EXPEDITIONARY FIGHTING VEHICLE

ESOH Integration into System Engineering

NDIA Conference 24-27 October 2005

PURPOSE

Highlight the Challenges of Integrating

ESOH

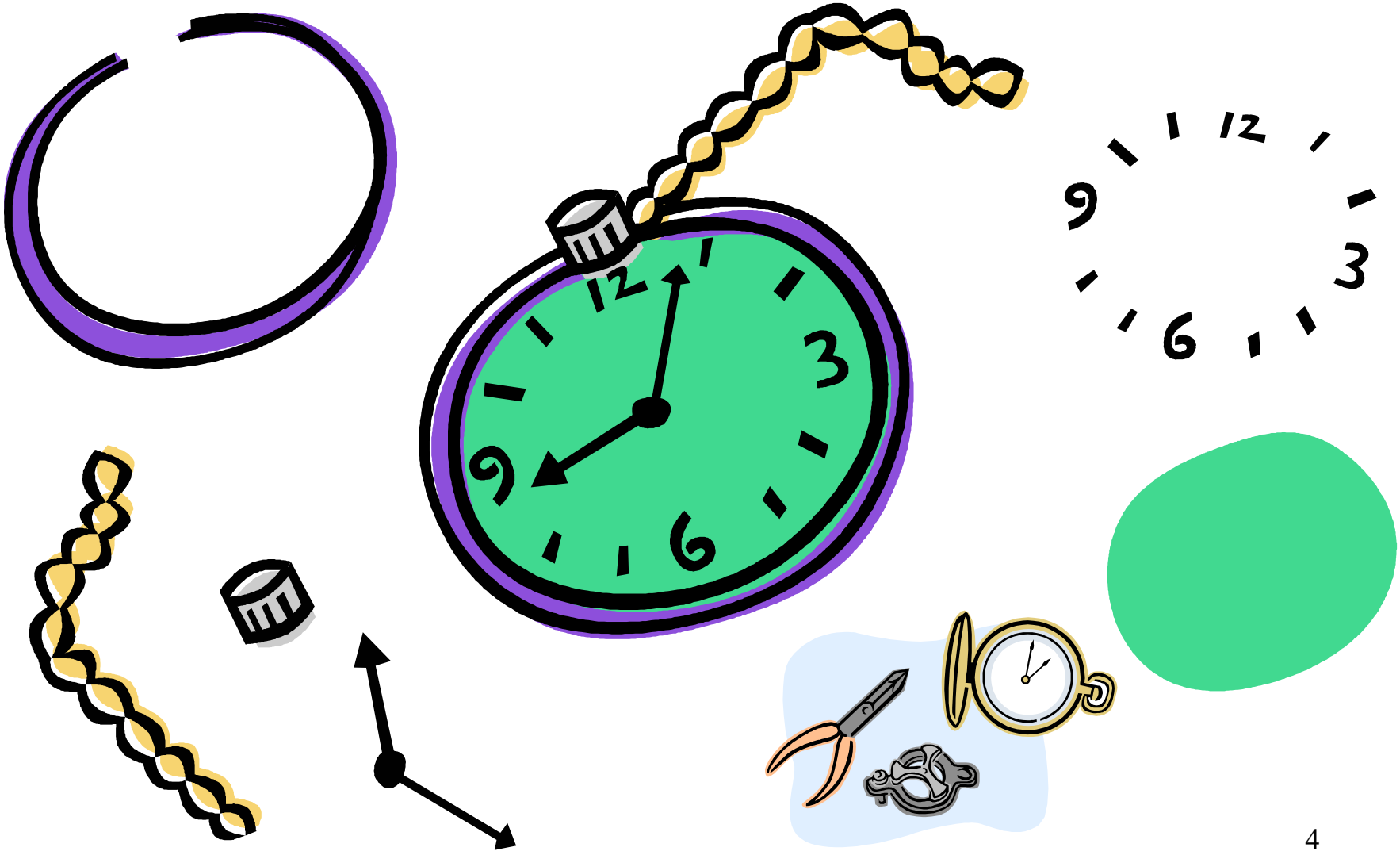
into the

Systems Engineering Acquisition process

KEY POINT

IT CAN BE DONE

BUILDING A WATCH



EXPEDITIONARY FIGHTING VEHICLE

EFV(P)

EFV(C)

MISSION ESSENTIAL FUNCTIONS

Move (Land)

Move (Water)

Shoot

Communicate

Carry

Protect

EFV MISSION

Provide High Speed Transport of Embarked Marine Infantry From Ships Located Beyond the Horizon to Inland Objectives

Provide Armor Protected Land Mobility and Direct Fire Support During Combat Operations

EFV DEVELOPMENT

FY95 - FY01
Program Development & Risk Reduction (PDRR)

1st Generation Prototypes

Integrated Functionality, Full Up System

Design Cycles

1st Gen Prototypes

FY01 - FY06
System Development & Demonstration (SDD)

2nd Generation Prototypes

Mature the Design, Prepare for Production

2nd Gen Prototypes

Milestone C

Sept 06
MS - C

FY07 – FY10
Production Readiness & Low Rate Initial Production (LRIP)

