A Case Study of an Evolving ESOH Program – One Company's Perspective

A Presentation By:

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October 27, 2010

Presentation Agenda

- Objective
- Background Information
- An Evolving ESOH Program
- What…How…Who
- Examples
- Achievements
- Summary

Presentation Objectives

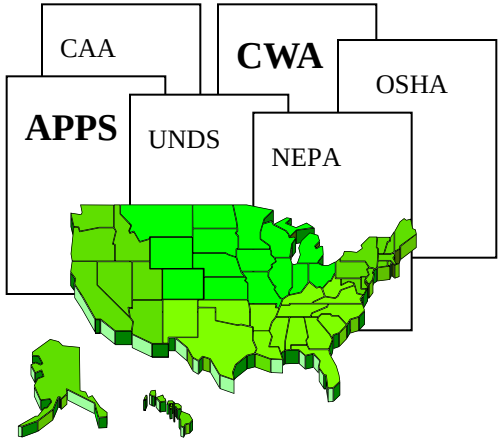
- **Illustrate the evolution of the environment, safety & occupational health (ESOH) discipline and its place within Electric Boat.**

- **Emphasize that ESOH is part of an integrated systems approach, involving ESOH engineers, as well as shipyard, design and engineering organizations.**

- **Demonstrate, through a few examples, that ESOH is a natural fit in the Human System Integration (HSI) domain.**

Background Information
Laws & Regulations Flowdown

Laws & Regulations



Department of Defense

INSTRUCTION

NUMBER 5000.02
December 8, 2008

USD(AT&L)

SUBJECT: Operation of the Defense Acquisition System

- **Ship Specifications**
- **Contract Requirements**
- **Program-specific HSI and ESOH Plans**

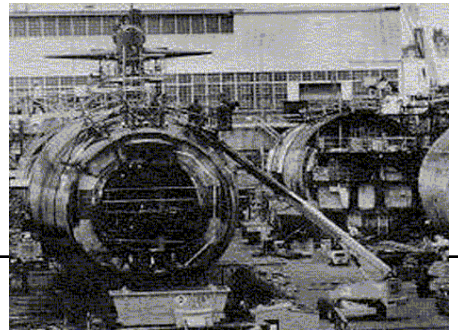
Background Information
The Life Cycle Approach

Operations

Manufacturing and Construction

DESIGN/BUILD/SUSTAIN

Maintenance and Overhaul



Ship and System Recycling/Disposal

Background Information - HSI Domains

Equips warfighters with the needed knowledge, skills & abilities

Training

Personnel Survivability

Provides that the warfighter will have all personal protection needed

Human Factors

Ensures that all aspects of the system are designed with full consideration of the inherent capabilities and limitations of the warfighter

Ensures that all aspects of the living and working spaces are designed with the warfighter in mind

Habitability

Environment

Design features that minimize the risks of illness, disability or death, and enhance job performance and productivity of the personnel that operate, maintain or support the system

Addresses all aspects of defining requirements for personnel as well as obtaining and retaining those individuals

