# The Future of the UNIFORMED ARMY SCIENTIST and ENGINEER PROGRAM

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TECHNOLOGY AND INNOVATION relevant to the field of battle have often been a key factor in gaining victory in combat. An often noted example is the Battle of Agincourt in 1415, around the advent of the rebirth of learning in the West we call the Renaissance. As the apex of King Henry V's campaign against France, the victory secured a temporary advantage for England in the later stages of the 100 Years War. During the fight, Henry V's Soldiers' used the English longbow, a weapon whose heyday began as early as 1250, but whose devastating effectiveness French nobility had yet to fully appreciate. Even though they had lost momentous battles to rustic English armies since Crecy in 1346, the French aristocracy did not grasp how technology had trumped their martial ardor. Henry's yeoman soldiers, wearing lighter armor than the French chivalry, dismounted, dug in, and directed their powerful archery at angles into the enemy's mounted frontal attack. To achieve England's success, Henry took advantage of French tactical inertia and obtuseness by matching it with technology, innovation, and a perspicuity untrammeled by chivalric arrogance.[1] The relevant lesson for today's American Soldier comes from the calculated way the English used their technology to advantage.

The advantage of employing the best technology with innovation and creativity is not lost on those who are developing future Army doctrine. Acquiring new technology and equipment, and having the foresight to creatively put them to good use, are the best ways to save Soldier's lives while completing missions. Assistant Secretary of the Army for Acquisition, Logistics, and Technology Claude M. Bolton says, "We must ensure that our warfighters have the capabilities they need to accomplish the nation's military demands in this new and emerging global environment...We must develop, acquire, and sustain key military capabilities that enable us to prevail over current challenges and to hedge against, dissuade, or prevail over future threats...The world situation demands an Army that is strategically responsive and dominant at every point on the spectrum of military operations. We are working hard to ensure that America's Soldiers continue to be the best trained, best led, and best equipped land force on Earth."[2] Put simply, Bolton was saying that the force development community must develop technological capabilities relevant for current and future strategic and tactical operations.

The U.S. Army Research, Development, and Engineering Command (RDECOM) has responsibility for this effort. RDECOM has research, development, and engineering centers (RDECs) situated throughout the country where

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PHOTO: A Soldier from the explosive ordnance disposal unit attached to 1st Battalion, 187th Infantry Regiment, 101st Airborne Division, prepares the PackBoT® Tactical Robot System to survey the area where a suspected improvised explosive device was found. (U.S. Army, SPC Charles Gill)

scientists and engineers use emerging technology to support today's Army and the future force.[3] In the past, most of these scientists and engineers were civilians, but in 2003, the Army initiated the Uniformed Army Scientist and Engineer (UAS&E) program to develop future leaders for the Army's research and development (R&D) community. Selectees are required to have advanced degrees in hard science or engineering and have combat and field experience. According to General Paul J. Kern, commander of the U.S. Army Materiel Command, "The uniformed Army scientist and engineer officer, equipped with field experience and an advanced engineering or hard science degree, provides the Army with specialized technical skills and understanding...These officers enable our Army to make informed decisions on new and emerging technology and then to rapidly transition that technology from the laboratory to warfighters on the battlefield."[4] In other words, having "warrior scientists" in the field helps streamline the process of getting technology to the Soldiers who need it.

As implemented, the UAS&E membership consists of Army acquisition officers drawn from a pool of those available in functional area 51S, Systems Planning, Research Design, and Engineering. Generally, officers within this field already have the expertise to develop technological solutions to requirements, but as mentioned before, those selected to the UAS&E program must have an advanced (master's or doctorate) degree in engineering or science.

The Research, Development, and Engineering Command has the greatest need for UAS&E officers; thus, the transition plan calls for RDECOM to change all but one of its military acquisition position list authorizations to 51S and modify the table of distribution and allowances to reflect the requirement for an advanced degree for those positions.[5] UAS&E officers, like other acquisition functional area officers, can also be field assistance science and technology (FAST) team leaders, advisors for combatant commands and combat maneuver training centers, or program managers. In addition, UAS&E officers can be assigned to Army and Department of Defense (DOD) laboratories, to the U.S. Army Military Academy at West Point, and to key scientific and engineering advisory positions throughout DOD.

Although some UAS&E officers are assigned to the dedicated positions at RDECOM, the majority of these scientists fill traditional acquisition jobs. Moreover, the functional specialty does not have a career program path with specific developmental assignments. It seems that the recruitment, development, and utilization of these scientists and engineers must change if we want to attract and retain the best candidates and use these scientists and engineers to their full potential.

## The Warrior Scientist

The UAS&E officer should be a warrior scientist, able to link the civilian science and engineering communities on one side and the military tacticians on the other. He would be a Soldier first, but also have credentials to match those of civilian scientists and engineers. In the acquisition field, the warrior scientist would be on the cutting edge of research and design for future combat system materiel solutions, yet have the military experience to know what has strategic or tactical relevance.

