AERONAUTICAL SYSTEM CENTER'S ESOH PROGRAMMATIC RISK TOOL

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Abstract

Program Managers (PMs) of major defense acquisition programs primarily use risk management to allocate resources and develop mitigation plans to reduce the potential impact to cost, schedule, and performance of weapon systems over their life cycle. Historically, Environmental, Safety, and Occupational Health (ESOH) risks have not been quantitatively represented at the table when resource allocation decisions are being made. To address this concern, Aeronautical Systems Center, Acquisition Environmental, Safety & Health Division, Pollution Prevention Branch (ASC/ENVV) has formed a team to develop and field the ESOH Programmatic Risk Tool (PRT). The ESOH PRT will assist PMs in meeting the requirements impacting acquisition of weapon systems by qualitatively and quantitatively evaluating ESOH risks associated with cost, schedule, and performance decisions. The tool follows updated Department of Defense Instruction (DoDI 5000.2), "Operation of Defense Acquisition System", requirements regarding Programmatic Environmental, Safety and Health Evaluation (PESHE) development and integration of ESOH considerations into the Systems Engineering (SE) process. This paper summarizes ASC/ENVV's initial ESOH PRT development efforts, current testing and implementation actions, and the benefits of using the ESOH PRT.

Background

ASC/ENVV established the following goals for developing and implementing the ESOH Programmatic Risk Tool:

- Provide Program Managers an assessment of the "health of their ESOH program(s)
- Quantify and qualify the ESOH programmatic risks
- Facilitate development of the PESHE
- Provide a ready means of addressing the ESOH regulatory requirements
- Provide report to highlight ESOH considerations
- Integrate ESOH considerations into the Systems Engineering process, and
- Make more effective ESOH programmatic decisions.

In 2003, ASC/ENVV formed an ESOH Programmatic Risk Tool (PRT) Team to develop and field the tool. The primary purposes of the team are to ensure that there is a seamless integration among the "E", "S", and "OH" disciplines in the development of the ESOH Programmatic Risk Tool and to guide all development and implementation efforts.

Ms. Amy Mercado Vince, Reconnaissance (RA) Systems Wing ESOH Integrated Product Team (IPT) Lead (ASC/U2SF) serves as the chair for the team and provides expertise in the environmental discipline. Other members of the team are:

- Mr. Bill LaFountain, ASC/ENVV provides occupational health and operational risk management (ORM) expertise to the group.
- Mr. Mike Badgero, Aeronautical Systems Center, System Safety Division (ASC/ENVS) provides system safety expertise to the group.
- Mr. Roddy Keish, ASC/ENVV supports the software/computer integration efforts of the working group.

