Training Systems Acquisition for Major Defense Programs

Fred Hartman
Institute for Defense Analyses
Alexandria, VA
fhartman@ida.org

Lori Frumkin
Alion Science & Technology
Alexandria, VA
lori.frumkin.ctr@osd.mil

ABSTRACT

The Office of the Secretary of Defense (Personnel and Readiness), Training Readiness and Strategy sponsored the Training Systems Acquisition for Major Defense Acquisition Programs (MDAPs) study to determine the impact of incorporating training systems considerations earlier in the acquisition process. This paper discusses details and provides findings and observations from the study completed in July 2012. The research effort, which was conducted in two phases, supports recent changes to the Defense Requirements Process that include requirements for training. It gathers and organizes data from new equipment programs that require significant human interaction, analyzes them for gaps and trends, and documents how training affects the system's total cost and effectiveness. Although Department of Defense regulations regarding MDAPs traditionally have addressed training in the context of human-systems integration and personnel issues, with document completion and delivery dates just prior to Milestone C, emerging Phase II results indicate that training system planning can and should begin prior to Milestone A, in the concept definition and analysis phases, and extend through the system's life cycle. The Phase II methodology includes analysis of specific case study systems to provide detailed evidence regarding the impact of training systems planning with corroborating details from multiple sources. This early systems training planning for operator, maintainer, and leadership, employing methodologies such as modeling and simulation, may be shown to provide opportunities to avoid later potential problems such as cost overruns and schedule delays and enable the full design capabilities of the new system. Test reports and other program-specific documents are included to extend the systems training information found in the training-related program documents. This work contributes to understanding of systems training planning in the acquisition process by providing compelling evidence documented from multiple accredited sources. Study results will inform and influence changes to the acquisition process and support a strengthened training role in the capabilities of MDAPs.

ABOUT THE AUTHORS

Fred Hartman is a Research Staff Member at the Institute for Defense Analyses (IDA) in Alexandria, VA, and has specialized in problem-solving with use of modeling and simulations, assessing training systems, and building and reviewing technical applications for over 30 years. Joining IDA in 1996 as a modeling and simulation advisor to the Deputy Under Secretary of Defense (Readiness), he went on to serve from 2000 to 2003 as Technical Director, Joint Simulation System, and simultaneously as Manager, Enterprise Division of the Defense Modeling and Simulation Office. In 2003, he was detailed to the Office of the Secretary of Defense (Personnel and Readiness) as Director, Joint Assessment and Enabling Capability and as Deputy Director, Readiness and Training Policy and Programs. In this assignment, he was study director for the Training Capabilities Analysis of Alternatives, a major training systems cost-benefit analysis for modeling and simulation applications in joint training, and for the Training Transformation Block Assessments. Back at IDA, he has continued to support the training and modeling and simulation areas with strategic planning and acquisition projects. Fred graduated from the U.S. Military Academy, received a Masters in Operations Research from the Naval Postgraduate School, has served for 6 years as a member of the Army Science Board, led a study panel for the National Academy of Sciences Board on Army Science and Technology, and is a past President and Fellow of the Military Operations Research Society.

Lori Frumkin has more than 25 years of experience in technical writing, training, and acquisition. She graduated from American University with a Literature degree and spent several years as a writer/editor for technical and non-technical publications for several Washington, DC area nonprofit organizations. She joined the World Bank in 1988 as a hardware and software trainer. In 1990, she became a senior-level trainer supporting the Army Staff (G-3) and was promoted to Department Manager within 2 years. She served as Training Manager for 12 years, providing end-user support, developing courses of instruction, and assisting G3 with transitioning to Windows-based software. She then moved to an analyst position supporting Office of the Secretary of Defense (Personnel and Readiness), Training Readiness and Strategy. She served first as a Training Analyst, developing the Training Transformation Implementation Plan, managing the reporting process, and moderating the Training Transformation Collaborative Web Forum, and then as an Assessment Analyst for the Joint Assessment and Enabling Capability. In 2008, she joined the Acquisition Team, writing and enforcing training policy and overseeing more than 50 programs for appropriate planning and funding for training in Major Defense Acquisition Programs.