**Recruiting scientists and engineers.** The Army needs to modify its current recruitment process so that it can attract the best possible Soldier-scientists to provide the expertise needed to meet the Army's future R&D requirements. As stated earlier, UAS&E officers are now selected primarily from the pool of acquisition officers. However, if the Army intends to recruit the best scientists, it should recruit them while they are still in college, with the promise to send candidates to graduate school after they are branch qualified. This strategy has several advantages. The pool of candidates with science and engineering backgrounds would be much larger than that of the acquisition field. Moreover, once commissioned and designated as candidates for functional area 51S, these selectees would likely focus on learning their tactical and strategic tradecraft with an eye toward applying their academic expertise to future technological innovations. From the beginning, they would have a keen interest in establishing and maintaining relationships with

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science and engineering leaders in their respective fields to have access to fresh ideas and new research in academia and commercial enterprise. Furthermore, newly commissioned candidates will see early designation of their functional area specialty as a commitment from the acquisition community and the Army. Using this recruiting and development strategy, the Army can take full advantage of investments it has already made in its university-affiliated research centers (UARCs) by sending officers to them for postgraduate education and applied research after basic branch qualification.

**Career path and developmental assignments.** If the Army wants warrior scientists to be developed to the logical extent that they should be, these officers should have the same sorts of experience that civilian scientists and engineers have. Accordingly, the Army should expand the role UAS&E officers have when serving in traditional acquisition positions such as program managers, field assistance science and technology (FAST) team leaders, and science advisors. Some of those possibilities are discussed below.

*Product and program managers***.** As product manager officers (PMOs), UAS&E officers would be responsible for one of several RDECOM product management offices, which foster the development of technologies that, when mature and operationally viable, will provide overmatch advantages to the U.S. Soldier. Examples include projects such as the electromagnetic gun, flexible display technologies, medical monitoring and treatment equipment, and advances in combat uniforms and personal protection equipment. Some of these projects are years away from materiel release and must overcome significant technological hurdles. If new technologies are to make it to the Soldier, program managers must know how the Army runs and understand the underlying science and technology. In short, these officers must be programmatic as well as technical leaders. If they are anything less, their credibility with civilian scientists and engineers suffers and the program could be at risk. As research programs experience technological breakthroughs and specific programs are established, the Army will be able to assign a program manager who has the experience and education to lead the rapid exploitation of this emerging technology.

*FAST team leader and combatant command science advisor*. The FAST program is made up of Science and Technology Assistance teams (STAT) and science advisors working together to identify technology Soldiers need in the field. Army uniformed scientist and engineer officers serve as team leaders and advisors who work closely with the combatant command leadership and Soldiers to gain an intimate understanding of Soldiers, their equipment, and the conditions they face. In so doing, they can identify capability gaps and use emerging technology to formulate materiel solutions to support mission requirements in the field.

While deployed in a combatant commander's area of responsibility, the advisor supports development of the user community's operational-needs statements, which document the urgent need for a materiel (equipment) solution either to improve a capability or to correct a deficiency that impacts mission accomplishment. During this time, warrior scientists carry a sidearm, use dedicated armored transportation, and employ secure satellite and SwiftLink digital communications systems. These tools give him and his team the ability to move independently within the constraints of the combat environment, to provide a secure communications link to the scientists and engineers in the rear, and to support basic self-defense requirements.

DOD

**Rapid entry vehicles (REVs) on the assembly line at Picatinny Arsenal, New Jersey, 2006. The REV is a modified M113 armored personnel carrier used for nonlethal crowd control and rescue squad insertions. The modifications include cutting large holes in the hull and installing ballistic glass windows and Bradley firing ports, which increase Soldier survivability through improved situational awareness and mobility.**

Science advisors assume the same risks as any other Soldier in the combat arena, but the potential payoff in understanding capability gaps warrants the risk.

Currently, UAS&E officers deploy four months with no return to the AOR. I propose the deployments last two to three months, punctuated by program initiation cycles at home station and a return deployment to the combatant command AOR. To support pivotal operational needs, they need to return to home station to conduct face-to-face discussions with those members of the science and technology (S&T) community most capable of rapidly fielding viable prototypes. The advisor uses this time to initiate near-term "technology insertion" prototypes and establish requirements for longer-term initiatives. The prototypes are the answers to the capability gaps the scientist discovered while in the operational environment. He might consider, for example, that an emerging technology such as high intensity light emitting diodes (LEDs) might someday replace Xenon discharge lamps for spotlights, since the LEDs do not require high operating voltages during startup. These prototypes are typified by the fieldings we are seeing today to satisfy urgent operational- needs statements, such as the Rapid Entry Vehicle, non-lethal munitions, or remote or robotic weapon capabilities. The advisor should then return to the combatant command AOR to update the user community on the status of these efforts and other relevant technology insertions the Army is deploying.

**Dedicated researcher and developer in RDECs and Army laboratories.** To make the best use of UAS&E officers, the Army should make these officers serve as researchers in an RDEC laboratory. UAS&E officers would provide a Soldier's insight into tactical and logistical considerations as they work with civilian scientists and engineers on applied research projects. These officers could greatly influence relevant and timely technological transitions in support of warfighting. Their perspective, which includes operational effects of things like dust, mud, grease, and lack of sleep, could help shape design constraints of equipment, to include durability, power requirements, and ease of use. Another benefit would be the opportunity for Army scientists to work with and learn from their civilian counterparts and possibly develop long-term professional affiliations with their peers in the R&D community.

