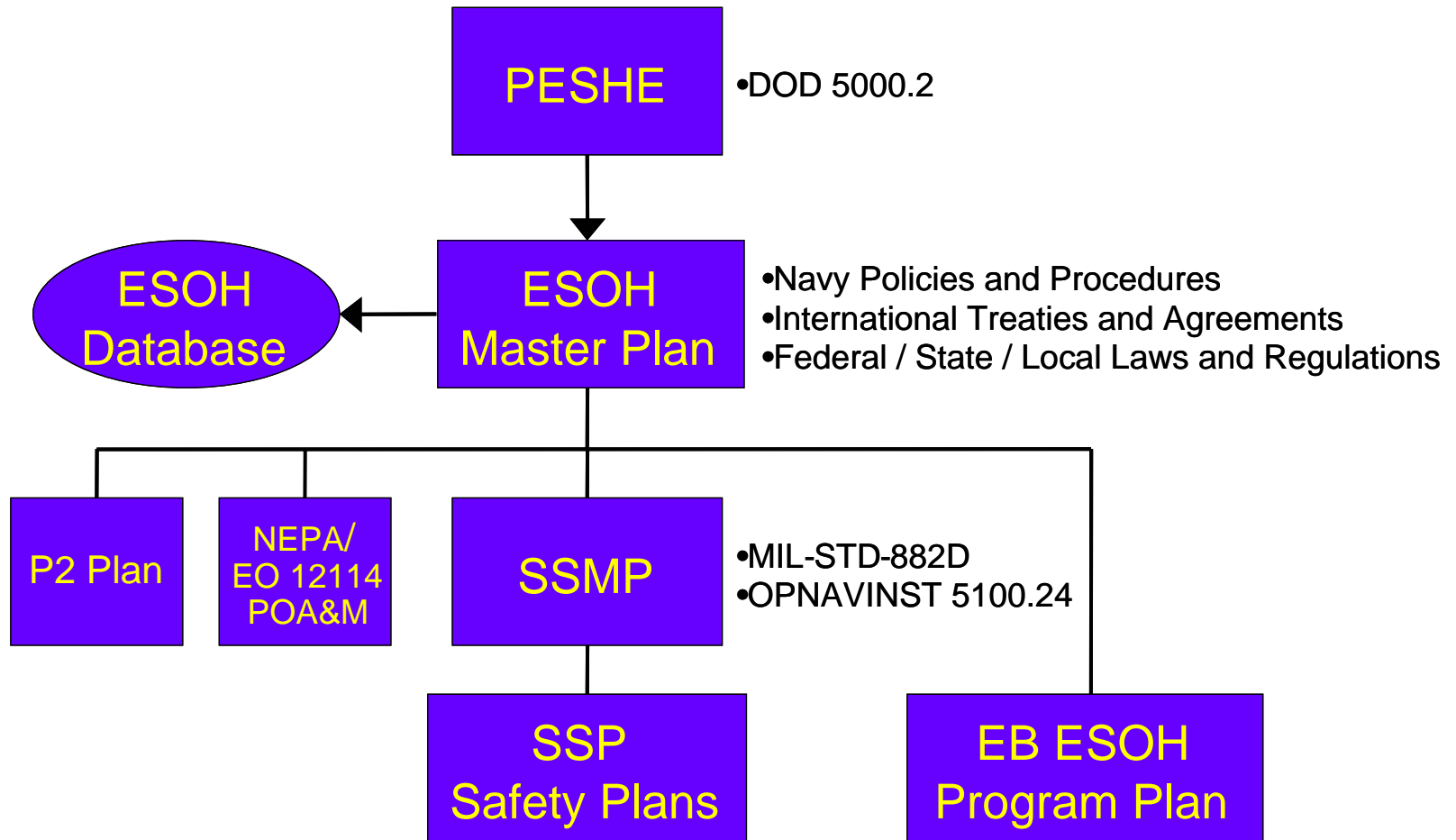
# SSGN Conversion ESOH



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



# 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