The ESOH PRT team developed a model and construct for the tool to include three primary components, 1) a questionnaire based upon an ESOH Success Tree Model; 2) an ESOH Risk Manager; and 3) a PESHE Template. The team's vision to integrate these components is shown in Figure 1. The following sections explain each of the components and the team's efforts to develop software or find an off-the-shelf software platform to complete the integration. Also explained are past and current development and implementation efforts and goals.
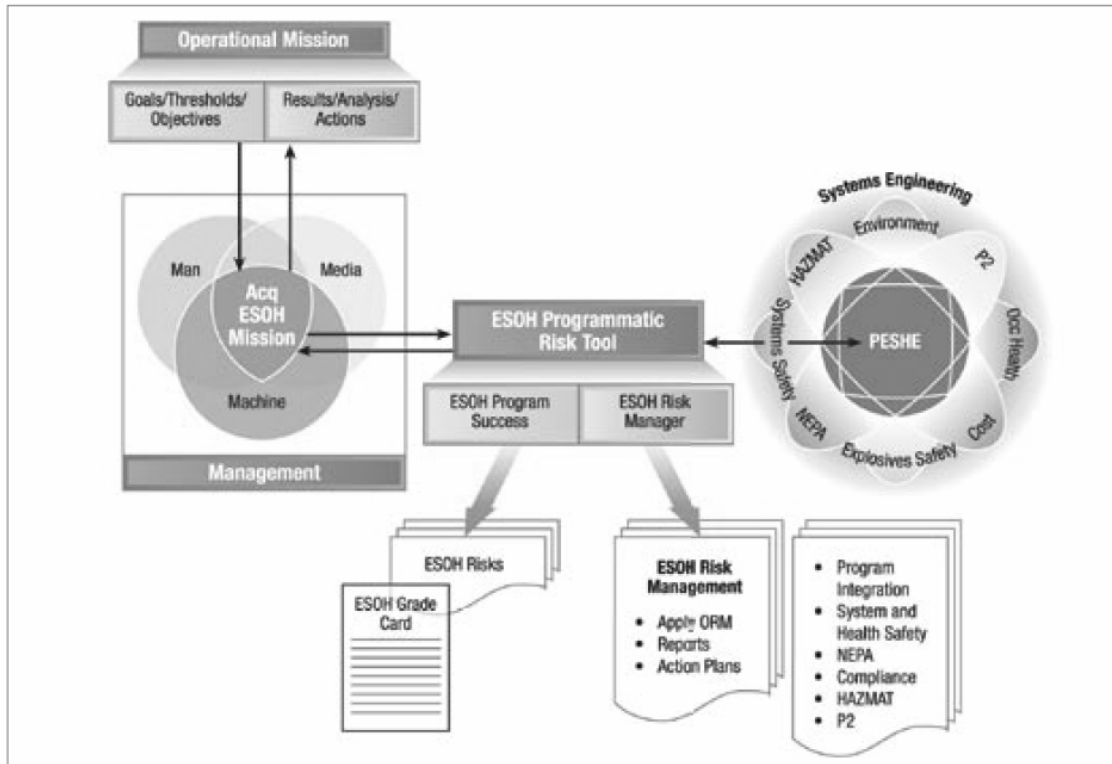
Figure 1. The Components and Construct of the ESOH Programmatic Risk Tool

Initial ESOH PRT Development Efforts

The ESOH Program Success Tree

The ESOH PRT Team chose the Operational Risk Management (ORM) 5M model as the basis for the ESOH Success tree. The 5M model applies a systematic risk management process and provides a basic framework for analyzing systems and determining the relationships between composite elements that work together to perform the mission. The 5M-model construct is composed of **M**an, **M**achine, **M**edia, **M**anagement, and **M**ission. The **M**an, **M**achine, and **M**edia components interact to produce a successful **M**ission. **M**anagement provides the policies and procedures to govern the interaction between **M**an, **M**achine, and **M**edia. The controlling factor in the operational success or failure is **M**anagement.

The team focused on building a work breakdown structure (WBS) for each of the 5M components to capture the most important aspects of ESOH risks

and regulatory requirements through the life cycle of the acquisition process. After several iterations, the team developed the final WBS shown in Figure 2 on the next page.

The ESOH Risk Manager

Concurrent with development of the ESOH Success Tree, the ESOH PRT team researched and evaluated options to build the ESOH Risk Manager. They investigated developing a database to meet their needs and evaluated several existing off-the shelf risk identification and assessment software platforms. After weighing cost, performance, schedule, and functional criteria for each of the options, the team chose the Technical Risk Identification and Mitigation System (TRIMS) software developed by the Best Manufacturing Practices Center of Excellence (www.bmpcoe.org) as the platform to build the ESOH PRT.

TRIMS is a process-oriented tool that has the capacity to: 1) identify hazards; 2) assess risks; 3) analyze risk control measures; 4) make control decisions; 5) implement risk control; 6) supervise

and review; 7) assign responsibilities; and 6) integrate with a PESHE. These TRIMS capabilities align with the ESOH PRT team's objective to use the six steps of the ORM process to identify mitigate risks. The Risk Manager also uses reverse failure tree analysis to assess the Program's management effectiveness and to identify risk.