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BACKGROUND

Systems training considerations have been found to be an important part of the systems-acquisition process. The impact of systems training in the early stages of Defense development programs is critical for successfully navigating the long and complicated journey from capability gap identification to the end of the system's useful life. The systems training considerations, which now come later in the acquisition process, are typically an element of the Defense acquisition process that extends over the full acquisition life cycle of major programs. A more thorough understanding of the full spectrum of training and training support systems, implemented early and continually in the process, will produce significant benefits over the system life and may shape and influence major program decisions along the way. The benefits and costs of modern simulators and simulations require consideration of the full range of options for individual, classroom, and unit training—beginning in the concept-development stage and extending through the life of a major system.

An additional incentive for including training systems in acquisition planning goes back to perceived shortcomings in the underlying Defense acquisition process. Over the last several decades, the Department of Defense (DoD) has initiated several efforts aimed at realizing the increased efficiency for major systems acquisition processes. Early planning for training supports the quest for efficiencies—especially across the full system life—because training considerations can inform critical decisions such as system design, deployment schedules, and manpower considerations. This can significantly improve cost, schedule, and performance, which directly supports the DoD acquisition-improvement efforts.

PHASE I METHODOLOGY

The goal of "Analysis of Systems Training Impact for Major Defense Acquisition Programs (MDAPs), Phase I," completed in July 2011, was to collect and process several decades of major systems training data to illuminate the role of training in optimizing total systems performance for acquisition programs (Wisher, et al. 2011). This research addresses key topics that were raised in the *Strategic Plan for the Next Generation of Training for the Department of Defense*, prepared by the Office of the Deputy Assistant Secretary of Defense (Personnel and Readiness) and signed by the Deputy Secretary of Defense on September 23, 2010. The next-generation training strategy provides guidance and outlines issues for the future of Defense training.

The Phase I research compiled an extensive list of reports and studies relating to systems-training acquisition for MDAPs and made the information available for future reference by creating an automated database of common variables. In addition, this effort addressed two central research questions:

1. Do the warfighters (operators, maintainers, and leaders) and the acquisition community benefit from early consideration of systems training in major acquisitions?
2. Does early planning for and funding of system training contribute to initial readiness and full use of a system's capability upon initial delivery?

The Phase I study findings documented results of a gap analysis that searched for differences between an "existing status" and a "potential status" for what might be the desired existence of training status. The study identified four types of gaps:

1. *Knowledge gap*—a best training practice has not been fully validated or proven for application for a given training system.
2. *Awareness gap*—a best training practice is proven, established, and relevant, but has not been applied for the training system of interest for a variety of reasons.
3. *Implementation gap*—a valid best training practice has been identified and attempted, but did not work properly in the case of a given training system.
4. *Commitment gap*—a valid best training practice is recognized but not applied due to policy, cost, schedule, or other factors.

The Phase I analysis yielded 26 instances of gaps, validating the need for a more critical treatment of training in major acquisitions.

PHASE II METHODOLOGY

The gap and trend analysis of the Phase I data provided a start point for the second phase of the study, which examines a series of selected systems for detailed training assessment using a case-study methodology. The Phase II research (Hartman, et. al. 2012) expanded on the Phase I study results to focus on the issue of whether systems training considerations introduced early and continuing through the life of the system are essential for reaching future training goals in an effective and timely manner. The study objective was to identify and analyze specific benefits of early and continuous incorporation of training details into acquisition programs. This study complements the latest DoD acquisition and training policies. The study provides citable evidence of systems training from selected MDAP programs over time. This phase included the participants in the Phase I effort, but also builds on the Phase I report, database, and findings, with additional study members from the Institute for Defense Analyses. The Phase II study team has years'-long, DoD-wide training and large acquisition program experience to provide the proper context for this case-study approach. In Phase II, five MDAPs from the Phase I study were selected and analyzed to provide a range of approaches to planning for, and integrating training into, the weapon systems:

- Patriot/Terminal High Altitude Air Defense (THAAD).
- Future Combat System (FCS)–Embedded Training (ET).
- Mine-Resistant Ambush Protected (MRAP).
- Husky Mounted Detection System (HMDS).
- P-8A Poseidon.

