Army Transformation: Uniformed Army Scientists and Engineers

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The Chief of Staff of the Army General Eric K. Shinseki recently approved in principle the creation of the Uniformed Army Scientist and Engineer (UAS&E) officer functional area. This article discusses the background, implications, and advantages associated with this new officer career path. The UAS&E functional area will provide the Army with a core population of officers who possess specialized expertise to help the Army make informed decisions and integrate technology to improve our ability to defend the nation.

"The nation that will insist on drawing a broad line of demarcation between its fighting man and the thinking man is liable to have its fighting done by fools and its thinking done by cowards."
— Sir William Francis Butler

We live in a society immersed in and dependent on technological innovation. The U.S. Army represents a microcosm of this society and has been and continues to be one of the largest users of widely diverse and advanced technology within the armed forces of the United States. The Army is currently undertaking sweeping changes in its force structure, transforming into a more strategically responsive, full-spectrum force that is a lighter, more lethal, and network-centric force that achieves these increased capabilities by leveraging advanced technology innovation.

This Army transformation is heavily invested in technology to lighten the force while increasing the lethality and survivability necessary for full-spectrum dominance. The general categories of technological innovations that are being leveraged include computers, communications, network technologies for the network-centric component, advanced and distributed sensors to provide improved multi-spectral sensing capabilities, composite materials that reduce the overall weight while maintaining or improving the capabilities of the protective armor, electric and hybrid power systems for propulsion and weapons, and many others.

As an institution, the Army needs a cadre of experts in science and technology to fully optimize the capabilities of the force and to understand the potential of future technologies.

The Army's new Officer Personnel Management System (OPMS III, formerly referred to as OPMS XXI) provides the mechanism to allow specialization within career fields. OPMS III has been implemented recently and is in marked contrast to the way the Army has historically managed officer specialization and career progression. Officers can specialize in Army operations, operational support, information operations, and institutional support. OPMS III provides the mechanism for a viable officer technical career progression.

Gen. Paul Kern, commanding general of the Army Materiel Command, has been instrumental in the creation of a viable career track for uniformed Army engineers and scientists. As he recently noted, "There is a tremendous capability when you have the operational experience of an officer and the technical training that allows a person to see what is in the future" [1].

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To be successful, the Army transformation requires a corresponding change in the Army officer personnel system that includes a core population of officers who focus on the science and technology that shapes the modern battlefield and the Army force structure. The recently approved in principle, Uniformed Army Scientist and Engineer (UAS&E) functional area will provide a dedicated cadre of experts to support the Army's scientific and engineering needs for the present transformation and future technological evolutions and transformations.

To accomplish the required transformation in the officer corps, the Army has created this new functional area to support a core population of Army engineers and scientists educated in the applied physical sciences. This functional area will include officers with advanced degrees in numerous scientific and engineering disciplines, including but not limited to the following:

- Aeronautical Engineering.
- Applied Mathematics.
- Biochemistry.
- Chemistry.
- Computer Science.
- Electrical Engineering.
- Mechanical Engineering.
- Physics.

This functional area will require approximately 100 officers from the grade of major (O-4) through colonel (O-6) who possess master's of science and doctorate degrees in these and other selected science and engineering disciplines. These officers will provide a core population of officers to serve as engineers and scientists in Army and Department of Defense (DoD) laboratories; the new Research, Development, and Engineering (RDE) Command; the Army staff and joint staff; and in key advisory positions throughout the Army and DoD.

Sample UAS&E duty positions include scientists, engineers, program managers, and advisors within the new RDE Command, Training, and Doctrine Command Battle Labs; Department of the Army and joint staff positions; and program managers at the Defense Advanced Research Projects Agency.

The UAS&E will provide a dedicated cadre of experts to support the Army's scientific and engineering needs. UAS&E officers will possess the field experience necessary to understand the unique environment, operational characteristics, and the technological needs of the Army.

UAS&E officers will possess advanced academic credentials and will

have developed expertise through progressive science and engineering assignments and will be qualified to contribute to science and technology research, advice, and policy development. Functional area designation and career field designation for the UAS&E functional area will be the same as those currently used for the Army Acquisition Corps and Foreign Area Officer functional areas within the Army's operations support career field.

Historical Background

The idea that the application of the military instrument of power in the conduct of war rests in a body of knowledge that could be studied and mastered by those in the profession of arms is a relatively recent concept.

During the 16th century, the officers who led armies into battle did not receive any special training or education in warfighting. Instead, they received their commissions as a result of aristocracy, heredity, or wealth. At the turn of the 17th century, advances in technology first changed the military's requirements for specialized education. Navigation, artillery, fortifications, and engineering [2] were all subjects first studied by officers in order to become more effective leaders in the military profession.