The TRIMS software applies a Work Breakdown Structure (WBS) comprised of *categories*, *templates*, and *questions* to identify and assess risks. (Figure 3)
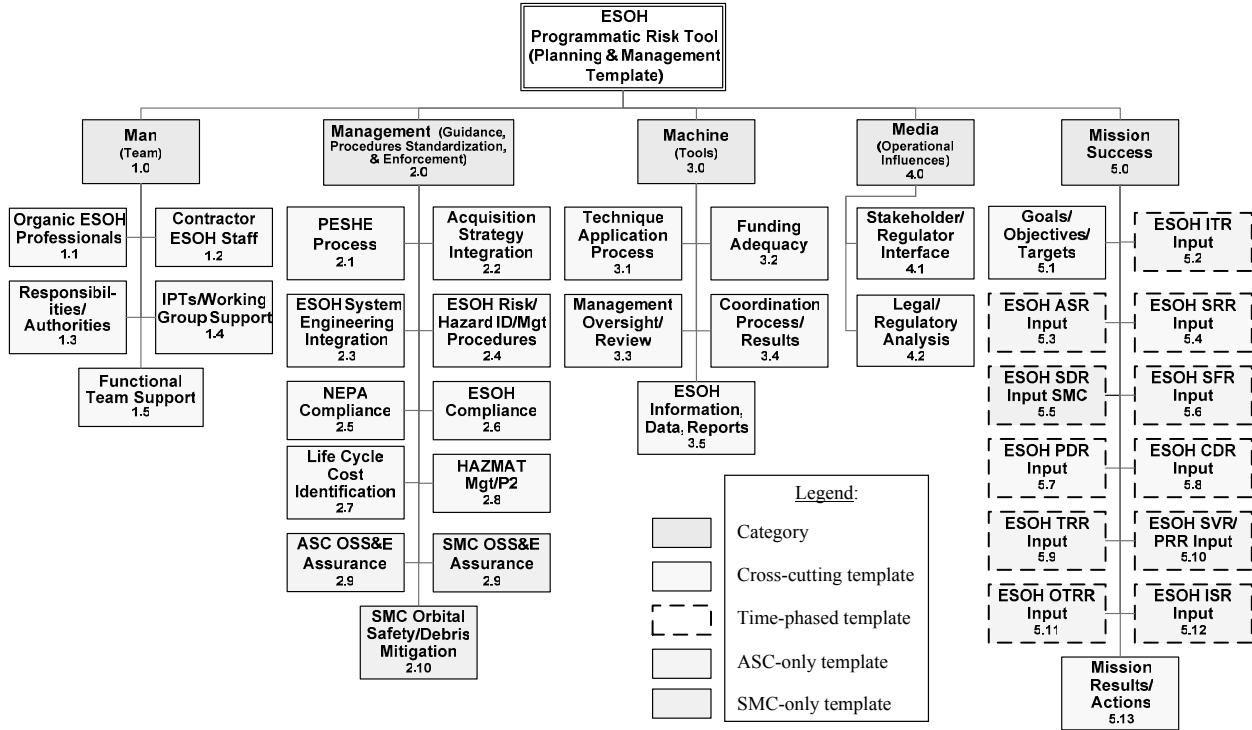

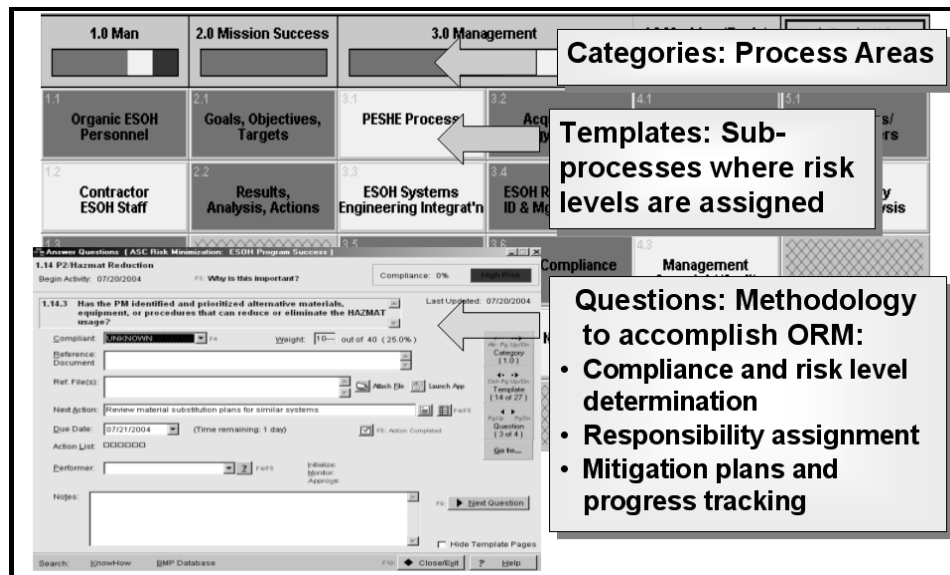**Figure 2. The ESOH PRT Work Breakdown Structure**