CASE STUDIES

Although evidence relative to the importance of training planning in acquisition has existed for years, this effort provides five well-known programs, each with specific examples to document the need for training systems planning through the system life cycle. To investigate how systems training approaches were handled in a representative sampling of MDAPs, five weapon systems were examined in detail. Two represent recent rapid acquisition programs, and the other three are representative of a range of older and more recent systems acquired through standard processes. The case-study results were examined to document the benefits of training in acquisition programs, and findings and recommendations are offered to improve systems training.

Patriot/THAAD

The Patriot began because of the need to replace an aging and limited air defense system in the 1970s, the Nike-Hercules, and augment another, the Hawk, with one that can defend against higher altitude threats and do so at ever-increasing ranges. The Patriot is a surface-to-air missile system having the primary mission to function as the Army's antiballistic missile system. This case study traces how a well-intended, but single-minded, objective to improve and extend system capabilities led to later problems with overall system performance. The principal reasons for this were human-performance and operator training issues that accumulated, but were not resolved, along the way. The Patriot system evolved with technical enhancements over a period of more than two decades. In parallel, the manner in which operators controlled the system also evolved, migrating from a manual mode to one in which operators became supervisors of a set of automated control systems. The operators, who remain the ultimate decision-makers, needed to deal with new technical features and information sources manifested through higher levels of automation. But operators lacked the rigorous training for this role as supervisor of automated functions and services that are subordinate to the operator. A high rate of fratricides during Operation Iraqi Freedom led to boards of inquiry and demands for improvements to operator training. Much of this was predictable.

As the case study illustrates, the lack of a proper job-task analysis, the apparent lack of a job-task reanalysis during or after significant upgrades, and the reliance on training devices that focused on narrow training scenarios and rote training methods had catastrophic aftereffects. Policies on personnel assignment, which impeded the development of needed expertise, were another factor.

The case study also poses an alert on how this predicament, improper job-task analysis and limited training, may be being repeated with an even more capable system, the THAAD, and it can also offer general recommendations on policies to upgrade training while technical capabilities are being upgraded.

THAAD is a separate air defense missile system that complements the lower tier Patriot system and the Navy's upper tier Aegis ballistic missile defense system. It is designed to destroy short-range and medium-range theater ballistic missile threats. Although originally an Army program, the program office for the THAAD is part of the Ballistic Missile Defense Systems under the Missile Defense Agency.

The first THAAD firing battery was activated in 2008 and received all hardware and components for full operation in early 2012. The interceptor missile has a range of about 124 miles. Of concern to the present case study is the potential for the lessons from Patriot not being applied to the relatively early deployment of the THAAD. Early flags by the ARL researchers involved with the Patriot analysis show parallels between the development of the two systems. For example, the job-task analysis for the THAAD appeared to replicate that of the Patriot, including the use of tabular displays, which are included in the Patriot, but not present in the THAAD. In general and as with Patriot, the cognitive aspects of task performance are not recognized in THAAD, resulting in a training framework that is drill, rather than thinking, oriented. The lessons from the Patriot need to be carried into other air defense systems as suggested by the Defense Science Board (2005).

