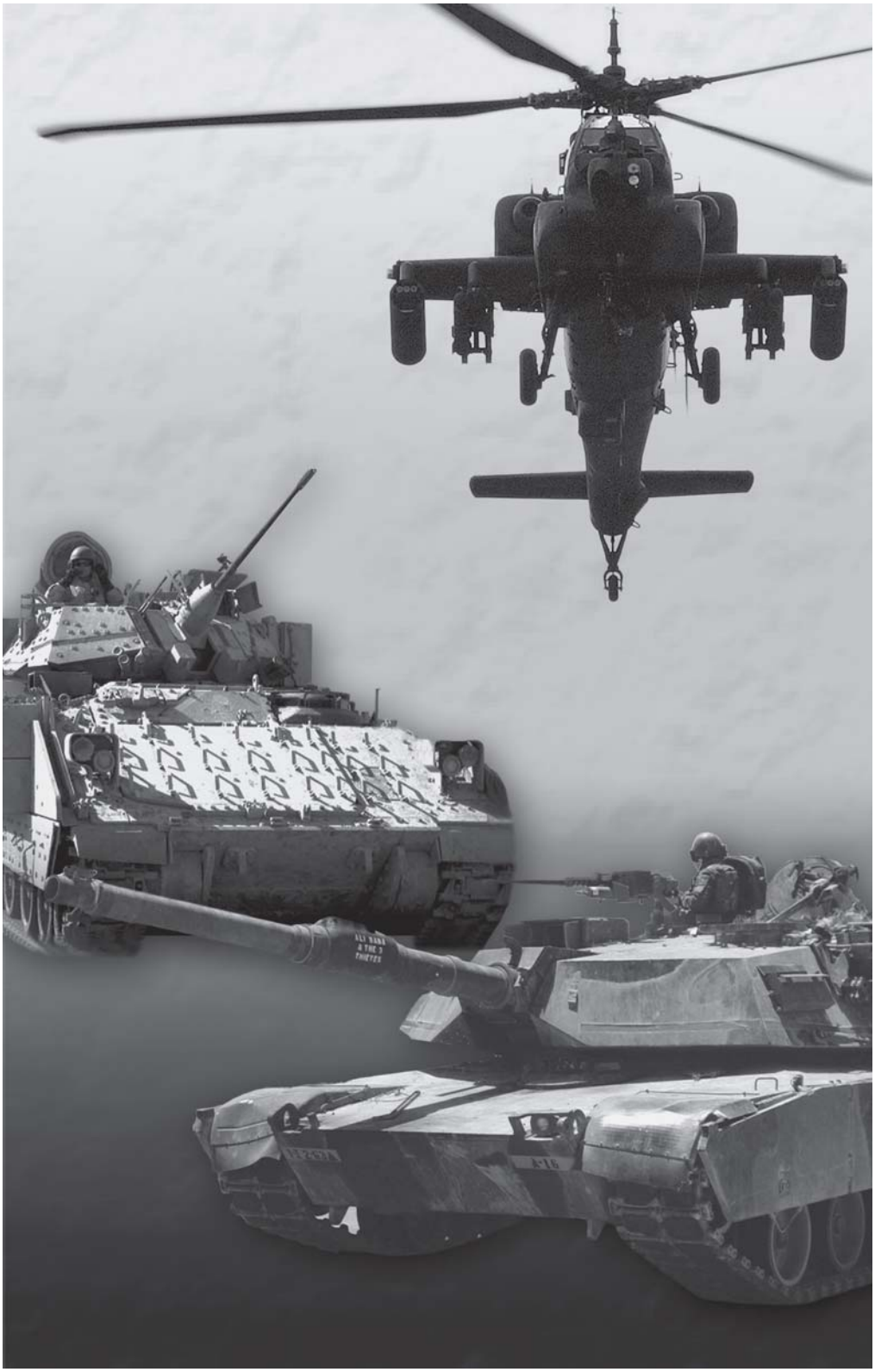

Photos courtesy of Department of Defense and SFC Joe Belcher, CSM Steven Stuckey, and SSgt. Klaus Baesu