Figure 3. The TRIMS Work Breakdown Structure

- The highest WBS element is called *categories*. *Categories* are used to address major topic or processes areas.
- The next level of the WBS includes *templates*. There can be numerous templates (sub-topics or sub-processes) within a category – *templates* are the WBS level where risk is assessed.

- The planned methodology for assessing risk is by asking questions regarding completing program or regulatory requirements within each *template*. The third level of the WBS, *questions,* fulfills this task.

Answering questions in the Risk Manager of the ESOH PRT comprises the principal data entry task for the user (Figure 4).
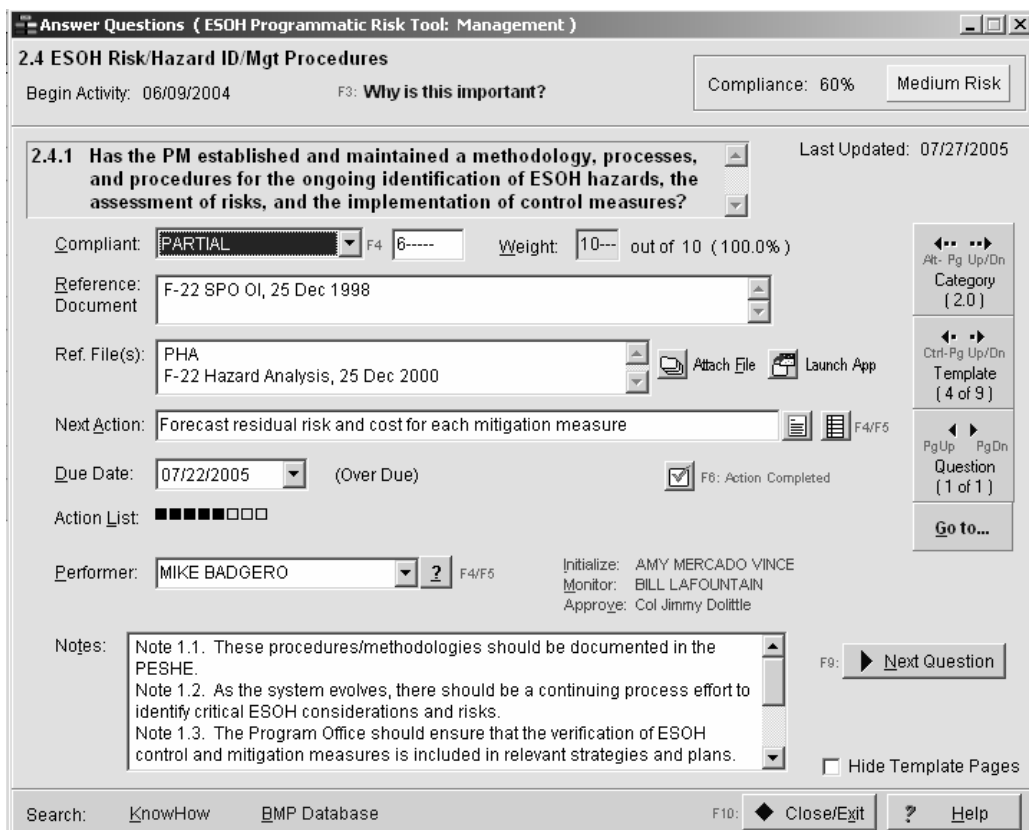

Figure 4. The Risk Manager "Answer Questions" Window

The user establishes compliance levels for the question by answering the question either "Yes", "No", "Partial" (assigns a value from 1 to 10), "Unknown", or "N/A". Based on the user's response, the TRIMS software calculates compliance and risk levels.