The implications of this case study center on the need to upgrade the entire range of training tools and learning content for a system as its technical capabilities are undergoing an upgrade. The training that may have been acceptable for an early operational capability is not necessarily adequate as the mission addresses new threats and the system takes advantage of technological upgrades. In the case of the Patriot missile defense system, enhancements over a period of more than 20 years were not complemented with enhancements to operator training. Just as advances in electronics, sensors, and propulsion systems pave the way for a more capable air and missile defense, so too do advances in training technology, the learning sciences, and the engineering of instruction pave the way for a better trained operational force. This case study has demonstrated the impact of early issues with training, the lack of expert development, an acceptance of status quo, and an aftermath of consequences. The early training issues began surfacing even with the baseline system, although these were largely correctable. Research on the operator's task reflected a complex task breakout. The initial job task analysis resulted in an almost unwieldy litany of an air battle engagement broken into more than 100 subtasks and steps.

Furthermore, the training analysis and technologies did not appear to keep up with the system upgrades. The training of routine drills with limited scenarios was criticized in the Board of Inquiry report after the Operation Iraqi Freedom fratricides, and the report called for training that would improve high-level judgment. Unit evaluations supported the view of overall preparedness based on satisfactory performance of routine battle drills. Also, evidence was published that training routines for Patriot operators did not generalize, or transfer, to more complex, stressing scenarios with conflicting information. The following recommendations were provided specifically to the two programs:

- System upgrades require training upgrades; improvements in systems hardware and software must be accompanied by corresponding training enhancements at all levels.
- As hardware and software are upgraded in a system, consider similar technical upgrades to the training systems.
- Move training assessment to the left (earlier) in the acquisition cycle.
- Employ training lessons learned in Patriot to the THAAD program.

Future Combat System

The FCS was conceived as a family of weapon systems comprising eight types of manned vehicles: Mounted Combat System, Infantry Carrier, Non Line-of-Sight Mortar, Non Line-of-Sight Cannon, Reconnaissance and Surveillance, Command and Control, Medical, and Recovery and Maintenance.[1] Although these FCS vehicle types differed in functions and capabilities, they shared a common chassis and engine to reduce the logistical burden of maintaining the combat force. Furthermore, all FCS vehicles were originally designed to be limited in size and weight to allow them to be transported by the Air Force's large fleet of C-130 aircraft. Perhaps the most innovative aspect of the FCS was that it connected the disparate vehicles and systems to a common network. This network was designed to allow the family of FCS vehicles and systems to act as a coherent whole and to conduct network-centric military operations. One of the key services provided by the FCS network was the embedded capability to train anywhere and anytime in live, virtual, and constructive simulation environments.

Note that the FCS Embedded Training (ET) system is not an appended ET system or add-on feature of the weapon system. Indeed, one of the first principles for design of the FCS ET system is that it be developed in parallel with, and fully integrated into, the operational system design (Shiflett 2009). The FCS ET system was integrated with four of the five given architectural layers of the FCS network: transport (telecommunica-tions), services (middleware that provides inter-

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1 The FCS Program also included unmanned systems, but they were not considered relevant to the embedded training capability and are not considered here.

operability within and across platforms), applications (software packages for 10 battle command functions), and sensors/platforms (distributed and networked array of multi-spectral sensors). This level of integration ensures that no additional systems or capabilities are required to immerse soldiers in realistic embedded training scenarios. The ET system was considered to be an essential capability of the FCS family of systems. The perceived capability gaps in deployability and responsiveness gave rise to the requirement to train anytime and anywhere for a variety of potential missions. Given these requirements, it would be difficult to imagine, much less design, an FCS family of systems without an embedded training capability.

Training as Key Performance Parameter (KPP)

One of the unique aspects of the FCS program was that it elevated system training to the level of a KPP. This ensured that training remained a high-visibility concern throughout the history of FCS program. And as the current Joint Capabilities Integration and Development System (JCIDS) manual notes, having system training as a KPP provides a hedge against the historic problem of trading away training resources to supplement increased costs of the parent system (DAU 2012).

In the FCS Operational Requirements Document (ORD), critical technologies were identified for each FCS KPP. Two critical technologies were deemed necessary to meet the Training KPP objective:

- Computer Generated Forces, which provide the virtual and constructive simulation training environment for ET.
- Tactical Engagement Simulation System (TESS), which enables valid simulations of enemy and friendly weapons effects required for live training.