A MULTITIERED APPROACH TO ARMY ACQUISITION

JOHN V. FARR, WILLIAM R. JOHNSON, AND ROBERT P. BIRMINGHAM

The Department of Defense (DoD) has embarked on an ambitious path with the goal of accelerating the acquisition of complex systems with the adoption of the DoD 5000 series. Although DoD guidance encourages innovation by program managers, the organizational culture and a biannual budget process have not produced any significant changes for more efficient materiel acquisitions. Evolutionary acquisition coupled with spiral development provides the acquisition community with the means to develop appropriate acquisition strategies and methodologies. Current Army business practices must be modified to pave the path incorporating the three-tiered approach to acquisition presented in this paper, focuses on processes based upon traditional acquisitions, proactive spirals, and reactive spirals in the current biannual budgetary environment.

Past successful major Army acquisition programs, such as the Bradley Fighting Vehicle, M1 Tank, Apache Helicopter, and the Multiple Launch Rocket System (MLRS) of the 1980s were developed in response to a well-defined, if unpredicable, threat. The current requirements-based acquisition system worked well for those platforms and has produced the most technologically advanced Army in the world. The threat, however, has radically changed. Asymmetrical threats posed by nonstate actors, such as Al Qaeda and Abu Siaaf, now operate well within our technology development, integration, and fielding cycles. Combined with our new reliance on soldier-centric, technology-enabled system-of-systems (SOS) programs, such as Future Combat Systems (FCS), traditional Army acquisition processes do not have the agility to develop, test, and field suitable, safe, and supportable materiel quickly enough to respond to rapidly adaptive, asymmetric threats.

The Department of Defense (DoD) 5000 acquisition regulations (2003a, 2003b) provide an unprecedented amount of flexibility to program managers (PMs)

encouraging evolutionary acquisition strategies and promoting the spiral insertion of advanced capabilities over time. The DoD 5000 acknowledges the dynamic nature of user requirements given the unpredictable threats in a post–cold war era. However, it does not provide guidance on how to execute and resource spiral development given a biannual budget cycle.

Spiral acquisition, when properly planned and resourced, offers many unique advantages over traditional procurement processes (modified from Johnson & Johnson, 2002), including:

- Incremental capabilities can be fielded quickly, giving the warfighter greater capabilities sooner.
- Risks can be spread across a series of spirals, with the added benefit of allowing the user to develop tactics, techniques, and procedures (TTP) incrementally as well.
- Each spiral can respond to lessons learned from preceding spirals.
- Technology improvements can be incorporated faster—lean, agile acquisition by its very nature.

