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Directed Energy

A Look to the Future

Maj Gen David Scott, USAF

Col David Robie, USAF

Hybrid Warfare

Something Old, Not Something New

Hon. Robert Wilkie

Preparing for Irregular Warfare

The Future Ain't What It Used to Be

Col John D. Jogerst, USAF, Retired

Achieving Balance

Energy, Effectiveness, and Efficiency

Col John B. Wissler, USAF

US Nuclear Deterrence

An Opportunity for President Obama to

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The *Air and Space Power Journal* (ISSN 1554-2505), Air Force Recurring Publication 10-1, published quarterly, is the professional journal of the United States Air Force. It is designed to serve as an open forum for the presentation and stimulation of innovative thinking on military doctrine, strategy, force structure, readiness, and other matters of national defense. The views and opinions expressed or implied in the *Journal* are those of the authors and should not be construed as carrying the official sanction of the Department of Defense, Air Force, Air Education and Training Command, Air University, or other agencies or departments of the US government.

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Air and Space Power Journal
155 N. Twining Street
Maxwell AFB AL 36112-6026

e-mail: aspj@maxwell.af.mil

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Both the Quadrennial Defense Review Report of 2006 and National Defense Strategy of 2008 call for increasing our capability to deal with irregular warfare, especially counterinsurgency. However, institutional moves required to provide our joint forces and coalition partners with capabilities tailored to such conflict have proved inadequate. Describing current conditions as mired in old paradigms and marked by a failure of imagination, the author points to a way to prepare Airmen and their weapons systems for irregular warfare.

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Energy, Effectiveness, and Efficiency

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The author analyzes the effect of escalating fuel prices on the US Air Force. Viewing energy in a strategic military context, he proposes that the acquisition, planning, and operational communities adopt a new method to evaluate systems based on a tripolar construct consisting of energy, effectiveness, and efficiency.

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An Opportunity for President Obama to Lead by Example

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President Obama has stated that the United States has a "commitment to seek the peace and security of a world without nuclear weapons." The author investigates how the United States can balance this goal with maintaining a position of strength in enforcing nonproliferation, arguing that reducing nuclear arsenals to bare minimums and adopting a no-first-use policy will prove most effective.

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Directed Energy

A Look to the Future

Maj Gen David Scott, USAF
Col David Robie, USAF

It is incumbent upon every Air Force officer to support the current fight; however, senior leaders, especially those on the Air Staff, must prepare the Air Force to take the fight into the next decade and even the next half century. As technologies mature, we continually assess their impact and enable our forces to embrace the capabilities they offer, all the while readying ourselves for any vulnerability they create when exploited by our foes. At a minimum, directed energy (DE) will be a game changer, but it has the potential to create a

revolution in military affairs. In anticipation of what I believe will prove an integral part of our force-application capabilities within 10–20 years, I wish to arm the readers of this journal with some important information. To begin, I outline where DE technologies are today, followed by a review of four programs critical to the Air Force: the Airborne Laser (ABL), the Advanced Tactical Laser (ATL), the Counter-Electronics High Power Microwave Advanced Missile Project (CHAMP), and the Active Denial System (ADS). I then review the vulnerabilities we



Airborne Laser

USAF photo

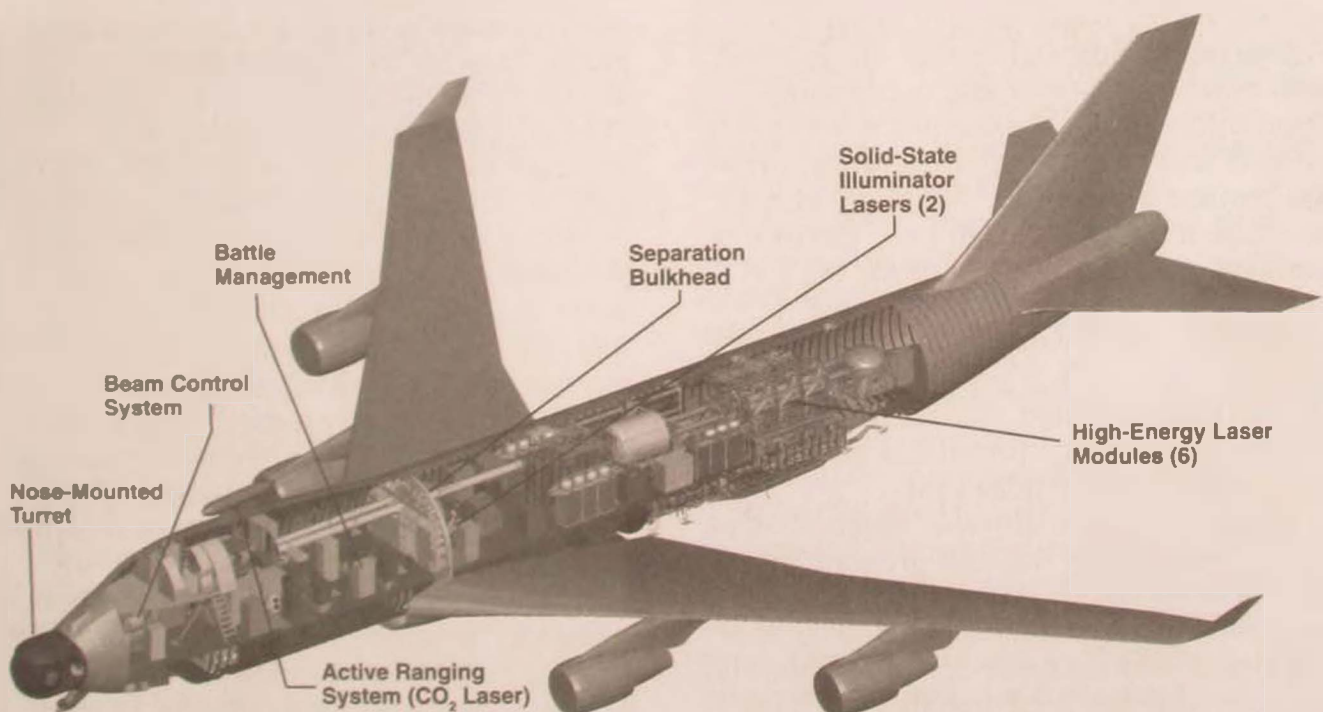
face and discuss the challenges to fielding these systems. I conclude by addressing the efforts we are undertaking as an Air Force to prepare for the arrival of DE weapons in air, space, and cyberspace.

Current and Near-Term Technology

DE weapons have been on the horizon for several decades. In 1960 Theodore Maiman invented the first laser, which used a synthetic ruby crystal and had an output power of only a few milliwatts. By the 1970s, laser power had reached the megawatt level, an advance that, in the early 1980s, led to development of the successful Airborne Laser Lab—a gas-dynamic laser mounted in a modified version of a KC-135 used for flight testing. Extensively modified by the Air Force Weapons Laboratory at

Kirtland AFB, New Mexico, the NKC-135A destroyed five AIM-9 Sidewinder air-to-air missiles and a Navy BQM-34A target drone during an experiment. More recently, advances in chemical lasers, optics, and beam control have led to both the ABL and ATL.

The ABL, a chemical laser mounted inside a Boeing 747, provides defense against tactical ballistic missiles such as the Scud.¹ Started by the Air Force in 1996, the program transferred to the Missile Defense Agency in 2001. Boeing serves as the integration contractor, Northrop Grumman furnishes the chemical oxygen iodine laser (COIL), and Lockheed Martin has responsibility for the nose turret and fire-control system. To date, the ABL has demonstrated the ability to track and illuminate targets and has fired the laser during ground tests. Live-fire tests against representative threats from tactical ballistic missiles are scheduled to begin in late calendar year 2009.



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Boeing 747-400F Airborne Laser

Considered by many individuals to be the most complex military weapon system ever developed, the ABL is designed to destroy ballistic missiles during their boost phase, when the laser's energy can weaken the missile structure enough to cause it to fail catastrophically due to the stresses of flight. The weapon system includes an infrared surveillance system to detect launch, a fast-tracking system and target-illumination laser for accurate tracking, and a beacon-illumination laser, which generates information to an adaptive optics system that precompensates the high-energy COIL beam and allows the atmosphere to focus the laser energy on target. Although each piece of this kill chain presents sophisticated challenges, the integration of all these systems multiplies the complexity. Regardless, the program has thus far addressed the challenges and remains on schedule to offer a game-changing capability to the nation.

Consider how this capability will affect future engagements. The current program will allow us to negate short, medium, and intercontinental ballistic missiles, thus significantly improving force protection, enabling us to operate from closer bases, and enhancing the positioning of naval forces. Future developmental spirals will give the ABL more laser power and better range. Combining these enhancements with relay mirrors may enable very-long-range, over-the-horizon engagement of enemy aircraft or cruise missiles.² We can even envision a number of ancillary missions for the ABL, perhaps including one for defensive counterair. These capabilities are not just dreams. The ABL has ground-tested the laser and demonstrated the tracking system on surrogate targets. It remains on schedule for live fire this calendar year.

Another possible airborne application of high-energy lasers, the ATL program began in 2001 as an Advanced Concept Technology Demonstration (ACTD) sponsored by Special Operations Command; it subsequently transferred to the Air Force in 2008. The ATL has demonstrated the optics and tracking system in low-power flight tests, fired

the high-energy laser on the ground, and (at the time of this writing) conducted two high-energy flight tests and target engagements. As noted in a recent Scientific Advisory Board study, the ATL will be able to engage targets at the speed of light with unprecedented precision and very little or no collateral damage.³ The current ATL incorporates a COIL into a C-130, filling the cargo space of the test aircraft because of the laser's very large size. However, when high-energy, solid-state lasers mature, one of these smaller, lighter-weight devices will fit within one of the three weapons stations in an AC-130. The combination of the laser's precision and the kinetics of the aircraft's 105 mm howitzers will give Air Force Special Operations Command a formidable force-application capability.

Laser technology is not the only area in which DE weapons have made significant advances. Radio frequency (RF) DE, most commonly high-power microwaves (HPM), has also demonstrated unique capabilities in nonlethal engagement. Over the next three years, the CHAMP ACTD seeks to demonstrate HPM weapons capable of disrupting any military system containing electronics by disabling or destroying the electronics components. To quote the father of HPM research, Dr. Bill Baker of the Air Force Research Lab, "The smarter the weapon, the dumber [counterelectronics] will make them"—all this with no effect on people or structures.⁴ This nonlethal capability not only will offer the president and secretary of defense a measured means to engage adversaries but also will give military leaders reprogrammable weapon systems with adjustable effects.

To employ the awesome capability of HPM weapons properly, we must begin preparing now. If all goes according to plan, CHAMP will become a program of record in 2014. If we wish to use it effectively, we must (1) develop the intelligence structure necessary to target the weapon (joint munitions effectiveness manuals for nonlethal engagement),⁵ (2) ensure that we have an appropriate delivery system in the inventory (current or future standoff weapons,



USAF photo

COIL-carrying C-130 (Note the elongated nose, which housed enhanced radar for controlling a remotely piloted vehicle on a previous mission.)

unmanned aircraft systems, etc.), (3) develop effective battle damage assessment (BDA), and (4) train our combatant commanders to use these tools productively. We must start developing this groundwork today to guarantee effective use of these game-changing technologies tomorrow.

Another RF system under development, the ADS, projects a gigahertz RF beam that rapidly heats the surface layer of a person's skin, producing a nonlethal effect described as "opening an oven door."⁶ The ADS presents our forces with a very-long-range "water cannon" for dispelling crowds or determining intent. We can deploy this system in a stationary application today, and the Joint Non-Lethal Weapons Directorate is currently developing a mobile application.

Vulnerabilities Associated with Directed Energy

We are not alone in developing DE capabilities. Potential adversaries are making significant investments in DE, and we are witnessing the development and commercial marketing of high-energy lasers for numerous very-short-range (requiring low beam quality) industrial applications.⁷

Founded, owned, and operated by Russian expatriates, IPG Photonics—a US-based world leader in high-power fiber lasers—currently markets a 50-kilowatt fiber laser with over 25 percent efficiency.⁸ In comparison, the Department of Defense's Joint High Power Solid State Laser program demonstrated a 100-kilowatt-class laser with good beam quality (militarily significant range) earlier this year with an efficiency of 15–20 percent. To be fair, this laser will have beam quality (a measure of how tightly a beam can be focused) far superior to that of the IPG industrial laser.

Additionally, the French, British, and Germans also have DE programs. For example, the Diehl company of Germany is marketing HPM devices capable of generating a counterelectronics pulse with a range of 10 or more meters. Clearly, DE capabilities are being developed around the globe. Preparing for these threats is critical.

Recently, the DE Task Force concluded its Directed Energy Net Assessment (DNA), a yearlong study that leveraged the expertise at the National Air and Space Intelligence Center, Air Combat Command, Army Acquisition Corps, Air Force Research Laboratory, and Air Staff to investigate vulnerabilities we will face in the next decade. Us-

ing two scenarios—a major contingency operation and an expeditionary operation—the DENA assessed threats from a near-peer nation and from a less sophisticated adversary using commercial off-the-shelf capabilities. During the past year, the DENA completed detailed scenario development, including mission-level objectives, a rigorous intelligence evaluation and threat lay-down, and technical analysis of DE effects on our systems. This information was then combined with modeling and simulation efforts and war-gamed by the USAF Weapons School to determine the impact on our operations. Finally, the study prioritized the vulnerabilities and recommended tactics, techniques, and procedures to mitigate these vulnerabilities. For vulnerabilities that require material solutions, the report provided concrete recommendations to help drive our research and investments in hardening our systems and protecting our forces.

Future Directions

DE capabilities are still in the laboratory; however, within this unclassified forum, I hope to provide *Air and Space Power Journal's* readers with a sense of urgency. On the threat side, the Chinese have a very active DE research program; Russian companies lead the world in fiber lasers; and a German company markets a counterelectronics suitcase bomb. On the developmental side, the ATL has successfully targeted, tracked, and fired on several ground targets; the ABL is scheduled to fire against surrogate targets in late calendar year 2009; we are beginning the CHAMP ACTD; and the ADS system is preparing for deployment now. DE weapons are truly just around the corner.

To prepare for the arrival of DE capability and threats, we have much to do. As mentioned above, we are conducting a DENA of our vulnerabilities. But our work will not stop there. The DENA will serve as a launching point for several efforts. First, it will identify areas needing more research and investigation. Although the DENA is not

meant to be an all-inclusive study, it will remove our blind spots and point to "what we don't know." Second, we will use the modeling and simulation results of the DENA to improve our war-gaming models and to influence the Capabilities Review and Risk Assessment process, thereby further defining our capabilities and vulnerabilities. Moreover, it will give us tools for assessing new tactics, techniques, and procedures used to employ or defeat DE weapons. Third, the DENA will drive our investments in hardening. Despite the Air Force's ever-present budget constraints, prioritizing our vulnerabilities will allow us to research and develop hardening strategies for our most critical vulnerabilities first. Finally, it will provide the basis for developing requirements. The DENA will equip us with the technical evaluation and critical assessment we need for solid requirements—the foundation of our acquisition process. Though not the end of vulnerability identification and mitigation, the DENA is a powerful start.

The Air Force must learn to employ DE weapons. We know kinetics; we know how to model the effects; we have detailed target sets and the joint munitions effectiveness manuals; we have detailed intel to support targeting; and we have sophisticated BDA techniques. To support a new era of weaponry, we must examine the entire kill chain and assess the required changes. To target the weapon effectively, we must change intel collection procedures to support new engagement methods (e.g., counterelectronics). With kinetic weapons, we developed methods to increase the yield (all the way to nuclear) and decrease the yield (e.g., small diameter bomb) to obtain the desired effect. DE weapons will allow an instantaneously variable "yield" (reprogrammable in flight). To support this capability fully, the combatant commander must have detailed understanding of the weapon's effects. This information is supported by researching those effects as well as modeling and simulating them. We have begun these efforts, but they remain in their infancy. Moving down the kill chain, we see that delivery methods in-

clude those that are manned and unmanned, expendable and recoverable, reprogrammable, terrain following, and stealthy, among others. When modifying existing platforms or developing new ones, we must take into consideration the unique aspects of employing DE weapons (incident angle with target, antenna size/location, optics, atmospheric effects, etc.). Finally, these weapons can be much more precise with variable lethality and thus significantly reduce collateral damage—a benefit in most cases. But BDA is much more difficult, requiring that we think outside the box since it doesn't involve just imagery. For example, we could conceive of cyber forces supporting BDA for a counter-electronics weapon. Fellow Airmen, welcome to the twenty-first century. We have much to do to prepare for the advent of DE in the battlespace.

Game-changing technologies such as this will affect the Air Force across the constructs of doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) (see table). Concepts of operations (CONOPS) and concepts of employment (CONEMPS) will continue to mature as we gain experience with DE systems and threats; however, DE policy is critical to the fielding of weapons. The only existing policy with respect to DE weapons is a prohibition on using lasers to inflict blindness.⁴ As more capable weapons are fielded, we will develop policy individually for weapons, based on the effects. Nevertheless, this work should begin now, during the tech-demonstration phase, so that the General Council has the required data to support and develop coherent policy. Additionally, training and education will play a significant part in developing war fighters who effectively employ as well as self-protect in the DE battlespace. Of course, new materiel solutions will affect personnel and facilities. Most importantly, though, it is incumbent upon Air Force leadership to fully understand the nature of these capabilities and the maturity of this technology so we can enable our forces to employ DE weapons and protect our people from their effects.

Table. DOTMLPF considerations for a DE Air Force

<i>DOTMLPF</i>	<i>Considerations</i>
Doctrine	<ul style="list-style-type: none"> • CONOPS • CONEMPS • Policy
Organization	<ul style="list-style-type: none"> • DE intelligence • DE concept exploitation—war gaming
Training	<ul style="list-style-type: none"> • New employment methods • Advanced weaponry • DE self-protection
Materiel	<ul style="list-style-type: none"> • Weapons • Platforms • Sensor/system hardening
Leadership and Education	<ul style="list-style-type: none"> • Weapons options • Weapons employment • Advanced technologies
Personnel	<ul style="list-style-type: none"> • DE weapons experts • DE weapons maintainers • Logistics support structure
Facilities	<ul style="list-style-type: none"> • Test and evaluation infrastructure • High-energy-laser maintenance facilities • HPM weapons storage

Conclusion

DE weapons will be the most significant technological change that most of us see in our military careers. The technology has been advancing for many years, but never before have there been so many key technology demonstrations: ABL, ATL, CHAMP, and ADS. I am convinced that, given the proper investment, we can develop a fieldable DE capability within the next five years. We have much to do while the scientists and engineers work: assessing vulnerability, developing CONOPS, and assessing our readiness to use these weapons effectively across the DOTMLPF construct. With such promising capabilities on the horizon, I hope you will join us in preparing the Air Force for the future fight. ✪

Notes

1. The ABL combines the power of six chemical oxygen iodine lasers to produce a megawatt-class weapon system.

2. The Tactical Relay Mirror System is an Air Force Research Laboratory program designed to demonstrate the ability to extend the range and accuracy of high-energy lasers by means of airborne mirrors or relay systems (active mirrors).

3. Dr. Hsiao-hua K. Burke et al., "Airborne Tactical Laser (ATL) Feasibility for Gunship Operations," Air Force Scientific Advisory Board Study (Washington, DC: Headquarters US Air Force, Scientific Advisory Board, 2008).

4. Douglas Beason, *The E-Bomb: How America's New Directed Energy Weapons Will Change the Way Future Wars Will Be Fought* (Cambridge, MA: Da Capo Press / Perseus Publishing Group, 2005), 214.

5. A separate group of these manuals is being developed for nonkinetic DE and electronic-warfare effects.

6. In over 11,000 tests, the system has not caused a single case of long-term damage; in most cases (99.9 percent), the symptoms vanish as soon as the individual flees from the beam.

7. Although industrial lasers can produce significant power, their potential military effective range is relatively short because the beams are optimized for very-short-range (a couple of inches to a foot or two) welding, cutting, and so forth.

8. With headquarters in Oxford, MA, IPG has manufacturing facilities in the United States, Germany, Russia, and Italy, as well as regional sales offices in Japan, Korea, India, and the United Kingdom.

9. In October 1995, the United States joined 43 other nations in approving a ban on blinding laser weapons. The international protocol was developed in Vienna, Austria, during a review of the Conventional Weapons Convention, also known as the Inhumane Weapons Convention.



Maj Gen David Scott

General Scott (USAFA; MS, Valdosta State University) is director, Operational Capability Requirements, Deputy Chief of Staff for Operations, Plans, and Requirements, Headquarters US Air Force, Washington, DC. He has served in a variety of positions at the squadron, group, wing, and joint levels in Europe, the Pacific, and the United States. The general has commanded a fighter squadron, an operations group, and a fighter wing. He also commanded the 31st Air Expeditionary Group, coordinating the operation of American, British, Canadian, Spanish, and Turkish aircraft flying from Aviano AB, Italy. He has served as chief of the Air Force House Liaison Office, Washington, DC; deputy assistant chief of staff of operations, Combined Forces Command and US Forces Korea; and vice-director of operations, North American Aerospace Defense Command, Peterson AFB, Colorado. Before assuming his current position, he was deputy commander, Combined Air Operations Center 7, Component Command-Air Izmir, Allied Command Operations (NATO), Larissa, Greece. A command pilot with more than 3,000 flying hours in the F-4, F-5, and F-16, General Scott is a graduate of Squadron Officer School, Air Command and Staff College, and Air War College.



Col David L. Robie

Colonel Robie (BS, MS, Pennsylvania State University; PhD, Georgia Institute of Technology) is the director of the Air Force's Directed Energy Task Force, Pentagon, Washington, DC. A member of the Directed Energy Professional Society, he has worked in the Directed Energy Directorate and Sensors Directorate of the Air Force Research Lab. Colonel Robie is also a command pilot with over 3,000 hours in the T-37 Tweet, T-38 Talon, and C-130 Hercules.

Hybrid Warfare

Something Old, Not Something New

Hon. Robert Wilkie

The boundaries between . . . "regular" and "irregular" warfare are blurring. Even nonstate groups are increasingly gaining access to the kinds of weapons . . . that were once the exclusive preserve of states. And even states will increasingly turn to unconventional strategies to blunt the impact of American power.

—Max Boot, *War Made New*, 2006

The possibility of continuous, sporadic, armed conflict, its engagements blurred together in time and space, waged on several levels by a large array of national and subnational forces, means that . . . war . . . is likely to transcend a neat division into distinct categories.

—Michael Evans, "From Kadesh to Kandahar"
Naval War College Review, Summer 2003



In the 1980s, Israeli military theorist Martin van Creveld forecast that conventional military conflict between the regular armed forces of nation-states would decline in frequency while low intensity conflicts conducted by militias, warlords, criminal gangs, and paramilitary forces would increase exponentially in the developing world.¹ His predictions have been borne out in the last decade, resulting in a direct and audacious assault on the Clausewitzian orthodoxy of Western military establishments, particularly those in the United States and the United Kingdom.

The latest manifestation of van Creveld's original thesis is hybrid warfare—a new variation on the older themes of conventional, irregular, and compound warfare that is beginning to take hold in the United Kingdom, Australia, Scandinavia, and, more recently, within the US Marine Corps and Joint Forces Command. During his appearance before the Senate Armed Services Committee in January 2009, Secretary of Defense Robert Gates used the term *hybrid* for the first time in public when he said that “we’re going to have to . . . take a look at the other elements of [the Future Combat System and] . . . see . . . what is useful in this spectrum of conflict from what I would call hybrid complex wars to those of counter-insurgency [COIN].”² Since assuming office in late 2006, Secretary Gates has consistently warned against repeating the post-Vietnam experience of forgetting how to wage successful COIN, which he considers a likely, recurring phenomenon throughout the “long war” against violent extremist movements. According to the *National Defense Strategy*, “Improving the U.S. Armed Forces’ proficiency in irregular warfare is the Defense Department’s top priority.”³ In an article in *Foreign Affairs*, the secretary declared emphatically that the time is long overdue for some “unconventional thinking” in the Pentagon.⁴

What, then, is a hybrid war? It is conflict in which states or nonstate actors exploit all modes of war simultaneously by using advanced conventional weapons, irregular tac-

tics, terrorism, and disruptive technologies or criminality to destabilize an existing order.

According to Frank Hoffman, chief American proponent of the theory,

Hybrid threats incorporate a full range of different modes of warfare including conventional capabilities, irregular tactics and formations, terrorist acts including indiscriminate violence and coercion, and criminal disorder. Hybrid Wars can be conducted by both states and a variety of non-state actors [with or without state sponsorship]. These multi-modal activities can be conducted by separate units, or even by the same unit, but are generally operationally and tactically directed and coordinated within the main battlespace to achieve synergistic effects in the physical and psychological dimensions of conflict.⁵

However, even Hoffman admits that “hybrid warfare *does not* represent the defeat or the replacement of ‘the old-style warfare’ or conventional warfare by the new. But it does present a complicating factor for defense planning in the 21st Century” (emphasis in original). He also notes that “the future places a premium on forces that are versatile, agile, adaptable and expeditionary minded.”⁶ War still means applying kinetic force, no matter what moniker you put on it.

In the United Kingdom, the Ministry of Defence has incorporated hybrid doctrine into its latest white paper on irregular warfare. In “Countering Irregular Activity within a Comprehensive Approach,” Rear Adm Chris Parry, Royal Navy, notes that

hybrid warfare is conducted by irregular forces that have access to the more sophisticated weapons and systems normally fielded by regular forces. Hybrid warfare may morph and adapt throughout an individual campaign, as circumstances and resources allow. It is anticipated that irregular groups will continue to acquire sophisticated weapons and technologies and that intervention forces will need to confront a variety of threats that have in the past been associated primarily with the regular Armed Forces of states.⁷

Furthermore, the most recent US national maritime strategy reflects the view of the future articulated by Gen James Conway,

Marine Corps commandant; Adm Gary Roughead, chief of naval operations; and Adm Thad W. Allen, commandant of the Coast Guard: "Conflicts are increasingly characterized by a *hybrid blend of traditional and irregular tactics*, decentralized planning and execution, and non-state actors using both simple and sophisticated technologies in innovative ways" (emphasis added).⁸

Hybrid war seems to be a modern variation of what has been called compound warfare, which begins with a regular force augmenting its operations with irregular capabilities. In the Peninsula War, the Duke of Wellington drove the French out of Spain by waging a conventional fight against Napoleon's marshals while unleashing Spanish guerillas in the French rear. Field Marshal Edmund Allenby did the same in Palestine against the Turks, launching a broad frontal infantry assault under cover of the massed guns of the Royal Artillery at the same time that T. E. Lawrence's Bedouin irregulars sliced into and cut the Ottoman supply lines. Mao and Ho Chi Minh used similar tactics against the nationalists and French/South Vietnamese, respectively.

Hybrid warfare's operative stratagem starts with irregular warfare—with irregular forces augmenting their capabilities with conventional weapons. The term itself captures the essence of the problem as it defines their organization and their means. As we have seen in this century, this situation creates a new level of ferocity by blending the fanaticism of irregular warfare with conventional military capabilities. A case in point is the Israeli fight against Hezbollah, which deployed regular cadres with irregular fighters capable of adapting and sustaining punishment while operating independently without reliance on centralized command and control. Hybrid warfare can also occur when a nation-state turns its regular formations into irregular fighters, as Saddam did with his fedayeen in 2003.

We face enemies who will come at us from multiple fronts—terror, cyber, information, psychological, conventional, and criminal. John Arquilla, a close adviser to Secre-

tary of Defense Donald Rumsfeld, remarked in 2007 that "networks have even shown a capacity to wage war toe-to-toe against nation states—with some success. . . . The range of choices available to networks thus covers an entire spectrum of conflict, posing the prospect of a significant blurring of the lines between insurgency, terror and war."⁹

Ron Tira of the Jaffa Center in Israel observes that hybrid actors are often immune to the conventional application of force applied by Israel and the United States: "The attempt to apply the Shock and Awe concept and the [effects-based operations] approach against a guerilla organization like Hezbollah is . . . similar to trying to break an amoeba's bones—using force irrelevant to the circumstances, to the facts, and to the nature of the war."¹⁰ Secretary Gates often notes that "the enemy gets a vote"¹¹ and that he is unlikely to vote to replay the classics like Midway, the Bulge, or the Meuse-Argonne; rather, Mogadishu, Fallujah, and Lebanon are the new paradigms. However, American military history is replete with examples of the armed forces engaging in and winning what Boot calls "The Savage Wars of Peace," the small fights in American history that are more prevalent than linear fights such as World War I, World War II, the Korean War, and Operation Desert Storm.¹²

What does this mean for the future fight and for the Air Force? COIN remains a solid foundation with which to address the matter. This is not new ground for the Air Force, which historically has been able to open the aperture of the spectrum of conflict beyond fighters and bombers. From the Flying Tigers, through support for the Chindits, to Air Force commandos in Vietnam, Laos, and Cambodia, the Air Force built successful partnerships, under fire, with developing nations and their air forces (what Col George Monroe, USAF, retired, calls "the Outback Air Force").¹³

If we take hybrid theorists at face value, then the major roles for airpower don't change. Counterair missions are standard in national security operations, including events like the Super Bowl and presidential inauguration. Air mobility is the sine qua

non for providing special forces the ability to respond to or attack the enemy quickly. Airborne intelligence, surveillance, and reconnaissance (ISR) provides time-critical and persistent capability to find, fix, and fight hostile forces. The huge demand placed on airborne ISR in Iraq and Afghanistan—the repeated calls to enhance ISR capabilities to detect improvised explosive devices and their operators—indicates that this airpower mission will only grow. Further, the ability of airpower to strike an enemy with precision, speed, and discrimination has become the preferred mode of attack in special operations. Importantly, all of these missions are vital to combined operations—in other words, there is nothing new under the sun. Sir Henry Rawlinson, who sketched out the devastating Allied combined-arms offensive at Amiens in 1918, employing photoreconnaissance, artillery, armor, sappers (World War I special forces), and 1,900 aircraft, would recognize the bare essentials of current operations. Billy Mitchell, Hap Arnold, and George Kenney would understand that airpower's basics are as relevant in this era as they were in theirs.

As does its irregular antecedent, hybrid warfare requires a vision that exploits the United States' technical advantage. This calls for more unmanned sensors, small aircraft, directed-energy weapons, and cyber warfare. It is essential to utilize directed energy and network attack, as well as assemble an electronic order of battle as rapidly as possible, and the Air Force can take the lead. Lt Gen David Deptula, the Air Force's deputy chief of staff for ISR, is already talking about developing "electronic fires" (jamming, directed energy, and network attack) quickly and taking them off the shelf. Because the nature of the electronic battlefield is so fluid, traditional hierarchies may not be able to move as quickly as needed to produce effects on the battlefield. New and decentralized organizations must emerge, melding space, ISR, and the ground to produce results.

As mentioned above, COIN remains the foundation of the hybrid environment. By denying the enemy the ability to attack

friendly forces and by disrupting and interdicting his supply lines, airpower is critical to the success of a COIN campaign. Victory is not possible without persistent ISR and combat air patrol. The Air Force puts a premium on surveillance, intelligence, and the discriminate use of kinetic power when dealing with low-frequency enemies like al-Qaeda. Airpower provides surprise, flexibility, and the ability to take the initiative away from insurgents. Look at the roll of enemy casualties coming out of Iraq and Afghanistan—the vast majority are the result of airpower writ large. So, with hybrid warfare as the theory du jour (when the gloss is stripped away, it is not much different from what we have experienced for over a century), we will still need conventional airpower, coupled with the Air Force's electronic punch, to carry the day. It is virtually impossible to engage in unconventional operations without holding the big stick of deterrence and without controlling the thin air. American engagement in small wars and COIN occurs under the umbrella of airpower and the nuclear shield. Without that power, small wars will escalate into large wars.

The big Air Force should argue that conventional and nuclear capabilities can and should complement each other in this climate. Rogue regimes that threaten their neighbors and our allies, potentially with nuclear weapons, are a problem today and will remain so in the future. In part, our goal is to reduce their ability to hold other nations hostage and to deny them the ability to project power. A new triad with a conventional strike force and ballistic missile defense moves us in that direction. A conventional strike force means that more targets are vulnerable without our having to resort to nuclear weapons. And missile defenses reinforce deterrence and minimize the benefits of rogue nations investing heavily in ballistic missiles: Iran and North Korea won't know if their missiles will be effective, thus making the United States and its allies feel less vulnerable.

What does seem lost in this and many debates is that in the constant drive to reinvent the principles and theories of war, ulti-



mately, both have remained constant. As the Australian Air Force would say, there is no business cycle in defense that creates a "new panacea" every five to 10 years from which to create something new and pro-

found. Old Nathan Bedford Forrest was right: "War means fighting and fighting means killing." No matter how much the think tanks pay for them, so-called revolutionary paradigms can't change that. ☉

Notes

1. See Martin van Creveld, *The Transformation of War* (New York: Free Press, 1991).

2. Senate, *Hearing to Receive Testimony on the Challenges Facing the Department of Defense, US Senate Committee on Armed Services, 111th Cong., 1st sess., 27 January 2009, 18*, http://armed-services.senate.gov/testimony.cfm?wit_id=7638&id=3614.

3. Department of Defense, *National Defense Strategy* (Washington, DC: Department of Defense, June 2008), 13, <http://www.defenselink.mil/pubs/2008nationaldefensestrategy.pdf>.

4. Robert M. Gates, "A Balanced Strategy: Reprogramming the Pentagon for a New Age," *Foreign Affairs* 88, no. 1 (January–February 2009), <http://web.ebscohost.com/ehost/detail?vid=7&hid=106&sid=028e9f71-84b8-4e24-971d-c4191b964831%40sessionmgr104&bdata=JnNpdGU9ZWwhvc3QtbGl2ZQ%3d%3d#db=aph&AN=35634218>.

5. Frank G. Hoffman, *Conflict in the 21st Century: The Rise of Hybrid Wars* (Arlington, VA: Potomac Institute for Policy Studies, December 2007), 8, http://www.potomac institute.org/publications/Potomac_HybridWar_0108.pdf.

6. *Ibid.*, 43; and Frank G. Hoffman, "Information Paper on Hybrid Warfare," Center for Defense Information / Strategic Vision Group, 12 March 2008, 8.

7. Joint Doctrine Note 2/07, "Countering Irregular Activity within a Comprehensive Approach," March 2007.

8. *A Cooperative Strategy for 21st Century Seapower* (Washington, DC: US Marine Corps, US Navy, US Coast Guard, 2007), [6], <http://www.navy.mil/maritime/MaritimeStrategy.pdf>.

9. John Arquilla, "The End of War As We Knew It? Insurgency, Counterinsurgency and Lessons from the Forgotten History of Early Terror Networks," *Third World Quarterly* 28, no. 2 (March 2007): 369, <http://www.informaworld.com/smpp/section?content=a771175280&fulltext=713240928>.

10. Ron Tira, "Breaking the Amoeba's Bones," *Strategic Assessment* 9, no. 3 (November 2006), <http://www.inss.org.il/publications.php?cat=21&incat=&read=84>.

11. See, for example, Julian E. Barnes et al., "A Battle over 'The Next War,'" *Los Angeles Times*, 21 July 2008, <http://articles.latimes.com/2008/jul/21/nation/na-nextwar21>.

12. Max Boot, *The Savage Wars of Peace: Small Wars and the Rise of American Power* (New York: Basic Books, 2002).

13. George M. Monroe, "The Rebirth of the Outback Air Force," *Armed Forces Journal*, February 2008, <http://www.afji.com/2008/02/3246746>.



The Honorable Robert Wilkie

Mr. Wilkie (BA, Wake Forest University; JD, Loyola University of the South [New Orleans]; LLM, Georgetown University Law Center; MSS, US Army War College) was the assistant secretary of defense for legislative affairs, serving as legislative adviser to the secretary of defense and promoting the Department of Defense's strategy, legislative priorities, policies, and budget to the United States Congress. He has served as counsel to Senator Jesse Helms (R-N.C.); counsel and adviser on international security affairs to the Senate Majority Leader, the Honorable Trent Lott (R-Miss.); special assistant to the president for national security affairs; and senior director of the National Security Council. He is an intelligence officer in the US Air Force Reserve, assigned to the Air Staff. He previously served in the US Navy Reserve with Naval Special Warfare Group Two and the Office of Naval Intelligence. A graduate of the College of Naval Command and Staff, Air Command and Staff College, the Army War College, and the Joint Forces Staff College, Mr. Wilkie has published articles in the *Naval War College Review*, *Parameters*, *Armed Forces Journal*, and *Proceedings*. He contributed a chapter on European defense to the book *Strategy for Empire: U.S. Regional Security Policy in the Post-Cold War Era* (SR Books, 2004). He is a recipient of the Defense Distinguished Public Service Medal, the highest civilian award of the Department of Defense.

Publishing in *Air and Space Power Journal* and Honoring Mr. Steve Garst for His Many Years of Service

Maj D. K. Stanford, USAF, Chief, Professional Journals

As a member of the editorial team at *Air and Space Power Journal (ASPJ)*, I have had the privilege of reading countless submissions over the past year. Some of the articles come from general officers, others from company grade officers. We also receive a number of pieces from academicians, government officials, and members of industry. All of these authors desire to *provide insight* into their position and let it compete in the marketplace of ideas.

In an era in which mastery of Power-Point seems the most important skill of a staff officer, you might ask yourself why you should take the time to hone your writing skills and publish scholarly articles. Writing about the education of officers in his article "Return of the Jedi" (*Armed Forces Journal*, October 2009), Maj Gen Robert H. Scales, USA, retired, opines that "proven strategic thinkers share a remarkably common provenance. Very early in their careers they learned to think critically and communicate strategically."

The ability to conduct rigorous analysis and present a cogent, fact-based argument is prerequisite to positions of leadership and influence in the strategic arena. Writing for *ASPJ* will help you develop these skills. Thus, you benefit personally, and the Air Force acquires another articulate thinker to shape and lead our future force.

Publishing in a scholarly journal is no cakewalk. It requires a measure of organization, discipline, and effort. The editorial staff at *ASPJ* is here to assist; we are always looking for articles of interest to our broad audience of air, space, and cyber power professionals. For more information on how to submit your article, please review the "Mission Debrief" page elsewhere in this issue.

* * * * *

Mr. Steve Garst recently retired from his position as senior illustrator and art director for Air University (AU) Press. Mr. Garst has faithfully served the Air Force for over 28 years, seven of them as the sole illustrator for *Air University Review* (the precursor of *ASPJ*). His work with the *Journal* remained constant for nearly three decades, and we will sorely miss him. His artistic contributions to the US Air Force are far too numerous to list; needless to say, if you've seen an AU Press publication, Mr. Garst's art probably either graces the cover or can be found within its pages. Steve has won numerous awards, and he's had much success in the private sector as well. Notable commissions include the signature-page portrait for *My American Journey*—the biography of former secretary of state Colin Powell. The editorial staff of the English, Spanish, Portuguese, French, Arabic, and Chinese versions of *ASPJ* thank Steve for his years of dedicated service and wish him and his family the best in their next adventure. ☺

We encourage you to e-mail your comments to us at aspij@maxwell.af.mil. We reserve the right to edit your remarks.

THE ARMY'S "ORGANIC" UNMANNED AIRCRAFT SYSTEMS AND AIRPOWER TRENDS 2010

I believe that the Air Force needs to accelerate its efforts in unmanned aircraft systems (UAS). In particular, I think it should develop UAS delivery of air cargo to forward bases in Afghanistan—for two compelling reasons. First, as noted in Maj Travis Burdine's article "The Army's 'Organic' Unmanned Aircraft Systems" (Summer 2009), "Improvised explosive devices (IED) have killed more ground soldiers than any other threat—over 60 percent of the total" (p. 95). No IED can destroy an unmanned aircraft. Second, as mentioned in "Airpower Trends 2010" (Summer 2009) by retired Air Force colonel John Jogerst, "We have solutions in hand to get unmanned systems from take-off to a destination—more than enough capability for straightforward missions like cargo delivery. No technical reason prevents us from deploying an unmanned tactical cargo air bridge by 2010" (p. 106).

In Afghanistan, we bring most material by air to Bagram Airfield. From there it is distributed to smaller airfields by C-130s. However, a C-130 can't land at a small forward base, so we use trucks, which are painfully vulnerable to IEDs. If the Air Force developed a short takeoff and landing (STOL) unmanned aerial vehicle (UAV), such as an unmanned version of the Pilatus Porter, it could get supplies to most of the smaller forward bases. A Pilatus Porter (and there are many other STOLs) can take off and land in fewer than 600 feet—as demonstrated by Air America during its operations in Laos when it regularly supplied the Hmong via rough 600-foot strips on ridgelines instead of using trucks subject to ambush.

If the Air Force were clever, it could be like FedEx: pack the material for the ultimate destination. In other words, a C-17

brings in 100,000 pounds from Europe to Bagram. It off-loads a smaller amount (say 20,000 pounds) to a C-130 that goes to a regional airstrip that supports 10 forward bases. The C-130's payload is split into 10 packages of 2,000 pounds that are shipped to each of these bases by UAV STOLs. The original packing is based on each base's unique needs and doesn't need repacking. Of course, there will be last-minute needs, but if this system satisfied 90 percent of the requirements, it could be quite efficient.

Our current stable of UASs (e.g., Predator, Reaper, etc.) is optimized for long endurance. What we need for a short-range cargo UAS is a craft with a high lift wing, rugged landing gear, and not necessarily a long range. The German Fieseler Storch of World War II, which had a high lift wing because of its slats and flaps, could land in 60 feet. That's the kind of design thinking we need: take the cargo the last tactical mile. (No one in the world seems to want to put a UAV together with STOL technology, but it is such an obvious payoff. The Army is looking at using an unmanned version of a Cessna Caravan for unmanned air-cargo resupply [see "Airpower Trends 2010," p. 106]. That aircraft won't make the last tactical mile although it will get closer than a C-130.)

One of the principal arguments against resupply by air instead of by truck is cost. Certainly no aircraft is ever going to be as cheap as a truck, but I don't think that is the expense the American public looks at. What concerns them is the lives of American soldiers. Although cargo UASs will not eliminate every IED death, those aircraft will definitely reduce them.

Each UAS strike against terrorists in Pakistan demonstrates the power of airpower. Every destruction of a resupply truck by means of an IED demonstrates the power of terrorists. If cargo UAV STOLs were used for

resupply, we could extend our power and lessen the enemy's.

