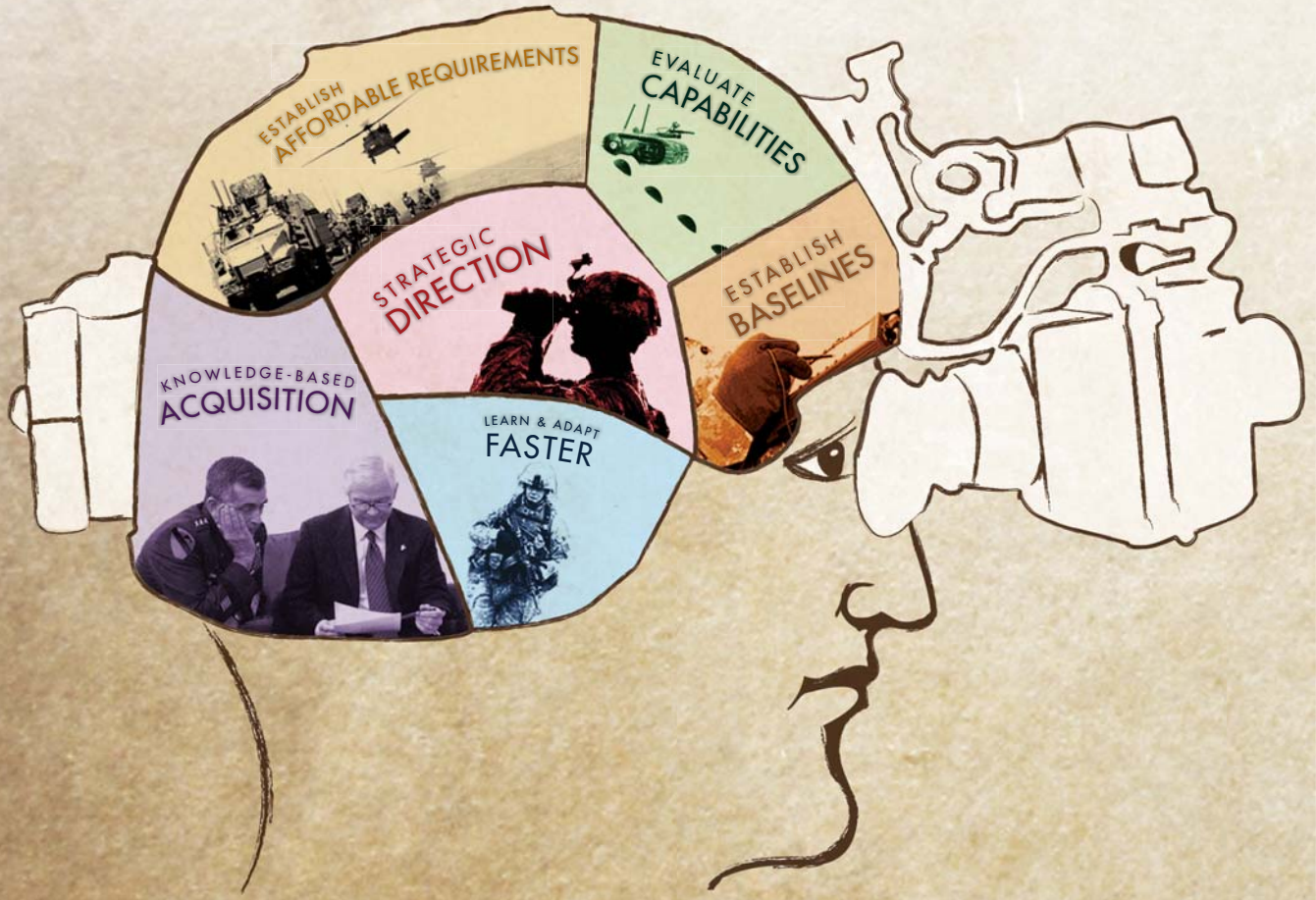
Embracing a Knowledge-Based Approach to Acquisition and Force Modernization