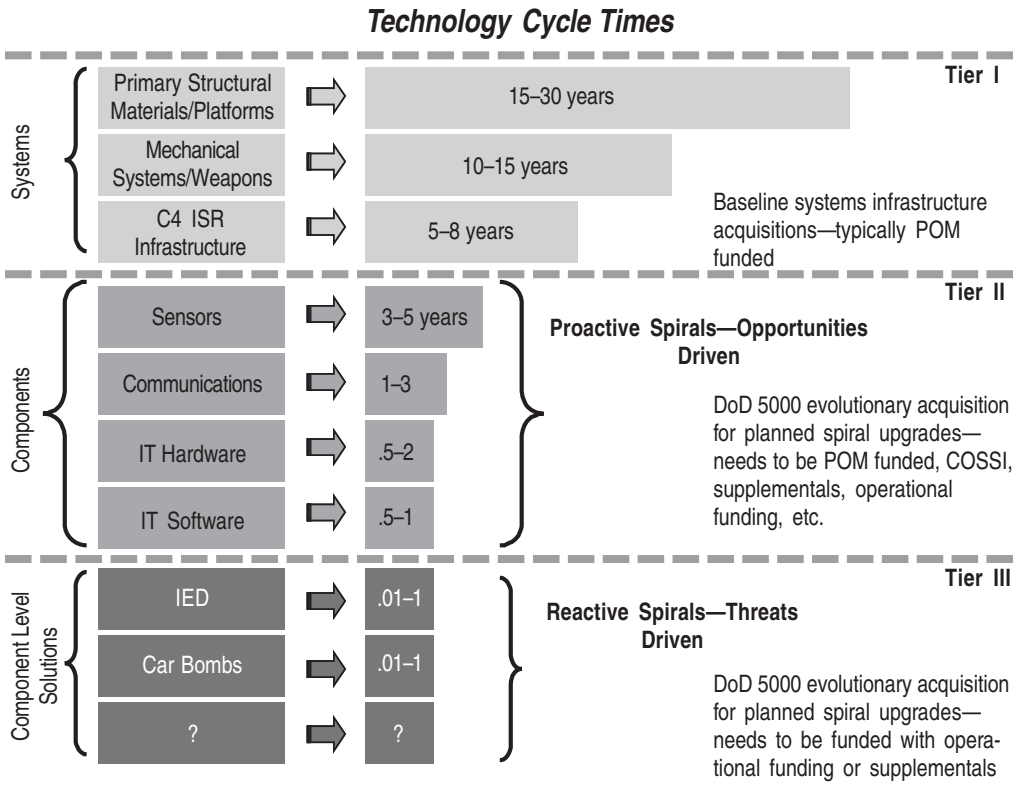

FIGURE 1. THREE-TIERED APPROACH TO ARMY ACQUISITION

As shown in Figure 1, we propose a *three-tiered* approach to spiraling in new technology that will enable requirements and acquisition proponents to respond to rapid changes in technology and the ability of threats to adapt inside our traditional materiel acquisition cycles. Furthermore, this proposed approach acknowledges the current biannual budget cycle and supports the evolutionary acquisition guidance found in DoD 5000. A description of each tier follows.

Without profit as a motivator, time to market is often not an issue—especially given the technological edge the DoD has in most modern weapons systems.

In the simplest of abstractions, major DoD programs are analogous to a matrix organization with numerous government stakeholders. Organizationally, the requirements developer, materiel developer, tester, and user are all typically stovepipe service organizations governed by culture, federal law, policy memorandums, regulations, memorandums of agreement, and so forth. Many of those documents are so unwieldy that significant resources are expended on peripheral issues. Cutting across these stovepipe organizations are the functions of research and development, testing, engineering, etc. All of these organizations have typically been focused on fielding a stable and mature system that meets documented user requirements. A contractor is then hired to build the system. All of the parties involved are interested in fielding the most stable, lethal, and sustainable system. Unfortunately, the disconnect between the desired requirement and contract defined by the system specification is so significantly broad and vague that it dictates a large test regime in order to close the gap between requirement and actual capability being built by the contractor. Without profit as a motivator, time to market is often not an issue—especially given the technological edge the DoD has in most modern weapons systems. The lack of schedule focus creates a culture that has historically called for a total system solution despite notorious requirements creep and a never-ending component to sub system-to-system test.

ACQUISITION OF TIER I SYSTEMS

We define Tier I systems as those that are major weapons platforms at the systems level. The defense acquisition system was designed to develop these major weapons platforms (ship, airplanes, and fighting vehicles) and the supporting communication systems, sensors, and software. In an era of long technology cycles, this approach

produced reliable, sustainable, and lethal systems. Unfortunately, the cycle time between the introduction of new weapons platforms or systems within the DoD is typically 15 to 30 years. Reasons for this vary but include:

- Most weapons platforms or systems require integration across the Army and DoD.
- The systems remain in the force for many users and are the biggest users of sustainability funding in the Army. Major changes can have enormous consequences on total sustainment costs for the Army.
- New weapons systems require enormous investments and are affected by political realities.
- A system consists of many components that cross the technology base, contractors, and many government agencies. Introducing new systems produces many ancillary effects.

The current weapons acquisition philosophy must be refined to reduce cycle times.