William Thayer
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DEFENSE OF US SPACE ASSETS

Capt Adam Frey's article "Defense of US Space Assets: A Legal Perspective" (*ASPJ-English*, Winter 2008; *ASPJ-Chinese*, Summer 2009) is certainly insightful. In particular, it ends with a suggestion that the United States should "maintain not only the ultimate strategic high ground but also the moral one" (p. 81), which reflects sound

reasoning and wisdom. However, under the section entitled "China's Test and Its Legal Ramifications," the author claims that "China's recent ASAT test offers an example of another type of attack: the 'kinetic energy weapon' " (p. 78), a statement with which I disagree. The United States and USSR began the development and testing of kinetic energy weapons; China, some 20 years behind, only followed their lead. A search of the Internet, for example, will reveal accounts of such incidents as the US shoot-down of a satellite in 1985 with a Vought ASM-135 ASAT from an F-15.

Liu Xing
Nanjing, China



In air combat, "the merge" occurs when opposing aircraft meet and pass each other. Then they usually "mix it up." In a similar spirit, Air and Space Power Journal's "Merge" articles present contending ideas. Readers are free to join the intellectual battlespace. Please send comments to aspj@maxwell.af.mil.

Cyber ACTS/SAASS

A Second Year of Command and Staff College for the Future Leaders of Our Cyber Forces

Maj Paul D. Williams, USAF, PhD*

At the dawn of airpower, the Army Air Corps created the Air Corps Tactical School (ACTS), which focused upon developing tactics, techniques, and procedures (TTP) as well as doctrine that would best use airpower in war. Currently, the Air Force's School of Advanced Air and Space Studies (SAASS) at Maxwell AFB, Alabama, produces highly capable warfare strategists in support of the joint fight. We need to blend ideas from these two programs into a school that develops cyber power leaders capable of guiding the Air Force into a future where we can fly, fight, and win in air, space, and cyberspace to support America's military objectives.

The Air Force is struggling to determine the best way of developing offensive and defensive capabilities for cyber warfare. Our war-fighting prowess across the land, sea, air, and space domains relies upon our ability to maneuver freely within cyberspace. Preserving that ability represents a critical defensive requirement. We must also become capable of holding at risk our adversaries' capacity to maneuver within cyberspace. This article introduces a concept concerning how and why our service should cultivate cyber-oriented warrior-scholars who can shape the Air Force fight in cyberspace.

In many ways, cyber warfare is in its "Billy Mitchell" days, analogous to the ad-

vent of airpower prior to World War II. We are aware of potential and actual risks in this new domain but do not fully understand them. Just as ACTS gave rise to modern airpower, so do we need a school that produces cyber-oriented warrior-scholars who can help guide the future Air Force. One possibility involves adding a second year of technical study of the cyber domain to the foundation in operational art and science offered by Air Command and Staff College (ACSC) at Maxwell. Such a second-year cyber school already exists within Air University: the intermediate developmental education (IDE) cyber warfare program at the Air Force Institute of Technology (AFIT), located at Wright-Patterson AFB, Ohio.¹ I propose that the Air Force create a two-year professional military education (PME) path consisting of ACSC followed by AFIT's cyber warfare program, paralleling the current path of ACSC followed by SAASS.

The Missing Ingredient

China, North Korea, and other countries have well-developed graduate education programs in cyber warfare.² Additionally, these nations send students to America's finest graduate institutions for master's and doctoral degrees in cyber disciplines such as computer science, computer engineering, and electrical engineering. These stu-

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dents return to their countries and apply their new knowledge towards developing cyber warfare capabilities. Although they may or may not use those capabilities against us, we need to consider the model they are following.

Air Force Doctrine Document 1-1, *Leadership and Force Development*, distinguishes between education and training as follows:

Education provides critical thinking skills, encouraging exploration into unknown areas and creative problem solving. Its greatest benefit comes in unknown situations or new challenges. Thus, education prepares the individual for unpredictable scenarios. Conversely, training is focused on a structured skill set, and the results of training performance should be consistent. Thus, training provides the individual with skill expertise. Education and training together provide the tools for developing Airmen.³

The current Air Force and Department of Defense (DOD) methodology for developing cyber warfare forces heavily emphasizes training instead of education. The expense of training in a budget-constrained environment compels us to field forces that are trained and equipped to respond to only a limited range of scenarios. These forces find themselves out of their depth when faced with the unpredictability of a trained and educated adversary. This is not a winning strategy—in fact, it is not a strategy at all. As we build cyber capabilities, we need to counter the enemy's "best athletes" with our own, led by highly educated and innovative warrior-scholars.

Fundamentally, operations in a new war-fighting domain such as cyberspace take place in a fog of uncertainty and new challenges. The situation we face today resembles the one confronted by early airpower advocates during the interwar period. Specifically, a comprehensive understanding of cyber warfare does not exist; there are only a handful of outspoken proponents of cyber warfare; and most people in the Air Force and other services have little idea what cyber warfare brings to their own mission, much less the joint war-fighting environ-

ment. To many people, cyber warfare is synonymous with communications; cyber attack means corrupting Web pages; and cyber defense means keeping our Web pages safe from attack and removing viruses from our administrative networks. From this perspective, it is hard to see how cyber warfare has much to offer as a war-fighting discipline; consequently, we find little popular support for the Air Force's push into cyberspace.

The popular perception is not far off the mark. Cyber warfare capabilities in the Air Force and DOD are still nascent, and many of the ones we do have are classified to the point that the joint force commander's (JFC) staffs cannot readily incorporate them into their plans. Inside the Air Force, it is difficult to develop advocacy for undeveloped and unproven cyber capabilities, forces, and organizations, given that supporting the development of cyber capability means not supporting some other proven capability. Externally, the JFC has difficulty articulating requirements for capabilities that the services can then provide because we do not yet have much to offer the JFC in terms of a trustworthy, usable means of cyber war fighting, not to mention a plan for employing it in combat.

How do we address these problems? We start with an understanding of the effects needed by the JFC in current and near-future conflicts, as well as existing kinetic war-fighting capabilities. Many "operators" or war fighters in today's Air Force possess such knowledge, but the developing cyber warfare force and the supporting science and engineering community do not have a good understanding of it. Equally important is awareness of today's technological capabilities for cyber warfare and their potential direction in the near future—knowledge primarily possessed by a handful of scientists and engineers. A leadership-oriented education program that combines both sets of understanding and that encourages creative thinking as well as problem solving will produce highly innovative, technically competent war fighters. These officers will

lead the fight, identify needed improvements or new effects, and work with the research and development communities to produce new war-fighting competencies.

This needed innovation is not the sole responsibility of the war fighter. Rather, it requires the involvement of the research, technology development, planning, and programming communities, as well as others, together with the active participation of operators in the technology-development process and an openness to innovation. As a service, we have found ourselves in similar situations before. Perhaps the best analogies come from the dawn of airpower, when technically oriented senior leaders shaped the future Air Force through their struggles to provide solutions to war-fighting problems.

Historical Analogues

We find a similar situation in the struggles of leaders such as Lt Gen Elwood "Pete" Quesada and Gen George Kenney as they tackled the integration of airpower into the US arsenal before, during, and after World War II.⁴ Virtually awash in a sea of change, both men commanded American forces at the beginnings of airpower and in the context of a world war. The manner in which these two iconic leaders dealt with our nation's war-fighting problems—specifically, their innovative exploration and adoption of technology as well as their pragmatic approach to war fighting—offers the Air Force valuable insights. Both Quesada and Kenney dealt with strategic and tactical puzzles by tossing aside dogma and searching for ways to improve the war-fighting effectiveness of their forces. These searches focused on continuous improvement, which entailed extensive experimentation followed by the adoption of workable ideas. Of particular interest is the fact that all of this innovation proceeded during the heat of battle—a notion that is anathema to the Air Force's current risk-averse culture. Both Quesada and Kenney had a complicated relationship with the prevalent service culture of their day,

which emphasized strategic bombing rather than close air support and interdiction. A similar situation exists today in the Air Force's understandable preference for the air weapon over cyber or space weapons. Both leaders matured in the pre-Air Corps Army, and this background and education gave them a shared understanding of and common language with the ground commanders they supported. Correspondingly, the current airpower-oriented officers who will shape the future cyber forces share an airpower background with the air commanders they will work with and support. From a strategic perspective, as junior officers, Quesada and Kenney spent time with senior leaders, gaining broad insights into many of the important issues of the period. Upon taking command, the two generals emphasized frequent meetings with the ground commanders to enhance the situational awareness of both sides. Moreover, they spent a great deal of time in the field identifying problems, devising fixes, recognizing accomplishments of their troops, and, in general, leading from the front of efficient, energetic, and effective organizations that thrived in a wartime environment.

From a cyber perspective, we need people who likewise will lead from the front while seamlessly integrating cyber warfare into the overall fight. They will need to work closely with the leadership as well as rank and file of the organizations upon which they rely—just as Quesada and Kenney supported the ground commanders.

Information, which serves as the foundation both of modern society and of military effectiveness, remains vulnerable to cyber attack. Warfare theorists such as Martin van Creveld inform us that, throughout history, although technology has brought promise of increased war-fighting power, it is characterized by vulnerabilities and limitations. Victory in future conflicts depends upon understanding and overcoming the limitations of technology while minimizing dependence upon vulnerable technology.⁵ Because we are not likely to divest ourselves of high-tech, information-dependent gad-

gets, we must determine how to fly, fight, and win in the face of determined and capable adversarial actions against those information systems. Doing so will require innovation, courage, and conviction from our leaders. The risk-taking and mission-oriented focus of Quesada and Kenney, who managed the interplay of command and technology in the context of war, offers us inspiration and motivation.

New capabilities will demand flexible leaders who can develop new TTPs and doctrine in conjunction with researchers, technology developers, and operators. Such a process calls for a mix of education (which provides broad understanding not only of theory but also of problem-solving skills), training (in a variety of weapon systems), operational experience, and a solid understanding of how the joint fight takes place. Creativity and problem-solving skills are important characteristics of the future cyber warrior, whether they be JFC planners, researchers, operators in the field, or staff officers. The cyber schoolhouses must become laboratories for conceptualizing and developing cyber war-fighting capabilities, much as ACTS was for Quesada and Kenney prior to World War II.

The Value of a Second-Year School

Air University's SAASS, the Air Force's second-year graduate school, graduates strategists and warrior-scholars who possess superior abilities to develop, evaluate, and employ airpower in conjunction with land and sea capabilities in complex war-fighting environments.⁶ Its predecessor, the School of Advanced Airpower Studies (SAAS), was created in 1988 primarily to develop strategists.⁷ The Air Force redesignated SAAS as SAASS in 2002.

Equivalent programs, such as the Army's School of Advanced Military Studies, the Naval Operational Planner Course, and the Marine Corps' School of Advanced Warfighting, develop advanced war fighters in their

respective services.⁸ The Joint Advanced Warfighting School turns out advanced campaign planners and strategists for the Joint Staff and combatant commands.⁹ The three service schools build upon an operationally focused foundation of first-year graduate studies in the Air Force's Air Command and Staff College, the Army's Command and General Staff College, and the Marine Corps' Command and Staff College residence programs.

Graduates of the advanced service schools have become some of the most influential strategists and leaders in their domains, able to leverage a broad understanding of the art of war and the dynamically evolving capabilities of our military forces into effective strategies against our enemies. The success of these officers' support of the JFC in achieving operational and strategic objectives demonstrates the value of advanced war-fighting education. The model of enhancing the broad war-fighting backgrounds provided to in-residence IDE graduates with higher education in a particular area offers an effective means of grooming influential and productive leaders who possess both depth and breadth in their war-fighting domains.

Cyber Not a Good Fit for SAASS

As the Air Force determines where to add an advanced cyber curriculum to its educational system, it is logical to consider enhancing an existing program such as SAASS. Simply put, however, that school is not the right place to develop a cyber equivalent of ACTS. The Air Force originally intended SAASS as an airpower school, but its charter to produce advanced warfare strategists drives a largely service-neutral curriculum—graduates develop joint strategies realized by using the full range of war-fighting capabilities across the air, land, sea, space, and cyberspace domains.¹⁰ SAASS students extensively examine theory and historical experience, developing an enhanced ability to think critically about how best to apply modern air, land, sea, space, and cyber-

space power across the entire spectrum of conflict.¹¹ The curriculum and focus remain general purpose and nontechnical.

In contrast, cyber warfare is inherently highly technical and new enough that leaders in this domain must likewise become technically proficient, much as the technical depth acquired by Quesada and Kenney contributed to their successes in terms of early airpower development. Adding an appropriate level of theoretical and engineering depth to SAASS not only would prove very expensive (e.g., hiring the appropriate faculty) but also would likely severely shortchange the strategy components of the curriculum. Ultimately, the development of cyber warfare TTPs, doctrine, and capability does not reasonably fit into a course of study concerned with domain-neutral strategy. This dilemma drives the need for a separate school.

An Earlier, Similar Proposal for Space

The Air Force space community faced a comparable situation in the 1990s, and similar ideas arose about the need for space power advocates. The service decided to include material about space in the SAASS curriculum and to keep air and space officers together in the same program.¹² The goal of having air, space, and cyber power advocates and strategists in the same room makes a great deal of sense, and of all of the Air Force's PME schools, with the exception of AFIT, SAASS has incorporated the most cyber material into its curriculum. At this point, the analogy breaks down. Instead of emphasizing general strategy, we need a program that seeks to understand the technology and theoretical underpinnings of the capabilities of cyber warfare and the way they can be leveraged alongside other joint capabilities in meeting the JFC's objectives. In this regard, the argument for a separate school reflects the need for ACTS before World War II. Current cyber strategists are trying to lift themselves up by their boot-

straps, and programs such as the one leading to AFIT's cyber warfare degree can help significantly.

AFIT's IDE Cyber Warfare Program

AFIT developed the IDE cyber warfare (ICW) program, which culminates in a master of cyber warfare degree, to support the handful of IDE students sent to that school in lieu of the in-residence ACSC program.¹³ The first students entered the program in 2007 and graduated in 2008. Because of its origins as an IDE program, the one-year ICW program's starting and graduation dates already match up with SAASS's.

ICW develops technical and leadership expertise in cyber warfare and cyber operations, with emphasis on the operational and strategic levels of war. The curriculum features education and research into the protection of friendly operations in cyberspace, coupled with the attack against or disruption of adversary capabilities. Ultimately, it produces proponents of cyber warfare who understand and can articulate how best to apply cyber power (offensive and defensive) in order to achieve strategic and operational military objectives. Although ICW concentrates on the cyber realm, cyber operations are closely related to information operations. Joint, Air Force, and sister-service doctrine for information operations establishes the foundation for technological constructs provided by the program. ICW's offerings encompass a wide variety of disciplines—both technical and nontechnical aspects—including the following:

- influence operations, psychological operations, and deception
- command and control warfare
- electronic warfare
- electronic sensors
- communications systems and networks
- computer and network attack, defense, and exploitation

- threat/vulnerability assessments and risk management
- legal/ethical aspects of cyber warfare
- strategic and tactical planning for cyber operations and warfare

As a war-fighting domain, cyberspace is undergoing rapid transformation, a trend that will continue for the foreseeable future. This implies that the educational development of our cyber leaders will require correspondingly rapid transformation. ICW's curriculum is developed and taught by the faculty of AFIT's Center for Cyberspace Research, which the secretary and chief of staff of the Air Force recently designated the Air Force's Cyberspace Technical Center of Excellence.¹⁴ In this role, the Center for Cyberspace Research acts as a unifying body for promoting cyberspace education, training, research, and technology development. Its location at the juncture between the Air Force's operational cyber forces and various cyber research, education, and training communities across the service, DOD, and national organizations ensures that programs such as ICW stay on the cutting edge of technology and theory.

Selection of Students for the ICW Program

Following the model of SAASS, a centralized process should competitively select officers from a pool of volunteers. Although all graduates of first-year residence schools should be eligible, this program has the main goal of developing advocates who will lead cyber warfare forces in developing cyber capabilities in support of the JFC's objectives. Thus, selection criteria should favor officers who will likely lead cyber units, integrate cyber into the planning process, or act as cyber advocates on joint and service staffs. Accordingly, Air Force specialty code (AFSC) 33S (communications), 14N (intelligence), 11X (pilots), 13S (space and missile operations), and 12X (electronic warfare /

navigator) officers and their sister-service peers would become the most likely prospects for attending such a program.¹⁵

How many cyber warrior-scholars do the Air Force and DOD need? SAASS graduates 40 advanced strategists and airpower advocates each year. Forty cyber graduates annually would be a terrific start. However, an initial cadre of 15 to 20 cyber-oriented warrior-scholars who can bring to the fight both the operational breadth provided by in-residence IDE and the technological depth conferred by ICW would constitute a powerful force for developing cyber capabilities in support of the joint fight. Granted, this article is Air Force centric, but the cyber fight is joint and interagency; therefore, programs such as this one should be open to all future leaders in cyberspace warfare.

Relationship to Cyber Force Development

This proposal is consistent with the Air Force mandate to develop operationally capable cyber warfare officers. Under the guidance of Headquarters Air Force/A3 and Air Force Cyber Command (Provisional), our service has spent more than two years developing a strategy to organize and train the new cyber warfare forces.¹⁶ The development effort culminated in April 2008 with an official Air Force strategy for developing cyberspace professionals. In that strategy, the secretary and chief of staff called for development of trained, educated warriors capable of tailoring cyber effects against enemy centers of gravity and integrating them seamlessly with the full spectrum of Air Force and joint kinetic and nonkinetic effects.

Downsides of the Proposal

The Air Force has too few officers in the field already. Clearly, the prospect of having officers attend school for an additional year will not improve that situation. We must also consider costs related to management and

permanent change of station (PCS), a significant issue in today's budget-constrained environment. Although we cannot downplay such real costs, they do represent an investment in the Air Force's cyber capability that will pay substantial dividends. Fortunately, due to recent decreases in student flows, AFIT has sufficient capacity to absorb 15–20 additional ICW students, thus confining the majority of the programmatic costs to management overhead and PCS expenses.

Potential Courses of Action

If the concept of a second-year school to develop cyber-oriented warrior-scholars makes sense for the Air Force, then we have at least three possible courses of action available to us:

Establish a New Air Force Program Dedicated to Developing Cyber-Oriented Warrior-Scholars

This program would parallel the ACSC-to-SAASS program and consist of the resident ACSC program followed by the resident AFIT ICW program. Competitively chosen from the 11X, 12X, 13S, 14N, and 33S AFSC in-residence school graduates, students would go into key positions after completion of their studies.¹⁷ The program's timelines would match those of ACSC/SAASS.

Pros. ACSC would give graduates of this program in-depth understanding of the operational art of war and employment of airpower, and AFIT's ICW would give them similar understanding of cyber warfare and the creation of cyber power. They would have both technical and operational proficiency, which would enable them to generate the innovative thought needed to develop cyber power as a war-fighting function; they would also become respected and influential leaders of the cyberspace forces. Because their selection for in-residence school has already identified them as probable senior leaders, they have a good chance of occupying key positions following the program. Finally, ACSC teaches officers how to use airpower to fight and win

at the operational level of war. The cyber education from AFIT's ICW would enable advocates of cyber power to integrate both kinetic and nonkinetic capabilities across the war-fighting spectrum.

Cons. The primary downside to this course of action is cost. Moreover, officers remain out of the fight for two years in order to complete the program, which involves two PCSs—one to ACSC and another to AFIT.

Send More Officers through AFIT's ICW

Selected from the 11X, 12X, 13S, 14N, and 33S IDE in-residence list, students would go to AFIT along the lines of the current IDE program and hold key cyber and related positions after program completion.

Pros. No significant programmatic or management changes need occur. This option also incurs only one IDE-related PCS, and students would be out of the fight for only one year.

Cons. Primarily, graduates would not receive the in-depth education in operational art and the science of war offered by the in-residence ACSC program, whose lectures and seminar discussions add substantially to a student's understanding of the material. This deficiency may decrease graduates' ability to integrate cyber power with air and space power.¹⁸

Re-create the AFIT ICW Program at Maxwell, Perhaps inside SAASS

This program, which parallels the ACSC-to-SAASS program, consists of the resident ACSC program followed by the Maxwell ICW program. Competitively chosen from the 11X, 12X, 13S, 14N, and 33S AFSC in-residence school graduates, students hold key cyber and related positions after program completion.¹⁹ Timelines match those of ACSC/SAASS.

Pros. The same as the ones for the first course of action.

Cons. The principal downsides involve the difficulty and expense of duplicating the educational capability in technical engi-

neering and science that exists at AFIT, whose ICW program requires classified and unclassified laboratory and classroom space, classified and unclassified network connectivity, and extensive technical equipment. The most significant difficulty would entail creating and maintaining an appropriate, effective graduate-level engineering faculty, usually requiring many years to develop. Finally, one of the main advantages of AFIT's ICW curriculum is that the faculty members are part of the Air Force Center for Cyberspace Research, which allows them to stay on the leading edge of cyber warfare through teaching, research, and outreach—an association not available to faculty at Maxwell. Finally, officers in the program would remain out of the fight for two years.

Recommendation and Conclusion

I recommend the first course of action—establishing a new Air Force program dedicated to developing cyber-oriented warrior-scholars. Though expensive in terms of time and the cost of an additional PCS, it offers the best education to officers who attend. The second course of action, increasing the number of students in the current AFIT ICW program, would face the disadvantages discussed above but might serve

well as an initial step while the program-matics of the first course of action are developed. The third option, duplicating the ability to teach an ICW-like program at Maxwell, is the least viable choice, primarily due to the duplication of capabilities as well as the high cost.

This program may not need to be permanent—the Air Force's abilities to fly, fight, and win in cyberspace will likely solidify into mainstream processes in 10 to 15 years. Until then, we need to determine how graduates of ACTS and SAAS were able to make the most of the new airpower capabilities. Following this model will enable the Air Force to develop cyber power fully and to integrate it seamlessly into our war-fighting capabilities. AFIT's ICW program, already up and running, can accommodate 15–20 additional students each year. I recommend that the Air Force follow the ACTS/SAAS/SAASS path by creating a second-year graduate path that emphasizes cyber and that parallels SAASS. Just as all second-year PME graduates have proven influential in raising American war-fighting power to its current heights, so will ICW graduates become innovative, forward-thinking officers able to guide our Air Force towards a future in which we can counter all potential adversaries in air, space, and cyberspace. ☼

Maxwell AFB, Alabama

Notes

1. "ICW IDE Cyber Warfare Program Guide," <http://www.afit.edu/en/eng/PDF/Program%20Guide%20-%20Cyber%20Warfare2.pdf> (accessed 3 October 2008).

2. Timothy L. Thomas, *Dragon Bytes: Chinese Information-War Theory and Practice from 1995–2003* (Fort Leavenworth, KS: Foreign Military Studies Office, 2004), 18–23; and Senator Mary Landrieu, "Combating Threats from Cyberspace," *Hill*, 17 June 2008, <http://thehill.com/op-eds/combating-threats-from-cyberspace-2008-06-17.html> (accessed 15 November 2008).

3. Air Force Doctrine Document 1-1, *Leadership and Force Development*, 18 February 2006, 26, http://www.dtic.mil/doctrine/jel/service_pubs/afdd1_1.pdf.

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5. Martin van Creveld, *Command in War* (Cambridge, MA: Harvard University Press, 1985), 261–75.

6. School of Advanced Air and Space Studies, Air University, <http://www.au.af.mil/au/saass/> (accessed 3 October 2008).

7. Stephen D. Chiabotti, "A Deeper Shade of Blue: The School of Advanced Air and Space Studies," *Joint Force Quarterly* 49, 2nd quarter (April 2008), http://www.ndu.edu/inss/Press/jfq_pages/i49.htm (accessed 27 April 2009).

8. See Command and General Staff College, United States Army Combined Arms Center, <http://usacac.army.mil/CAC2/cgsc/>; Naval Operational Planner Course, <http://www.nwc.navy.mil/academics/courses/nop.aspx> (accessed 17 May 2009); and School of Advanced Warfighting, Marine Corps University, <http://www.tecom.usmc.mil/mcu/csc/saw/index.htm> (accessed 6 January 2009).

9. See Joint Advanced Warfighting School, National Defense University, http://www.jfsc.ndu.edu/schools_programs/jaws/overview.asp (accessed 6 January 2009).

10. School of Advanced Air and Space Studies (see note 6).

11. Col G. Scott Gorman, commandant, School of Advanced Air and Space Studies, interview by the author, 7 January 2009.

12. Lt Col Bertrand Sparrow, DEI deputy chair, Air Command and Staff College, Maxwell AFB, AL, to the author, e-mail, 14 October 2008.

13. "ICW IDE Cyber Warfare Program Guide."

14. Center for Cyberspace Research, Air Force Institute of Technology, <http://www.afit.edu/ccr/> (accessed 7 October 2008).

15. In 2009 or 2010, the 33S (communications and information officer) and some 12X (navigator and electronic warfare officer) AFSCs are converting to 17D (for nonrated officers) and 12W (for rated officers) cyber warfare officers, respectively. For the purposes of this article, 33S and 12X are interchangeable with 17D and 12W.

16. For an early description of that effort, see Maj Timothy P. Franz et al., "Defining Information Operations Forces: What Do We Need?" *Air and Space Power Journal* 21, no. 2 (Summer 2007): 53-63.

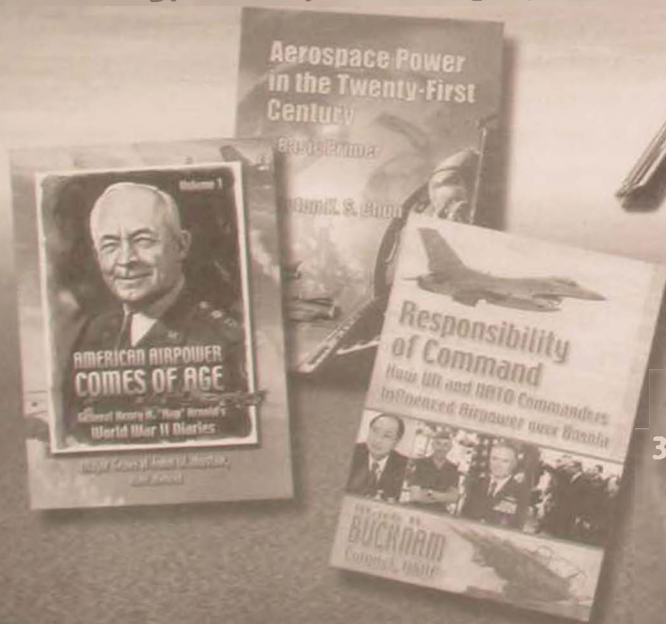
17. Other AFSCs, such as the 61/62/63 family of scientists and engineers, would undoubtedly benefit from this program as well. However, because they probably would not lead cyber forces, we should emphasize AFSCs most likely to capitalize on their cyber skills in the war-fighting domains.

18. At the time of this writing, the author is nearing the end of the in-residence ACSC program; he completed the nonresident program in 2007.

19. *Ibid.*

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War Fighters in Acquisition

A Requirements Document for the Test Professional

Maj Aaron Tucker, USAF*

Nations nearly always go into an armed contest with the equipment and methods of a former war. Victory always comes to that country which has made a proper estimate of the equipment and methods that can be used in modern ways.

—Maj Gen Billy Mitchell

Equipping, including research and development, is a primary responsibility of the Air Force.¹ Yet, a loss of expertise during acquisition-reform initiatives and a lack of immediate and continuous involvement of test professionals have caused the service to struggle in its attempts to execute this critical task properly. Within the defense acquisition corps, these individuals contribute critical capabilities and expertise to the mission of supporting the materiel needs of the war fighter. To be fully effective, they must become involved in this acquisition process at the earliest stages. A proposed cadre of test professionals strikes a balance between system/mission experts and developmental test experts. These groups are developed along separate career paths that provide both recent operational experience and profound technical expertise to decision makers in the acquisition arena. A cadre of deliberately developed test professionals also seeds the ranks of senior officers with direct experience in acquisition. The result is a full integration of such professionals across a system's life cycle, from initial definition of requirements through development and initial op-

erating capability to sustainment of war-fighting capability in our nation's defense.

A Brief Sketch of Air Force Acquisition

Report after report has shown that there are fundamental problems with the way we buy major weapons systems.

—Senator Carl M. Levin, 6 May 2009

The relationship between the government's and industry's conduct of flight test has always provided a constructive tension designed to serve the requirements of the war fighter while pushing the leading edge of existing technology. Industry offers innovative, quality solutions to the war fighter's requirements while government testers ensure that the products meet those requirements. The military has recognized the need to develop its own standards and perform an independent evaluation of commercially produced aircraft since their initial use in World War I. The Air Corps Act of 1926, however, reduced military flight test and evaluation to brief acceptance-test programs. By the end of World War II, so many

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deficiencies were detected late in the procurement process that an independent Flight Test Division was established to conduct test and evaluation independent of the contractors and project offices. To meet the need for practitioners of this independent testing, the military established a test pilot school to improve technical competencies and standardize flight-test methodologies.²

By the end of the twentieth century, advances in technology, political shifts in acquisition policy and funding levels, and mission requirements had affected the balance of roles, responsibilities, and authority between government and industry testers. A series of acquisition-reform initiatives in the 1990s generally decreased government involvement in test planning, execution, and reporting. At best, government testers became partners in the conduct and analysis of tests. At worst, they simply evaluated test results for the program office, resulting in a significant reduction of experienced government test personnel and a veritable freeze in accessing, training, and educating the next generation of test professionals.⁴ "The lack of skilled oversight is costing the government," notes Sue C. Payton, the previous assistant secretary of the Air Force for acquisition. "I could save millions of taxpayer dollars . . . but I have to have the workforce with the domain knowledge that could be able to oversee it and manage it."⁴

Senators Carl Levin (D-MI) and John McCain (R-AZ) of the Senate Armed Services Committee introduced the Weapon System Reform Act of 2009 in order to "remedy a fundamentally broken defense acquisition system."⁵ The defense acquisition program suffered from a loss of resident expertise in the 1990s and a lack of involvement of test professionals early in the process. This, along with other political, fiscal, and technical factors, has resulted in a series of major acquisition programs that cannot be executed either on budget or on time, thus degrading the ability of the war fighter to respond rapidly to emerging threats and maintain superiority in a turbulent world. "I can't tell you how many programs have come to me that

aren't signable because they are improperly structured or funded," says John J. Young, the previous deputy undersecretary of defense for acquisition, technology, and logistics.⁶

The Air Force's acquisition workforce declined from 57,000 personnel 20 years ago to 24,000 at the end of 2008.⁷ According to Payton, "If you look at the workforce, we were up around 500,000 people in acquisition in all of the Defense Department. It is down to about 200,000 now. . . . What we are managing is scarcity."⁸ This scarcity refers not only to the total workforce but also to the proportion of government testers, which has declined compared to contractor personnel. The latter comprised 20 percent of the acquisition workforce in 1994, a ratio that more than doubled to 50 percent in 2003, thereby creating a dependence of inexperienced government officials on contractors. In the last 15 years, many programs have been adversely affected by poor judgment that can be attributed to an inexperienced acquisition/test workforce and funding reductions.⁹ The Air Force is not alone in its predicament; all of the services produced underfunded programs, offered poorly built budgets, and underestimated requirements as preludes to seeking a cash infusion from the Office of the Secretary of Defense.¹⁰ The problems seen in the defense acquisition corps in general are also felt in the developmental test and evaluation enterprise:

- A large number of the most experienced management and technical personnel in government and industry were lost with no adequate replacement pipeline.¹¹
- Major personnel reductions strain the pool of the government's experienced test personnel. A significant amount of developmental testing occurs without an appropriate degree of government involvement or oversight and, in some cases, with limited government access to contractor data.¹²

- The number of Air Force test personnel has declined by approximately 15 percent, and engineering personnel in supporting program offices have been reduced by as much as 60 percent in some organizations. Moreover, these reductions occurred during a time when programs have become increasingly complex.¹³

The Benefits of Test Professionals

Test professionals must appreciate their often unrecognized leadership roles and carefully apply their substantial responsibilities.

—Lt Col E. John Teichert
"Testing Efficacy: The Substantial Influence of Test Professionals"

Upon taking office as the 19th chief of staff of the Air Force in August 2008, Gen Norton A. Schwartz identified acquisition excellence as one of his top initiatives.¹⁴ A critical part of any proposed solution to General Schwartz's challenge is the deliberate development of a cadre of test professionals. As a subset of the larger defense acquisition corps, these professionals deliver capabilities and value critical to an effective acquisition program. The skills of the test professional must be applied across the acquisition process, from the initial generation of requirements to the sustainment of weapons systems.

Test professionals' dedication to the needs of the war fighter is critical to their ability to translate needed war-fighting capabilities into a set of requirements. These needs serve as the genesis of a reliable system that functions effectively and efficiently in the intended operational environments against known and conceivable threats. The test professional's early involvement in the acquisition process can help focus research efforts, define test assets, assess technical risks, determine test

resources, and scope the test program. It is critical that such professionals become involved in the generation of requirements before the Joint Requirements Oversight Council locks them in. Several acquisition programs (e.g., the Joint Air-to-Surface Standoff Missile and the Space-Based Infrared System) significantly exceeded their budgets partly due to poorly written, unrealistic requirements.¹⁵ Test professionals are particularly suited to aligning operational requirements with test-related evaluations that verify and validate a system design. That process is often heuristically based and heavily influenced by their military judgment and prior test experience.

The current trend in industry to protest source-selection decisions serves as an added impetus for developing well-defined, verifiable requirements. Poorly articulated metrics have contributed to embarrassing bid protests, such as the \$35 billion Air Force KC-X tanker-replacement debacle.¹⁶ Such protests are "dragging us down to the *n*th degree," Payton observes. "Acquisition folks have not taken adequate measures to make sure requirements are testable and verifiable in contract award."¹⁷ The acquisition community and test professionals are now held to the practical standard of writing requirements that are of practical use by a source-selection authority and unassailable in court. Anything less will cause delays of needed capability to the war fighter.

Test and evaluation is perfectly situated to significantly affect the life-cycle cost of a system—at the crossover of cost and risk (see figure).¹⁸ The economies of detecting design deficiencies and implementing solutions on only a handful of test articles, compared to implementing a solution on a fielded system, support the cost of maintaining a developmental test capability. Roughly 75 percent of a system's life-cycle costs are set in the initial design process, so an early, rigorous test program will save time and money over the life cycle of the system.¹⁹ In both the development of a new system and the long-term sustainment efforts that follow, test professionals are critical to

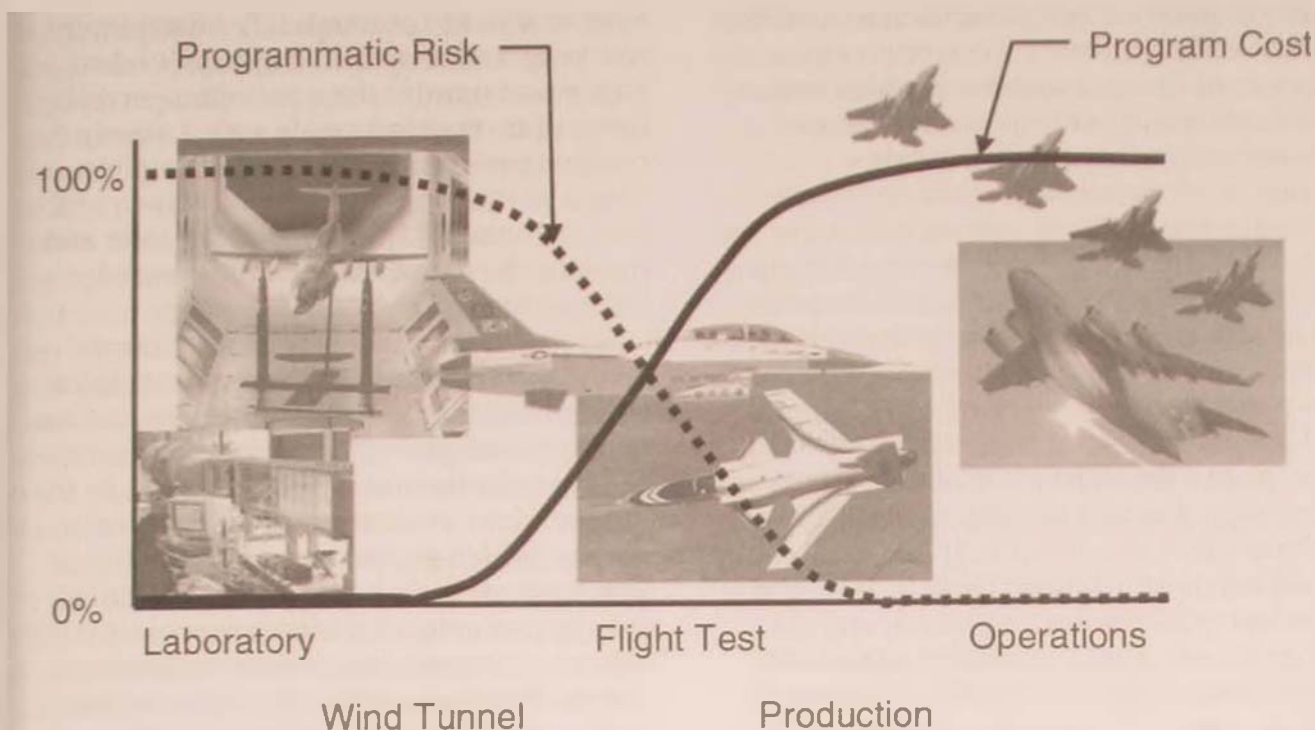


Figure. Test at the crossover of cost and risk. (Reprinted from Aaron A. Tucker and Cihan H. Dagli, "Design of Experiments as a Means of Lean Value Delivery to the Flight Test Enterprise," *Journal of Systems Engineering* 12, no. 3 [forthcoming], 203.)

ensuring that the system is fully and accurately tested and evaluated. Payton observes that "it's more beneficial in the long run to spend an additional 20 percent on a program in the development phase (including prototypes or flyoffs) than to pay for 58 percent overruns in the future when a project is found to be lacking in technology or test procedures."²⁰ As test articles are designed and built, programmatic risk begins to decrease because design choices have been bounded or selected, technology has matured, and cost and schedule uncertainties come into focus.

Introducing the Weapon Acquisition Reform Act of 2009, Senator McCain noted that the "key to defense acquisition programs performing successfully is getting things right from the start—with sound systems engineering, cost-estimating, and developmental testing early in the program cycle."²¹ Integration of test professionals at the earliest stages of requirements generation is essential in order to realize the benefits

of systems engineering by tracing measurable requirements through test to delivery of the capability. The skills that such individuals bring to the development team augment and focus the program manager's task of managing the cost, schedule, and performance of a system. Tightly controlled performance metrics help rein in cost and schedule expansion. Excluding test personnel and their experience from the development phase is a short-sighted attempt to save money and results in increased life-cycle costs.²² While war fighters operate their equipment as established systems replete with the inertia that makes change difficult, test professionals can affect a system design when changes are still relatively cheap and easy.²³ Further, each system must be considered as part of the larger, networked battlespace and integrated into a system of systems, which is most easily accomplished early in the process. Modern systems of systems fuse information from sensors across the battlespace, from ground

to air to space. Fully testing such a capability substantially increases the complexity and expense of the test with each added sensor, which gives further impetus for the early involvement of test professionals.

Just as air systems demand thorough testing to ensure their safe and effective operation, space equipment also requires rigorous testing which is encumbered by peculiar challenges. Space systems in orbit are unique pieces of hardware that are subject to a particularly unforgiving environment and generally cannot be directly accessed once placed into service. These systems are exposed to thermal shock and atmospheric extremes that are difficult, if not impossible, to test accurately before launch. Few, if any, identical systems are produced, and no ability exists to correct discrepancies discovered after launch. Thermal/vacuum testing, one of the final evaluations of orbital systems, offers the best approximation of the hard vacuum of space. Such fidelity, however, remains extremely expensive and takes weeks to execute in one of a handful of facilities in the country. The availability of thermal/vacuum chambers that can accommodate large satellites is particularly limited. Integration testing of the orbital system and ground control is also very important. These system-level tests account for 35 to 50 percent of nonrecurring costs.²⁴ Test professionals with operational experience are particularly critical in space acquisition programs because they occupy the best position for discovering discrepancies and correcting them before a system is placed in orbit.

Software is one of the few systems that can be developed and maintained after the launch of a space system. In the last two decades, systems have become increasingly software intensive. In order to manage the complexity of software-intensive systems, many programs have adopted a block-upgrade strategy whereby each upgrade drives its own developmental test program, which merges into almost continuous test programs (e.g., F-16 Block Upgrades, C-17 Follow-on Flight Test Program, and Global Positioning

System Blocks I through III). Sustainment test programs maintain a system's relevancy and require the continuous involvement of test professionals with a steady focus on requirements and test discipline. These personnel must ensure delivery of the new capability in a block upgrade and prevent the degradation of baseline capabilities through regression testing.

The value of test professionals corresponds to systems-engineering principles which hold that programmatic risk and uncertainty are probabilities that can be mitigated or eliminated. Their value lies in the independent evaluation of system performance, which supports fielding decisions. Test professionals help generate requirements, evaluate acquisition proposals, and offer their expert insight into technology and performance risk rather than simply select the lowest-cost proposals. If these individuals fail to perform their duties properly, the needed change may prove technically impossible or fiscally prohibitive.²⁵ Similarly, the time for the system's effectiveness may have passed, resulting in a defeat on the battlefield, the fielding of an enemy countermeasure, or a paralyzing war of attrition. Test professionals with an operational focus can break through crippling limitations by questioning assumptions and applying technology to provide new capabilities.

