ASPJ
Air & Space Power Journal

November–December 2012
Volume 26, No. 6
AFRP 10-1

## Senior Leader Perspective



## Features



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# Airmen

## Delivering Decision Advantage

Lt Gen Larry D. James, USAF

Air Force intelligence, surveillance, and reconnaissance (ISR) provides global vigilance—our hedge against strategic uncertainty and risk—to the Air Force, the joint war fighter, and our nation. Our mission, in defense of America's interests, is to enable decision advantage by operating integrated, cross-domain ISR capabilities with joint, national, and international partners. Our Air Force ISR vision is to be the preeminent ISR enterprise providing the right information to the right decision makers at the right time. Our objective is to provide our nation's decision makers, commanders, and war fighters with a continual information advantage over our adversaries—an advantage measured not in terms of the volume of information gathered but in the value and quality of the intelligence we provide. The fundamental job of Air Force ISR professionals is to answer questions by engaging decision makers at all levels in a dialogue that seeks to refine what they need to know in order to make decisions, command forces, and employ weapons.

When our nation's leaders select a military option, Air Force ISR is integral to American power projection and indispensible to the effective application of airpower. Air Force ISR provides the intelligence necessary to characterize the battlespace and determine how airpower should best be applied, not only in tactical execution but also at the operational and strategic levels of war. We provide Airmen the ability to hold targets at risk across the depth and breadth of the battlespace—on the ground, at sea, in the air, in space, and in cyberspace—and to apply deliberate, discriminate, and (when required) deadly combat power.

Today, Air Force ISR operates the world's premier global network of collection capabilities and analysts. Our worldwide network of ISR Airmen performs this mission for our country every day. These analysts are the backbone of our ability to move actionable intelligence to the right person at the right time. Deployed around the world and at home, we have conducted distributed operations to fulfill ISR requirements since Operations Southern and Northern Watch. Since 2001 we have increased our overall ISR hours flown by 4,300 percent, added 47 sites into our distributed network, and expanded the ISR force by 4,228 Airmen. In less than nine months, we developed, acquired, and fielded the MC-12 Liberty—the fastest fielding of a weapon system since the P-51 in World War II—to meet wartime ISR requirements. Today it sustains the highest operational tempo of any Air Force manned platform. In 2011 our global network demonstrated its robustness when we seamlessly executed ISR operations for counterinsurgency missions in Iraq and Afghanistan, humanitarian assistance for Japan after the tsunami, and combat air operations against Libyan forces.

## Global Network: All Sources, All Domains

Following two decades of combat, the Department of Defense and the Air Force are adjusting to new priorities as outlined in *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense* and the *Capstone Concept for Joint Operations: Joint Force 2020*.[1] As we refocus our attention and rebalance our capabilities, the Air Force ISR enterprise

will remain focused on mission accomplishment. To remain the world's preeminent ISR force in an era of increased strategic uncertainty, where threats may arise quickly from multiple locations, our network of ISR Airmen must seamlessly integrate and fuse information from all sources across the air, space, and cyber domains, as well as operate a mix of sensors across the entire spectrum of conflict.

Our Air Force ISR enterprise today leverages years of experience executing global distributed operations to ensure that our Air Force can continue to hold targets at risk anywhere on the globe, even in nonpermissive environments. In the future, the mix of sensors and capabilities we employ to execute global integrated ISR will change as we prepare for operations in antiaccess, area-denial environments. It is clear that ISR in contested, degraded, and operationally limited environments challenges us to use sensors from all domains to collect the right information. As Airmen we recognize that in addition to operating in the air domain, we also operate in the space and cyber domains; this is especially true with respect to our ISR mission as we orient our enterprise to operate across the full spectrum of conflict.

The integration of air, space, and cyber information is a powerful capability—one in which we must continue to invest our talent and resources. For instance, the space layer provides a broad spectrum of capabilities to characterize nonpermissive environments. The first operational use of space was to meet ISR requirements, and today we operate a number of sensors capable of penetrating denied areas and collecting otherwise unavailable intelligence. Today we continue to mature our space intelligence capabilities and develop innovative ways to use the space domain to answer questions in near real time and support strategic indications and warning. Integrating the information collected from our space architecture, just as we do with sensors from the airborne layer, will broaden our ability to characterize the battlespace.

In an antiaccess, area-denial environment, cyber may be a critical means to penetrate and persist from an ISR perspective. For decades, cyber has been a valuable source of information to understand and

characterize targets across all domains. Today we continue to advance our expertise and skills to integrate the vast amounts of intelligence collected from cyber. Additionally, operations in cyberspace are indivisible from ISR because, in cyber, there is a tremendous demand to simultaneously understand and exploit vulnerabilities to enable operations. Just as in the air domain—in which it took 600 hours of ISR and 15 minutes of kinetic operations to kill Abu Musab al-Zarqawi, leader of al-Qaeda in Iraq—in cyber it requires an even higher ratio of ISR to enable a keystroke to attack or defend a network.

Executing integrated ISR missions in air, space, and cyberspace is not fundamentally a new idea. However, bringing the information collected across all three domains into a single open architecture to exploit, analyze, correlate, and fuse together is a new way of thinking. Our intent is to construct a mosaic of information from all layers to characterize targets across all domains. We continue to evolve our global network to enable continuous sharing of information among the military services, combatant commands, coalition partners, and intelligence community with the goal of achieving interoperability at the data level. From specialized collection to open-source reporting, a fused mosaic of intelligence will enhance our ability to deliver decision advantage. In an era when strategic threats are increasingly uncertain and the risk of strategic miscalculation is high, fused intelligence will allow decision makers at all levels to hedge against surprise.

The ability to cast a wide net and fuse information from all available sources blurs the distinction between what is and what is not an ISR sensor. The superior technology of our most advanced aircraft is found not only in their weapons but also in their highly capable suite of sensors. From the imagery and motion video collected by targeting pods to the signals collected from defensive avionics, our ISR enterprise must be able to exploit and analyze this information. In some scenarios, these advanced aircraft may be our primary sources of information.

## Information Interoperability

Given these emerging realities, our mission emphasizes the information and tools for the ISR analysts over the platform or sensor that collects data. We must be less parochial about owning information and about procuring and operating sensors and capabilities. A preeminent ISR enterprise is able to take information from any source in order to characterize targets in all domains. With access to information from all sources, analysts must employ exploitation tools that enable them to focus on information understanding—spending their valuable time answering the "why" and "so what," as opposed to conditioning the data through staring, annotating, and tagging. The development of automated tools will enable critical thinking and result in improved battlespace awareness. As we move forward, we will optimize our ability to fully integrate all sources of information into our global network. Giving our analysts full access to all available information will enhance our ability to provide decision advantage.

Intelligence from all sources and all domains places a significant burden on our capacity to move all types of information across our global network. The Air Force ISR enterprise has unique and complex communication and data-handling requirements. In 2001 we transmitted and stored 255 terabytes per month; today that number has increased to 1.3 petabytes. Today's advanced hyperspectral sensors collect multiple layers of complex data that require conditioning and formatting. The next generation of wide area motion imagery sensors will be capable of collecting 2.2 petabytes of data per day, bringing 450 percent more data into our network than Facebook adds each day. In addition to managing volume and complexity, we must also protect the information we transmit around the world. In an increasingly congested and contested environment, information assurance is as important as connectivity and capacity.

To ensure that our ability to execute globally integrated operations endures, the resources we devote to science and technology and research and development must be done deliberately and coherently.

Our ISR enterprise will refashion legacy organizations and cumbersome processes to create and present a true enterprise—one that is innovative, robust, and adaptable. We must integrate emerging science and technology into operational capabilities at the speed of technological change. Investing in exquisite advanced sensors alone will not help us develop, operate, and maintain a breadth of capabilities across the spectrum of conflict. We must leverage the work of others and avoid unnecessary duplication of capabilities within the Air Force and among the services, coalition partners, and commercial sector. Proprietary systems and solutions are antithetical to a robust, adaptable, and flexible enterprise. Our vision requires us to think differently. We must focus our research and development of today to improve the capability of current sensors and prepare our enterprise for new technologies we have yet to understand. To be the go-to intelligence source for Airmen, as well as our joint and coalition teammates, and to operate a seamless, open-architecture enterprise across all domains—ingesting, analyzing, and fusing information from all sensors, regardless of platform—will require integrated science and technology and research and development processes and organizations.

## Airmen Are Our Advantage

Every day, through a mix of aircraft, satellites, and computer-based operations, Airmen collect and process massive volumes of raw information. As impressive as this is, it is not the quantity of information our sensors collect that allows us to create decision advantage. Rather, it is the quality of the actionable intelligence—answering the questions asked—created by trained ISR professionals. The power of our network is in the quality of our ISR Airmen, connected globally and ready to respond to emerging crises. ISR is an increasingly complex operational art that, notwithstanding our extensive use of advanced technologies and automated tools, always requires a man in the loop. We will continue to cultivate critical thinking in our ISR Airmen and deepen our knowledge in key functional competencies. In addition we

are committed to improving language and cultural training. Our sustained ability to answer war fighters' questions as the future security environment becomes more unpredictable is a product of our continued commitment to invest in the development of our ISR Airmen and to foster a culture of critical thinking.

Air Force ISR professionals are also an integral part of the joint and coalition team. Air Force ISR allows our forces to own the night in Afghanistan, connect with partners across Europe and Africa, and provide warning on the Korean peninsula. ISR Airmen partner with joint forces in real time from remote locations or when deployed with them. Today we fly mixed crews with coalition partners conducting reconnaissance missions in three theaters of operations. We process, exploit, and analyze information in the same air operations fusion cells with coalition partners. We do this together as a team of ISR professionals to enhance battlespace awareness and ensure decision advantage for our combat forces. Air Force ISR Airmen are engaged in global operations 24/7/365, integrated with our sister services, international partners, and the intelligence community.

Characterizing the battlespace as a single continuum is a key component for successful cross-domain operations. No longer can we afford to operate in single domains while ignoring the implications of our actions upon the other domains. Maturing our all-source, cross-domain capabilities is the next step in the evolution of Air Force ISR. Air Force ISR professionals are Airmen first, part of America's asymmetric advantage, always ready to provide global vigilance and ensure decision advantage for the nation. ✪

## Note

1. Department of Defense, *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense* (Washington, DC: Department of Defense, January 2012), http://permanent.access.gpo.gov/gpo18079/DefenseStrategicGuidance.pdf; and Joint Chiefs of Staff, *Capstone Concept for Joint Operations: Joint Force 2020* (Washington, DC: Joint Chiefs of Staff, 10 September 2012), http://www.jcs.mil//content/files/2012-09/092812122654_CCJO_JF2020_FINAL.pdf.

**Lt Gen Larry D. James, USAF**

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# For and from Cyberspace

## Conceptualizing Cyber Intelligence, Surveillance, and Reconnaissance

Col Matthew M. Hurley, USAF

Thirty years ago, at the dawn of the digital age, the notion of a synthetic, virtual realm where human beings would interact and compete was largely the stuff of science fiction.[1] We thrilled to films like *Tron* and *WarGames*; we shuddered to think that "Skynet" might become self-aware, as foretold in the movie *Terminator*. When the movie was over, however, we rubbed the nightmare out of our eyes and stepped back into the light of the "real" world.

Today, we see cyberspace as more than a flight of sci-fi fancy: we consider it an operational domain, as significant as the four traditional environments of land, sea, air, and space.[2] Yet cyberspace differs obviously from those more familiar, natural domains. How does intelligence, surveillance, and reconnaissance (ISR) apply to this new, dynamic, and artificially crafted environment? What challenges face the

Air Force ISR enterprise as it seeks to understand this novel operational realm? Finally, what should that enterprise do in order to meet the problems and demands inherent in cyberspace? This article addresses each of these fundamental questions in turn.[3]

## Defining Cyber Intelligence, Surveillance, and Reconnaissance

Unlike ISR operations in the natural domains, those in cyberspace have yet to be formally defined in joint or service doctrine. Despite wide reference to "CYBINT," its relationship to signals intelligence and open-source intelligence, and even calls to establish more granular disciplines such as "SkypeINT" or "VoIPINT," current thinking on the subject remains immature.[4] As Lt Gen Larry D. James, deputy chief of staff for ISR, remarked in 2011, "We're just starting to think through some of those things from an Air Force perspective."[5] Thus, although the term *cyber ISR* has gained increasing traction within Air Force ISR circles, it has simultaneously drawn queries from elsewhere within the Department of Defense (DOD) and the Air Staff as to its meaning.[6] This article begins by offering a conceptual starting point as a springboard to clarity and future doctrinal refinement.

Perhaps we can best understand cyber ISR through two component activities: ISR *from* cyberspace and ISR *for* cyberspace. ISR from cyber dates back to the first efforts to extract data from adversary networks during the 1980s, and analysts today continue to comb cyberspace for "any information of intelligence value [we] can glean from that domain," according to Lieutenant General James.[7] This includes, for example, foreign news media, chat rooms frequented by threat actors, blogs and video from crisis areas, or commercial imagery, to cite just a few applications. It also incorporates the more familiar concept of computer network exploitation (CNE). After collecting this information in cyberspace, we can use it to support operations in any domain.

For its part, ISR for cyber is perhaps best defined by Air Force Policy Directive 10-17, *Cyberspace Operations*, which tasks Air Force ISR to "ensure [the] ability to provide collaborative analysis, fused intelligence, and cross-domain, integrated, and automated ISR PCPAD (planning and collecting, collection, processing and exploitation, analysis and production, dissemination) capabilities to enable cyberspace operations."[8] This definition suggests the criticality of all-source intelligence during the planning and execution of cyberspace operations. Operating in cyberspace demands more than just ISR from cyber; any intelligence discipline can supply information of crucial intelligence value to cyberspace operations.[9] As noted by Maj Gen Robert P. Otto, commander of the Air Force ISR Agency, "When we say 'ISR for Cyber,' we are referring to the ISR conducted to support Cyberspace superiority"—regardless of the source, method, or medium.[10]

CNE, which some individuals mistakenly equate to cyber ISR, falls neatly within the first mission area—ISR from cyber. Air Force doctrine defines CNE as "enabling operations and intelligence collection capabilities conducted through the use of computer networks to gather data from target or adversary automated information systems or networks."[11] More explicitly, CNE is "usually performed through network tools that penetrate adversary systems. . . . Tools used for CNE are similar to those used for computer attack, but configured for intelligence collection rather than system disruption."[12] Both descriptions imply deliberate intrusion into target hardware, software, or related networks.[13] However, they do not incorporate the passive collection of open-source information of potential intelligence value, another important form of ISR from cyber. The latter could include downloading publicly released video of the latest adversary fighter, reading foreign doctrine or military publications, monitoring chat rooms, and a host of other activities that do nothing to—and leave nothing on—a cyber system or network. They do, however, contribute to the essential purpose of ISR—getting the right information to the right decision makers at the right time.