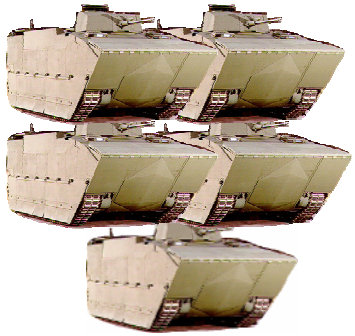
Low Rate Initial Production Vehicles

Full-Up System Live Fire, Initial Operational Test & Evaluation

LRIP

FY11 – FY20
Full Rate Production

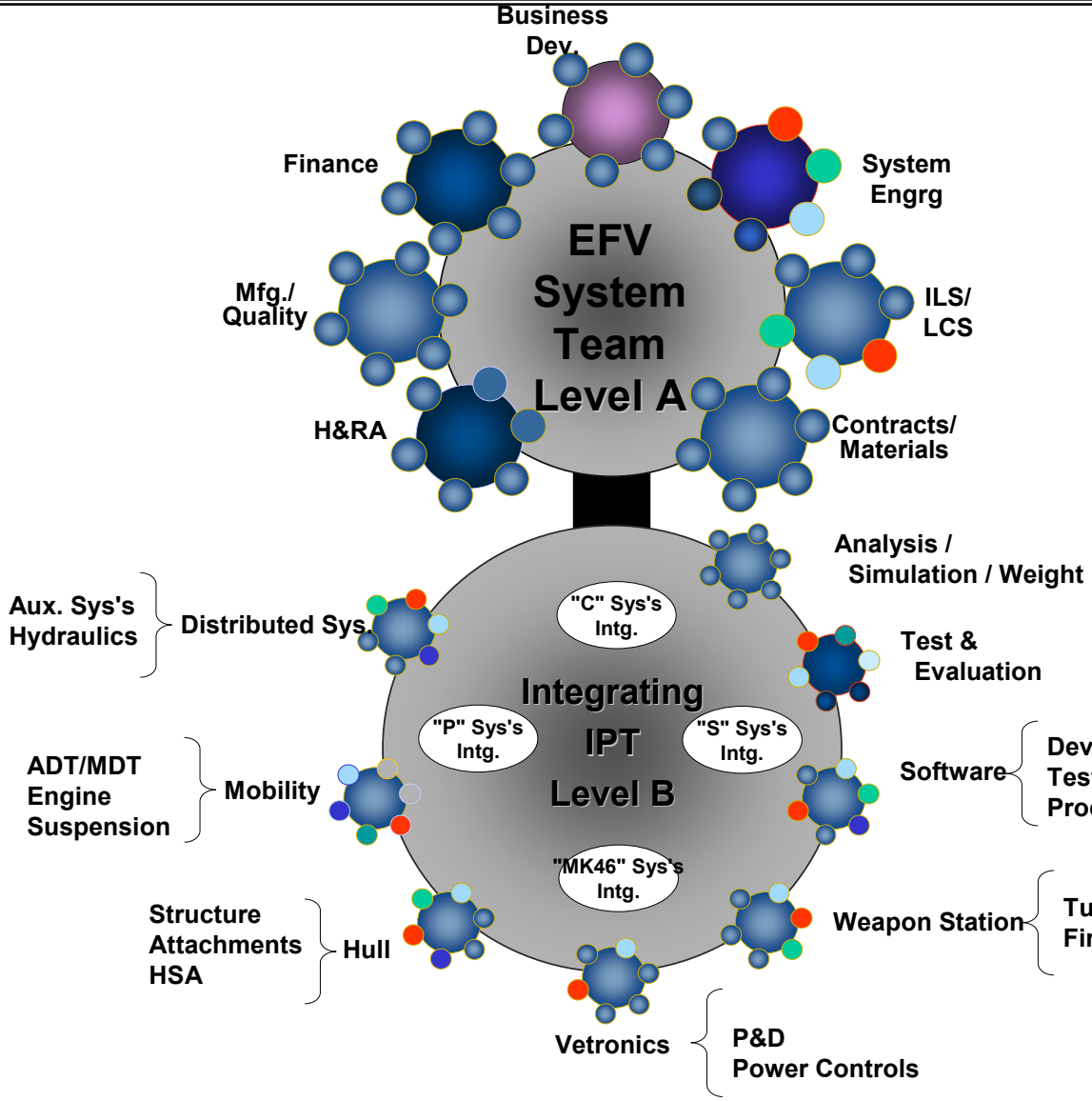
Full Rate Production Vehicles



EFV

FRP

INTEGRATED PRODUCT TEAMS



- **IPT Organization**
  - Lead by GDAMS
  - Multifunctional Representation
  - Government Representation
  - User Representation (Operator and Maintainer)
  - Subcontractor Representation
- **Decisions Made Based On**
  - Combat Effectiveness
  - Maintainability
  - Production costs
  - Operations and Support Costs