Efficient programmatic practices are in continual demand from the test professional: risk management, test planning, mission relevance, deficiency reporting, and programmatic wherewithal.²⁶ Test professionals must develop an ability to understand and balance cost, schedule, performance, and their attendant risks and uncertainties. An understanding of the needs of the war fighter is critical to decisions about performance risk. Which capabilities can be cancelled, delayed, or modified, and which are not negotiable? Test professionals have a unique perspective that allows them to find problems or deficiencies before a fielding decision is made, to evaluate design fixes, and to prevent re-

work on production systems. Even within a single developmental test program, a skilled, experienced test team can save time and money by reducing the fly-fix-fly cycle. Developmental test is expensive but not nearly as costly as not having skilled, experienced test professionals. The price of finding a deficiency late in a system's life cycle and then implementing a design change can be quite high.²⁷ For instance, space system programs spent 10 percent of the development schedule and 10 percent of their profit margins fixing problems not discovered until the final system-level thermal/vacuum test.²⁸

Maj Gen David J. Eichhorn, commander of the Air Force Flight Test Center, believes that the "government's role can't be allowed to degrade into nothing more than deep pockets / check writers."²⁹ Complete information informs the decisions of acquisition authorities as they continually balance cost, schedule, and performance while steering a direct course to deliver combat capability to the war fighter. Test professionals have the responsibility of collecting and interpreting rigorous technical data from the earliest analyses of materiel solutions and technology-development efforts through sustainment. They should then educate acquisition decision makers on the underlying assumptions and probabilities associated with the system. Even before actual test data is available for a system, test professionals can advise decision makers using judgment born of education, training, and experience as practical testers. Source-selection teams can leverage the judgment of these professionals to evaluate proposed test programs.³⁰

Tools such as design of experiments (DOE) and theory of constraints have been applied to overcome the debilitating need for absolute surety and the distractions of false dilemmas. Both tools employ a statistically rigorous analysis to determine the probability that a particular reality actually exists, based on a finite number of observations. DOE-based test plans enable the development of analyses and conclusions couched in terms of statistical confidence and power intervals.

These statistical measures of the quality of test data are critical to sound, objective acquisition decisions. Further, test professionals can present decision makers with discrete levels of test resources required to answer a particular question—essentially buying increments of statistical confidence and power.³¹ One case study proposes that a DOE-based flight-test experiment can save 70 to 84 percent of the cost of traditional, one-factor-at-a-time approaches.³²

Balance within a Cadre of Test Professionals

Scientific results cannot be used efficiently by soldiers who have no understanding of them, and scientists cannot produce results useful for warfare without an understanding of the operations.

—Dr. Theodore von Karman
Toward New Horizons

Test professionals, who have a variety of technical skill sets, include operators, engineers, and program managers trained and educated in the art and science of test. Each career path should be developed within a cadre of test professionals comprised of a balance of two types of experts:

1. System/mission experts who have depth, recency, and career focus in operations coupled with firsthand test experience.
2. Developmental test experts who may have a background in operations and maintain a career path focused on developmental test.

Both types of experts are operator, engineer, and program-manager members of a combined test force (CTF), which can focus on a system (e.g., an F-35 CTF) or a capability (e.g., a Global Reach CTF or a Global Power CTF). All members of a CTF contribute to the developmental test and evaluation program to develop capabilities for the war fighter. System/mission experts provide extensive system expertise to evaluate new

capabilities and support the CTF's training, standardization, and operations functions. Developmental test experts act to ensure that systems are evaluated safely, effectively, and efficiently through test and safety planning and reporting. Both share in the execution of test missions according to their specific skill sets—by exchanging ideas and experience, they enhance the CTF mission of providing decision-quality data for acquisition programs.

System/mission experts should be closely identified with the operational community. The Defense Science Board's report on developmental test and evaluation recommends, as a minimum, making available a cadre of operational personnel to support developmental test and evaluation for Acquisition Category I (total procurement of more than \$2.19 billion) and special-interest programs.³¹ System/mission experts can ensure that evaluations are conducted in the context of the mission, which can be evolving with emerging threats and new tactics, techniques, and procedures. They would evaluate the system in terms of mission capability and report the results in terms of operational significance to the user.³⁴ This cadre brings operational considerations such as the utility of new capabilities to the developmental test program and seeds the future ranks of senior leaders with officers who have working-level experience in test and acquisition. A National Research Council study of 2008 characterizes inexperienced government and industry personnel in key leadership positions as the largest driver of cost-development time and performance risk.³⁵ A continuous flow of recent operational expertise to the test enterprise is justified by considering the benefits to the acquisition programs and the professional development of the individuals.

System/mission experts' professional development broadens from a concentration on operations to include an acquisition perspective. After one or two operational assignments, an operator with a technical background and experience as an instructor in a major weapons system is eligible to join

the cadre of test professionals. For individuals with solid operational credentials, an assignment in test and evaluation could become an alternative to a tour as a schoolhouse instructor or air liaison officer. Weapons school graduates would be particularly valuable to a test organization. The Defense Acquisition University's online courses in acquisition and test and evaluation would serve as an entrée for novice test professionals, and training in a National Test Pilot School or an Air Force Test Pilot School short course could train operators and flight test engineers for operational and developmental test assignments. Moreover, flight-test assignments that perform program management could provide staff officer experience for senior captains or junior majors, coupled with flying duties. Although out of the air and space expeditionary force's deployment cycle for their weapons systems, test professionals could support individual deployment taskings commensurate with their skill sets, enabling them to stay connected with current operations and shoulder their fair share of the deployed mission.

The breadth of acquisition experience gained by a system/mission expert depends largely on the program, but most test professionals would become familiar with and have the opportunity to affect several programs in different stages of the acquisition process before returning to the war-fighting commands. Along with taking Defense Acquisition University courses, this experience would qualify the individual for an Acquisition Professional Development Program Level II or III certification in test and evaluation.³⁶ The courses and training that lead to these certifications would help system/mission experts understand the capabilities and limitations of operational and developmental test and evaluation. Additionally, acquisition certifications and test experience would expand their eligibility for higher-level staff assignments in test, acquisition, plans, programs, and operational tactics and training. Finally, due to their involvement with next-generation systems, these experts would become very familiar with the newest sys-

tem capabilities and would be uniquely qualified to deliver a system to the war-fighting command as the initial cadre in a leadership capacity. These rising leaders would be able to draw on their direct experience with acquisition as they progress to roles of increasing responsibility. The Air Force should emphasize the value of a test and evaluation tour to ensure that system/mission experts are promoted to augment the ranks of senior leaders with individuals who are able to draw on their direct experience with acquisition as they progress to roles of increasing responsibility.

Acquisition programs benefit from the valuable, recent operational experience of system/mission experts. Furthermore, these personnel can be drawn from the general pool of operators, engineers, and program managers, thus providing a flexible, responsive manning source from which to quickly increase or decrease the manning according to the needs of the particular test program. The inclusion of system/mission experts in a cadre of test professionals also greatly enhances the amount of operational expertise organic to the acquisition program. Finally, system/mission experts who are operators can participate in the vast majority of test missions because only medium- and high-risk test missions (12 percent of test sorties) require graduates of a test pilot school to execute the mission.³⁷ The fact that that requirement may be met by contractors or waived by the test leadership further increases the opportunity for system/mission experts to execute test missions.³⁸

Drawing on their extensive knowledge of systems and tactics in major weapons systems, operator system/mission experts can serve as instructors or evaluators for the CTF and as command chief pilots for Air Force Materiel Command. They must take care, however, to overcome the philosophy of rigid training and standardization rules necessary in operational units. The developmental-test mission demands flexibility in order to execute tests safely and efficiently. This flexibility is enabled by test discipline, technical judgment, and outstanding airman-

ship of highly experienced aircrews. Test is not executed by inexperienced copilots or basic wingmen. The learning curve is always very steep, test professionals are rarely comfortable, and each person must carefully manage operational risk as it relates to the specific test mission. The risk of realizing a hazard is also carefully mitigated by the operating environment (e.g., daytime, good weather, sanitized airspace, and very long runways), a mission profile that has been vetted through multiple levels of technical and safety reviews, and the diverse team of experts charged with planning, executing, and monitoring highly instrumented test vehicles.

System/mission experts complement developmental test experts within a CTF. The system/mission expert's career is weighted heavily toward operational assignments, whereas the developmental test expert starts with a technical background, adds operational experience, and continually builds momentum with assignments in test and acquisition in order to mature as an acquisition professional. The developmental workforce tends to be relatively static due to the extremely long lead time needed to select and train developmental test experts. To be effective, they should start developmental test assignments early in their careers after beginning with a base of operational expertise upon which to develop skills and experience. Operators, engineers, and program managers who are growing as developmental test experts need to learn their craft through a combination of education, training, and experience while undertaking a series of increasingly difficult tasks. Their professional development includes honing critical-thinking skills, technical acumen, and engineering judgment. The challenge involves developing their ability to move flexibly among developmental test programs and provide effective, system-generic test expertise while remaining operationally relevant. Balanced experience across major weapons systems is a critical skill for developmental test experts to possess.

The value of the dedicated test professional becomes evident when designing or executing a critical test point. A system must demonstrate its capabilities near the edge of the operating envelope when significant resources are at stake. Examples include a maximum-performance braking event when tire and wheel damage is expected, maximum weight operations on a dirt landing zone, or the release of an expensive weapon at the edge of the operating envelope. Graduates of test pilot school are the best candidates for assessing technical and safety risks in order to ensure that the test is designed and executed properly the first time. Their training allows them to design the test based on theory enabled by a sense of what's actually practical. When executing the test, operator and engineer developmental test experts approach the

the simple goal of training a skill set by also educating a test professional's critical thinking and judgment. For example, the US Air Force Test Pilot School's curriculum received approval to begin granting a master of science degree in flight-test engineering, starting in May 2008. Intermediate Developmental Education in-residence credit as well as Defense Acquisition University equivalency (up to Level III Test and Evaluation coursework) had already been approved. This trend toward strategic education supports the progression of a developmental test expert. Test pilot school selection boards consider demonstrated officership as well as strong academic performance in the applied sciences. They don't simply select a test pilot school student but a future developmental test professional. Test professionals progress to command test and development

The years of technical development and training in the test skill set produce a developmental test expert who makes decisions and gathers data that is well worth the cost of training.

test point with a situational awareness developed toward controlling dynamic, multivariate systems. This enables them to observe the test as well as overall system performance and report on the test with the benefit of years of trained observation. Developmental test experts can meet the challenge of maintaining operational relevance by reserving time for participation in major exercises or operational deployments.

The common thread among the syllabi at all test pilot schools is that theoretical expertise supports safe, effective, and efficient flight test and accurate reporting. Each school strikes its own balance of instruction in performance, handling qualities, and systems. They all, however, attempt to surpass

centers; hold senior acquisition, planning, and programming positions; or step into research to provide operational and test perspectives to technology-development efforts. In addition, the military test pilot schools are considered strategic assets because they provide a flow of expertise into industry as well as into the government test establishment.³⁹

The years of technical development and training in the test skill set produce a developmental test expert who makes decisions and gathers data that is well worth the cost of training. A flight-test engineer can pay back those training costs by designing a test plan that safely and effectively validates a system's capabilities. A test pilot can

justify those training costs by executing the test point on the first attempt and by accurately reporting the results. A cadre of deliberately developed test professionals justifies its cost many times over by enabling acquisition decisions based on rigorous, accurate data from a source that protects the interests of the war fighter and taxpayer.

Conclusion

Better be prepared to dominate the skies above the surface of the earth or be prepared to be buried beneath it.

—Gen Carl A. Spaatz

The chief of staff of the Air Force's initiative to regain acquisition excellence recognized that Congress and the Department of Defense had lost confidence in the service's acquisition decisions at a time when resources must be carefully conserved. Test professionals are critical to providing accurate information for those acquisition decisions. They perform the necessary function of translating needed capabilities to requirements, managing development programs, and accurately and fully testing systems. The value of test professionals is realized through independent evaluation that exposes system flaws early in development when they can be solved easily and quickly. They also produce decision-quality data for acquisition decision makers who must be able to rely on those data. Therefore, it is critical that a cadre of deliberately developed professional testers be fully integrated into acquisition from the earliest stages.

This cadre of test professionals includes a necessary balance of system/mission experts and developmental test experts. The former include operators, engineers, and program managers who come from operational assignments and contribute mission focus and system expertise to test programs before returning to operational assignments. They can gain acquisition experience that will prove critical later in their careers as senior leaders in operations, acquisition, plans, or programs. Developmental test experts develop core skills in operations, engineering, and program management that are critical to planning and executing safe, efficient, and effective test programs. Their career path remains in test and acquisition to take advantage of experience and judgment that has been sharpened by the challenges of developmental test.

Fixing the problems in test and evaluation represents a complex undertaking yet is only a small part of achieving acquisition excellence. Deliberate development and investment in the acquisition corps in general, and in the test professional in particular, are necessary for the Air Force to answer the chief of staff's call. Acquisition excellence is based on properly navigating a series of programmatic decisions fraught with risks and assumptions. Test professionals reduce those risks and assumptions with data and educate the judgment of decision makers to deliver needed capability to the war fighter and secure the national defense. ★

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50 Years Later

Tough Questions Facing Nuclear Arms Reduction

Lt Col Andrew S. Kovich, USAF^{1*}

Among those states or actors who aspire to attain nuclear weapons, which will give that desire up if we do? Answer: Zero. What nation, not now seeking nuclear weapons, will do so if we sustain a reliable, safe and secure nuclear deterrent? Answer: Zero. And what nation will seek to gain nuclear capabilities if it loses confidence in our nuclear-umbrella deterrent? Answer: Many.

—Gen Larry Welch, USAF, Retired
Former Air Force Chief of Staff

On this 50th anniversary of the intercontinental ballistic missile (ICBM) force, the nation must look very carefully at options for its strategic force structure in total. In 2006 the Defense Science Board declared that “nuclear capabilities remain an essential element of U.S. national security strategy and defense posture.”¹ Recently the Congressional Commission on the Strategic Posture of the United States reinforced that assertion: “Nuclear weapons have safeguarded our security for decades during the Cold War by deterring attack on the United States or its allies. We will need to maintain this deterrence capability for some years to come.”² Three major efforts now under way will affect the nation’s strategic posture: the Nuclear Posture Review (NPR), Quadrennial Defense Review (QDR), and renegotiation of the Strategic Arms Reduction Treaty (START). The Air Force must educate itself more broadly and deeply on the issues fueling the nuclear debates that are occurring as part of these endeavors. After all, nuclear weapons are national assets that ensure America’s freedom of action in the world, and the Air Force retains sole responsibility for the stewardship of nuclear bombers, ICBMs, and dual-capable aircraft.

US leadership will make decisions about its strategic forces in a very unpredictable secu-

rity environment. The current administration must consider such issues as the proliferation of technologies and delivery capabilities involving weapons of mass destruction, bids by nonstate actors for nuclear capability, and the ever-present challenges of peer/near-peer competitors.³ In light of these matters, our leaders must address arms-reduction activities with regard to a multipolar world versus the bipolar world of the Cold War era. If we assume that a decrease in nuclear infrastructure is desirable, then advocates of a reduced strategic force posture need to answer some important questions.

Adm Richard Mies, USN, retired, former commander of US Strategic Command, recently offered some valuable ideas worthy of careful consideration.⁴ In view of the current “en vogue” movement toward a world free of nuclear weapons, he argues that the following questions require answers prior to the formulation of any national agenda: Is moving to a nuclear force of zero feasible? Is it verifiable and enforceable? Is it inherently stabilizing and sustainable? Finally, is such a force posture desirable?⁵ Rather than suggest comprehensive answers to these questions, this article seeks to frame the arms-reduction discussion.

Unfortunately, each of the aforementioned questions leads to other questions—none of

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them accompanied by clear answers. Regarding feasibility, "What detailed, specific actions must be taken by individual nations and the international community and what time-frames are envisioned to complete those actions?"⁶ According to Admiral Mies, "nations don't distrust each other because they are armed; they are armed because they distrust each other."⁷ Despite the desire to reduce the US nuclear arsenal, the fact of the matter is that other nations are seeking nuclear capabilities or modernizing their existing forces. North Korea and Iran are developing nuclear capabilities and delivery systems with greater and greater reach.⁸ Additionally, Russia appears determined to maintain a sizable, "tactical" nuclear force that has not been, and apparently will not be, addressed or reduced within the context of bilateral arms-reduction efforts with the United States.⁹ Moreover, China continues to modernize its long-range nuclear forces, thus increasing its ability to hold more targets at risk.¹⁰ US arms-reduction efforts within the nuclear enterprise are unlikely to dissuade these sorts of activities, which, if not carefully measured and deliberately considered, could undermine US security.

On the verifiability front, who will perform verification, and how will compliance be enforced? One dilemma concerns the need for intrusive verification protocols required to pursue this course of action. Even if this proves successful at some level, can we be assured of complete accountability? If we can satisfactorily answer these first two questions, will this nuclear-free world become more stable, and can it be sustained? The ability to create and deliver nuclear weapons exists; this fact will not change, regardless of the international protocols instituted. What will prevent dishonesty? We will always have world leaders driven by the human desire for power or prestige. Finally, if we can actually realize "zero," is this condition really desirable? Although the world would become less susceptible to nuclear war, "zero" might well prove more accommodating for large-scale conventional war.¹¹

The United States has decreased its nuclear forces by 75 percent since the end of the

Cold War and, earlier this year, met the number of operationally deployed warheads mandated by the 2002 Moscow Treaty.¹² Moreover, force reductions, although desired by many individuals for increased security, may in actuality place the United States in a far less secure and less certain defense posture, one that brings greater risks and dangers.¹³ Issues related to lower force sizes include a lack of credibility in our extended-deterrence capability, more emboldened potential adversaries, fewer options available to the president, and dramatic changes to our nuclear-force targeting schemes.¹⁴ A robust, reliable, and credible nuclear deterrent must exist to favorably influence these areas of concern—first, by deterring their operational use and, second, by assuring our allies that our deterrent underwrites their common national security objectives.

Since the first operational use of an atomic device in 1945, nuclear weapons have maintained a central role in US defense policy. A robust nuclear force assures our allies and friends, dissuades the rise of other peer/near-peer competition, deters hostile regimes from taking actions contrary to US interests, and, if needed, enables the president to defeat adversaries promptly. The policies of each presidential administration have differed slightly, but five enduring deterrence themes remain:

- Nuclear weapons exist fundamentally to deter nuclear attack against the U.S. and its allies.
- At a minimum, the U.S. will never be without nuclear weapons.
- War plans have provided flexibility and options to the National Command Authorities.
- Sufficient nuclear forces (and associated command and control) are maintained to assure their survivability and capability to inflict "unacceptable damage" to any adversary, even if that nation strikes first.
- Generally, the targets for nuclear weapons have been the potential enemy's nuclear forces, other military forces, leadership, and war supporting industry.¹⁵

The fact is that these forces have always played a vital role in the security of the United States. The dangers of the twenty-first century do not indicate that we no longer need nuclear-deterrent effects.

Although most of today's Air Force personnel do not work directly in the nuclear arena, they do defend the United States; thus, all Airmen entrusted with providing national security must have an understanding of what nuclear weapons offer the nation. As military professionals, we must

carefully consider these questions related to nuclear arms reduction. Safeguarding the American way of life is the Air Force's primary duty, and we must be able to provide sound military advice to the national leadership. In this historic year of decisions resulting from the NPR, QDR, and START negotiations, perhaps the most appropriate question asks how well the Air Force is prepared to respond to the most important arms-reduction issues of our generation. ✪

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Minimizing the Loss of Student Pilots from Voluntary Attrition

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Losing a student from Air Force undergraduate pilot training (UPT) incurs both direct and indirect costs to the service. In addition to the fact that it wastes an opportunity that another Air Force asset could have used, all or part of the approximately \$750,000 that a UPT training slot costs will see no return on investment.¹ Seeking to minimize attrition from all causes, Air Education and Training Command (AETC) uses a variety of screening tools for selecting students. The largest category of student loss from UPT is voluntary attrition, called "dropping on request" (DOR). Attempting to minimize this type of attrition, in 2004 the Air Force changed the syllabus for evaluating students prior to attendance at UPT by replacing Initial Flight Training (IFT)—a decentralized course that provided 50 hours of flight instruction and a private pilot's license—with Initial Flight Screening (IFS), a more centralized program that offers only 25 hours of flight instruction but that demands more rigorous training and emphasizes officership. Now, five years later, we need to evaluate the effectiveness of this change.

Historical Perspective

Since the beginning of military aviation, the Army Air Corps and then the US Air Force have outlined requirements for qualification of student pilots and have sought effective screening of training applicants to select those who would become the most successful. Selection criteria and the number of student pilots needed by the service

have changed substantially over time as political situations altered, as the physiology of humans in the flying environment became better understood, and as the performance of aircraft developed.²

A variety of methods have been used to actively manage the volume and capacity of pilot training. As early as 1938, student pilots completed initial training requirements under the tutelage of civilian instructors before continuing their training at Brooks and Kelly Fields, Texas.³ Just as the number of required pilots varied through the conflicts of the last century, so did civilian screening and training programs. Analysis of these methods validated their efficacy as well as their shortfalls. In 1955 the Flying Training Air Force, a forerunner of AETC, conducted a study that compared attrition rates of 538 students who had received preflight training to those of 541 who had not. They found similar overall attrition rates but a smaller rate of voluntary attrition from subsequent training in the group that had undergone the preflight program.⁴ Additionally, the latter students "scored higher in . . . attitude, motivation levels, knowledge of service, and practical experience."⁵ Later, between 1956 and 1958, a study found an attrition rate from UPT of 6.3 percent for Air Force Reserve Officer Training Corps (AFROTC) cadets who had received civilian instruction in light planes as part of the Flight Instruction Program prior to UPT, compared to 24.7 percent for those who had not.⁶ However, participants in the program "had to unlearn a variety of bad flying habits during primary training."⁷ Since then, programs including

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military and civilian courses have offered pre-UPT training to Air Force Academy and ROTC cadets. Most recently the Air Force has used a centralized and standardized syllabus for contracted instruction to provide flying-orientation and training programs to students interested in proceeding to UPT.⁸

Over the years, the Air Force has also studied physical and psychological variables, employing them as tools for screening pilot candidates. Methods for aptitude testing, used as early as 1928, include a variety of psychological evaluations, psychomotor testing, and standards for physical examination.⁹ A board for training selects today's UPT candidates, based on a combination of factors such as academic performance, letters of recommendation, and Pilot Candidate Selection Method scores—generally predictive of success in UPT.¹⁰ The latter scores include the Test of Basic Aviation Skills and the Air Force Officer Qualification Test, as well as the number of flying hours that the candidate may have accumulated. Prior to beginning UPT, students complete a battery of neuropsychological tests called the Medical Flight Screening-Neuropsychiatric (MFS-N)—standard for all UPT candidates since 1994—which includes verbal and performance IQ



Courtesy AETC History Office, Randolph AFB, Texas

*Stanine testing, first used in 1942, categorized the performance of student aviators on nine psychomotor tests, thus helping to assign them to aircrew roles. (From Anne Krueger Hussey, *Air Force Flight Screening: Evolutionary Changes, 1917–2003* [Randolph AFB, TX: Office of History and Research, Headquarters AETC, 2004], 9, <http://www.aetc.af.mil/shared/media/document/AFD-061109-020.pdf>.)*

testing; personality testing; and cognitive testing for attention, concentration, and psychomotor skills.¹¹ Though not part of the UPT selection criteria, these data are a rich source of information on the attributes of the candidate and have been used to construct a composite neuropsychological picture of the successful Air Force aviator. The results of neuropsychological testing may also serve as a baseline study for the individual aviator in the event that a medical evaluation necessitates repeated testing.

Transition from Initial Flight Training to Initial Flight Screening

As mentioned above, in 2004 the Air Force changed the method, locations, and requirements for pre-UPT training from IFT (a 50-flying-hour program) to IFS (a 25-flying-hour program). IFT began in 1998 after Air Force-wide grounding of the T-3 aircraft due to several fatal mishaps, which halted the Enhanced Flight Screening UPT training program.¹² In accordance with federal guidance for pilot preparation, a civilian-only staff conducted the IFT program.¹³ The training enjoyed wide latitude in methods, focusing mainly on the end state—successful completion of requirements for obtaining a private pilot's license. To provide IFT for UPT candidates, AETC contracted with flight schools that conducted training at over 200 locations nationwide. On average, most students (civilian and military) needed 70–80 flying hours of instruction to attain the license. AETC accelerated training requirements to mandate that students successfully solo by 25 hours, pass a check ride with a Federal Aviation Administration examiner, and earn their private pilot's license by the 50-hour training point (compared to the average of 70–80 hours of flight time needed to attain licensure for general aviation students). This compressed requirement served as an indicator of the candidate's potential for successful completion of



Courtesy AETC History Office, Randolph AFB, Texas

Fielded at ROTC sites throughout the United States, the Basic Attributes Tester, used from 1982 to 1991, helped determine which UPT applicants had favorable psychological factors, psychomotor skills, and cognitive abilities. (From Anne Krueger Hussey, *Air Force Flight Screening: Evolutionary Changes, 1917–2003* [Randolph AFB, TX: Office of History and Research, Headquarters AETC, 2004], 44, <http://www.aetc.af.mil/shared/media/document/AFD-061109-020.pdf>.)

UPT.¹⁴ After finishing IFT, candidates underwent Medical Flight Screening and, if cleared, joined a UPT class.

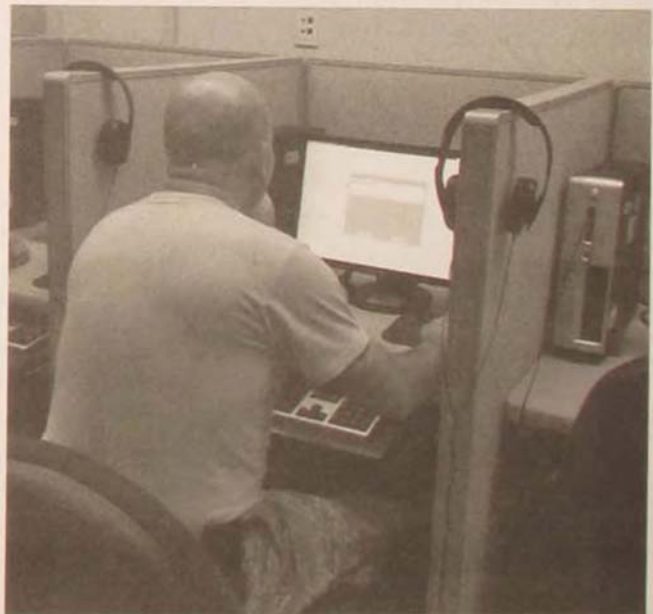
Over time, there arose widespread perception that the Air Force lacked sufficient oversight of the IFT program. Leaders at Headquarters US Air Force and AETC felt that the decentralized training was not rigorous enough to prepare students adequately for UPT and that its content varied too much.¹⁵ They surmised that the absence of a UPT-like environment for flight training and discipline could be the cause of increased rates of voluntary attrition at UPT.

These concerns prompted a search for other options to meet the needs of the Air Force. Developed to correct problems, minimize attrition, and provide a more UPT-like training environment, the IFS program would limit training sites and enhance Air Force oversight by centralizing the training at a single location over the course of several years. AETC developed a structured syllabus and contracted with a single agency (Doss Aviation) to execute the program at its facility in Pueblo, Colorado. IFS focuses less on training and more on screening to identify the most appropriate

candidates to continue to UPT. Toward that end, it includes 18 hours of flight academics, 12 hours of ground training, and 28 hours of officer development—but just 25 hours of flight time.¹⁶ Importantly, Medical Flight Screening occurs before IFS begins; the requirement for solo flight moves up to the 17-flying-hour point, with a check ride by a military or civilian pilot; and the program offers no pilot's license.¹⁷ As IFT drew down and IFS ramped up, the programs overlapped somewhat, and significantly fewer civilian schools participated in IFS since the Air Force intended to limit the program to the Pueblo facility.

Comparison of Initial Flight Training and Initial Flight Screening

In light of the fact that (1) the Air Force wishes to minimize attrition from UPT, (2) the IFS program has significantly decreased the number of flying hours completed by students before entering UPT, and (3) all entrants to UPT have satisfactorily com-



Courtesy Aerospace Neuropsychiatry Branch, USAF School of Aerospace Medicine

Medical flight-screening tests, which include testing of verbal and performance IQ as well as a detailed psychological profile, have been used since 1994 to gather baseline neuropsychological information on UPT candidates.

pleted Medical Flight Screening but have less flying experience, it is time to assess the impact of the program change. This article reports the findings of a study in which the author compared the two pre-entry training programs to determine if a significant difference exists between their UPT attrition rates (due to medical issues, failure to progress, or voluntary withdrawal). These findings should prove useful to the AETC Operations Directorate (AETC/A3) and might help guide planning for future programs in pilot training.

Methods

As a preliminary step, the Institutional Review Board of the Air Force Research Laboratory reviewed and approved the research outline, assuring the existence of appropriate safeguards for the confidentiality of personal information.¹⁸ The author then queried the flight-training database at AETC/A3 for the total number of students who had completed the 25-hour IFS program since its inception, either at Pueblo or at a civilian flight school, from 2005 through late 2008. Students who had completed the 50-hour IFT program at any location between 2004 and 2006 (the time frame just preceding the change) served as a comparison group. Cross-referencing of these rosters through the Training Information Management System database revealed which of these students had officially started UPT. Rosters for both programs listed the outcome for all students, indicating whether they had completed UPT through phase two (during which they train in a specific airframe) or attrited from the program. The study excluded students who had attrited prior to the rest of their classmates' graduation from phase two. Categories of attrition included DOR, medical reasons (MED), failure in academic or flying performance (Flying/Academic), and lack of adaptability (LOA)—which includes students who withdrew due to fear of flying, persistent airsickness, or manifestations of apprehension. When the data noted no outcome for a stu-

dent or listed the category of attrition as "other," the author contacted the registrar at the UPT base for clarification. The defined and validated data then underwent statistical analysis.

Next, the study evaluated reasons for DOR attrition. The author contacted the UPT bases again to gather information on students' underlying reasons for their DOR. The registrars do not have access to such specific information; neither is it forwarded to AETC. In all cases, either the registrar or squadron leadership reviewed paper or electronic files maintained locally to determine why the student requested release from training. The author grouped these reasons into broad categories and completed a statistical analysis, according to whether the student completed IFS or IFT. Finally, he compared in aggregate the MFS-N test scores for the group who had attrited by DOR to composite scores that characterize the successful Air Force pilot.

Results

Raw data received from AETC/A3 included information on students who had completed IFS but whose classes had not yet graduated from phase two of UPT. These entire classes were eliminated from the analysis, including those in that group who had already attrited, leaving 40 students with undefined outcomes or with attritions categorized as "other." Registrars at the UPT bases clarified these outcomes. Completion of the data collection and validation yielded 1,649 students with defined outcomes (630 from IFS and 1,019 from IFT). Only one student remained categorized as "other" due to closure of the UPT training programs at Moody AFB, Georgia, in 2005. The author then sorted the data by program type and completion status for the initial evaluation (table 1).

The study utilized chi-square analysis to determine if a significant difference existed between the overall attrition rates for the two programs. Subsequently, sorting of the data by specific type of attrition for further analysis proceeded in two steps: (1) a com-

Table 1. UPT attrition according to type of pre-UPT training

Type of Training	Outcome Status					Total Student UPT Starts
	Number of Attritions (Rate per 1,000 students)					
	MED	DOR	Flying and Academic	LOA	Other	
25-hour IFS program	4 (6.3)	33 (52.4)	29 (46)	13 (20.6)	0	630
	Total (All Cause) Attrition = 79 (125.4)					
50-hour IFT program	12 (11.8)	24 (23.5)	62 (60.8)	11 (10.8)	1	1,020
	Total (All Cause) Attrition = 110 (107.8)					
Total	16	57	91	24	1	1,650
	Total (All Cause) Attrition = 189 (114.5)					

parison of students in the category of attrition under consideration to those in all other categories (attrited and completed) combined, and (2) analysis using only the category of attrition under consideration versus the graduates but not including the other types of attrition (i.e., attrition versus graduates only).

Discussion

The evaluation showed no significant difference in attrition across all causes between the IFS and IFT programs.¹⁹ When we consider specific causes, it is apparent that the shift to the IFS curriculum has not improved the DOR rate. The 25-hour program reflects a statistically significant increase in attrition due to DOR, compared to the 50-hour IFT program.²⁰ Even with 40 percent fewer students, IFS had a higher LOA rate, so that kind of attrition may also be related to the type of training, though we have less confidence in this relationship.²¹ This LOA finding remained consistent when compared both to graduates only and to all UPT starts; it may become more well defined as the number of IFS trainees increases. Medical Flight Screening prior to IFS may contribute to the lower rate of medical attrition.

Since IFS offers only half the number of flying training hours, we may surmise that

the decreased exposure to flying may influence more students to enter UPT, especially those who are perhaps unsure of their commitment to flying or less motivated to pursue an Air Force flying career. Registrars at the UPT bases compiled the reasons for DOR among members of the group considered in this analysis. Table 2 summarizes the broad categories of attrition.

Students who DOR from UPT because they did not enjoy flying or did not have the desire to fly accounted for half of the total DOR attritions. The number of students who DOR from UPT after having completed IFS showed a significant statistical increase over the number who DOR for the same reason after finishing IFT.²² The decreased number of flying hours that these students experienced prior to starting UPT may have some bearing on this finding.

An aviation psychologist and a biostatistician at the Air Force School of Aerospace Medicine Consultation Service compared the aggregate MFS-N data from the DOR group to the composite data of the successful Air Force pilot. Despite the existence of statistically significant differences with adequate statistical power on a few of the 45 categories of the test profiles, "the effect sizes were not large enough to warrant viewing the differences as clinically meaningful."²³ We might still determine the rela-

Table 2. Reasons for DOR attrition by base and type of pre-UPT training

Reason for DOR	Total DOR = 57 No data available from Moody (n = 9) Reason for DOR available (n = 48) Total DOR from UPT after IFT = 15 Total DOR from UPT after IFS = 33											
	Did not enjoy flying, lack of desire to fly		Persistent airsickness issues despite treatment		Personal and family issues		Stress and self-assessment of poor performance		Did not want service commitment		Did not provide reason	
	IFT	IFS	IFT	IFS	IFT	IFS	IFT	IFS	IFT	IFS	IFT	IFS
Columbus	1	9		1			1				1	1
Vance		2	1	1		1		1			2	3
Laughlin	2	8	1		2	2	1	1		2	2	
Sheppard	1	1										
Total	4	20	2	2	2	3	1	3		2	5	4
% by training	4/15 27%	20/33 61%	2/15 13%	2/33 6%	2/15 13%	3/33 9%	1/15 7%	3/33 9%	0/15 0%	2/33 6%	5/15 33%	4/33 12%
% of total DOR	24/48 50%		4/48 8.3%		5/48 10.4%		4/48 8.3%		2/48 4.1%		9/48 18.75%	

relationship between an applicant's test results and the likelihood of DOR from UPT by utilizing a more thorough characterization of the underlying reason for DOR attrition. This could prove useful in helping guide a future programmatic change.

Limitations

Limitations of this analysis include, first, lack of detail on the students' background and flying history. We could expect candidates who have held a private pilot's license or have had significant flying experience (military or civilian) prior to attending UPT to be more motivated to fly and to display better performance during training. Second, the data and the categorization of reasons for DOR may not accurately reflect the students' true motivation for their attrition. The author had varying levels of access to the "show cause" letters and categorized them subjectively as a "best fit" into poten-

tially overlapping categories. Despite the possibility of multiple causes for DOR, the study placed the individual in only a single category of DOR attrition. Further, closure of one of the UPT training bases prevented the gathering of specific reasons for DOR among students located there. Similarly, specifics of the medical diagnoses leading to attrition and the reasons for categorization as LOA lack clarity. Such details could make the study more meaningful and help define relationships that may exist between the MFS-N scores and UPT attrition.

Finally, changes in Air Force policies during the period under consideration may have affected the results. AETC's Initial Flight Training Branch (AETC/A3FI) reports that for a period of time in 2006 and part of 2007, the Air Force separated lieutenants who failed their initial flight training. Those who DOR were also required to pay back any scholarship money the Air Force had given them. The number of such

students remains unknown, as does the amount of money actually recouped by the Air Force—but the DOR rate dropped when the policy was in effect.²⁴

Recommendations

The Air Force may be able to minimize DOR and LOA attrition by implementing additional screening processes to assess students' adaptability and motivation for flying. Moreover, specific clarification of the reasons for DOR may help outline the programmatic actions needed to lessen this type of attrition.

For example, when requesting DOR from training, students must supply a "show cause" letter, provided to the wing commander through the chain of command. Additionally, requiring UPT students to categorize more specifically their reason for DOR by selecting from a list of common options on a worksheet would allow tracking at the major command level. This data would prove useful in determining specific underlying causes for DOR that we might anticipate on the basis of the MFS-N scores or address by implementing programmatic changes. ☛

Travis AFB, California

Notes

1. "There are no 'good' figures [on costs per student] for these courses as the variables and conditions for analysis are too numerous. . . . These [are] approximations: IFS—\$14,000, IFT—\$9,000, UPT—\$750,000." Wayne Mudge, AETC/A3FI, to the author, e-mail, 7 May 2009.
2. For a detailed history of the Air Force's programs for candidate screening and flight training, see Anne Krueger Hussey, *Air Force Flight Screening: Evolutionary Changes, 1917-2003* (Randolph AFB, TX: Office of History and Research, Headquarters AETC, 2004), <http://www.aetc.af.mil/shared/media/document/AFD-061109-020.pdf>.
3. *Ibid.*, 5.
4. *Ibid.*, 25-26.
5. *Ibid.*, 26.
6. *Ibid.*, 26-27.
7. *Ibid.*, 27.
8. "Flying Training: Initial Flight Screening," AETC Syllabus S-V8A-S (Randolph AFB, TX: Headquarters AETC, 2006), <http://www.dossifs.com/usaf/Docs/SyllabusAug06.pdf>.
9. Hussey, *Air Force Flight Screening*, 5.
10. See the frequently asked questions regarding the Pilot Candidate Selection Method: "PCSM Program," Air Education and Training Command, <https://pcsm.aetc.af.mil/FAQS/FAQS2.HTM#ONE> (accessed May 2009).
11. Wayne Chappelle, aerospace psychologist, USAF Aeromedical Consultation Service (USAFSAM/FEC), personal communication with the author, 27 April 2009.
12. Hussey, *Air Force Flight Screening*, 60-61.
13. "Flying Training: Initial Flight Screening"; and 14 *Code of Federal Regulations*, part 61, subpart C.
14. Wayne Mudge, AETC/A3FI, to the author, e-mail, 18 November 2008.
15. Hussey, *Air Force Flight Screening*, 68.
16. "Flying Training: Initial Flight Screening," 1.
17. Mudge, e-mail, 18 November 2008.
18. Air Force Research Laboratory, Institutional Review Board Protocol no. F-BW-2008-0004-H, 17 September 2008-17 September 2009.
19. $p = 0.05$. (This means that there is a 95 percent likelihood that the finding is not due to chance alone.)
20. $p = 0.005$.
21. $p = 0.15$. (This means that there is a 15 percent possibility that the finding is due to chance alone.)
22. $p < 0.05$.
23. Furthermore, "it is possible in the instances where power was sufficient that increasing sample size might increase power, but in those outcomes where power was sufficient, the only thing that would increase effect size would be increased separation in the mean scores. . . . Miniscule differences in mean scores could result in significantly different findings at $p < .05$ with a power = $> .80$. The effect size . . . is a function of mean and standard deviation in its simplest form: effect size = (mean of sample - mean of population) / pooled standard deviation). In order to increase effect size, the difference in means must increase or standard deviation change or some combination thereof. Again, we have determined that an effect size of .7 or greater would be clinically meaningful, and, as such, our outcomes don't meet that criterion." Bill Thompson, USAFSAM/FEC biostatistician, to the author, e-mail, 1 May 2009.
24. Wayne Mudge, AETC/A3FI, to the author, e-mail, 1 December 2008.

Operating the Distributed Common Ground System

A Look at the Human Factor in Net-Centric Operations

Lt Col Jason M. Brown, USAF*

Imagine a situation commonplace in the mountains of Afghanistan. Taliban insurgents prepare to ambush an allied military convoy in Helmand Province. They coordinate a scheme of maneuver, attack sequence, and withdrawal between elements scattered in the hills above the convoy's chosen road. Thousands of miles away, in a 4,000-square-foot room packed with screens showing imagery, maps, telemetry, and video feeds, a signals intelligence (SIGINT) analyst in the 13th Intelligence Squadron recognizes the impending ambush. She quickly presses a button attached to her headset and speaks to a U-2 pilot half a world away: "Bat zero-six, this is GMS with an update for Widow zero-two." Details on the enemy ambush quickly follow, and the pilot switches over to the frequency monitored by Widow 02, a joint tactical air controller assigned to the convoy, to pass the intelligence to him.

However, the Airman's work is not complete. After the ground mission supervisor finishes her communication, the intelligence, surveillance, and reconnaissance (ISR) mission commander, the officer leading the crew exploiting intelligence from the U-2, directs all section leads in the room to rally around his position. Headsets come off, and a huddle forms in the center of the large room, which is noticeably increasing in energy. The ISR mission commander addresses his crew, discussing a plan to refine the coordinates of the potential ambushers.

He turns to the leader of the analytical and reporting section, directing him to fuse the latest intelligence reporting in the area with historical SIGINT and imagery gathered within the unit and at other locations. The ISR mission commander develops a plan with another mission commander for two unmanned aircraft systems in the area, an RQ-4 Global Hawk and an MQ-1 Predator, to cross-cue intelligence from the U-2. Finally, he directs his crew to coordinate everything with their intelligence counterparts, the battalion S2 personnel in Widow's tactical operations center. Moments later, an Airman first class and a private first class, separated by 12 time zones, exchange what they know about the potential ambush in real time through a classified computer chat program, and a wave of intelligence about the enemy's location begins to arrive at Widow's tactical operations center. Within minutes, the Taliban hunters become the hunted.

Every day, intelligence professionals conduct combat operations like this one. They execute ISR operations that provide threat warning to patrolling soldiers and marines, find potential locations of improvised explosive devices along convoy routes, and track insurgents for targeting purposes. These professionals operate not only from remote forward operating bases in Iraq or Afghanistan but also from bases and agencies within the United States and around the world. Many of them are part of the Distributed Common Ground System

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(DCGS), a unique and potent twenty-first-century weapon system.