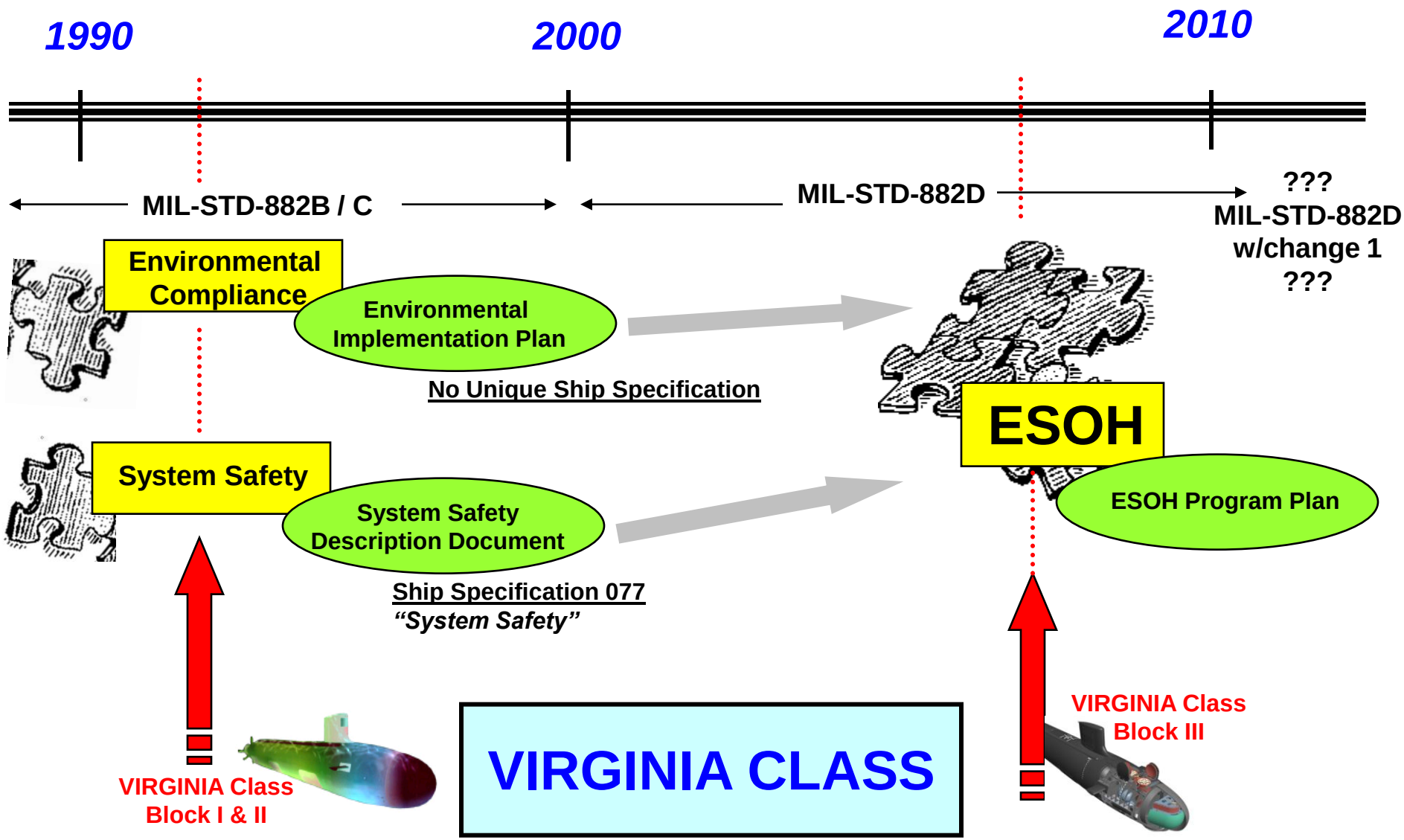
Personnel

Manpower

System Safety

Occupational Health

An Evolving ESOH Program – Overall Program Level Focus



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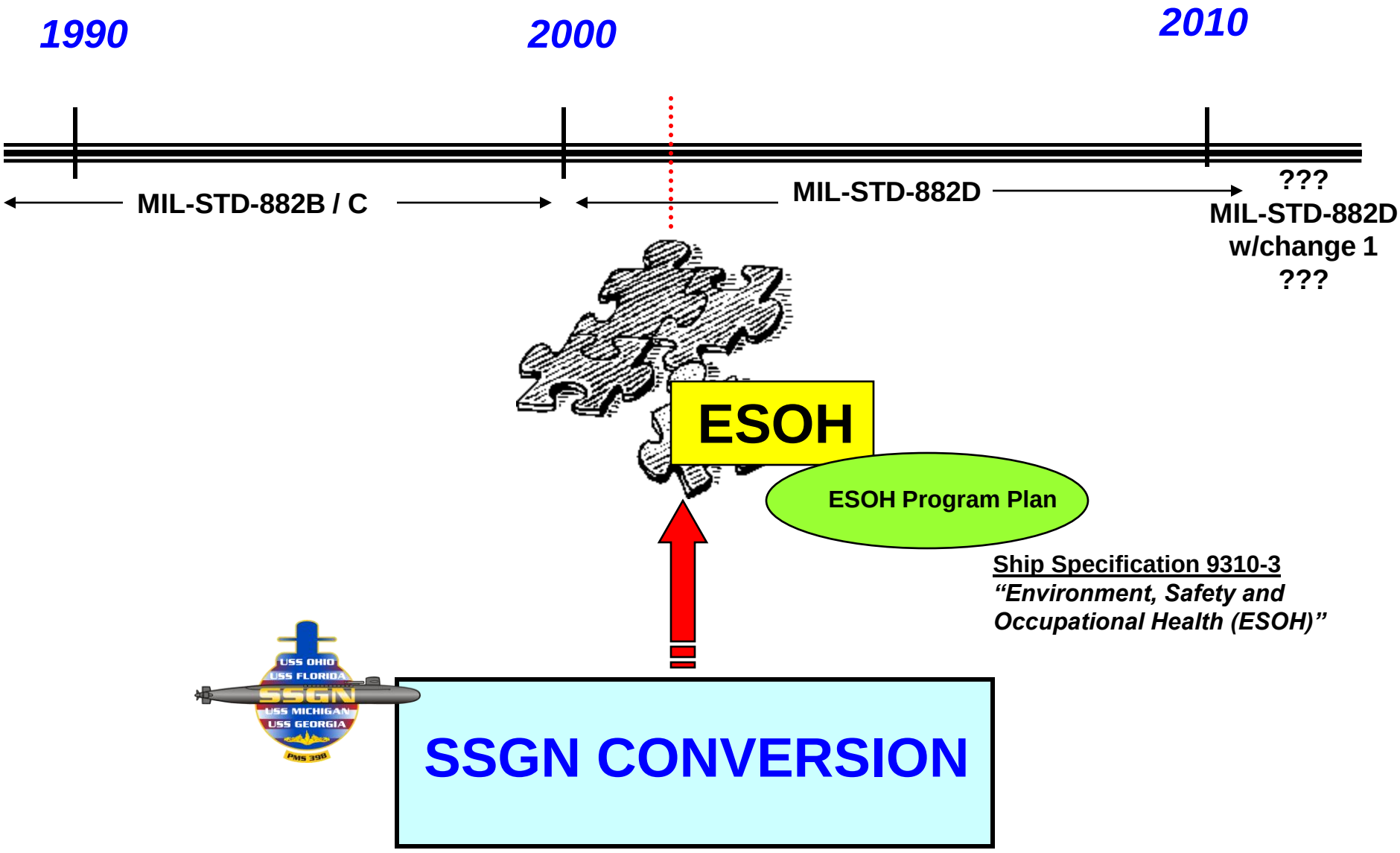