Key to Representatives

- Marine Corp
- Test & Evaluation
- Systems Engineering
- ESOH

EFV DEVELOPMENT

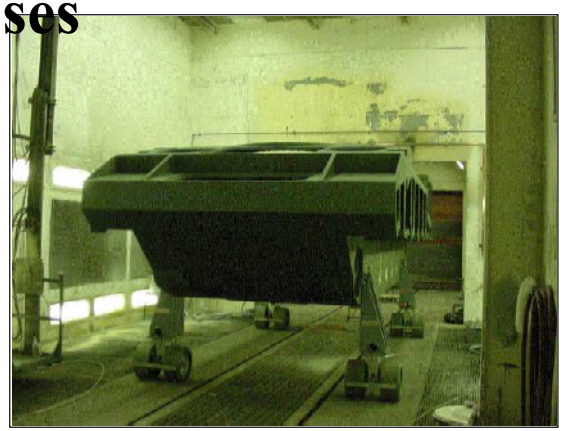
"Program Development and Risk Reduction Phase"

- **Utilized whole system trade process**
- **Manufactured three "objective" vehicle prototypes**
- **Conducted initial Live Fire Test**
- **Conducted Early Operational Assessment**

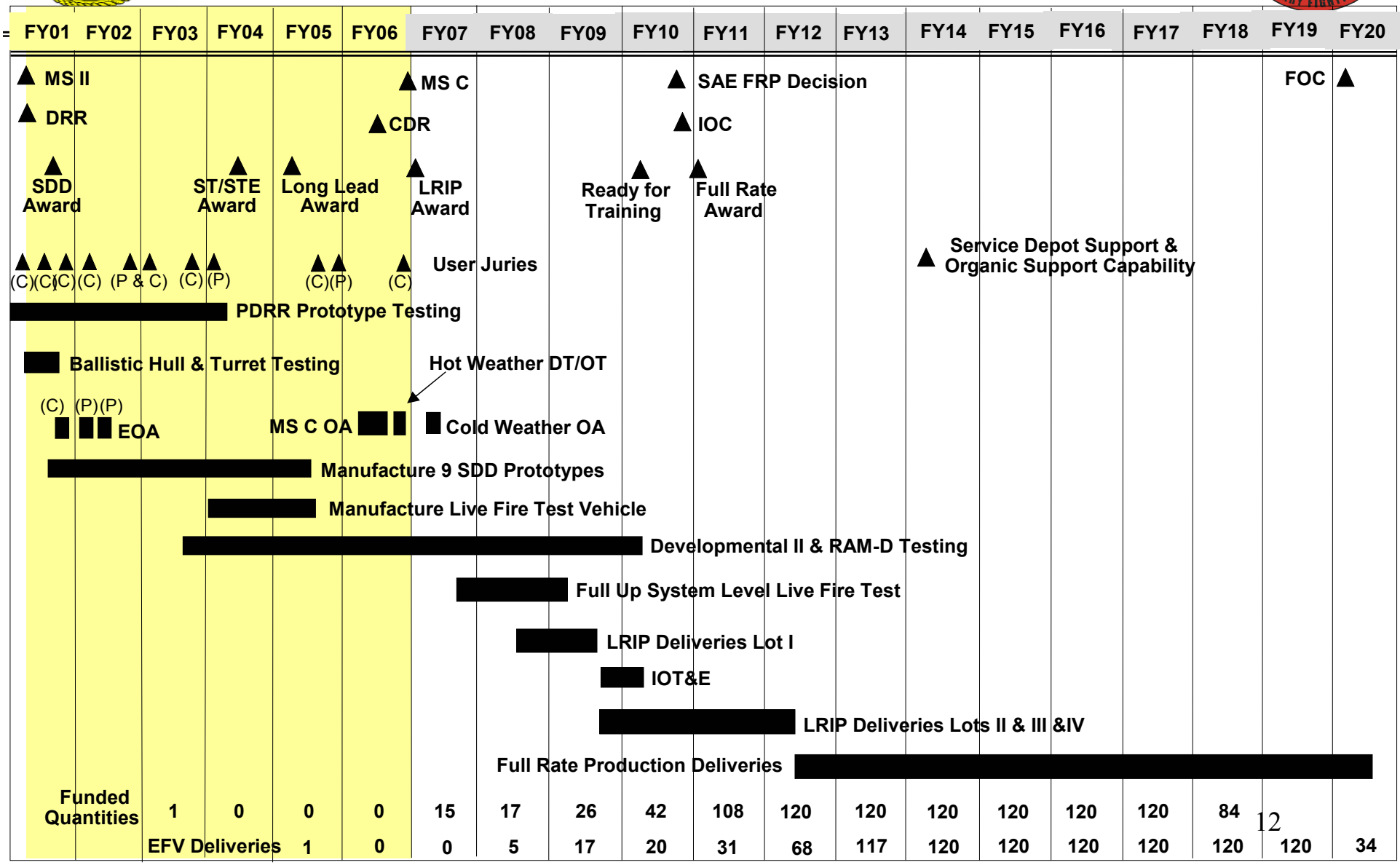
EFV DEVELOPMENT

"System Development and Demonstration"

- **Build and test (DT and OT) SDD second generation prototypes**
- **Continue to mature the vehicle**
- **Develop manufacturing / production processes**
- **Build school facilities**
- **Conduct Pre-Milestone C OA**
- **Prepare for Low Rate Initial Production**



EFV PROGRAM SCHEDULE
24 March 2005



Environmental, System Safety and Occupational Health Integration

FOUNDATION

WHY SUCCESSFUL?