Another, perhaps less obvious, implication of raising training to KPP status is that it requires the system developer to monitor critical training technologies. For the FCS, that amounted to increased concern about the maturity of Computer Generated Forces and TESS technology. In fact, that led to the early identification and eventual resolution of problems of integrating TESS with systems within the FCS platforms and with architectures of live training instrumentation systems at major combat training centers. Had this technology not been monitored, the TESS issue could have languished from lack of attention and not been addressed appropriately.

FCS Findings

Although the FCS program was canceled, its ET system was considered by our study team to be a good model of training development for MDAPs. Discussed below are positive aspects of the FCS ET system's design and development that apply to MDAPs in general and not just to the FCS in particular.

Stress Training from Outset

Even in the earliest conceptual discussions of the proto-FCS system in the Army After Next studies, embedded training was considered an essential capability of the proposed weapon system. As the FCS moved into the initial conceptual phase, the studies and analyses were required to assume that embedded training was a fundamental system capability. Then, as the FCS program moved to the Technology Development phase, training was defined as a KPP. This stress on training enabled the topic to emerge and be maintained as a principal consideration throughout the design and development of the weapon system.

The early incorporation of training into system design and development is consistent with current guidance on the JCIDS. The JCIDS Manual (dated 19 January 2012) maintains that training requirements should be addressed in parallel with planning and materiel development (DAU 2012). Specifically, this manual asserts that training KPPs are required for all MDAPs and Major Automated Information System programs. Although formal KPPs are not required for Milestone A (entry into Technology Development phase), the guide requires that an initial/draft training plan be developed during the Materiel Solution Analysis phase prior to Milestone A. The FCS program essentially performed these studies in the pre-Technology Development phase of conceptual development from 2000 to 2003.

Integrate Embedded Training with Weapon System

One of the more remarkable aspects of the FCS ET system was the degree to which the embedded training system was integrated into the FCS operational hardware and software. Such integration provides different types of benefits. First, integration of training with the operational system maximizes training fidelity in that it allows individuals and units to train as they fight and enables the units to train anytime and anywhere the operational systems are available—including during deployments. Second, integration benefits overall system development by reducing needless duplication in software development and by avoiding increases in size, weight, and power requirements associated with appended training systems.

Another important, albeit nonobvious, benefit of the integration of training and operational systems is that it reduces baseline divergence of training systems and operational software (TRADOC 2006). As illustrated in previous cases, such divergence is common if the training system is developed as a separate component from the operational system. In contrast, integrating training and operational systems provides an inherent constraint to ensure that training upgrades are synchronized with system upgrades.

Monitor Maturity of Critical Training Technologies

Simply stressing training in materiel development is not enough. Training system developers need to provide due diligence by closely monitoring the maturity of technologies required to implement training effectively. For FCS, the TESS technology was identified as potentially problematic. However, early identification of problems enabled developers to find appropriate solutions. Similarly, newer training systems may be dependent on other advanced technologies, such as models of text understanding, methods for measuring eye fixations and movements, and brain activity monitoring. If such technologies are deemed "critical" for the training system, then developers must monitor the maturity closely to ensure that the technologies will actually work as intended in the operational environment. (The unanswered questions that led to the program cancellation did not pertain to its training system or related training technologies.)

In summary, the following recommendations, provided specifically to the FCS program, are relevant to training systems planning:

- Stress training from outset—All MDAPs (including rapid acquisitions) should address training as an integral part of the acquisition program.
- Move training assessment to the left (earlier) in the acquisition cycle.
- Integrate embedded training with MDAP weapons systems.
- Continually monitor technical maturity of critical training technologies.
- Provide training with the fielded system as a package to realize full potential/capability of new systems.

Mine Resistant Ambush Protected

The DoD MRAP acquisition program was initiated in 2007 and used a "tailored" rapid-acquisition process to rapidly acquire and field a family of protective vehicles. The rapid-acquisition process elements consisted of (1) using proven technologies and commercially available products; (2) establishing minimal operational requirements; and (3) using a concurrent development, test, and evaluation framework. DoD made the acquisition of MRAPs one of its highest priorities and maintained direct control of system integration (Feickert 2008).

