GROWING THE ARMY'S FAAD WEAPON SYSTEMS INTO MATURITY

An Applied Success Story...or Was It?

Julian Cothran

A true success story — a surface-to-air missile system setting new standards for acquisition • An Army program demonstrating greatly shortened concept-to-delivery — one where all contract deliveries are on-time and within-budget • A weapon system overwhelmingly popular with the soldiers and combat-proven in Desert Storm operations...

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This is a story about a system maturing to meet soldiers' needs, the processes involved in that growth trek, and constraints encumbered on those processes. It is a story about the processes initiated to grow the weapon system into maturity; and the management philosophy, tools, and techniques applied, e.g., Total Quality Management (TQM), to those processes; and about the initiatives of the individuals who had vision and stood fast in their commitment to long-term planning. These efforts, teams, and initiatives formed the force that sustained the momentum of the program, without which the program would have faltered and died an early death. Before we venture behind the scenes,

U.S. Army photo

FIGURE 1. Forward Area Air Defense (FAAD System)

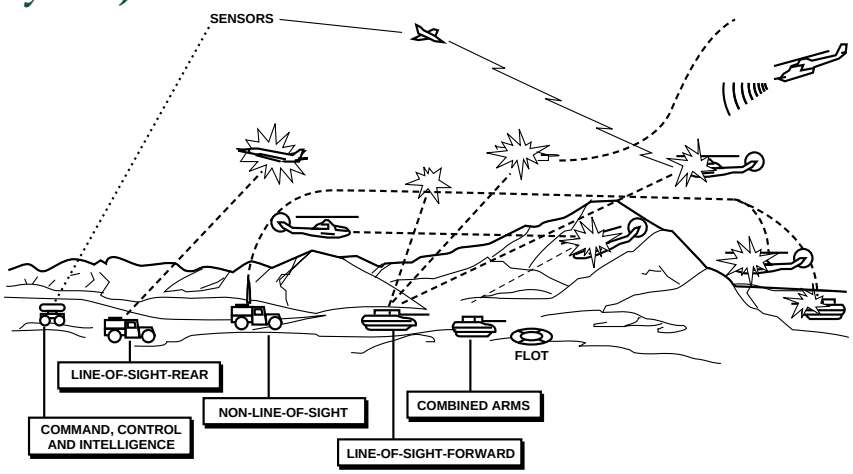
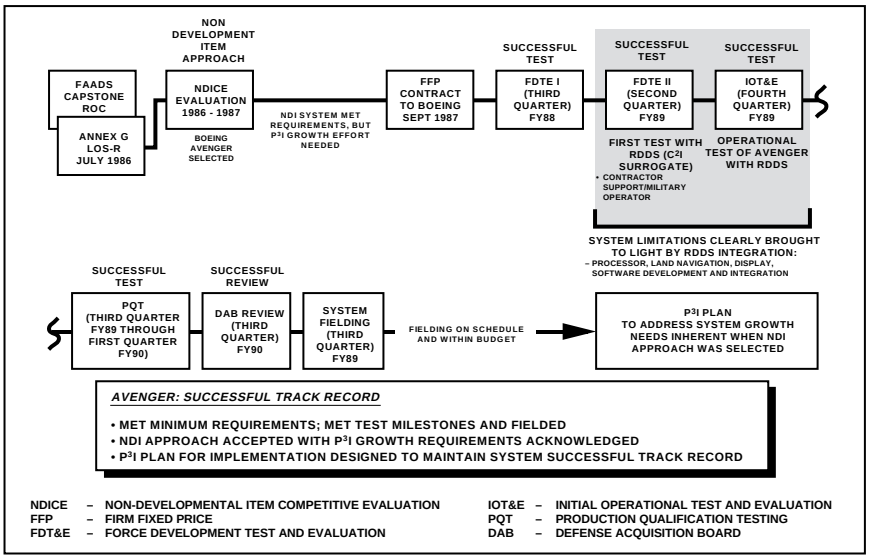
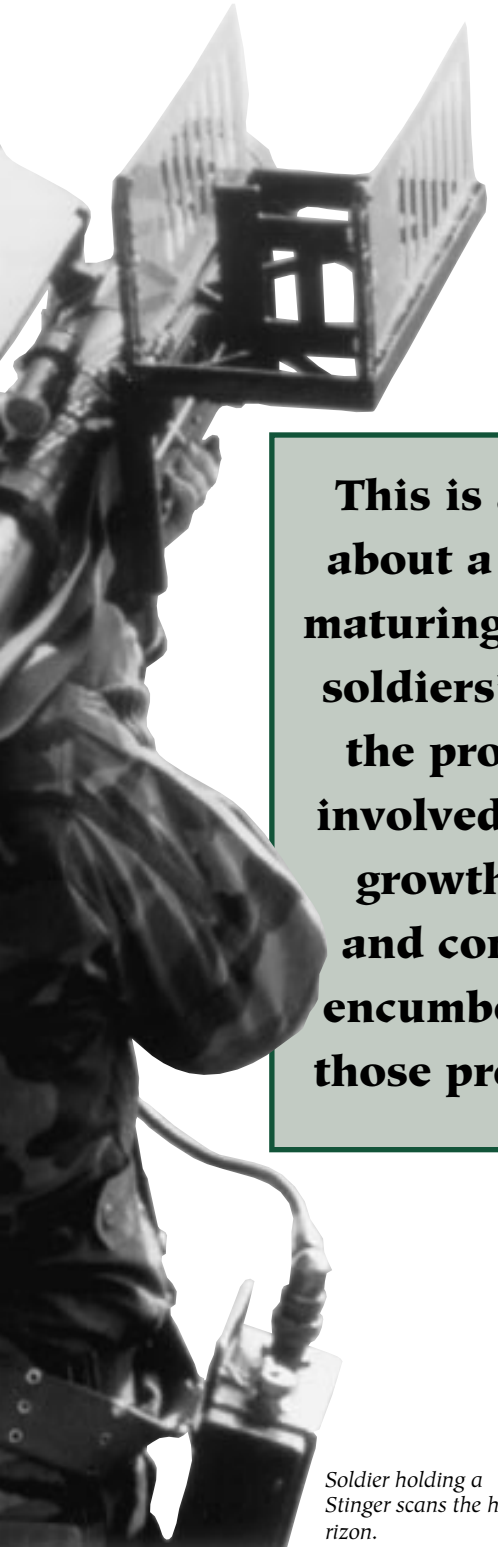