Cyber situational awareness, another ISR-related concept that features prominently in the relevant literature, concerns the perception, discernment, and understanding of who is present and what is occurring within cyberspace, whether friendly, hostile, or anywhere in the gradients.[14] Yet situational awareness writ large is more than ISR, shading into command and control, non-ISR elements of battlespace awareness, and even individual cognition.[15] While ISR is central to situational awareness, therefore, the two should not be conflated. We do not consider environmental monitoring an intelligence-collection discipline, for example, although it is a function of battlespace awareness and involves similarly analytic processes. Nor do we count all human knowledge as "information of intelligence value" even though knowledge presupposes awareness.

Given this starting point for defining and bounding cyber ISR, one must then explore the environment in which we conduct it. As the paragraphs below demonstrate, cyberspace as a domain poses significant issues that we must overcome if we wish to understand it fully and operate within it effectively.

## Challenges of Cyberspace

RAND analyst Martin Libicki has identified a trend in American political and strategic thinking. Specifically, when confronted with a new paradigm (such as aerial warfare during World War I or the opening of space to military applications), we generally first react by trying to jam the square peg of game-changing innovation into the round holes of the past. Now that we have declared cyberspace an operational domain, Libicki worries that "we will take our old rules and walk them over." However, he contends that "you cannot do that with cyberspace. You have to think about it from its [own] principles."[16] Certainly, broad and enduring commonalities exist in ISR tradecraft and other military activities across all domains, but Libicki's fundamental point—that we cannot simply rewrite existing doctrine and tactics, techniques, and procedures by inserting *cyber* wherever we find *air* or *space*—warrants

attention. The distinctive nature of cyberspace brings new opportunities as well as new challenges, and these call for novel ways of thinking rather than a perfunctory cookie-cutter solution.[17]

The unique attributes of this newest operational milieu distinguish cyber ISR from complementary activities in the "natural" domains. In the first and most obvious place, cyberspace was created by humans, who continuously modify it; each online click or keystroke by over 2 billion users ripples through cyberspace. "The other domains are natural," observes Gen Michael V. Hayden, USAF, retired, former director of the National Security Agency and the Central Intelligence Agency. "This one is the creation of man. Man can actually change this geography, and *anything* that happens there actually creates a change in someone's *physical* space" (emphasis in original).[18] Cyberspace's man-made origin has resulted in three facets that distinguish it from the relatively consistent natural domains: complexity, adaptability, and rate of change. Granted, nature is complex, nature adapts, and nature changes—but not to the degree and pace that cyberspace does. We can still recognize the same mountains, seas, and stars known to our ancestors. Today's cyberspace, however, bears virtually no similarity to its predecessor of just two decades ago—the length of an individual military career.[19]

Regarding complexity, cyberspace is breathtakingly intricate and maddeningly nonlinear. Everything can be connected to everything else in cyberspace—some 50 billion devices produced to date—while objectively small changes routinely produce effects out of all proportion to their initial scale.[20] Consequently, cyberspace thinking "must consider *the relationship of things*, i.e. the network, and how people have chosen to structure and use the cyberspace domain" (emphasis in original)—no easy task, given the number, instability, unpredictability, and complexity of those relationships.[21]

Cyberspace's inherent adaptability contributes to both its complexity and dynamic nature.[22] It continually changes (through the actions of billions of disparate users) to conditions both within and around cyber-

space, such as new technologies, threats, or policies and laws. Of note, the Internet itself was deliberately designed to facilitate rapid expansion and adaptability to technical innovation.[23] The changes that prompt those adaptations also occur at a rapid pace as new, innovative, and often unanticipated technologies continue to alter the cyber landscape more rapidly than they change any other technical realm.[24] According to a quartet of British observers, "The pace of change can be so abrupt as to render the conventional, action/reaction cycle of strategic evolution out of date before it has begun: it is as if a government operational analyst has been sent to observe the effects in battle of the flintlock musket, only to discover upon arrival that the Maxim gun has been invented."[25]

Cyberspace's dramatic growth contributes to its complexity and adaptability. Unlike the physical domains, which are relatively constant in terms of size, cyberspace is expanding exponentially in every significant respect.[26] By mid-2011, more than 2 trillion transactions had traversed cyberspace, involving 50 trillion gigabytes of data.[27] Fast-forward to 2025, when we can anticipate some 5.5 billion digital denizens, representing 60 percent of the world's projected population. They will use 25 million applications to conduct billions of interactions daily, generating or exchanging 50 trillion gigabytes of data *per day*. The online masses will have roughly 3 billion Internet hosts to choose from, each of which may feature thousands of individual websites.[28] For those people seeking to make sense of cyberspace, its rapid expansion poses a compelling problem.

Traditionally, military planners and practitioners have equated size and distance with similar scales of time: traversing great distances or conquering large areas takes additional time. It took more than a week for convoys to sail from the United States to Great Britain in World War II, for example, and nearly 10 months passed between the time that the Allies landed in Normandy and their crossing of the Rhine. In cyberspace, however, time as traditionally understood in military affairs has become irrelevant.[29] Theoretically, we can deliver a cyber payload

from source to target, from any point to any other on the globe, in less time than it takes an average person to blink. Cyberspace has given us operations at the "speed of byte."[30]

Cyberspace's worldwide pervasiveness, when combined with the speed of cyber effects, confers a new and daunting dimension to the notion of "global reach."[31] Physical cyber nodes inhabit each of the natural domains—in, around, and above every continent and sea. Cyberspace crisscrosses the globe, both drawing people together to an unprecedented degree and giving our foes heretofore unimagined avenues of attack.[32] In the past, war fighters have always enjoyed discrete theaters in which to operate.[33] In cyberspace, however, hostile actions may originate in or be routed through literally any location where an Internet-enabled device can function.[34] Furthermore, cyberspace's global nature has rendered traditional borders between sovereign entities essentially meaningless.[35] Because of a savvy adversary's ability to launch intrusions or attacks across multiple frontiers with near impunity, "Geography is completely irrelevant. So there is no use in determining the geo location of some server where, let's say a denial-of-service attack emerged from because I could just set up this server that I use to launch my attack in the United States. It's not a problem. I can do that. I can use a server in China. I can use a server in Malaysia or in Brunei."[36] The worldwide diffusion and geoambiguity of cyberspace complicate effective ISR, since there are no static physical spaces on which to focus attention—a radical departure from geocentric conceptions of ISR.

Not only nation-state borders but also nation-states themselves have become less relevant in cyberspace. No cyber-enabled nation's government can claim a monopoly of force in this domain, nor can it assert total ownership of the infrastructure vital to military operations.[37] In the first case, the low costs of entry into cyberspace, coupled with the widespread availability of increasingly sophisticated threatware, have presented nonstate actors and even individuals the opportunity to conduct activities formerly the exclusive province of a state's security

apparatus.[38] But now, in cyberspace, actors "do not need to be well educated nor well resourced. . . . They simply need to have intent and the ability to use technology to perpetrate their activity."[39] Additionally, some 90 percent of cyberspace infrastructure is privately owned despite its government-sponsored origins—and despite the fact that our government and armed forces rely heavily on that commercial infrastructure.[40] As a result, in cyberspace "distinctions and divisions between public and private, government and commercial, military and nonmilitary are blurred."[41]

These characteristics of cyberspace contribute to "the most vexing question of all" for ISR professionals: attribution of intrusions and attacks.[42] As Air Force Space Command acknowledges, "The ability to hide the true (originating) source of an attack makes it difficult to identify the attacker. Furthermore, the design of the Internet lends itself to anonymity."[43] One factor that complicates attribution—the large number of online actors—is reflected by the difficulty of trying to uncover an insider threat within the DOD. If each user represented a node and each e-mail message a link, one would have to analyze 755,230,064,000 links between 237,387,616 nodes in a single year—a tally that does not include Internet searches, file accessions, or other types of theoretically observable cyber activity.[44]

Compounding the sheer scale of the potential target set are cyber tools that complicate attribution further. Botnets ranging up to millions of machines, proxy sites dedicated to anonymizing, onion routing, and related techniques all pose intimidating barriers to positive attribution.[45] More fundamentally, the Internet in particular "operates on inherently unauthenticated protocols," meaning that "attribution and non-repudiation collide often with anonymity."[46] Though daunting, attribution is "not impossible," according to Col Daniel Simpson, commander of the 659th ISR Group; "however, you need the work of good, hard analysis by smart ISR professionals."[47] Despite improvements regarding attribution, it "is always going to be more difficult," according

to William J. Lynn III, former deputy secretary of defense. "Missiles come with a return address, cyber attacks do not."[48]

Incomplete or inaccurate attribution also exposes the ISR enterprise to potential violations of law, policy, and constitutional norms. Not only can uncertainty regarding the nature of an intrusion (domestic or foreign; criminal, military, or intelligence) delay attribution while title 10/18/50 authorities are untangled, but also inaccurate or premature attribution may lead to infractions under those authorities.[49] As former FBI director Robert Mueller testified, "At the outset, you do not know whether [a cyber intruder] may be a state actor, a group of individuals operating at the behest of a state actor, or a high-school kid across the street."[50] Proposed solutions to this challenge—such as data sharing among the military, intelligence community, and industry; more aggressive, comprehensive collection to enable proactive defense; or "re-engineering" the Internet to facilitate attribution and geolocation—have drawn the ire of organizations advocating online privacy, civil liberties, and Internet freedom.[51] This article does not purport to be a legal note or discussion.[52] Nevertheless, it is worth noting that we risk finding ourselves "in uncharted waters with regard to cyber law," given the sometimes uncertain boundaries between intelligence and law-enforcement activities in cyberspace.[53]

## Way Ahead and Recommendations

Considering the obstacles inherent in cyberspace, the ISR enterprise must make and sustain appropriate investments in ideas, resources, and personnel if it wishes to operate effectively in the newest domain. In the realm of ideas, the first task entails determining how ISR fits into the broader scope of cyber operations. Currently, the Air Force and joint community lack consensus on this point. Most military and national doctrine and policy publications concentrate on offensive and defensive cyber activities; for its part, ISR is generally relegated to a supporting role. For example, in 2010 Air Force Space Command—the core function lead integrator for the Air Force cyber enterprise—

described ISR as a "capability" "necessary" to the "missions" of cyberspace support, cyberspace defense, and cyberspace force application.[54]

Such notions fail to recognize that ISR often *is* the mission. At all other times in the course of cyber operations, it remains both central and essential. Indeed, operations in cyberspace are "soaked in intelligence," and without ISR, cyber operations "would be no better than the proverbial shot in the dark."[55] Lieutenant General James contends that "we don't separate ISR from operations in the air and space domains. In cyberspace, they're even more closely intertwined."[56] Therefore, we need doctrinal, educational, and organizational constructs that forcefully emphasize the centrality and operational nature of cyber ISR—not for its own sake but in recognition of the fact that without it we are functionally deaf and blind, to the detriment of all operations.

To be effective, however, cyber ISR needs much more than institutional emphasis, money, or people. The enterprise must adapt its tradecraft to match the operating environment. In the case of cyberspace, ISR must be globally aware and constantly vigilant, predictive rather than reactive, dynamic and agile, and able to manage exponentially increasing volumes of data. This vision further requires changes in the way we recruit and train cyber ISR professionals, how we employ them to protect civil liberties and privacy, and, indeed, how we integrate cyber ISR into the unified intelligence enterprise.

### *Predictive ISR and Early Warning*

According to observers like Mike McConnell, former director of national intelligence, the current "state of the art" in cyberspace ISR and defense relies on "after-the-fact forensics" to assess damage and identify perpetrators of individual attacks.[57] In the past, we have also relied on perimeter defense and firewalls, but capable foes ultimately will find a way to bypass or breach any "Cyber Maginot Line," however sophisticated.[58] Instead, we need a Cyber Distant Early Warning Line, with attribution and defensive capabilities primed to respond to threats before they can do damage.[59]

To facilitate the earliest possible warning of activity occurring literally in the blink of an eye mandates a more predictive approach based on real-time global awareness of cyber activities and the context in which they occur.[60] Predictive cyber ISR builds upon past experience and emerging trends to identify indications of impending digital mischief, such as preexisting grievances against the United States, an active "patriotic hacker" community, online chatter, new technologies, or adversary doctrine.[61] We must monitor these and other potential tipoffs as part of "a continuous process, leveraging indicators to discover new activity with yet more indicators to leverage."[62]

### *Agile and Dynamic*

Of course, "early" warning is relative. During the Cold War, we assumed that an intercontinental ballistic missile would travel some 30 minutes between launch and impact, but today a cyber strike can flash from Beijing to New York City in 30 milliseconds.[63] Such speed requires degrees of agility and dynamism that seem fantastic, even fanciful in the context of "physical" warfare. According to Dr. Kamal Jabbour of the Air Force Research Laboratory, "cyber agility" entails not only rapid analysis but also "anticipation of future behaviors and effects, and effective real-time provisioning of defensive measures."[64] This, however, demands that the ISR enterprise at least tie for the lead in all things cyber: speed, stealth, flexibility, adaptability, and other factors that have made cyberspace so challenging in the first place.[65] Ongoing scientific and technology initiatives, such as "Cyber Vision 2025," offer a valuable starting point for understanding these issues and devising solutions. Secretary of the Air Force Michael Donley has directed the service's leadership to forge a way forward to realize that vision.

### *Automation and Visualization*

The vast amount of data collected in cyberspace recalls a Chinese proverb: "Absolute light and absolute darkness have the same effect—

we cannot see anything."[66] At present, cyber sensors collect petabytes of data, and collection of yottabytes is not far off.[67] Already, however, the collection outstrips our ability to identify the "nuggets," analyze them, and fashion them into actionable intelligence. Cyber ISR, therefore, "requires the development of algorithms and visualizations capabilities to make activities in the cyber domain intelligible."[68] Technologies that enable automated ISR analysis, operating pictures, and predictive software fall to one side of the equation and correctly demand more intellectual and fiscal attention. No less important, however—and arguably paramount—is the element on the other side of the equal sign: the human variable.

### *Recruiting and Training*

Many of us are so-called digital immigrants. Our first direct experience with integrated circuits involved a 1970s-vintage calculator, a digital watch, or perhaps early video games. Cyberspace and the speed at which it evolves continue to frustrate and sometimes frighten those who stepped off the analog boat—willingly or otherwise—into the digital New World. Our successors, though, are a different breed. Today's recruits may well have had their birth announced via e-mail; they may not remember a single moment when a computer was not within immediate view. These are not your father's Airmen. They are still the best in the world, but "Fly, Fight, and Win" has a different connotation to someone whose idea of warfare derives primarily from nine years of playing "Call of Duty." Yet, potentially, these digital natives represent our biggest assets in the realm of cyberspace. Gen Keith B. Alexander, director of the National Security Agency and commander of US Cyber Command, apparently recognizes this, having recently delivered a recruiting pitch at a convention of self-professed hackers.[69] The requisite human talent is there—and abundant. Once on board, it needs only training in the first-tier standards of cyber operations. But that requires "deep and powerful technical and analytic expertise"—expertise that must continually progress to match the domain's explosive evolution.[70] Although Lieutenant General James contends that cyber ISR training

is improving, the task is not yet complete.[71] Given cyberspace's continuous evolution, further refinement of Air Force specialty code–awarding syllabi; graduate courses; and tailored, adaptive on-the-job training must continue to rank among the top priorities for cyber ISR.