The user must also attach reference documents to validate the level of compliance and may want to add reference files. If required or desired, the user can also build action plans, based on the ORM process, to assess and mitigate the risk, and can assign Performers who have responsibility to complete actions associated with the template or questions.

To establish an action plan, the user opens a List of Actions window in the Risk Manager and documents specific actions and due dates. The user can then track progress by entering completion dates for the actions (Figure 5).

After answering all questions in the ESOH PRT Risk Manager, the user can track compliance/risk levels and progress in completing action plans through the use of three reports or outputs from the Risk Manager: 1) a *Summary Report* that gives a graphical depiction of colored-coded risk levels (Figure 5); 2) a *Detailed Report* that summarizes data from the TRIMS questions and mitigation plans (Figure 6); and 3) a *Risk*

Matrix Report that gives a conventional probability versus consequence risk matrix (Figure 7). The data in these reports can be tailored to provide PMs the quantitative ESOH risk to support their decision making process. These reports are then exported to the PESHE template to provide a continuous updated risk evaluation and review.
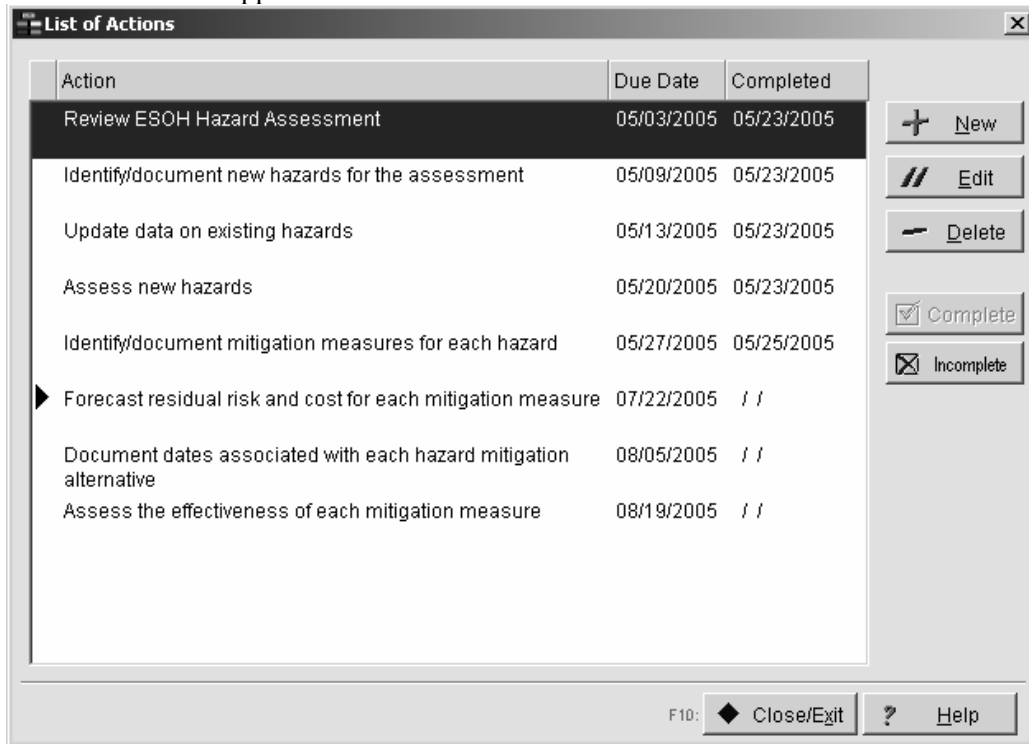

Figure 5. The Risk Manager "List of Actions" Window

Figure 6. The Risk Manager "Summary Report"

2.4 ESOH Risk/Hazard ID/Mgt Procedures   (Medium Risk - 60%)

Notes: *None*

Initialize:	AMY MERCADO VINCE
Monitor:	BILL LAFOUNTAIN
Approve:	Col Jimmy Dolittle
Begin Activity:	06/09/2004
Last Update:	07/27/2005

2.4.1   *Has the PM established and maintained a methodology, processes, and procedures for the ongoing identification of ESOH hazards, the assessment of risks, and the implementation of control measures?*

Notes: Note 1.1. These procedures/methodologies should be documented in the PESHE.
Note 1.2. As the system evolves, there should be a continuing process effort to identify critical ESOH considerations and risks.
Note 1.3. The Program Office should ensure that the verification of ESOH control and mitigation measures is included in relevant strategies and plans.
Note 1.4. The Program Office should ensure that ESOH risks are identified based on lessons learned from legacy systems, to include mishap and lost time rates associated with legacy systems; similar systems, pre-system acquisition activities; Demil and Disposal of similar systems; ESOH regulatory issues at potential locations for system testing, training and fielding/basing.