Unfortunately, modification must be made to the acquisition system to reduce the time for technology insertions. Concepts such as *Unit Set Fielding* (as manifested in the Stryker Brigade Combat Team Program), the *Modernization through Spares* concept (as demonstrated in the Force Battle Command Brigade and Below [FBCB2] program), and the integration of Field Commanders in the spiral upgrade process for the Maneuver Control System (MCS) reflect a slow but measurable evolution in Army acquisition. Yet, with the introduction of the FCS, the Army has chosen future families of systems that depend on information technology as a key force multiplier. Since these systems are becoming more reliant on the integration of a wider array of advanced technologies, cycle times must be reduced to field the most lethal force on the battlefield. The current weapons acquisition philosophy must be refined to reduce cycle times. Some key changes that should be explored include:

- Expectations must be managed. Many will want to compare the baseline system with the legacy system it was designed to replace. The ultimate system (baseline with spirals) must be compared against the legacy system.
- A single, accountable integrator must be placed in charge of the process, to include testing within the government among the contractor teams.

- Systems must be designed up front for spiral development and conform to existing DoD and commercial standards for interoperability. Spiral development and technology must be designed to be backwards compatible. Functional and physical architectures must be described and the interactions documented and modeled to promote *openness*.

- A spiral approach does not work if the user cannot accept fielding a significantly less (80 percent, for example) than desired solution when the baseline is fielded.

- The test community must be involved at all phases of the program. Partial long-term capability must be seen as success. The test community cannot delay fielding waiting for a 100 percent solution.

- The requirements must evolve and be flexible with possible updates in the middle of the acquisition. Contracts must be written to allow for a moving baseline.

- The logistics community must buy into having multiple configurations fielded. Fortunately, commonality and modularity at the component and subcomponent level should help reduce some of the logistics burden.

- Communications must be continuous and trust be built among the total development team. This is not limited solely to the PM and contractor, but among members of the government team as well.

- Up-front modeling and simulation to support testing and evaluation must be funded at adequate levels to reduce risk. Modeling and simulation will be key to designing up-front proactive spirals. Conversely, they will be very important in identifying the capabilities lost at the SOS level if the funding for a spiral is removed.

Open and agile systems should be the mantra of Tier I acquisition with a fixed and inflexible production date under a single government and contractor leadership. Like commercial industries, backwards planning from that date must drive all decisions with time to market as a key performance metric. Also, creative and innovative contracting must be written to facilitate open systems.

ACQUISITION OF TIER II SYSTEMS

As shown in Figure 1, Tier II candidates for spiral development are at the component and subsystem level. These candidates should be characterized as those most affected by short technology cycle times. One of the key elements of spiral development for Tier II is that as technology matures, it should be inserted in the baseline system or matured for future spirals (see Figure 2). Given the rapid pace of change, few can predict with a high degree of certainty how new technology will evolve in the two to five year time horizon. Thus, business processes must be developed that allow for