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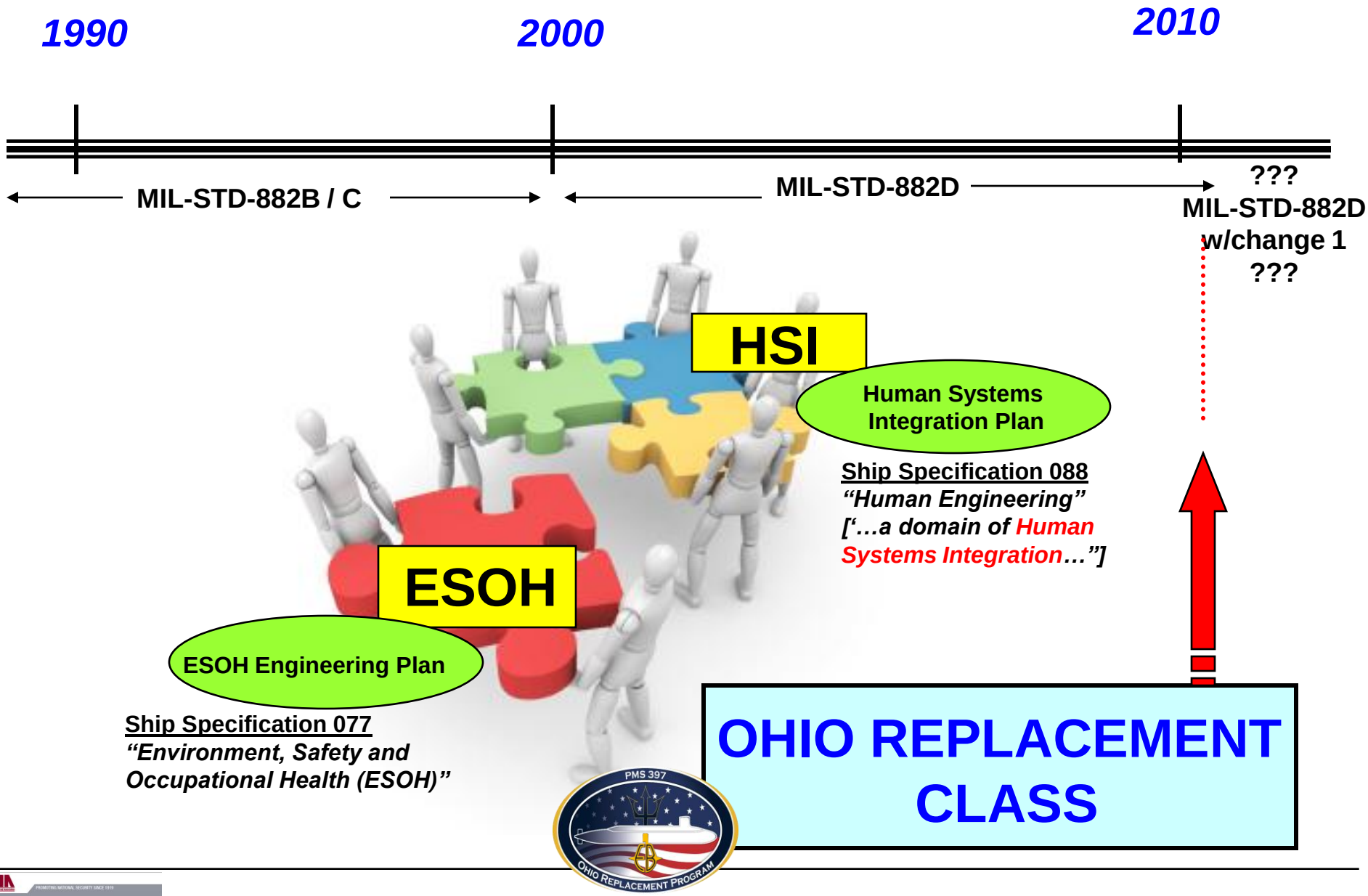
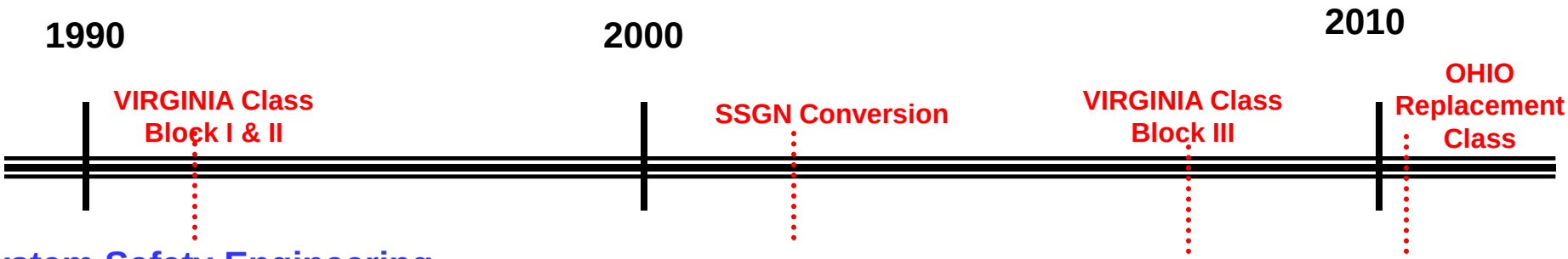