Compliant:	PARTIAL *(6/10)*
Reference:	F-22 SPO OI, 25 Dec 1998
Performer:	MIKE BADGERO
Action:	Review ESOH Hazard Assessment
Due Date:	05/03/2005 **Completed:** 05/23/2005

Action:	Identify/document new hazards for the assessment
Due Date:	05/09/2005 **Completed:** 05/23/2005

Action:	Update data on existing hazards
Due Date:	05/13/2005 **Completed:** 05/23/2005

Action:	Assess new hazards
Due Date:	05/20/2005 **Completed:** 05/23/2005

Action:	Identify/document mitigation measures for each hazard
Due Date:	05/27/2005 **Completed:** 05/25/2005

Action:	Forecast residual risk and cost for each mitigation measure
Due Date:	07/22/2005

Figure 7. The Risk Manager "Detailed Report"

NOTE: The Detailed Report shown above captures the all the input data provided by the user in the "Answer Questions" window for all templates and questions in the Risk Manager. This information includes the following:

- The WBS levels associated with the Risk Manager templates and questions
- The compliance status
- The Reference to validate compliance status
- The Performer
- The List of Actions, Due Dates, and Completed Dates
- The last Update made to the Action List

The matrix shows the following legend:

1.1 Organic ESOH Personnel
1.2 Contractor ESOH Staff
1.3 IPTs/Working Group
1.4 Responsibilities/Authorities
1.5 Functional Team Support
2.1 PESHE Process
2.2 Acquisition Strategy Integration
2.3 ESOH Systems Engineering Integration
2.4 ESOH Risk/Hazard ID/Mgt Procedures
2.5 OCSSE Assurance
2.6 ESOH Compliance
2.7 Life Cycle Cost Identification
2.8 NEPA Compliance
2.9 P2/Hazmat Reduction
3.1 Technique Application Process
3.2 Funding Adequacy
3.3 Management Oversight/Review
3.4 Coordination Process/Results
3.5 ESOH Information, Data, Reports
4.1 Stakeholder/Regulator Interface
4.2 Legal/Regulatory Analysis
5.1 Goals, Objectives, Targets
5.12 Results, Analysis, Actions

Printed: 27 Jul 2005

Figure 8. The Risk Manager "Risk Matrix Report"

The PESHE Template

ASC/ENVV has been developing the ESOH Programmatic Risk Tool to assist PMs in managing ESOH risks and to meet the new PESHE requirements, as defined under DoDI 5000.2.

The new guidance requires that the PESHE, which starts off as a planning tool in the acquisition process, becomes an ESOH risk management tool over the weapon system life cycle. The new guidance requires that the PESHE is a living decision-making document that helps identify and manage ESOH risks over the weapon system life cycle (Figure 9).

The ESOH PRT team has three objectives for integration of the ESOH PRT and the PESHE: 1) Ensure the ESOH PRT helps users meets the new DoDI 5000.2 requirements, 2) Ensure that data from the ESOH PRT can be extracted to build a

time-phased PESHE throughout a weapons systems life cycle, and 3) Use the ESOH PRT as a PESHE data repository or time-based archive of ESOH evaluation actions throughout the systems engineering process.

To accomplish these objectives, the ESOH PRT team developed a time-phased systems engineering approach in the Mission Success category of the ESOH PRT. This category addresses ESOH inputs into the systems engineering (SE) process for each of the SE technical reviews.