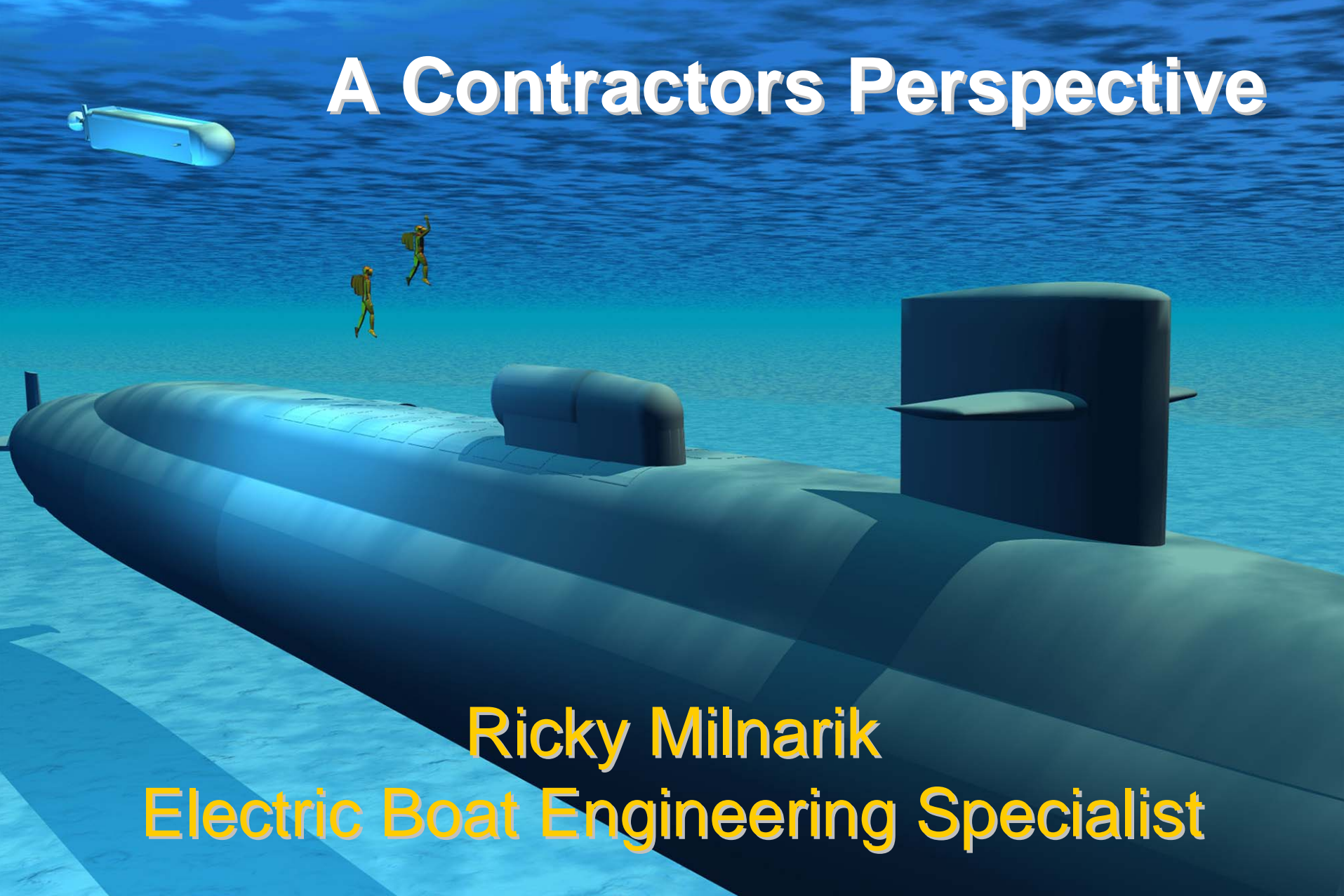
# SSGN Conversion ESOH

- 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 experienced 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**