LTG Michael A. Vane

Secretary of Defense Robert M. Gates recently noted that the armed services must accelerate their development and acquisition processes. Adapting their methods will require continued close involvement with industry and the adaptation of their best ideas and initiatives to help us become more efficient while improving operational effectiveness. We, in the Army Capabilities Integration Center at U.S. Army Training and Doctrine Command (TRADOC), Fort Monroe, VA, understand that to accelerate the Army's operational requirements and acquisition processes, it is imperative to incorporate the many industry lessons learned and best practices to more quickly and effectively place capabilities in the hands of our Soldiers.



A knowledge-based approach—getting more information earlier on operational requirements, costs, technical feasibility, and trade space—is key to achieving affordable force modernization and one that industry leaders have found to be highly successful.

To use a knowledge-based approach, you need to have a good understanding of where you are. Force modernization really starts by establishing baselines.

Baselines must be more than just the numbers and types of organizations and their associated personnel, equipment, and materiel. The baseline also must establish what organizations or warfighting functions were designed to do; their current and projected ratios of boots-on-the-ground to dwell time; how they train and to what standard; how they employ their "how to fight" doctrine and execute their battlefield functions; what the Soldiers, training, sustainment, and equipment life-cycle costs are; and the one-time procurement costs.

Another essential component of the baseline is describing what dependencies the organization or warfighting function relies on from other organizations or warfighting functions to accomplish its missions.

It is from this baseline that one begins to establish the force modernization strategy of potential improvements and determines whether the capability improvements justify the associated costs.

Setting a Strategic Direction

Once you know where you are, it is important to know where you are going. Army concepts and their associated implications for doctrine, organization, training, materiel, leader development and education, personnel, and facilities (DOTMLPF) are critical to framing the strategic direction for force modernization.

But you must also stay linked to what Soldiers in the current fight need. These Soldiers at the "edge" provide the best feedback, lessons learned, and insights into where the Army needs to go.

This is also the hotbed for innovation, where opportunity, demand, and feedback from the edge need to be linked in real time. Here, opportunity is clearly associated with the pace of technological change, and the demand is dictated by a very adaptive adversary.

Those engaged in the close fight have some of the best ideas for the needs. This means the Army must also stay closely linked to the technology community so that we can lead innovation by keeping needs linked to opportunities. And these needs and ideas must be quickly incorporated into the mainstream of emerging concepts and developments, to make them relevant to today's fight while moving us closer to the force envisioned in our force modernization strategy.

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The Army does this through warfighting forums, such as those led by U.S. Army Forces Command on Brigade Combat Teams; TRADOC Centers of Excellence on the other warfighter functions, signal, and aviation; and close cooperation with the U.S. Army Research, Development, and Engineering Command labs.

Closing the Gap, Affordably

We are now at a point where we want to close the gap between where we are and where we are going. We want to make the Army more operationally adaptive and effective, but we must do it in a way that is affordable in the long run.

We must take a hard look at the quality of our acquisition personnel and increase the number and quality of contracting officers and civilian analysts; improve services contracting; and invest in generating contracting expertise at the general-officer level.

We must also increase our numbers and expertise in systems engineering, quality assurance, operations research and systems analysis, and cost estimating and contracting throughout the Army.

What we have learned from industry is that we must strive for more knowledge earlier in the acquisition cycle. Knowledge is power, and knowledge earlier is more power. A knowledge-based approach accelerates development and reduces the time required to produce and field solutions.

For potential materiel gaps, this requires the Army to assemble multidisciplinary teams upfront and to form better and broader partnerships across the user, developer, and acquisition communities. The multidisciplinary teams should consist of scientists; engineers; costing, pricing, and purchasing experts; operators; testers; legal reviewers; and users (Soldiers). The assembling of this team during the initial design phase allows for greater fidelity and

confidence in the identification of requirements and costs.

It is our intention to achieve 70 percent or more requirements identification and definition for each capability, ensuring that they are resource-informed earlier and in-house before we issue requests to industry for proposals.