The ESOH PRT team understood that the SE process provides a time-phased approach to integrate ESOH objectives, targets, requirements, considerations, and products into the acquisition decision making process, where appropriate. To ensure effective integration into acquisition processes, ESOH personnel must assess the inputs

into the SE process (Initial Capabilities Document, Capabilities Development Document, Test & Evaluation Strategy, etc.) at appropriate phase points; build plans, strategies, and schedules to meet program requirements; and provide inputs to evaluate progress toward meeting overall program requirements in a PESHE product.

Since the SE process uses Technical Reviews as a primary method for assessing or overseeing the progress of an acquisition program, managing ESOH inputs into Technical Review processes ensures integration of the ESOH considerations into the systems engineering process, helping to attain ESOH and overall goals and objectives.

Also since users can attach Reference Files to the ESOH PRT, the tool can be used as a data repository to compile and store PESHE-related products, providing a central repository and a time-based archive of ESOH/PESHE products. A time-based ESOH archive can greatly facilitate inputs to the SE review process.

To enable this systems engineering integration approach in the ESOH PRT, users are asked to attach specific PESHE products required by DoDI 5000.2 to the ESOH PRT at Milestone and programmatic review decision points for each of the technical review templates in the Missions Success category. This approach will ensure compliance with DoDI 5000.2 and help the ESOH PRT team achieve its PESHE objectives.
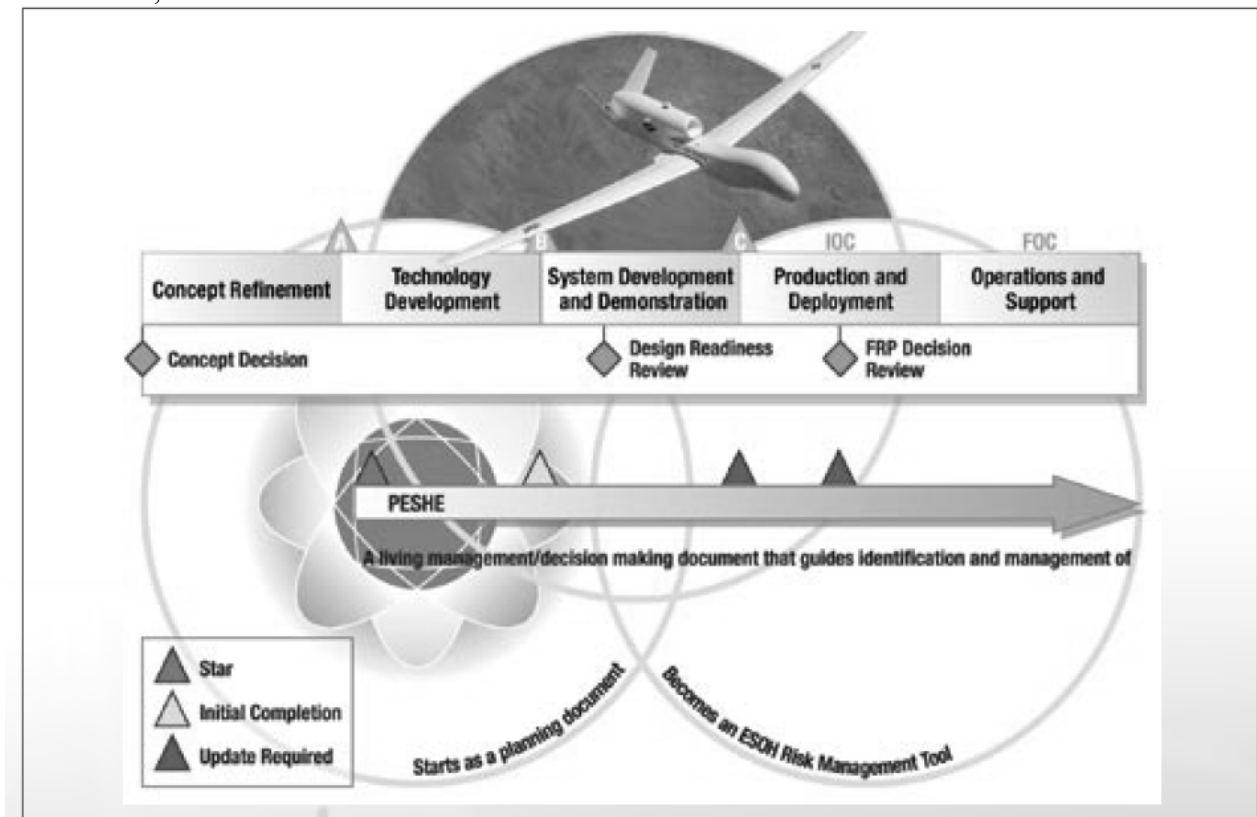