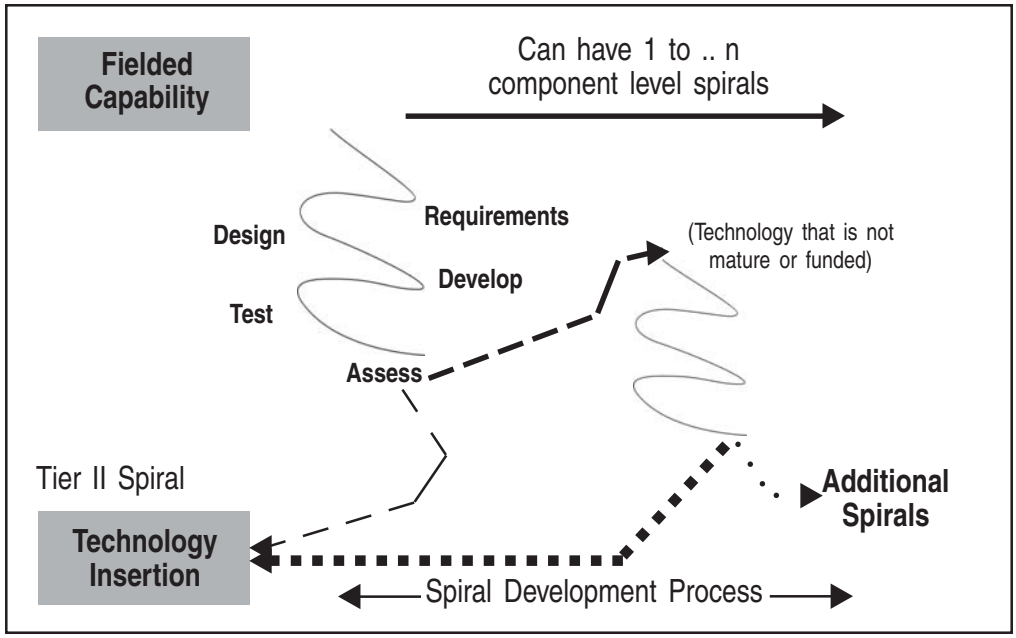

FIGURE 2. SPIRAL OF NEW TECHNOLOGY INSERTION STRATEGY

both time- and capability-driven insertions. Flexibility also should be inherent in the system in the event additional funding (i.e., congressional supplementals) becomes available. The key tenet of a Tier II insertion is that spirals are forecasted, planned, and most importantly, budgeted in the Program Objective Memorandum (POM).

Spiral acquisition is inherently flexible and could lead to budget cutbacks in difficult times. Often, definable products cannot be associated with a given spiral. The program must be designed to weather delayed insertions without catastrophic failure (rejection by the user community). The leadership (DoD and congressional) must accept that spirals are subject to change based upon technology and user needs. An education process must be undertaken to inform Congress and other funding agencies on both the benefits and risks of spiral development. Several challenges exist within the current Army paradigm with regard to planned spiraling of technology, including:

- Questions need to be answered, such as "Can the user philosophically accept multiple configurations of a system?" and "Can the sustainment be designed to ensure an adequate support system?"

- More component-level testing should be allowed (with government oversight) to facilitate reduced spiral cycle time.

- Testing at contractor sites (with government oversight) should be encouraged to reduce time and cost.

- Realistic models and simulations must be used to assess the impact of spirals on the total system or SOS.

- The PM and the contractor should have more oversight of component-level testing and should not conduct system testing for component spirals. For spiral development, the testing community must be involved with the PM and system developer or integrator throughout the acquisition process.

Unfortunately, in an era of shifting funding priorities and a rapidly changing geopolitical environment, time-driven insertions (similar to the block upgrade approach currently used) are hard to defend—especially when the capabilities that will be delivered are uncertain because of evolving technology. For significant lapses of time after release of the baseline, technology insertions should be planned and programmed based primarily upon capabilities to be delivered. Thus, when funding is not provided, a shortfall in capabilities can be demonstrated at the SOS level and the program will be easier to defend during the funding process.

Complex and unwieldy regulations and oversight leading to delays in timely technology insertions will prevent the leveraging of technology to field the "best" system.

Once a baseline system has been fielded, contractors must have incentives to improve performance, reliability, and cost effectiveness, thereby facilitating contractor-initiated Tier II spirals. This can be accomplished using value engineering (agreements to share cost savings with the contractor during pre- and post-production), an annual post-product research and development budget, or having mechanisms for incentives in the contract to improve cost and performance. The contractor teams must be empowered to improve the systems. Complex and unwieldy regulations and oversight leading to delays in timely technology insertions will prevent the leveraging of technology to field the *best* system. The Army must encourage contractor-initiated spirals in lieu of a requirement-driven process. Most important, like commercial vendors, time to market must drive fielding at all levels.

The issue of reducing the time to market for fielding baseline systems is different, but is related to spiral development and the associate incremental upgrades. Because there is significant overlap in processes, organizational and cultural issues must be changed. It is hoped that many of the processes proposed for Tier II acquisitions will eventually be adopted for Tier I acquisitions as well.