An Evolving ESOH Program – Organizational Structure



System Safety Engineering

D495 – TRIDENT Planning

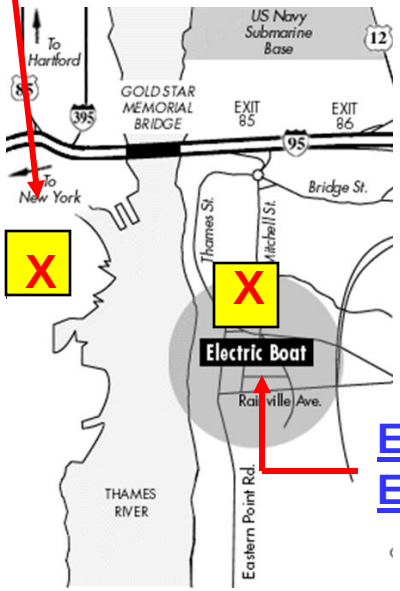
D428 – Electrical System Design

D411 – Life Cycle Engineering

Life Cycle Engineering

> Human System Engineering Programs

> RMA & ESOH



Human Factors Engineering

D427 – Power & Auxiliary System

D411 – Life Cycle Engineering

Environmental Engineering

D470 - Life Cycle Support

ESOH Engineering

ESOH Engineers are integrated into Design/Build/Sustain Teams to provide the ESOH perspective to help design out potential safety hazards and environmental impacts early in the design process.