FIGURE 2. AVENGER History/Time-Phased Development





Soldier holding a Stinger scans the horizon.

This is a story about a system maturing to meet soldiers' needs, the processes involved in that growth trek, and constraints encumbered on those processes.

let's identify the time and environment where our story starts in order to comprehend the messages projected.

The Setting

The Army's Forward Area Air Defense (FAAD) concept surfaced in 1985 and gained much momentum by the spring of 1986 as it arose from the ashes of the canceled Sergeant York Gun System (25 August 1985). In the mid-1980s, the Army's critical operational Air Defense deficiencies were: (1) increasing threat weapon ranges and lethality beyond the capabilities of deployed defensive systems; (2) Air Defense system capabilities inadequate to support the new AirLand Battle concepts; (3) vulnerability of critical support and command installations vital to battlefield sustainment; and (4) effectiveness shortfalls of the STINGER MANPADS (Man Portable Air Defense System) due to human factors limiting the weapon system's full potential.

Four elements comprise the FAAD systems (Figure 1) as they combine with the forward components to form a combined arms team.

- The AVENGER, the line-of-sight rear system that rapidly locks on and fires eight STINGER missiles.
- The air defense tank system, line-of-sight, forward-heavy, designed to protect front-line ground forces from enemy air attack.
- The fiber-optic guided missile, non-line-of-sight, successfully blending the Army's best target recognition system — the soldier — with an advanced anti-helicopter and anti-armor missile.
- The FAAD command, control, communications and intelligence (C^3I) for battle management, sensors, air defense coordination, and exchange of command data.

The C^3I system collects (via a combination of active and passive sensors on the weapon fire units and remote sensors), processes, and disseminates intelligence and targeting information to

the various FAAD weapon systems and other members of the combined arms team. Generally, the Army refers to the FAAD C^3I as the 'glue' that binds the components of the FAAD system of systems together. The combined arms team was also considered for enhanced engagements of air threats.