ACQUISITION OF TIER III SYSTEMS

Most important, we propose a third tier element to the acquisition process that is designed to respond quickly to the modern enemy's decision cycle, which has demonstrated an ability to pivot inside the DoD's ability to field technical solutions, thus neutralizing many historically capable systems. Tier III insertions are typically at the component or subsystem level. Currently, the U.S. Army is responding to a threat that is adaptive with changes in materiel and tactics that evolve well within our ability to respond with a material solution. Improvised explosive devices (IEDs), rocket-propelled grenades (RPGs) with timing fuses, car bombs, and so on, have caused our soldiers to respond mainly with solutions that are tactics-based, even though technology often exists that can neutralize the threat.

Currently, the U.S. Army is responding to a threat that is adaptive with changes in materiel and tactics that evolve well within our ability to respond with a material solution.

The Tier III acquisition strategy must be designed to respond to unforeseen threats rapidly with material solutions (a high Technology Readiness Level [TRL]), items from the technology base (6.4 and 6.5), or commercial vendors. The U.S. Army has a similar ad hoc program, termed the Rapid Equipping Force (REF), that is being funded primarily with congressional supplementals in support of Operation Iraqi Freedom. However, this process needs to be formalized to provide the sustainment mechanisms needed to support the materiel developments. To ensure success, Tier III acquisitions should:

- Have a single point of contact that responds to requirements generated by the combatant commanders.
- Be funded from a wide variety of sources (Commercial Operational and Support Savings Initiative, POM, operating funds, etc.) to ensure that many mechanisms exist for funding and does not rely solely on congressional supplementals.
- Institutionalize a process to ensure that training, supportability, and funding are adequate for each type of technology infusion.
- Support technology upgrades on a regular cycle at the system, subsystem, and component level (this also applies to Tier II insertions).