By the time that the 2008 Defense budget was released, the MRAP funding requests exceeded $8 billion for 7,700 vehicles across services, and after massive production in 2009, the cost rose to $22.7 billion for 14,000 MRAPs. Schedule and cost performance were very good overall. But following rapid production and deployment of MRAP vehicles (2007–2008), it became clear that sustaining a fleet of about 15,000 vehicles "could pose significant challenges" (CRS 2008, GAO 2008). The exact vehicle type and inventory varied greatly by military service, type of mission, and theater of operations, but *all vehicles* were designed in a similar fashion—*tall and heavy*. The vehicle designs gave ample protection, in most cases, but at a price of increased vehicular accidents—primarily vehicle rollovers.

From 2007 to 2008, which represented one of the most significant fielding time periods, there were 122 MRAP mishaps, and over half of these mishaps were rollovers. Vehicle design contributed to the mishaps. The MRAPs, being much higher are heavier than their predecessors, are inherently less stable. For example, the Caiman MRAP is 9 feet tall and weighs 19 tons. Other factors contributing the high number of mishaps were the poorly constructed roads, low bearing weight river berms, and poorly constructed bridges found in the operational theaters.

Following such a rash of mishaps, military leaders expressed concern about the adequacy of training for drivers. The U.S. Marine Corps and the U.S. Army supported the idea of augmenting training with additional schoolhouse training that addressed the issues of vehicle design and common road hazards. Consideration also was given to the use of training simulators that could model selected MRAP vehicle driving characteristics and could train to scenarios with realistic terrain conditions.

Findings for the MRAP case study suggest that an argument can be made for improving weapon system acquisition by establishing, funding, and enforcing a disciplined methodology for timely and systematic training development and timely delivery of training—whether or not that acquisition is on a "rapid" or normal time scale.

It is therefore recommended that follow-on efforts consider addressing the issue of identifying and defining (or redefining) the development framework, processes, and methods for training development and continual training system evaluation. The following recommendations were determined specifically for this program:

- All MDAPs (including rapid acquisitions) should address training as an integral part of the acquisition program.
- Move training assessment to the left (earlier) in the acquisition cycle.
- Any MRAP follow-on efforts should include a comprehensive training systems plan (with early introduction of simulators) as an integral part of the program.
- Provide training content and simulators with the fielded system as a package to realize the full potential of new systems.

Husky Mounted Detection System

The HMDS, developed for the Joint Improvised Explosive Device Defeat Organization, is used by route-clearance patrols to detect mines and improvised explosive devices (IEDs) in support of Operation Enduring Freedom. The HMDS was executed as a rapid acquisition program in response to the large number of casualties that had occurred in Operation Iraqi Freedom, as well as in Operation Enduring Freedom. The HMDS was first deployed in 2008. A new version (First Generation, Second Edition) was deployed in October 2011. A total of 180 systems have been deployed to date, with a third edition now in development. Each combined system (HMDS and Husky) costs approximately $500,000. The HMDS consists of a 4-panel, 51-channel ground-penetrating radar mounted at the front of a Husky vehicle and a touch-screen graphical user interface (GUI) mounted inside the cab of the Husky. During route-clearance missions in theater, the single occupant (soldier operator) drives the Husky, stops upon audio alert of a suspected target, examines the ground-penetrating radar data using the GUI mounted in the cab of the Husky, and determines whether to mark the suspected target for further interrogation. If an alert is further investigated, it slows the rate of advance of the route-clearance patrol. If an alert is ignored, the Husky or another vehicle in the patrol could be hit by a mine or IED. The Husky and the HMDS are considered separate systems. All operators of HMDS must be trained on driving the Husky before receiving training on HMDS. This case study will only discuss HMDS training, not the Husky training.