Here's What ESOH Engineering Does…

Minimize / Eliminate Safety Hazards & Environmental Impacts:

- Carcinogens (lead, cadmium, beryllium, Cr^{+6})
- Mechanical/electrical/acoustic shock
- Ozone Depleting Substances -ODSs- (freon, 1,1,1-trichloroethane)
- Slips/trips/falls
- Volatile Organic Compounds -VOCs- (e.g., toluene, MEK, trichloroethylene)
- Ordnance detonation
- Toxic off-gassing products
- Unguarded rotating machinery

The Earlier in the Design that Hazards are Identified, the Easier it is to Implement Change in the Design

Here's How We Make It Happen...

Participate In Design Reviews and Product Development

Perform Hazard Analyses in Accordance With MIL-STD-882D

- Construction & Vendor Dwgs
- System Diagrams
- Test Procedures
- Standard Parts Library
- Tech Manuals & Ship System Manuals
- Planning Yard Alteration Work Packages

This Process Supports All Submarine Classes and Development Projects

Here's How We Make It Happen...

ESOH Filter Includes:

- Ship Spec Requirements
- NAVSEA Lists of Hazardous Materials
- Submarine Atmosphere Control Manual (ACM) Requirements
- Electric Boat SP 7-20 (Chemical Risk Reduction)
- Ammunition and Explosives Safety Regulations
- Human Engineering Design Standard Practice
- Weapon System Safety Guidelines Handbook

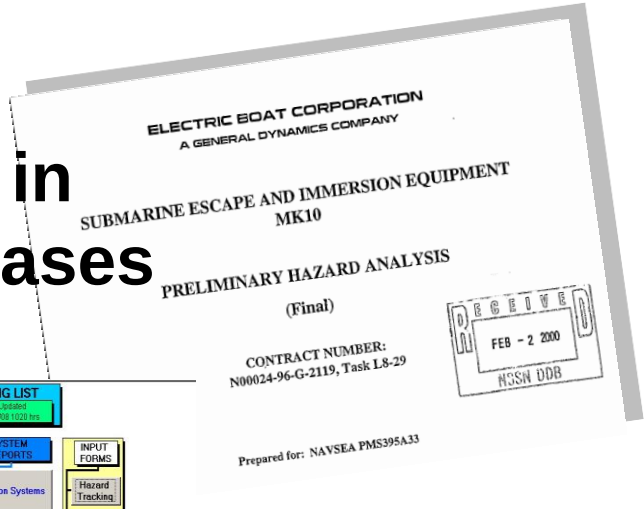
Identify ESOH Hazards and Mitigating Actions

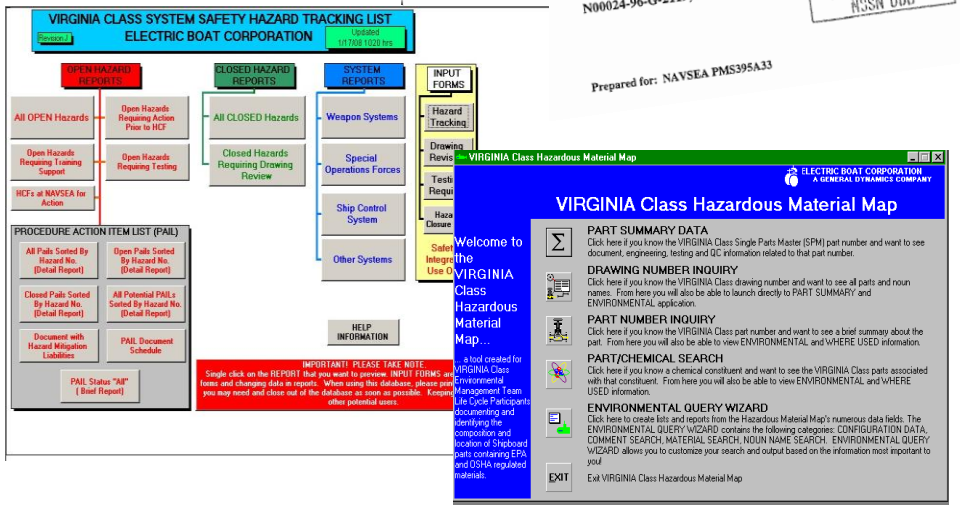
- Environmental Impacts
- Safety Hazards

Here's How We Make It Happen...