Figure 9. PESHE Requirements in the Acquisition Process

Current ESOH PRT Testing and Implementation Efforts

During the initial ESOH PRT development phase, ASC/ENVV briefed other Air Force and DoD acquisition organizations on their vision and direction for implementing the ESOH PRT. As the result, the ESOH PRT team has expanded to include the following members:

- Mr. Thomas Huynh, Space and Missile Systems Center (SMC/AXF). Responsible as SMC Government support for ESOH PRT development

- Mr. Jon Kocara, ASC/ENSA. Responsible as ASC systems safety engineering expert.
- Major Marvin Ee, Headquarters USAF (AF/ILEVQ), provides the Air Staff perspective on the use of this tool as part of ASC's ESOH management system (ESOHMS).
- Mr. Sherman Forbes, SAF/AQRE. Responsible as Secretary of the Air Force (SAF) advisor for ESOH PRT development.
- Mr. Louis Kanaras, US Army Environmental Center (USAEC). Responsible as US Army advisor for ESOH PRT development.

ASC/ENVV also completed and signed a charter with Space and Missile Systems Center (SMC) to use the expertise and experience from each of their organizations to further refine the tool. This partnership will also focus development of the tool to address acquisition processes governed by both DoDI 5000.2 and National Space Systems acquisition directives (NSS-03-01).

Currently, ASC/ENVV and its contractors have completed the ESOH PRT templates and questions for an Alpha test phase evaluation of the ESOH PRT. ASC/ENVV conducted an Alpha Test training session for SMC in July 2005 and for ASC organizations in early August 2005. Based on feedback from the Alpha test, ASC/ENVV plans to conduct a Beta test in late 2005 and complete and field the tool in the Spring of 2006.

Benefits of the ESOH PRT

The use of the ESOH PRT provides numerous benefits to Program Mangers and Air Force acquisition organizations. The ESOH PRT promotes detailed understanding of ESOH requirements to facilitate decision making throughout the acquisition process. Specifically, the ESOH PRT:

- Supports resource allocation—funding, manpower, and schedule
- Assess ESOH program health through the planning and execution phases
- Quantifies programmatic ESOH risks
- Assesses regulatory compliance
- Provides reports to highlight issues
- Build mitigation plans
- Provides progress tracking methodology
- Measure performance—ESOH goals/objectives/standards

Furthermore, the ESOH PRT provides the following additional benefits:

- Promotes standardization across acquisition program offices to provide greater environmental, safety, and occupational health synergy
- Facilitates system life cycle updates by cross feeding information to the PESHE
- Provides examples of risk minimization and acceptance benefits and burdens from similar weapon systems
- Ensures compliance with DoDI 5000.2 and Mil-Std 882D, *Standard Practice for System Safety*.

Besides these benefits, ASC and SMC plan to use the ESOH PRT as part of their ESOH Management Systems (ESOHMS).

Feedback regarding the benefits of the ESOH PRT by ASC's Directors of Engineering (DOEs) and other Program Managers has been very positive. Ms. Maureen Koetz, SAF/IEE, commended ASC/ENVV on the proactive approach taken to manage ESOH risks.

Summary

In summary, the ESOH Programmatic Risk Tool enhances Acquisition and Operational missions by assisting Programs to find cost effective solutions in less time. The tool also ensures compliance with DoDI 5000.2 requirements by providing a solid risk mitigation and tracking mechanism, integrating ESOH considerations into the acquisition process, and updating the PESHE over a system's life cycle. For further information about the ESOH Programmatic Risk Tool, please contact Ms. Amy Mercado Vince, ASC/U2SF, at (937) 255-2412.

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24th Digital Avionics Systems Conference
October 30, 2005