Examining Requirements

As part of this effort and in addition to establishing threshold requirements, we also see the need to identify sub-threshold requirements, to set the stage for trades during the development and design process and to support high-fidelity modeling or virtual prototyping.

Design engineers have to deal with many competing requirements and performance parameters or criteria. We have to define the acceptable trade space within which they will operate. These must be well-defined with metrics, and we must be able to use the metrics and the cost/benefit to make affordable trades across warfighting functions and the DOTMLPF. Analyzing these criteria using modeling and virtual prototyping will reduce time, energy, and money.

All this will provide more cost and performance data than what is currently required at the defense acquisition Milestone A and as prescribed by the *Weapon System Acquisition Reform Act of 2009*; DoD Directive 5000.01, *The Defense Acquisition System*; and DoD Instruction 5000.02, *Operation of the Defense Acquisition System*.

True success in this process will require the Army to develop in-house expertise to better understand what we need and to identify the associated technical risks to better guide and support industry efforts. Obtaining greater knowledge of requirements upfront will drive down costs, risks, and time to production, particularly when this knowledge is coupled with affordability targets in dollars and force structure.

Learning and Adapting Faster

One of the challenges in a knowledge-based approach is trying to determine when you know enough to go forward, while not letting the learning rigor develop into rigor mortis. Understanding that learning is a continuous effort, the Army must adapt to a shorter, faster "learn, adapt, learn, adapt" cycle. The Army must move away from an over-reliance on necessary long-term, sequential planning and become flexible enough to include emergent learning and innovation, to evolve capabilities as opposed to pursuing long-lead, high-risk, leap-ahead technologies.

Lessons from the current fight continue to show that a faster cycle of change is needed, along with the ability to field in increments to support the operational Army's battle rhythm, the Army Force Generation (ARFORGEN) cycle.

The pace of change, the deployment cycles, and the need to learn and adapt mean that the Army may not buy the same item for every unit. This leads to a strategy requiring the Army to equip to mission and to buy fewer, more often. The Army is already seeing pressures to buy for those units that must be ready in the ARFORGEN cycle, set up decision points for the next cycle, adjust contracting to reflect incentivizing competition through that next decision, and insert technology as it becomes available.

Force modernization needs to be related to readiness. This includes forcing ourselves to look at the cost of maintaining operational availability versus a new start: What is the crossover point of upgrading or modernizing a current system with component parts, compared with a new program? We need a long-term, informed strategy that has frequently established decision points.

All of these factors give the Army a tremendous incentive to get more knowledge earlier, to more effectively execute the development and acquisition of capabilities by the most rapid, efficient, and affordable means.

With the current resource constraints and the demand to drive continuing relevance of sometimes lengthy institutional processes, TRADOC has shifted from a five-year to a two-year cycle to examine and update operational and functional concepts. As stated earlier, these documents are key to developing the force modernization strategy, as they identify the gaps from the baseline.

These shifts allow for more frequent submissions to keep up with the pace of change, incorporate lessons learned, and support critical budget and program decisions.

From a process standpoint, this cycle leverages warfighting-focused concepts as the basis for Capabilities Based Assessments to inform Program Objective Memorandum development. With a faster concept cycle and more knowledge earlier, we can provide budget input that gives us higher confidence in executing an affordable force modernization strategy.

Evaluating Capabilities

Experimentation, testing, and exercises are valuable venues for gaining knowledge earlier in the process. But today these venues are too sequential, with very little sharing nor a collaborative building of the knowledge base earlier and throughout their execution. Separate, sequential events mean longer time and increased costs.

The Army must move to converge its experiments, evaluations, and testing. This convergence has the greatest potential to accelerate the delivery of capabilities without sacrificing necessary learning. To speed up testing, all known and emerging test issues, test criteria, and all earlier test results must be made available and used to inform all follow-on experimentation, testing,

and evaluation. This will require testers to credit the programs in concert with experiments and exercises with these early results.