Implement Mitigating Changes to Designs and Procedures

Document Results in Reports and Databases





Eliminate ESOH Hazards

- Unsafe Conditions
- Toxic Exposures
- HazMat Disposal

Example #1: Procedural Improvement

PROBLEM

Existing Tech Manual (TM) had No Beryllium Warning

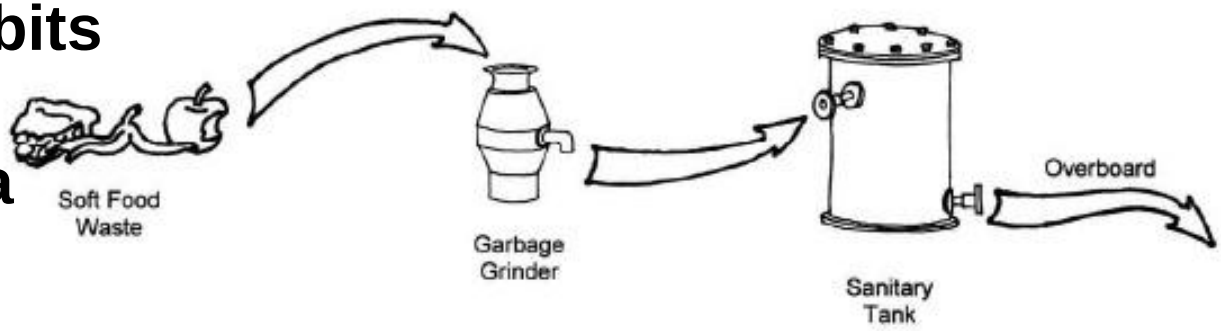
- ↗ VIRGINIA & SSGN hazmat
- ↗ DoD "Emerging Contaminant"
- ↗ Carcinogen

SOLUTION

During TM Revision, Added "WARNING" Statements at Each Step Involving Work on Beryllium Piece Parts

Example #2: VIRGINIA Class Plastics Waste Stowage

The Act to Prevent Pollution from Ships (APPS) Prohibits Navy Submarines from Disposing Plastics at Sea After December 31, 2008.



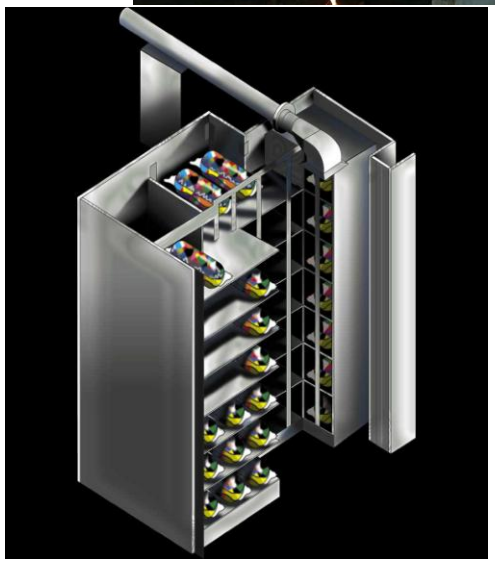
Stowage of Plastics Waste Creates a Potential Fire Safety Risk Due to the Concentration of the Plastics Waste Becoming Fire Sustaining Fuel.

Example #2: VIRGINIA Class Plastics Waste Stowage (Cont'd)

Testing was Performed to Assess Fire Characteristics of Burning Bags Filled With Plastics Waste

A Fire Risk Assessment per MIL-STD-882 was Performed

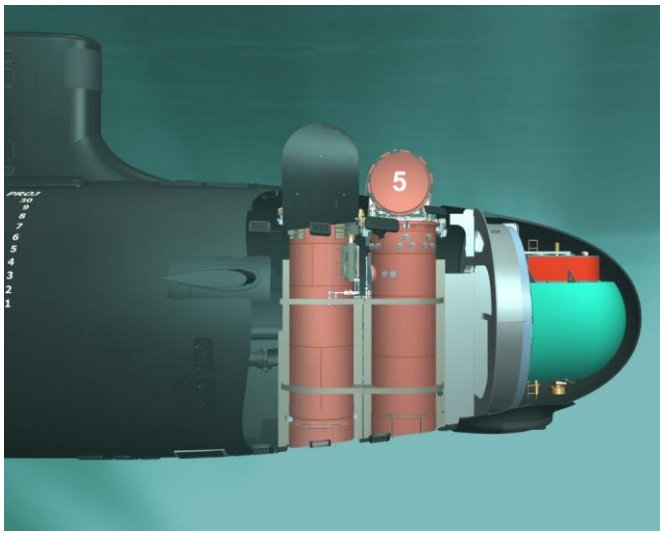
- No additional design changes were recommended in the stowage arrangement in the environmental space
- The risk was considered acceptable by the Fire Fighting System Design/Build Team and the NAVSEA Program Office.