- Strong Foundation
  - ORD / CPD
  - SOW
  - Specification
  - Management Support
    - Policy Statement
- Strategy & Processes
- Flexibility
- Stretch The Limits

STRETCHING

- **NO carcinogens**
- **NO teflon**
- **Comply with ALL current and emerging laws**
- **No toxic fumes under normal or abnormal conditions (fire)**
- **No ODS**
- **Subcontractor's requirements same**

ESOH RISK DEFINITIONS

CATEGORY	DESCRIPTION	MISHAP DEFINITION
Category I	**Catastrophic**	**Exceeds maximum allowable use, release, or consumption** (E). **Death, system loss, or severe environmental damage** (S). **Personnel exposure levels lead directly to death or complete disability** (H)
Category II	**Critical**	**Significant impact on site/facility annual allowable use/release consumption** (E). **Severe injury, severe occupational illness, major system or environmental** (S). **Personnel exposure levels exceed maximum legal exposure or single exposure level suspected to result in severe occupational illness or severe health degradation/partial disability** (H).
Category III	**Marginal**	**Allowable release rate/consumption requiring Permit/Waiver** (E). **Minor injury, minor occupational illness, or minor system or environmental damage** (S). **Personnel exposure level exceeds allowable continuous exposure level resulting in minor occupational illness or occupational restrictions and temporary disability** (H).
Category IV	**Negligible**	**Monitored by Federal, State, Local agencies, No Permit/waiver required** (E). **Less than minor injury, occupational illness or less than minor system or environmental damage** (S). **Personnel exposure level within OSHA standards or other applicable TLVs resulting in negligible occupational illness or only minor health impacts** (H).