The FAAD system of systems only worked if all the systems functioned together. With time as an enemy, after the demise of Sergeant York and the 'Big Bear' as a looming threat, off-the-shelf equipment and technology posed a viable solution and appeared available, in many cases, to meet the FAAD system component requirements. To acquire FAAD at the lowest cost, the Army adopted a non-developmental acquisition (NDI) strategy. The line-of-sight-rear (LOS-R) component of the FAAD system is the AVENGER — one of the NDI solutions. The following paragraphs focus on AVENGER — The System, and its NDI acquisition.

AVENGER — The System

The AVENGER (LOS-R or Pedestal Mounted STINGER) is designed as a STINGER-based missile system with eight ready-to-fire missiles, and a .50-caliber machine-gun system mounted on a Highly Mobile Multipurpose Wheeled Vehicle chassis. Combining the lethality of the STINGER, proven in battle, with a fire-on-the-move mobile platform and computer control, the AVENGER created new capabilities for the STINGER missile that resulted in a balance of firepower, mobility, and protection.

The NDI competitive evaluation pitted three contractors in a shoot-off in the fourth quarter, 1986 through June 1987. Awarded in the fourth quarter, 1987, the AVENGER (LOS-R) weapon system won the initial production contract. Subsequently, the first units for testing came off the assembly line in the fourth quarter, 1988. A true acquisition success story, the program took 3 years from the decision to create the AVENGER (LOS-R) weapon system, to its actual fielding — the first shoot-on-the-move missile air defense system. Figure 2 depicts the history of the AVENGER's time-phased approach.

The AVENGER system (as shown in Figure 3) performed to design and met the User's initial threshold requirements for the NDI AVENGER system fielding. Additional on-board sensors and the AVENGER and FAAD C^3I system integration were to further increase system effectiveness, maximize lethal keep-out range, and minimize fratricide. The non-recurring engineering for these integrations was accomplished through a Pre-planned Product Improvement (P^3I) program. The TQM implementations of the systems and processes to grow the AVENGER into the User's desired weapon, e.g., objective requirements, are the focus of this success story.