### *"Normalization" of Cyber ISR*

Manpower and training, as well as material and technologies, have recently drawn the attention of multiple high-level initiatives within the DOD and the Air Force, including the Air Force chief scientist's "Cyber Vision 2025" study; the 2012 Air Force Cyber Summit; and the DOD's Cyber Strategic Portfolio Review. Concrete outputs—and, consequently, future cyber ISR capacity—will depend upon the results of these and other deliberations, the fiscal environment, and the continued evolution of cyber threats and opportunities. Conceptually, however, work can and should begin today on "normalizing" cyber ISR. As Lieutenant General James and other Air Force ISR leaders have forcefully maintained, effective ISR must be seamless and domain-agnostic. ISR seeks to deliver timely, relevant, and actionable intelligence to the appropriate decision makers. The location and means of collecting intelligence information are of comparatively little significance to that ultimate objective. In this context, normalization involves dismantling the stovepipes we've erected around All Things Cyber and recognizing that, in the end analysis, the resulting information itself matters to the mission—not the manner or domain in which we acquire it. Nevertheless, in light of the distinctiveness of the cyber domain, the comparative newness of our operations within it, and programmatic practicalities, we still have multiple mental and institutional hurdles to clear before ISR for and from cyber is as readily understood, recognized, and resourced as ISR for and from air or space. Ultimately, this is a question of education and leadership, but before we can teach and lead, we must first understand that cyberspace has come into its own as a domain that presents ISR demands and opportunities in fundamentally the same manner as the other domains. Intelligence for and from space was also new and conceptually compartmentalized in the

not-so-distant past, but its contribution to operational effectiveness has grown dramatically with its diminishing novelty.

### *Protection of Civil Liberties and Privacy*

Any and all cyber ISR investments, however, must adhere to the government's obligation to protect civil liberties and constitutional rights.[72] Colonel Simpson acknowledges that "the current infancy of cyber law and policy creates difficulties for ISR in determining and managing authorities and boundaries."[73] The balance among awareness, security, and civil liberties is an evolving one that demands constant attention and carries considerable implications for public trust.[74] This is more than an ancillary concern to the ISR enterprise; as military professionals serving our citizens and Constitution, these issues warrant continued vigilance and strict adherence. Despite today's legal ambiguities that cloud cyberspace and regardless of whatever relevant court decisions appear in the future, the entire intelligence community must remain steadfastly committed to the Constitution and every citizen's right to privacy.

## Conclusion

Over the past century, the Air Force and its predecessors have demonstrated their mastery of new operational domains—first in the air and later in space. In both cases, ISR proved critical to opening and securing new environments. Cyberspace, for all its unique attributes, shares that fundamental trait: the absence of timely, relevant, and actionable ISR reduces the success of all other military activities to chance. As the odds stack up against the defender in this new domain, though, relying on chance is not an option.[75] The difficulties facing cyber ISR sometimes seem insoluble, but they only appear that way. No doubt the unprecedented speed of airpower caused considerable mental dislocation during its maturation, as did the vastness of space in the following decades. Without question, as we enter a new operating

environment, we will encounter many of the same intellectual growing pains. We should remain confident, however, in our ability to overcome them through an increasingly persistent and pervasive understanding of cyberspace provided by—and contributing to—cyber ISR. To continue that positive trend, we must invest; to invest, we must commit; but to commit, we must first fully understand the nature and extent of the challenges and opportunities facing us as an Air Force and a nation. ISR is the key to that understanding—in cyberspace as in every other domain of human enterprise. ✪

## Notes

1. In *Neuromancer*, William Gibson prophetically coined the term *cyberspace* to hypothesize a flight of science-fiction fancy, "a consensual hallucination experienced daily by billions. . . . Data abstracted from the banks of every computer in the human system. Unthinkable complexity." William Gibson, *Neuromancer* (New York: Ace Books, 1984), 69.

2. Joint doctrine defines cyberspace as "a global domain within the information environment consisting of the interdependent network of information technology infrastructures, including the Internet, telecommunications networks, computer systems, and embedded processors and controllers." Joint Publication (JP) 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 8 November 2010 (as amended through 15 August 2012), 77, http://www.dtic.mil/doctrine/new_pubs/jp1_02.pdf. The author, however, is compelled to agree that "'Cyber' itself is such a nebulous concept that determining the fundamentals of what it is and how it affects the military domain has exercised years of planning man-hours." Daniel Wasserbly, "Charting the Course through Virtual Enemy Territory," *Jane's International Defence Review* 44, no. 5 (May 2011): 60. Or, as Gen Michael V. Hayden, USAF, retired, observed, "Rarely has something been so important and so talked about with less clarity and less apparent understanding than this phenomenon." Michael V. Hayden, "The Future of Things 'Cyber,' " *Strategic Studies Quarterly* 5, no. 1 (Spring 2011): 3, http://www.au.af.mil/au/ssq/2011/spring/hayden.pdf.

3. This article does not address threats—the literature regarding that subject is as expansive and varied as the threats themselves. However, in all military operations, effective threat response begins with conceptually sound, well-planned, and well-executed ISR.

4. For CYBINT see Dr. Kamal T. Jabbour, *50 Cyber Questions Every Airman Can Answer* (Wright-Patterson AFB, OH: Air Force Research Laboratory, 7 May 2008), 20, http://www.au.af.mil/au/awc/awcgate/afrl/50_cyber_questions.pdf; for CYBINT's relationship to signals intelligence, see, for example, Air Force Doctrine Document (AFDD) 2-0, *Global Integrated Intelligence, Surveillance, & Reconnaissance Operations*, 6 January 2012, 40, http://www.e-publishing.af.mil/shared/media/epubs/afdd2-0.pdf; and for open-source intelligence as described by Frederick J. Wettering, see "The Internet and the Spy Business," *International*

*Journal of Intelligence and Counterintelligence* 14, no. 3 (Fall 2001): 344. See also "Cyber Vision 2025: United States Air Force Cyberspace Science and Technology Vision 2012–2025," draft, AF/ST TR 12-01, 1 September 2012, 42. "VoIP" refers to Voice over Internet Protocol applications.

5. Ben Iannotta, "Voice for Balance," *DefenseNews*, 1 November 2011, http://www.defensenews.com/article/20111101/C4ISR01/111010318/Voice-balance.

6. As the author has personally experienced multiple times within the past few months, as of the time of this writing.

7. Lt Gen Larry D. James, interview by the author, 30 July 2012.

8. Air Force Policy Directive 10-17, *Cyberspace Operations*, 31 July 2012, 3, http://www.e-publishing.af.mil/shared/media/epubs/AFPD10-17.pdf.

9. Intelligence and National Security Alliance, *Cyber Intelligence: Setting the Landscape for an Emerging Discipline* (Arlington, VA: Intelligence and National Security Alliance, September 2011), 14, https://www.vita.virginia.gov/uploadedFiles/VITA_Main_Public/Security/Meetings/ISOAG/2012/Sept_ISOAG_CyberIntel.pdf. See also AFDD 3-12, *Cyberspace Operations*, 15 July 2010, 24, http://www.e-publishing.af.mil/shared/media/epubs/afdd3-12.pdf, which notes that "employing full-spectrum cyber effects requires a multi-INT analysis approach" and "all-source cyber-focused ISR."

10. Maj Gen Robert P. Otto, written interview responses, 14 August 2012.

11. AFDD 3-12, *Cyberspace Operations*, 49.

12. Clay Wilson, *Information Operations, Electronic Warfare, and Cyberwar: Capabilities and Related Policy Issues*, CRS Report for Congress (Washington, DC: Congressional Research Service, 20 March 2007), 5, http://www.au.af.mil/au/awc/awcgate/crs/rl31787.pdf.

13. Bryan Krekel, *Capability of the People's Republic of China to Conduct Cyber Warfare and Computer Network Exploitation* (McLean, VA: Northrop Grumman Corporation, 9 October 2009), 8–9, http://www.uscc.gov/researchpapers/2009/NorthropGrumman_PRC_Cyber_Paper_FINAL_Approved%20Report_16Oct2009.pdf.

14. Dr. Kamal Jabbour, "The Science and Technology of Cyber Operations," *High Frontier* 5, no. 3 (May 2009): 11, http://www.afspc.af.mil/shared/media/document/AFD-090519-102.pdf; "Cyber Vision 2025," 20; Air Force Space Command, *Functional Concept for Cyberspace Operations* (Peterson AFB, CO: Air Force Space Command, 14 June 2010), 7; and Lt Gen Michael J. Basla, "Cyberspace from a Service Component Perspective" (address, Cyberspace Symposium, US Strategic Command, 15 November 2011), http://www.afspc.af.mil/library/speeches/speech.asp?id=686. In his address, Lieutenant General Basla, vice-commander of Air Force Space Command, described cyber situational awareness as "an operationally relevant picture of the battlespace to include the status of the joint networks, of the Air Force networks, and the disposition of our forces, friendly or otherwise."

15. The *Manual for the Operation of the Joint Capabilities Integration and Development System* (Washington, DC: Joint Staff J8 / Joint Capabilities Division, Pentagon, 19 January 2012), https://www.intelink.gov/inteldocs/action.php?kt_path_info=ktcore.actions.document.view&fDocumentId=1517681, defines the joint capability area "battlespace awareness" as "the ability to understand dispositions and intentions as well as the characteristics and conditions of the operational environment that bear on national and military decision making by leveraging all sources of information to include Intelligence, Surveillance, Reconnaissance, Meteorological, and Oceanographic" (B-B-2). The individual cognitive aspects of situational awareness are perhaps best exemplified by the single-seat-fighter-pilot origin

of John Boyd's observe, orient, decide, act (OODA) loop. See, for example, Col Phillip S. Meilinger, ed., *The Paths of Heaven: The Evolution of Airpower Theory* (Maxwell AFB, AL: Air University Press, 1997), xxiii; and Maj David S. Fadok, "John Boyd and John Warden: Air Power's Quest for Strategic Paralysis" (Maxwell AFB, AL: School of Advanced Airpower Studies, 1995), 13.

16. Martin Libicki, "Cyberpower and Strategy" (remarks at the 8th International Institute for Strategic Studies Global Strategic Review, "Global Security Governance and the Emerging Distribution of Power," Sixth Plenary Session, 12 September 2010), [3], http://www.iiss.org/EasySiteWeb/getresource.axd?AssetID=46892&type=full&servicetype=Attachment.

17. Lt Col Steven E. Cahanin, USAF, "Principles of War for Cyberspace," research report (Maxwell AFB, AL: Air War College, Air University, 15 January 2011), 1, http://www.airpower.au.af.mil/digital/pdf/articles/Jan-Feb-2012/Research-Cahanin.pdf.

18. Hayden, "Future of Things 'Cyber,' " 4.

19. Comparing today's cyberspace to its early 1990s incarnation, for example, one might see similarities in standards such as e-mail, message boards, and online connectivity to informational databases. Radical changes such as the ubiquity of social media, streaming video, online voice and video communications, mobile connectivity, and, yes, the sophistication and pervasiveness of today's cyber threat have all, in retrospect, far outdistanced even the most ambitious forecasts of 20 years ago.

20. Cahanin, "Principles of War for Cyberspace," 2; Brookings Institution, *Deterrence in Cyberspace: Debating the Right Strategy with Ralph Langner and Dmitri Alperovitch* (Washington, DC: Brookings Institution, 20 September 2011), 2, http://www.brookings.edu/~/media/events/2011/9/20%20cyberspace%20deterrence/20110920_cyber_defense.pdf; and Paul W. Phister Jr., "Cyberspace: The Ultimate Complex Adaptive System," *International C2 Journal* 4, no. 2 (2010–11): 13–14.

21. Cahanin, "Principles of War for Cyberspace," 2.

22. "Remarks of the Honorable Michael B. Donley, Secretary of the Air Force, Air Force Association CyberFutures Conference, Gaylord National Resort, Friday, March 23, 2012," 3, http://www.af.mil/shared/media/document/AFD-120326-056.pdf.

23. Department of Defense, *Department of Defense Strategy for Operating in Cyberspace* (Washington, DC: Department of Defense, July 2011), 2, http://www.defense.gov/news/d20110714cyber.pdf.

24. Cahanin, "Principles of War for Cyberspace," 3–4.

25. Paul Cornish et al., *On Cyber Warfare*, Chatham House Report (London: Chatham House [Royal Institute of International Affairs], November 2010), 29, http://www.chathamhouse.org/sites/default/files/public/Research/International%20Security/r1110_cyberwarfare.pdf.

26. Even though space may be infinite, or finite but expanding, or finite and contracting (theories vary), the human dimension of space—that is, where humans have established a more-or-less permanent presence, even remotely—is almost exclusively confined to our own solar system. With the exception of the Apollo moon landings and interplanetary, lunar, or solar probes, this human dimension resides between 50 and 22,000 miles above the earth's surface.

27. Brookings Institution, *Deterrence in Cyberspace*, 2. By mid-2012, every minute of every day saw the following uploaded to or traversing through cyberspace: 48 hours of Youtube video; 204,166,667 e-mail messages; 2,000,000 Google search queries; 684,478 Facebook

posts; 571 new Internet websites; 27,778 *Tumblr* blog posts; and more than 100,000 Twitter tweets. Oliur Rahman, "How Much Data Is Created on the Internet Every Minute?," *Ultralinx*, 24 June 2012, http://theultralinx.com/2012/06/data-created-internet-minute.html.

28. "Cyber Vision 2025," 9.

29. Richard M. Crowell, *War in the Information Age: A Primer for Cyberspace Operations in 21st Century Warfare* (Newport, RI: Naval War College, 2010), 21, http://www.carlisle.army.mil/DIME/documents/War%20in%20the%20Information%20Age%20-%20A%20Primer%20for%20Cyberspace%20Operations%20in%2021st%20Century%20Warfare%20-%20R%20M%20%20Crowell.pdf.

30. Contrary to popular belief, activities in cyberspace do not occur at the speed of light; rather, cyber operates at the speed of electrons. Light travels at approximately 186,000 miles per second, while electrons—due to the fact that they have mass—travel "only" two-thirds of that speed—some 125,000 miles per second. Jabbour, *50 Cyber Questions*, 11.

31. As suggested by Mike McConnell, "Cyber Insecurities: The 21st Century Threatscape," in *America's Cyber Future: Security and Prosperity in the Information Age*, vol. 2, ed. Kristin M. Lord and Travis Sharp (Washington, DC: Center for a New American Security, June 2011), 25–39, http://www.cnas.org/files/documents/publications/CNAS_Cyber_Volume%20II_2.pdf.

32. Robin Geiß, "The Conduct of Hostilities in and via Cyberspace," *Proceedings of the Annual Meeting* (American Society of International Law) 104 (24–27 March 2010): 371; and Crowell, *War in the Information Age*, 21.

33. Even the world wars weren't, strictly speaking, for Allied commanders didn't have to worry about that potential Axis thrust from Switzerland or Swaziland.

34. Geiß, "Conduct of Hostilities," 371; and Cahanin, "Principles of War for Cyberspace," 5.

35. Susan Freiwald, "Electronic Surveillance at the Virtual Border," *Mississippi Law Journal* 78, no. 2 (Winter 2008): 329, http://www.olemiss.edu/depts/ncjrl/pdf/ljournal09Freiwald.pdf; Geiß, "Conduct of Hostilities," 371; and Cahanin, "Principles of War for Cyberspace," 5.