Although the DCGS is a human system, its guiding documents and literature might suggest otherwise. For example, according to the *Air Force Distributed Common Ground System Enabling Concept*, "The Air Force Distributed Common Ground System . . . is a powerful, network-centric, global enterprise designated as the Air Force AN/GSQ-272 SENTINEL intelligence, surveillance, and reconnaissance weapon system."¹ This enabling concept, like many other DCGS documents, emphasizes network-centric operations and machine-to-machine technology as opposed to the skills of the intelligence professionals who operate the system. Discussions within the DCGS literature on human factors that either drive or impede the pursuit of "actionable intelligence" or the execution of the "kill chain" are often difficult to find.²

This lack of emphasis on the human factor inadvertently masks its centrality to the success or failure of the DCGS—a network-based, not a platform-based, weapon system. Indeed, one of the system's most distinguishing aspects is the fact that its performance is tied more to human than to platform capabilities.³ In other words, the quality of the DCGS is defined less by machines and more by the complex and largely intangible web of human behaviors and abilities—the *human factor* within the system. RAND consultants John Arquilla and David Ronfeldt recognized this truism in 1997:

The information revolution is not solely or mainly about technology; it is an organizational as well as technological revolution. Thus, the emphasis . . . is less on the advance of technology than on the challenges for organization—and on the interactions between technological and organizational changes that have implications for doctrine and strategy.

. . . The information revolution favors and strengthens network forms of organization, while making life difficult for hierarchical forms. The rise of network forms of organization—particularly "all channel networks,"

in which every node can communicate with every other node—is one of the single most important effects of the information revolution for all realms: political, economic, social, and military.

. . . This will place the U.S. military (and police) forces under growing pressures to formulate new concepts for organization, doctrine, strategy, and tactics.⁴

This passage describes the modern challenges and realities of conducting ISR operations within the DCGS weapon system, the Department of Defense (DOD), and the intelligence community (IC) as a whole. The DCGS is evolving into a family of interconnected "systems" that span the DOD and intelligence community.⁵ The point getting lost in this evolution is that the DCGS is ultimately a system of people; the machines, software, and communications links are tools. Those who operate the Air Force DCGS understand that the human factor defines the system more than any other.

What (or Who) Is the Distributed Common Ground System?

Understanding the DCGS must begin with understanding the impact of ISR on the modern battlefield. According to the Air Force *Theater ISR CONOPS*, published in 2008, "Technology, the nature of the joint operating environment, and the modus operandi of U.S. adversaries have made the role ISR plays in joint operations more critical than ever."⁶ ISR is in the real-time fight to such a great extent that commanders will not execute their mission without participation of specific ISR assets and units, such as the DCGS.

The DOD created the DCGS as an interoperable "family of systems" developed by each service as a result of lessons from Operations Desert Storm and Allied Force.⁷ The Air Force's initial contributions to the DCGS were five interconnected distributed ground station (DGS) units equipped with

millions of dollars' worth of intelligence systems and, more importantly, manned with every type of intelligence and communications Airman. The DGS is "the foundation of the AF DCGS infrastructure, capable of processing and exploiting multi-source intelligence (multi-INT) and executing sensor control."⁸ In addition to the five core sites, the Air National Guard operates a number of smaller and interconnected DGS units.

Because of the high-tech nature of DGS units, outsiders frequently view them as multi-INT processing, exploitation, and dissemination (PED) nodes for airborne ISR, reachback organizations, or intelligence fusion and production centers. These labels define part of their mission, but DGS units and the DCGS enterprise encompass much more. The Air Force does not treat the DCGS like traditional reachback organizations that provide support for long-range analysis and planning; rather, it integrates this system into combat operations in the same manner as any other weapon system. DCGS units conduct combat operations daily. Personnel take raw information, turn it into relevant intelligence, and deliver it to operators within minutes (or seconds, depending on the source) of its collection. These intelligence professionals, or ISR operators, receive training in the nuances of language, pictures, and video. However, their connectivity to combat operations creates a set of challenges familiar to traditional operators but relatively new to large intelligence organizations and units.

Operators understand the comment by German field marshal Helmuth von Moltke (the elder) that "no plan survives first contact with the enemy." In today's operational environment, reconciling the plan with reality is as important for ISR operators as it is for infantrymen or fighter pilots. Consequently, DCGS commanders must interpret guidance, translate purpose and intent, and make decisions that affect the battle. They must recognize and prioritize emerging requirements and determine which aspects of the plan to retain and which to jettison during execution. For example, if a troops in

contact (TIC) situation arises and a DGS unit is executing a U-2 or Global Hawk mission in the area, should commanders drop or delay the planned collection targets in order to support the TIC? The answer to this question depends on dozens of variables, including guidance from higher headquarters, the importance of planned targets, the nature of the TIC, flight time, and PED timelines.

The outcome of these situations depends on the multiple skills and insights of a DCGS commander and crew—in particular, their ability to solve problems, communicate effectively, and think critically and creatively. ISR operators must deal with the ambiguity, friction, and incomplete information inherent in all military operations. An extensive training and education program is vital in preparing today's ISR operators for these demanding missions.

Training and Educating Distributed Common Ground System Crews

The DOD is beginning to recognize the mounting demands on intelligence personnel who conduct modern, net-centric warfare. For example, the *Theater ISR CONOPS* notes that "people are the foundation of joint, unified ISR operations, not platforms, sensors or technology. ISR personnel are now in the tactical fight. This requires a warrior ethos, critical thinking skills, creativity, and ability to make decisions under pressure and friction."⁹ Training and educating ISR operators to meet these expectations remain a challenge for the services and national intelligence agencies.

Led by an officer (the ISR mission commander), an Air Force DCGS crew consists of several analysis and reporting segments (each led by a noncommissioned officer), which are modular and scalable, depending on the mission. The crew includes an all-source intelligence cell called the DCGS analysis and reporting team (DART), imagery intelligence (IMINT), full-motion video

(FMV) intelligence, SIGINT, measurement and signatures intelligence (MASINT), and sensor/mission planning segments. As in any small military unit, the leadership and experience of the officers and noncommissioned officers determine the DCGS crew's success. These leaders must understand the goals for the weapon system and ISR enterprise, and must guide their personnel toward fulfilling these missions. Training, therefore, should begin with a focus on the crew position and eventually expand to include the role of ISR operations in a campaign.

Like all operators, DCGS personnel must complete an extensive training program, beginning with formal training at Goodfellow AFB, Texas. Subsequently, Airmen arrive at their assigned DGS unit and spend the next three months going through mission-qualification training, after which they must pass a battery of tests and a formal crew-position evaluation. Upon completion of this field training, the intelligence group commander will designate the Airmen "combat mission ready" and assign them to a crew. Each DGS unit also conducts continuation training to update crew members on friendly and enemy weapons and tactics, intelligence preparation of the operational environment, and rules of engagement.

The formal aspect of the training program tests each crew member's rote knowledge and technical skills. However, military professionals understand that regurgitating information on demand and knowing how to use the switches and buttons do not guarantee operational effectiveness. Given the complexity of the DCGS mission, the most important skills are crew coordination, critical thinking, and problem solving. To test these skills, each segment leader and ISR mission commander must go through a verification process that presents several leadership and mission-related challenges. Preparation for the evaluation provides a number of additional benefits—most importantly, the interaction of crew members from different occupational specialties.

Ultimately, the training program for an Air Force DCGS attempts to find a balance

between traditional "intelligence" and "operations" functions. Intelligence personnel can no longer afford to pigeonhole themselves into "analysis" or "collection" jobs. Modern warfare has created the demand for well-rounded *ISR operators* who possess not only analytical depth and operational knowledge but also a high degree of "systems thinking."¹⁰ They must be able to weigh the capabilities and limitations of ISR, given a commander's goals and the enemy's most likely course of action. The skills of understanding what a crew member needs to know and how to discover it are relevant at all levels, from the tactical through the strategic. The ability to balance the efficient and effective use of ISR assets, units, and personnel is part of this complex process.

Operating Efficiently and Effectively

In the last few years, debates between military organizations over ISR have tended to degenerate into arguments between efficiency and effectiveness.¹¹ The parochial nature of these debates has created a paradigm that treats efficiency and effectiveness as competing, rather than complementary, notions. Arguments over where to locate and whom to give control of intelligence functions such as analysis and PED are central to this debate. Typically, arguments for placing ISR forward emerge from efforts to show greater effectiveness, while those for locating it in garrisons emphasize efficiency. In reality, efficiency and effectiveness can and should balance and complement one another, not compete. The DCGS functions on the principle that harmony must exist between operational-level efficiency and tactical-level effectiveness. "Distributed" DCGS operations achieve this balance by exploiting the capabilities and mitigating the limitations of net-centric warfare.

In the ISR context, the term *distributed operations* describes the ability of the DCGS to assign missions to any element within the enterprise, regardless of geographical



location, while maintaining a strong regional focus to its actions.¹² For example, in a single month, the California-based DGS supported ISR operations or crisis-action planning in four unified commands.¹³ Tackling such a mission load presents challenges. Although a DGS unit is fairly large—as many as 500 personnel—the high demand for ISR can easily overwhelm it. Each DGS has a crew manning letter that determines the minimum number and type of crew members required for each kind of ISR mission. Although each DGS can surge and flex to a degree, the letter, which draws on historical precedent, combat needs, and commander's assessment of risk, determines the mission capacity for that station. Distributed operations allow the enterprise

strong argument against distributed operations. Commanders need to know that ISR personnel understand the issues within their areas of operations. The DCGS enterprise addresses this concern by working to establish habitual relationships between DGS units and supported components, thus allowing DCGS crews to maintain a regional focus and establish relationships with forward units. The network behind the DCGS allows it to flex support between theaters when required, but the enterprise is as consistent as possible when matching a DGS to a supported unit.

The DCGS enterprise also recognizes the importance of face-to-face interaction with supported units. The Air Force began deploying ISR liaison officers (ISRLO) in 2006

The belief that ISR must be part of a single team involved in a single battle constitutes a strong argument against distributed operations.

to flex entire missions or segments of missions between DGS units. For example, a Global Hawk mission may have more IMINT targets than a single DGS can handle, especially if the DGS is already working Predator and/or U-2 missions with FMV, IMINT, and MASINT requirements. When this happens, the DCGS operations center at Langley AFB, Virginia, can drive efficiencies throughout the enterprise by federating portions of that mission among several DGS elements. Essentially, a DCGS crew can operate "virtually," scattered among many locations.

This type of federation and distribution of operations, which is based on extraordinary networking capabilities, clearly enhances system efficiency. However, it also leads to some very understandable human-related concerns about effectiveness. The belief that ISR must be part of a single team involved in a single battle constitutes a

to forward-deployed Army and Marine Corps division-level headquarters to coordinate air component ISR capabilities and missions, including the DCGS. Just as the air liaison officer coordinates requirements for close air support, so does the ISRLO, but for ISR. As much as possible, ISRLOs come from the DGS unit that habitually supports that ground component or task force. This helps establish camaraderie and trust between these war-fighting units.

The pursuit of actionable intelligence, the core mission of the DCGS, provides an even greater reason to deploy an ISRLO forward. Those who must take action (i.e., the forward-deployed commanders) determine the criteria for actionable intelligence. Frequently, commanders articulate those criteria via verbal or implicit communication as opposed to written orders. Someone not in the room with these decision makers may

not understand fully what they require. That is not to say that people cannot have meaningful communications and relationships via networks. The success of Internet social-networking tools like Facebook and Skype prove otherwise. That said, the ISRLO is incredibly valuable to the DCGS weapon system. Despite a loss in manpower, which can negatively affect the DCGS's efficiency, forward-deployed ISRLOs increase effectiveness by linking DGS units with combat forces.

The primary aim of the DCGS enterprise is to achieve a balance between effective and efficient operations. Manpower, logistical limitations, and the ever-increasing global demand for ISR continue to drive the efficient development of the DCGS enterprise. However, the recent emphasis on de-

the human factors influencing them. The network enables distributed operations, but, ultimately, well-trained professionals drive mission success. Therefore, as the demand for ISR grows, the requirement for more and better-trained ISR operators will continue to increase. This is already leading to an expansion of the PED federation beyond Air Force DCGS to intelligence units from other services. As the enterprise grows and achieves the vision of becoming truly interoperable, the joint community will have to find ways to promote the same training and operating standards to which Air Force DCGS "customers" have become accustomed.

Similarly, the need for direct interaction between DCGS operators and combat units will increase rather than diminish. Accordingly, we should expect technological im-

In order to realize the full potential of net-centric operations, we must focus on the human factors influencing them.

centralized planning and execution of ISR has also highlighted the value of face-to-face relationships between ISR operators and those they support. Recognizing the impact that ISRLOs have had on the effectiveness of ISR support, commanders on the ground want their positions to expand to the brigade level.¹⁴ In the end, both effectiveness and efficiency are necessary. Operating within the DCGS enterprise, and certainly the global ISR enterprise, requires finding the correct, complementary balance between the two.

Conclusion

In order to realize the full potential of net-centric operations, we must focus on

improvements to enhance both the efficiency *and* effectiveness of ISR support to combat units. New and better technology is particularly important when it generates improvements in the interaction and relationships between ISR operators and intelligence users. Human networking tools are as critically important to the future of the ISR enterprise as are data manipulation and improvements in system networking. Technological improvements are only part of the solution. Expanding and appropriately manning the ISRLO positions below division level should occur in conjunction with manning and technological developments within the DCGS.

The joint community should update intelligence doctrine to address the capabilities of network-based weapon systems and

the reality that ISR is operations. Intelligence professionals are making decisions integral to mission success. Their operations are incredibly dynamic and challenging. Planning, command and control, and execution of network-based ISR weapon systems, as well as the human infrastructure within those systems, should evolve to more closely mirror traditional operational methodologies. In other words, ISR operations should be guided by mission-type orders rather than a time-consuming collection-requirements management process.

Finally, the joint and intelligence communities need to look beyond the interoperable, interconnected network and decide what the DCGS task organization

should look like in the future. As the demand grows for ISR across the globe, DCGS operations will shift between theaters and combatant commands more and more frequently. The DOD and intelligence community will have to determine the appropriate command and control relationships to address this requirement. They should consider standardizing and increasing interoperability among the military units comprising the DCGS federation, with the ultimate goal of making it a truly joint organization. Air Force DCGS, a system of highly focused military intelligence professionals, can provide a solid foundation for such an endeavor. ✪

Beale AFB, California

Notes

1. US Air Force, *Air Force Distributed Common Ground System Enabling Concept* (Washington, DC: Headquarters Department of the Air Force, 2005), 3. Hereafter referred to as *Air Force DCGS*.

2. The "kill chain" is defined as *find, fix, track, target, engage, assess*. See Air Force Doctrine Document 2-1.9, *Targeting*, 8 June 2006, 49, http://www.dtic.mil/doctrine/jel/service_pubs/atdd2_1_9.pdf.

3. J. P. Harvey, "Circumstances and Technology: The Effective Tasking and Use of Network-Based Assets" (master's thesis, Naval War College, 2000), 7-9.

4. John Arquilla and David Ronfeldt, eds., *In Athena's Camp: Preparing for Conflict in the Information Age* (Santa Monica, CA: RAND, 1997), 5-6, http://www.rand.org/pubs/monograph_reports/MR880/.

5. See the *Distributed Common Ground/Surface System (DCGS) Homepage*, 25 October 2004, <https://jit.fhu.disa.mil/dcgs/index.html>.

6. US Air Force, *Theater ISR CONOPS* (Washington, DC: Headquarters Department of the Air Force/A2CP, 2007), iii.

7. Department of Defense, *Capstone Requirements Document for Distributed Common Ground/Surface Systems JROCM 001-3* (Washington, DC: Department of the Army/DAMO-RQ and Department of the Air Force/AF-XORR, 6 January 2003), 1.

8. US Air Force, *Air Force DCGS*, 19.

9. US Air Force, *Theater ISR CONOPS*, 31.

10. Systems thinking is "based on the perspective of the systems sciences that seeks to understand the interconnectedness, complexity, and wholeness of the elements of systems in relation to one another." Field Manual 3-24 / Marine Corps Warfighting Publication 3-33.5, *Counterinsurgency*, December 2006, 4-3, <http://www.usgcoin.org/library/doctrine/COIN-FM3-24.pdf>.

11. Michael T. Flynn, Rich Juergens, and Thomas L. Cantrell, "Employing ISR: SOF Best Practices," *Joint Force Quarterly* 50, 3rd Quarter (2008): 58, http://www.ndu.edu/inss/Press/jfq_pages/editions/i50/15.pdf.

12. Joint Publication 2-01, *Joint and National Intelligence Support to Military Operations*, 7 October 2004, III-10, http://www.dtic.mil/doctrine/jel/new_pubs/jp2_01.pdf.

13. Between July and September 2008, DGS-2 conducted ISR operations for US Northern Command, US Southern Command, US Central Command, and US European Command.

14. Raymond Odierno, Nichoel Brooks, and Francesco Mastacchio, "Evolving ISR," *C4ISR Journal* 7, no. 8 (September 2008): 38.

Airpower in the Next War

In the Shadow of Georgia

Lt Col Thomas McCabe, USAFR, Retired*

Currently, American military planning for the next war is very much in flux. We can reasonably assume that the global war against jihadi Islamic terrorism, whatever that war is called, will continue unless al-Qaeda and its allied movements are decisively and openly defeated. What we used to refer to as major theater wars against regional rogue states such as Iran or North Korea remain possible, as does one with an emerging peer competitor such as China, over the very long term. (Of course, the timing of a war with China might drastically accelerate in case of a dispute over Taiwan.)

Recently, another possible scenario emerged—or, perhaps more correctly, re-emerged. In the aftermath of the Russia-Georgia war of August 2008, the new democracies on Russia's western border—especially Ukraine and the Baltic States of Estonia, Latvia, and Lithuania (and possibly Poland)—are feeling vulnerable to what they perceive as a newly aggressive and potentially expansionist Russia.¹ Considering their history, this is hardly surprising. What is surprising, since the Russians did not start the war with Georgia, is that this also seems to be the attitude of many leaders in Europe and the United States as well, including both candidates in the 2008 presidential election.

It is probably premature to read much into the situation just yet. We need to remember that (1) however much the Russians may have set the stage, the Georgians started the conflict by crossing the frontier with South Ossetia with the intention of occupying the enclave and (2) the Russians responded to what they considered a severe

provocation as they had warned they would for years.² The Russians have been fairly restrained in the aftermath so far. If the United States had found itself in Russia's position, we probably would have reacted far more drastically.

In light of this situation, we need to consider not only two sets of policies for dealing with two different circumstances but also the role the US Air Force would play in those policies. The first policy treats the Georgia situation as unique and not, in and of itself, an indication of renewed Russian expansionism. The second does not consider the situation unique but deems it an indication of an expansionist Russia. Finally, the article addresses implications for the Air Force if we fail to take steps to deter a newly expansionist Russia or if those steps prove inadequate and we face a war with Russia in Eastern Europe.

Georgia as a Unique Situation

For the time being, our best policy option is a low-key response while we wait to see how the situation evolves. This assumes that the situation in Georgia was and is unique—two enclaves in a bordering state that had declared themselves independent and that were and are under Russian protection. No other such enclaves exist, so the situation in Georgia is potentially a one-of-a-kind case. If the Russians show that it is not unique and if they act belligerently against neighboring states, using the presence of Russian minorities in those states as a pretext, then we will

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undoubtedly be dealing with a new situation that requires a new policy.

The United States should first attempt to defuse the possibility of Russian pressure against neighboring states diplomatically. We should quietly remind all concerned that the Russians did not start the war with Georgia and that an obvious way to avoid war with Russia is to not attack it.

Next, we should remind the Eastern Europeans that, in material terms, nothing fundamental has changed. This was not Russia's Operation Desert Storm, during which it demonstrated a new and dramatically improved military capability; rather, this was a Russian Grenada.⁴ Russia's overall military readiness remains very low. It has only started to recover from the military collapse that accompanied the general collapse which followed the fall of Communism. Although it probably enjoyed more effective readiness in the North Caucasus Military District in Georgia than in any other of its districts, that situation resulted from the circumstances in the Caucasus—specifically, two past wars and a residual insurgency in Chechnya as well as an ongoing border dispute with Georgia. Even then, the posture of its forces was not especially good. With only a few exceptions, Russia's standards of training and readiness remain very low; the equipment in its inventory is largely obsolete and often badly maintained; and it is buying very little new or upgraded equipment. Further, after nearly 20 years of maintaining industrial workers on near-starvation rations, Russia cannot be certain of their ability to rapidly produce a great deal of new equipment. Thus, any reemergence of that country as a military giant will likely take a long time, especially now in the context of worldwide economic turmoil.

However, pointing out that Russia is no longer a military superpower and will not become one again in the foreseeable future offers little comfort to those who live in the shadow of whatever power Russia actually has. Instead the United States should (1) provide primarily political support for maintaining the independence of the states that consider themselves potentially threatened and

(2) take steps to improve the transparency of the regional military situation.

The first of these steps could take the form of a joint declaration that no current border or ethnic disputes in Eastern Europe justify war or military intervention, and that no one should attempt to change borders by force. Largely a restatement of the principles of the Helsinki Accords and the Conference on Security and Cooperation in Europe, such a declaration, hopefully, would not provoke controversy. Signatories would include the North Atlantic Treaty Organization (NATO), the European Union (EU), the Organization for Security and Cooperation in Europe, the United States, the major European states, the northern European neutrals (Sweden and Finland), and (if possible) Russia. We might use Russian-favored phrases and themes about the inadmissibility of the use or threat of force inconsistent with the Charter of the United Nations; respect for the sovereignty, territorial integrity, political independence, and unity of states; the inviolability of borders; noninterference in internal affairs; and changing of borders only in accordance with international law by peaceful means and by agreement. Having the declaration put forward by the EU or one of the neutral states and then endorsed by NATO and the United States might make it more acceptable. The central point of the exercise is the creation of a multilateral agreement intended to serve as an informal nonaggression pact, emphasizing that the situation and the rules have not changed. There are times when bland generalities can be useful. A Russian refusal to sign would at least clarify the situation, especially when analyzing reasons for the refusal; moreover, it would possibly serve as a strategic warning of trouble ahead and as justification for increasing the defensive readiness of countries potentially threatened.

Next, NATO and the United States should jointly and separately remind everyone that the Baltic States of Estonia, Latvia, and Lithuania are members of NATO and, as such, have a guarantee of the alliance's protection

in case of attack. The situation is more ambiguous in Ukraine, whose population includes a large Russian minority, including the Crimea—historically part of Russia. Not a member of NATO, Ukraine is uncertain if it wants to join the alliance. Much of European NATO is in no hurry to have it join. At this point, I would hesitate to give any military guarantee of Ukraine's independence, especially since it hasn't asked for one. I would propose nothing more than US and NATO statements that any military incursions against Ukraine would be regarded as a matter of the utmost seriousness.⁴

At this point, the United States and NATO should quietly remind the Russians that, however much they have fulminated about the expansion of NATO to Russia's borders, NATO does *not* have much of a military presence there. Since the end of the Cold War, NATO has massively cut back its forces, especially in Europe, and Afghanistan has largely drained off whatever expeditionary capability NATO may have left.⁵ There is no vast American or other NATO military force camped on Russia's borders. A small unit (usually four aircraft) for the air sovereignty mission represents the only regular NATO military presence in the Baltic States. Then we should point out that we prefer to keep things that way but that we will respond if the Russians increase their threat to the neighboring states. By doing so, we make clear to the Russians that any increase in military tensions in the region remains up to them.

Finally, the United States, NATO, EU, and regional states, preferably including Russia, should work to improve the military transparency of the region. The aim here is to ensure that all parties have an accurate view of the military readiness of the regional states and, thus, an accurate perception of the threat—or, preferably, the lack of such a threat. This should build on existing programs such as Open Skies and the Conventional Forces in Europe inspection programs if the Russians ever end their suspension of participation in the latter. The organizations and states involved might consider setting

up a monitoring center to track the day-to-day military situation, possibly under neutral auspices, thereby reassuring the regional governments that no imminent military threat exists or that the center would warn them if one arises. The United States and NATO should be prepared to undertake the sharing of relevant intelligence on the issue. It should be noted that these nonconfrontational, noncontroversial steps should present no security dilemma to Russia.

In this scenario, the US Air Force functions as a central participant in the monitoring program. As the primary American service for intelligence, surveillance, and reconnaissance (ISR), especially operational and strategic ISR, the Air Force can expect to serve as a resource of expertise in this area. Moreover, with the permission of the governments, it might provide regular reconnaissance overflights, possibly by unmanned aircraft systems.

If Georgia Is the First Step . . .

We should consider what to do if a darker scenario emerges, in which Georgia is the first step of a revived Russian program of revanchist expansionism, and, in spite of everything, Russia manages to reemerge as a major military threat. We should remember that Russia does not need superpower status to be dangerous: imagine a large Iraq with a superpower nuclear arsenal.

The first step should explore diplomatic and political options. We must quietly remind threatened states of the limits of military power—that it cannot protect them against economic or political pressure or subversion, or even cyberspace attack. Since we can expect the Russians to undertake an information campaign to portray neighboring states as the source of any trouble leading to a crisis, those states should adopt postures that demonstrate to the world that they have not done anything unreasonable. Forums such as the United Nations and Organization for Security and Cooperation in Europe could reaffirm this stance.

We should then reemphasize that the Baltic States (and Poland if Belarus and Russia merge or if Russia forward-bases forces in Belarus) are members of NATO and remain under its military protection. In parallel, we should quietly remind the continental European NATO members of their obligation to defend the Eastern European members if they come under attack. Assuming that Ukraine remains democratic, NATO should consider extending guarantees (although not unconditional ones) against military threats to Ukraine's territorial integrity. If NATO will not do so, the United States should.

Next, NATO should start planning and preparing for the defense of Eastern Europe, an area where it has reportedly undertaken only minimal steps along those lines.⁶ NATO's preparations in Norway during the Cold War could serve as a template for doing this in a minimally provocative manner. NATO did not permanently base combat forces there, but the US military and Canada did pre-position equipment in Norway and regularly practiced reinforcing exercises.

As a preliminary reconceptualization of a military strategy for deterring a hostile Russia from encroaching on Eastern Europe, the strategy based on principles originally laid down in the Nixon Doctrine nearly 40 years ago could serve our purposes. That doctrine identified the American role in such a war: reinforcing our regional allies. The United States should expect the local government(s)—supplemented by regional NATO forces—to provide the bulk of any ground army necessary, with US ground troops functioning as a strategic reserve. American reinforcements should consist primarily of airpower, including attack helicopters, airmobile troops, air defense and theater missile defense, and logistics and materiel support. In addition, the United States should provide “force enablers,” such as command, control, communications, and intelligence (C3I) capabilities, electronic warfare, and mobility.

The obvious first step involves helping threatened states raise the cost of any aggression by improving their defenses, spe-

cifically by upgrading the local militaries and emphasizing territorial defense—especially air defense and antitank capability.⁷ Taking this step improves defensive capabilities and avoids provoking the Russians. Since the threat will have changed, the Baltic States and Poland may need to reevaluate their policies of moving to professional militaries and at least consider conscripting people for reserve territorial-defense forces. This should accompany efforts to upgrade the professionalism and effectiveness of their militaries. NATO members Estonia, Latvia, Lithuania, and Poland will find this task easier since they can conduct such efforts under the auspices of the alliance.

The US Air Force plays a central role in this strategy:

- The critical ISR mission will involve monitoring the regional situation, building a targeting database, and keeping it updated.
- Through conducting exercises and combined training, as well as making selective investments and upgrades in infrastructure, we should prepare the ground for emergency reinforcement. The speed and reach of airpower are major factors. This program should include hardening air bases so that they can survive long enough for reinforcements to arrive.
- Given the small size of the Baltic States and the vulnerability of their bases to Russian attack, it might be advisable to use those sites as forward operating locations, with main operating bases in more secure areas farther to the rear. Therefore, part of this program should involve working out arrangements for staging bases in rear areas, especially Poland.
- Peacetime exercises conducted by US Air Forces in Europe with local military units should emphasize air defense, suppression of enemy air defenses, and close air support. We must work out ways to plug local forces into the NATO air tasking system and the

terminal control of air strikes—one of the key roles of US special forces during the 1991 Gulf War and the 2001 war in Afghanistan, and an obvious role for them in this situation.

Airpower in an Eastern European War

Both the nature and circumstances of a war in Eastern Europe, especially one centered on Ukraine, are likely to be different from any we have prepared for recently. This kind of war may more closely resemble what the United States would have faced if Saddam Hussein had kept rolling into Saudi Arabia after overrunning Kuwait, or what we confronted in Korea during the summer of 1950. I call it an expeditionary war—that is, one in which the United States projects military power into a theater of operations where the war is already under way and where preparations for receiving that power have been limited (at best) or lacking (at worst).⁸ Preparing the Air Force for such a war will have a variety of effects on all aspects of airpower, ranging from doctrine and organization to training, tactics, and equipment.

Contrast the comparatively benign circumstances we encountered during Operations Desert Shield/Storm, Allied Force, and Iraqi Freedom with those we will likely deal with in a future military crisis in Eastern Europe against an aggressive Russia with rebuilt military forces. Since the collapse of the Warsaw Pact and the Soviet Union, this region, in military terms, has remained something of a power vacuum—one that the United States and NATO have taken only limited steps to fill. The weak economic condition of these countries, combined with NATO's ambivalence toward offering military commitments to Ukraine, has resulted in only limited preparations for receiving NATO and/or American reinforcements. Further, these problems are likely to get worse the farther east we go. We can ex-

pect to experience at least the following differences from the earlier wars in Iraq and Yugoslavia:

- Wars of the recent decades may have lowered US military readiness, and we will not have the cushion of supplies that we enjoyed in Desert Shield/Storm or Iraqi Freedom.
- Reasons for the fight may seem unclear or extremely messy, such as disputed borders, irredentism among divided ethnic groups, or Russian claims of protecting Russian-speaking minorities. Russia may put considerable effort into building a somewhat plausible justification for its actions, perhaps making the international environment less supportive of outside intervention.
- Because of geographic proximity, the enemy will likely outnumber us in combat aircraft and quite possibly in combat power throughout the war.
- The technical sophistication of many or most of their aircraft and weapons may prove at least equal to ours.⁹
- In a war fought to restore the prewar geopolitical status quo while avoiding escalation to a larger conflict, we may have to permit the enemy a geographic sanctuary, as we did in the Korean and Vietnam Wars.
- The enemy will have the initiative, and we will be reacting. Militarily, this means that we cannot expect to mass overwhelming power, as in Desert Shield, and that we must expect to fight a war with little or no preparation. We must assume that the enemy will contest everything we try to do and that we may need to fight our way in.
- The transportation and communications infrastructure of the regional allied states may be limited, outdated, and only partly interoperable with American/Western standards. Further, a sophisticated enemy may attempt to

degrade any infrastructure through a variety of means, including cyberwar. The number of access points for American entry may be limited and heavily targeted by the enemy.

- We cannot assume that we will establish supremacy in reconnaissance and intelligence.
- American forces may not have numerical predominance in the defending coalition.
- We will need to bring with us most or all of our supplies, including fuel.
- Local allies may have only aged and poorly maintained equipment left over from the Warsaw Pact.
- Local militaries may be only partially trained to Western standards.
- We cannot assume the widespread use of English.
- We may defend countries with impoverished or bankrupt economies.

Thus we could very well face a grim and uncertain conflict, with the potential for escalating into nuclear warfare. We should remember that neither the United States nor Russia has forsworn the first use of nuclear weapons.

The Role of Airpower in Expeditionary War

We can estimate that the scale of a US deployment to a war in Eastern Europe will be at least as large as that planned for a major theater war—that is, an Air Force deployment equivalent to several combat wings although deployment of fifth-generation aircraft such as the F-22 and F-35 may (at least hypothetically) reduce the number of platforms required.¹⁰ Although this article assumes the centrality of airpower to American participation in any such war, its role may prove profoundly different from that in our most recent wars. This is likely to become especially evident in three key areas:

air superiority, the strategic air campaign, and the operational air campaign.

Air Superiority

Unlike wars in the last 20 years, an expeditionary war in Eastern Europe may necessitate major effort and resources to establish US/allied air (and potentially space) supremacy. Further, the prospect of allowing the enemy a geographic sanctuary for political reasons will eliminate our ability to reduce the air threat by offensive counter-air missions against enemy bases, requiring that we establish air superiority through air-to-air combat.

An enabling function rather than an end in itself, air superiority allows us to apply airpower against the enemy's core power through the strategic air campaign and against his military instruments of power through the operational air campaign.

Strategic Air Campaign

Unfortunately, the strategic air campaign is unlikely to duplicate the degree of strategic paralysis we imposed on Iraq. There will be no Instant Thunder for several reasons.¹¹

First, Russia will remain a major nuclear power with intercontinental reach. A strategic air campaign, even a conventional one, would involve comprehensive and systematic attacks on the Russian national command structure and would carry grave risks of escalation to an even larger war—perhaps nuclear. Such risks may lead American political leaders to give the enemy a geographic sanctuary.¹²

Second, the sheer size of Russia, the number of potential strategic targets, the distances to those targets, and the limited size of the US strategic bomber force severely hamper our ability to project conventional power against Russia. If we had a strategic bomber force as large as the one in the early 1960s, such a campaign might be feasible. Since we don't, it isn't.¹³

Third, the capability and redundancy of Russia's defenses, the hardness of many of its C3I targets, and the mobility of many or

most of its air defense assets significantly elevate the difficulty of comprehensively collapsing or suppressing Russian air defenses with nonnuclear attack—a central requirement for a successful conventional strategic air campaign.¹⁴

Finally, a war in Eastern Europe may require that we respond in desperate haste to Russian aggression. Unless we are prepared to expend the intellectual resources necessary to formulate a conventional strategic-deterrence-and-response plan against Russia in peacetime, we must accept the possibility that we will have no time to prepare one after the war starts.¹⁵

Thus, we obviously cannot expect that our air attack will strategically paralyze the Russian government or military.¹⁶ We must assume that airpower will focus on the operational and tactical levels of war rather than the strategic level, for the purpose of defeating the enemy's military effort. Any strategic air campaign that we wage under such conditions would supplement the operational air campaign by realizing three more limited objectives: (1) disrupting enemy C3I, (2) suppressing enemy air defenses in the theater of operations and in any part of Russia adjacent to the theater of operations, and (3) acting as a diversion to tie down enemy resources, especially fighter aircraft and mobile air defenses, in parts of Russia distant from the theater of war. Failure to comprehensively suppress enemy air defenses will likely have an ominous impact on the "halt" phase of any interdiction effort.¹⁷

Operational Air Campaign

Designed to defeat the enemy military in the combat theater of operations, the operational air campaign consists of deep attack and close air support (CAS). The former uses conventional firepower, primarily airpower, to influence the ground battle at the operational level of war by isolating and shaping the ground battlefield, weakening the combat power of enemy ground forces not yet in contact with friendly forces, weakening the capability of enemy offen-

sive air and operational-level surface-to-surface missiles, and/or interfering with the enemy scheme of maneuver.¹⁸ CAS, which aims to influence the war at the tactical level, and its Army equivalent are critical from the beginning in an expeditionary war because of the inherent limits of deep attack and the circumstances of the war.¹⁹

As with strategic attack, deep attack has value only if the national political authorities allow attacks to hit the targets necessary for effectiveness. Prohibiting such attacks massively compromises their value. In Iraq we were allowed to hit those targets. In a war in Eastern Europe fought in immediate proximity to Russia, will our political leadership take the political risks inherent in attacks on targets in Russia? Or will the enemy be permitted a sanctuary?

Circumstances, not our preferences, may dictate another critical factor in reducing the potential of deep attack: the type of war we fight and the way we need to fight it. We may arrive in-theater with the war already under way and with friendly forces losing. As a matter of direst necessity, airpower may function in a fire-brigade role on a very chaotic battlefield to help plug gaps, contain or counterattack breakthroughs, shore up existing defenses, and buy time until the cavalry thunders in from Western Europe and/or North America. We should expect that providing "troops in contact" CAS will remain central from the first to the last day of our involvement. This assumption has several major implications for US force structure and equipment:

1. The United States needs air forces equipped for and skilled in the CAS mission against a modern enemy. The occasional suggestions that CAS be downgraded as an Air Force role to preserve resources for more doctrinally preferred roles have dangerous and potentially disastrous implications.²⁰ Doctrinal objections to CAS, however valid in an intellectual sense, may ultimately prove immaterial out where the tread meets the mud.²¹ It

does no good to paralyze the enemy's government or stop the advance of second-echelon forces if the first echelon overruns you.

2. We will need both ground and airborne forward air controllers (FAC) to direct CAS missions on a very confused battlefield. These critical personnel must be capable of functioning at night and surviving on a very nasty battlefield. We should consider using Army helicopters as airborne FACs and investigate unmanned aerial vehicles as a longer-term option.²² In peacetime, we should train local troops in the key role of calling in American air strikes, enabling them to effectively protect regional ground forces. In addition, one of the first reinforcing units of American ground troops committed should include ground FACs having at least minimal knowledge of the local language, military, and situation. As previously mentioned, US special forces filled this role during Desert Storm and are obvious candidates to do so again here.
3. Essential to the success of any tactical air effort, personnel who fly attack helicopters and tactical support aircraft must develop skills in joint antiarmor attack tactics, which combine the use of fixed- and rotary-wing CAS and attack platforms, enabling each to act as a force multiplier for the other.²³ Further, although in the past such joint tactics have emphasized CAS, we should systematically explore joint tactics for attack helicopter / conventional attack aircraft against forces not yet in contact.
4. We also need an effective and secure "identification, friend or foe" system for ground vehicles, especially since

regional allies and enemies may use similar equipment.

5. Since we cannot assume air supremacy or even superiority, we must have a command and control system that can wage offensive and defensive battles at the same time.

Conclusion and Implications

In an expeditionary war, likely much grimmer than Desert Storm or Allied Force and having less certain prospects for success, we would enjoy few of the advantages we had in the Gulf and the Balkans—and we would feel the immense weight of disadvantages absent in those conflicts. Effectively fighting this kind of war may require revolutionary changes in the Air Force: in our doctrine, organization, style of warfare, and equipment. Our service needs to understand what it means to be an expeditionary force in an expeditionary war, during which we may have to establish our bases while under assault.²⁴ An expeditionary air war in Eastern Europe will also require an unprecedented degree of joint operations between the US Air Force and Army. Attack and transport helicopters, as well as air defense and ground-based theater missile defense, are Army missions.

Yet, to those who study history, these challenges are not new. We have been here before, when we fought the tactical air portion of the Second World War. Moreover, and more currently, we would do well to study many of the methods and structures of the Marine Corps.²⁵ The time to start is now, when we have the chance to approach the problem systematically and carefully rather than frantically, with a rush and a roar when the bombs start falling. ✪

Burke, Virginia

Notes

1. Intriguingly, this may also be the case with Finland, which has refused to sign either the Land Mine Treaty or the Cluster Munitions Treaty and whose foreign minister, Alexander Stubb, recently suggested that the country consider joining NATO. See "Finnish Foreign Minister: NATO Opportunity, Not Threat For Finland," Open Source Center, EUP20090403203002, 3 April 2009, <https://www.opensource.gov/public/content/login/login.fcc?doAction=true>.
2. See "Day-by-Day: Georgia-Russia Crisis," BBC, 7 August 2008, <http://news.bbc.co.uk/2/hi/europe/7551576.stm> (accessed 28 September 2009).
3. I am speaking only in material terms. Grenada's most dramatic effect was that it restored the US military's morale and pride.
4. I am not specifically mentioning Finland in these scenarios: the Russian-Finnish borders have long since become settled and quiet, and the Russians have no minority in Finland to target. However, the Finns do occasionally make noises about joining NATO. See "Finnish Foreign Minister."
5. In the mid-1960s, for instance, the US Army had the equivalent of nearly six divisions in Western Europe. The US Army in Europe currently has four brigades and is scheduled for further reductions. See C. Todd Lopez, "U.S. Army Europe Commander Says Loss of Brigades Could Affect Evolving Partnerships," Army News Service, 10 February 2009, <http://www.eucom.mil/English/FullStory.asp?art=%7BA37E7D80-7F7B-4261-B279-780D89039443%7D> (accessed 28 September 2009).
6. According to one publication, NATO has a plan to defend Poland but none to defend the Baltic States. See "Have Combat Experience, Will Travel," *Economist* 390, no. 8624 (28 March 2009): 70. See also Patrick Lannin, "NATO Chief Calms Baltic Fears over Russia," Reuters, 12 September 2008, <http://www.iii.co.uk/investment/detail?type=news&code=cotn:BARC.L&it=&articleid=6891115&action=article> (accessed 28 September 2009). The United States has proposed that NATO start preparing such contingency plans. See "The Arctic Contest Heats Up," *Economist* 389, no. 8601 (11 October 2008): 70.
7. In its most recent war with Israel, Hezbollah demonstrated what determined people can do with bunkers and antitank missiles.
8. This definition draws on the one the Marine Corps has used for *expeditionary campaign*. Ann Keays, Doctrine Division, Marine Corps Combat Development Command, telecommunication with the author, January 1999. I have been unable to locate a joint definition for *expeditionary war*. Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 12 April 2001 (as amended through 19 August 2009), http://www.dtic.mil/doctrine/jel/new_pubs/jp1_02.pdf (accessed 28 September 2009), does not include such a definition. See also Lt Gen Charles E. Wilhelm, "Expeditionary Warfare," *Marine Corps Gazette* 79, no. 6 (June 1995): 28-30. Such a war would differ drastically from conflicts such as Desert Storm or Allied Force, which, though conducted under expeditionary conditions, had extensive regional infrastructures available for use.
9. This assumes that a rearming Russia will have reequipped its air forces with both upgraded (Su-27SMs and MiG-29SMTs) and new aircraft (Su-34s and -35s and MiG-35s). These platforms are as good as, if not better than, any F-15s and F-16s in the US Air Force inventory. See Yefim Gordon, *Russia's Military Aircraft in the 21st Century*, trans. Dmitriy Komissarov (Hersham, Surrey, UK: Midland Publishing, 2006).
10. For planning purposes, the US force structure laid out in 1994 assumed the following aviation component for each of the two major theater wars (then called major regional contingencies) for each contingency: 10 Air Force fighter wings, up to 100 Air Force heavy bombers, and four to five Navy aircraft carrier battle groups. See Les Aspin, *Annual Report to the President and the Congress, 1994* (Washington, DC: Government Printing Office, 1994), 15. In each contingency, the hostile state was assumed to have a force of up to 750,000 troops, 4,000 tanks, 1,000 combat aircraft, and 1,000 Scud-class missiles. See John T. Correll, "The High-Risk Military Strategy," *Air Force Magazine* 77, no. 9 (September 1994): 37, <http://www.airforce-magazine.com/MagazineArchive/Pages/1994/September%201994/0994strategy.aspx> (accessed 28 September 2009). Although Russian deployments might involve smaller numbers than these, the quality of their equipment is likely to be much better than the T-55 and MiG-21 equivalents implicitly assumed in the 1994 scenarios.
11. Instant Thunder, the plan devised by Col John Warden and planners at Headquarters US Air Force during Desert Shield, sought to defeat Iraq decisively through a strategic air campaign aimed at the nerve centers of its national power rather than its fielded forces. See Col Edward C. Mann III, *Thunder and Lightning: Desert Storm and the Airpower Debates* (Maxwell AFB, AL: Air University Press, 1995), especially chap. 2, <http://www.au.af.mil/au/aul/aupress/books/b-2/mann.pdf> (accessed 28 September 2009).
12. In the Korean War, we allowed our enemies—the Soviet and Chinese air forces—a sanctuary in

Manchuria. But one can argue that they allowed us a sanctuary on the aircraft carriers offshore and, aside from occasional harassment raids on our bases in Korea (usually by biplanes at night), at our air bases in Korea and Japan.