We must adjust our thinking about testing and deciding based only on the requirement, and get to evaluating the potential capability. When possible, virtual prototyping should replace physical prototype modeling to further accelerate learning.

High-fidelity modeling or virtual prototyping is a true trademark of how industry converges ideas and simulations, and a practice we can learn from. Industry uses these methods to identify performance and cost-informed trade assessments upfront. As demonstrated by the auto industry, this may reduce costs by as much as 25 percent and decrease production time by 8–14 months.

Valid test data must be included earlier and throughout, aligned and compared to a growth curve tied to eventual critical operational issues and criteria. Testing over the shoulders with industry and at various developmental activities and experiments must be leveraged. This, in turn, delivers more specifics to the design engineers and teams building the prototypes.

Today, the Army has demonstrated the ability to converge experimentation, exercises, and training with the Army Evaluation Task Force (AETF) and the Army Expeditionary Warrior Experiment. There is great opportunity to have all of the essential elements and to execute complex tasks in parallel, while retaining the independence required by law for our test community.

Obtaining Soldier Feedback

Another key element of more knowledge earlier is to get customer feedback upfront and throughout. With the AETF, our user battle labs, and the Army's research and development centers in mind, we must get actual, experienced Soldiers on equipment earlier in the development and testing processes. Designs for Army equipment and vehicles should be developed to meet Soldiers' needs from the "inside out," not the "outside in." Soldiers' needs and expectations must be at the forefront of new designs. These include Soldier basic loads, power needs, Soldier access to network information, and safety concerns.

This is simply a smarter, better, and, in the long term, more effective way to operate. The later Soldiers engage on equipment, the harder it is to go back down the development curve when they identify problems. Adjustments made later in development are costly in time and dollars.

The Army Manpower and Personnel Integration (MANPRINT) program is also used to influence design so that materiel and information systems can be operated, maintained, and supported in the most cost-effective manner, consistent with available manpower, personnel aptitudes and skills, and training. The result is to optimize total system performance.

The MANPRINT program ensures that Soldier performance is the central consideration in system design, development, and acquisition. It is the technical process of integrating the interdependent elements of human factors engineering, manpower availability, personnel skills and

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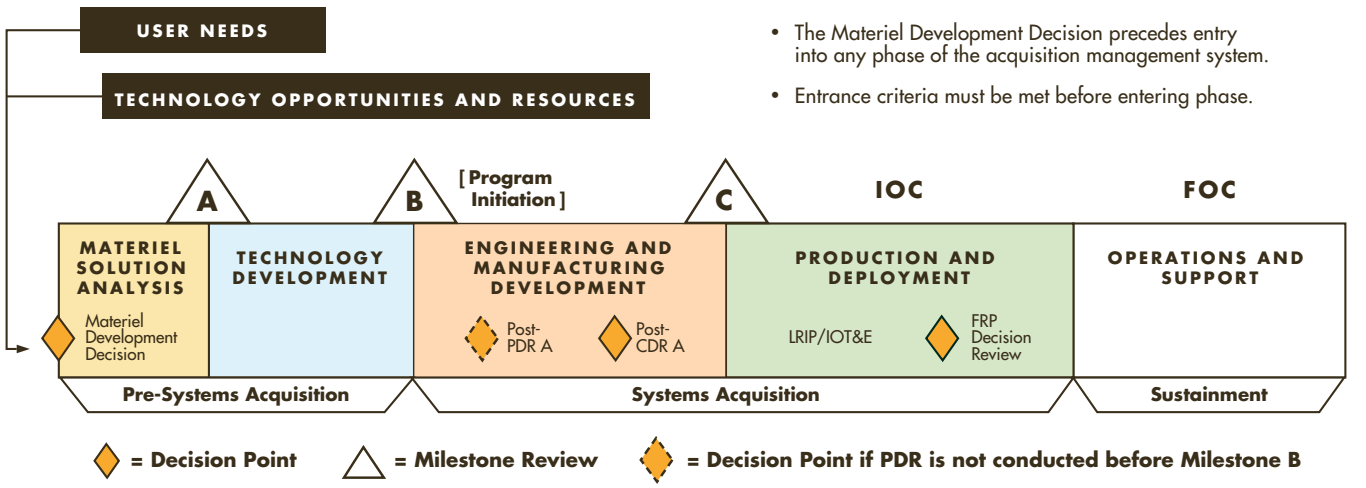