**Liaison to industry, academia, and service academies.** There are other assignments available to UAS&E officers, currently not being filled, that would benefit the Army's research efforts and would be professionally rewarding for the officers concerned. I propose that the Army assign UAS&E officers to positions in industry and academia (the latter to include the service academies at West Point, Annapolis, and Colorado Springs). Such environments provide the opportunity for developing indispensable experience and credentials.

Industry could provide opportunities to work with teams of scientists conducting focused or applied research directed toward a manufacturing capability. The competitive nature of the military-industrial marketplace would give warrior scientists the most timely and forward-looking experiences. Furthermore, the UAS&E officer would have the opportunity to publish in trade journals and gain recognition from the greater technical community.

Academia offers complementary opportunities. Officers could obtain advanced degrees, become members of trade societies, publish peer-reviewed articles in professional journals, teach, and perform basic research.

Opportunities also exist for applied research through the Army's UARCs, such as the Massachusetts Institute of Technology's Institute for Soldier Nanotechnology and the University of Texas's Institute for Advanced Technology. Army UARCs focus on critical emerging technologies such as electromagnetic guns and nanotechnology. Current UARCs at major universities can become a virtual network of world-class science and technology education nodes for the Army. Officers

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assigned to these universities for postgraduate work would have opportunities not only to push back the boundaries of cutting edge technology, but also to apply new technology to battlefield requirements being addressed by the UARC at that university. This educational opportunity would have all the advantages of the Naval Postgraduate School, but with a tier-1 university.[6]

DOD

**Completed rapid entry vehicles staged at Picatinny Arsenal for shipment to Iraq, 2006.**

While working as instructors, research scientists, or engineers at universities, service academies, or in industry, UAS&E officers would have opportunities to develop and prove their expertise as research scientists or research group leaders. Such a position would earn them credibility in their individual scientific spheres and could also allow them to serve as agents of recruitment.

## Providing a Bridge—The Future UAS&E Officer

The most effective UAS&E officers will be warrior scientists, "renaissance Soldiers" in the sense that they will be responsible for using their imaginations and scientific curiosity to cope with future battlefields. These officers will be a bridge from the civilian science and engineering communities to military tacticians. Such relationships will help the Army break out of outmoded, inertial ways of thinking.

The warrior scientists will bring current tactical insight and strategic foresight to the R&D community. They will have a unique perspective of battlefield requirements—one that is not the same as their brothers and sisters in arms or their peers among scientists and engineers, but a derivative of both. They will be credible among their civilian counterparts and be able to translate battlefield requirements into viable program elements.

Because they understand the missions, functions, and logistical nuances of the forces, warrior scientists will be able to identify the required capabilities and determine the most relevant solutions in a given operational environment. Ideally, given the cultivated flexibility of their scientifically trained minds, they will develop the foresight to see how technology could shape future military strategy. At the same time, their military background will bring technical expertise and leadership skills into a realm characterized by management of cost, schedule, and performance. Their vision will provide a path to break out of this old realm into one marked by technical leaps and innovation.[7]

A UAS&E program that bridges warriors, scientists, and engineering professionals with the acquisition workforce requires a long-term investment and a shift in how the Army recruits candidates and develops selectees. Combatant commanders and leaders within the acquisition community should make equal purchase in this investment or it will fail. ***MR***

**NOTES**

1. For more information about the Battle of Agincourt, see on-line <http://en.wikipedia.org/wiki/Battle of Agincourt>, accessed 15 May 2007.

2. Claude M. Bolton, Jr., *How the Army Runs* (Carlisle, PA: The U.S. Army War College, 2005-2006), chap. 11, 199, <www.carlisle.army.mil/usawc/dclm/ htar2005-update.htm>, accessed 15 May 2007.

3. Ibid., 217-18. "A mainstay of the Army strategy for military technology is a viable in-house research capability. Laboratories and research, development, and engineering centers are the key organizations responsible for technical leadership, scientific advancements, and support for the acquisition process. Activities of these organizations range from basic research to the correction of deficiencies in field systems. Academia and industry as well as hands-on bench work contribute to the science and technology mission. Technology insertion into systems is accomplished via the flow of patents, data, design criteria, and other information into [tactical databases, airborne tactical data systems, advanced concept technology demonstrators], new designs, and fielded systems." (para. 11-23.d, 217, 218).

4.Karen Jolley Drewen, "New program to develop Army scientists and engineers," *RDECOM Magazine*, November 2003, 27-28.

5. Aaron Brown, "Uniformed Army Scientist and Engineer (UAS&E) Program," draft information paper, 27 December 2005, <http://asc.army.mil/docs/programs/uase/UASE_INFO_PAPER.doc>.

6. From e-mail correspondence and review notes on an early draft of this manuscript by Dr. Harry D. Fair, Ph.D., director, Institute for Advanced Technology.

7.Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fall*, (Boston: Harvard Business School Press, 1997), 53. Christensen's discussion focuses on disruptive innovations and value networks.