It can be argued that officer education is, in fact, the cornerstone of the arms profession. It is the responsibility of the military to continually develop and integrate new and improved methods of warfare as a way of achieving superior means to conduct and win wars. To be effective in the process of adapting and adopting new technologies, however, requires military leaders who are imaginative and innovative. Education enables informed and creative leadership.

Officer education has long been a focus of both individuals and study groups. The first-prize papers awarded for contributions to the "Proceedings of the U.S. Naval Institute" in 1879, for example, were on the subject of officer education [3].

Table 1: *Typical UAS&E 30-Year Career Progression*

Uniformed Army Scientist and Engineer Career Progression	
Years of Service	**Duty Assignment**
0	• Commissioned as a second lieutenant. • Attends the Infantry Officer Basic Course.
1-3	• Promoted to first lieutenant. • Serves as a platoon leader. • Promoted to captain.
4	• Attends the Infantry Captains Career Course.
4-7	• Serves as a company commander and possibly in a staff position.
7	• Accessed into the Uniformed Army Scientist and Engineer (UAS&E) functional area.
7-9	• Attends advanced civil schooling and earns a master's of science degree in mechanical engineering.
9-10	• Completes the Command and General Staff Officer Course (either in residence or by correspondence).
10-13	• Serves in a UAS&E branch-qualifying duty position (for example, as a research scientist or instructor at the United States Military Academy). • Promoted to major.
13-16	• Attends advanced civil schooling and earns a doctorate in in mechanical engineering.
16-19	• Serves in a UAS&E duty position (for example, as a technical advisor in the Mounted Maneuver BattleSpace Lab within the Training and Doctrine Command). • Promoted to lieutenant colonel.
19-22	• Serves in a UAS&E duty position (for example, as a deputy director in the Research, Development, and Engineering Command).
22	• Attends Senior Service College. • Promoted to colonel.
23-30	• Serves in senior UAS&E duty positions (for example, as a science advisor to the commander, Southcom or as an Army or Defense Science Board member).

In 1996, an Army Science Board study titled "The Science and Engineering Requirements for Military Officers and Civilian Personnel in the High Tech Army of Today and Tomorrow" focused on the need for increased officer technical competency. This study concluded the following:

> ... the Army's reliance on modern weapon systems and technology has been growing, its cadre of technology-literate line officers and science, math, and engineering (SM&E)-educated officers has been reduced. [4]

Additional background information on this topic [5] is available in the sidebar that accompanies this article.

In the current and future military environment, there exists a changed relationship between officers and technology. Firepower and maneuverability previously defined the realm of officer competencies. The American way of war and the relationship between systems engaged in warfare on the modern battlefield has fundamentally changed as a result of modern technology.

Scientific Competency

Modern technological marvels provide instant access to work, family, and resources almost anywhere in the world, and have fundamentally changed how people interact. Yet never before have we become so distant from, and at the same time ignorant of, the fundamental science that enables this technology. Technical illiteracy is an epidemic that plagues modern society.

Today, individuals can rely upon engineers and scientists to provide more capable innovations. Within the armed forces, the tactics and doctrines to employ these technologically advanced weapon systems are developed by the military themselves. A lack of understanding of science and technology is an inconvenience for civilians, but it can be fatal on the battlefield.

It is neither practical nor desirable that every officer in the armed forces attempt to understand all of the science and technology that supports our modern military. The UAS&E functional area will provide the Army with a small group of officers who possess the specialized technical skills and understanding necessary to help the armed forces make informed decisions and integrate technology to improve our ability to defend the nation.

UAS&E Career Progression

As currently envisioned, the UAS&E functional area will access Army officers into the functional area at about their seventh year of active-duty service. UAS&E officers will be assessed into their functional area at the same time as their non-UAS&E peers.

To better envision the UAS&E functional area career progression, let us consider the career of a hypothetical officer, John Smith, who is commissioned as a second lieutenant in the infantry following the completion of his undergraduate degree in mechanical engineering. Table 1 follows his career from the time he enters active duty as a second lieutenant until he retires as a colonel 30 years later.

The UAS&E career field will provide promotion opportunities through the rank of colonel and will help improve the Army's return on investment from the time and resources dedicated to providing officers with advanced civil schooling.

Advantages

The Army can achieve the following benefits from creating and supporting the UAS&E functional area:

- By supporting a core group of technically and tactically proficient officers, the Army can better ensure that the maximum advantage is gained from new systems and equipment.
- UAS&E can help the transformed force achieve its full potential through the correct employment of advanced warfighting systems and technologies.
- By providing science advisors to senior-level commanders, UAS&E officers can help reduce resistance to change and help decision-makers understand the benefits of properly applied technologies.
- It provides excellent incentives for recruiting and retaining science and engineering professionals.
- It provides the Army with a set of honest brokers.
- It can help change the Army's general perceptions of technically oriented service.

Summary

"If you don't like change, you're going to like irrelevance even less" [6].