36. Brookings Institution, *Deterrence in Cyberspace*, 15; and Crowell, *War in the Information Age*, 21.

37. Cyber "bases," cyber "airspace," or cyber "force structure," for example.

38. McConnell, "Cyber Insecurities," 61; Gregory C. Radabaugh, "The Evolving Cyberspace Threat" (working paper, Air Force Intelligence, Surveillance, and Reconnaissance Agency, August 2012), 8; Cornish et al., *On Cyber Warfare*, 30; and Crowell, *War in the Information Age*, 21.

39. Intelligence and National Security Alliance, *Cyber Intelligence*, 7. For similar assessments, see Kevin Coleman and John Reed, "Cyber Intelligence," DefenseTech.org, 3 January 2011, http://defensetech.org/2011/01/03/cyber-intelligence/.

40. Cahanin, "Principles of War for Cyberspace," 5.

41. House, *House Armed Services Subcommittee, Cyberspace Operations Testimony, General Keith Alexander, Washington, D.C., Sept. 23, 2010*, [1], 111th Cong., 2nd sess., http://www.defense.gov/home/features/2011/0411_cyberstrategy/docs/House%20Armed%20Services%20Subcommittee%20Cyberspace%20Operations%20Testimony%2020100923.pdf. Rep. Ike Skelton (D-MO), chairman of the House Armed Services Committee at the time, made this statement in his introductory remarks.

42. Kenneth Geers, *Sun Tzu and Cyber War* (Tallinn, Estonia: Cooperative Cyber Defence Centre of Excellence, 9 February 2011), [4], http://www.ccdcoe.org/articles/2011/Geers

_SunTzuandCyberWar.pdf. For a more thorough treatment of the attribution challenge, see Martin C. Libicki, *Cyberdeterrence and Cyberwar* (Santa Monica, CA: RAND Corporation, 2009), http://www.rand.org/content/dam/rand/pubs/monographs/2009/RAND_MG877.pdf.

43. Air Force Space Command, *Functional Concept for Cyberspace Operations*, 10.

44. Rand Waltzman, "Anomaly Detection at Multiple Scales" (presentation, DARPA Cyber Colloquium, Arlington, VA, 7 November 2011), slides 3–4.

45. "Onion routing" refers to a technique, originally developed by the Navy, to hide the origin and content of packets as they traverse a network. Packets are sent through a network of randomly selected proxy servers, with successive levels of encryption and then decryption, before delivery to their final destination as plain text. W. Earl Boebert, "A Survey of Challenges in Attribution," in National Research Council of the National Academies, *Proceedings of a Workshop on Deterring Cyberattacks: Informing Strategies and Developing Options for U.S. Policy* (Washington, DC: National Academies Press, 2010), 43–46.

46. Jabbour, *50 Cyber Questions*, 9.

47. Col Daniel Simpson, commander, 659th ISR Group, interview by the author, 8 August 2012. The 659th is the Air Force's premier cyber ISR unit, focused on "digital network exploitation analysis and digital network intelligence." See Capt Karoline Scott, "New ISR Group Supports Cyber Operations," Air Force News Service, 10 September 2010, http://www.af.mil/news/story.asp?id=123221324; and AFDD 3-12, *Cyberspace Operations*, 24.

48. Kristin Quinn, Vago Muradian, and Marcus Weisgerber, "The Pentagon's New Cyber Strategy," *DefenseNews*, 18 August 2011, http://www.defensenews.com/apps/pbcs.dll/article?AID=2011108180316.

49. Libicki, *Cyberdeterrence and Cyberwar*, 96.

50. Wasserbly, "Charting the Course," 60.

51. Decian McCullagh, "House Passes CISPA Internet Surveillance Bill," ZDNet, 27 April 2012, http://www.zdnet.com/news/house-passes-cispa-internet-surveillance-bill/6360341. One opposing representative, Jared Polis (D-CO), claimed that the Computer Intelligence Sharing and Protection Act (CISPA) would "waive every single privacy law ever enacted in the name of cybersecurity. . . . Allowing the military and NSA to spy on Americans on American soil goes against every principle this country was founded on." See also Sanjay Goel, "Cyberwarfare: Connecting the Dots in Cyber Intelligence," *Communications of the ACM* 54, no. 8 (August 2011): 137; and Mike McConnell, "Mike McConnell on How to Win the Cyber-War We're Losing," *Washington Post*, 28 February 2010, B01, http://www.washingtonpost.com/wp-dyn/content/article/2010/02/25/AR2010022502493.html. In addition to general rights-oriented organizations such as the American Civil Liberties Union, advocacy groups include the Electronic Frontier Foundation (which offers a tutorial on "Surveillance Self-Defense" at https://ssd/eff/org), savetheinternet.com (which features the "Declaration of Internet Freedom"), the Electronic Privacy Information Center, the Center for Democracy and Technology, the Technology Liberation Front, and the OpenNet Initiative ("Our aim is to investigate, expose and analyze Internet filtering and surveillance practices"), http://opennet.net/about-oni. In the author's opinion and experience, no category of activity by the intelligence community has drawn such keen attention and public backlash in the United States since the Church Committee reports of 1976.

52. For insight into recent legal debates regarding cyberspace privacy, search and seizure law, and other constitutional norms, see Susan W. Brenner, "Fourth Amendment Future:

Remote Computer Searches and the Use of Virtual Force," *Mississippi Law Journal* 81, no. 5 (2012): 1229–62; Timothy Casey, "Electronic Surveillance and the Right to Be Secure," *University of California–Davis Law Review* 41, no. 3 (February 2008): 977–1033; Elizabeth Gillingham Daly, "Beyond 'Persons, Houses, Papers, and Effects': Rewriting the Fourth Amendment for National Security Surveillance," *Lewis & Clark Law Review* 10, no. 3 (Fall 2006): 641–71; Dan Fenske, "All Enemies, Foreign and Domestic: Erasing the Distinction between Foreign and Domestic Intelligence Gathering under the Fourth Amendment," *Northwestern University Law Review* 102, no. 1 (2005): 343–81; Freiwald, "Electronic Surveillance," 329–62; John N. Greer, "Square Legal Pegs in Round Cyber Holes: The NSA, Lawfulness, and Protection of Privacy Rights and Civil Liberties in Cyberspace," *Journal of National Security Law and Policy* 4, no. 1 (2010): 139–54; Orin S. Kerr, "Applying the Fourth Amendment to the Internet: A General Approach," *Stanford Law Review* 62, no. 4 (April 2010): 1005–49; Mike McNerney, "*Warshak*: A Test Case for the Intersection of Law Enforcement and Cyber Security," *University of Illinois Journal of Law, Technology and Policy* 2010, no. 2 (Fall 2010): 345–57; Amanda Yellon, "The Fourth Amendment's New Frontier: Judicial Reasoning Applying the Fourth Amendment to Electronic Communications," *Journal of Business & Technology Law* 4, no. 2 (2009): 411–37; and Mark D. Young, "Electronic Surveillance in an Era of Modern Technology and Evolving Threats to National Security," *Stanford Law & Policy Review* 22, no. 1 (2011): 11–39. Representative questions raised by these notes and case studies include the following:

- Are computers analogous to "containers" protected from "unreasonable search and seizure" under the Fourth Amendment?
- Is online communication to be treated the same as sealed letters under privacy and constitutional rights (content vs. noncontent)?
- Is surveillance of a specific individual's cyber communications (particularly e-mail and texts, for which an expectation of privacy exists) subject to the same limitations and restrictions as wiretapping?
- How do cyber intelligence professionals ensure compliance with mandates of Executive Order 12333, United States Intelligence Activities, to limit collection against foreign threats (i.e., how can you tell if the subject under surveillance or collection is or is not a "US person" subject to constitutional and executive protections)?
- Above all, how are individual rights to be balanced against the government's responsibility to ensure collective security against foreign *and* domestic threats?

53. McNerney, "*Warshak*," 346.
54. Air Force Space Command, *Functional Concept for Cyberspace Operations*, 15.
55. Libicki, *Cyberdeterrence and Cyberwar*, 155, 156.
56. James, interview.
57. RADM J. Michael McConnell, telephone interview by the author, 23 August 2012.
58. See, for example, William J. Lynn III, "Defending a New Domain: The Pentagon's Cyberstrategy," *Foreign Affairs* 89, no. 5 (September–October 2010): 99.
59. Ned Moran, "A Cyber Early Warning Model," in Jeffrey Carr, *Inside Cyber Warfare* (Sebastopol, CA: O'Reilly Media, 2010), 200; and Geers, *Sun Tzu and Cyber War*, 10.

60. Gregory C. Radabaugh, "The Evolving Cyberspace Threat" (working paper, Air Force Intelligence, Surveillance, and Reconnaissance Agency, August 2012), 9.

61. Eric M. Hutchins, Michael J. Cloppert, and Rohan M. Amin, "Intelligence-Driven Computer Network Defense Informed by Analysis of Adversary Campaigns and Intrusion Kill Chains" (paper presented at the 6th International Conference on Information Warfare and Security, George Washington University, Washington, DC, 17–18 March 2011), 3, http://www.lockheedmartin.com/content/dam/lockheed/data/corporate/documents/LM-White-Paper-Intel-Driven-Defense.pdf; Moran, "Cyber Early Warning Model," 208; and Radabaugh, "Evolving Cyberspace Threat," 9.

62. Hutchins, Cloppert, and Amin, "Intelligence-Driven Computer Network Defense," 3.

63. McConnell, telephone interview.

64. Dr. Kamal Jabbour, "Cyber Vision and Cyber Force Development," *Strategic Studies Quarterly* 4, no. 1 (Spring 2010): 65, http://www.au.af.mil/au/ssq/2010/spring/spring10.pdf.

65. Little wonder that some of our Air Force cyber warriors unofficially refer to themselves as "ninjas."

66. Richard Stiennon, *Surviving Cyberwar* (Lanham, MD: Government Institutes, 2010), 121.

67. A petabyte is 1 billion gigabytes; a yottabyte is 1 billion petabytes.

68. "Cyber Vision 2025," 40.

69. Damon Poeter, "DefCon: NSA Boss Asks Hackers to Join the Dark Side," *PC Magazine*, 29 July 2012, http://www.pcmag.com/article2/0,2817,2407783,00.asp.

70. Intelligence and National Security Alliance, *Cyber Intelligence*, 14. See also Wayne Michael Hall and Gary Citrenbaum, *Intelligence Collection: How to Plan and Execute Intelligence Collection in Complex Environments* (Santa Barbara, CA: Praeger, 2012).

71. James, interview. As Colonel Simpson observes, "Training is another challenge to overcome," given "the current lack of technical ability to conduct detailed cyber analysis." Simpson, interview.

72. Lynn, "Defending a New Domain," 103.

73. Simpson, interview.

74. A 2010 survey, for example, found that 88 percent of Americans believe they should enjoy the same legal privacy protections online as they do in the physical sphere. Only 4 percent disagreed. US Department of Commerce, *Comments of Digital Due Process, in the Matter of Information Privacy and Innovation in the Internet Economy*, docket no. 1004020174-0175-01 (Washington, DC: US Department of Commerce, National Telecommunications and Information Administration, 14 June 2010), 4, http://www.digitalddueprocess.org/files/NTIA_NOI_061410.pdf.

75. Lynn, "Defending a New Domain," 99.

**Col Matthew M. Hurley, USAF**

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# Manned Airborne Intelligence, Surveillance, and Reconnaissance

## Strategic, Tactical . . . Both?

Maj Tyler Morton, USAF

*We've adapted over time . . . from a predominantly strategic asset that is able to bring a tremendous amount of capability to bear in the tactical environment.*

—Lt Col Rich Rosa, Commander
763rd Expeditionary Reconnaissance Squadron, 2011


The Obama administration's desire to rebalance the United States' global focus to the Western Pacific and East Asia has serious ramifications for the manned airborne intelligence, surveillance, and reconnaissance (ISR) community.[1] That force, historically steeped in strategic-level intelligence collection, has become—through

the exigencies of the counterinsurgency conflicts of the early twenty-first century—the world's finest supplier of tactical-level intelligence. The US Air Force's arsenal of manned airborne ISR assets is a fixture over the battlefields of Afghanistan, and ground war fighters rely on these platforms for tactical intelligence.[2] The intelligence that the United States' manned airborne ISR force communicates often means the difference between life and death for ground forces engaged in combat. This was not always the case, however. Prior to the Persian Gulf War, these platforms were the masters of the peacetime airborne reconnaissance program. They spent the Cold War flying near the periphery of the Soviet Union—and that of many other nations—gathering intelligence designed to inform national-level decision makers. Beginning with the Persian Gulf War and developing fully in Operation Enduring Freedom, manned airborne ISR was transformed. First providing indications and warning to aircrews patrolling over Iraq and developing the ability to give near-real-time threat warning to ground forces in Afghanistan, the new force is now a world-class provider of tactical intelligence. The upcoming Asia rebalance and the near-simultaneous Afghanistan drawdown, however, herald a shift in mission. The question now becomes, What next for manned airborne ISR?

If a mission shift does indeed occur for manned airborne ISR, the force will require a major retooling of its capability. A community now overwhelmingly intent on the tactical-support mission needs time to reorient itself to a strategic mind-set. Two decades of flying over Iraq and Afghanistan have undoubtedly whittled away at the community's ability to conduct sustained missions in the Pacific theater; the majority of Airmen who will fly these missions were raised in the tactical environment. Additionally, the manned airborne ISR community faces the possibility of maintaining both capabilities—strategic and tactical. As the following discussion shows, manned airborne ISR forces historically have been asked to fluctuate between collecting strategic intelligence and tactical. Traditionally, though, following termination of the tactical requirement (Korea, Vietnam), the ISR force returned to its strategic focus. Will this time be different? Will the Air Force seek to

maintain some level of tactical-support capability or abandon it, as it has so many other times? If it does choose to retain a tactical capability, it faces the unenviable challenge of training and maintaining dissimilar collection, processing, and exploitation; analysis and production; and dissemination tactics, techniques, and procedures.

Finally, the Air Force also confronts the daunting task of preserving the manned airborne ISR fleet in times of fiscal austerity. As highlighted by the subsequent discussion, after major periods of combat, the United States traditionally has sought to downsize the force; ISR forces have not always been immune from these cuts. Fortunately, history offers many examples of shifts in manned airborne ISR's mission and its ability to persevere, despite the sometimes draconian budget restraints. From the establishment of consistent strategic manned airborne ISR against the Union of Soviet Socialist Republics (USSR) to today's tactical mission over Afghanistan, the manned airborne ISR force has been asked to alter its direction many times. By examining the initial development of that force and tracking its historical mission swings, this article shows that manned airborne ISR forces have adapted before and can successfully do so again. The limiting factors—now, as in the past—include time, personnel, and resources.