**GENERAL DYNAMICS**  
Electric Boat

# 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.



# 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)

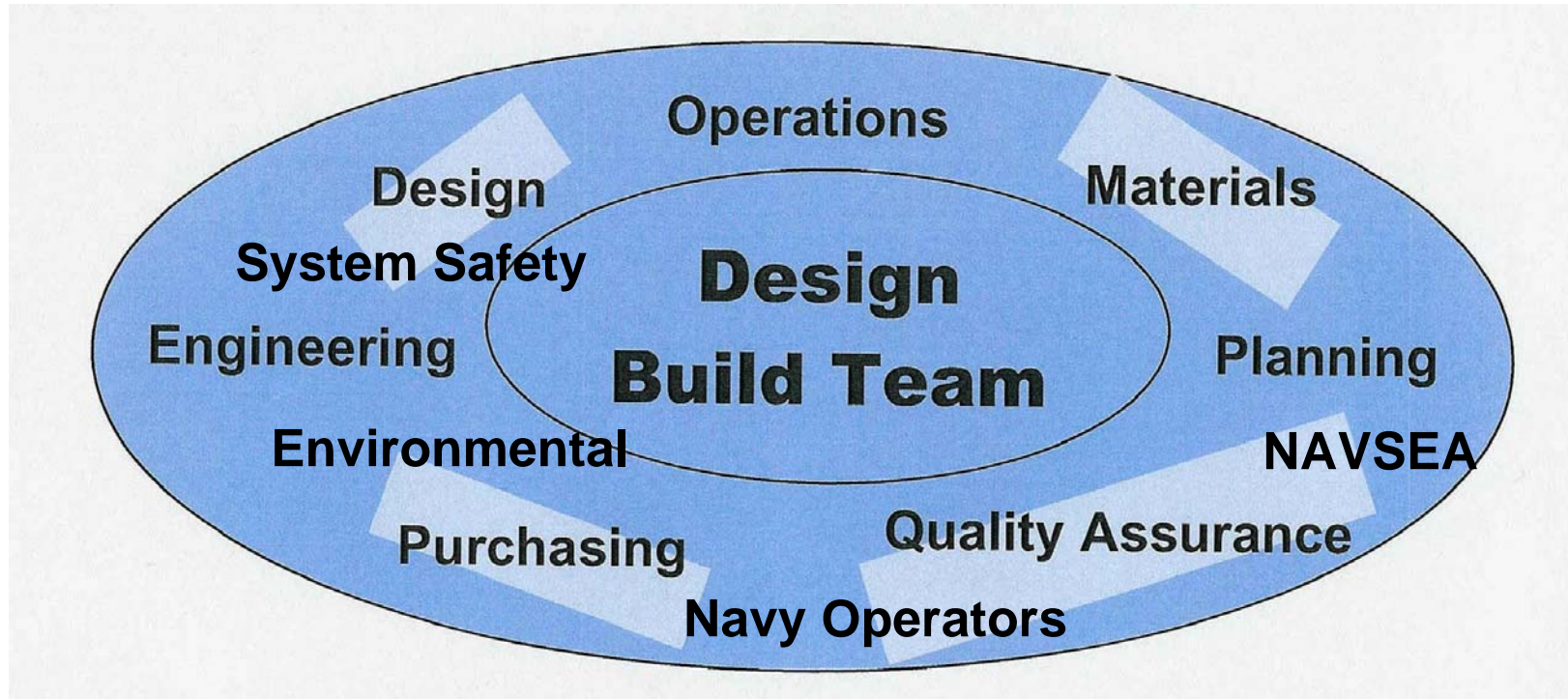
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- Methodology consists of activity-based product management and concurrent engineering Design Build Teams (DBTs).
- Team assignments are structured in accordance with program development and manufacturing needs.