HEALTH – NORMAL OPERATIONS
SAFETY – MISHAP

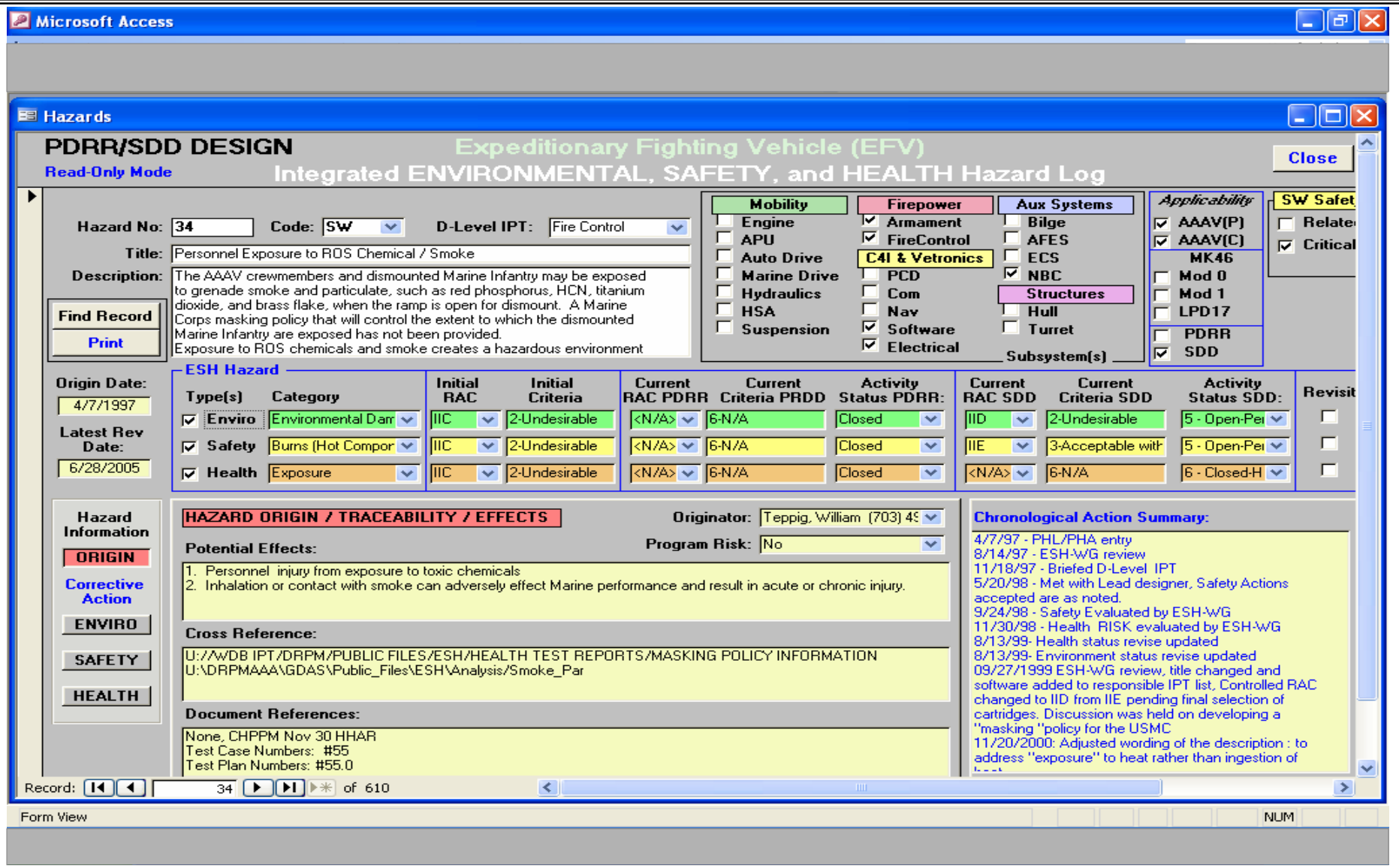
ESOH DATABASE

- **Access Database with all Environmental, System Safety and Occupational Health Hazards in a Single Database that allows Relative Ranking of Risk from the Program Manager's perspective.**

- **The form changes as data entries occur and allows coverage of risks from design concept to disposal with a continuous chronological list of events as well as cross references to documents, drawings and other sources of data.**

- **Scope of risk includes traditional hardware and procedural risks as well as software, health, and environmental issues.**

ESOH DATABASE



CHALLENGES

- **Status Quo**
- **Path Of Least Resistance**
- **Technology Shortfalls**
- **Balance Between Cost, Schedule, Performance**
- **Contractor Concern – Today's Dollar's Not Life Cycle Cost**

SUCCESSES

- **Requirements Flow Down To Subcontractor's**
- **Trivalent Chromium**
- **Water reducible CARC**
- **Engineers /T&E/ IPT's Asking Questions**
- **QA & Logistic Engineers "Catching" & "Reporting" Non-Compliant Parts**
- **FM-200 Approval For Use**
- **Tracking Hazmats To Grams**

New Guidance Coming out – Already There

HOW

- **Proactive**
- **Involved With System Engineers Vice Versa**
- **Support IPT's**
- **Review TIR, FRACAS/DCACAS, STR**
- **Sign Off ECP's**
- **Procurement Request**
- **Education**
- **Establish Procedures – Safety Alert**

FIRM, CONFIDENT PUSH

IT CAN BE DONE

It takes Work!!!!