## Strategic Manned Airborne ISR

Although militaries first envisioned and operationalized manned airborne ISR as a tactical collection asset, the inability of balloons and aircraft to provide timely intelligence rapidly and consistently to ground customers led forces around the world to begin using their airborne platforms to deliver strategic intelligence. At the dawn of World War I, ground commanders believed that aerial reconnaissance of the front and artillery observation were the aircraft's main contribution to land warfare. Both of these missions inextricably linked the aircraft—whether balloon or airplane—to the war fighter on the ground. Despite the linkage, as the war began, armies remained uncertain of the value of the new capability. Communications remained problematic, and

many skeptical ground commanders still questioned the veracity of the intelligence gained by observation.[3] Furthermore, a number of the airborne observers exaggerated their reports.[4] As stalemate ensued on the ground, however, airborne ISR became the primary—if not the only—means of gathering intelligence about enemy movements. The technical development of aircraft and the additional capabilities they offered also justified the new reliance on ISR.

Aircraft progress was staggeringly rapid—new platforms reached the front, only to find themselves outclassed in a matter of months by the next development.[5] During the course of the war, airspeeds doubled, maximum altitudes and climb rates tripled, engine horsepower increased fivefold, and aircraft added armament.[6] With these capability increases came additional tasks. By the end of the war, aircraft were performing a considerable number of missions, most of them new: strategic bombing, air interdiction, attack from aircraft carriers, air defense, ground attack, and ISR.

ISR was not new, but the depth and height at which aircraft could penetrate enemy territory had changed. The additional capabilities permitted deep-penetrating ISR and fundamentally altered the type of intelligence supplied by aircraft. No longer was airborne ISR limited to the front lines, nor was it tied to the ground war fighters; the new capabilities enabled aircraft to look deep into enemy territory and allowed Airmen to predict an enemy's course of action. By seeing the enemy's movements well behind the front lines, ISR Airmen could forecast his intentions with sufficient time for friendly forces to head off assaults and frustrate his plans. Because of these new capacities, Airmen quickly validated their significance.

In the First Battle of the Marne, deep-penetrating airborne ISR detected a fatal error committed by Gen Alexander von Kluck of Germany. In a move designed to cut off Paris from the main French forces, von Kluck wheeled his units eastward. By doing so, he exposed the entire right flank of the German First and Second Armies.[7] Manned airborne ISR assets detected the weakness, enabling two

French armies and the British Expeditionary Force to take advantage and rout the Germans, forcing them into a 40-mile retreat to the Aisne River where they began fortifying their positions for what would become the infamous trench-war stalemate.[8] The First Battle of the Marne changed the course of the war. Airborne ISR provided the intelligence that allowed Allied commanders to act decisively and save what seemed a likely French defeat and loss of Paris.

In this example, ISR aircraft had sufficient time to return from their sorties and report what they had seen, just as the French and British had time to design a counterattack. Strategic collection was beginning to take form. Nevertheless, problems still plagued direct air-to-ground communication. Foreseen as early as 1907 by Benjamin Foulois, future chief of the Air Corps, the inability of aircraft to relay intelligence information accurately and rapidly was the bane of tactical ISR.[9] During the early stages of the war, the primary method for communicating intelligence obtained from ISR sorties called for the pilot to land his aircraft near the artillery battery and simply tell the gunners what he had found.[10] When possible, observers would annotate locations of hostile artillery batteries on maps to aid in their descriptions.[11] These reports often proved imprecise because in the excitement of the first taste of combat, the observers' inadequate prior training frequently led them to misidentify troop nationalities and activities.[12] The use of aerial photography helped obviate some of these problems, but the airborne ISR force never overcame difficulties with tactical communication. Although this situation fundamentally sealed the fate of tactical intelligence collection at the time, it opened the door for the strategic level of manned airborne ISR that would typify the majority of the United States Army Air Forces' (USAAF) effort during World War II and beyond.

Airpower emerged from World War I as a worthy complement to the Army's capabilities, but it remained vulnerable to major force drawdowns and the return to isolationism that characterized the period. Although the National Defense Act of 1920 recognized the success of

airpower by establishing the Air Service as an independent branch of the Army, by the late 1920s, the Army had instituted drastic cuts to aviation in an attempt to modernize the ground forces.[13] Airmen had not risen to the highest ranks of Army leadership and were thus powerless to prevent air cuts ordered by the still-parochial ground generals. This move away from the air and back toward the ground left the Air Corps, particularly the fledgling ISR forces, with little money to acquire new aircraft and with few people to advance airpower doctrine into the modern era.

As a new war brewed in Europe and the Pacific, American airborne ISR found itself woefully underprepared. ISR doctrine had not advanced, and even though World War I had established the value of strategic intelligence collection, airborne ISR remained doctrinally tied to the ground forces and inherently short range in nature. In addition to stagnant doctrine, the capabilities of ISR aircraft had not kept pace with the rapidly modernizing militaries. Airmen had vigorously advocated for additional reconnaissance aircraft, but when America's part in the war began in 1941, the Air Corps possessed few modern airframes.[14]

Despite the innovation-stifling environment, airborne ISR was on the precipice of a major evolution. As World War II progressed, enhanced aircraft capabilities, along with dogged determination, permitted America's airborne ISR forces to make significant contributions to Allied success. In addition to the incredible expansion of the imagery intelligence (IMINT) mission they had validated during World War I, airborne ISR forces in World War II created a first-rate capacity for collecting communications intelligence (COMINT) and electronic intelligence (ELINT). In the summer of 1942, during flights to determine the extent of German radar coverage in the Sardinia-Taranto-Tripoli areas, the British experimented with placing linguists on 162 Squadron's Wellington ELINT aircraft.[15] Their ability to give pilots advanced warning of German fighter activity became highly valued. As with so many other developments, the Americans adopted the British procedure, and

by October 1943 they were flying with linguists on their Mediterranean ELINT ferret aircraft.[16] In addition to protecting the aircraft and bomber formations, the linguists could call in friendly fighters to attack German aircraft. According to 1st Lt Roger Ihle, one of the earliest American airborne electronic warfare officers, "We had these German-speaking boys we had monitoring all of the aircraft frequencies of the Germans, so when they heard the Germans starting to scramble, why, they told the [American] fighters what was happening."[17] The presence of linguists improved situational awareness, so by late 1944, bomber crews commonly flew with a number of them on board.[18]

These advancements—enhanced IMINT, COMINT, and ELINT—solidified the role of airborne strategic intelligence. In fact, due to the development of these new capabilities, the terms *strategic aerial reconnaissance* and *tactical aerial reconnaissance* had already entered the USAAF's lexicon before the end of the war. In the intelligence appendix of the USAAF's report on the contributions of airpower to the defeat of Germany, the US Air Forces in Europe / A-2 defined *strategic aerial reconnaissance* as "the program of acquiring aerial intelligence as a basis for carrying on strategic air warfare against the enemy" and *tactical aerial reconnaissance* as something concerned with "large scale daily cover of the enemy forward areas, damage assessment photographs for fighter bomber attacks, and enemy defenses, airfields, and other special targets up to 150 miles from the front."[19] Moreover, the United States Strategic Bombing Survey concluded that "the U.S. should have an intelligence organization capable of knowing the strategic vulnerabilities, capabilities and intentions of any potential enemy."[20] This clear delineation solidified the USAAF's needs for an indigenous, long-range strategic airborne collection capability after the war and armed the future Air Force with the justification to sustain the growth of airborne ISR.

Following World War I, the American military faced a major force drawdown as a return to isolationism had become the common mantra. After World War II, however, the United States confronted a menacing

threat that it could not avoid by simple retrenchment. As the Cold War with the USSR escalated, it became clear that the Soviets would be a major adversary for the foreseeable future. In a time before intercontinental ballistic missiles, the Air Force's long-range bombers represented the United States' only viable attack option. When Air Force planners began building target information for strategic air warfare, they quickly recognized the paucity of intelligence on the USSR. If called upon, Air Force bombers needed to know about the critical Soviet targets; in the late 1940s, American-derived information simply did not exist.[21] When the Soviets joined the nuclear age in 1949, the need became paramount.

To meet the Cold War's intelligence demands, the Air Force began conducting airborne strategic intelligence missions along the periphery of Soviet-held territory. Initially, ISR aircraft—typically, modified C-47s, B-17s, or B-24s—based in Britain and occupied Germany conducted photomapping of large areas under Soviet control.[22] Under a project known as "Casey Jones," Air Force aircraft mapped nearly 2,000,000 square miles of Europe and North Africa.[23] In the Arctic, modified B-29s from Strategic Air Command's (SAC) first operational unit—the 46th Reconnaissance Squadron—photomapped potential divert locations for SAC bombers.[24] The IMINT proved useful, but the inability to obtain deep-range photographs, together with the increased danger posed by Soviet air defenses, forced planners to search for other solutions. In September 1946, SAC began flying dedicated ELINT collection missions along potential Arctic bombing routes for the purpose of characterizing Soviet radar sites.[25] Although successful, the sorties painted only a small picture of the USSR's air defenses. To truly understand the threat, the United States would have to order overflights of Soviet territory.

Frustrated by the lack of information on Soviet radar locations and capabilities, and with inaccurate map data of the Soviet coastline, on 5 April 1948, Secretary of the Air Force Stuart Symington sent a letter to Gen Carl Spaatz, the Air Force chief of staff, expressing his concern

about the lack of detail and urging Spaatz to authorize direct overflight of the USSR.[26] Spaatz agreed, and on 5 August 1948, the 46th Reconnaissance Squadron conducted the first mission authorized to overfly the USSR.[27] These wildly successful sorties generated unprecedented images of Soviet radar sites as well as detailed photography of the Russian littoral area. Soviet air defenses quickly evolved, however, and by the early 1950s, when the risk of losing an aircraft over Soviet territory had become too great, President Dwight Eisenhower ordered the development of the U-2. That aircraft enjoyed early success overflying the USSR, but the Francis Gary Powers incident of May 1960 again relegated the collection of airborne strategic intelligence to the periphery of the USSR.[28]

During the Cold War, using ISR aircraft to collect strategic intelligence became a core requirement for understanding the Soviet military. Peripheral and direct overflight missions provided the intelligence that the United States needed to remain one step ahead of the Soviets. Although oftentimes dangerous, the collection of strategic intelligence does not typically carry a sense of urgency.[29] Usually not time-sensitive, it contributes to an overall understanding of the enemy.[30] But on occasion the Air Force used its strategic airborne ISR platforms to support tactical commanders directly. These situations challenged the ISR community because the information collected often meant life or death for troops on the ground and other Airmen in the skies. In Korea and Vietnam, airborne ISR Airmen developed innovative ways to ensure that their intelligence reached the war fighter. Their efforts demonstrated that airborne ISR assets could satisfactorily fill both roles—strategic and tactical—but that fully making the transition took time and ingenuity.

## The Korean War: COMINT to the Cockpit

When North Korea invaded the south in June 1950, American airborne ISR was woefully unprepared to provide ground and air commanders the support they needed. A dearth of linguists, photo inter-

preters, equipment, and aircraft all contributed to the scarcity of information in the early stages of the conflict. As the war progressed, however, airborne ISR evolved. Airmen of the US Air Force Security Service (USAFSS) created a system to deliver airborne COMINT directly to the cockpits of fighters and bombers, supplying them with unprecedented situational awareness. These successes in Korea laid the groundwork for the integration of airborne ISR in subsequent conflicts.

When the war began, Far East Air Force's (FEAF) signals intelligence (SIGINT) capability was in atrocious condition. In June 1950, the USAFSS's 1st Radio Squadron Mobile, the only operational SIGINT unit under FEAF's control, did not possess an airborne collection capability.[31] Further, at the start of the war, the squadron had no Korean linguists and limited access to North Korean COMINT.[32] In an internal report, USAFSS characterized its SIGINT at the outbreak of war as "pitifully small and concentrated in the wrong places."[33]

Immediately upon the outbreak of the war, USAFSS Airmen began developing innovative ways to get intelligence to the war fighter. Just as they had done in World War II, Airmen began flying as "tagalongs" on non-ISR aircraft. As early as January 1951, Unit 4 of the 21st Troop Carrier Squadron was flying deep-penetrating, low-level missions into North Korean territory for the purpose of infiltrating friendly spies. These Douglas C-47 sorties often carried a Korean-American Airman to advise the mission aircraft of enemy activity and to support Fifth Air Force's intelligence requirements.[34] In that month alone, the unit flew as many as 13 "radio intercept" missions.[35] These forays deep behind enemy lines gave FEAF unprecedented understanding of the enemy situation and contributed significantly to Fifth Air Force's air-planning effort.[36]

Seeking to move intelligence directly to the cockpit, in February 1953 the USAFSS installed a COMINT collection position on a C-47 airborne tactical air control center.[37] In the beginning, "Mosquito Mellow," as it became known, passed messages among tactical air control parties, airborne controllers, fighter-bombers, and the ground control sta-

tion.[38] Over time, though, the aircraft's prowess in shortening the communications chain between tactical aircraft and the ground control station led it to become a de facto airborne command post. The USAFSS installed a secure communication method that let the onboard linguist validate the intelligence he collected with the USAFSS's Detachment 153 ground unit. After confirming the information, the linguist then relayed it to the tactical air control center's crew, who quickly passed it directly to other aircraft in the area. This process often had the effect of diverting fighters, bombers, and ground forces from their primary missions to support emerging situations as detected by the airborne linguist.[39]

The final effort by the USAFSS to supply airborne COMINT directly to the war fighter occurred in a project known as Blue Sky. Maj Leslie Bolstridge of the 6920th Security Group proposed the idea of equipping C-47s with COMINT collection equipment.[40] In late 1952, FEAF gave the group three C-47s, assigning them to the 6053rd Radio Flight Mobile at Yokota Air Base (AB), Japan.[41] Commencing almost immediately, the operations were a huge success. Flying over mainland Korea and the Sea of Japan, the newly outfitted RC-47 delivered unprecedented access to targets deep within North Korea and China. Even though the C-47s did not have direct communications with war fighters, ingenious Airmen devised a system by which the aircraft would jettison its tape recordings to waiting members of the USAFSS's Detachment 153 ground unit on Cho Do Island, Korea. In a procedure that foreshadowed the CORONA imagery satellite's delivery mechanism, the RC-47's crew rigged parachutes on the recorded tapes and then released them over a designated area of beach on the island.[42] The tapes then quickly went to Detachment 153, which subsequently passed any pertinent intelligence directly to the war fighters. Although not as timely as direct warning of threats eventually became, this method provided valuable intelligence. As proof of its value, when one of the squadron's RC-47s crashed during a takeoff from Yokota AB, Gen Otto Weyland, the FEAF commander, offered his own VIP C-47 as a replacement for the damaged aircraft.[43]

When the war began, airborne ISR had no significant tactical capability. Nevertheless, as it had done in World War II, the Air Force built a competent airborne COMINT force. Mostly neglected in the early stages of the war, airborne COMINT became a major contributor to the success of both land and air power. More importantly, the ability of Airmen to swing their focus rapidly from the USSR to Korea showed not only their flexibility but also the power of their innovation. When properly outfitted with adequate equipment—in this case the C-47—the aircrews quickly improvised and found ways to contribute to the fight. Their experiences in Korea helped the Airmen who succeeded them replicate many of their accomplishments in the Vietnam War.