FIGURE 3. AVENGER

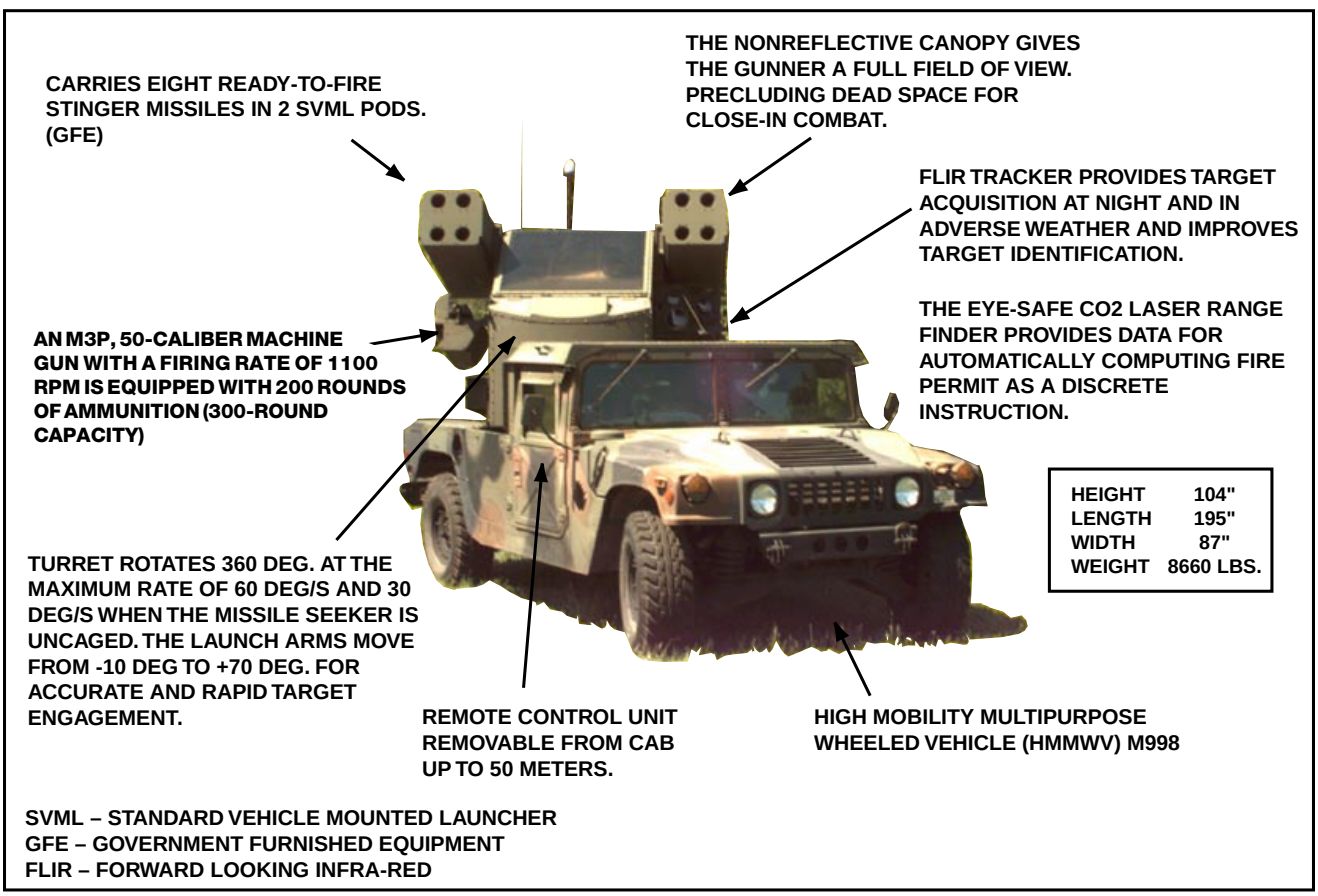
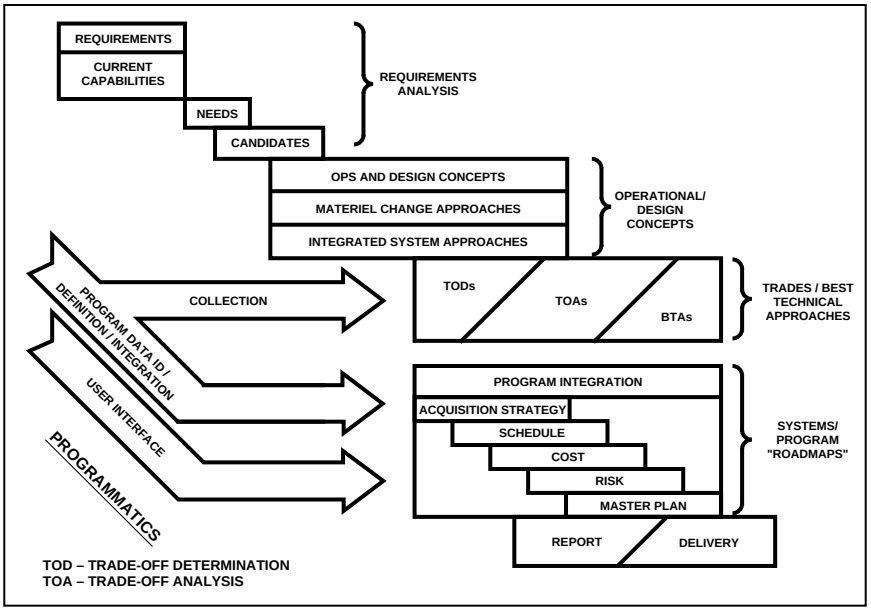


FIGURE 4. Technical/Programmatic Interface — AVENGER Growth Vision



The Process

The FAAD's (User requirements) Capstone Requirements Operational Capability (ROC) document defines requirements that characterize the AVENGER weapon system. Other interrelated requirements in the Capstone ROC describe top-level interfaces the AVENGER fire unit must have with subsystems of the FAAD C²I components and the non-cooperative target-recognition devices. Requirements also exist for an AVENGER Integrated Weapon Systems Display (IWSD) and an upgraded Remote Control Unit.

The Capstone ROC's P³I clearly shows the NDI AVENGER required system growth to meet all LOS-R requirements and combat future threats. Included in the LOS-R ROC Annexes were key growth requirements such as 360-degree passive detection system, environmental control, FAAD C²I interoperability, and others. The need for a comprehensive AVENGER P³I plan emerged as a result of the Range Data Distribution System test efforts at Fort Hunter Liggett, Ga. The full P³I impacts on NDI AVENGER were apparent: (1) the AVENGER Control Electronics, e.g., fire control and central processing unit, needed to be upgraded; (2) north referencing equipment was required; (3) the IWSD development was required; and (4) other cost-effective modular upgrades were needed.