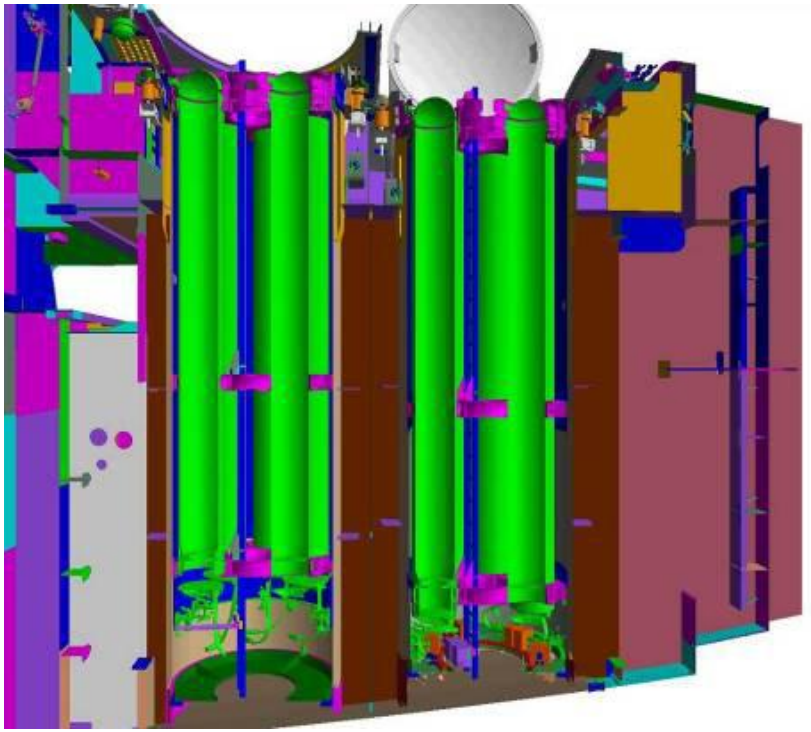


Example #3: VIRGINIA Payload Tube (VPT) Multiple All-Up-Round Canister (MAC) Center Access Ladder

Confined Space Safety Issues (Limited Access to Equipment and No Outside Ventilation) Documented in the VPT Preliminary Hazard Analysis (PHA).

No Access to the Payload Tubes From Inside the Ship Like SSGN Class





Example #3: VPT MAC Center Access Ladder (Cont'd)

Hazard Mitigation Includes:

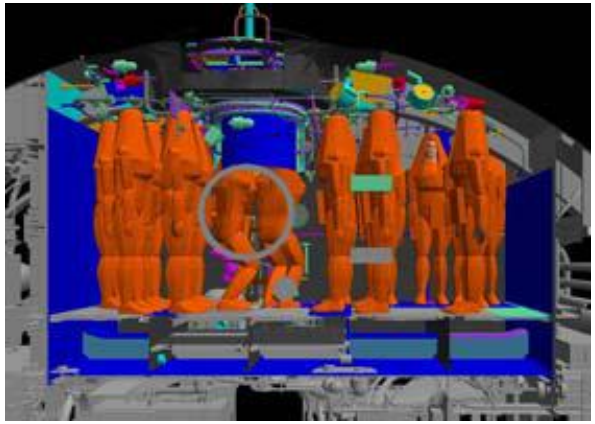
Demonstrating Accessibility to Vital Equipment (Full Scale Wooden Mock-up)

Providing Continuous Forced Air Ventilation to the VPT Through a Custom-built Center Cell Ladder

Example #4: Submarine Escape

Preliminary Hazard Analysis (PHA) on the Submarine Escape and Immersion Equipment (SEIE) MK 10 Made the Following Recommendation:

"Provide realistic MK10 S.E.I.E. pressurized ascent training for the submarine crews."



Example #4: Submarine Escape (Cont'd)

That Recommendation Resulted in Construction of the New Submarine Escape Trainer at SUBASE New London.

ESOH Program Achievements

A Successful Team Approach has resulted in:

- **1995-1997 Environmental Security Awards - VIRGINIA Class Excellence in Pollution Prevention by a Weapon System Acquisition Program (NAVSEA/CNO/DoD/DON)**
- **1998 EPA Stratospheric Ozone Protection Award to VIRGINIA Class Program**
- **2006 Dept of Navy Special Recognition for Excellence - awarded to SSGN ESOH Integrated Product Team**
- **2007 International System Safety Conference Award for Best Paper – "Anatomy of an Award Winning Safety Program: A Case Study of the SSGN OHIO Class Conversion Safety Program"**

ESOH Success Recognized

Special Recognition by the Navy 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."