## Vietnam: Project Teaball

Successful operations of the USAFSS's detachments during the Korean War made possible the delivery of sanitized COMINT to the war fighter. In perhaps the most well known effort of the Vietnam War, Doyle Larson, a colonel at that time, developed a similar system called Project Teaball. Whereas the Korean War effort provided only COMINT, Larson's system enabled the rapid dissemination of multisource information directly to the war fighter.

Responding to a plea for help from Gen John Vogt, the Seventh Air Force commander, Larson's team investigated ways to protect the Seventh's aircraft.[44] Because ongoing U-2 flights over Laos were already downlinking intelligence collection to a van at Nakhon Phanom Royal Thai AFB in Thailand, Larson's team decided that setting up a command and control van next to the U-2 exploitation van offered the best way of relaying the intelligence.[45] This new system would allow the command and control van to pass warning information about direct threats to pilots within seconds of reception.

In subsequent weeks, both General Vogt and Gen John Ryan, the Air Force chief of staff, approved the project and directed its implementation. Upon arrival in-theater and fearful of relying solely on the U-2's

collection, Larson's team members began to look for more platforms that could contribute.[46] Visiting the RC-135M Rivet Card crews in Japan, they discovered that the aircraft could pass its collection to the USAFSS's 6929th Security Squadron at Osan, Korea, which could then relay it to the Teaball van at Nakhon Phanom via secure communications. In addition to the U-2 and RC-135 information, they also incorporated radar data from orbiting EC-121 Warning Star and US Navy radar picket ships. These multiple sources of information gave the Teaball operations center the most robust intelligence picture available.

On 26 July 1972, Project Teaball went into effect.[47] After suffering initial growing pains marked by communications problems, the project met with huge success.[48] As in Korea, American pilots now had the information they needed to avoid enemy air ambushes and to set up their own. Within weeks, pilots were contacting the Teaball Weapons Control Center before their sorties to ensure that they could receive Teaball-derived intelligence.[49] The air-to-air kill ratio skyrocketed from 1:2 (before Teaball) to over 4:1.[50] Looking back on Teaball operations, General Vogt declared that "with the advent of Teaball, we dramatically reversed this [1oss-to-victory ratio]. . . . During Linebacker we were shooting down the enemy at the rate of four to one . . . same airplane, same environment, same tactics; largely [the] difference [was] Teaball."[51]

Teaball unequivocally had shown that airborne ISR forces could deliver intelligence directly to the war fighter. As was the case in Korea, the ingenuity of the Airmen made the difference. Given time and resources, they altered their mind-set from Soviet-based strategic intelligence to one highly capable of delivering intelligence directly to those who needed it. Not everything was perfect: communications complications, linguist confusion, and pilot buy-in complicated the system, but in the end, the intelligence delivered by the airborne ISR forces saved lives.[52]

After Vietnam, manned airborne ISR forces once again cast aside the lessons learned from war and returned to collecting strategic intelli-

gence against the Soviets. This reorientation on the USSR continued until Operation Urgent Fury in Grenada again underscored the inability to deliver tactical intelligence to joint ground customers.[53] Afterward, aircraft engineers labored tirelessly to automate data flow and supply compatible radios that allowed aircrews to talk directly to ground forces and other air assets. By the time Operations Desert Shield and Desert Storm began, these capabilities were in place. Throughout the counterinsurgency conflicts of the early 2000s, manned airborne ISR crews fine-tuned these capabilities so that we can now offer both threat warning and enemy information in near real time to a multitude of war fighters.

## Conclusion

Granted, the tactical ability of today's manned airborne ISR force remains critical to the successful execution of ground operations and has saved countless lives, but without firm leadership, the upcoming rebalance to the Pacific could herald the demise of such proficiency. The previous discussion has shown that, when returning from its forays into tactical collection, the Air Force's manned airborne ISR force historically has abandoned the tactical collection mission. The upcoming Asia-Pacific shift following the drawdown in Afghanistan, however, differs from the case studies mentioned here. Going into both Korea and Vietnam, the Air Force had to create new aircraft capabilities and dissemination methods to deliver tactical intelligence to war fighters. As we leave Afghanistan, this will not be the case. The airborne ISR force has integrated these tactical capabilities into the aircraft's baselines. Whether we use these platforms for collecting tactical or strategic intelligence, their radios and advances in data distribution will remain, allowing the assets to flow seamlessly from the tactical to the strategic environment as necessary and making the decision to maintain competency in tactical collection much easier. We deserted the tactical mission after the Korean War, and rebuilding it for Vietnam took time

and considerable effort. We now have a hard-earned tactical support capability that we should not abandon as our gaze turns to the Pacific.

If the communications hardware is adaptable, the question then shifts to our aircrews' ability to flex between the two missions. Has our concentration on counterinsurgency for the last 11 years atrophied our strategic skills? Undoubtedly, the Air Force has not completely abandoned the strategic mission, but for more than 20 years the preponderance of its efforts has been in the Middle East and Afghanistan. As in Korea and Vietnam, the need to deliver timely intelligence directly to the war fighter has driven today's aircrew tactics, techniques, and procedures. Today's young airborne ISR Airmen have always conducted the tactical mission; for them, switching to the strategic will demand considerable retraining. Our Airmen are razor sharp, but the current fight calls for a paper-thin level of analysis. The delivery of timely intelligence has bred a linguist force short on analytic skills. Strategic collection will precipitate a return to the days of slower, methodical analysis and reporting—relearning that skill will also take time.

History has shown that airborne ISR Airmen are more than capable of transitioning from tactical to strategic collection. As missions vacillated between Cold War strategic collection and tactical forays (Korea and Vietnam), our manned airborne ISR forebears had the luxury of dropping the tactical skill set when they returned to strategic collection. Modern ISR aircrews will not be as lucky. Because of the uncertainty of the threat environment, the Air Force must maintain tactical capabilities. Our force includes some of this nation's best talent; like their predecessors, they undoubtedly have the aptitude to make the transition. But we cannot compensate for an 11-year hiatus from the strategic collection mission overnight. Today's tactical fight demands rapid dissemination of intelligence with little in-depth analytic focus. Tomorrow's strategic missions will be different. As was the case during the Cold War, national decision makers need comprehensively developed intelligence. Consequently, the manned airborne ISR force must change its mind-set to accommodate them. These Airmen will have to

learn and relearn strategically focused linguistic, analytic, and reporting skills. Moving from the rapid, first-glance type of intelligence that typifies today's missions to one that calls for patience and target development will not be easy. We cannot make an absolute shift to the strategic, though. As mentioned above, we must be able to return to the tactical mission as the exigencies of today's dynamic environment demand. Doing so requires a great deal from our ISR Airmen. As always, they will succeed, but it is imperative that our leaders give them the time, personnel, and resources that they need. ✪

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# The F-22 Acquisition Program

## Consequences for the US Air Force's Fighter Fleet

Lt Col Christopher J. Niemi, USAF

The majority of US Air Force fighter aircraft in service today are F-15s, F-16s, and A-10s acquired in the 1980s. During that decade, the service had a fighter strength of approximately 36 fighter wing equivalents, with the average aircraft in the fleet about 10 years old. Since then the number of fielded fighters has steadily decreased, the Quadrennial Defense Review (QDR) of 2010 having established a requirement for 16–17 fighter wing equivalents.[1] Additionally, the Air Force has acquired very limited numbers of new fighters since the early 1990s, causing the fighter fleet's average age to increase steadily. Acquisition of the F-22 slowed but did not stop this trend (fig. 1). By 2011 the average age of fighters was 21.3 years.[2]

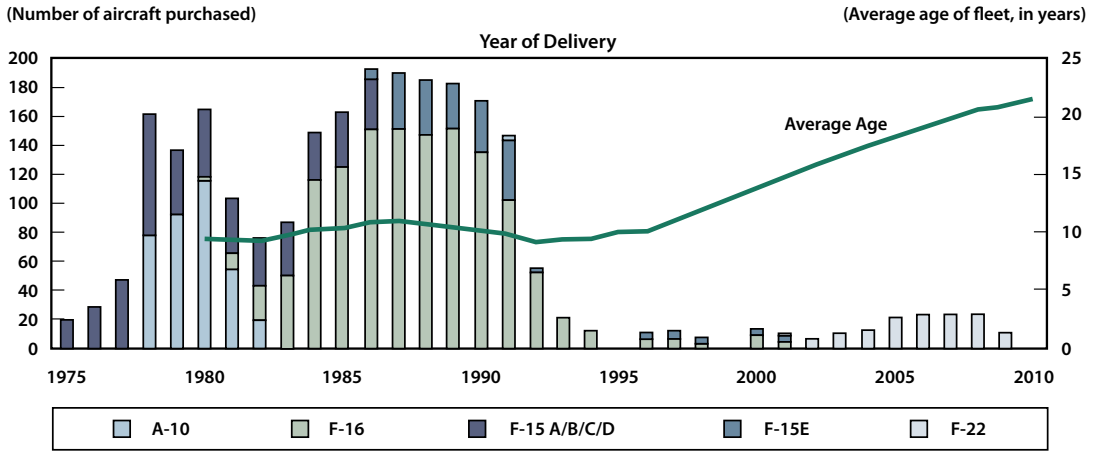


**Figure 1. The Air Force's current inventory of fighter aircraft, by year of delivery.** (From Congressional Budget Office, *Alternatives for Modernizing U.S. Fighter Forces* [Washington, DC: Congressional Budget Office, May 2009], 9, http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/101xx/doc10113/05-13-fighterforces.pdf.)

More importantly, the corresponding percentage of planned service life "used" has markedly increased (fig. 2). By 2009, 80 percent of the fleet's aircraft had used more than 50 percent of their originally planned service life. Clearly, the Air Force's fighter fleet is wearing out.

This sustained decline in fighter inventory coincided with the development and acquisition of the F-22. Originally, the Air Force intended to obtain 750 F-22s, primarily as replacements for air superiority F-15s acquired through the 1980s. As late as 2008, Air Force Chief of Staff T. Michael Moseley stated that the service needed at least 381 F-22s to meet operational requirements.[3] Nonetheless, in 2009 Secretary of Defense Robert Gates announced that F-22 production would end at 187.[4]

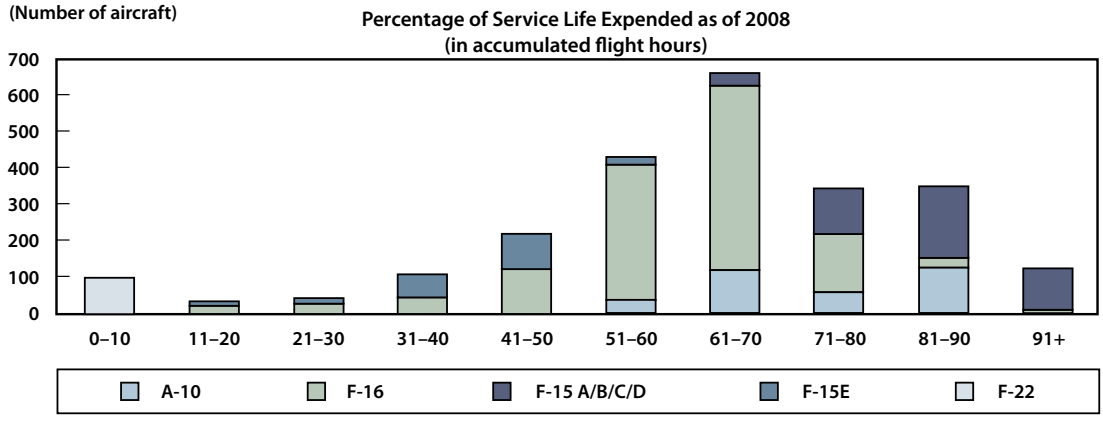


**Figure 2. The Air Force's current inventory of fighter aircraft, by percentage of service life expended**. (From Congressional Budget Office, *Alternatives for Modernizing U.S. Fighter Forces* [Washington, DC: Congressional Budget Office, May, 2009], 9, http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/101xx/doc10113/05-13-fighterforces.pdf.)

In consideration of this decision, this article examines the F-22 program in an attempt to answer two questions. First, given the clear need to recapitalize its fleet, why did the Air Force acquire just 25 percent of the F-22s originally planned? Second, could it have realized a better result by making alternative decisions during F-22 development? Finally, the article briefly addresses current fighter acquisition efforts in the context of the Air Force's experience with the F-22.

## History of the F-22 Program

Originally, the Advanced Tactical Fighter (ATF) program sought to counter a Soviet threat during the Cold War. The ATF's mission—air superiority—included finding and destroying high-priority enemy interceptors, standoff jammers, and large, offensive attack formations.[5] Plans did not call for air-to-ground attack, reconnaissance, or other "multirole" missions. Advancements in Soviet weapons, especially the MiG-29 and Su-27 aircraft, during the 1980s heavily influenced the

ATF's design. Developed about a decade after the F-15, these platforms possessed similar aerodynamic performance although their avionics and long-range weapons remained inferior. Nonetheless, these Soviet advancements led Air Force leaders to believe that the F-15's decisive air superiority advantage was fading. They wanted the ATF to preserve the technological advantage needed to battle superior Soviet numbers without incurring unacceptable losses.[6]

Seven companies presented proposals to the Air Force during the concept-exploration phase. The service subsequently decided to incorporate a demonstration/evaluation phase with two contractors competing in a flight-test competition using full-scale prototypes, selecting Lockheed Martin and Northrop Grumman to lead the two teams in developing the YF-22 and YF-23, respectively. In 1991 Secretary of the Air Force Donald Rice announced that although both designs met requirements, the Lockheed Martin proposal was superior because it offered "better capability at lower cost."[7] The Air Force considered the Lockheed Martin / Boeing / General Dynamics team more likely to deliver on its promises than the Northrop / McDonnell Douglas team, whose reputation was tarnished by B-2 problems and the A-12 cancellation.[8] Thus, the ATF became the Lockheed Martin F-22.

The demonstration/evaluation phase transitioned to the engineering, manufacturing, and development (EMD) phase in 1991. At that time, the Air Force forecast that the new fighter would reach initial operational capability (IOC) 10 years later—in 2001.[9] Although the service intended to replace approximately 790 air superiority F-15s with F-22s, early post–Cold War cuts reduced planned production from 750 to 648 in 1991.[10] At that time, it estimated the total cost of the program at $99.1 billion in "then-year dollars."[11] Of that amount, $19.5 billion was dedicated to development (including $3.7 billion already spent during demonstration/evaluation).[12] The remaining $79.6 billion went to production, making the average production unit cost (APUC) $122.8 million.[13]

### *Early Engineering, Manufacturing, and Development*

In the early 1990s, the overall Department of Defense (DOD) budget came under increasing pressure in anticipation of a post–Cold War "peace dividend." By fiscal year (FY) 1997, the DOD budget had decreased 38 percent from its FY 1985 peak while the procurement portion of the budget was simultaneously reduced by two-thirds (both figures in constant-year dollars).[14] The dwindling budget created an exceedingly difficult environment for F-22 development.