Management focused on: (1) satisfying the User's [customer's] requirements; (2) sustaining a quality product; (3) ensuring continuous product improvement (modularity in phased development) and processes necessary to produce, thus improving all aspects of performance, both weapon system product and acquisition process, to achieve long-term cost reductions; and (4) User, Developer, and Contractor teaming.

With this focus, the Objective Systems Working Group (OSWG), a combined industry and government (User and Developer) team was chartered to: identify unfulfilled User requirements, develop materiel solutions to requirements, and integrate the materiel solutions into a 'wholistic' approach evolving the system to meet objective requirements. The tools and techniques applied, both during the working group phase and the implementing phase of the P³I Plan, are recognized today as the essence and pillars of TQM.

The TQM Approach

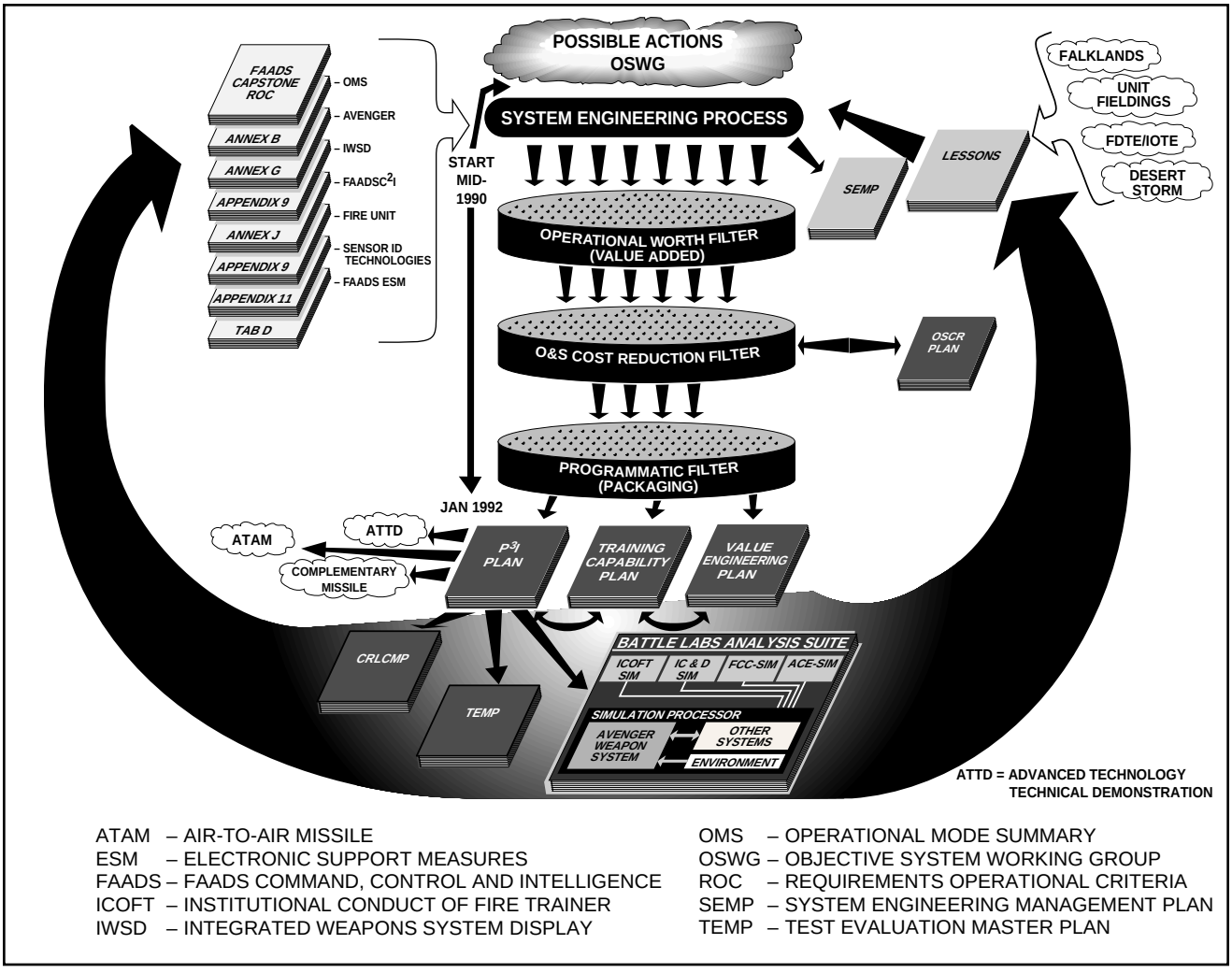
Recognizing that the interaction of the people involved, in consonance with applied technical expertise, would determine the success or failure of the effort and the resultant P³I Plan, Army planners mapped out the interaction, and iterated the entire process as an open system. Figure 4 shows the analyses process flow with interfaces and assessments.