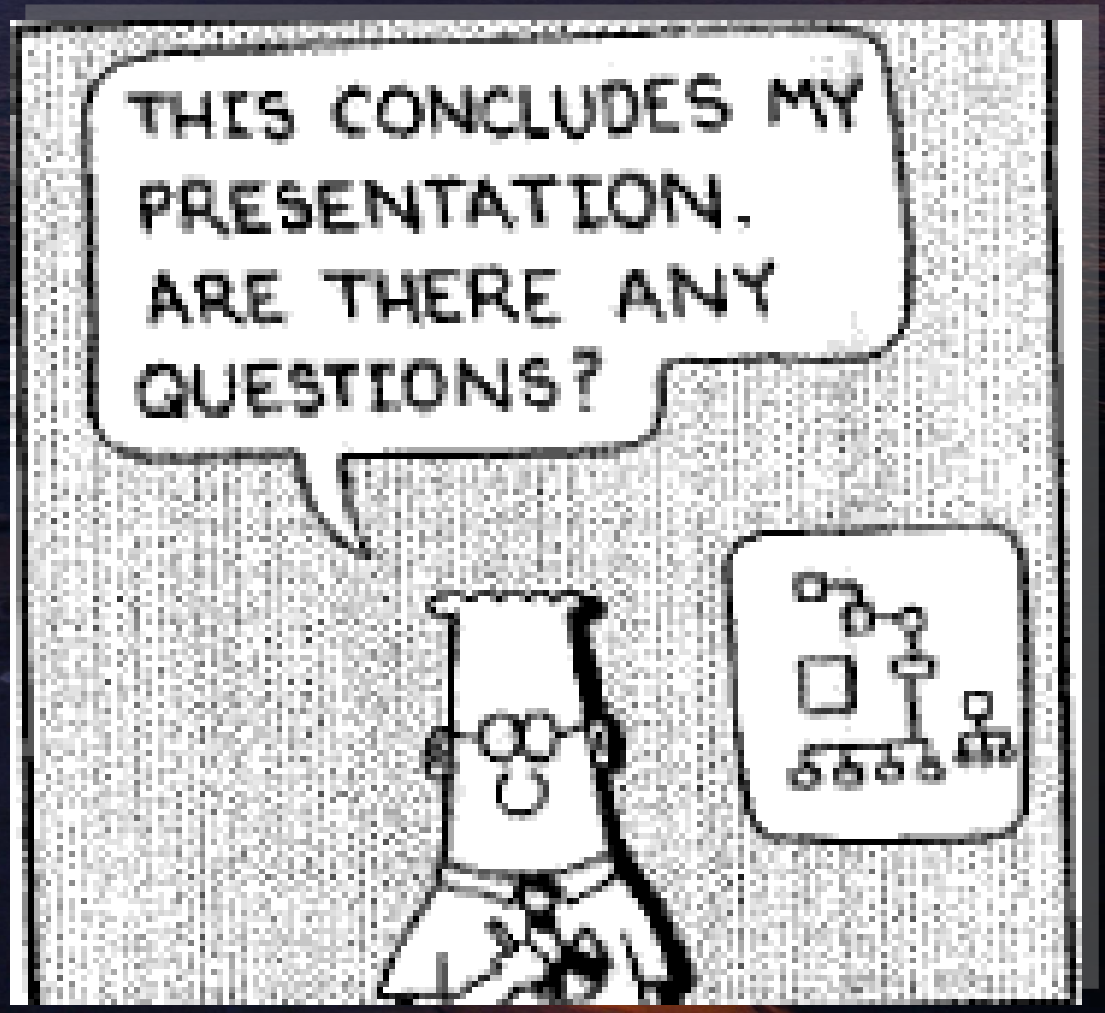
Hon. Donald C. Winter, Secretary of the Navy

September 2006

Summary

- **Performed ESOH tasks in a variety of successful projects and programs**
- **Successfully integrated environmental considerations into the System Safety approach described in MIL-STD-882D (DoD Standard Practice for System Safety)**
- **Continue to interface with Shipyard Safety, Fire Dept., Industrial Hygiene, vendors, Environmental Resources Management, and Design/Build/Sustain teams in ESOH tasks**

ESOH is Part of the Integrated Systems Engineering Approach and Incorporates HSI Requirements


THIS CONCLUDES MY PRESENTATION. ARE THERE ANY QUESTIONS?