# Design / Build Teams

A typical DBT makeup is shown below



# Design / Build Teams

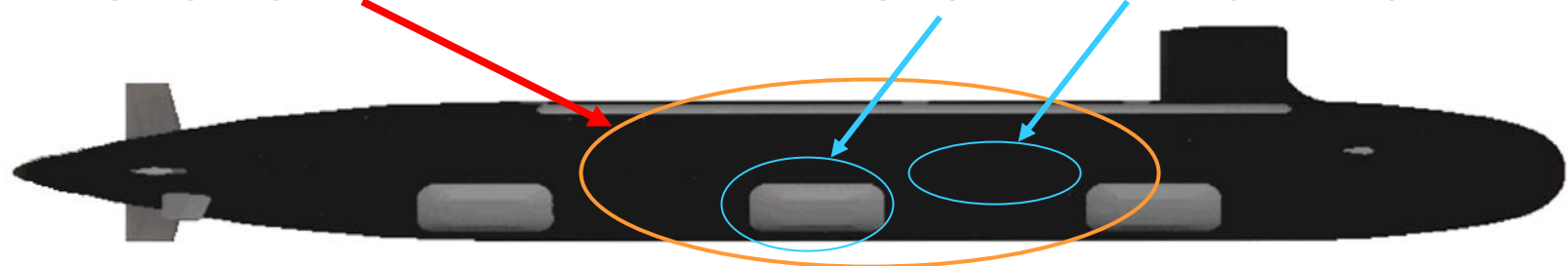
DBT functional managers / technical leaders have direct management and control of their specific functional areas.



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 !

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

**SEPARATE PARALLEL PROCESSES**

# Before SSGN !

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- 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

Microsoft Access - [PRIMARY : Form]

File Edit View Insert Format Tools Window Help

**OHIO CLASS SSGN CONVERSION PROGRAM ENVIRONMENT, SAFETY, AND OCCUPATIONAL HEALTH (ESOH) HAZARD / IMPACT TRACKING DATABASE**  
Version 1.0 Updated: 12 July 2002

**ESOH HAZARD / IMPACT REPORTS**  
(Prelim = Prior to PMS398 Concurrence) (Open + Closed = All)

	<b>ALL SSGN CONVERSION SYSTEMS</b>	Prelim	Open	Closed	All
<b>1000 Series</b>	<b>ATTACK WEAPON SYSTEM</b>	Prelim	Open	Closed	All
<b>2000 Series</b>	<b>ATTACK WEAPON SUPPORT SYSTEMS</b>	Prelim	Open	Closed	All
<b>3000 Series</b>	<b>SOF ORDNANCE STOWAGE AND HANDLING SYSTEM</b>	Prelim	Open	Closed	All
<b>4000 Series</b>	<b>SOF DIVER SUPPORT SYSTEMS</b>	Prelim	Open	Closed	All
<b>5000 Series</b>	<b>OTHER SYSTEMS AND EQUIPMENT</b>	Prelim	Open	Closed	All
	<b>ALL ORDNANCE/WEAPON SYSTEM RELATED</b>	Prelim	Open	Closed	All
	<b>ALL SOF SUPPORT SYSTEMS RELATED</b>	Prelim	Open	Closed	All
	<b>SSGN CONVERSION SYSTEM SOFTWARE</b>	Prelim	Open	Closed	All
	<b>SSGN ENVIRONMENTAL MANAGER'S REPORT</b>	Prelim	Open	Closed	All
	<b>SSGN SAFETY MANAGER'S REPORT</b>	Prelim	Open	Closed	All
	<b>PROCEDURE ACTION ITEM LIST (PAIL)</b>	By Document	By ESOH ID No.	Document Schedule	