The management focus is customer satisfaction (the 'cornerstone' of TQM); the customer (User/Developer) is the one from whence came the requirements; while the FAAD Capstone ROC is where both needs requirements and desires or wants (growth to an objective system) are defined.

A partnership was formed with the customers, and their representatives played an active part on the senior advisory committee of the OSWG, ensuring focus to achieve customer satisfaction. Later a customer-supplier agreement, formalized via top-level management signature, formed a contract and teaming relationship. This relationship emerged during the implementation phase of the P³I program, after development of the P³I plan by the OSWG. The customer-supplier agreement is the System Improvement Plan (SIP). Accordingly, the SIP defines individual materiel changes, weapon system block modifications, and identifies budget lines.

The Program Management Office (PMO) FAAD, and the Missile Command Research Development and Engineering Center continually followed up on the P³I Plan to ensure customer satisfaction. As crafted for the future, the P³I plan met several goals. First, the products (AVENGER materiel changes) emerging from the process offered operational 'value added'. Next, the materiel changes were affordable. Also, the P³I showed 'value added' within the materiel ac-

FIGURE 5. The System Engineering Process



ATAM – AIR-TO-AIR MISSILE
ESM – ELECTRONIC SUPPORT MEASURES
FAADS – FAADS COMMAND, CONTROL AND INTELLIGENCE
ICOFT – INSTITUTIONAL CONDUCT OF FIRE TRAINER
IWSD – INTEGRATED WEAPONS SYSTEM DISPLAY
OMS – OPERATIONAL MODE SUMMARY
OSWG – OBJECTIVE SYSTEM WORKING GROUP
ROC – REQUIREMENTS OPERATIONAL CRITERIA
SEMP – SYSTEM ENGINEERING MANAGEMENT PLAN
TEMP – TEST EVALUATION MASTER PLAN

quisition process for lowest-level acquisition approval and implementation, which increased the PMO's control over the program to support the life cycle. Finally, the program built an effective government program team that engendered enthusiasm in its members through job empowerment. This program is reflected in the System Engineering Process (Figure 5).

The product development team's leadership created a vision that went beyond hanging additional sensors on the AVENGER and increasing its computing capacity and through-put. They envisioned their purpose as ensuring an interoperability on the battlefield via digitization; and emphasizing the fire unit and the soldier puller, thus maximizing results where it counts — on the battlefield. These results are inherent in the product the team developed — the P^{3}I AVENGER.

The TQM principles employed to produce the product combined management techniques, improvement efforts, and specialized technical skills within a process structure focused on continuous improvement to produce the pay-offs experienced. These pay-offs suggest that the approach used may offer substantial rewards to other PMOs in the form of rekindled expertise, synchronized efforts, and establishing pride in their in-house teams.

The Changing World Environment

The rapidly changing world environment and the corresponding U.S. response in defense posture demanded a complete reassessment of the Army Air Defense's Battlefield Functional Mission Area in doctrine, tactics, and weapons. This environment has changed more in the last 3 years than the preceding 40 plus years.

Figure 6 depicts an environment where excitement of new start development is changed to NDI and materiel change as the mode for weapon system acquisition...an environment overshadowed by complexity in weapon systems; cost and schedule overruns; performance shortfalls in fielded systems; software-driven weapon system design, trainer and maintenance design; and finally, by procurement roadblocks.

The world environment is challenging if not demanding that the traditional acquisition management and system engineering process change and identify a better, shorter, and more cost-effective means of accomplishing its purposes and implementing its processes. An environment not providing definitive instructions or guidance...an environment demanding more productivity, versatile output, and less resources than were available over the past 40 years...an environment in a state of shifting and creating new paradigms (e.g., TQM, Battle Labs, funding, acquisition reform) as it changes.