— Gen. Eric K. Shinseki
Army Chief of Staff

The Army has recognized the need to develop and support a cadre of uniformed experts in specialized scientific and technological fields in order to help transform itself. The UAS&E functional area will help meet that need by developing future leaders for Army and DoD research and development organizations who understand soldiers, future technologies, and warfighting.

This small investment in officer personnel within the Army will return large dividends in the future through the effective and efficient application of science and technology to the ever-changing art of war.◆

The Quest for Uniformed Army Scientists

The following is a historical outline of the quest for uniformed army scientists:

- **1802 –** President Thomas Jefferson signed legislation authorizing the creation of the United States Military Academy at West Point, N.Y. West Point was the first engineering school in the United States.
- **19th Century –** Most large engineering projects completed within the United States (including railroads, bridges, harbors, dams, and roads) benefited from the direct participation of West Point graduates.
- **1925 –** The Army sent Jimmy Doolittle to the Massachusetts Institute of Technology to earn a doctorate in aeronautical engineering.
- **World War II –** Numerous scientists in uniform served the nation and the Army. For example, Lt. Goldstine, who held a doctorate in mathematics, encouraged the Ballistic Research Lab to work on a *digital* electronic computing device.
- **1947 –** Maj. Gen. Henry S. Aurand, director of Research and Development, general staff at the War Department, tried to create a corps of scientist-officers.
- **1982 –** The Army Science Board found that 40 percent of the officers working in research, development, and acquisition positions for the Army had no schooling in science, engineering, or business. They encouraged the creation of the Army's Technology Enhancement Program (TEP).
- **1984 –** Lt. Gen. Maxwell Thurman, Army deputy chief of staff for Personnel, directed the initiation of the TEP. Initial entry second lieutenants were sent to earn master's of science degrees. Mid-career majors were sent to earn their doctorates in science and engineering fields.
- **1985 –** Brig. Gen. Hines, the deputy commanding general of the Army Personnel Command, created a new officer branch to manage officers in the TEP – the Science & Technology Corps.
- **1990 –** Gen. William Tuttle, commanding general of the Army Materiel Command (AMC), offered 140 AMC positions for a Uniformed Army Scientist Program. The Defense Acquisition Workforce Improvement Act was signed into law.
- **1991 –** Gen. Gordon Sullivan, Army vice chief of staff, directed a Red Team Analysis of the uniformed army scientist question.
- **1992 –** Lt. Gen. Thomas Carney, deputy chief of staff for Personnel, approved the Army Engineer and Scientist (AES) program. The post-Cold War Army drawdown tabled implementation of this program.
- **1998-2001 –** Various Army organizations studied the feasibility of creating a Uniformed Army Scientist and Engineer functional area for officers.
- **2001 –** Gen. Paul Kern reintroduced the concept of a uniformed Army scientist program.
- **2002 –** Gen. Eric K. Shinseki, Army chief of staff, approved in principle a request from Gen. Paul Kern, commanding general of the Army Materiel Command, to create the Uniformed Army Scientist and Engineer (UAS&E) functional area.

References

1. Tice, Jim. "General Out to Overhaul Three Creaky Career Tracks." Army Times 4 Feb. 2002: 21.
2. Van Creveld, Martin. The Training of Officers. The Free Press, 1990: 14.
3. Brown, Allen D. Naval Education. Proceedings of the U.S. Naval Institute, No. 9. 1879: 305.
4. U.S. Army. "The Science and Engineering Requirements for Military Officers and Civilian Personnel in the High Tech Army of Today and Tomorrow." Army Science Board Study, Feb. 1996.
5. Shoop, Barry L. "Officer Education Reform: The Need for Increased Technical Competency." Advanced Research Project Report. U.S. Naval War College, Newport, RI, June 2002.
6. Shinseki, Gen. Eric K. "Chief of Staff Remarks (As Prepared)." AUSA Conference, Nov. 2001 <www.army.mil/leaders/CSA/speeches/2001108CSAREMARKSAUSA.htm>.

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Office of Naval Research

www.onr.navy.mil

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United States Army Program Executive Office Enterprise Information Systems

http://www.eis.army.mil

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National Science Foundation

http://www.nsf.gov/

The National Science Foundation is an independent agency of the U.S. government. The foundation consists of the National Science Board of 24 part-time members and a director, each appointed by the president with the advice and consent of the U.S. Senate. Other senior officials include a deputy director who is appointed by the president with the advice and consent of the U.S. Senate and eight assistant directors.

Society of Women Engineers

http://www.swe.org/

The Society of Women Engineers (SWE) is a nonprofit educational service organization dedicated to making known the need for women engineers and encouraging young women to consider an engineering education. The SWE stimulates women to achieve full potential in careers as engineers and leaders, expands the image of the engineering profession as a positive force in the quality of life, and demonstrates the value of diversity.

The Institute of Electrical and Electronics Engineers

www.ieee.org/portal/index.jsp

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