Be Consistent & Persistent

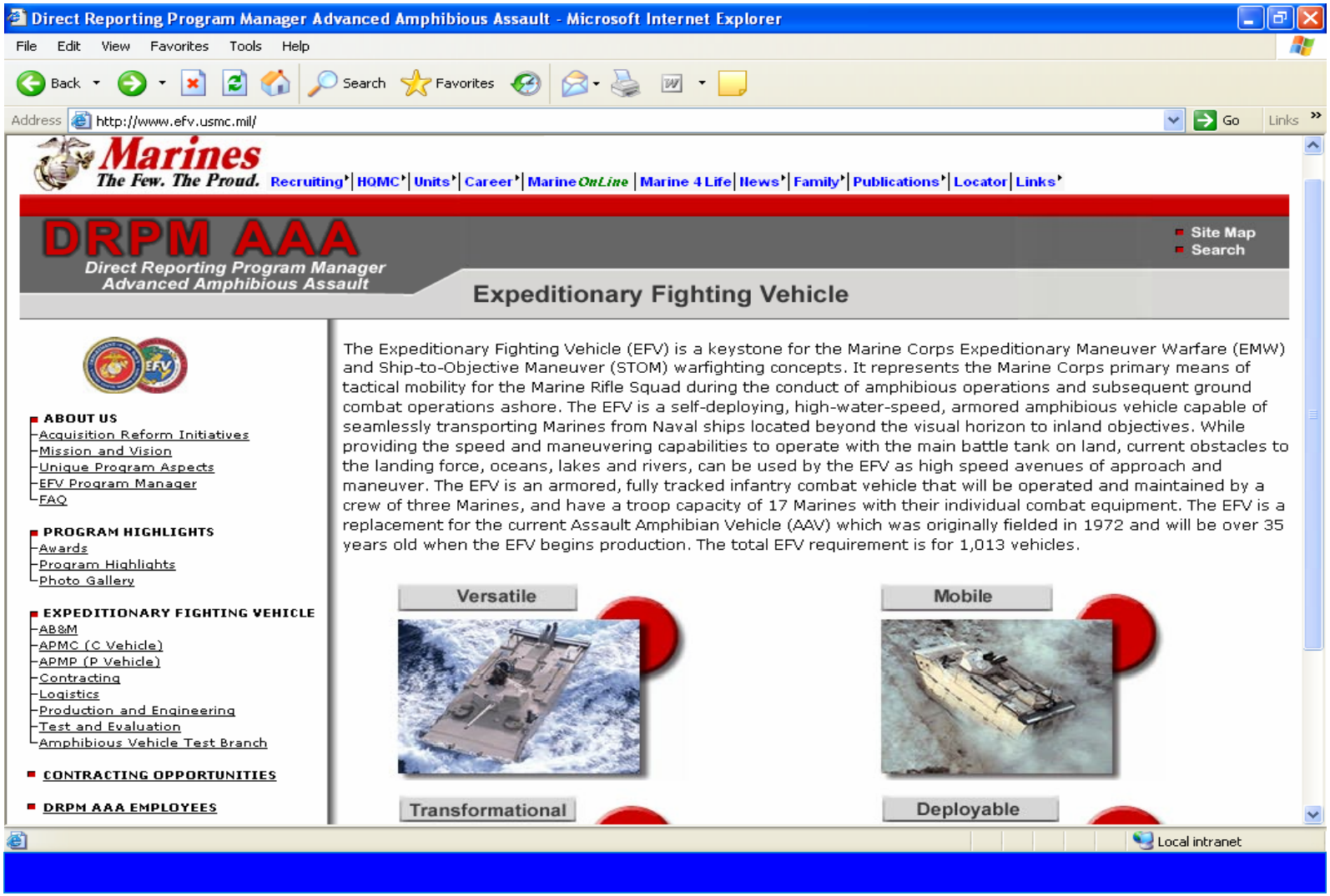
It is Challenging

The End...

QUESTIONS??

DRPM AAA
Web Site Address

http://www.efv.usmc.mil



Presenter

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EXAMPLES

Environmental Safety and Health (ESH). (Threshold)

The AAAV program will meet all environmental, safety and health Federal, State, and Local laws and regulations throughout the vehicle life cycle. Consideration must be given to the potential environmental impacts associated with developing, fielding, operating, maintaining, and disposing of the AAAV, and these considerations will be documented in accordance with the National Environmental Policy Act (NEPA). MIL-STD-882D shall be used as guidance for System Safety. The AAAV will meet all safety requirements established by applicable ESH-related review boards (e.g., the Weapons Systems Explosives Safety Review Board, Lithium Review). The AAAV shall minimize the use of materials, substances, or chemicals that cause adverse environmental impact or adversely degrade the AAAV performance and operational readiness in potential theaters of operation (threshold).

CPD
(Capability Production Document)

Environmental Safety and Health (ESH). (Threshold)

The EFV program will meet all environmental, safety and health Federal, State, and Local laws and regulations throughout the vehicle life cycle. Consideration must be given to the potential environmental impacts associated with developing, fielding, operating, maintaining, and disposing of the EFV, and these considerations will be documented in accordance with the National Environmental Policy Act (NEPA) or EO 12114, as applicable. The EFV shall minimize the use of materials, substances, or chemicals that cause adverse environmental impact or adversely degrade the EFV performance and operational readiness in potential theaters of operation. MIL-STD-882 shall be used as guidance for System Safety. …….. The EFV Program shall follow DoD directives and instructions such as MIL-STD-1472, MIL-STD-759, MIL-STD-1474 to implement Federal guidance from DODI 6055.1 in applying OSHA and non-DoD regulatory safety and health standards to military-unique equipment, systems and operations. Minimization of OH risk shall always be a consideration/factor when addressing safety and environmental concerns with the environment. ……..

- 3.2.5.18 Environmental, System Safety, and Health (ESH) Management Program

  The Contractor shall update and maintain the System Safety Program Plan (SSPP), Hazardous Material Management Program (HMMP) Plan, and the Hazardous Material Management Program (HMMP) Report developed in PDRR. The Contractor shall ensure that all aspects of these plans and reports are integrated into the SDD system engineering process and design. The Contractor shall update and conduct where applicable the following ESH program analysis: System Hazard Analysis (SHA), Subsystem Hazard Analysis (SSHA), Software Safety Analysis, Fault-Tree Analysis, and the Operating and Support Hazard Analysis (OHSA). The Contractor shall closeout the PDRR developed ESH Hazard Tracking Log Database. The Contractor shall then use the residual PDRR ESH Hazards to establish the SDD baseline ESH Hazard Tracking Log Database retaining the PDRR Hazard Tracking Log Database for historical record and reference. The SDD baseline Hazard Tracking Log Database shall track residual PDRR ESH Hazards and document and track ESH Hazards discovered during PDRR Integration and Assembly, PDRR testing, and SDD phase. The Contractor shall provide access via the Virtual Design Database to the Hazard Tracking Log to the DRPM, IPTs and applicable support Contractors. The Contractor will use MIL-STD-882C and NAS 411 as guidelines. The Contractor, using Government Furnished Information from PDRR, shall update and maintain a Health Hazard Assessment (HHA). The Contractor shall conduct a HHA on the final system design prior to SDD contract end. The most current results of these ESH tasks and analysis shall be documented for Design Reviews and the final results included in the Final Design Reports. The Contractor shall develop the EFV design, including Software development and the MK46 as a subsystem, to minimize hazards and ensure compliance with all Federal, state, and local ESH laws, regulations, and standards. The Contractor shall consider the impact on the environment during test site selection and test planning. The Contractor shall provide documentation to support these test-related decisions which can be added to the DRPM AAA ESH Administrative Record. The Contractor shall provide documentation to support the Government-developed National Environmental Protection Act (NEPA) analysis, including documentation relating to component, subsystem, and system testing, and fielding. The Contractor shall provide technical support to the DRPM AAA in gaining approval from all ESH related Review Boards such as: Weapon Systems Explosive Safety Review Board (WSESRB), Software System Safety Technical Review Panel (SSSTRP). Program Environmental Impact Review Board (PEIRB), Laser Safety Review Board (LSRB), United States Marine Corps Headquarters Environmental Impact Review Board (USMC HDQTRS EIRB), Test Site Safety, and Test Site Environmental. The Contractor shall establish a procedure for handling ESH related Test Incident Reports (TIRs), FRACAS reports and Engineering Change Proposals (ECPs) to completion or closeout. Any documents affecting the system and subsystems' configurations shall be reviewed and concurred in by the Contractor's ESH team. The Contractor shall define and establish an ESH checklist for verifying vehicle test readiness prior to Contractor testing and vehicle delivery. The Contractor shall develop procedures for emergency operations and influence the integration of emergency equipment to include but not limited to as appropriate; emergency egress lighting, a "Flight" Recorder type device, and emergency flotation devices. The Contractor shall certify to the Government that each EFV is safe for operation and testing prior to each EFV delivery.