13. In 1962 Strategic Air Command boasted a strategic bomber force of 639 B-52s, 880 B-47s (and 146 EB/RB-47s), and 76 B/TB-58s, backed up by 515 KC-135 and 503 KC-97 tankers. See Norman Polmar, ed., *Strategic Air Command: People, Aircraft, and Missiles* (Annapolis, MD: Nautical and Aviation Publishing Company of America, 1979), 79.

14. The command bunkers built to harden the old Soviet command structure against nuclear attack have not gone away, and some past reports indicate that the Russians continued to maintain them even during the collapse of their military. See Tamar A. Muhuron et al., "Russian Military Almanac," *Air Force Magazine* 78, no. 6 (June 1995): 68.

15. In the past, preparation of a plan (historically called a Single Integrated Operational Plan [SIOP]) usually took about 18 months although efforts were under way in the early 1990s to shorten the cycle drastically. See Gen George Lee Butler, "Reengineering Nuclear War Planning," *Strategic Review* 22 (Summer 1994): 77–80. A conventional strategic-deterrence-and-response plan would probably prove even more complicated than a nuclear one for at least four obvious reasons: (1) the much larger number of smaller targets, (2) the inability to use nuclear weapons for defense suppression, (3) the lower probability of kill of conventional weapons against individual targets compared to that of nuclear weapons, and (4) the much more central consideration of avoiding collateral damage and casualties. More complicated than past nuclear targeting plans, such a plan would presumably take even longer to prepare.

16. There is, of course, the separate matter of what to do if we manage to inflict strategic paralysis since the latter, like air superiority, is an enabling condition—not an end in itself. See Maj Howard D. Belote, "Paralyze or Pulverize? Liddell Hart, Clausewitz, and Their Influence on Air Power Theory," *Strategic Review* 27, no. 9 (Winter 1999): 40–46.

17. See David Ochmanek et al., *To Find, and Not to Yield: How Advances in Information and Firepower Can Transform Theater Warfare* (Santa Monica, CA: RAND, 1998), http://www.rand.org/pubs/monograph_reports/MR958 (accessed 28 September 2009). This study assumes that the first several days of any "halt" campaign would concentrate on suppressing enemy air defenses.

18. For this definition of *deep attack*, an expansion of the interdiction mission, see Maj

Thomas R. McCabe, "The Limits of Deep Attack," *Airpower Journal* 7, no. 3 (Fall 1993): 13, <http://www.airpower.au.af.mil/airchronicles/apj/apj93/fall93/mccabe.htm> (accessed 28 September 2009). This approach was the primary focus of the air component of Operational Plan 1002, the original operational plan to defend the Arabian Peninsula. See Mann, *Thunder and Lightning*, 28.

19. The Army does not consider attack-helicopter operations CAS, calling them "close combat attack." See Maj Michael H. Johnson, "Cleared to Engage: Improving the Effectiveness of Joint Close Air Support," *Air and Space Power Journal* 22, no. 2 (Summer 2008): 71–81, <http://www.airpower.au.af.mil/airchronicles/apj/apj08/sum08/sum08.pdf> (accessed 28 September 2009).

20. For example, see Gen Merrill A. McPeak, "The Roles and Missions Opportunity," *Armed Forces Journal International* 138, no. 8 (March 1995): 33.

21. See Lt Col William G. Welch, "Is Fixed-Wing Close Air Support Worth It?" *US Naval Institute Proceedings* 120, no. 9 (September 1994), for a well-articulated statement of this point of view. Unfortunately, using doctrine to define problems out of existence does not actually make them go away.

22. Evidently the Army does not do that. See Johnson, "Cleared to Engage," 74.

23. See Air Land Sea Application Center, *JAAT: Multiservice Procedures for Joint Air Attack Team Operations* (Langley AFB, VA: US Air Force Doctrine Center, 1998).

24. For a sobering overview of what it takes to keep bases operational under fire, see Christopher J. Bowie, "The Lessons of Salty Demo," *Air Force Magazine* 92, no. 3 (March 2009): 54–57, <http://www.airforce-magazine.com/MagazineArchive/Pages/2009/March%202009/0309salty.aspx> (accessed 28 September 2009).

25. The Marines have an enormous advantage in the area of expeditionary warfare since all of their ground troops, aviation, and air defenses are contained within one organization—the Marine Air-Ground Task Force. However, although they pride themselves on being an expeditionary force and the Air Force can selectively profit from their experience (especially the use the forward operating locations to base helicopters and vertical and/or short takeoff and landing aircraft), the Marines are totally unprepared to wage air warfare at the operational level. Strictly speaking, they are a ground-centered amphibious expeditionary force, with the air element intentionally subordinate to the ground scheme of maneuver, concentrating on CAS. Granted, the US Air Force needs to do CAS and do it well, but we need to be able to do much more than that.

Preparing for Irregular Warfare

The Future Ain't What It Used to Be

Col John D. Jogerst, USAF, Retired

Tactically, the US Air Force performs superbly in a counterinsurgency (COIN) fight. Strategically, though, that fact is irrelevant; the critical capability involves building the partner nation's indigenous airpower—an essential distinction. The Air Force analyzes missions from the perspective of how it would conduct them, using all of its tactical and technical expertise. During COIN operations, this approach can easily influence us to take action ourselves. In the

discussion that follows, the reader must constantly keep in mind the difference between doing COIN (the job of the local authorities) and enabling COIN (the role of external actors).

The continuing Air Force debate over how to meet the challenge of irregular warfare (IW) reflects the fact that the above distinction is not obvious. Can our existing forces and organizations successfully meet irregular chal-



lenges? Is the irregular threat more or less likely or dangerous than the conventional threat? How do we balance these competing requirements?

Regardless of the internal debate, our political leadership has clearly expressed a need for better IW capability. The national security strategy of 2006 calls for engagement in regional conflicts through prevention and resolution, intervention, and postconflict stabilization and reconstruction.¹ Similarly, the *Quadrennial Defense Review Report* of 2006 urges a shift in emphasis “from major conventional combat operations - to multiple irregular, asymmetric operations.”² The new administration has not changed this direction. Reportedly, dissatisfaction with the Air Force’s focus on conventional, high-tech warfare, among other factors, led to the firing of its secretary and chief of staff in June 2008.³ Consider the “Revolt of the Admirals” in 1949, an incident that resulted in the firing of three Navy admirals, including Louis Denfeld, the chief of naval operations. At the time, the disagreement had to do with the relative merits and priorities of buying long-range nuclear bombers (B-36s) or building a new class of supercarriers (the USS *United States*) that could deliver nuclear strikes from forward locations. Is the F-22 our *United States*, or will we shift our priorities to build needed capabilities for IW?

To Remain Relevant in the Most Likely Conflicts of the Next 30 Years, the Air Force Must Be Able to Conduct Irregular Warfare

Contrary to doctrine and direction, the Air Force’s actions make clear that it does not consider IW a priority. It’s now fashionable in the Pentagon for airpower ad-



vocates to dismiss COIN as the “last war” and call for an all-out push for modernization to prepare for war with a technologically sophisticated peer or near-peer enemy.⁴ Despite an inability to predict our involvement in insurgencies after the initial phases of Operations Enduring Freedom or Iraqi Freedom, the Air Staff appears confident that such insurgencies will not occur again.

Yet, of the 14 major conflicts raging in the summer of 2008, none were conventional fights between nation-states.⁵ Of the 30 or so major conflicts of the past decade, only four occurred between nations.⁶ Today, places such as Sudan, Sri Lanka, Colombia, and the Philippines see wars between ethnic groups, insurgents, and religions. A recent RAND study found significant cause for concern in eight specific regions that lie effectively beyond the control of any recognized government.⁷ What is the likelihood of the US military’s becoming involved in these conflicts?

We have used military force over 300 times in our history—a number that in-

cludes only 11 declared wars and a few more sustained conventional conflicts (e.g., Korea, Vietnam, the two Gulf Wars, etc.).⁸ Although military personnel may recommend that our political leadership avoid involvement in other nations' internal wars, it is not our decision. History shows that we must be ready and able to meet a full spectrum of challenges, which includes assisting other nations with internal conflicts.

IW does not generally threaten the survival of the United States; however, it poses significant threats to our interests in today's globalized environment. For example, irregular wars influence two of the five largest US oil suppliers—Nigeria and Venezuela. In Nigeria, local unrest and attacks on facilities and personnel in oil-producing areas have directly affected that country's oil exports. Venezuela harbors some Colombian insurgents, causing significant tensions in the area. In March 2008, Colombia demonstrated its willingness to conduct cross-border operations against those insurgents when it attacked and killed a rebel leader hiding in Ecuador. Escalating tensions in the region could easily involve the United States, given our ongoing support of the Colombian government.

I leave calculating the probabilities of conventional and irregular conflicts to the intelligence experts—hopefully wiser now after Iraqi Freedom. Regardless, the capability of irregular and conventional enemies has been amply demonstrated by the decades of terrorism culminating on 11 September 2001 and by the numerous civil wars and unconventional conflicts currently raging. In a rapidly changing and uncertain environment, we don't know what we don't know. Events of the future will be as unanticipated and momentous as the collapse of the Soviet Union or the attacks of 11 September. We can only develop as wide a range of capabilities as we can, including those needed for IW. So what are "irregular" capabilities (other than not regular)?

Irregular Challenges Cover the Spectrum, from Terrorism to Insurgencies and Civil War

Defining IW as a negative—everything that's *not* conventional warfare—does little to determine needed capabilities. Air Force doctrine defines it as "a violent struggle among state and non-state actors for legitimacy and influence over the relevant populations," a broad statement that essentially covers all violence aimed at causing political change, whatever the source.⁹ The military professional needs a more specific prescription.

That same doctrine does provide some clarification, however: "IW encompasses a spectrum of warfare where the nature and characteristics are significantly different from traditional war. It includes, but is not limited to, activities such as insurgency, [COIN], terrorism, and counterterrorism," another "not conventional" definition.¹⁰ Violent political competition ranges from street demonstrations in Palestine, through terrorism in Colombia, to full-scale civil war between conventional forces in Lebanon. However, within this violence a common thread exists that distinguishes irregular from conventional conflicts: it concerns not why but how the fight is conducted.

Conventional warfare entails fighting distinct, identifiable, and unambiguous military forces, whose defeat (as well as the destruction of their infrastructure) is a well-studied problem for conventional forces: identify centers of gravity and apply firepower. Regardless of the adversary force, when its members take the field as a distinct military entity, conventional tactics prove effective against them. After defeating the enemy's military forces, we decide that we have won if the enemy government has acceded to our demands or if we have destroyed that government and occupied its territory. Yet, conventional war plants the seeds for irregular war. If we occupy enemy territory, then we are vulnerable to continued irregular resistance.

In IW we fight enemies who intentionally remain ambiguous. They employ every type of violence but, for the most part, avoid operating as an identifiable armed force. This is not to say that they are not organized, do not call themselves an "army," and do not mass when they see an advantage. The point is that irregular opponents blend in with the population. Either their rear area, their sanctuary, lies outside the formal conflict arena or does not occupy a geographic area at all, existing instead within the local population. In the latter case, they do not cross a physical border to initiate hostilities. Military forces' role in the ultimate (political) victory is complete when they suppress violence to a level that allows a "normal" society to function. This scenario presents unique but not unprecedented challenges for military action.

The Military Aspect of These Challenges Is Well Covered under Counterinsurgency

The problem of dealing with organized, disaffected, and violent adversaries within a population is embedded in the notion of COIN, "those military, paramilitary, political, economic, psychological, and civic actions taken by a government to defeat insurgency," the latter term defined as "an organized movement aimed at the overthrow of a constituted government through use of subversion and armed conflict."¹¹ Our definition of insurgency, written from the perspective of the "constituted government," parallels that of IW, defined in a more objective fashion that focuses on the violent struggle between governments and insurgents for legitimacy. Other than the change in perspective, the struggle remains the same—to determine who will rule. We should, therefore, consider the lessons of COIN in developing forces for IW.

Remarkably, all the services agree on COIN doctrine in terms of its determining the legitimate government for a nation or

society. Joint doctrine talks to "the building of viable institutions that respond to the needs of society."¹² Air Force doctrine takes aim at the struggle for legitimacy and influence over the population.¹³ Army and Marine Corps doctrine echoes this stance: "Political power is the central issue in insurgencies and counterinsurgencies; each side aims to get the people to accept its governance or authority as legitimate."¹⁴

The issue of legitimacy is complex, but the de facto standard of government legitimacy involves the ability to occupy and control territory—one of the ways we define a nation-state. Whether or not that control is coerced or freely granted by the population in return for government and social services simply constitutes a detail. Regardless, controlling a population means putting boots on the ground—forces aren't in control if they're not present or can't reach the location. Most importantly, a local authority must do the controlling with its own boots.¹⁵ Since the essence of legitimacy is presence, every fight in a COIN battle occurs eyeball to eyeball and locally. The COIN battle turns on controlling the population, and we can't do that from a distance or solely from the air.

For the insurgent, success depends upon maintaining the initiative. By denying the government identifiable targets, the insurgent ensures that it can only react to his moves. By massing forces only at times and places of his choosing, he controls the pace and terms of the conflict.

By dispersing within the population, insurgents avoid presenting an unambiguous target readily distinguishable from noncombatants (or staying in external sanctuaries not accessible to government forces). Compared to conventional forces, they generate few traces susceptible to the collection of technical intelligence. Oftentimes, only the locals can provide the most relevant information—the identities of the insurgents.

Their proximity to the population turns any firepower advantage into a disadvantage insofar as the insurgents try to induce the United States or our partner nation to

react with large-scale violence that might cause civilian casualties, destroy property, and demonstrate lack of concern for the citizenry's welfare. This can also have the secondary effect of increasing the insurgents' perceived legitimacy by raising their stature from that of violent criminals to an organized force that can legitimately compete with the partner nation's government.

Tactically, insurgents unencumbered by heavy weapons and armor can move on foot or in civilian vehicles among populated areas as fast as, or faster than, conventional military forces. Unlike government forces, who must be overt and identifiable in order to demonstrate their presence to the population, insurgents can remain indistinguishable from other civilians.

For the joint/combined force commander, this situation effectively limits friendly ground forces to parity with the insurgents in information, firepower, and mobility, making for a small-arms, small-unit fight. Only airpower can break this stalemate.

The Value of Airpower in Counterinsurgency Is Indisputable, but Counterinsurgency Will Never Become an Air-Centric Fight

In the COIN environment, airpower allows friendly forces to see, move, and shoot, enabling them to dominate insurgents stuck on the ground. At the same time, the latter's need for low visibility effectively denies them significant air capabilities. Thus, threats to friendly air forces include only ground-based sabotage, small-arms fire / antiaircraft artillery, and limited numbers of small surface-to-air missiles. For Airmen, this presents a uniquely asymmetric airpower equation.

Airpower enables small units operating in complex terrain to create, occupy, and exploit the high ground. Wide area, long-term surveillance and immediate overhead reconnaissance let friendly forces see the enemy and anticipate his actions, reducing

the insurgent's ability to control the initiative and achieve tactical surprise.

Aerial mobility allows friendlies to respond to, pursue, or break contact with insurgents, returning the tactical initiative to government forces. This denies insurgents the ability to achieve local superiority by massing forces and limits the time they have to conduct an operation. Aerial mobility effectively converts their tactic of massing forces for local superiority into opportunities for government forces to identify and destroy them.

Airpower provides small units with immediate, precise, and scalable firepower. The immediate aerial backup changes the tactical equation from one of firepower parity to overwhelming friendly superiority. The precision of line-of-sight fires and guided weapons produces less collateral damage than the truck bombs or mortars in the insurgents' arsenal. Airpower offers a range of effects from area saturation with small-caliber weapons (mini-guns) to artillery fire (with the AC-130's 105 mm howitzer) or destruction of hard targets (with Hellfire missiles and various precision-guided bombs). The friendly force can tailor the effects and direct them precisely to destroy insurgents while limiting collateral damage.

The Army's recent creation of Task Force Odin in Iraq reflects its understanding of the value of airpower and its willingness to pay for it.¹⁶ The Army created an ad hoc force of C-12 aircraft, Warrior and Shadow unmanned aircraft, and Apache helicopters tactically controlled by US and Iraqi ground force units to see, move to, and shoot bad guys. The Army diverted scarce resources to augment the capability supplied by the theater Air Force.

Yes, airpower is extremely relevant for COIN. Tactically, it gives small units the situational awareness, mobility, and firepower needed to overwhelm insurgents and exploits the insurgents' vulnerability by preventing them from massing forces or holding fixed positions. Yet, one must be careful not to overstate the value of airpower.

Lately, airpower advocates led by Maj Gen Charles Dunlap and Dr. Phillip Meilinger have called for an air-centric approach to COIN.¹⁷ Unfortunately, they have focused on its kinetic aspects—a strength of airpower—instead of the larger political battle, largely unaffected by airpower. One doesn't defeat an insurgency by killing insurgents—unless one is willing to kill the entire segment of society whose grievance gave rise to the insurgency. Those airpower advocates are like the discoverers of the wonder drug penicillin, which cures a myriad of bacterial infections, just as airpower quickly destroys identifiable insurgents. Alas, not all infections are bacterial, and penicillin is not effective against viral infections, just as airpower cannot provide the persistent, face-to-face contact needed to free citizens of the viral influence of insurgent activities in their neighborhoods.

The “air control” strategy of the Royal Air Force in Iraq during the 1920s and 1930s, often mentioned as a good example of air-centric COIN, used British airpower in conjunction with small ground forces to attack massed rebels and conduct reprisal attacks against their villages. Although it proved tactically successful in coercing local tribal authorities and protecting ground forces, it produced only temporary effects and did nothing to build local governance in the region. Of course, the British had no intention of establishing local institutions to compete with imperial influence.¹⁸

The military advantage of airpower's high ground becomes a disadvantage (or irrelevant) in other phases of COIN aimed at controlling populations, which live on the low ground. Airpower cannot provide the personal presence of a “cop on the corner,” nor does it provide basic community services. The local population can see and solicit assistance from ground forces and other government representatives in the local area, but they have essentially no contact with airpower. COIN and IW have to do with government legitimacy—governance

up close and personal. Face-to-face contact is not airpower's strong point.

One must remember that COIN itself is *not* a military-centric fight, allocating no independent roles for land, air, or military forces in general. Strategic planning must occur at the interagency level with the partner nation, whose political agenda, local political considerations, and US interagency inputs must all become part of any planned military operation. In many cases, these considerations will shape or preclude military operations. In COIN the politicians *do* run the war. Airmen having expertise in IW/COIN must make an informed contribution to the strategy, but they do not drive it. This is war, but with a difference.

At best, military force is a necessary evil in COIN—useful for defeating military formations, establishing enough initial safety to allow local police and security forces to take control, and creating conditions favorable for local political and economic development. We demonstrated in Vietnam and Afghanistan that US military forces can utterly annihilate insurgents who mass or gather in conventional military formations. As we learned then, and are learning now in Iraq, conventional military forces find it very difficult to locate and deal with a dispersed insurgent force actively hiding in urban areas and within a population.

Though Tactically Adept, Well-Trained Conventional Forces Have Proven Strategically and Operationally Inept at Doing Counterinsurgency

*If all you have is a hammer, everything
looks like a nail.*

—Bernard Baruch

Ironically, today's “general purpose forces” are anything but that, having superbly adapted to the requirements of high-intensity mechanized conflict. We are cur-

rently organized, trained, and equipped to conduct conventional warfare—conflict between overt political entities using hierarchically organized military forces.

This would not pose a problem if insurgents presented us with a familiar target set and reacted in familiar ways. Unfortunately, they do not. Insurgents study history too, and those who do not learn are quickly removed from the “gene pool.” The surviving insurgents design their strategies to negate conventional forces’ advantages of mass and firepower.

outlook and organizational culture comfortable with decisive battle and firepower but not with the constraints of long-term politico-military operations with less-than-proficient allies.²¹

In our recent “surge” of combat forces in Iraq, we still see the desire to seek decisive battle with insurgents and maximize the use of our firepower advantage, despite the current emphasis on COIN education within the US Army. Our COIN doctrine emphasizes the protracted nature of the conflict and the need to build partner-

“Military forces that successfully defeat insurgencies are usually those able to overcome their institutional inclination to wage conventional war against insurgents.”

Today, our Airmen have undergone excellent training to win a conventional war. Like all competent professionals, in an unfamiliar situation, we reach first for the tools we know best. Army / Marine Corps COIN doctrine elegantly recognizes this pitfall: “Military forces that successfully defeat insurgencies are usually those able to overcome their institutional inclination to wage conventional war against insurgents.”¹⁹ Air Force doctrine may not say this as clearly but recognizes it implicitly: “IW is not a lesser-included form of traditional warfare.”²⁰

A recent RAND study makes this point clearly and unambiguously. After briefly surveying US experience in small wars prior to 1960 and taking a closer look at the Vietnam War and current operations in Iraq, it found that small, flexible units unencumbered by conventional doctrine and organizations can successfully counter insurgent activity, both directly and working through local forces. Conventional forces, despite good COIN planning and doctrine, wage COIN unsuccessfully, reflecting an

nation governance and civil society along with military capability. The RAND study delivers a clear message—we have valid COIN doctrine, but doctrine on the shelf cannot compete with a lifetime of conventional education and training. We can do COIN—we just refuse or forget to.

Equally important is the fact that general-purpose forces are configured by design, training, and attitude to do the mission themselves, not through local proxies or a partner nation’s forces. This causes significant problems for COIN missions. Dr. Meilinger bemoans the fact that governments relying on US support are often portrayed and perceived as American “puppets,” to their disadvantage in the competition for legitimacy.²² This charge reflects an accurate perception of our conventional forces’ preferred operational patterns. The US military’s usual practice of arriving in overwhelming force and operating independently of another nation’s control reinforces the perception of the United States as an external player—an “imperialist.”

To gain and retain legitimacy, the host-nation government must give the appearance of being in charge. Our military can do this only by building up local forces to take the lead in fighting insurgents. A quick look at the Air Force's "scorecard" for Iraqi Freedom/Enduring Freedom shows that we have missed this point. Through July 2008, the Air Force Airpower Summary shows nothing about Iraqi Air Force operations and capabilities—only US and coalition sorties—though this has recently changed to reflect some local contributions.²³ To provide COIN capability and ensure that well-trained general-purpose forces focus on the conventional mission, we must remove the IW/COIN distraction from conventional forces by developing distinct organizations tailored to conduct IW/COIN.

Counterinsurgency Requires Forces Organized, Trained, and Equipped for the Mission

In conducting COIN, we concern ourselves not so much with the value of airpower as its source. External forces may serve as a stopgap, but they are not the solution. The Air Force needs to get serious about creating and sustaining indigenous airpower for COIN—building the 100-wing Air Force called for by Secretary of Defense Robert Gates.²⁴ In short, we must create and sustain a foreign internal defense (FID) capability for the Air Force that can build those 60-odd additional wings for partner nations.

Creating both an institutional FID capability for the Air Force and a cadre of COIN experts to do the mission requires establishing a permanent wing focused on this mission. Why a wing? Because we fight, train, and allocate resources that way. The unit needs to consist of equal parts technical training wing and operational composite wing tailored for IW and COIN. Call it an IW Wing with a FID Group as its training

component and a COIN Group as its operations arm.

The FID Group would create airpower for the host nation or fill gaps in its organization. Many countries facing insurgencies or harboring terrorists have no effective airpower. Some have aircraft but poor recruiting, training, command, or sustainment capabilities—core Air Force functions that we can teach. The FID Group needs specialists in all of the organizational functions of the Air Force (organize, train, equip, and provide forces; develop doctrine; etc.) to build those capabilities in the partner nation so it can sustain the fight.

The COIN Group would teach airpower employment and establish initial capability, thus demonstrating the utility of airpower to partner nations. Charged with instructing them in the employment and control of forces (i.e., teaching tactics, planning, and command and control), the COIN Group needs a small complement of aircraft—not high or low tech but the right tech for the particular countries. The group's weapon systems would provide mission proficiency, initial combat capability, and a model for partner-nation implementation. We should select weapons and support systems for their capability, affordability, maintainability, and commonality with other nations in a target region. Some nations can operate F-16s, but most cannot. The wing must have specialized systems, not because we need new capabilities but because systems should match the partner nation's specific requirements and limitations.

Assuming that our strategy calls for transferring these systems to the partner nation, the IW Wing will need to own them. If not, it can lease them, which will reduce costs and enable the wing to change specific weapon systems rapidly to match the requirements of a variety of partner nations.

The COIN Group must possess a variety of capabilities (surveillance, airlift, strike) and a small combined air operations center for organic command and control for tens of sorties per day, not thousands. Squadron-

sized elements of light strike; mobility; intelligence, surveillance, and reconnaissance; and rotary-wing systems should be adequate. We should size the IW Wing so that it functions as a nucleus around which we develop the host nation's capability rather than try to be a complete national air force.²⁵

This wing provides an initial, core combat capability. If the partner has no resources for confronting an advanced or large-scale insurgency, we can augment the IW Wing with a conventional Air Force air and space expeditionary force (AEF). Adept at destroying military targets, conventional forces can move effectively against insurgents operating massed forces or in the open. When we run out of those targets—usually very quickly—we withdraw the AEF and fall back behind the local government and the US political team supporting it. After having dealt with the initial threat, we need only a small force structure of unique aircraft to support COIN operations.

The IW Wing also gives the Air Force an incubator to nurture credible IW/COIN experts and strategists for the regional combatant commanders. To conduct IW successfully, we must spend just as much time educating leaders and shooters about it as we spend educating them about major theater wars of the past. Otherwise, we subject ourselves to a repeat of recent history—on-the-job training or a fallback to firepower-intensive, conventional operations. “Losing” man-hours to classroom education and field exercises is infinitely preferable to losing lives (mostly those of locals and our ground forces) in relearning how to fight dirty little wars.

FID teaches us the key lesson that the best equipment, training, and intentions won't work unless we earn the respect of the partner nation's personnel—and it takes time to build useful relationships with our counterparts. Although the AEF construct we use to present forces works for supporting conventional operations, short rotations of standard force modules do not lend themselves to the lasting associations de-

manded by effective FID. Rather, we must implement long-term deployment or recurring deployments of the same US personnel to a focus country, assuring that the wing's internal organization features regionally oriented teams whose deployment cycles respond to the operational needs of the host nations. The IW Wing will be at war. If we can't deploy the same individuals for the duration, then we must ensure that they deploy regularly.

Building relationships and mutual respect also requires that all personnel in contact with the partner nation make an investment in cultural and language skills. The IW Wing should maintain a variety of language qualifications attuned to likely areas of US interest. Intensively preparing a small number of individuals for the wing promises a bigger payoff than trying to provide everyone in the Air Force a smattering of language/cultural training.

Dedicated Irregular Warfare / Counterinsurgency Forces Need Not Be Excessively Large or Expensive

Successful COIN requires the partner nation targeted by the insurgency to take the lead in operations. After all, the war is about who exercises governance over the population—and that isn't the United States. Thus, the partner nation must provide and pay for the bulk of the forces, and we must limit equipment and systems to those it can afford, operate, and sustain. As noted above, during IW/COIN, a wing-sized US force serving as the core of a partner nation's capability is more valuable than large numbers of US weapon systems. At the same time, the insurgents' need for stealth also effectively confines the threat to sabotage of friendly air forces, small-arms fire / antiaircraft artillery, and a few small surface-to-air missiles, which, in turn, reduces the technical and performance requirements—and cost—for airpower tailored to the COIN mission.

Choosing not to resource a dedicated IW/COIN organization and capability amounts to a false economy. The absence of an IW Wing forces us to use conventional means to fight irregular conflicts. Each day, conventional airpower proves that it can carry out the kinetic mission in Iraq and Afghanistan, but it does so at a horrendous cost: \$18 billion (\$8 billion in procurement and \$10 billion in operations and maintenance) to run the Air Force portion of operations in Iraq and Afghanistan for fiscal year 2007. (From 2001 through 2007, the Air Force spent a total of \$63 billion for these operations.)²⁶

Keeping a fleet of B-1s, KC-10s, F-15s, TR-1s, and so forth, in the fight to drop a weapon occasionally in permissive airspace is a bit like hunting gnats with an elephant gun. Those weapon systems (and their supporting logistical and command and control structure) are invaluable against the massed forces of a technologically adept enemy, but in a COIN fight we use them at only a fraction of their potential, all the while consuming resources at full speed. Worse, these conventional forces contribute little or nothing to building capability for the partner nation. Spending \$1 billion a year on a dedicated COIN force instead of \$18 billion would take considerable pressure off the Air Force's sustainment and recapitalization accounts. Until we make the investment in people, organizations, and weapon systems dedicated to building host-nation airpower, we will face an endless and expensive grind of AEF deployments as our only option in unconventional conflicts.

Counterinsurgency Forces Must Satisfy the Criterion for US Victory in Irregular Warfare: We Go Home When the Partner Nation Can Take Over the Fight

At the tactical level, we have COIN doctrine. Significantly (perhaps unintention-

ally), at the joint/strategic level, we do not have COIN doctrine. We do have Joint Publication 3-07.1, *Joint Tactics, Techniques, and Procedures for Foreign Internal Defense (FID)*, and joint doctrine defines FID as "participation by civilian and military agencies of a government in any of the *action programs taken by another government* or other designated organization to free and protect its society from subversion, lawlessness, and insurgency" (emphasis added).²⁷ Intentional or not, this definition recognizes the most fundamental, yet most often forgotten, key to victory in IW and/or COIN. An external power cannot "win" the war; it's a fight for political legitimacy between local factions.

This is the most important point to remember in conducting COIN. Unless we intend to deploy forces indefinitely, we must build up partner-nation capabilities and legitimacy—which calls for a low-visibility effort that puts local forces in the lead as soon as possible. In the words of T. E. Lawrence, "Do not try to do too much with your own hands. Better the Arabs do it tolerably than that you do it perfectly. It is their war, and you are to help them, not to win it for them."²⁸ Thus, we think of victory in terms of the Iraqi Air Force's flying Tucanos and Mi-17s adequately—not the US Air Force's flying F-22s and CV-22s flawlessly.

In this area—building local airpower—the Air Force is failing. Its unmatched capability lies far beyond what most nations need or can achieve. Other than Air Force Special Operations Command's 6th Special Operations Squadron and US Central Command Air Forces' 370th Air Expeditionary Advisory Group (formerly the Coalition Air Force Transition Team), the Air Force has no organization or infrastructure dedicated to developing indigenous airpower. A small unit, the 6th focuses on tactically training existing local air forces to support the activities of special operations forces. The 370th has a larger complement and broader capability but functions as an ad hoc unit with no institutional infrastructure, training only Iraqi and Afghani air forces.

To do FID, we must dedicate an organization to that mission. If it's not somebody's job, then it's nobody's job. The United States

cannot be the world's policeman, but we can make sure the local cops are ready and able to police their own societies. ☛

Notes

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Achieving Balance

Energy, Effectiveness, and Efficiency

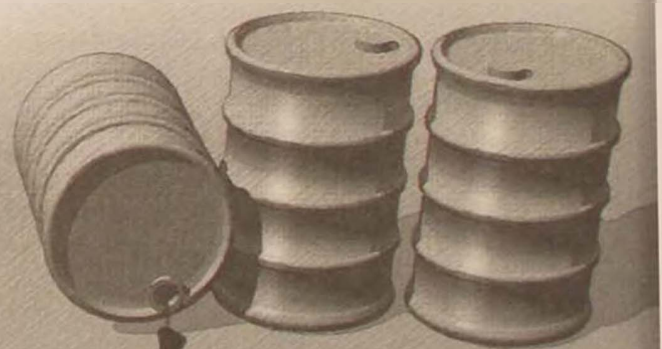
Col John B. Wissler, USAF

In 2005 Hurricanes Katrina and Rita severely affected the United States' petroleum-refining capacity, causing gas prices to spike as high as five dollars per gallon. In an instant, Americans glimpsed a new future defined by constrained energy supplies; in reality, the global demand for energy is increasing faster than the supply.¹ The summer of 2008 saw a repeat of this occurrence, driven not only by natural events but also by other forces as gas prices exceeded four dollars per gallon causing, among other things, a drastic drop in demand for sport utility vehicles.

China, India, and other countries are rapidly increasing their consumption while production from known oil fields is peaking (referred to as Hubbert's Peak), a phenomenon predicted since the 1950s with varying degrees of accuracy.² Furthermore, we are experiencing a decline in the discovery of new fields and the amount of oil associated with them. Although we do not know exactly when world oil production will begin to decrease, it will likely occur in the next 30 years although we will feel the effects before then due to greater demand.

Consequently, we should consider viewing energy in a strategic military context. Such a perspective must focus on the continued availability of energy supplies and on how and why the military uses energy. Taking this approach can then influence the Department of Defense's (DOD) acquisition and use of weapon systems.

To a large extent, energy dictates this country's foreign policy interests and is critical to the nation's prosperity, even as other countries complain that the United States has 5 percent of the world's population but uses 22 percent of the world's energy.³ Because of its outstanding properties with respect to storage, energy density, and ease of



use, petroleum is a particularly useful and necessary commodity, especially to the United States. Peter Tertzakian, who identifies a strong, almost linear relationship between the United States' gross domestic product and oil consumption, demonstrates how this relationship underwent a sharp change after the oil shock of 1979.⁴ Fairness aside, the nation's well-being is tied directly to the availability and use of cheap, ubiquitous energy sources for transportation, food, defense, industry, and health.

Because energy is a vital national interest, the United States feels compelled to engage in places that have large oil reserves and/or the infrastructure to extract, transport, and process those reserves. As the demand for and availability of worldwide petroleum diverge, the nation will likely take an even greater interest in regions that contain oil reserves. Unfortunately, these areas are often places of unrest, instability, and oppression located in remote parts of the world. Despite the existence of various ways of ensuring the accessibility of energy resources, if the nation wishes to employ the military as an instrument of national policy to this end, the DOD must field forces that can quickly deploy thousands of miles, remain there for a long time, function with impunity, and dominate the battlespace.

Operating a predominantly petroleum-fueled force at such distances is expensive. Although it uses less than 2 percent of the nation's overall oil consumption, the DOD remains the largest institutional user in the United States, accumulating an annual fuel bill of over \$5 billion. Within the DOD, aviation accounts for over 70 percent of that figure, much of it related to mobility (e.g., airlift and air refueling) as opposed to combat forces.⁵ Although the DOD pays market rates for fuel, the real costs, which include the fuel's price as well as transportation and infrastructure expenses, are considerably higher; in fact, some estimates indicate that

the cost of transporting fuel, especially to a remote location, runs 10 to 100 times the market rate. A Defense Science Board study of 2001 mentioned \$17.50 per gallon as the cost of fuel delivered by Air Force tankers worldwide, not the approximately one dollar per gallon that the DOD paid for fuel at that time. The cost of fuel for forward-deployed Army units was higher, in the range of hundreds of dollars per gallon.⁶ Although these figures include the cost of fuel itself, overhead, expenses associated with the vast delivery infrastructure, and fuel needed to run that infrastructure (e.g., tanker aircraft and trucks), increases in fuel prices clearly have a huge impact on the price of operating at the extended distances characteristic of today's expeditionary forces.

Effectiveness, Efficiency, and Energy

Given energy's strategic importance to the prosperity and defense of the United States, it is useful to consider energy in relation to effectiveness and efficiency. In a sense, this is much like a strategic analysis of ends, ways, and means whereby "ends" represent what we need to achieve (i.e., effectiveness of a mission or task), "ways" describe how we realize those ends (i.e., efficiency in the use of resources), and "means" represent what we actually use to attain them (i.e., the energy expended). Thus, we can depict effectiveness, efficiency, and energy as competing "poles" wherein lies the system that the DOD must develop, field, and use (fig. 1).

For the acquisition, planning, and operational communities, this three-pole construct illustrates the inherent tensions that they must consider when developing and employing weapon systems. Rather than focus exclusively on one aspect of the problem (e.g., reducing energy expenditures,

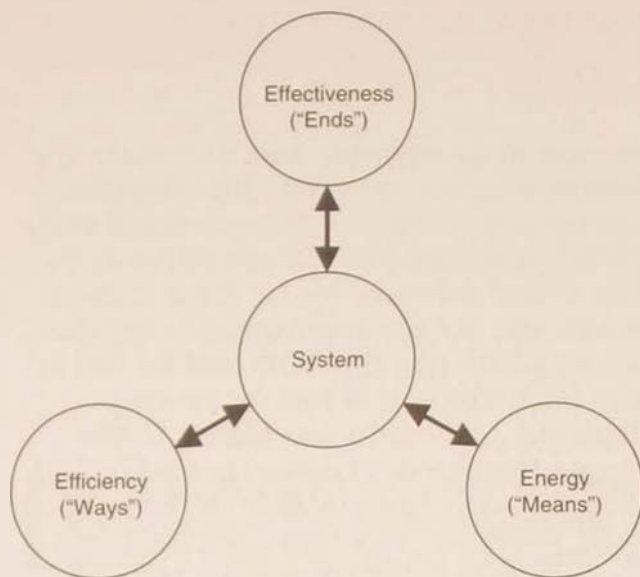


Figure 1. Three-pole ends-ways-means concept in an energy context

increasing efficiency, or improving effectiveness) to the exclusion of the other two aspects, we must pursue a balanced approach. For example, an attempt to design an aircraft only for maximum efficiency might produce something like the Gossamer Albatross, arguably one of the most efficient aircraft ever built, which flew across the English Channel using power generated by only one person. Applying such an approach to ground vehicles might yield a bicycle, a model of efficient ground transportation. However, these extremely energy-efficient vehicles have little military capability.

Warfare is an endeavor of absolutes, and the absolute requirement is mission effectiveness. Most combat systems dominate not because they are efficient energy users but because they are profligate energy users, giving them the speed, maneuverability, and power to prevail. Even though operating efficiently generally increases affordability, particularly in times of increasing energy costs, having the most efficient fighter aircraft or ground vehicle may allow us to get to the fight, but we may find ourselves outclassed upon arrival. Therefore, as the DOD addresses the issue of increased energy costs, it must confront the tensions between energy input, efficiency, and effec-

tiveness and seek an optimum balance within those tensions for the mission or need at hand.

When the DOD acquires new weapon systems, it specifies requirements that capture the most important characteristics desired by the user. These requirements usually involve measures related to effectiveness (e.g., range, speed, protection, and payload) or sustainability (e.g., amount or level of needed maintenance) but often do not take efficiency into account, especially for combat systems. However, the latest DOD 5000-series guidance directs consideration of the fully burdened cost of energy in the development of new weapon systems, especially during trade-off analyses.⁷

But how should we define such efficiency-related requirements? The thermodynamic definition of efficiency is the amount of useful work produced by a system divided by the amount of energy utilized by that system.⁸ Unsurprisingly, however, the devil is in the details: exactly what constitutes the energy utilized by a system and the useful work it produces? For that matter, what is the system in the first place? In the case of a weapon system, is it the platform, the weapons carried on and fired by the platform, or the support systems, such as refueling vehicles? What if the system does not carry a weapon per se, thus demanding other measures of effectiveness?

Fundamentals

Using energy efficiently while maintaining effectiveness poses a complicated question that bears directly on combat performance and the desired characteristics of weapon systems. Conceptually, we can consider energy by examining the trades among energy, effectiveness, and efficiency (see fig. 1). Energy is related to the effort required to carry out a task or mission (analogous to the energy input), effectiveness to the reason for executing that task (analogous to a system's useful work), and efficiency to the endeavor's "cost versus benefit."

Thermodynamic definitions illustrate this relationship (fig. 2). A low-efficiency system requires an inordinate amount of effort or energy to yield a given level of effectiveness. As the efficiency of a system increases, the effort or energy decreases, but eventually we face diminishing returns; that is, substantial increases in efficiency yield progressively smaller reductions in required energy. At this point, we must consider optimizing the system based on the cost of attaining such increases in efficiency versus the benefits of reducing the necessary energy; this may entail devising radically different ways of doing things.

Using an electrical power plant as an example, George Tsatsaronis and Antonio Valero discuss the importance of conducting a *thermoeconomic* analysis that systematically looks at all parts of a system, balancing energy, efficiency, effectiveness, and cost.⁹ Given thermoeconomics' goal of meeting mission requirements while using energy efficiently, we should be able to apply these techniques to military systems.

Application of Concepts

When considering any system and its energy flows, we must define that system carefully and clearly. Weapons are complex machines composed of myriad parts. In fact, most weapon systems are actually systems of systems; true battlefield effective-

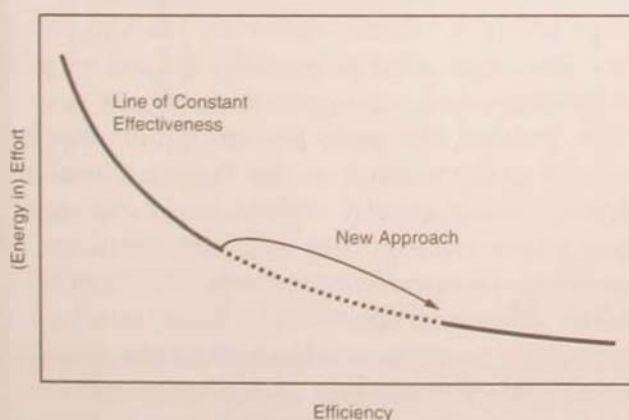


Figure 2. Relationship among effort (energy), effectiveness, and efficiency

ness demands that each system operate with other systems. For example, in today's joint environment, combat aircraft attain maximum effectiveness when they operate with air-control aircraft, tankers, and ground forces. Therefore, as discussed above, we must be careful about increasing efficiency or reducing energy consumption without first considering the system of systems in question and its overall purpose in the larger operation.

