Technology Insertion Planning Process (TIPP)

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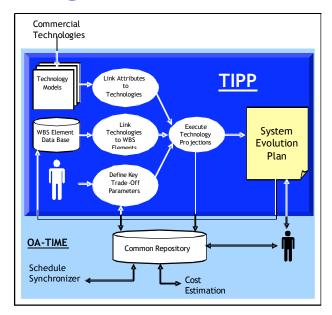
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Command: NAVSEA (PEO Ships)

Topic: # N05-053



PROBLEM STATEMENT

The Navy identified the Acquisition Program for DD(X) as a program in need of a decision aid to support future technology insertion focusing on meeting performance, reliability, maintainability, and sustainability requirements while optimizing cost and schedule providing the customer best value and lower life-cycle ownership costs. The Navy's objective is to develop a technology insertion planning tool that relates ship, system, and technology capabilities to prognostic design variables such as performance factors, capacities, cost, schedule, and life-cycle factors.

The tool addresses Total Ship Design and Spiral Technology Insertion and Development involving large numbers of technology trade decisions within a complex and constrained programmatic design environment (cost, schedule, performance). Decisions involve estimates of technology maturity; impact on component, system, or ship performance, development and implementation costs and schedules; and life-cycle factors such as reliability, maintainability, and sustainability.

WHO CAN BENEFIT?

In addition to the specific application upon which TIPP is designed the process and tool are applicable to all platform/system configurations including air, land, and sea and includes features specifically designed to address the unique requirements of technology insertion. Any major system whether government or commercial designed to provide greater than a 5 year life cycle will require frequent upgrades to minimize or eliminate obsolescence and improve performance at the lowest life-cycle cost. The Technology Insertion Planning Process and tool provides a means to plan for and optimize upgrades based on selectable customer priorities such as cost, performance, reliability, weight, power, etc. TIPP will

enable Program Managers and Chief Engineers to be "proactive" versus "reactive" in the life cycle management of their systems.

BASELINE TECHNOLOGY

Traditionally, maintaining operational effectiveness via technology insertion was accomplished through planned major system upgrades every 7 to 10 years. These major upgrades began with the definition of performance requirements based on current threat capabilities and a reasonable growth margin. In this type of upgrade cycle, performance falls behind the threat prior to the next upgrade cycle. Major changes in equipment and software standards occur between upgrades requiring significant changes in implementation. In some cases these upgrades create a need to "design beyond the state of practice" which caused significant expenditures in research and development, extended the development cycle, and result in "unique" implementations providing little ability to leverage commercial technology. Figure 1 provides a relational view of performance and cost over time using the Traditional Technology Insertion method.

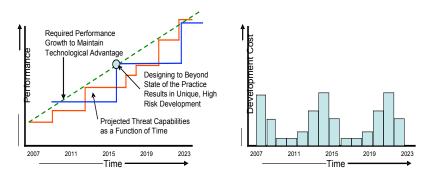


Figure 1 - Traditional Technology Insertion

TECHNOLOGY DESCRIPTION

Leveraging the advantages of commercial technologies into today's complex systems brings both programmatic and technical challenges to the acquisition office and the contractor. These new challenges include:

- When is the optimal time to procure hardware for a system in development?
- What quantity of resources should be procured in support of the development effort?
- How do I ensure that the system components are not obsolete at the time of initial system delivery?
- How do I plan sparing requirements in the context of the short life cycle of commercial products?
- Is it possible to link upgrades in performance with advances in technology to minimize cost and impacts to the platform?

The Technology Insertion Planning Process was originally developed and used on the Virginia Class Submarine C³I "Design to Affordability" and the Acoustic Rapid COTS Insertion (ARCI) programs. This process enabled the customer to leverage the use of

COTS in addition to Mil-Standard developed systems by addressing the steps necessary to plan for and proactively address the above bulleted items. As a result the customer was able to realize significant cost savings in development and operations and sustainment of major submarine acoustic and combat control systems. Figure 2 represents the new approach to Technology Insertion leveraging COTS technology and provides a view of performance and costs over the same period of time as in Figure 1. Actual data collected from the "Design to Affordability" and ARCI programs indicate significant cost savings in development of approximately 6:1 and Operations and Sustainment costs of 8:1 per platform.

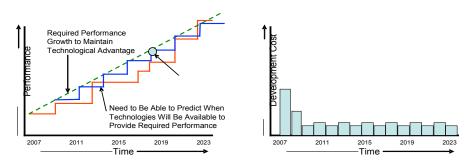


Figure 2 - New Technology Insertion Planning Process

Under SBIR N05-053 portions of the overall TIPP process were incorporated into the TIPP tool. The TIPP tool automated many of the manual process steps used in the initial efforts on Virginia Class Submarines and ARCI. TIPP greatly reduces the effort to develop and maintain Technology Insertion Plans that address the ship/system life-cycle sustainability needs. Originally the TIPP process was done manually using Excel spread sheets and the "stubby pencil" approach. This effort was labor intensive and took on the order of months to develop a Technical Insertion Plan. Additionally, updating these plans annually became so cumbersome that they were typically not updated. With the use of the TIPP tool this effort has been greatly reduced to the order of weeks versus months. As the TIPP tool development continues new capabilities and automation efforts will reduce even further the time to establish system baselines, perform technology projections and optimize technology insertion plans.