- 3.2.5.18.1 System Safety Assessment Report (SAR) [CDRL L022, Safety Assessment Report]

  The SAR shall be provided to the Government for approval and review. The SAR shall be updated as needed to incorporate design changes. The SAR shall be expanded to cover environmental and health areas in as much detail as the safety.

- **3.2.5.18.2** Hazardous Material Management Program (HMMP) Report **[CDRL L048, Hazardous Material Management Program (HMMP) Report]**

  The Contractor shall provide the HMMP Report to the Government for approval as described in CDRL L048. The HMMP Report will be updated as needed to incorporate design changes.

- 3.2.5.18.3 ESH Review Board Data Packages [CDRL L049, ESH Review Board Data Packages]

  The Contractor will be notified of ESH related Reviews by DRPM AAA letter. The Contractor shall provide a draft data package for ESH related reviews. The Contractor shall provide final data packages in electronic format for each of the ESH Reviews. The Contractor shall provide technical assistance in preparation of presentation materials for ESH reviews.

System Specification

ONLY A PORTION OF ESOH REQ.

- 3.3.1.2 Environmental Protection

  All materials, parts, and processes used in the EFV shall be compatible with the performance and environmental requirements specified by this specification.

  During the manufacture, operation, service, transportation or storage of the EFV, the use of known Environmental Protection Agency (EPA) Identified Hazardous Materials, Substances, Chemicals and/or Processes as prohibited or restricted by applicable Federal, state and local statutes shall not be used or emitted. Acceptable alternative methods and materials shall be indicated. The alternatives shall be evaluated and tested in accordance with existing DoD policy prior to their implementation into the system design.

  The system shall pursue an Ozone Depleting Substance (ODS)-Free design in its system, subassemblies, components, manufacture, operation, service, transportation, storage and material selection, which is in compliance with applicable Federal, state and local statutes.

- 3.3.1.3 Toxic Products and Formulations

  Material selection shall minimize personnel exposure during normal and abnormal situations, including outgassing caused by high temperature and/or fire environments. Solvent selection shall present the least hazard, consistent with functional requirements.

- 3.3.1.3.1 Toxic Fumes

  The EFV shall have provisions to prevent the accumulation of toxic fumes within personnel areas per MIL-HDBK-759 due to EFV operations, particularly engine, heaters, or weapons operation.

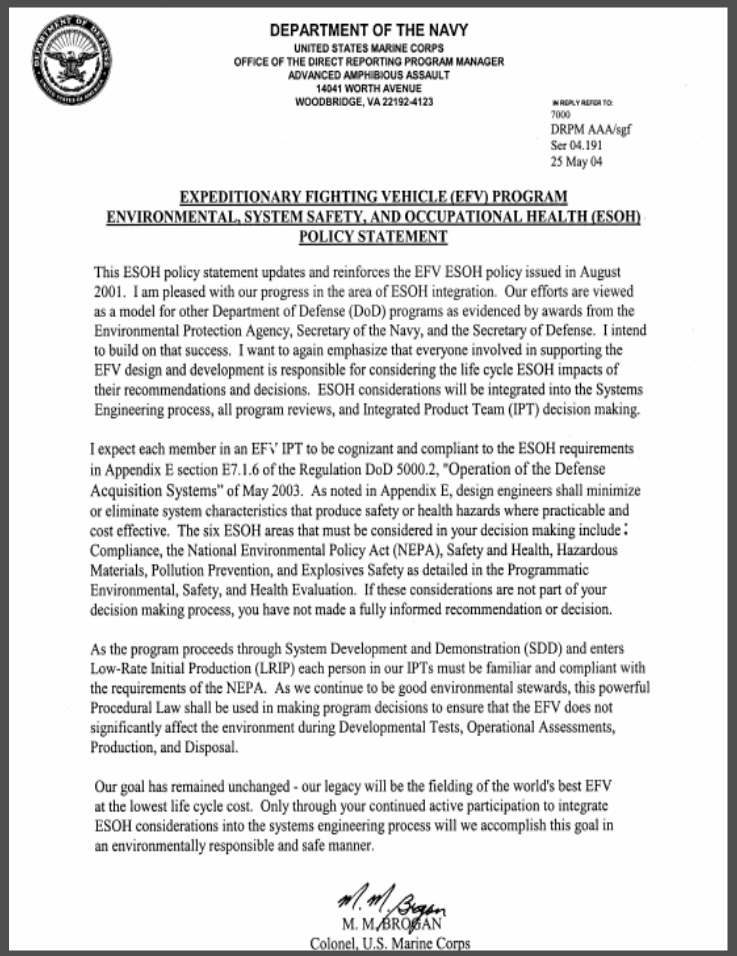
- 3.3.1.4 Dangerous Materials and Components

  The EFV and its components shall not use any material which produces hazardous environments during any phase of the life cycle. For example, materials such as lead, cadmium and polytetrafluorethylene will liberate toxic gases or liquids when exposed to extremely high temperatures, and therefore shall not be used.

