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

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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
SSGN Conversion

Parallel conversion at Puget Sound Naval Shipyard & Norfolk Naval Shipyard
A NAVSEA (Program Office) Perspective

Mike Parulis for Thomas Cook
NAVSEA PMS398T12G
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 / WESRB, Legacy, Shipboard Shock, Packaging, Handling and Transportation)
SSGN Conversion ESOH

- PESHE
  - DOD 5000.2

- ESOH Master Plan
  - Navy Policies and Procedures
  - International Treaties and Agreements
  - Federal / State / Local Laws and Regulations

- ESOH Database

- P2 Plan

- NEPA/EO 12114 POA&M

- SSMP
  - MIL-STD-882D
  - OPNAVINST 5100.24

- SSP Safety Plans

- EB ESOH Program Plan
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
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)

- 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.
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.
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 (DBEAs) on identified ship systems.
Before SSGN!

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

[Image of the ESOH Hazard / Impact Database software interface]

NAVSEA
NAVAL SEA SYSTEMS COMMAND

L DYNAMICS
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
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.
“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.”