**For Analyst / Program Office Use Only**

**DATA INPUT AND FORM GENERATION**

IDENTIFICATION FORM

CLOSURE FORM

NEXT ACTION INPUT

PAIL DOCUMENT DATES

EXIT

Design View

# ESOH Hazard / Impact Database

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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

Microsoft Access - [ESOH HAZARD/IMPACT IDENTIFICATION]

File Edit View Insert Format Records Tools Window Help

**SSGN PROGRAM ENVIRONMENT, SAFETY, AND OCCUPATIONAL HEALTH (ESOH) HAZARD / IMPACT IDENTIFICATION FORM** Hazard / Impact ID Number

System: \_\_\_\_\_

Subsystem: \_\_\_\_\_

Hazard/Impact Title: \_\_\_\_\_

Hazard/Impact Description: \_\_\_\_\_

Categories of Items Relating to Hazard / Impact: (Check one or more.)  HARDWARE  FIRMWARE  SOFTWARE

Is hazard/impact related to Ordnance/Weapon System?  No

Is hazard/impact related to Special Operations Forces?  No

Type of Hazard / Impact (Check one or more.)  NEPA  ESOH COMPLIANCE  SAFETY AND HEALTH  
 POLLUTION PREVENTION  HAZ MATERIAL MGMT  EXPLOSIVES SAFETY

Life Cycle Phase (Check one or more.)  MANUFACTURE  TEST EVALUATION  MAINTENANCE  
 INSTALLATION  OPERATION  DISPOSAL

Initial \_\_\_\_\_ Mishap Severity \_\_\_\_\_ Mishap Probability of Occurrence \_\_\_\_\_ Mishap Risk Assessment Value

Recommended Mitigation Action or Rationale for Accepting without Mitigation: \_\_\_\_\_

Activity Having Lead Responsibility for Mitigation: \_\_\_\_\_

Does mitigation either affect existing procedures or require new procedures?  No

Projected Final \_\_\_\_\_ Mishap Severity \_\_\_\_\_ Mishap Probability of Occurrence \_\_\_\_\_ Mishap Risk Assessment Value

To preview the IDENTIFICATION FORM, click on button. To print the form, click on the print icon on the preview screen.

To close and return to DATABASE opening screen, click on button .....

PROCEED AS FOLLOWS AFTER SYSTEM DEVELOPMENT MANAGER SIGNS IDENTIFICATION FORM.

**1** Fill out AFTER Identification Form has been signed by SYSTEM DEVELOPMENT MANAGER.  
 System Development Manager Name and Activity \_\_\_\_\_ Date Hazard/Impact Identified: \_\_\_\_\_  
 Identifying Hazard/Impact: \_\_\_\_\_

**2** Click on the "NEXT ACTION INPUT" button and fill out the information on the "NEXT ACTION TOWARD HAZARD/IMPACT CLOSURE INPUT FORM" pertaining to this hazard/impact. At this time, denote Status of Hazard/Impact as "Preliminary."

PROCEED AS FOLLOWS AFTER PROGRAM OFFICE (PMS398) SIGNS IDENTIFICATION FORM.

**1** Fill out AFTER Identification Form has been signed by PROGRAM OFFICE.  
 Program Office Concurrence of Hazard/Impact ID (Name): \_\_\_\_\_ Date Concurred: \_\_\_\_\_

**2** If mitigation affects existing procedures or requires new procedures, information concerning the procedures must be entered into the Procedure Action Item List (PAIL) at this time. To do so, click on "PAIL" button and enter the required data.

**3** Click on the "NEXT ACTION INPUT" button and update the information on the "NEXT ACTION TOWARD HAZARD/IMPACT CLOSURE INPUT FORM" pertaining to this hazard/impact. At this time, denote Status of Hazard/Impact as "Open."

Record: 13 of 13  
 Unique number of hazard/impact: \_\_\_\_\_



# ESOH Hazard / Impact Database

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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 SECRETARY OF THE NAVY  
WASHINGTON, D. C. 20380-1000

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



“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.”