Consequently, recognizing that weapon systems use energy to produce an effect or fulfill a mission, we should first define that mission or effect and then seek an optimal solution in terms of the expenditure of energy.¹⁰ Doing so allows us to ascertain the best alignment among effect, efficiency, and energy.

Techniques of thermoeconomic analysis formerly applied to power plant design have now found an application in aircraft design. David J. Moorhouse has used this approach to optimize designs for reconnaissance and transport aircraft, thereby enhancing both efficiency and mission effectiveness.¹¹ The Gossamer Albatross's focus on extreme efficiency to the detriment of military utility still offers important lessons that we see applied in long-endurance systems such as the Global Hawk and the Defense Advanced Research Projects Agency's Vulture program.¹² Again, we must first define the system, assess its performance requirements (i.e., the desired effectiveness), develop a means of relating those needs to the energy flows, and then optimize for maximum efficiency or minimum energy necessary to obtain the desired effect.¹³

Since every added feature that seeks to increase efficiency has a cost associated with it, we must determine whether that feature is worth the expense—typically expressed in terms of procurement or acquisition cost, but the price of energy also figures in.¹⁴ In some cases, a degree of inefficiency may be preferable when the cost of maximizing efficiency while maintaining effectiveness proves too high.

For instance, only a tiny fraction of the energy used by automotive systems actually fulfills the purpose for which the energy is intended (i.e., turning the wheels, thereby propelling the occupants). In the average American car, only about 15 percent of the energy going into the tank as gasoline actually moves the car's occupants, and two main factors drive that fuel consumption: the load placed on the power train by the vehicle and its subsystems, and the efficiency of the power train itself.¹⁵ In a different analysis, Amory Lovins and others show that approximately 85 percent of a light vehicle's fuel energy is lost as heat and noise, and that only between 10 and 15 percent actually reaches the wheels to move the vehicle and its occupants. Furthermore, most of that energy goes toward moving the heavy vehicle, and only the barest fraction, about 1 percent, actually moves the occupants themselves.¹⁶

In some cases, attaining both efficiency and effectiveness is possible. For example, some power-train designs handle not the peak load but the average or cruise load (for a typical car, only about 10 percent of the engine's full potential at highway speeds) and include augments systems to provide peak power for acceleration.¹⁷ Indeed, hybrid automobiles use a small gas engine for cruise speeds, augmented by an electric motor for acceleration. The aircraft-oriented analogy to the hybrid propulsion system is embodied in new engine concepts such as the Adaptive Versatile Engine Technology (ADVENT) system, which can radically alter its design cycle to shift from high-power, low-efficiency, turbojet-like operation to lower-power, high-efficiency, turbofan-like operation. By varying its configuration as it operates, ADVENT offers the promise of engines having as much as 25 percent greater fuel efficiency or 30 percent greater takeoff thrust, enabling either extended range/loiter or higher dash speeds.¹⁸ The National Aeronautics and Space Administration and the Air Force are pursuing new concepts such as the Blended Wing Body aircraft that may offer up to 30 percent

more efficiency than conventional aircraft; these new platforms will be capable of carrying a similar payload, thus retaining effectiveness at transporting cargo.¹⁹

The centrality of weight to the use of energy in moving systems is a key point. Because of its relatively small load at cruising speed, a lighter vehicle yields major fuel savings.²⁰ Reducing weight by a certain proportion initiates a ripple effect through the vehicle amounting to several times that proportion in reduced energy consumption to move that load.²¹

Traditionally, a military requirement for high speed and agility calls for a lightweight system with reduced protection in lieu of using heavy armor or an inordinate amount of energy to move the system. But how would maintaining the same level of protection at reduced weight affect the relationship between effectiveness and efficiency? By reducing weight, we decrease the amount of energy necessary to move the system. Reducing weight by a sufficient amount without sacrificing protection permits the use of drastically different types of motive power—perhaps fuel-cell-powered electric motors instead of gas turbines. The smaller energy requirement then ripples through the entire force; that is, the less energy required for primary mission vehicles, the less fuel transported in secondary support vehicles, which use energy themselves.

Therefore, building lighter systems is desirable and strategically advantageous, perhaps using synthetic materials such as carbon fiber that offer potentially drastic weight reductions and accompanying energy savings. Indeed, the push toward lighter mechanized systems such as the Future Combat System could greatly reduce fuel consumption while maintaining mission-adequate mobility and protection. In the aviation domain, advanced lightweight materials, appropriately engineered into aircraft structures, not only are key to new concepts such as the above-mentioned Blended Wing Body but also may offer great improvements in conventional aircraft designs.

Addressing the three-pole energy-efficiency-effectiveness issue in the development of weapon systems presents a complicated problem; except in the most basic cases, the sheer number of variables defies analytical approaches. However, by taking full advantage of modeling and simulation, developers can “war-game” energy cost/availability and its effect on military operations. The DOD can develop new energy-related metrics and assess their effect on combat performance, much as the Army has used modeling and simulation to assess the impact of switching from its legacy heavy force to the lighter, more mobile Future Combat System. This would allow the use of thermo-economic analysis on a broad scale.²²

Without formal requirements, we could argue that embarking on these efforts wastes time and money, and that resources are better spent on addressing “real,” more near-term, problems. Though perhaps not a near-term issue, energy has become increasingly important and will become more constrained in the future. Therefore, we should assess the effect of changes in the

energy universe now, with or without identified user requirements. The results of such investigations can then inform the development of formal requirements when the user is ready to define them.

Operations and Maintenance Considerations

In the war-fighting arena, the balance between efficiency and effectiveness must tilt toward effectiveness. An efficiency-based solution that may work on a stateside garrison base may not work for an overseas or expeditionary base, particularly one in a combat zone. In combat systems, efficiency is a secondary consideration; effectiveness, based on mission requirements, must remain the ultimate goal.

Today's systems as well as those now in development will be in service for 30 years or more. Figure 3 shows Hubbert's Peak overlaid with acquisition timelines for three of the DOD's most expensive weapon systems, all of them almost completely de-

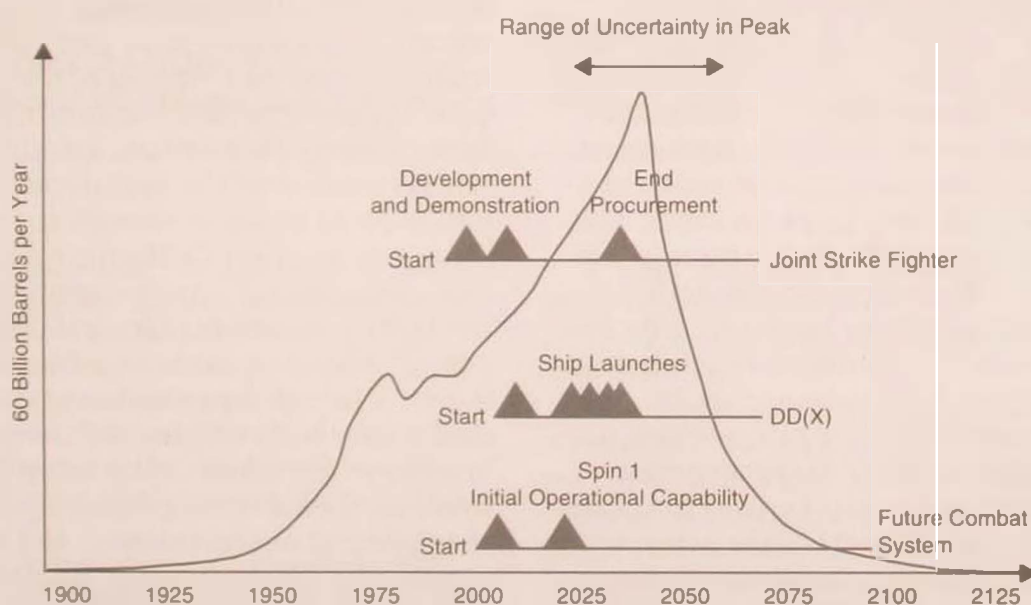


Figure 3. Hubbert's Peak overlaid with typical life-cycle milestones from current acquisition programs. (From "Air Force Proposes Initial Joint Strike Fighter Locations," US Federal News Service, 4 October 2006; Douglas Barrie, "Lightning Strike," *Aviation Week and Space Technology* 165, no. 20 [20 November 2006]: 44; "Future Combat Systems Restructuring: A Balancing Act," US Federal News Service, 8 February 2007; and "Program Schedule," http://peoships.crane.navy.mil/DDG1000/images/scheduleIV_lg.jpg [accessed 21 August 2009].)

signed and in test or early production; advanced lightweighting or power-system technologies may not be viable options for them. Given the massive investment already made in these systems, any DOD energy strategy must accommodate them or risk marginalizing that investment and further delaying needed combat capability.

In these cases, we must assure access to petroleum-like fuels, perhaps via Fischer-Tropsch processing of biomass or coal.²³ We might conceive of DOD fuel plants operated as government-owned, contractor-operated facilities, wherein the DOD essentially supplies itself with its own fuel, much as it does with ammunition from Army plants or depots for refurbishing aircraft and tanks. However, because this would likely become extremely expensive, a better approach might involve subsidizing a domestic capacity normally tapped for civilian use but available for critical military needs.

In other cases, simulators may reduce training-related fuel consumption. For example, unmanned systems offer ways to attain mission effectiveness without the need to train operators in situ. Many unmanned systems such as the Global Hawk are not even directly controlled by the operator, who instead assigns tasks via a system interface; the aircraft then executes those tasks more or less autonomously. For other unmanned systems, operators use synthetic vision as a way of interfacing with them. In either case, the operator cannot tell if the system is real or simulated. Thus, operators can undergo realistic training without becoming airborne.

We also employ simulators to reach unprecedented levels of training fidelity for manned systems. The Air Force, which uses them to reduce training hours on aircraft, has progressed to the point where it can net together simulators from widely separated bases in a distributed mission-training system.²⁴ In fact, not only do these measures save fuel but also they permit training otherwise available only at great cost and effort because of the difficulty in bringing assets together in one location. Most likely, however, these sophisticated systems are best

suited for training on large, complex weapon systems netted together. For operations requiring judgment, skill, and face-to-face interaction in difficult environmental conditions, such as counterinsurgency or special operations, simulators may prove less useful. Fortunately, many of those operations and their accompanying training are much less fuel intensive than large force-on-force engagements.

The consideration of effectiveness, energy, and efficiency for non-war-fighting systems, such as the ones on bases in the continental United States, offers a different set of options for systems designers. In these situations, efficiency can play a larger role. For example, DOD bases, which generally purchase their electricity from local utilities and use organic sources only in emergencies for critical needs (e.g., medical or air traffic control), have begun making changes. The Air Force is using "green" energy sources such as wind power to provide electricity to western bases.²⁵ As the cost of energy increases, DOD installation managers can enhance the efficiency of new buildings and incorporate distributed energy production, for example, by making use of roof-mounted solar panels. The DOD could have its own version of the California Solar Initiative, which commits that state to incorporating photovoltaic systems on a million roofs over the next decade. The initiative could result in enough renewable electricity to offset California's need for five new conventional power stations.²⁶ Finally, the DOD can retrofit older buildings with energy-efficiency measures. The department's share of the stimulus program includes new technologies for increasing efficiencies—for instance, by using electric vehicles, thus reducing consumption on stateside and overseas bases, and by improving the efficiency of jet engines.²⁷

With regard to transportation, most installations operate a fleet of gasoline- or diesel-powered vehicles, many of which travel only a few miles a day and never leave the base. We could address energy efficiency and petroleum dependence by converting these fleets

to alternative energy sources such as flex fuel and electricity, thus reducing energy requirements without sacrificing effectiveness. This is happening now at many bases that use what are essentially heavy-duty golf carts for applications which required a gas-powered pickup truck only a few years ago.

In both the infrastructure and transportation arenas, an opportunity exists for synergy between the civil/commercial and military sectors of the US economy. As Lt Col Michael Hornitschek points out, the DOD has often served as a catalyst for change.²⁸ Even as it saves taxpayer funds and becomes a market by itself, the military can serve as a proving ground for the commercial marketplace. Then, as the commercial market develops, the DOD can capitalize on the economies of scale to meet its needs for energy-efficient non-war-fighting systems. Such approaches must have the support of policy changes that require accounting for true energy costs instead of hiding them during planning, programming, and budgeting.²⁹

Conclusion

Reducing our dependence on foreign oil can have beneficial strategic and economic

effects. It would diminish the Middle East's strategic importance by making the United States less reliant on that troubled part of the world. It would also reduce friction points with countries such as China, with whom the United States will face increasing competition for energy sources. Finally, it would reduce the likelihood that countries controlling those sources could dictate events and conditions to the United States. Clearly a long-term issue, energy will have a major effect on where, when, and with what the DOD fights.

However, the issue is not simply about reducing our use of energy and increasing our efficiency. Because of the high stakes that accompany military operations, we must focus first on effectiveness, thus creating a tension between efficiency on the one hand and effectiveness on the other and necessitating approaches that seek an optimum solution appropriate for the mission at hand. We must balance the ends we seek, the ways we attain them, and the means we use. In tomorrow's energy-constrained world, we can do this only by taking a systems-level perspective that attempts to strike a true strategic balance among effectiveness, efficiency, and energy. ☆

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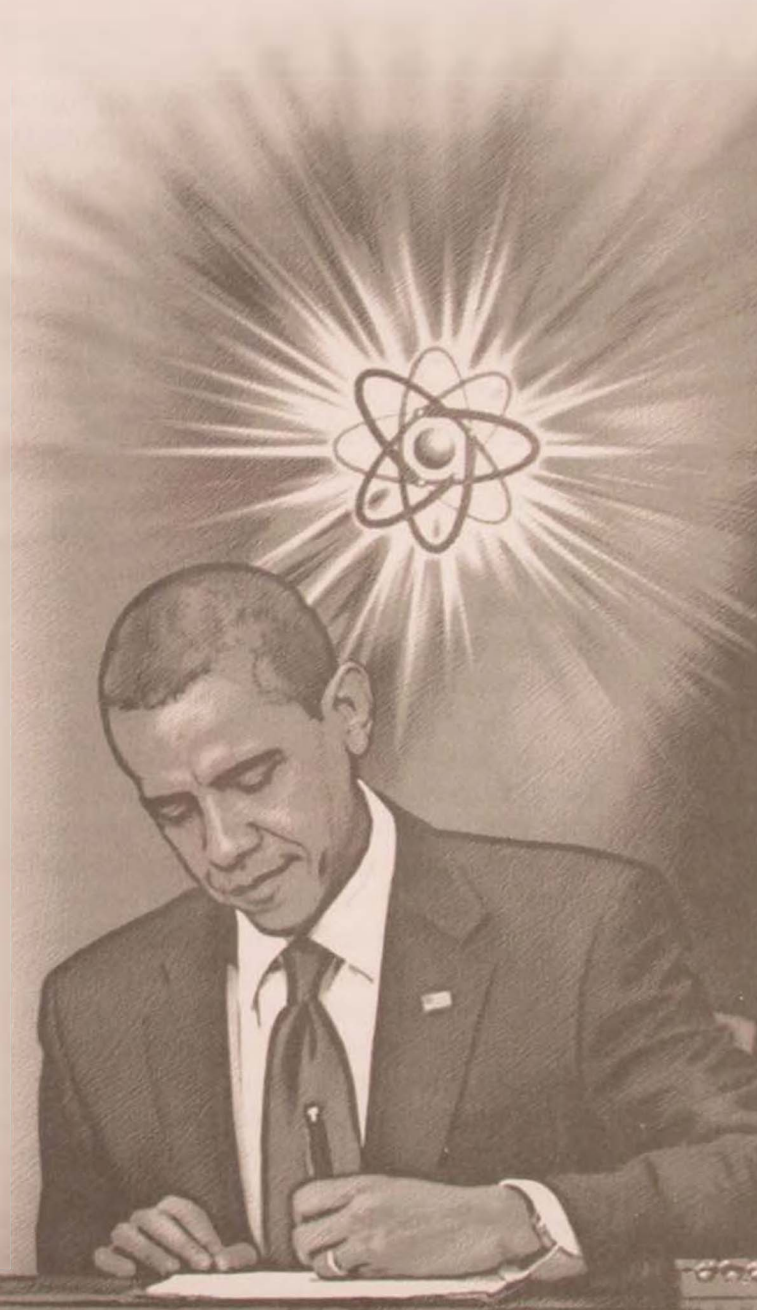
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US Nuclear Deterrence

An Opportunity for President Obama to Lead by Example

Group Capt Tim D. Q. Below, Royal Air Force

Although the United States has undertaken significant nuclear arms reductions since the end of the Cold War, as has Russia, and is currently on track to achieve the cuts agreed under the terms of the Moscow Treaty by 2012, many people argue that the contemporary security environment warrants further reductions.¹ The *Nuclear Posture Review* of 2002 formally recognized the termination of an adversarial relationship with Russia and set out a move away from a Cold War-styled "threat-based" approach, instead adopting a "capability-based" approach. This would provide a "credible deterrent at the lowest level of nuclear weapons consistent with U.S. and allied security," with the broadest possible range of options to respond to any one of a variety of security challenges.² The capability-based approach established a "new triad" composed of offensive nuclear and non-nuclear strike systems, active and passive defenses, and a "responsive nuclear infrastructure."³ On 5 April 2009, Pres. Barack Obama gave a groundbreaking speech on nuclear weapons in Prague, Czech Republic, stating the United States' commitment to the visionary goal of "the peace and security of a world without nuclear weapons."⁴ Working in the strategic environment, this article considers the direct and indirect nuclear threats to the United States and evaluates the relative merit of retaining extant US nuclear force levels, undergoing complete nuclear disarmament, or implementing unilateral denuclearization



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to the level of minimum deterrence.⁵ It concludes that the United States should denuclearize now to an objectively determined level required for true minimum deterrence, reject the first use of nuclear weapons, and unequivocally articulate its rationale for so doing.

Nuclear Threats in the Contemporary Global Environment

Direct threats to US security stem from proliferation, risks of accidents and unauthorized or inadvertent use, and nuclear terrorism. Roger Molander, of the RAND Corporation, asserts that "in the near future, a large number of countries are each going to develop a small number of nuclear weapons."⁶ The Union of Concerned Scientists considers this the greatest long-term danger confronting both US and international security today.⁷ Moreover, the more widely proliferated nuclear weapons become, the more theoretical opportunities may arise for theft of nuclear material. Conversely, a minority of public proponents argue that wider proliferation may lead to more stability and that the existence of nuclear weapons potentially makes it possible to approach a "defensive-deterrence ideal," reducing the probability of *any* warfare breaking out.⁸ This minority cannot, however, escape the fact that the chances of an explosive accident or an unauthorized or inadvertent launch increase as the number of nuclear states increases.

The *National Security Strategy of the United States of America* (2002) declared that "the gravest danger our Nation faces lies at the crossroads of radicalism and technology."⁹ Similarly, the national security strategy of 2006 is unequivocal in its assessment that, in the wake of 9/11, "there are few greater threats than a terrorist attack with WMD [weapons of mass destruction]."¹⁰ Despite programs such as the Proliferation Security Initiative, hundreds of complete weapons

and even more nonassembled critical weapon components are currently stored in conditions that leave them vulnerable to theft by determined criminals. This parlous state of nuclear security has not gone unnoticed by the criminal fraternity.¹¹ Hans Kristensen, of the Federation of American Scientists, however, considers the threat of nuclear terrorism "very hypothetical" and certainly not something that justifies an "operational nuclear weapon" for a response.¹²

It should be noted that none of the direct threats arise from the use of nuclear weapons by state actors. These actors, however, do present indirect threats to the United States through their potential to inhibit US influence and their contribution to regional instability.

Although China has long declared a "no-first-use" policy, its nuclear strategy is becoming increasingly differentiated.¹³ At the strategic level, although minimum deterrence continues to govern China's strategy, with Russia's nuclear capability deteriorating during a period of conventional US dominance, Chinese policy makers may be turning towards new nuclear strength in order to prevent the United States from securing military supremacy in perpetuity.¹⁴ The greater visible threat, however, is China's regional counterforce strategy, driven largely by developments in South Asia.¹⁵ Here, it could employ a parallel, two-tier strategy, with short-range missiles "useful for political coercion, and, if necessary, for defeating Taiwanese military forces, while its long-range missiles induce restraint by the United States."¹⁶

North Korea is one of only two nations (with Iran) identified in the national security strategy of 2002 as posing a serious security challenge to the United States.¹⁷ Apparently, North Korea has produced weapons-grade fissile material and continued its missile-development program with the launch of a Taepodong 2 on 5 April 2009. In a stance reminiscent of superpower attitudes during the Cold War, most analysts believe that the North Korean re-

gime views nuclear weapons as a means of retaining the status quo, preventing the collapse of its totalitarian regime, and keeping its enemies at bay.¹⁸ More specifically, the objective of a North Korean nuclear capability might even be only to preclude US intervention in a regional conflict.¹⁹

As a *de facto* nuclear power, India offers a rationale for nuclear weapons driven by three factors.²⁰ First, several Indian leaders judge that "India is a great power and should have weapons that great powers have."²¹ Second, India does not view the Nuclear-Weapon States' (NWS) positive security assurances as an adequate level of reassurance in lieu of the nuclear weapons that the Non-Nuclear-Weapon States (NNWS) have had to forgo under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT).²² Third, India perceives that China poses a major threat. Unfortunately, Indian policy generates regional conflict, driving Pakistan's nuclear strategy, whose sole declared reason for holding nuclear weapons is to deter any possible Indian aggression.²³

Israel's official posture is one of calculated nuclear ambiguity. As the only extant presumed nuclear power in the region, Israel holds as declared "policy that it will not be the first to introduce nuclear weapons into the Middle East."²⁴ Meanwhile, Iran is pursuing programs that could enable it to develop nuclear weapons within several years. Its acquisition of nuclear weapons could prove extremely destabilizing within the Middle East, and "spillover" from a nuclear Iran would present a variety of regional threats, not the least of which is emboldened support for terrorism and Shia activism.²⁵

Often classified as a "former" threat, Russia today poses no realistic threat of premeditated nuclear attack.²⁶ Nevertheless, of the five NWSs, Russia is the only one, apart from the United States, having a four-figure arsenal of nuclear weapons; moreover, the *Nuclear Posture Review* of 2002 describes Russia as a possible resurgent threat and peer competitor of the future.²⁷ The remaining two nuclear powers—the United King-

dom and France—pose little threat to global or US security. The rationale for both forces was well expressed in a speech delivered by French president Jacques Chirac in 2006: "In the face of the concerns of the present and the uncertainties of the future, nuclear deterrence remains the fundamental guarantee of our security. Wherever the pressure comes from, it also gives us the ability to keep our freedom to act, to control our policies, to ensure the durability of our democratic values."²⁸

Retention of the US Nuclear Weapons Status Quo

Deputy Secretary of Defense Keith Payne justified the rationale for the numbers of warheads specified in the Moscow Treaty only in the terms used in the 2002 *Nuclear Posture Review*: assurance, dissuasion, deterrence, and hedging.²⁹ When interviewed in 2002, John Bolton, undersecretary of state for arms control and international security, explained the rationale simply as "Uncertainty. Uncertainty about the world. Uncertainty about the geostrategic circumstances that we might face due to threats that we can't foresee."³⁰ With the exception of dissuasion, all of these concepts date back to the Cold War. Nevertheless, they are used here to evaluate the benefits, costs, and risks of retaining the US nuclear weapons status quo in the modern security environment.

In a joint submission to Congress in 2007, Secretary of Defense Robert Gates, Secretary of Energy Samuel Bodman, and Secretary of State Condoleezza Rice reasserted the United States' continuing intention to "assure our allies that the U.S. nuclear arsenal continues to serve as the ultimate guarantor of their security, thus obviating any need for them to develop nuclear weapons of their own."³¹ Furthermore, they stated that the warhead levels mandated by the Strategic Offensive Reductions Treaty (SORT) were sufficient and necessary to "demonstrate to allies and adversar-

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ies alike that the United States has the necessary means, and the political will, to respond decisively against aggression and the use of weapons of mass destruction."³² This is an important consideration in limiting proliferation among allies since nations such as Japan, South Korea, and Taiwan in particular are concerned states that could pursue their own nuclear programs if they felt that the American umbrella was in any way uncertain.³³

Nuclear weapons are uniquely effective for deterrence because they are enormously destructive and can be delivered in swift retaliation. Indeed, nuclear deterrence can even prove effective against an irrational adversary when nuclear weapons threaten his very existence.³⁴ Nevertheless, it is important to keep the nuclear threshold high to maintain credibility, and recent administrations have considered a degree of strategic ambiguity also useful in extending the effectiveness of nuclear deterrence.

Considering Russia a potential contingency when developing the 2002 *Nuclear Posture Review*, the United States scaled its responsive-force arsenal for any possible future change in Russian policy direction or deterioration in bilateral relations.³⁵ This is wise since following a prudent and conservative path for future nuclear forces has merit, given the rapidity with which the geopolitical situation can change.³⁶ The maintenance of a fallback posture sufficient to deter a resurgent Russia also has the automatic benefit of avoiding uncertain national and regional threats such as an ascendant China.³⁷

The costs and risks of maintaining current force levels include lack of transparency of current nuclear arms-control treaties; erosion of nuclear credibility; risks of proliferation accruing from retention of the current arsenal; risk of inadvertent or unauthorized use; and budgetary issues. An unusual aspect of the Moscow Treaty is the fact that, upon US insistence, it includes no verification measures. Neither does it require the destruction of warheads. Instead, the treaty allows their retention so long as

they are not operationally deployed. Despite the current relatively cordial relations between Russia and the United States, the uncertainty which this generates undoubtedly influences strategic planning assumptions and may itself be used as justification for the stockpiled retention of newly non-operational warheads in a spiraling cycle of uncertainty and mistrust.³⁸

The Defense Science Board Task Force has consistently questioned the continuing credibility of the US nuclear deterrent to effectively threaten and destroy a range of critical targets.³⁹ Deterrent value, in simplistic terms, is a function of both capability and will.⁴⁰ The capability provided through the 2002 *Nuclear Posture Review* was considered earlier. Here, the will is in question. Writing in 1994, Paul Nitze asserted that US decision makers would likely prove unwilling to use nuclear weapons in retaliation for aggression.⁴¹ Former secretary of defense Robert McNamara went further, contending that use of nuclear weapons against a non-nuclear state would be both "militarily unnecessary, morally repugnant, and politically indefensible."⁴² These historical, military, moral, and political considerations combine to "self-deter" any nation, including the United States, from the employment of nuclear weapons, accordingly undermining the credibility of their theoretical employment.

McNamara judges that the United States' retention of its nuclear arsenal as a mainstay of military power sends the message to the NNWSs that America, "with the strongest conventional military force in the world, require[s] nuclear weapons," thus undermining nonproliferation efforts.⁴³ Moreover, current US nuclear policy insinuates the legitimacy of nuclear weapons and is in fact considered "the strongest imaginable rationale for other countries to acquire nuclear weapons."⁴⁴ Indeed, the United States' retention of nuclear weapons at the present substantial, forward-deployed levels ensures that Russia will do the same and may result in a Russian security dilemma

entailing dangers of erroneous, accidental, or unauthorized use that can no longer be justified by any plausible need for this many weapons. Yet, nobody is forthcoming on what threats justify the maintenance of this posture, with the associated acceptance of this risk.⁴⁵

Once nuclear employment loses credibility, it follows that paying the price to retain nuclear capability is nugatory and that a nation would do better to abandon it, especially when that price is high. Referring to the Stockpile Stewardship Program, the Secretary of Energy's Advisory Board concluded in 1995 that "current business-as-usual is not 'financially sustainable.'"⁴⁶ Meanwhile, in terms of financial cost as well as technical feasibility, even the 2002 *Nuclear Posture Review* accepts that refurbishing existing warheads over the next two decades will present "a major challenge."⁴⁷

In sum, the benefits of retaining the US nuclear-weapons status quo (assuring allies, dissuading and deterring adversaries, and hedging against uncertainty) exist in tension with the opposing risks of proliferation, inadvertent or unauthorized use, credibility erosion, and the verification opaqueness inherent in the Moscow Treaty. Moreover, whatever the net benefit or cost of these, the financial cost of maintaining the status quo arsenal is significant, while its modernization remains unfunded.

Total US Denuclearization

The *Report of the Defense Science Board Task Force on Nuclear Capabilities* of 2006 concluded that in the post-Cold War era, no viable national consensus exists on the need for and role of nuclear weapons in the security of the United States.⁴⁸ However, President Obama has reiterated that the United States will not disarm unilaterally.⁴⁹ Accordingly, total denuclearization is considered in an omnilateral context, and, according to Frank Miller, Pres. George W. Bush's senior director for defense policy and arms control at the National Security

Council, "the ultimate abolition of nuclear weapons can be attained responsibly only in world conditions far removed from those in which we now live."⁵⁰ In postulating this far-removed world, however, one discovers that the price of realizing such a denuclearized environment entails significant risk and would require considerable international confidence.

In a stable, denuclearized world, all of the direct-threat categories of proliferation, accidental and unauthorized or inadvertent use, and terrorism, as well as indirect threats arising from restraint on US influence and regional nuclear instability, would be eliminated. However, the de facto great-power status that nuclear weapons capability currently confers upon states would be removed, and the elimination of nuclear weapons would leave the United States, with its currently immense economic and military superiority, as the only indisputable post-Cold War superpower. For this very reason, it is unlikely that either Russia or China would consider nuclear disarmament an acceptable alternative to today's uneasy nuclear balance of power.⁵¹

Gen Lee Butler, the last commander of US Strategic Air Command, posits that "a world free of the *threat* of nuclear weapons is necessarily a world *devoid* of nuclear weapons" (emphasis in original).⁵² In essence, he asserts that the elimination of nuclear weapons themselves represents the only means of eradicating proliferation. But can the nuclear genie be put back in the bottle? Perhaps so, for "uninvention" may prove effectively possible through the natural wastage of human practical knowledge, especially were a formal ban on testing, such as the Comprehensive Test Ban Treaty, to enter into force.⁵³

In 1996 the Canberra Commission on the Elimination of Nuclear Weapons concluded that "the proposition that nuclear weapons can be retained in perpetuity and never used—accidentally or by decision—defies credibility. The only complete defence is the elimination of nuclear weapons and assurance that they will never be produced

again.⁵⁴ Recognizing that the United States currently enjoys continuing conventional dominance, one may conclude that so long as nuclear weapons continue to exist, they will be used or threatened against the United States to gain an asymmetric advantage.⁵⁵ Mikhail Gorbachev concurred in 2005, observing that “ultimately, the only way to avert [the threat of terrorism with WMDs] is to destroy the stockpiles of nuclear . . . weapons.”⁵⁶

Although Ambassador Ronald Lehman asserts that a nuclear-free world “will undoubtedly spend significant resources insuring that it remains denuclearized,” the price of doing so will be less than for retaining or modernizing an aging nuclear capability.⁵⁷ Moreover, although the costs of retaining nuclear arsenals are borne only by those nations that hold them, all nations could expect to share the expense of maintaining a nuclear-free world, albeit unevenly, for the common good.

Christopher Ford, US special representative for nuclear nonproliferation, identified six criteria concerning the necessary global security environment that must be achieved and maintained in order to free the world of nuclear weapons.⁵⁸ First, there must be greater trust and an easing of tensions between nations to enable them to transcend competitive military dynamics. Critics argue that such an environment of international transparency and trust is too far removed from today’s security situation to be attainable. They may be correct. Yet, as General Butler said, “Elimination is the only defensible goal, and that goal matters enormously.” He is adamant that a clear and unequivocal commitment is essential to achieving this goal.⁵⁹

Second, all states must have robust faith in enduring adherence to the nonproliferation goals of the NPT. A proliferation paradox becomes particularly important as the levels of nuclear weapons reduce towards zero: for regional powers, adversaries or otherwise, the less dependent the United States becomes on nuclear weapons, the more attractive their acquisition becomes.⁶⁰

This “clandestine catch” is the fundamental problem facing proponents of total denuclearization.⁶¹ Furthermore, a nonnuclear world might result in only a *latent* instability, such that a rush to rearm would occur should disagreement regarding a vital interest one day reemerge, presenting its own novel set of unpredictable security risks.⁶²

Third, there must be equal confidence that illicit proliferation by both state and nonstate actors has been irreversibly eliminated. This would require putting extensive safeguards in place and strictly enforcing them. Such a regime is incompatible with the current nonverifiable arms reductions and disdain for intrusive inspection regimes. Yet, it is verification that engenders confidence and predictability.⁶³ Moreover, one of the greatest long-term proliferation challenges today is that dual-use nuclear technology complicates the positive identification of facilities having military purposes.⁶⁴

Fourth, considering security through only nuclear and conventional lenses is incomplete, and the pursuit of *all* types of WMDs must be verifiably halted across the globe. The 2006 *Report of the Defense Science Board Task Force on Nuclear Capabilities* contends that the idea that a nuclear-free world is safer for the United States because it would dominate a conventional-arms-only world inadequately addresses the variety of WMD threats confronting the United States.⁶⁵ The task force views US nuclear capability as a required deterrence against chemical and biological threats already outlawed by international convention and forsworn by the United States.⁶⁶

Fifth, deterrent mechanisms for the consequent nonnuclear environment would need to be fully understood in order to prevent the world order from collapse. Arguably, the nuclear threat has successfully kept the United States and Russia from going to war with each other since 1945, and “one should be extremely cautious in making radical changes to a strategic situation that has served the world successfully for decades.”⁶⁷

Finally, provisions would need to be in place assuring that reversion to nuclear weapons, either through "breakout" or clandestine development, would be met with a swift, effective, and robust nonnuclear response. However, proponents agree that the necessary mechanism already exists within the NWSs' positive security assurance, describing the idea that a small state might be able to develop and employ nuclear weapons as "just nonsense" since the major powers have the capability to crush such a player out of existence conventionally.⁶⁸

Overall, should nuclear weapons be globally eliminated, the three prime contemporary nuclear threats to the United States would be eliminated with them, and that nation would emerge as the undisputed sole world power. However, the prerequisite for global denuclearization is the surmounting of associated costs and risks of international confidence, attainment of which at present remains illusory.

US Denuclearization to the Level of Minimum Deterrence

Cold War nuclear philosophy centered on the assured elimination of Soviet nuclear forces and infrastructure. The modern threat environment is entirely different. A fundamental difference exists between the capabilities required for war fighting and those for war deterring.⁶⁹ The contemporary role of US nuclear weapons is to deter aggression, with the potential to apply pain to any aggressor *only until that aggression is terminated*.⁷⁰ A US policy shift already appears to have occurred and "the U.S. . . . strategic dialogue no longer focuses on the question of *how many weapons are enough?* But . . . has shifted to . . . the flip side of the question, *how few are enough?*" (emphasis in original).⁷¹ Moreover, Harold Brown, secretary of defense from 1977 to 1981, argued that purely deterrent forces, and their size, "can perhaps be made substantially, though not completely, insensitive to changes in the posture of an opponent."⁷²

Several nuclear strategists suggest that the current security situation warrants a significant, unilateral reduction in the number of US nuclear warheads. Some of them propose that a figure in the hundreds may be achievable.⁷³ Given the uncertainty of international reaction to unilateral US nuclear arms reductions, initial decreases should be reversible, enabling the United States to hedge against uncertainty. Moreover, despite the feasibility of unilateral US reductions to approximately 1,000 warheads, decreases below that level would need to proceed in consultation with all of the other nuclear powers.⁷⁴

A minimum-deterrence posture generates a more realistic sense of proportional-response capability than that of post-SORT arsenals. Moreover, because minimum-deterrence force levels lend credence to the concept that nuclear weapons are genuinely being held only as the "instrument of last resort," a minimum-deterrence posture enhances their credibility, especially if lower-yield weapons are employed.

Although Kenneth Waltz might disagree, John Deutch asserts that any degree of denuclearization has a beneficial effect on containing proliferation.⁷⁵ The Union of Concerned Scientists argues that claiming the right to use nuclear weapons preemptively in certain circumstances removes the incentive for nations to remain nonnuclear. Given the awesome and unrivalled superiority of US conventional forces, as expressed as far back as 1993, "there is no visible [conventional] case where the United States could be forced to choose between defeat and the first use of nuclear weapons."⁷⁶ In the absence of any conceivable requirement for the first use of nuclear weapons, the United States should adopt a declared no-first-use policy.

In addition, the combination of an unambiguous posture of minimum deterrence and a declared no-first-use policy would enable the United States to further reduce its nuclear-alert status. This would significantly decrease the possibility of accidental

or inadvertent launch yet maintain the desired level of deterrence.⁷⁷

The cost of maintaining a nuclear arsenal is significant. Opportunities to reduce nuclear expenditure through denuclearization to minimum-deterrence levels could accrue from each of the following: reducing the volume of the nuclear warhead arsenal; reducing the diversity of nuclear warheads; retracting to a single delivery option; and dealerting personnel and delivery systems.

Unilateral reductions in the number of nuclear warheads towards a position of minimum deterrence, coupled with retraction to a single delivery option, would gain the attention of the NNWSs and NWSs alike, building international confidence along the road to total denuclearization. Moreover, reducing the role of nuclear weapons in international affairs would further bolster this confidence while significantly enhancing the United States' standing in the international community.⁷⁸

The nuclear postures of both the United States and Russia affect the nuclear strategies of all other states indirectly through a "loose coupling."⁷⁹ In addition to the direct benefits of gaining the attention of the NNWSs and building international confidence, unilateral disarmament would have the second- and lower-order effects of preparing the ground for the safe management of the proliferation paradox as nuclear weapons later reduce towards zero.

A reduction in US forces to minimum-deterrence levels would nevertheless require the United States to reconsider and potentially retract its global positive-security assurance since it may not be supportable with only a truly minimum-deterrent force. The United States can likely reduce its arsenal to some degree without triggering either first-order or other cascading proliferation effects, but it is not clear what that degree is; furthermore, if the NNWSs were confronted with a choice between significant US denuclearization or retention of US security assurances, their reaction remains unknown.

Of all the costs of adopting a minimum-deterrence posture, a potential reduction in US coercive power might be the most significant. Even a perceived reduction in coercive power available to bring to bear on Iran compared to that employed in the United States' unsuccessful nonproliferation campaign against North Korea might prove unpalatable for America. Any deterrence at minimum levels in the post-Cold War era remains uncertain because there is little historical precedent for it. Intangible *goals of honor*, related to values not held by Western cultures but prevalent in the origins of war across centuries of conflict, may become ever more tangible in an increasingly diverse world.⁸⁰

Certainly, the NNWSs have a valid argument that, to be effective, weapons reductions should be both irreversible and verifiable. Reductions under SORT, in contrast, are reversible. Nevertheless, by disarming transparently (if initial disarmament steps were well received by the international forum), reductions could theoretically then be made verifiably irreversible. However, given the very nature of international uncertainty, the practical difficulty of predicting future security requirements with the level of confidence required for making reductions irreversible should not be underestimated.⁸¹

The new triad expounded in the 2002 *Nuclear Posture Review* no longer specifies diverse delivery options. With their unparalleled survivability and the capacity to accommodate an operational force of up to 1,000 warheads, the extant US fleet ballistic missile submarines could be fielded as the sole arm of US nuclear deterrence.⁸² However, as the variety of warhead designs and delivery options diminishes, the capability impact of a latent failure in any given system rises.⁸³ Theoretically, these concerns could be mitigated by retention of a small number of each of a wide selection of weapons systems. However, the infrastructure and maintenance costs per warhead would make the expense of such a policy prohibitive.

On balance, despite the significant risk that adopting a posture of minimum deterrence with a no-first-use policy may not yield all of the desired benefits, it at least has the potential to constitute what General Butler describes as a waypoint along President Obama's desired path towards total elimination.⁸⁴ Moreover, initially reversible reductions can contain the cost of failure without incurring an enduring level of risk to US security beyond that which prevails today.

Conclusion

This article's analysis reveals three underpinning US strategic objectives: to reduce the global volume of nuclear material in the world, to eliminate proliferation, and to improve regional stability. Maintenance of the status quo is contrary to all three. Conversely, provided that nuclear arsenals do not decrease to such a level as to trigger an unstable nuclear arms race, a reduction in the US arsenal would contribute directly to the first of these objectives and, potentially, indirectly to the other two. However, although denuclearization to an intermediate level would retain credibility and incur minimal risk to homeland security, it might result in increased proliferation in the regions of greatest US concern. Such a possibility calls for fostering increased international confidence to manage and contain this risk. Moreover, the intermediate force levels required must be objectively determined by assessing post-Cold War requirements for deterrence and must not be skewed by fallacious relative evaluations benchmarked against obsolete Cold War force levels for war fighting.

Such proposed arsenal reductions are based on the assumption that the United States will not intervene in a regional conflict with nuclear weapons. Adopting that assumption as declared policy would remove any ambiguity in US intent and would have four direct benefits. First, it would underpin a stance of minimum de-

terrence. Second, it would enhance the United States' negative security assurance, contributing to the second objective through the containment of proliferation. Third, it would positively contribute to enhancing regional stability, the strategic objective most difficult to realize directly and thus far unaddressed. Fourth, it would be an enabling step towards total global denuclearization, contributing to the international confidence that must necessarily accompany any disarmament.

The greatest single risk of taking this course of action is that withdrawing the explicit US positive security assurance as the quid pro quo of denuclearization might result in proliferation both in the developed world and in regions of "immediate concern." For their part, those states that shelter under the current US nuclear umbrella must realize that denuclearization of the NWSs is incompatible with the retention of nuclear assurances for allies. This fact is foremost among the implications of nuclear disarmament and would need to be the subject of informed, open, and educated debate to achieve international consensus and provide the implicit reassurance necessary to avoid precipitating international proliferation or regional instability.

Thus, one concludes that the United States should take three concurrent actions: reduce its nuclear arsenal to the objectively determined level required for minimum deterrence; make an associated, unequivocal declaration against the first use of nuclear weapons; and articulate clearly the rationale underpinning these moves. Although these actions would be exemplary of the United States in its role as a responsible great power, the nation would be stepping into uncharted territory and should manage the associated risks to US security by temporarily trading transparency for reversibility. These three steps may represent a bold move, but if the United States wishes to retain its premiership as the world's leader, then it should not shy away from such an opportunity. ☉

Below

Notes

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Culture Clash

Bomber Nuclear Operations in a Post–Cold War World

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A global power requires a conventional bomber force that is aggressive, creative, and decisive. It also requires a nuclear bomber force that provides flawless, positive control of weapons and follows procedure to the letter.