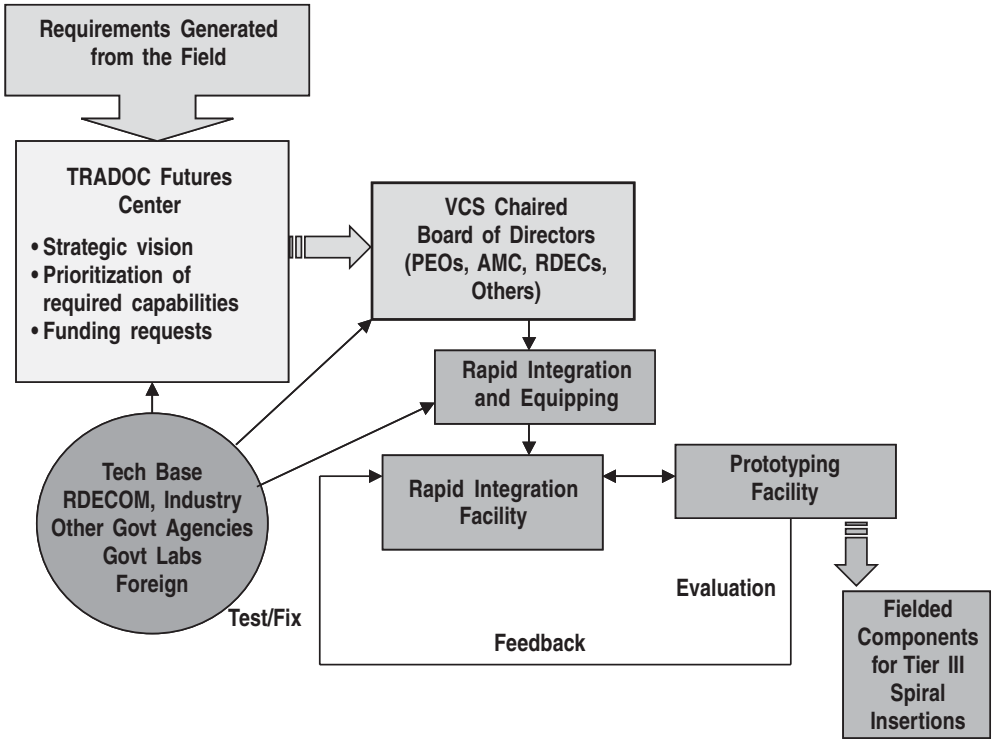

FIGURE 3. NOTIONAL ORGANIZATIONAL STRUCTURE FOR TIER III TECHNOLOGY INSERTIONS

Figure 3 presents a notional organizational structure for managing Tier III acquisitions. The figure is not designed to be all-inclusive. Instead, it is meant to show what elements are essential to rapidly field technology insertion spirals that respond to the enemy's decision cycles.

Tier III insertions have a unique set of challenges. These include obtaining an honest assessment of a technology's capabilities, risk, and life cycle costs. Compounded by competing parochial interests both inside and outside the government, an organizational structure similar to that shown in Figure 3 will be needed to rapidly respond to the solider in the field.

OBSTACLES TO A THREE-TIERED ACQUISITION SYSTEM

The greatest challenge to the three-tiered acquisition system proposed will be to program and protect funding for the Tier II and III spirals. In the past, spiraling has been resisted except for well-defined upgrades (in terms of capabilities). In general, planned upgrades based upon emerging technology still in the technology base have not been successful. For example, in 2001 and 2002, the Comanche program underwent its final restructure prior to its termination in 2004. As part of this restructure, the

program office refocused the entire operational requirements document and contract to accommodate the new DoD 5000 evolutionary approach to acquisition. Although the Office of the Secretary of Defense (OSD) embraced the time-phased delivery of concepts, few in OSD or the Army understood how to execute such a program within the current POM to budget process. The Comanche PM realigned the total program around four Blocks or spirals, each block building on the previous technology insertion. Although Blocks 1 through 3 were well defined and fully funded, Block 4 included less-defined capabilities that included improvements historically defined as Pre-planned product improvements (P3I), such as reliability improvements, new Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) waveforms, improved accuracy and range, etc. Although the Army, through the Army Systems Acquisition Review Council (ASARC) process, supported keeping funding in the POM to bring on Block 4 as the requirements definition improved, Army leadership removed the Block 4 funding during the Defense Acquisition Board (DAB) process because of uncertain support at the congressional level. Proactive spirals (Tier II) will be the greatest challenge of the three-tiered approach.

One of the major lessons learned from Operation Iraqi Freedom is that the troops in the field must be trained and their tactics modified to insert new technology into a deployed force.

In a time of war, congressional supplementals, Commercial Operational and Support Savings Initiative (COSSI), operational funding, Defense Advanced Research Projects Agency (DARPA), and so on, could be used to fund Tier III spirals. Funding also must be available for sustainment—not just Research and Development (R&D) and procurement for Tier III spirals. One of the major lessons learned from Operation Iraqi Freedom is that the troops in the field must be trained and their tactics modified to insert new technology into a deployed force.

SUMMARY AND CONCLUSIONS

The DoD is embarking on an ambitious path with the goal of accelerating the acquisition of complex systems with the adoption of the new 5000 series. The Army has been slow to adapt the spiral development espoused in the 5000 series, mainly because of cultural issues and funding concerns. Spiral development holds the promise of delivering capabilities to the warfighter sooner. Evolutionary acquisition, coupled with spiral development, provides our acquisition community with the means to develop

appropriate acquisition strategies and a methodology for implementing technology insertion.

To effectively establish this concept, current Army business practices must be modified to pave the path ahead incorporating the three-tiered approach presented. Risks can be spread across many insertions with the lessons learned from earlier spirals easily incorporated into the next insertions. Technology-centric systems, such as the FCS, can then evolve in a sustainable manner depending upon operational needs. This will not be an easy task, but it is sufficiently necessary for our nation's military forces to meet the challenges of the 21st century.

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