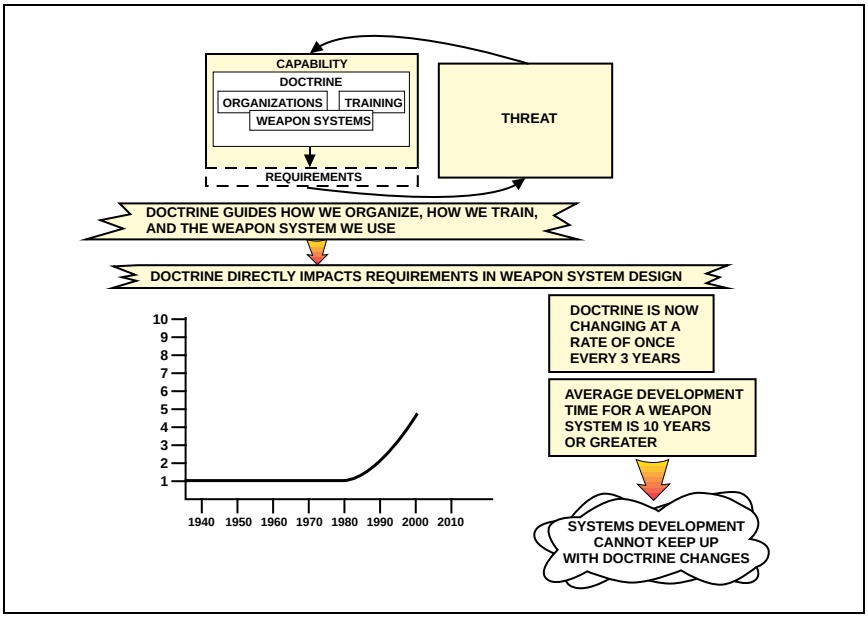
Epilogue

Albeit the AVENGER program and P^{3}I efforts are canceled, the P^{3}I AVENGER's capability is the 'seed kernel' from which Air Defense is able to digitize the forward battlefield from sensor-to-shooter. In this way, low-altitude-air-defense makes a decisive contribution to AirLand Operations employment.

Reflecting upon the overview and looking from a micro perspective at the product development team, the PMO, the user of the product (the P^{3}I AVENGER), and the TQM concept, the P^{3}I effort is a success. From a macro view, considering the Air Defense customer, the Army, and the changing world situation, the P^{3}I effort failed due to cancellation.

Managers concentrating on 'now' see the AVENGER P^{3}I as a drawdown casualty; whereas, managers who aspire to leadership and visualize with a deeper, more projected view of the process and environment around them, see the P^{3}I effort as applied TQM. Who is right, and who is wrong? Was the AVENGER program and its P^{3}I effort a success or failure? Consider this — while the program is canceled, the TQM techniques worked. Time alone will reveal the answer after the hourglass has sifted its sand. Right now it rests in the eyes of the beholders, where they sit, and how they view their environment. While we await an answer, the true success or tragedy may be how management views this creative team that made it all happen — 'the paradigm pioneers' — and how they and their concepts are used in the future,

FIGURE 6. Doctrine (Rate of Change)



'WORLD-CLASS' CUSTOMER?

Michael Linkletter

I attended DSMC's Advanced Production and Quality Management Course (APQMC) approximately 1 year ago. There was one concept that stuck with me and will remain with me throughout my career. They taught the concept of the 'world-class' customer. Essentially, people have been focusing on world-class suppliers and manufacturers without any regard to the customer. How can the government expect someone to be world class if we are not world-class customers? The problem with the government as a customer is the excessive burdens we place on contractors to do business our way, not necessarily the best way. I came away from the class as an engineer who is now more open to alternatives to the government way proposed by contractors.

One of the unique characteristics of the class was the participation of industry as students in the class. In one case a student from Boeing [Seattle] demonstrated the problem I noted above. Boeing does about 80 percent of their work commercially. They have approximately 800 people in the financial department for commercial activities versus approximately 3,000 people in the financial department to handle government contracts. What does this tell us about the burden of doing business with the government? In my view it speaks volumes...

Editor's Note:

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