The Air Force's post–Cold War sustainment strategy entailed sacrificing force structure and preserving modernization programs.[15] Implementation of this strategy called for decreasing active duty manning by more than 40 percent—from 602,582 to 351,375 personnel between FY 1987 and FY 2000—while the service aggressively retired older tactical aircraft like the F-4, F-111, and A-7.[16] Consequently, by 1993 the Air Force's force structure had shrunk from 36 to 27 fighter wing equivalents, well ahead of the post–Cold War drawdown identified in the outgoing Bush administration's base force.[17] However, the new Clinton administration, determined to reduce the growing federal deficit, soon planned a second major restructuring of the military.

The Air Force believed that simultaneously funding multiple development programs for tactical aircraft probably was not tenable.[18] Furthermore, senior Air Force leaders strongly supported the F-22. For example, Gen Michael Loh, commander of Tactical Air Command in the early 1990s and author of the original ATF Statement of Need in 1981, remained "closely, and continuously involved with the ATF program" throughout his active duty career.[19] Gen Merrill McPeak, then the Air Force chief of staff, declared in 1994 that the F-22 "is probably the single most important [acquisition] program" in the entire Air Force.[20] After retiring, he continued to testify on the need to procure additional F-22s. As a result of this widespread support, other developmental programs such as the A/F-X (a joint Air Force and Navy strike fighter) and the Multirole Fighter (an F-16 replacement) were sacri-

ficed for the F-22 during the Bottom-Up Review (BUR) negotiations.[21] The F-22 program survived, but the aircraft needed to do more.

Undersecretary of Defense for Acquisition John Deutch was initially undecided on the F-22. He advocated that the initial operational aircraft incorporate an air-to-ground strike capability, enabling the F-22 to eventually replace the F-117.[22] In response, the Air Force moved to broaden the F-22's capabilities by formalizing limited air-to-ground strike—a capability under consideration for some time. The modified F-22 design carried two 1,000-pound Joint Direct Attack Munitions (JDAM) guided by the Global Positioning System in its internal weapon bays. Lockheed Martin incorporated this "add-on" capability for the relatively modest sum of $6.5 million.[23] For the first time, the Air Force had modified the F-22's design to incorporate an additional capability other than air-to-air.

The BUR, released in 1993, further reduced the Air Force's fighter strength to 20 fighter wing equivalents.[24] Planned F-22 production also decreased to 442 jets, a roughly proportional cut consistent with the new, smaller force structure. Although disappointed, the Air Force was relieved that the F-22's projected IOC date did not slip further beyond 2003 (since 1991 it had already slipped two years).[25]

### *What Is the Threat?*

Throughout its history, the primary criticism directed against the F-22 program was that the post–Cold War threat environment did not justify its cost. The 1993 BUR identified the DOD's responsibilities after the Cold War: deter major regional conflict, maintain overseas presence, conduct small-scale intervention operations, and prevent attacks involving weapons of mass destruction.[26] Air Force senior leaders continued to focus on advanced airborne threats of the future. They believed that although Russia was less likely to present a direct threat to America, its advanced aircraft (or even Western developmental programs such as the French Rafale) still justified continuation of the F-22 program.[27] Additionally, General McPeak established a commitment to

stealth that strongly influenced the Air Force's acquisition policy for the next 20 years: "As we field combat air forces for the future, stealth and precision must be first-order requirements."[28] His testimony to Congress provided the most plausible F-22 justification, arguing that the F-15C's replacement must preserve the ability to operate over enemy territory: "If we want to defend United States airspace, the F-15 will work fine. But I do not know where we are going to have to go in the year 2010 and have this fight. What I do know is I want to fight over *his* guys—not over *my* guys—and that is what air superiority means to us, and that is really why we need the F-22" (emphasis in original).[29] However, General McPeak also argued that we needed the F-22 for lower-threat environments, noting that Bosnian air operations also justified the aircraft even though pilots did not face advanced threats there.[30] The Air Force's support for the F-22 remained consistent and unified, but others were not convinced.

In December 1993, the General Accounting Office (GAO) presented a classified F-22 report to Congress. An unclassified version, along with public testimony, followed in early 1994.[31] The report assessed the F-15 as superior to projected air threats in four of five performance categories (flight performance, radar, long-range missiles, short-range missiles, and range). Additionally, the report analyzed seven countries whose air forces represented potential threats to future air superiority missions. It concluded that (except for China) each of those air forces possessed between 188 and 460 fighter aircraft, far fewer than the number of US air superiority F-15s in service at that time. Furthermore none of them had more than a handful of advanced fighter aircraft with performance in the F-15's class. Finally, the report predicted that high costs likely would prevent proliferation of these aircraft. In short the GAO recognized that the F-22 greatly improved air superiority capabilities but contended that the F-15 could adequately meet air superiority requirements through at least 2014. Based on this assessment, it recommended that the Air Force delay IOC for seven years.

The service aggressively countered the GAO report, arguing that it underestimated the threat while overestimating the F-15's capabilities. The Air Force's own analysis projected that the F-15 was inferior to the future threat in "range" and "short-range missiles," equal in "radar" and "long-range missiles," and superior only in the "flight-performance" category. Ironically, today's F-22 fails to deliver improved performance in those areas in which the Air Force assessed the F-15 as most deficient: range and short-range missiles.[32] Nonetheless, the service reinforced its F-22 argument with thousands of simulations modeling the F-15 against the Mnogofunksionalni Frontovoy Istrebitel (Multifunctional Frontline Fighter), a Soviet developmental project that never entered production. Scenarios pitted two F-15s against eight of these fighters, based on the BUR requirement to fight two major regional conflicts simultaneously. According to Air Force models, the F-22 would establish air superiority in seven days while the F-15 needed 22–25 days—and only after experiencing 4.8 times the losses.[33] In effect, the Air Force had defended the F-22 by using its own assumptions about future threats without addressing the GAO's fundamental allegation—the implausibility of the Air Force's threat assumption.

### *The 1997 Quadrennial Defense Review*

Just a year after the BUR, the F-22 program again came under pressure. Deputy Secretary of Defense Deutch sent a memo to the services on 18 August 1994, calling for a review of several major acquisition programs. Deutch himself noted that the reduced threat made the F-22 program vulnerable.[34] He asked the Air Force to comment on the possibility of delaying F-22 production by up to four years.[35] Shortly afterwards, Lockheed Martin set up a "derivatives team" to explore further expansion of the F-22's mission set.[36] The team looked into a suppression of enemy air defenses (SEAD) variant (providing a follow-on capability to the Block 50/52 F-16) and an electronic surveillance version that could collect electronic emissions deep in enemy territory. However, neither of the two variants got off the drawing board, and the derivatives team stood down in 1997 to focus on the original design.[37]

Nonetheless, the Air Force felt more pressure to demonstrate that the F-22 could fulfill additional requirements. One anonymous congressional staffer remarked, "I hope the Air Force is ready to unveil some new improved, better version."[38] Recognizing that significant design changes were cost prohibitive, the Air Force turned to adapting the baseline F-22 to other missions. For example, *Aviation Week and Space Technology* reported that the F-22 would "collect electronic intercepts and thereby pinpoint the location of enemy headquarters for Navy Tomahawk cruise missile or Army artillery rocket attacks." Moreover, Air Force officials hinted at a strategic electronic-intelligence collection capability similar to that of the RC-135 Rivet Joint.[39] However, these capabilities were not part of the F-22 design criteria, and currently fielded F-22s cannot conduct these missions effectively.[40]

Other examples revealed the Air Force's struggle to defend the F-22. For example, one anonymous Air Force official noted that the F-22 offered "good connectivity with off-board sources, a sensor suite that collects a lot of information on its own, plus an electronically scanned radar that has good sensitivity against low RCS [radar cross section] cruise missiles, and a good combination of missiles."[41] In fact, upgraded F-15Cs are equal or superior to the F-22 in these areas (except for its sensor suite, where the F-22 enjoys marked superiority). Furthermore, this argument ignored both the F-22's greatest advantage (stealth) and the availability of upgraded F-15Cs years before F-22 IOC at much lower cost.[42] One finds another example in Gen Ronald Fogleman's defense of the requirement for 442 F-22s, claiming that it would reduce territory lost by 18 percent as well as lower ground casualties by 28 percent and armor losses by 15 percent in future land battles—claims largely undermined by the wars in Iraq, Afghanistan, and Libya.[43]

Despite the Air Force's objections, the May 1997 QDR imposed further cuts in the planned production of F-22s to 339 aircraft. This QDR noted that, unlike previous reductions which mirrored overall force cuts, a reduction to 339 was "consistent with its much greater capability compared to the F-15, as well as our overall affordability concerns and

force structure decisions."[44] The only silver lining was that the Air Force had received a "promise to support production of two wings of F-22 strike aircraft," which would restore total F-22 production to the 400–500 range—a promise never kept.[45]

### *Later Engineering, Manufacturing, and Development*

By 1996 rising program costs led the assistant secretary of the Air Force for acquisition to charter a joint estimating team (JET) to approximate the program's future costs and determine ways to control the growth of such expenses. The JET estimated that the EMD would cost $18.7 billion (this figure does not include $3.7 billion spent during demonstration/evaluation). Congress subsequently adopted this number to establish an EMD limit in the National Defense Authorization Act for Fiscal Year 1998. It also implemented a $43.4 billion limit for production.[46] This marked a significant change for the F-22: a requirements-driven program had now become budget-driven. Under this "buy-to-budget" acquisition strategy, decreased production numbers would fund additional production costs.[47] Air Force and Lockheed Martin officials initially expressed confidence in their ability to keep costs below the new congressional limits without reducing production. However, expenses continued to rise.

In the wake of the 1997 QDR, the Air Force implemented a new construct for its deployable forces. By 2000 all operational fighter squadrons had been grouped into one of 10 air and space expeditionary forces (AEF) packages that could deploy to meet deterrence, contingency, or war-fighting requirements. Meanwhile, it was becoming clear that producing 339 F-22s would cost significantly more than $43.4 billion, a situation that demanded a new acquisition strategy to secure additional funding support and stop the erosion of production numbers. The AEF construct became the fundamental justification for F-22 numbers. The Air Force argued that since each AEF had an air superiority F-15C squadron (each including 24 aircraft) assigned to it, the service needed 10 operational F-22 squadrons.[48] Secretary of the Air Force

James Roche later quantified the exact requirement at 381, after including training, test, and attrition F-22s in the total.[49] The AEF requirement formed the foundation of the Air Force's F-22 acquisition argument throughout production years.

In 2001 President George W. Bush appointed Donald Rumsfeld secretary of defense with a mandate to reform the DOD. Secretary Rumsfeld used the word *transformation* to describe the process of preparing the department for new and different threats in the post–Cold War world. During early testimony to the House Appropriations Committee, he also made clear the need for recapitalization: "The Tomahawk cruise missile program, the F-15, F-18 and the F-16 aircraft flying today, were developed in the 1970s. . . . Because of the long procurement holiday of the 1990s, we have been left a poor hand. We must resolve to leave a better hand to our successors."[50] The only question concerned which acquisition programs supported transformation. Even at this early point, Secretary Rumsfeld appeared skeptical about the F-22 program; in fact, he did not mention the Air Force's highest acquisition priority a single time during his testimony.

By late 2004, Secretary Rumsfeld had concluded that additional F-22s did not support his transformation vision, so he sought additional production cuts. Massive cost overruns, combined with a high-profile acquisition scandal involving senior acquisition executive Darleen Druyun, undermined the Air Force's ability to defend the program.[51] Late in 2004, Presidential Budget Directive 753 removed production funding after FY 2008, effectively ending production at 183 F-22s.[52] The Air Force spent the next five years trying to overturn this decision but ultimately secured support for only four additional F-22s

## *Performance and Cost*

To understand the production limitation of 187 F-22s, one must further examine the aircraft's performance and cost. Simply put, does the F-22's performance meet expectations and, if so, at what cost? In terms of performance, the initial operational test and evaluation in 2004

found the F-22 "overwhelmingly effective."[53] Air Force analysts reinforced this evaluation recently, estimating that the F-22 exchange ratio is up to 30 times better than that for F-15s, F-16s, or F/A-18s in similar high-threat scenarios.[54] Although fourth-generation pilots are used to "seeing" nonstealth fighters 50 miles or more away with their radars, they typically fail to detect F-22s with their radar, visually or otherwise. Today's F-22 clearly excels at its originally designed air-to-air mission, reinforcing the fact that stealth enables tremendous advantages in the radar-dominated environment of modern aerial combat.

Further, the F-22 has demonstrated a capability to conduct air-to-ground attack in high-threat environments where fourth-generation fighters simply cannot survive. Advanced surface-to-air-missile systems such as the Russian S-300 (North Atlantic Treaty Organization [NATO] designations SA-10 and SA-20) are the deciding factor in these environments. The S-300, similar to the American Patriot surface-to-air missile, has been operational since 1980. Although no Middle Eastern country currently possesses S-300s, Iran has expressed interest, and both China and Russia have fielded large numbers of them. This system can engage fourth-generation fighters at ranges exceeding 100 miles.[55] A single S-300 battalion has the potential to render F-15Es, F-16s, and F/A-18s incapable of striking targets within a circle approximately 200 miles across.[56] Additionally, the follow-on S-400 (NATO designation SA-21) further improves maximum engagement range. Fortunately, F-22s can utilize their stealth to operate effectively well inside the maximum engagement ranges of these systems.[57]

However, F-22 performance is not without shortcomings, the two most substantial of which include limited range and high maintenance requirements. The aircraft's maximum range is slightly superior to that of the F-16 but significantly inferior to that of the F-15C, which it was designed to replace.[58] This fact has three important consequences: operational missions need more air-to-air tanker support, the F-22 has a limited ability to deeply penetrate hostile airspace, and pilots cannot take full advantage of the F-22's supercruise capability. The aircraft has

also proven more difficult to maintain than originally anticipated. The Air Force acknowledged that the F-22's "radar-absorbing metallic skin is the principal cause of its maintenance troubles, with unexpected shortcomings."[59] The service needs to maintain these coatings continuously to ensure the combat readiness of F-22s, thereby significantly increasing the necessary maintenance manpower (and cost). Moreover, even traditional (non-stealth-related) maintenance rates proved initially higher with the F-22 compared to those of older fighters. However, rates have improved vastly as maintenance personnel have acquired more experience. For example, the mean time between maintenance amounted to .97 flight hours in 2004, but that for newer F-22s has recently increased to 3.22 flight hours.[60]

Another important consideration has to do with specialization. Air-to-air performance demands drove highly specialized requirements, with heavy emphasis on countering advanced airborne threats. This led to a highly specialized design with an integrated avionics architecture that has proven costly to modify in response to evolving needs. Consequently, the F-22 remains inferior to older fourth-generation fighters in some scenarios. For example, the F-22 will never have the capability of an air-to-ground platform like the A-10, F-15E, F-16, or F/A-18 in low-threat environments. Those fighters employ a much wider variety of air-to-ground munitions, can more easily incorporate emerging technologies (e.g., new-generation targeting pods), generally have greater range and loiter time, and are less expensive to procure and operate. These factors, combined with the absence of any airborne threat in Afghanistan, Iraq (since 2003), and Libya, largely explain why the F-22 did not participate in those conflicts. Nonetheless, critics were quick to charge that the F-22 lacked a viable mission when the Air Force's newest fighter didn't deploy to those countries.