When I joined my first operational unit, after initial qualification training in the B-52, the remnants of Strategic Air Command (SAC) were still prevalent. Older crew members spoke longingly about Mother SAC, hoping that somehow the command would rise again.

Air Combat Command (ACC) had just combined the bombers of SAC and the fighters of Tactical Air Command (TAC). At the time, it was doubtful that one could find two more divergent cultures in the Air Force. SAC represented the force built by Gen Curtis LeMay to deter the Soviet Union. TAC represented the Air Force that would support the Army in a conventional conflict.

Each culture's flight crews disdained the other. TAC warriors saw SAC as a regimented organization that could not improvise. SAC warriors saw TAC as a fraternity of cowboys. Neither understood how the other became the way they were—and probably did not care to understand.

Regardless of who was correct, the bomber community generally accepted that TAC had won the philosophical debate. Therefore, we worked diligently to change the culture to correspond to the new ACC. Training emphasized the conventional mission. The Air Force established a weapons school for the B-52, B-1, and, finally, the

B-2. While these weapons schools continued to teach nuclear weapons, they migrated to a more conventional curriculum.

ACC welcomed these changes, which led to the successful combat debut of the B-2 during the war in Kosovo, during which it "accounted for only 1 percent of all NATO sorties, [yet] the aircraft's all-weather, precision capability allowed it to deliver 11 percent of the munitions used in the air campaign."¹ Kosovo proved that a bomber could lead the fight—even into the most heavily defended areas.

The B-2 again led the initial air strikes in the Afghanistan and Iraq wars. More importantly, the B-1 and B-52 have continued the fight by providing close air support (CAS) to US and coalition forces. Korea taught us that bombers do not do CAS. The invention of munitions guided by the global positioning system enabled us to change that doctrine. However, we cannot attribute effective bomber CAS solely to technology but must acknowledge a change in bomber culture that is now successful and complete.

Unfortunately, the changes were not all positive. The inadvertent flight of a half-dozen nuclear-tipped cruise missiles from Minot AFB, North Dakota, to Barksdale AFB, Louisiana, in 2007 demonstrated, from a nuclear perspective, just how wrong the change in bomber culture had gone. The regimented culture that produced nuclear warriors who did not deviate from the plan was in place for a reason. TAC trained creative warriors who made decisions on the fly, but SAC created warriors who had no greater responsibility than the sure control

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of nuclear weapons, and who carried out decisions made for them by the president.

Now, the Air Force is faced with the prospect of rebuilding the nuclear bomber culture. Yet, it must do so without destroying the valuable conventional culture engendered in the bomber community since the end of the Cold War.

Complicating matters, the bomber fleet underwent significant downsizing, going from 10 B-52 wings in 1989 to two by 1994. Despite the introduction of the B-1 and B-2, the net loss amounted to approximately 100 bombers.²

The larger bomber force structure of the Cold War era created flexible options for the Air Force. The nuclear and conventional B-52 wings could focus exclusively on their respective missions, thus creating distinct cultures between their crews. The conventional B-52 crew members subsequently helped lead the post-Cold War change in bomber culture. In essence, fewer bombers now means fewer options for the Air Force as it tries to revive the nuclear culture.

One solution would involve retaining dual-role bomber wings but somehow increasing the emphasis on nuclear training—not an attractive option. Establishing a culture that is both creative and regimented would prove difficult. A better option would call for creating nuclear and conventional wings, which would entail bringing the B-52H attrition reserve online until a new bomber can be built. In addition, the Air Force should reexamine requirements for nuclear deterrence.

Because a global power must have the ability to deter, it needs a credible force of nuclear bombers. By the same token, because it must quickly project power around the globe, it needs a capable force of conventional bombers. Ultimately, the Air Force must create the force structure to allow the United States the flexibility to do both. In the meantime, we must devise a solution that will rebuild the nuclear bomber culture without destroying the valuable conventional bomber culture we worked so hard to create. ✪

Notes

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The Doctrinal Basis for Reinventing and Sustaining the Nuclear Enterprise

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Reinventing and sustaining the nuclear enterprise relies on a foundation of sound doctrine that provides the guiding principles for (1) ensuring that the United States presents a credible deterrence and (2) fostering a culture which promotes confidence and eliminates the risk of nuclear surety incidents. The new Air Force Doctrine Document (AFDD) 2-12, *Nuclear Operations*, offers this foundation.

Nuclear operations remain essential to the national security of the United States. As affirmed in the *National Security Strategy of the United States of America* (2006), "Safe, credible, and reliable nuclear forces continue to play a critical role."¹ Requisites of an effective nuclear deterrent strategy include a credible capability and the willingness to employ that capability as perceived by those whom one intends to deter. The willingness to employ is a political decision whereas the credible capability is a military responsibility, the preponderance of which the US Air Force shoulders.

Two well-publicized nuclear surety incidents raised questions about the Air Force's ability to present a credible capability and served as indicators of a systemic, corporate decline of that service's nuclear enterprise. One incident, the unauthorized weapons transfer from Minot AFB, North Dakota, to Barksdale AFB, Louisiana, occurred in August 2007. The other incident involved the misshipment of four forward-section assemblies used on the Minuteman III intercontinental ballistic missile (ICBM).² Several in-

vestigations and reports followed these incidents, among them the Air Force's strategic plan titled *Reinventing the Air Force Nuclear Enterprise*, which establishes reinvention of the nuclear enterprise as the Air Force's highest priority. Recommendations from this plan include restoring the culture of compliance, rebuilding our nuclear expertise, investing in our nuclear capabilities, organizing to enable clear lines of authority, providing sustained institutional focus, and reinventing the Air Force's nuclear stewardship role.³

In keeping with these fundamental precepts of strategic deterrence and the Air Force's highest priority of reinventing the nuclear enterprise, the LeMay Center for Doctrine Development and Education at Maxwell AFB, Alabama, recently published the aforementioned AFDD 2-12. That document contains guidance for the Air Force's nuclear operations, based on a body of knowledge gained from experience and lessons learned in organizing, training, and equipping nuclear forces. This new doctrine covers a spectrum of topics that includes fundamentals of nuclear operations, command and control (C2) of those operations, planning and support considerations, surety, and training. In the process of covering these topics, AFDD 2-12 presents doctrinal principles for reinventing and sustaining the nuclear enterprise. This article briefly reviews some of those principles and highlights changes from the previous doctrine of nuclear operations, published in 1998.

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Deterrence and Effects

AFDD 2-12 begins by examining Air Force nuclear operations within the context of the service's day-to-day role as an element of deterrence and as a provider of strategic effects, emphasizing key ideas in boldface. Early in the document, one such statement asserts that "although nuclear forces are not the only factor in the deterrence equation, our nuclear capability underpins all other deterrent elements, and the fundamental purpose of the US nuclear arsenal is to deter an enemy's use of its nuclear arsenal or other WMD [weapons of mass destruction]."⁴ This statement underscores the critical role of nuclear operations in deterrence and, consequently, the importance of maintaining a credible nuclear capability.

AFDD 2-12 also addresses the matter of extended deterrence, another important policy construct. Through alliances and treaties, the US strategy of extended deterrence provides friendly and allied nations a nuclear umbrella that assures them of its commitment to their security. Moreover, it serves as a nonproliferation tool by obviating their need to develop and field their own nuclear arsenals.⁵

Nuclear deterrence is believed to have strategic effects because an adversary's (or potential adversary's) leadership should consider the cost of aggression against the United States, its interests, or its allies so high as to outweigh any possible gain. The actual use of nuclear weapons will also yield strategic effects. AFDD 2-12 emphasizes that "the nature of nuclear weapons is such that their use can produce political and psychological effects well beyond their actual physical effects."⁶ Due to the potential severity of the effects of nuclear weapons, only the president of the United States has the authority to order their use.

The concept of nuclear deterrence has evolved since the Cold War era to adapt to evolving national security requirements. In 2001 Secretary of Defense Donald Rumsfeld observed that "credible deterrence no longer can be based solely on the prospect of

punishment through massive retaliation. Instead, it must be based on a combination of offensive nuclear and non-nuclear defensive capabilities."⁷ The 2001 Nuclear Posture Review codified Rumsfeld's statement by defining a new triad that departed from the Cold War triad's construct of bombers, ICBMs, and submarine launched ballistic missiles (SLBM) (see figure).⁸ However, the conceptual assimilation of this new triad did not fully occur. In fact, a finding of the Secretary of Defense Task Force on DOD Nuclear Weapons Management found that many of those involved in the Air Force nuclear mission did not generally understand the concept of the new triad as articulated in national and defense policy documents. The report went on to recommend that the Air Force update its nuclear doctrine with the new triad concept.⁹ As now contained in AFDD 2-12, the new triad incorporates a mix of strategic offensive and defensive capabilities that include nuclear and non-nuclear strike, defenses, and a robust research and development infrastructure with an industrial base:

Strike Capabilities

Deployed nuclear strike capabilities include the three legs of the previously existing nuclear triad (ICBMs, submarine-launched ballistic missiles, and bombers) and theater-based, nuclear-capable dual-role aircraft. Non-nuclear strike capabilities include advanced conventional weapons systems (long-range, precision-guided weapons and associated delivery means), offensive information operations, and special operations forces which can be used to hunt for mobile missiles or operate against WMD facilities.

Defenses

Active defenses include missile and air defenses. Passive defenses include measures that reduce vulnerability through operations security, communications security, emission security, physical security, mobility, dispersal, redundancy, deception, concealment, and hardening. Passive defenses warn of imminent attack, support consequence management activities that mitigate the damage caused by WMD use, and protect critical in-

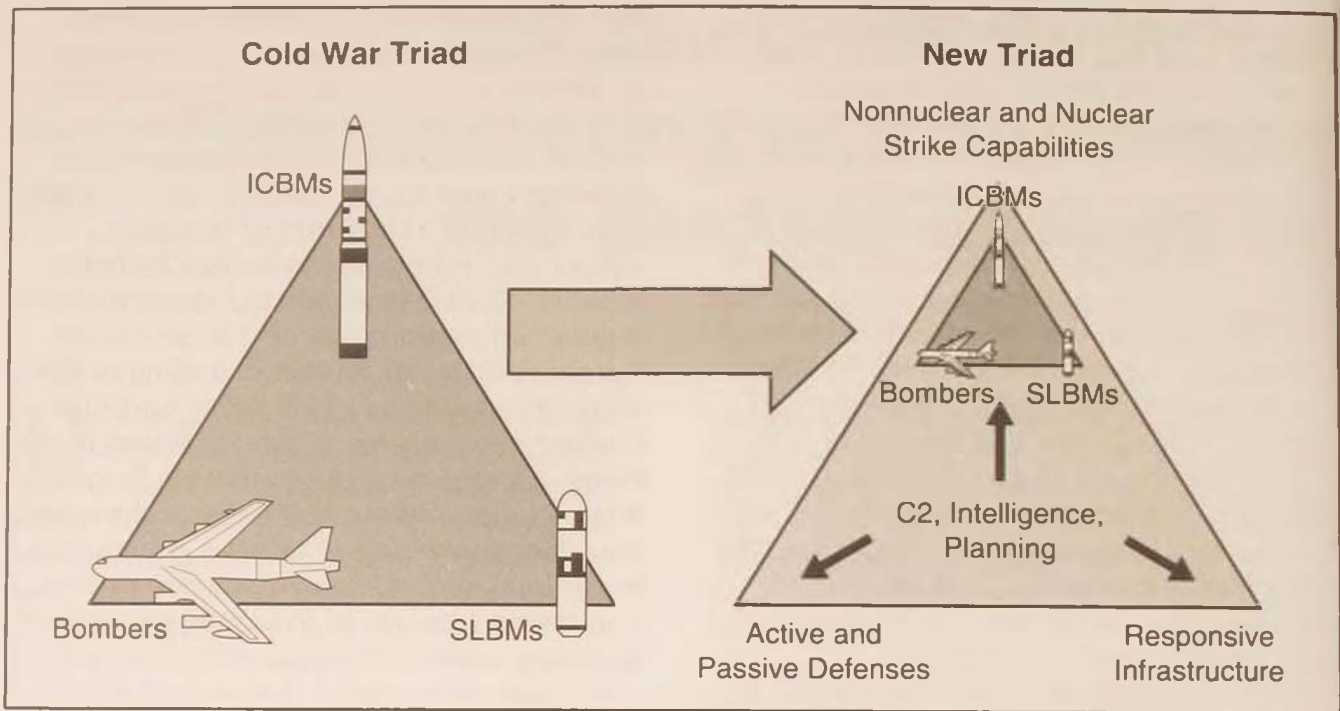


Figure. Comparison of the Cold War triad and the new triad. (Adapted from AFDD 2-12, *Nuclear Operations*, 7 May 2009, 6, http://www.dtic.mil/doctrine/jel/service_pubs/afdd2_12.pdf.)

formation systems. This element of the new triad comprises defenses for the US homeland, forces abroad, allies, and friends.

Infrastructure

This component of the new triad has two elements. First, the research and development and industrial infrastructure includes the research facilities, manufacturing capacity, and skilled personnel needed to produce, sustain, and modernize the elements of the new triad as well as supporting intelligence and C2 capabilities. Second, a responsive infrastructure that can augment US military capabilities through the development of new systems or accelerated production of existing capabilities in a timely manner provides strategic depth to the new triad.¹⁰

Command and Control

Effective nuclear operations require a robust C2 capability that ensures control of nuclear weapons. According to AFDD 2-12, “effective C2 is critical for the proper em-

ployment of nuclear weapons.”¹¹ At the top of the nuclear C2 structure, civilian leaders will always decide whether or not to use these weapons. As mentioned earlier, only the president of the United States has the authority to order their use. A communication system that is survivable, redundant, secure, and interoperable enables this C2 capability. Survivable C2 should be able to operate in a chemical, biological, radiological, or nuclear environment. Redundant systems ensure the availability of communications. Interoperable systems guarantee effective communications across myriad systems employed in this C2 infrastructure.

Nuclear Surety

AFDD 2-12 emphasizes nuclear surety by dedicating a new chapter to the subject. It opens by declaring that “perfection is the standard for the safety, security, and reliability of nuclear weapons operations.”¹² To prevent nuclear accidents, incidents, loss,

or unauthorized or accidental use, the Air Force conducts a stringent nuclear surety program that applies to materiel, personnel, and procedures. Safety, security, and reliability are indeed the hallmarks of such a program.

Strict adherence to directed procedures and weapon system design is critical for safety. This combination provides fail-safe assurance against the unauthorized use of nuclear weapons. Examples include control measures such as inherent features of warhead design that prevent accidental or unauthorized nuclear yields as well as operational procedures that prevent accidental or unauthorized use.

With regard to security, AFDD 2-12 notes that "nuclear weapons and their components must not be allowed to become vulnerable to loss, theft, sabotage, damage, or unauthorized use."¹³ A specialized security infrastructure and highly trained personnel assure the security of nuclear weapons.

The final component of an effective nuclear surety program takes the form of both the weapon system's and the individual's reliability. Sustainment, testing, and modernization ensure the reliability of nuclear weapon systems, whereas that of individuals depends upon assuring that only trained, certified, and dependable people have access to nuclear weapons, delivery systems, and C2 systems. Personnel monitoring allows only those persons whose behavior demonstrates integrity, reliability, trustworthiness, allegiance, and loyalty to

the United States to perform duties associated with nuclear weapons.

Certainly, all individuals working in nuclear operations are responsible for safety, security, and reliability, but commanders especially must guarantee the effectiveness of the nuclear surety program. AFDD 2-12 expresses the effects of successful nuclear surety: "Adversaries and allies should be highly confident of the Air Force's ability to secure nuclear weapons from accidents, theft, loss, and accidental or unauthorized use."¹⁴

The importance of nuclear surety cannot be overemphasized. Effective strategic deterrence requires a credible capability attainable only with an effective nuclear surety program. Such surety begins with knowing the doctrinal principles contained in AFDD 2-12.

Conclusion

Nuclear operations and their contributions to strategic deterrence will remain a critical aspect of US national security strategy. Effective deterrence requires the military to present a credible nuclear capability so that an adversary's (or potential adversary's) leadership will believe that the cost of aggression against the United States, its interests, or its allies will be so high as to outweigh any possible gain. A reinvigorated and sustained nuclear enterprise yields a credible capability. AFDD 2-12, *Nuclear Operations*, offers the doctrinal basis for realizing just such an enterprise. ✪

Notes

1. *The National Security Strategy of the United States of America* (Washington, DC: White House, March 2006), 22, <http://www.strategicstudiesinstitute.army.mil/pdffiles/nss.pdf> (accessed 10 September 2009).

2. *Report of the Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase I: The Air Force's Nuclear Mission* (Arlington, VA: Secretary of Defense Task Force on DOD Nuclear Weapons

Management, September 2008), 13, http://www.defenselink.mil/pubs/Phase_I_Report_Sept_10.pdf (accessed 10 September 2009).

3. *Reinvigorating the Air Force Nuclear Enterprise* (Washington, DC: Headquarters United States Air Force, Air Force Nuclear Task Force, 24 October 2008), 1, 3, <http://www.af.mil/shared/media/document/AFD-081024-073.pdf> (accessed 10 September 2009).

4. Air Force Doctrine Document (AFDD) 2-12, *Nuclear Operations*, 7 May 2009, 2, http://www.dtic.mil/doctrine/jel/service_pubs/afdd2_12.pdf (accessed 10 September 2009).

5. *Ibid.*

6. *Ibid.*, 3.

7. US Senate, *Statement of the Honorable Donald H. Rumsfeld, Prepared for the Confirmation Hearing before the US Senate Committee on Armed Services, 107th Cong., 1st sess., 11 January 2001, [4]*, <http://armed-services.senate.gov/statemnt/2001/010111dr.pdf> (accessed 10 September 2009).

8. See "Weapons of Mass Destruction: Nuclear Posture Review [Excerpts]," *GlobalSecurity.org*, <http://www.globalsecurity.org/wmd/library/policy/dod/npr.htm> (accessed 10 September 2009).

9. *Report of the Secretary of Defense Task Force*, 3.

10. AFDD 2-12, *Nuclear Operations*, 6-7.

11. *Ibid.*, 12.

12. *Ibid.*, 22.

13. *Ibid.*, 25.

14. *Ibid.*, 22.

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The Fire: The Bombing of Germany, 1940–1945 by Jörg Friedrich, translated by Allison Brown. Columbia University Press (<http://www.columbia.edu/cu/cup>), 61 W. 62d Street, New York, New York 10023, 2006, 552 pages, \$34.95 (hardcover).

War is hell—often even more hellish for civilians than for the military. *The Fire* is the English translation of the work originally published in German as *Der Brand*, the latter reviewed by Dr. Douglas Peifer in the Spring 2004 issue of this journal. There is no need to repeat that excellent review here. I would only add that Jörg Friedrich, born in 1944, does not really seem to appreciate the difference between the era of total war and our era of limited war; thus, he focuses on the trials of German civilians under fire. Undoubtedly, that was one of the most terrible experiences in the history of warfare. That Friedrich elsewhere castigates Nazism and the Holocaust really does not relieve the current work of the notion that it is taken out of the context of total war. Even those of us brought up during the later period know that it is hell, having witnessed the experiences of Vietnamese, Korean, and many other civilians who have suffered enormously as a result of war. Nothing much in *The Fire* is new or unique, and its poor organization makes for very difficult reading. The air warrior/scholar certainly knows that war is hell and has found that out from many other works on strategic bombing in World War II which are better balanced and set in context. The record shows that the military in general already understands this—so much so that civilian leadership often had to push it into war. Air warriors/scholars

cannot afford to spend their limited reading time on more than 500 tedious pages to discover what they already know.

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Defence from the Skies: Indian Air Force through 75 Years by Air Commodore Jasjit Singh. Knowledge World Publishers (<http://www.knowledgeworldonline.com>), 5A/4A Ansari Road, Darya Ganj, New Delhi 110002, 2007, 280 pages, \$75.00 (hardcover).

Tracking the birth and growth of one of the oldest air forces in the world is not an easy task, considering the diversity of platforms, roles, and theaters with which the Indian Air Force (IAF) has had to cope over the last 75 years. A number of good books have been written on the history of the IAF, the most recent *The History of Aviation in India: Spanning the Century of Flight* by Mr. Pushpinder Singh. However, a void existed with regard to the interpretation and analysis of events as they unfolded over the years. Filling this void was possible only if someone who has participated in the IAF's growth, and then tracked it with a magnifying glass from the outside, was willing to stick his neck out to forthrightly and substantively dissect events, strategy, and doctrine as they actually unfolded.

On that count, Air Commodore Jasjit Singh does not disappoint. By any yardstick, *Defence from the Skies* is a definitive and seminal contribution that needs to be read, digested, and reread. What is it about this book that differentiates it from others on the history of the IAF? First, its sheer canvas is sweeping and fast moving. Second, the author's ability to analyze events and campaigns is clinical, to say the very least. Third, his weaving of history, policy, and doctrine into a framework for the future has to be seriously considered by our strategic community.

A number of pioneers of the IAF, Air Chief Marshal P. C. Lal notable amongst them, have tracked and interpreted events up to the 1971 war with Pakistan. Air Commodore Jasjit has rightly concentrated on events that, in his opinion, needed greater clarification during the early years. He has put the reluctance to use airpower in 1962, despite having platforms to effectively interdict the Chinese forces, into the correct perspective and attributed that aversion to the lack

of all-around knowledge about the capabilities of airpower on the part of both politicians and ground commanders. The author devotes much space to jointness in the various conflicts that India has fought. How many of us knew that in May 1948, when Air Commodore Mehar Singh made his historic landing at Leh in a Dakota (a DC-3, in common US parlance), Maj Gen K. S. Thimayya—then a divisional commander—was on board, along with his troops, in a display of brave jointness? That Pakistan launched a preemptive air strike in 1965 is common knowledge. Until this book came out, however, it was also widely accepted (even by our own Ministry of Defence archives) that beyond an air stalemate, the IAF did not dent the Pakistani Air Force's (PAF) capability. Armed with telling statistics, Air Commodore Jasjit has embarked on a spirited rebuttal of the common perception that the PAF emerged as a victor in the 1965 air war. The fact of the matter is that the bulk of IAF losses occurred as a result of the opening days' preemptive strikes on both the western and eastern theaters in the form of aircraft parked on the ground. A comparison of aerial losses thereafter shows that the IAF suffered much lower attrition than did the PAF. So much for perceptions. The author is very candid about the total lack of synergy between the IAF and the Indian Army during the 1965 war, attributing it to a mind-set that looked at the IAF as merely a tactical air force—a holdover of World War II. Shifting to analysis assessment, did anyone realize that the Israeli Air Force drew a page out of the PAF's tactics and launched its stunning preemptive strike in 1967, decimating the Arab air forces before they could take to the skies?

The author offers two fresh perspectives on the Battle of Longewala, a glorious chapter in the history of the IAF. Why, he asks, did the Pakistani 18th Division advance in the open desert without air cover? Did its members forget Rommel's experience in the North African desert during World War II, when the Royal Desert Air Force inflicted critical damage on his supply lines and significantly aided Field Marshal Bernard Montgomery's victory? In the same battle, the author questions the tactical employment of only four Hunter aircraft against the 18th Armored Division when more were available at Jodhpur and Uttarlai airfields. An authority on the employment of airpower in the Kargil conflict, the author has written a separate book on the subject—no doubt the reason why the chapter on Kargil in *Defence from the Skies* is crisp, extremely well

written, and effectively illustrated with good maps. The role of the IAF in peacekeeping missions has been highlighted only in recent years, and the author reinforces this with some extremely interesting extracts from his brother's diary that describe the peace-enforcement mission in the Congo during 1961, when IAF Canberras performed magnificently. The last few chapters offer some extremely good ideas on lessons from the past, our desire for self-reliance, and airpower's coming of age in the 1990s. A passionate believer in the strategic capabilities of airpower, Air Commodore Jasjit spares no effort in suggesting doctrinal changes that would enable the IAF to cope with the challenges of future warfare. He is also quite critical about the lack of understanding of airpower and its capabilities on the part of politicians through the years and counters the myth that only airpower is escalatory. In fact, airpower de-escalated the situation during the Kargil conflict.

I wish that the author had thrown some light on the Karachi air strikes of 1971, as it may have put to rest the ongoing debate over who hit Karachi first—the IAF or the Indian Navy. The expanding role of airpower in subconventional warfare also would have added value to the doctrinal section. The layout of the book, which features excellent photographs, is aesthetic and appealing. Unfortunately, the stiff price tag will make it primarily a library acquisition. A paperback edition, however, would find its place at the bedside of every discerning airpower enthusiast. All in all, *Defence from the Skies* is a superb book and a must-read for anyone who wants to enrich his or her knowledge about the IAF in particular and airpower in general.

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Crisis and Crossfire: The United States and the Middle East since 1945 by Peter L. Hahn. Potomac Books (<http://www.potomacbooksinc.com>), 22841 Quicksilver Drive, Dulles, Virginia 20166, 2005, 224 pages, \$36.00 (hardcover), \$17.56 (softcover).

Peter L. Hahn, author of *Crisis and Crossfire*—part of Potomac Books' Issues in the History of American Foreign Relations series—provides a credible review of US involvement in the Middle East and presidential doctrines covering that

region. Particularly striking are the behind-the-scenes explanations of actions during early US political ventures as well as Middle East peace conferences. Hahn does a splendid job of setting the stage for US political and economic involvement in the area.

Before World War II, US government officials had little interest in the Middle East. "‘Egypt is a charming place to be stationed,’ William J. Jardine, the American minister to Cairo, wrote in 1932. ‘As I see it, there is not much going on here of tremendous importance to my government. . . . It appears to me to be quite a side-show’" (pp. 1-2). One may reasonably conclude that official US involvement in the Middle East after World War II focuses on regional stability to ensure the flow of and US access to Middle Eastern oil. The author illustrates how this interest arose as British influence in the region waned and grew more intense as the US economy became more dependent on foreign oil. Hahn’s ensuing discussion of World War II and Cold War-era US government activities lead the reader through a number of security systems, treaties, and alliances that ultimately set the stage for or helped preclude future conflicts in the region. Furthermore, Hahn shows how US interest has also waxed and waned with the degree of Soviet—and, later, Russian—activity in the region.

The discussion of US presidential doctrine for the Middle East is enlightening. Hahn begins with the Truman Doctrine of 1947 and works his way through to Pres. George W. Bush (current as of 2005). I was happy to see discussion not only about oil-rich Saudi Arabia, Iraq, and Iran, but also about Israel, its neighbors and their collective issues, and US presidential involvement in a search for peace in that part of the Middle East.

At times, it seems that the author’s personal opinions, perhaps shaped by some of the sources he used, intrude themselves into the text. Additionally, I noted with interest a comment by Robert J. McMahan, the series editor, who remarks in the introduction that books in this series will feature a broad international perspective on the external behavior of the United States. However, glancing through the bibliography of primary published sources and secondary materials, one finds little more than a handful of international sources in the secondary materials and none in the primary sources (two-thirds of which consist of the US Department of State’s *Foreign Relations of the United States* volumes).

Despite these shortcomings, as a historical review of US involvement in the Middle East, *Crisis and Crossfire* serves as a good resource. However, readers desiring deeper analysis and perhaps even recommended courses of action for American foreign policy in the region may desire to seek alternate texts.

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Evader: The Epic Story of the First British Airman to Be Rescued by the Com’ete Escape Line in World War II by Derek Shuff. Spellmount Publishers, Tempus Publishing Group (<http://www.spellmount.com>), The Mill, Brimscombe Port, Stroud, Gloucestershire, GL5 2QG, 2003, 216 pages, \$32.95 (hardcover).

On 5 August 1941, dropping from the skies of Belgium, a British Royal Air Force Wellington 1c bomber, call sign "G for George," crash-landed in Antwerp after its first successful bombing raid over enemy territory. The ensuing journey back to Allied lines was a harrowing adventure that Flight Sgt Jack Newman had not expected to take, but through the brave actions of many resistance fighters from Belgium, France, and Spain, he lived to tell his story more than 50 years later to Derek Shuff, author of *Evader*. Many strange twists of fate ultimately led Newman to become the first British airman safely transported through the Com’ete Escape Line.

Newman would eventually split off from the two other airmen from the G for George but not before they barely escaped with their lives. Local resistance fighters suspected that the three airmen were German spies trying to identify both the resistance members who transported downed Allied airmen to safety and the routes they used. A 21-year-old former Belgian Air Force pilot ultimately had to make the decision of life or death for the three airmen. Thankfully, he made the correct one.

Over the next five months, Sergeant Newman stayed at safe houses, met interesting people, and lived with the danger of being captured or killed. At one house, the other occupants were young German soldiers. At another, the mistress of the home was a nun, and her brother, there on a visit, was a "gun-toting monk" (p. 59). On his journey to freedom, he met two pilots (also on the run)—a Canadian and an Australian. For

the remainder of his journey, Newman's guide to safety was none other than the head of the Com'ete Escape Line—a 23-year-old girl, code-named "De'de'e' " (little mother). They traveled more than 1,200 miles into three countries, over a mountain range more than 8,000 feet high, across a rope bridge, and hoped the Spanish would not kill them. Sergeant Newman finally set foot on English soil on 14 January 1942.

More than an interesting read, *Evader* tells a story of survival, luck, selfless sacrifice, and the desire to end German occupation. Shuff incorporates interviews that he conducted with the principals, uses reports written either during the war or just after, and includes photographs as well as personal correspondence. Most of the book reads like a novel, with minute attention to detail and vivid visuals jumping off the page.

Readers will encounter a few minor issues with the book. For example, Americans will find some of the British slang hard to understand, although for the most part, it is confined to the introduction to Newman's life. Changes in font size also prove somewhat distracting but not as much as the constant shifts in point of view—sometimes more than five times in a three-page span.

Nevertheless, I recommend this book to everyone, especially Airmen and readers who have an interest in history and World War II. *Evader* not only demonstrates how a person can survive a harrowing wartime situation through perseverance, training, luck, and the generosity of others but also offers tidbits of information that might help the next Airman who finds himself or herself in Jack's situation—even more than 60 years later.

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Billy Mitchell: Crusader for Air Power by Alfred F. Hurley. Indiana University Press (<http://www.iupress.indiana.edu>), 601 North Morton Street, Bloomington, Indiana 47404-3797, 2006, 204 pages, \$19.95 (softcover).

Many people think of Billy Mitchell only as a martyr to the development of American military airpower. According to author Alfred Hurley, this is the result of overemphasizing one or two sensational elements of his story—especially his highly controversial court-martial of 1925—in biographies, films, and television programs. However, in his recently reprinted biography of

Mitchell, first published over 40 years ago, Hurley sees Mitchell's sensationalism as the means to draw attention to his views on aviation. He presents Mitchell as a tireless crusader for American airpower from 1918 to the end of his life. Instead of highlighting the actions that led to Mitchell's court-martial and his fading from public attention, Hurley focuses on the genesis and development of Mitchell's ideas about aviation and the process of how he progressively acquired, applied, and publicized them.

A retired Air Force general officer, a well-known military historian, and chancellor and president emeritus of the University of North Texas, Hurley has published several books and articles on American airpower, is working on a biography of Curtis LeMay, and has contributed to various historical works and journals. He has taught at the US Air Force Academy as well as Indiana University and has lectured at the National, Army, and Navy War Colleges and Air Force service schools. At the Air Force Academy, he led the development of the well-known symposia in military history, now almost 40 years old. He has also remained active in many historical and educational associations.

Hurley presents Mitchell as a tireless and outspoken advocate for the fullest development of American airpower after he experienced its first real combat use in France during World War I. He reviews Mitchell's wartime and postwar experiences, the origins and evolution of his ideas on airpower, and the waning of his influence after his court-martial and subsequent resignation from the Air Service. Hurley added an appendix to the 1975 revision of the biography, in which he discusses the contributions of George O. Squier, the officer who first introduced aeronautics to the Signal Corps, and he adds material from the transcript of Mitchell's court-martial. Throughout, Hurley avoids the prejudices and extremes of both Mitchell's staunchest supporters and his severest critics to present a fairly evenhanded account of one of America's most controversial personalities and certainly the most controversial of military aviation's pioneers and advocates. In doing so, he provides, in his own words, "the first documented, critical, and hopefully, balanced study of Mitchell and his work" (p. viii).

According to the author, Mitchell returned from Europe "fully determined to bring about a revolution in American military policy by persuasion alone" (p. 39). Unfortunately, his ideas, garnered from his wartime experiences and bor-

rowed from other like-minded European airmen, especially Hugh Trenchard—wartime and postwar chief of the Royal Air Force (the only separate air force to emerge from the war)—were well in advance not only of most of his fellow Army and Navy officers but also of contemporary aviation technology and the views of the American public. For the rest of his life, Mitchell would face similar problems as he continually refined his ideas on the proper and effective use of airpower and propounded these evolving ideas to different audiences through different means.

Other people have seen as sensationalism and deliberate controversy Mitchell's efforts to persuade superiors, fellow officers, Congress, and the American public on the need for a modern and independent air service that could make a distinctive and vital contribution to national defense. By focusing on the origins and continual evolution of Mitchell's airpower ideas, however, Hurley sees them as tactics. For example, the bombing trials of 1921 were not just a demonstration of the ability of airplanes to sink major warships. They were also a means to publicize to the postwar, budget-conscious, "moralistic" Congress and American public one way airpower could contribute to national *defense*, as opposed to demonstrating a purely offensive air force.

Moving forward to 1924, the book shows that the American public, Congress, and new president Calvin Coolidge were even more focused on "normalcy," isolationism, and budget cutting than they were in 1921. Now lacking an issue to drive home his airpower ideas, Mitchell resorted to public accusations and attacks on the failure of senior military officials to provide an adequate national defense and then made "progressively more reckless statements" to keep his name in the headlines (p. 97). According to Hurley, "Mitchell, instead of recognizing this new state of affairs and modifying what he was doing, kept swinging harder until he himself dramatized his case with his own court-martial" (p. 91). After the trial, Mitchell lost favor with the press that had previously supported him and even with the active duty Airmen who believed in the same ideas. His aggressive and extreme tactics, according to Hurley, led the press to refuse his articles and affected the willingness of Airmen to work slowly within "the system" to achieve their goals.

In the end, most of Mitchell's ideas on the use of airpower by an independent air service have proven valid. During the 1930s, the Air Corps Tactical School further refined his airpower ideas

into doctrine for precision strategic bombing during daylight. Although flawed as used during World War II because of the available technology, its implementation ultimately led to the creation of the US Air Force in September 1947. Finally, we can still readily see the influence of Mitchell's ideas in current Air Force doctrine and air operations concerning the use of precision-guided munitions. The issue, as Hurley notes, was Mitchell's erroneous belief that "the realization of his vision would justify the tactics" (p. 139).

Despite the age of *Billy Mitchell: Crusader for Air Power*, it is still compelling and should be read by the general public, students, military historians, and Airmen alike. My only criticism concerns the appendix, added to the 1975 edition to bring the biography up to date. I would have preferred that the author integrate its contents into appropriate chapters of the book rather than include it as a separate section.

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The Army after Next: The First Postindustrial Army by Thomas K. Adams. Praeger Security International (<http://psi.praeger.com>), Greenwood Publishing Group, 88 Post West Road, P.O. Box 5007, Westport, Connecticut 06881-5007, 2006, 336 pages, \$49.95 (hardcover).

The fall of the Soviet Union was a watershed for the US military. The inexorable shift from set-piece warfare through a period of global engagement into an era of international counterterrorism and counterinsurgency wrought serious debate within the Department of Defense. The history of defense transformation is complex. Particularly enigmatic is the chronicle of the US Army's handling of transformation during this period. In *The Army after Next*, defense analyst Thomas K. Adams illustrates "a narrative of army transformation, the attempt to create a postindustrial army, the greatest change in American military structure since the civil war" (p. 3). The title itself represents the ambitious nature of the Army's efforts in contributing to advancement of the revolution in military affairs (RMA). Adams spent 34 years as an officer in intelligence and special-operations assignments ranging from Vietnam to Bosnia. He writes with an air of unabashed objectivity covering two

themes: the RMA and the parallel development of Army and Air Force doctrine.

The author begins his chronicle by highlighting notions that came of age in the late 1990s: net war, cyber war, and information warfare. Additionally, the criteria for an RMA include technological innovation, advancement of doctrine, and organizational adaptation. The main concept in the RMA is the ability to harness vast quantities of information using a centrally controlled network in order to attain information dominance. The concept of information dominance is superior to other theories since it combines a vision of future warfare with military requirements. Adams asserts that information substitutes for mass on the battlefield but criticizes sensor development (the means of attaining information dominance) as an exercise of technology demonstration rather than one piece of a deployable combat system (p. 207). Concerning the RMA, the author is critical of the Army's potential due to the subsequent conflict between change and bureaucratic institutions.

Former secretary of defense Donald Rumsfeld and Army leadership disagreed on programs he viewed as self-serving, particularly those organic to each service. Moreover, Secretary Rumsfeld perceived the Army as retaining the same organizational structure as divisions fighting during World War II—centered squarely on heavy armor. Although armor is perfect for pitched maneuver battles, it is logistically poor. Reorganization of manpower—high on the Army's list of changes—is one area that Adams praises. The Army revamped its organization by removing a layer of hierarchy and laterally distributing forces within the divisions, creating brigade combat teams as a means to increase expeditionary capability and operational maneuverability on the battlefield. In addition, the progeny of new combat vehicles—the Stryker—achieved several goals for the Army: increased lethality with decreased weight, increased deployability without sacrificing vulnerability, and a reduced requirement for logistical support (pp. 80–83).

The Stryker represents the next generation of Army combat vehicles. Designed to be easily deployable, it nevertheless remains a logistically heavy burden for the Air Force. Once the problem of staging the vehicle in-theater is solved, it takes two C-130s to move a vehicle and full crew within the theater. Logistical shortcomings limited the creation of new doctrine—to be based on the premise of a rapidly deployable combat vehicle, which the Stryker most certainly was not.

Operational progress staggered because the Army's field testing took longer than expected. Meanwhile, as testing lurched forward, use of the vehicle in combat proceeded. On the battlefield, however, shortcomings of Army transformation became more apparent. Perhaps the invasion of Iraq was so swift that some Stryker units had to stop in order to receive actionable intelligence on enemy positions from their higher headquarters. On three occasions, units were ambushed during halts. In Adams's estimation, the "Army after next" overpromised and underdelivered. Although American soldiers performed valiantly, the mediocre performance of their machinery highlighted the shortcomings of the network as well as the information dominance required for it to function as conceived. Furthermore, at a staggering cost of \$117 billion covering its development thus far, the Army after next continues to drain defense budgets. Digitization and spiraling costs, as Adams perceives, are the bane of Army transformation. However, digitization is the lifeblood of the Air Force.

The Army sees itself as the primary, decisive war-fighting component—supported by airpower. Until recently, that concept had no rival. The success of airpower during the first Gulf War, however, precipitated an intellectual following for the broad application of airpower. Superficially, Air Force transformation met the criteria for the RMA. In stark contrast with the Army, the Air Force transformed rapidly. It yielded enormous cuts in the bomber force, restructured forces, and overhauled electronic systems in all airframes. During every application of airpower since the end of the Cold War, the Air Force lobbied that the precise application of airpower to the proper targets (centers of gravity) of an enemy can render military victory. Doctrinally, the Air Force proposed full-spectrum dominance: operations harnessing joint capabilities, leveraging information superiority, and covering all intensities of the combat spectrum. As Afghanistan and initial combat operations in Iraq illustrated, airpower is low risk and politically palpable in contrast to otherwise potentially bloody outcomes. Based on Adams's account, Army and Air Force transformation competed, forcing both services to change for the better.

As a study of Army transformation, *The Army after Next* is important to any officer because it offers an unapologetic critique that covers efforts to change fighting systems as well as their organization and doctrine. Adams simplifies inescapable detractors such as the ever-changing lexicon

of transformation and the Army's structural metamorphoses. Transformation is exceedingly complicated in concept and exponentially more complex in execution, a fact ultimately proven on the battlefield. This book's greatest advantage for American Airmen is its ability to reflect evenhanded analysis of the evolution of Air Force and Army transformation—ultimately pointing to the future. Although the benefits of technology are used every day in American combat operations, Adams concludes that the unrealized vision of Army leaders was too far reaching and costly to implement.

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A History of the American People by Paul M. Johnson. HarperCollins Publishers (<http://www.harpercollins.com>), 10 East 53d Street, New York, New York 10022, 1999, 1,104 pages, \$20.00 (trade paperback).

Since the Frenchman Alexis de Tocqueville first cast a curious eye on the American continent in 1831, the United States has been an open book to the world, its successes and failures made known to all. Once again, a European has reached across the Atlantic to examine the American people. The renowned British historian Paul Johnson, author of *Modern Times: The World from the Twenties to the Eighties* (1983) and *A History of the Jews* (1987), has compiled *A History of the American People*, an ambitious one-volume text of American history.

He begins his book by asking three open-ended questions by means of which he seeks to frame the story of the American people: "Can a nation rise above the injustices of its origins [i.e. displacement of Native Americans, slavery, etc.] and, by its moral purpose and performance, atone for them? . . . Have [Americans] forged a nation where righteousness has the edge over the needful self-interest? . . . Americans originally aimed to build an other-worldly 'City on a Hill' . . . to be a model for the entire planet. Have they made good their audacious claims?" (p. 3).

With these questions as background, Johnson traces the history of the nation chronologically, writing in an easy-to-read, storytelling fashion. The book is divided into eight parts, each containing 15–20 sections with such titles as "John Adams and the European War" and "Why the De-

pression Was So Deep and Long-Lasting." One enjoyable feature of the book is the author's interspersed biographical sketches of notable Americans such as Benjamin Franklin, Henry Clay, Jefferson Davis, and Andrew Carnegie.

In addition to explaining significant historical events such as the Louisiana Purchase and the Battle of Gettysburg, Johnson discusses trends that shaped the development of the country. American immigration and birth rates in the early nineteenth century surpassed all historical precedent. The population and economy were able to grow since land was easily available to anyone who would farm it. Johnson asserts that "in the entire history of the United States, the land-purchase system was the single most benevolent act of government" (p. 290).