TIPP provides the program manager and/or chief engineer with the ability to analyze alternative approaches for system upgrades driven by new mission needs, obsolescence issues, or fleet inputs (gaps). TIPP provides a convenient mechanism to document the current system baseline technologies and project the evolution of those technologies over the life cycle of the system.

TIPP is highly configurable allowing the user to define key trade-off parameters for the alternatives evaluated. These parameters include:

- The frequency of when the system will be updated
- Trade-off criteria
- Constraints such as throughput performance, power, volume, footprint, etc

The output of TIPP is a plan of record that reflects performance upgrades and the deployment of new technologies based on least impact to the program.

Additionally, TIPP is one of many tools within the Open Architecture Technology Insertion and Management Environment (OA-TIME) suite designed to help the Program Manager and Chief Engineer maintain fleet superiority while minimizing Total Ownership Costs (TOC). OA-TIME provides tools that synchronize schedules, assess risks, predict the impacts of technology, and estimate costs across systems and platforms within the enterprise.

CURRENT STATE OF DEVELOPMENT

Currently the TIPP tool base contract (SBIR) development effort has been completed and supports the functions described in the "Current TIPP Tool" block in Figure 3. ASSETT is using the tool on a subcontract to Progeny in support of PMS 495 for the Open Architecture and Technology Insertion Planning for Littoral Mine Warfare. Additionally, the TIPP Tool was used to support Littoral Combat Ship (LCS) Mission Package Computing Environment (MPCE)

technical insertion planning.

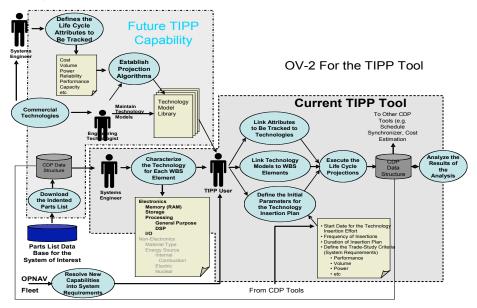


Figure 3 - Technology Insertion Planning Process/Tool

Our current assessment of TIPPs technology readiness level addresses three major areas including the TIPP Prototype Tool, the Baseline Trajectory Model, and Technology Models. We currently rate each of these major elements at the TRL 5 level, component and/or breadboard validation in a relevant environment. We also believe that TRL 6 can be accomplished with a larger representation of ship/system data. To date we have only been able to use smaller data sets from the LCS and LMW systems.

In Figure 3 above, the block "Future TIPP Capability" indicates we would like to develop automated download capabilities for indented parts list to establish the system baselines,

update and add to our current Technology Model Libraries, continue to integrate COTS tools for Optimization, and to update and add to our current Technology Projection Algorithms. Additionally, we will continue to improve the User Interface as well as the continued integration of TIPP into OA-TIME and interface with new Collaborative Development Partnership (CDP) tools.

TIPP has completed several Joint Demonstrations with other CDP members, integrating with other tools in operating the OA-TIME via the Collaborative Tool Framework (CTF).

REFERENCES

- Mr. Gary Humes, PMS 495 Mine Warfare Program Office, 202-781-1189, gary.humes@navy.mil
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ABOUT THE COMPANY

ASSETT, a small business with 45 employees, represents over 250 years of experience in design, development, test, and support to mission critical military systems. The ASSETT engineering staff has played major roles on many ASW and combat system programs at Lockheed Martin, LORAL, and IBM Federal Systems. In these roles they have supported PEO (SUB), NAVSEA, NAVAIR, SPAWAR, and NUWC. The engineering staff specializes in providing innovative research, systems engineering, and engineering solutions to complex systems. ASSETT personnel have extensive experience and seasoned lessons learned from complex design, development, integration, production, and support programs that include:

- Military systems including submarine combat systems,
- Non-military systems including air traffic control,
- Commercial systems including IBM internal Information Technology,
- Financial Management Systems (FMS) including NAVSEA's FMS, and
- Academia including Stevens Institute of Technology.

ASSETT employees have been instrumental in architecting the Navy's transition from milspec to COTS based tactical systems and are responsible for the Technology Refreshment and Insertion methodology in use by the Navy today. This innovation was the result of ASSETT personnel's response to the VIRGINIA Class C³I "Design to Affordability" effort in 1996. In addition to process innovation, our personnel have held key roles in the design and development of the Fixed Distributed Systems (FDS), Acoustic-Rapid COTS Insertion (ARCI), and New Attack Submarine (NSSN) Command, Control Communication and Intelligence (C³I) programs.