To provide military personnel with a desperately needed capability as quickly as possible, the HMDS was developed using rapid acquisition. Unfortunately, how the life-cycle logistician is to include training systems considerations in rapid acquisition is not well defined. One consequence of this for HMDS was that no training plan was developed before deployment. At the first deployment, HMDS training occurred only in theater and was conducted by the original equipment manufacturer. Although the training was scheduled to last 1 week, soldiers were often pulled away from HMDS training to complete other operational tasks or training. In some cases, the soldiers received no training on HMDS before they operated it. If soldiers received the entire week of training, it was structured to begin with a day of classroom training, in which the instructors provided an overview of the system to the students. The remaining 4 days of training were spent on the actual system. Over the course of training (both classroom and in vehicle), soldiers spent approximately 4 hours on troubleshooting; 24 hours on threat detection and identification; and the remaining time on system constraints, GUI operation, and vehicle operations. Even though the majority of soldiers are certified Husky operators prior to HMDS training, some additional training is devoted to learning to drive the Husky with ground-penetrating radar panels, which are mounted to the Husky for HMDS operations and significantly change the performance of the vehicle.

The case study showed that it took 2 years for proper HMDS training to be developed, allowing the full capability of the HMDS to be realized by the operators. Since training development did not begin until 1 year after deployment, it took a full 3 years for HMDS to reach its desired training effectiveness performance level. All acquisition programs must recognize that full system effectiveness will not be reached until a training plan is in place to achieve the full system operational capabilities.

The following recommendations were provided specifically to the HMDS program:

- All MDAPs (including rapid acquisitions) should address training as an integral part of the acquisition program.
- Move training assessment to the left (earlier) in the acquisition cycle.
- "Right size" student-to-trainer ratio.

- Allow for training to be completed without interruption.
- Provide training as a package with the fielded system to realize full potential/capability of new systems.

P-8A Poseidon

The P-8A is a modified Boeing 737. The U.S. Navy plans to purchase 117 P-8As to replace its fleet of P-3C aircraft, and unlike the single-mission P-3C, the P-8A will be a multi-mission aircraft with the primary mission of long-range anti-submarine warfare; anti-surface warfare; and intelligence, surveillance, and reconnaissance. In addition, the P-8A Poseidon is capable of broad-area, maritime, and littoral operations. This broader mission responsibility adds to the complexity of crew training and is discussed in more detail in the report. The first test aircraft began formal flight testing in late 2009, with the initial operational capability slated for 2013.

The P-8A will conduct rotational deployments consisting of three 6-month phases (Basic, Intermediate, Deployed), consistent with the Fleet Response Plan. In November 2005, the Navy announced that the P-8A preliminary design review (PDR) conducted October 31 through November 4 of that year was the best major weapons system PDR it had ever reviewed. A successful critical design review was completed in July 2007.

While the aircraft design was deemed successful, several findings were documented regarding systems training for the P-8A: (1) training simulators are not networked; (2) the training packages lag systems development; (3) contractor determines maintenance training requirements; (4) multi-mission capability is not being addressed in increased training; and (5) manpower requirements for logistics support were increased by the contractor, affecting maintenance training. The P-8A will have a 9-member crew, in contrast to the 11-member crew for the P-3C. Note this crew reduction comes in spite of the broader, multi-mission role of the P-8A, which will require the logically broader training associated with the expanded mission capabilities.

The following recommendations were prepared specifically for the P-8A program:

- Add requirements to provide network connectivity and logical interoperability for the suite of P-8A simulators to ensure Battle Group, Fleet, and Joint Task Force training scenarios are fully supported with integrated live, virtual, and constructive training environments.
- Require analysis of the training load associated with the increase in mission areas to verify if the crew will actually have time and resources to satisfy all the mission and training requirements.
- Synchronize scheduling of simulators, training tools, and training packages to be available to train for first deployment so full system capabilities are available for initial operations.
- Expedite any changes to logistics and maintenance plans to include the full complement of maintenance personnel and training to define the best courses of action.
- Move training assessment to the left (earlier) in the acquisition cycle.