- 3.3.6 SAFETY

  The system shall ensure the highest degree of safety and health, consistent with mission requirements, throughout its life cycle. The system shall have a warning and monitoring sensor package which includes appropriate displays and/or audible signals to advise crew members of hazardous conditions. All components shall be designed for ease of maintenance and removal to allow maintenance personnel the ability to access necessary components without requiring extraordinary time, effort, or personnel danger.

DRPM Policy Letter



DEPARTMENT OF THE NAVY
UNITED STATES MARINE CORPS
OFFICE OF THE DIRECT REPORTING PROGRAM MANAGER
ADVANCED AMPHIBIOUS ASSAULT
14041 WORTH AVENUE
WOODBRIDGE, VA 22192-4123

IN REPLY REFER TO:
7000
DRPM AAA/sgf
Ser 04.191
25 May 04

EXPEDITIONARY FIGHTING VEHICLE (EFV) PROGRAM
ENVIRONMENTAL, SYSTEM SAFETY, AND OCCUPATIONAL HEALTH (ESOH)
POLICY STATEMENT

This ESOH policy statement updates and reinforces the EFV ESOH policy issued in August 2001. I am pleased with our progress in the area of ESOH integration. Our efforts are viewed as a model for other Department of Defense (DoD) programs as evidenced by awards from the Environmental Protection Agency, Secretary of the Navy, and the Secretary of Defense. I intend to build on that success. I want to again emphasize that everyone involved in supporting the EFV design and development is responsible for considering the life cycle ESOH impacts of their recommendations and decisions. ESOH considerations will be integrated into the Systems Engineering process, all program reviews, and Integrated Product Team (IPT) decision making.

I expect each member in an EFV IPT to be cognizant and compliant to the ESOH requirements in Appendix E section E7.1.6 of the Regulation DoD 5000.2, "Operation of the Defense Acquisition Systems" of May 2003. As noted in Appendix E, design engineers shall minimize or eliminate system characteristics that produce safety or health hazards where practicable and cost effective. The six ESOH areas that must be considered in your decision making include: Compliance, the National Environmental Policy Act (NEPA), Safety and Health, Hazardous Materials, Pollution Prevention, and Explosives Safety as detailed in the Programmatic Environmental, Safety, and Health Evaluation. If these considerations are not part of your decision making process, you have not made a fully informed recommendation or decision.

As the program proceeds through System Development and Demonstration (SDD) and enters Low-Rate Initial Production (LRIP) each person in our IPTs must be familiar and compliant with the requirements of the NEPA. As we continue to be good environmental stewards, this powerful Procedural Law shall be used in making program decisions to ensure that the EFV does not significantly affect the environment during Developmental Tests, Operational Assessments, Production, and Disposal.

Our goal has remained unchanged - our legacy will be the fielding of the world's best EFV at the lowest life cycle cost. Only through your continued active participation to integrate ESOH considerations into the systems engineering process will we accomplish this goal in an environmentally responsible and safe manner.

M. M. BROGAN
Colonel, U.S. Marine Corps

PESOHI STRATEGY

- Integrating ESOH requirements into systems engineering processes
- ESOH Risk management and mitigation measures integrated into Life Cycle Cost and development of the EFV
- Integral part of the test – fix – test analysis to provide the user with a product they need and can safely and healthfully use
- Product and process improvement approach to the design and fabrication of EFVs that will meet the user's needs

Environmental Strategy

- Vehicle and Program compliance with all Federal, State and local environmental laws
- Eliminate unacceptable and undesirable environmental hazards from the design and lifecycle of the EFV
- Reduce lifecycle cost by proactively influencing the EFV design.

System Safety Strategy

- Eliminate unacceptable and undesirable system safety hazards from the design and the lifecycle of the EFV.
- Ensure DT and OA is conducted safely.
- Collect and analyze all necessary software system safety and system safety data prior to Milestone C.

Occupational Health Strategy

- Assure that the vehicle accommodates a safe, healthy work environmental for personnel.
- Ensure compliance with all local/federal/DoD laws and regulations; maintain knowledge of current guidelines and regulations.
- Proactively participate in the design to ensure hazards are controlled or eliminated from the start.
- Enhance Marine performance and ensure mission performance by eliminating/controlling hazards that may cause adverse health effects.
- Maintain a medical surveillance program to monitor potential exposures resulting from identified health hazards.
- Provide timely assessment response as part of the test-fix process to assist the development team in making informed decisions regarding the impact on health and personnel performance.

SAFETY ALERT PROCESS