Aviation makes several appearances in the book: the Wright brothers setting up the country's first public company (p. 623); Gen Jimmy Doolittle's raid on Tokyo (p. 799); the dropping of the atomic bomb from Col Paul Tibbets's B-29 *Enola Gay* (p. 803); the Berlin airlift, which provided "Stalin, and the whole world, with an awesome demonstration of American airpower" (p. 814); and two quotations from Gen Curtis LeMay, who asserted that Vietnam could be "bombed back into the Stone Age" (p. 881).

Beginning with the New Deal era (circa 1933), the book takes a decidedly partisan tone as Johnson makes no attempt to disguise his own conservative political perspective. Considering the limited number of pages allotted to the civil rights movement, the author spends disproportionate effort in criticizing affirmative action and sympathetically explaining President Nixon's involvement in Watergate. Additionally, pages are filled with details of the alleged marital infidelities of Presidents F. D. Roosevelt, Kennedy, and Johnson. (The author himself—as he admitted in 1998—was carrying on an 11-year extramarital affair.) For a supplemental view of American history from a more left-leaning perspective, see Howard Zinn's *A People's History of the United States* (1980). For a history of the American military, see *For the Common Defense: A Military History of the United States of America* (1984) by Allan R. Millett and Peter Maslowski.

A History of the American People is an informative and enjoyable book, bringing to life the history we once learned in the classroom and reminding us why we serve. The book's placement on the Air Force chief of staff's reading list for 2006 serves as a reminder that airpower and space power are not ends to themselves; rather,

they exist and are employed most meaningfully in the defense of a nation worth defending—one that, by learning from its history, can overcome its mistakes and serve as a shining example of democracy.

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Soul Soldiers: African Americans and the Vietnam Era edited by Samuel W. Black. Senator John Heinz Pittsburgh Regional History Center and the Historical Society of Western Pennsylvania (<http://store.pghhistory.org/?cid=10#>), 1212 Smallman Street, Pittsburgh, Pennsylvania 15222, 2006, 218 pages, \$29.95 (hardcover), \$19.95 (softcover).

Whether it was the American Revolution, Civil War, Spanish-American War, or wars of the past century, African-Americans participated to gain full acceptance into society.

Divided into three sections and drawing upon the experiences of eight authors of various backgrounds who come together through the common threads of their views of the war in Vietnam, *Soul Soldiers* will galvanize readers. For example, in "Combat and the Interracial Male Friendship," Herman Graham III relives the history of African-American military participation and argues that the Vietnam War was the first engagement in which blacks and whites fought as equals. This sense of equality, he notes, enhanced a sense of camaraderie to support survival "so that each soldier would do his part to make the collective effort work" (p. 1). Yet he finds that the level of intimacy experienced by service members was socially unacceptable in the civilian world. Racial conflicts reemerged once service members returned to the rear, where they found drug use widespread.

In "Going to Mess Up Some Beasts Tonight," James E. Westheider describes racial conflicts wherein a distinct and nearly complete racial polarization existed at defense installations, where many Southerners provoked fights with blacks, especially those who they believed had become uppity. Other whites embraced notions of black inferiority, thereby helping to complicate the experience of black service persons. The assassination of Dr. Martin Luther King Jr. also helped to increase racial antagonisms. Although some whites were sympathetic to blacks

during this time, others openly rejoiced at the news that the troublemaker had been eliminated. At Cam Ranh Bay, for example, whites raised the Confederate flag in celebration.

In "And Sing No More of War," Kimberley L. Phillips uses poetry to illustrate the black woman's response to the war in Vietnam. She cites June Jordan's poem as an example of the black woman's vocal opposition to the war. Jordan vehemently disagrees with jazz singer Ethel Ennis, who sang the "Star Spangled Banner" at the inauguration of Richard Nixon in 1973, saying, "My sister/what is this song/you have chosen to sing?/. . . to celebrate murder?" (Ennis also sang at the inauguration of Jimmy Carter in 1977 and toured Europe for the State Department in the 1950s with Benny Goodman, Louis Armstrong, and Count Basie.) Yet Phillips quickly reminds readers that many prominent blacks, including singer James Brown and actor Sammy Davis Jr., supported the Nixon administration. Other black poets, including Nikki Giovanni and Carolyn Rodgers, denounced the war. Dr. King's denunciation of the war in 1968, Phillips writes, made it easier for such blacks as actor and singer Harry Belafonte to bridge the gap between activism and civil rights.

Still, some black entertainers feared that open criticism of the government might brand them as Communist sympathizers and precipitate the end of their careers, just as the perception of radicalism ended the career of Canada Lee in the 1940s and that of Josephine Baker in the 1950s. Yet such singers as Nina Simone were galvanized by the violence in Birmingham in 1963 and the murder of Medgar Evers in Jackson, Mississippi, the same year. Simone also collaborated with black poet Langston Hughes in 1968 to write music for his poem "The Backlash Blues." In late 1971, she teamed up with Donald Sutherland and Jane Fonda to perform music and comedy routines in protest of the war.

Heather Stur's contribution, "In Service and in Protest," examines the impact of the war on black women and the black community. Women such as Elizabeth Allen volunteered to go to Vietnam, reasoning that "I knew African Americans were most likely to end up in the battle units, in the death units, and I really wanted to do something [to help]" (p. xiv). The inclusion of black men and women in the military effort, especially after the Tet offensive of 1968, united them to oppose racism and sexism in the military and to view the "Vietnam War as an exten-

sion of the civil rights injustices African Americans fought at home" (p. 86).

Stur observes that in 1967 only 39 percent of the black male population was eligible for the draft as compared to 63 percent of the white male population, yet 64 percent of the eligible black males were drafted as compared to only 31 percent of the eligible white males. According to Stur, a knock on any door in any black community would reveal someone with a son, nephew, or cousin in Vietnam. The unfair draft affected not only the men who served but also the families they left behind. Some families had multiple sons as well as father-son and brother-sister combinations serving in the war. Other families may have had several generations committed to the war.

In "As I Recall . . ." Samuel W. Black contends that the Vietnam War and the Korean War differed from previous military engagements in that they were the first ones fought with an integrated armed force, but the latter war was fought with greater civil and constitutional rights in society for African-Americans. The black military man went beyond the quest for full citizenship; blacks now wanted a redefined patriotism.

Soul Soldiers is a must-read text that provides an in-depth assessment of the military experience of African-American men and women. The installments were written by persons with impeccable credentials; each section is well written, thoroughly documented, and superbly illustrated.

The study nevertheless offers a revealing commentary of American society. It shows the continuation of the legacy of the separate-but-equal tenets of the *Plessy* decision of 1896 despite the signing of Executive Order 9981 by Pres. Harry S. Truman to desegregate the armed forces in 1948 and the role Truman's order played in paving the way for the *Brown* decision in 1954. Samuel Black charges that American society in the Vietnam War era remained "two separate societies, one black, one white—separate and unequal" (p. xi).

Richard Bailey
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The Ash Warriors by C. R. Anderegg. Air Force History and Museums Program (<http://www.airforcehistory.hq.af.mil/publications.htm>), 200 McCord Street, Box 94, Bolling AFB, Washington, DC 20332-1111, 2005, 146 pages, \$21.00 (softcover) (from the Government

Printing Office). Available free at http://www.airforcehistory.hq.af.mil/Publications/fulltext/PACAF_PINATUBO.pdf.

In his first published book, Col C. R. Anderegg, USAF, retired, builds a compelling chronological detail of Clark Air Base's last days during the eruption of Mount Pinatubo. With a gift of forthright storytelling, Colonel Anderegg pieces together the elements of Clark's plight nicely, documenting his own firsthand testimony and interviewing 100 eyewitnesses in this scholarly work.

Originally published in 2000 by Pacific Air Force's history office and reprinted in 2005 by the Air Force History and Museums Program, this book, though certainly a historical record, offers the reader much more. (By the way, for any additional printings, I would recommend adding a subtitle to clarify its contents, such as *The Ash Warriors: How One Base Responded to Volcanic Disaster*.)

I particularly enjoyed reading about the ingenuity of our Airmen, evident in the security force's employment of the F-4 infrared pod to detect thieves and lava flows at night. In addition, the author includes compelling stories of how the use of swimming goggles in the ash storms and backup brick radio generators saved lives. The sometimes uncomfortable stories intrigued me by highlighting the volatility and devastation of the situation. Water shortages forced members of one family to drink from their water bed and others to shower unabashedly in the middle of a Philippine rice paddy. These incidents personalized the hardships of Clark's residents.

The author makes an effort to dispel widely dispersed rumors and misconceptions that arose during the confusion of evacuation both before and after Mount Pinatubo's eruption. For example, having served as vice-commander of the 3rd Tactical Fighter Wing at Clark, he sets the record straight by noting that the F-4s left the base as part of a planned drawdown only a few months earlier than originally forecast—not because of political pressure or volcanic activity.

Additionally, after the eruption, local Philippine news always placed commanders on the defensive by issuing erroneous—often panicked—reports citing, for example, that everyone on Clark had been killed or that the detonation of a US nuclear weapon had actually caused the explosion. The base's public-affairs campaign to inform and direct the public always seemed an uphill battle that never silenced the endless questions and

confusion generated by emergency phone lines, radio call-ins, and media interviews.

Lastly, Anderegg reminds readers of the great leadership at Clark and Subic Bay during the eruption and coinciding hurricane, both of which sealed the fate of all military personnel in the Philippines. Despite the confusion and multiple natural disasters, not one US citizen died—everyone evacuated safely.

Would the American military still be in the Philippines had the volcano remained dormant? Probably, but it would have had to assume an astronomical financial burden stemming from base reconstruction, not to mention the necessity of dealing with ever-increasing demands from the Philippine government. Anderegg briefly mentions the importance of the political aspects but, rightly, does not dwell on the subject.

Should Mount Fuji (currently classified as an active but low-risk volcano) ever erupt, commanders at Yokota Air Base would face the same sort of situation that confronted their counterparts at Clark—coping with a foreign government and large noncombatant evacuations. Thus, *The Ash Warriors* also serves as a valuable case study for support commanders or emergency-management personnel. Furthermore, engineers should take note of the author's characterization of water distribution and sanitization (including personal hygiene) as probably the single most important factor in preventing death and sustaining sanity in the days immediately after Pinatubo's eruption.

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Military Ethics: The Dutch Approach—A

Practical Guide edited by Th. A. van Baarda and D. E. M. Verweij. Brill (<http://www.brill.nl>), Plantijnstraat 2, P. O. Box 9000, 2300 PA, Leiden, Netherlands, 2006, 396 pages, \$132.00 (hardcover).

Why do terrible humanitarian crimes happen during wartime? Why did American soldiers torture prisoners at Abu Ghraib Prison or rape a young girl and murder members of her family in Iraq? Why did apparently normal people participate in the killings in the Holocaust, the Bataan Death March, the My Lai Massacre, or the slaughter at Fort Pillow? More importantly, how can these crimes be prevented?

Preventing such transgressions is the reason for training in military ethics. Baarda and Verweij have edited a Dutch training manual on military ethics, writing or cowriting nine of its 16 chapters. Developed from a practical training guide, the manual is time-tested and credible. Specifically written for the Dutch military, the book offers examples and principles that apply equally well to other military forces. American military personnel will recognize the concepts of command responsibility, proportional force, necessity, and humanity; they are already familiar with considering military codes of conduct.

Although American readers will learn much from *Military Ethics*, military members from any nation will find it especially useful for creating or teaching an ethics training program. The real-world examples come from a wide range of military and humanitarian operations conducted by many different militaries.

The examples and chapters are specifically written for the different Dutch military services and for members of many professions who have independent ethical standards, such as doctors, social workers, and other medical specialties. Other chapters consider the problems of command, ethical leadership, reasons for abandoning or ignoring ethical principles, and ways of helping troops maintain their ethical standards.

The many chapters allow specific discussions of professional ethical conflicts. When doctors' medical ethics conflict with their military ethics, how do they resolve difficult problems? Can confidential counselors or social workers effectively help people if they must also turn in soldiers who have committed a crime?

In addition to specific examples and discussion questions, the book includes 24 photographs, two drawings, and 13 charts. The photographs help make the manual more relevant since they show real people and real ethical problems. The charts prove especially helpful in explaining the ethical analysis used to consider problems.

The most important ethical analysis in this manual focuses on the role of commanders. The chapter on command responsibility explains the specific reasons that people lose their sense of morality through "moral disengagement." People may create a new justification for their actions, shift responsibility, blame the victim, ignore the real consequences of their actions, or use another tactic to commit terrible crimes. The chapter discusses the proper command response to each tactic and uses real-world cases to illustrate key points.

This book maintains a wonderful balance between the instructional, analytical text and the numbers and types of examples. The latter will help military members and other readers fully understand the analysis and importance of preventing crimes against humanity.

Anyone interested in this subject will enjoy *Military Ethics: The Dutch Approach—A Practical Guide*. I strongly recommend that commanders read it so they can help instill and maintain morality and responsibility throughout their commands.

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Dictatorship of the Air: Aviation Culture and the Fate of Modern Russia by Scott W. Palmer. Cambridge University Press (<http://us.cambridge.org>), 32 Avenue of the Americas, New York, New York 10013-2473, 2006, 328 pages, \$40.00 (hardcover).

Scott Palmer's *Dictatorship of the Air* is a unique, scholarly work that thoroughly explains the cultural threads of Russia's pre-1945 aviation history. The book is organized into three primary areas: imperial aviation before 1917, origins and institutions of the postrevolution air fleet to 1929, and Soviet aviation under Stalin until 1945. The book is the product of a decade of Dr. Palmer's research, including his frequent personal study in Russia and extensive consultation of primary sources. *Dictatorship of the Air* is most certainly successful in its comprehensive coverage of early Russian/Soviet aeronautical progress, if slightly less so in fulfilling part of its ambitious subtitle, "... and the Fate of Modern Russia."

The book's strength derives from its depth of research in an era of Russian aviation seldom addressed and from the skillfully woven threads between technological progress and national culture. Along the way, Palmer relates accounts of heroic aviators of the day (generally not well known or remembered by an American/Western audience), their aircraft (e.g., *Russian Warrior*, *Il'ya Muromets*, *ANT-3 Proletariat*, *ANT-14 Pravda*, and *ANT-20 Maxim Gorky*), and their notable feats (such as distance records and transpolar flights). Documentation begins with the seventeenth-century legend of a "Russian Icarus" and covers in considerable detail both the actual achieve-

ments and exaggerated glorification of the nation's early aviation history.

The author concedes that in early twentieth-century Russia, arousal of the popular imagination and public air-mindedness by aerial feats was not entirely unlike that in Europe. But, most particularly in Russia, government and citizenry alike "saw the airplane as a sign of things to come . . . key to Russians' dreams of modernity" (p. 282). Progress in aviation was seen as "a portent of national progress and pride," "a sign of the future," and "an instrument for collectively liberating the nation from the constraints of its past" (p. 6). Yet, the author points out that across time, compared to the West, "twentieth-century Russia failed early and often" (p. 286).

This contention might be validated, considering Russia's repeated, early reliance on the West for technology; the initial collapse against Germany in 1941; and the state's eventual economic decline and the fall of Communism. However, it may too easily dismiss modern Russian technological successes in both air (from early swept-wing jets to late-generation fighter aircraft, heavy-lift helicopters, and wide-body transports, just to name a few) and space (including Sputnik, Soyuz, unmanned explorers, and space-station support). In any case, the author generously supports his thesis, and the reader can judge from the detailed evidence offered.

Dictatorship of the Air is richly illustrated with photos of early Russian aircraft, aviators, and posters exhorting the virtues of aeronautics. An impressively researched and skillfully written work, it deserves a respected place among the literature of Russian aviation and culture.

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Last in Their Class: Custer, Pickett and the Goats of West Point by James S. Robbins. Encounter Books (<http://www.encounterbooks.com>), 900 Broadway, Suite 400, New York, New York 10003-1239, 2006, 500 pages, \$26.95 (hardcover).

Nobody knows how the cadet at the academic bottom of a class became known as a "goat." Apparently the term came into use long after Custer, Pickett, and many other goats finished at the US Military Academy. That said, the book uses the goat to make a point.

When it comes to bravery or competence or leadership in battle, there is no distinction between the head and foot of the class. That is the significant message of this work—merely finishing the academy, even if at the bottom, is distinction enough. Many more enter than graduate, and both James McNeill Whistler and Edgar Allan Poe washed out.

Last in Their Class is part social history of West Point, part combat history of the nineteenth-century US Army. Holding the two themes together are the US Military Academy's goats, those who finished at the bottom of the class. Most goats, as most West Pointers, are obscure even when successful. Others become notable in history, the same as do many who excel at the academy. Goats figured prominently in Andrew Jackson's forays into Florida and Narciso López's filibuster into Cuba. Goats fought the assorted battles of a century of Indian wars and performed nobly in the Mexican-American War and the Civil War (especially the latter, which consumes over one-fourth of the book.)

As the subtitle indicates, prominent goats included both George Armstrong Custer and George Pickett, but there were many more goats than these two famous leaders. The book stretches the term to include immortals, those in the bottom section of the class. Immortals they are because the number remains constant, with a new cadet dropping into immortal status each time a cadet washes out. Just as there is always a goat, so are there always the immortals. And this group goes on to serve either with distinction or without, either for a full career or just for a year or two. There is no set career path, no pre-ordained glory or shame, regardless of one's academic accomplishment.

As a history of West Point, the book works well. It explains the formation, the early search for standards, and the evolution from a gentlemen's club to a seat of serious and demanding military education. It describes the setting—scenic, if isolated from the rest of society—the changes in the academy and its expectations for its students, and the relations of both the academy and the cadets with the surrounding community. Ample anecdotes provide color—the practices of the institution; the individual behaviors; and the human, personal element of life in an all-male institution with extremely high and rigid standards.

When the book begins tracking the goats' postacademy careers, the author's reliance on West Point archives becomes limiting. Today's military histories usually incorporate documents

and scholarly works from the enemy's perspective since understanding the enemy's motivations and expectations helps to clarify developments on the battlefield. A review of the footnotes reveals no use of secondary works from the other side's perspective. Aside from the Civil War chapters, this history is strictly US Army issue. It works better as collective biography than as military history. The author ties up loose ends in a final chapter, where he tracks Pickett to his death and Custer to his immortality and brings the goats into the twentieth century in a quick survey.

The goat disappeared in 1978 because the academy decided, somewhat pompously, that its cadets should strive for academic excellence rather than concern themselves with besting somebody else. That doesn't mean that nobody ends up last in the class—immortals are, after all, immortal, and somebody has to be last, the same as somebody has to be first. Is it possible that we, as a society, have lost our sense of humor, our feeling for the appropriateness of the occasionally ridiculous? Maybe what we need are goats and immortals and high jinks at the academy—and everywhere else too.

Last in Their Class will appeal to several audiences. Military history buffs will enjoy yet another leisurely 500-page tour of the nineteenth-century officer corps in action. Cultural and social history fans should find the recapturing of nineteenth-century customs and pastimes interesting, amusing, and possibly enthralling. And those who simply enjoy good writing just might want to spend a few hours with this book.

Dr. John H. Barnhill

Houston, Texas

The Rescue of Streetcar 304: A Navy Pilot's Forty Hours on the Run in Laos by Kenny Wayne Fields. Naval Institute Press (<http://www.usni.org/naulinstitutepress/index.asp>), 291 Wood Road, Annapolis, Maryland 21402, 2007, 384 pages, \$26.96 (hardcover).

On 31 May 1968, Lt Kenny W. Fields, a Navy officer and A-7A Corsair II pilot with the call sign Streetcar 304 from Attack Squadron 82, launched from the aircraft carrier USS *America* on his first combat mission. In his second pass at a target in Laos, Fields was shot down. Parachuting into an area thick with soldiers of the People's Army of

Vietnam and Laotian Communist guerillas, he begins an epic story of survival, evasion, and rescue. By the time rescue forces recover Fields from hostile territory after more than three days on the run, seven other aircraft had been lost or heavily damaged in the action, and Communist forces had captured another American pilot.

In this gripping first-person tale, Fields combines his personal recollections, radio logs, and interviews with other participants to assemble a comprehensive portrayal of this incident. A talented writer, he vividly conveys the facts, emotions, decision making, and sensations of a person in an extraordinary situation. The story encompasses not only what Fields experienced but also the perspectives of others in the action (primarily Air Force flyers based in Thailand) as well as his wife and parents back in the United States. The compelling descriptions of what it is like to brief a mission; creep through a pitch-black jungle, pursued by enemies; find oneself at the receiving end of a cluster-bomb attack; and experience extraction by helicopter from a hot pickup zone make it difficult to put this book down.

A nice feature is the author's consistent use of call signs rather than names for all of the Americans involved in the action. This practice provides an operational feel to the tale and helps the reader follow the rather complicated flow of events in the air and on the ground. In the epilogue, Fields introduces the principal participants by name, offering a short biography of each man. This outstanding book lacks only a map showing such locations as Yankee Station and Nakhon Phanom, Thailand.

For today's Airmen, the Vietnam War is ancient history, as distant as World War II to those of us who served in the last decade of the Cold War. Yet war is fundamentally a human, as opposed to technological, activity. The thoughts and feelings of people do not change, and, as in Vietnam, the United States is currently fighting a war in which the enemy desires to capture and mistreat Americans as part of his information-warfare strategy. Anybody exposed to capture, whether flying an aircraft, driving in a truck convoy in Iraq, or manning an entry-control point in Afghanistan, would benefit from reading *The Rescue of Streetcar 304* and assessing his or her own physical, psychological, and equipment preparedness to prevail in a situation requiring survival, evasion, resistance, and escape.

Kenneth P. Katz
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L'Ouarsenis: La guerre au pays des cèdres by Mohamed Boudiba. Editions L'Harmattan (<http://www.editions-harmattan.fr/index.asp>), 5-7 rue de l'Ecole Polytechnique 75005 Paris, France, 2003, 286 pages, 23 €.

Mohamed Boudiba, an Algerian lawyer and part-time historian, describes how the Algerian War of 1954–62 affected his native Ouarsenis region, a mountainous area known for its beautiful cedar trees. In 18 chronological chapters written in French, he presents the war as ordinary inhabitants experienced it.

Like most accounts of the Algerian War, this one is biased. The author clearly sympathizes with the Algerian Front de Liberation Nationale (FLN) in its struggle for independence from France. He idealizes the FLN and its military wing, the Armée de Liberation Nationale (ALN). Comments such as "the inhabitants of the hamlets lived in a true symbiosis with the ALN" (p. 80) may occasionally have been true, but the ALN levied heavy demands for support upon the Ouarsenis's impoverished residents. Those who did not donate suffered the consequences. The author acknowledges that the FLN tortured people but suggests they did so because of French disinformation campaigns that used false "letters of the devil" to discredit FLN leaders. He also concedes that after the war, FLN members killed many Algerians who had served the French military. They even killed dogs that had guarded the *pieds noirs* (Europeans who had settled in Algeria). Finally, Mr. Boudiba blames the Si Salah Affair, an abortive peace negotiation between a few FLN leaders and President de Gaulle, on de Gaulle's treachery. That episode is the subject of almost as many conspiracy theories as Pres. John F. Kennedy's assassination, but the author does not mention alternative explanations.

The book relentlessly criticizes French colonial policies, compares the French to Nazis, and condemns them for environmental destruction. Decrying military efforts to control the Algerian countryside as reminiscent of medieval feudalism, the author portrays *pieds noirs* as arrogant outsiders who thought that "the enemy in that Algerian War is the population" (p. 111), implying a Nazi-like genocidal motivation rather than a political one. He castigates the French military's use of collective punishments and torture as Nazi-like expedients that conflicted with France's declared policy of spreading Western civilization. Contrasting the strict celibacy of FLN members with the debauchery of their For-

eign Legion opponents, who included former Nazis and routinely patronized prostitutes, the author depicts Col Mesnière de Schacken, a French intelligence officer assassinated by the FLN, as the epitome of a villainous Frenchman. The colonel comes across as an archetypical, monocle-wearing Nazi who condoned institutionalized torture. Annoyingly, the book spells his name two different ways—even on the same page (p. 176). Mr. Boudiba's vilification of the French Air Force for using napalm to deforest the scenic landscape may remind readers of American use of Agent Orange to defoliate Vietnam.

Mr. Boudiba's narrative reflects airpower's prominent role in the Algerian War during routine operations and the occasional combined-arms "steamroller" operations conducted by the French. His remark "True pointer dogs of the mountains, the [T-6] Piper-Cub became the partisan's bugbear in this war" (p. 45) illustrates the importance of aerial reconnaissance. He makes simple observations, such as how French aircraft flew only by day, prompting the FLN to operate often at night, and how insurgents quickly dispersed after ambushes to ensure that French aviation would not have enough time to intervene. In one of his few elaborations on air operations, he lambastes the French for bombing towns into rubble, either as collective punishment after FLN attacks or as a way to depopulate areas in order to isolate the FLN from the population. Not surprisingly, he compares these operations to the notorious German bombing of Guernica in 1937, during the Spanish Civil War (p. 101).

Readers need to approach this work with caution. It is an interesting social history of warfare in the Ouarsenis from which military professionals can glean insights into the Algerian "human terrain," but it offers few operationally relevant counterinsurgency tips. This account of counterinsurgency in a remote, mountainous, tribal region slightly parallels the current situation in Afghanistan, but readers should avoid exaggerating the similarities. The Algerians were fighting for national independence from colonial rule—a different political goal than the one the Taliban seek. Readers also need to be familiar with French and Algerian politics, culture, and jargon of the 1950s and 60s. The glossary of acronyms, though incomplete, helps in that regard. The bibliography also offers assistance, but the absence of footnotes complicates efforts to trace information back to its source. Nevertheless, *L'Ouarsenis: La guerre au pays des cèdres* is worth reading for historical context, provided one under-

stands its biases and limitations. Indeed, the book reflects how completely the FLN's influence operations shape Algerian attitudes to this day.

Lt Col Paul D. Berg, USAF
Maxwell AFB, Alabama

The Forgotten 500: The Untold Story of the Men Who Risked All for the Greatest Rescue Mission of World War II by Gregory A. Freeman. Penguin Group (<http://www.penguin.com>), 375 Hudson Street, New York, New York 10014-3657, 2007, 336 pages, \$23.95 (hardcover).

It might not be too difficult to find books about the Balkans in World War II. One could probably locate quite a few of them—but not many that also cover special-operations aviation, clandestine incursions, and Communist plots against the free world, as does *The Forgotten 500*. Author Gregory Freeman tells the story of Operation Halyard, the largest behind-enemy-lines rescue mission of World War II. Opening with a description of downed Airmen making their way through the hinterlands of Serbia, he discusses the route by which the Airmen had arrived in the mountains of that rugged land—specifically, the bombing raids on the Ploesti oil facilities. Freeman then describes the beginnings of the Office of Strategic Services, precursor of the Central Intelligence Agency, and introduces some of the characters who play a role in the drama that unfolds in the following pages. The remainder of the book tells the story of the daring rescue of hundreds of downed Airmen from under the noses of the German army and the sacrifices made by Serbs in order to facilitate that rescue. Freeman uses his background as a journalist to good effect here—though the book is nonfiction, he succeeds in recounting details of the rescue through the tales of men who lived through the experience. His story is a good one, told well.

Despite the book's length, most people should be able to read it quickly and easily. However, those seeking a strictly academic text on Operation Halyard or a book heavily laden with military jargon or history should look elsewhere. Clearly, the author has written it for a general audience, and the subject matter benefits from this treatment.

I must also mention that *The Forgotten 500* sheds light on the overarching political condi-

tions in place during the rescue operation, which in turn illuminates the great-power politics that played out during the war. Freeman offers an excellent description of how the marriage of convenience between Western democracies and Communist powers directly affected the operational and tactical levels of war. Although he does not explicitly assume a particular political viewpoint, he assuredly holds a dim view of Communism—an attitude that comes across as quite refreshing, providing the thematic glue that binds the disparate pieces of the story.

Overall I recommend *The Forgotten 500*. Freeman shines a spotlight on an often-overlooked aspect of the history of World War II, and the reader benefits from his account of the deeds of brave men who risked much to return Airmen to the fight against Fascism.

Capt Travis Nels, USAF
Geilenkirchen, Germany

The Son Tay Raid: American POWs in Vietnam Were Not Forgotten, Texas A&M University Military History Series no. 112, by John Gargus. Texas A&M University Press Consortium (<http://www.tamu.edu/upress>), John H. Lindsey Building, Lewis Street, 4354 TAMU, College Station, Texas 77843-4354, 2007, 352 pages, \$29.95 (hardcover).

On 20 November 1970, a team of volunteers transported by one HH-3 and three HH-53 helicopters as well as A-1E Skyraider close-support aircraft, MC-130 Combat Talons, and various other support platforms performed a meticulously planned and well-executed raid on a North Vietnam prisoner of war camp located near the small town of Son Tay. The concept for this raid, known initially as Operation Ivory Coast and later as Operation Kingpin, originated from aerial-reconnaissance photos taken in May 1970 when analysts at the Defense Intelligence Agency concluded that approximately 60 prisoners at the camp were using laundry to send signals. Located 23 miles west of Hanoi, the camp was in just the right location for the daring raid, accessible from the west (by means of one main road and a smaller one with a bridge that the rescuers could later destroy) and flanked by a river on three sides. These geographical boundaries essentially limited potential North Vietnamese access to the one main road, which American

ground forces and orbiting A-1E Skyraiders could defend from any North Vietnamese attack.

The book's author, John Gargus, one of several mission planners, participated in the raid, serving as a navigator on one of the MC-130s. Detailed with charts, maps, and navigational information, *The Son Tay Raid* establishes a tempo that never slows as Colonel Gargus guides the reader through the intricacies and difficulties of planning a major incursion deep into the heart of North Vietnam in near-complete secrecy. Fewer than a dozen individuals knew the true mission.

Once the raiding force landed in Thailand, other components went into motion, including F-105 Thunderchiefs from the 6010th Wild Weasel Squadron from Korat Royal Thai AFB and F-4 Phantoms from the 13th and 555th Tactical Fighter Squadrons. Commanders of these squadrons were asked to release their personnel and aircraft with no more explanation than "a top-secret mission." In fact, one aircraft would not come back, and another sustained severe damage. Brig Gen Leroy Manor, the raid's overall commander, asked the Navy's Task Force 77 to provide the largest air raid in the history of Vietnam to that point. Three carriers had orders to send their aircraft over Hanoi and Haiphong—with no offensive weapons due to political considerations.

The raid, which tested new technology and provided lessons in joint planning and execution, flew in complete radio silence until it hit the target. Additionally, MC-130s performed radio-silent night refuelings of the HH-3 and HH-53 helicopters that would transport the American prisoners. Colonel Gargus details how crews used untested versions of night vision goggles, forward-looking infrared, and Combat Apple aircraft, taken off the production line early. In the end, however, the Son Tay raiders discovered that the prison camp was empty—as a result of the fear of flooding in the nearby river (apparently caused by the CIA's Operation Popeye, a cloud-seeding action).

Readers can find much of the Son Tay story in Benjamin Schemmer's *The Raid*, but Colonel Gargus adds volumes of new and previously unpublished information, charts, pictures, and intricate details of ground operations in and around the prison camp. One very interesting addition does not appear in Schemmer's book: the enemy's side of the story, which details how the North Vietnamese viewed and spun the story to their people. The Son Tay raid seriously damaged the confidence and esteem of the North Vietnamese army and air force.

Two very positive consequences of the raid were that it improved treatment of American prisoners of war and that many of the dozens of outlying prison camps were closed, and their captives sent to Hanoi, where they benefited significantly from the company of comrades once again.

Capt Joshua Pope, USAF
Maxwell AFB, Alabama

Von Braun: Dreamer of Space, Engineer of War by Michael J. Neufeld. Alfred A. Knopf Publishers (<http://www.randomhouse.com/knopf/home.pperl>), 1745 Broadway, New York, New York 10019, 2007, 624 pages, \$35.00 (hardcover).

More than 30 years after his death, German-born rocket pioneer Wernher von Braun remains a controversial and polarizing figure. In the span of a single year, he was both the subject of *Dr. Space*, an admiring new biography by Huntsville, Alabama, journalist Bob Ward, and dismissed as an "odious opportunist" in *Masters of the Air*, Donald L. Miller's popular history of the American strategic bombing offensive (p. 418). To his supporters, von Braun is a visionary who sought the betterment of mankind through space exploration. His critics see him as a ruthless cog in the Nazi war machine, callously exploiting concentration-camp labor to build his rockets and turning a blind eye to the evil of the regime he served.

Historian Michael Neufeld, chairman of the Space History Department at the Smithsonian Institution's National Air and Space Museum, successfully navigates these interpretive currents and has produced what must be the definitive biography of von Braun. Neufeld wrote a fine study of the evolution and politics of the V-2 program, *The Rocket and the Reich: Peenemünde and the Coming of the Ballistic Missile Era* (1995). Now he turns his attention to the man at the center of that program.

Neufeld explicitly rejects the term *rocket scientist* in describing his subject. Von Braun was, first and foremost, an engineer. His genius lay in his ability to lead enormous teams working on complex, multifaceted projects—a skill he demonstrated at Peenemünde, in the US Army's ballistic missile program in the 1950s, and, finally, in his management of NASA's Saturn booster program in the 1960s. He was also a

tireless advocate for space exploration and had a gift for reaching mass audiences with his compelling vision.

The centerpiece of Neufeld's portrayal is the argument that, in order to realize this vision, von Braun made a "Faustian bargain" with the Third Reich. As von Braun later told a colleague, he was in search of "a rich uncle" to support his work—and it mattered little if that uncle was named Sam or Adolf. This is not an entirely new interpretation, but Neufeld's treatment is exceptionally nuanced and thoroughly researched. He marshals the evidence concerning von Braun's Nazi Party and SS membership, his connection to the slave-labor empire at the Mittelwerk V-2 production facility, and—perhaps most damning—his persistent and willful attempts to falsify the story of his past. Neufeld addresses, but does not dwell on, the expedient Cold War climate that led the US government to acquiesce in, and even assist with, von Braun's deception.

Yet this is not a one-dimensional portrait. Neufeld notes von Braun's courage in rejecting SS chief Heinrich Himmler's attempt to take over V-2 development. On at least one occasion, the engineer attempted to better the lot of an imprisoned French scientist. In the segregated South in the early 1960s, he became "a cautious but important voice for integration and racial moderation" (p. 396). Neufeld notes that von Braun could easily have become wealthy by "cashing in" on his fame in the private sector during the 1950s or 1960s but loyally remained with his team. Von Braun sometimes comes off as less an amoral manipulator than a charmingly naive character, making futuristic TV programs with Walt Disney and (less successfully) collaborating on a poorly received biographical motion picture entitled *I Aim at the Stars*.

In sketching this portrait, Neufeld overcame significant obstacles. Von Braun's family has never cooperated with biographers, the documentary record is incomplete, and many of the engineer's professional colleagues have closed ranks around him. The author must sometimes infer conclusions in the absence of complete evidence, and he does so judiciously.

This is far more than a compelling biography. It raises important issues about the complex nature of large military-technical-scientific enterprises and the managerial and ethical challenges associated with them. It makes significant contributions to the history of the Second World War, the Cold War, and the space age. Yet throughout, Neufeld maintains focus on his subject. For all of

his undeniable accomplishments, von Braun operated in uncomfortable proximity to unspeakable crimes and shut his eyes to what was going on around him. He later went to great lengths to convince others, and perhaps himself, that it was not so.

Dr. Richard R. Muller
 Maxwell AFB, Alabama

The Warrior Ethos: Military Culture and the War on Terror by Christopher Coker. Routledge (<http://www.routledge.com>), Taylor and Francis Group, 270 Madison Avenue, New York, New York 10016, 2007, 184 pages, \$150.00 (hardcover), \$35.95 (softcover).

With the US military increasingly involved in combat operations across the globe, the concept of a warrior ethos—generally defined as the professional attitudes and beliefs that characterize the service member—is getting increased emphasis among the armed services, including the Air Force. According to Gen T. Michael Moseley, former Air Force chief of staff, “the warrior ethos has always been a part of an Airman’s character, but some people may have lost sight of it.”

The warrior ethos is threatened in today’s world because the modern warrior is beset by technological, societal, and cultural challenges. Maintaining a warrior mind-set is becoming increasingly difficult in a battlefield characterized by sophisticated weaponry and in an environment that includes space and cyberspace. Moreover, Western society’s revulsion to all conflict is reflected in the current antiwar movement that protests military operations in Iraq but insists on supporting the soldiers. Finally, the warrior is asked to maintain a sense of honor in the face of an enemy who displays none.

Christopher Coker, professor of international relations at the London School of Economics (LSE), addresses these issues in *The Warrior Ethos*, published as part of the LSE International Studies Series. Through history, literature, philosophy, and the popular media, Coker examines the development of the warrior myth. For both good and ill, he continually refers back to both the Homeric and Platonic versions of Achilles as the warrior model, asserting that the warrior ethos is in decline.

The author contends that Western society’s distaste for war places the warrior in an unten-

able position. Today’s morality cannot permit honoring the warrior who, as with Achilles, may actually grow fond of the thrill of combat. Consequently, society must deal with the same dilemma that faces the antiwar crowd. How does one hate the war but love the warrior? The answer, according to Coker, lies in the media’s portrayal of today’s heroes not as modern-day Audie Murphys and Sergeant Yorks, but as victims in the style of the fictionalized Rambo or as real individuals, such as shot-down Air Force pilot Scott O’Grady and Army private Jessica Lynch.

The author further argues that the increasing use of technology, including virtual reality and unmanned weapon systems, is diluting the warrior spirit. He foresees technology bringing a dark future of robotics and chemical enhancements to the battlefield, which he fears will result in the warrior’s becoming more dispossessed of the sense of being engaged in combat and the sapping of the warrior’s free will. To Coker the essence of the warrior spirit is the ability of combatants to choose their own fate, and the modern battlefield threatens that choice.

Although he sees the romanticized version of the warrior in jeopardy, the author maintains that it is essential that today’s soldiers keep in touch with their warrior heritage, including honoring the enemy—a trait not found in terrorists. He fears that the frustrations of battling terrorism lead to a reliance on contractual legal mechanisms, as opposed to an unwritten moral covenant among warriors.

If one can find anything to criticize in Coker’s work, it is his analysis of modern-day terrorists and the warrior code. He concedes that warrior codes are largely cultural constructs but then views the terrorists almost completely through the lens of Western thought, citing little testimony from al-Qaeda or any other terrorist group. Nearly all of his support on terrorist attitudes comes from observations of Westerners, save for some historical context from Arabic chronicler Ibn Kahldun—dated seven centuries ago—and current terrorism training manuals.

Although never having known military life and combat firsthand, Coker does an admirable job of relating the experiences of warriors in both fictional and nonfictional terms. His thought-provoking analysis on the role of the warrior challenges the conventional thought in today’s military that all those who serve in uniform are warriors. He reserves the warrior moniker only for those directly involved in the fight and at risk. The imposing intellectual level of

Coker's book might scare off many in the armed forces—an unfortunate possibility because they would benefit most from this thoroughly insightful treatment of today's military culture.

Dr. John Farrell
Maxwell AFB, Alabama

The Prince: The Secret Story of the World's Most Intriguing Royal, Prince Bandar bin Sultan by William Simpson. HarperCollins (<http://www.harpercollins.com>), 10 East 53d Street, New York, New York 10022, 2006, 496 pages, \$32.50 (hardcover); 2008, 496 pages, \$18.95 (trade paperback).

I must begin this review by admitting that I am not an avid reader of biographies. So I did not relish the task of reviewing the almost-500-page book *The Prince*. However, William Simpson's biography of Saudi prince Bandar bin Sultan soon forced me to revise my opinion. The book was both readable and highly informative, tracing the life of a man who has been at the center of world affairs for three decades.

The Prince chronicles the life of Bandar through his various roles at the nexus of American and Saudi political life. Beginning when he was a fighter pilot, the book notes that the Saudi government tapped Bandar to facilitate sensitive arms negotiations between the United States and Saudi Arabia. This led him into a life of politics and intrigue during which he served in numerous capacities over the years. These high-profile roles included acting as a lead negotiator to end the war in Lebanon in 1982 and the Iran-Iraq War in 1988. He was also the "bagman" for the Iran-Contra deal, transferring American money to the Iranians during this controversial episode in American history. He was a decisive factor in convincing Soviet premier Mikhail Gorbachev to withdraw from Afghanistan, a key player in bringing allied forces to Saudi Arabia to repel Saddam Hussein after the first Gulf War, and an instrumental architect of the 1991 Israeli-Palestinian peace summit in Madrid. Bandar's relevance continues into today's politics. He served as a tireless advocate of his embattled country in the court of American public opinion after the terrorist attacks on 11 September 2001. And his credible skepticism of Saddam Hussein in the run-up to the Iraq war in 2003 helped the administration

of George W. Bush make the fateful decision to enter Iraq to find elusive weapons of mass destruction. In essence, Bandar's place at the center of world events makes this biography also a history of the modern Middle East.

Forewords by Nelson Mandela and Margaret Thatcher reveal the book's gravitas. I was surprised to discover the close relationship between Mandela and the Saudi prince. Mandela—or Madiba, as he is affectionately nicknamed—re-married on his 80th birthday in 1998, inviting family and only a handful of friends, including the prince. The author was also able to secure interviews with such power players as former secretaries of state Colin Powell and Henry Kissinger, and part of what makes the book so interesting is to see how Bandar interacted with these players over the years. First meeting Secretary Powell when he served as an attaché years before, Prince Bandar would later interact with him when Powell was the US Army chief of staff during the 1991 Persian Gulf War and the secretary of state at the beginning of this decade. Similarly, the Bush family's giving him the nickname "Bandar Bush"—signifying his status as an adopted relative—and George H. W. Bush's frequent fishing trips with the prince have no doubt helped fuel conspiracy theories about the Bush family's connections to the Saudis. One thing that clearly emerges from the book is the respect that Prince Bandar has for the senior President Bush. The former president's character and kindness come through in many anecdotes related by the prince.

My main criticism of the work has to do with one of the main failings of the genre: a tendency to identify with and defer to the subject of the biography. William Simpson was Bandar's classmate in military training in the United Kingdom, and the two have remained friends for years. Although this review makes clear that I am impressed with the prince's credentials and accomplishments, Simpson's portrayal seems to assign an almost uncritical preference for Bandar's perspective and policy agenda. Nonetheless, *The Prince* is well written and well researched—and currently the only biography of Bandar. Military professionals and members of the national security community will find it a worthwhile read, especially given the conflicts of our time.

Matthew J. Morgan
Atlanta, Georgia

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