SUMMARY

The Phase II training systems acquisition study has met the research objectives of providing compelling evidence from a range of case study programs to reinforce the need (with actual program evidence) for early and continuous consideration of systems training in the MDAP program process. The study objective was to identify and analyze the benefits of early and effective incorporation of system training details in the acquisition process. The study results complement the latest acquisition and training policies and provide a cohesive, logical thread pulling together training systems acquisition in the important new DoD policies. Through a series of case studies, the study team found ample evidence to support the premise that training planning should occur early and continually through the acquisition process. The MDAP program managers should include detailed and comprehensive system training plans that encompass the wide variety of training venues, simulators, access to online content, and embedded training. Specific recommendations from each of the case studies detailed above find a common need for achieving increased readiness and full operational capability of the weapons systems through lifelong systems training solutions.

The case studies in this report reinforce the value of determining comprehensive training needs over a program life cycle. Training simulators and learning content for the system operators and maintenance personnel need to be fielded and available before initial introduction of the hardware system.

Here is a summary of the detailed recommendations from this research:

- Move training assessment to the left (earlier) in the acquisition cycle.

    - Revise Defense and service acquisition policies to require earlier and continuous assessments of training.
- All MDAPs, including rapid acquisitions, should address training as an integral part of the acquisition program.
- System upgrades require training upgrades. Improvements in system hardware and software must be accompanied by corresponding training enhancements at all organizational levels.
- Integrate embedded training with MDAP weapons systems as feasible. Net-centric systems of the future provide special opportunities to build in embedded training.
- Monitor technical maturity to incorporate parallel critical training technologies.
- To realize full capability of new systems, provide training with the fielded system as a package.
- Require MDAPs to provide network connectivity and logical interoperability for the suite of simulators and training tools so training scenarios are fully supported and integrated with the live, virtual, and constructive training environments.
- To ensure full system capabilities are available for operations, synchronize scheduling of simulators, training tools, and training packages to be available to train for first deployment.

REFERENCES

DAU. *Joint Capabilities Integration and Development Systems* (*JCIDS*) *Manual.* Online document, Washington, DC: Defense Acquisition University, 2012.

DSB. *Patriot Systems Performance.* Report of the DSB Task Force on Patriot Systems Performance, Report Summary, Defense Science Board, Washington, DC:Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, 2005.

Feickert, Andrew. *CRS Report for Congress: Mine-Resistant Ambush-Protected Vehicles: Background and Issues for Congress.* RS 22707, Washington, DC: Library of Congress, 2008.

GAO. *2009 Is a Critical Juncture for the Army's Future Combat System.* GAO-08-408, Washington, DC: United States Government Accountability Office, 2008.

Hartman, Frederick E., et.al. *Analysis of System Training Impact for Major Defense Acquisition Programs (MDAPs): Training Systems Acquisition.* Alexandria, VA: Institute for Defense Analyses, July 2012.

Shiflett, James E. "BCTM Embedded Training Software (BETS) Capability Summary." Washington, DC: Science Applications International Corporation, May 2011.

Shiflett, James E. "The Application of Embedded Training into Operational Systems: FCS and Beyond." *North Atlantic Treaty Organization Workshop on Human Dimensions in Embedded Virtual Simulation* (*NATO HRM-169*). Orlando, FL: North Atlantic Treaty Organization, 2009.

TRADOC. *Soldier as a System.* TRADOC Pamphlet 525-97, Fort Monroe, Virginia: United States Army Training and Doctrine Command, 2006.

TRADOC. *The U.S. Army Learning Concept for 2015.* TRADOC Pamphlet 525-8-2, Fort Monroe, VA: US Army Training and Doctrine Command, 2011.

Wisher, Robert A., et.al., *Analysis of System Training Impact for Major Defense Acquisition Programs.* Monterey, CA: Naval Postgraduate School, August 2011.