CDR: Critical Design Review
FOC: Full Operational Capability
FRP: Full-Rate Production
IOC: Initial Operational Capability
IOT&E: Initial Operational Test and Evaluation
LRIP: Low-Rate Initial Production
PDR: Preliminary Design Review

abilities, training design, system safety, health hazards, and survivability.

Understanding Resource Constraints

Another key challenge in using a knowledge-based approach to support an affordable force modernization strategy is knowing what the Army's resource constraints are and how to work within them.

Specific priorities must be established within and across force modernization strategies, for both operational and resource targets, to help make trades and find redundancies. Every capability we put into the force must have a clear cost/benefit associated with it. Cost and benefit must drive the decisions.

Strategic planning and programming guidance from senior leadership and staff should reflect the dollar and manpower constraints early in the development process.

As part of a knowledge-based approach, these procedures hold great potential for the Army. Program managers will know more before they contract. They will know more about costs, thereby driving down costs; they will know more about performance, thereby driving down risks; and vehicles are produced sooner, perhaps within a 4- to 5-year window by increasing knowledge at Milestone A that is now required at Milestone B.

But, at the end of the day, speed matters—speed in terms of responding to the current fight, synchronizing all elements of DOTMLPF for simultaneous delivery, and adapting the force overall.

The Army is at war; 8.5- to 11-year production cycles are too long. The threat changes, technologies change, and political leadership changes.

Although the Rapid Equipping Force fielding timelines for existing off-the-shelf equipment such as the Mine Resistant Ambush Protected Vehicle and Counter-Rocket, Artillery, Mortar averaged 1 to 2 years, the development and fielding of the M2 Bradley Infantry Fighting Vehicle took 17 years, and our Patriot Air Defense Artillery system, 21 years. The Army has continuously lagged behind the civilian sector regarding new equipment acquisitions when compared with recent industry achievements of a 5.8-year average for commercial aircraft, 2-year average for automobiles, or 1.5-year average for commercial spacecraft.

The Army can do better, and must motivate and incentivize the workforce to deliver warfighter outcomes for the Soldier, and not just to achieve process gates. At the same time, we need to clearly understand the risks we are mitigating and those we are accepting as we make the necessary trades to sustain an affordable force modernization strategy.

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Conclusion

The Army is improving and creating a more viable and responsive acquisition program.

Embracing a knowledge-based approach to acquisition accelerates development and reduces the time required to produce. By using a multidisciplinary team upfront, the process incorporates more knowledge earlier, thus allowing for high-fidelity modeling or virtual prototyping and performance and cost trade decisions to help drive down costs and risks.

The realities of conflict compel the Army to become mentally and physically adaptable, able to outthink, outwit, and outperform adversaries.

The character of conflict also places more demands on research, development, and procurement. These include the ability to integrate new and innovative commercial technologies without burdening the receiving unit.

The Army must learn from industry and adopt more effective best practices. A knowledge-based approach to acquisition is a way to increase effectiveness and move toward more affordable force modernization.

LTG MICHAEL A. VANE is the Deputy Commanding General, Futures, and Director, Army Capabilities Integration Center at TRADOC. He holds a B.S. from the U.S. Military Academy and an M.S. in joint command, control, and communications from the Naval Postgraduate School. Vane is a graduate of the U.S. Army Command and General Staff College and the U.S. Army War College. He commanded the 11th Air Defense Artillery Brigade, 32nd Army Air and Missile Defense Command, and the U.S. Army Air Defense Artillery Center and Fort Bliss, TX.