In sum the F-22 performs as designed and, for the most part, meets expectations. It is a superb air-to-air fighter whose stealth, advanced avionics, and maneuverability offer immense advantages in modern combat. The aircraft also boasts significant air-to-ground capabilities.

However, the F-22's utility for these missions depends very much on the threat. In the absence of radar-dependent surface threats, it offers no advantage over older fourth-generation aircraft in air-to-ground missions. The next question addresses how much this performance cost.

The F-22 program embraced many leading-edge technologies. It was the first operational air-to-air fighter to incorporate stealth, integrated avionics, thrust vectoring, and supercruise. Congress, especially the House of Representatives, expressed concern about the F-22 from the beginning because members believed that the Air Force had a "highly unrealistic assumption of outyear funding levels."[61] By 1993 the GAO, Congressional Budget Office (CBO), and Defense Science Board had expressed concern about the discontinuity between the DOD's projected funding levels and projected program costs.[62] Continuing perturbations due to technical challenges and funding instability forced the Air Force to restructure the F-22 program in 1993, 1994, 1996, and 1997—while developmental cost simultaneously increased by $5 billion.[63]

Diminished congressional confidence in the Air Force's ability to control program costs led to the FY 1998 cost caps. When those caps were originally set, near-unanimous consensus existed regarding projected developmental costs among the Office of the Secretary of Defense (OSD) Cost Analysis Improvement Group (CAIG), JET, Air Force, and CBO. All of them estimated the EMD cost at $18.7 billion and the total research, development, testing, and evaluation (RDT&E) cost at approximately $22.4 billion.[64] Unanticipated technical problems that came to light a few years later prevented the four independent estimates from predicting the later cost overruns. By 2007 the cost of total RDT&E had ballooned to approximately $30.4 billion, about 36 percent more than the FY 1998 congressional limit and 56 percent more than planned at the beginning of EMD.[65]

Unlike forecasts of developmental expenses, estimates of production costs varied widely in 1997. The Air Force had the lowest estimate but still expected production to cost billions more than the $43.4 billion limit imposed by Congress. The CBO, OSD CAIG, and JET predicted

higher production costs although all estimates were lower than the actual costs.[66] The author could find no explanation for why Congress set the production cap at $43.4 billion, a level inadequate to fund 339 F-22s under the best of circumstances. By FY 2009, Congress had adjusted the original $43.4 billion production limit to $37.6 billion since inflation was in fact lower than assumed in the original FY 1998 legislation.[67] As production drew to a close, an estimate for the total cost for mass producing 179 aircraft (EMD money funded eight "preproduction" aircraft conforming to production standards) came to $34.1 billion—about 90 percent of the total allocated for 339 F-22s in the FY 1998 legislation. The F-22's APUC was $191.6 million—56 percent higher than the $122.8 million planned at the beginning of EMD.[68]

Figure 3 compares these cost performance numbers to those of other fighter developmental programs. It depicts the total growth of program cost throughout EMD (except for the F-35, which will not complete EMD for many years) and demonstrates that despite the F-22's unprecedented cost increases, they remained roughly consistent with those of other cutting-edge technology defense programs. For example, F-14 program costs increased 45 percent during its EMD.[69] Furthermore, since beginning EMD, the F-35 program has experienced a 58 percent growth in the cost of RDT&E and an 81 percent growth in projected APUC, already exceeding the total growth of the F-22 program.[70] Since the F-35 EMD will continue for many years, additional developmental problems (and cost increases) will almost certainly emerge. Nonetheless, total planned production thus far has been only modestly affected because the Air Force, Navy, and Marines (along with the services of several partner nations) desperately need the F-35 to recapitalize thousands of aging fighters. Thus, the F-22's cost overruns, though substantial, were not the primary factor in curtailing production.

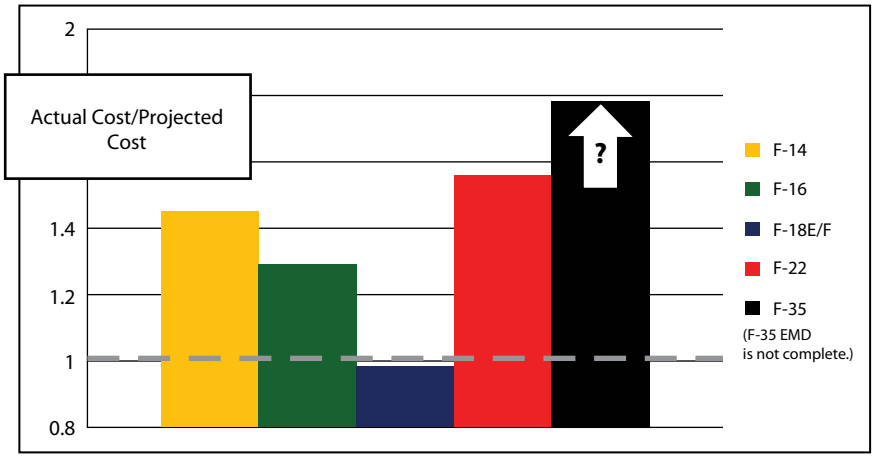


**Figure 3. Cost increase during engineering, manufacturing, and development**. (Cost data for the F-14, F-16, and F/A-18E/F from Obaid Younossi et al., *Lessons Learned from the F/A-22 and F/A-18E/F Development Programs* [Santa Monica, CA: RAND, 2005], 10, http://www.rand.org/content/dam/rand/pubs/monographs/2005/RAND_MG276.pdf.)

## Why 187?

The ATF was designed for a specific mission—countering the Soviet Union's advanced fighter aircraft. The dissolution of that state effectively eliminated this threat and simultaneously undermined the Air Force's threat-based argument. The service continued to argue vigorously that fighting large numbers of advanced fighters remained a valid requirement, even as the post-Soviet development of Russian advanced fighters slowed to a crawl. The failure of potential adversaries such as Iraq, North Korea, or Iran to acquire significant numbers of advanced air-to-air fighters further undermined the Air Force's argument.

Against this backdrop, two factors further weakened the service's position. First, as described in the earlier historical analysis, Air Force officials made overly optimistic claims about F-22 capabilities. Although intended to convince congressional and DOD skeptics that the F-22 was a good investment, these claims significantly damaged the Air

Force's credibility and ultimately limited its ability to defend the program. Second, the Air Force (and Lockheed Martin) repeatedly demonstrated that they could not accurately predict the program's total cost or timeline—a fact made clear by multiple cost overruns and program restructurings. By the late 1990s, these factors, in combination with a limited air-to-air threat, exacerbated the Air Force's difficulty in securing additional program funding. However, the F-22 retained strong congressional support, particularly from those districts and states directly involved with production. The FY 1998 cost caps enabled Congress to limit total expenditures without alienating these influential constituencies.

In 2003 planned production decreased to 276 under the FY 1998 program's cost caps as cost overruns continued to mount. The AEF argument proved no more effective than the threat-based one from the decade prior; therefore, the cost cap remained the de facto limit. Clearly, Congress could have repealed the production cap (as it had done with the developmental cap in FY 2002) but did not support additional production. In the end, the Air Force could not have fought harder for the F-22: the dogmatic support for the program by General Moseley and Secretary of the Air Force Michael Wynne evidently played a key role in their unprecedented dismissal.[71]

Primarily, the Air Force acquired only 187 F-22s because they were both too expensive *and* too specialized. The aircraft could have executed combat missions any time after attaining IOC in 2005, but the nation simply did not need its unique capabilities in those conflicts. Since becoming operational, the F-22 has conducted only deterrence deployments and homeland defense intercepts—missions hardly worthy of its unmatched prowess and cost. Meanwhile, F-15Es, F-16s, F/A-18s, and A-10s continued to prove their utility, flying combat in Iraq, Afghanistan, and Libya. Furthermore, F-15Cs updated with new, advanced radars, avionics, and weapons remain competitive with all air-to-air platforms currently fielded by potential adversaries.

As production began to wind down, the Air Force could not convince Congress to raise total program funding, despite the exceptional performance demonstrated by the F-22. Figure 4 depicts how decreased production (after the 1997 QDR) offset increased developmental and production costs, keeping total outlay under the FY 1998 cap. In the end, the Air Force fielded just 25 percent of the F-22s originally planned and less than half of its long-standing requirement of 381. The service must consider this disparity between required and actual production numbers in future acquisition programs.

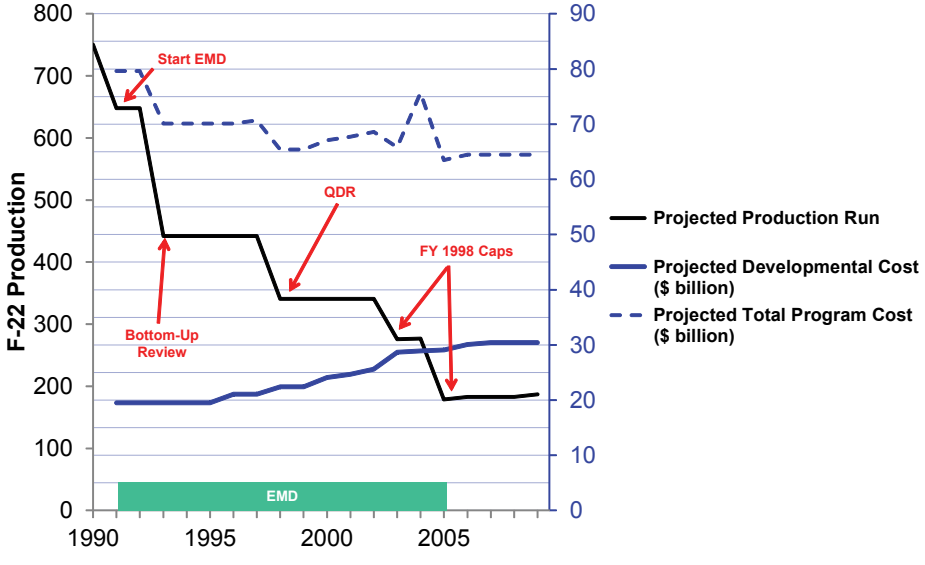


**Figure 4. Cost versus production.**

## Alternative Possibilities

The F-22 acquisition program adversely affected recapitalization of the fighter fleet in two ways. First, 187 F-22s cannot recapitalize the entire air superiority F-15 fleet as originally planned; F-15Cs will need to remain in service for many years to supplement the F-22s.[72] Second, and more significantly, the Air Force delayed multirole, close air support, and SEAD fighter recapitalization during the F-22 acquisition. As

a consequence, today's average age for Air Force fighters is twice the historical norms, and the service will not field significant numbers of new fighter aircraft for many years. Could the Air Force have avoided this predicament? It missed two key opportunities. First, the Air Force could have delayed the start of EMD, reassessed ATF requirements, and modified the F-22 design to broaden its capabilities. Second, it could have acquired additional fourth-generation aircraft to mitigate developmental risk with the F-35.

### *Delaying Engineering, Manufacturing, and Development*

By the time the Air Force had awarded the F-22 EMD contracts in August 1991, two world events plainly indicated that the overly specialized ATF deserved reconsideration. First, demonstrations from the Baltic States to the Caucuses in the late 1980s began to reveal cracks in the Soviet Union's foundation. In October 1989, Mikhail Gorbachev formally announced a policy of nonintervention in the Warsaw Pact nations, effectively freeing them from Soviet influence. By the time Secretary Rice announced that the YF-22 had won the demonstration/evaluation competition in April 1991, the former Soviet Socialist Republics of Lithuania, Latvia, and Georgia had already declared independence. Although the Soviet Union formally existed until December 1991, it had already become evident that the presumed source of future air superiority threats was imploding. Based on these events, Secretary of Defense Dick Cheney ordered a review in January 1990 to reassess acquisition requirements and presented the Air Force with an opportunity to adapt the ATF program to the emerging post–Cold War reality. However, the service defended the program as planned.[73]

The second event, the Gulf War of 1991, represented the first mass-on-mass US conventional military conflict in 40 years. F-15Cs achieved an extraordinary 31-to-0 exchange ratio in air-to-air combat.[74] Furthermore, this victory involved only 28 percent of the entire air superiority fleet of the US Air Force. Attack, multirole, and SEAD assets were more heavily stressed during this operation.[75] Although overall losses

proved lower than anticipated, older-generation Iraqi air defense systems managed to down 13 of the US Air Force's aircraft. The service lost no aircraft to airborne threats.[76] These facts should have made evident two very important realities: (1) fielded Air Force air-to-air fighters were quite capable of meeting near-term air superiority needs, and (2) surface-based weapons rather than airborne fighters were emerging as the primary threat to the United States' future offensive air operations. The Air Force did not draw these conclusions, subsequently issuing the EMD contract in August 1991 without any modification to requirements.[77]

If the service's leaders had realized that surface-to-air-missile systems were eclipsing air-to-air threats as the primary danger to future air operations, they could have better leveraged the investment in ATF demonstration/evaluation to counter weapons like the S-300. The ATF's stealth made the aircraft inherently more survivable against these threats, but it lacked a robust air-to-ground attack capability to target them. Furthermore, niche air-to-air capabilities such as thrust vectoring and some specialized avionics could have been eliminated to reduce cost and weight. Range should have received more emphasis, possibly even at the expense of supercruise. In addition to JDAMs, the Air Force should have added air-to-ground radar, Link-16 data-link transmit capability, and an infrared targeting sensor. These modifications would have greatly enhanced the F-22's utility in threat environments dominated by surface threats without degrading air-to-air performance.

Any delay can seriously damage an acquisition program: costs increase, and the program might be killed outright. Undoubtedly, the Air Force knew this, and it may have used this fact in its decision to continue the program as originally planned. However, barring cancellation of the program, the Air Force could have better defended a less specialized F-22 and probably could have acquired more than 187. Although the JDAM was incorporated relatively easily, other upgrades took much longer; indeed, the Air Force began fielding air-to-ground

radar (enabling the F-22 to locate ground targets autonomously) and the small-diameter bomb in late 2011. Unfortunately, the Air Force has found it impossible to add an air-to-ground infrared sensor or rectify the F-22's limited range.

### *Continuing Fourth-Generation Procurement*

Only a handful of fourth-generation F-15Es and F-16s were delivered after 1992, serving primarily to keep production lines open for future foreign sales. Although the GAO and members of Congress repeatedly urged the Air Force to consider acquiring additional fourth-generation fighter aircraft, the service has steadfastly concentrated on F-22s and F-35s for the last two decades.[78] By 2012 the results of this fifth-generation fighter acquisition policy had become clear: the Air Force has fielded 187 F-22s while the fighter fleet's average age has simultaneously grown to more than twice the historical average. Even if additional F-22 production proved feasible, it could not meet greater requirements for fighter recapitalization. First, the F-22's cost (APUC of $191.6 million) virtually guarantees that the service cannot acquire it in sufficient numbers to address the increased need. More importantly, the F-22 is simply too specialized; it cannot execute interdiction, time-sensitive targeting, close air support, or SEAD missions as effectively as older fourth-generation aircraft. Today, the Air Force plans to recapitalize 1,770 aging F-15Es, F-16s, and A-10s entirely via the F-35 program.

Commenting on the F-35 in 2003, Air Force Chief of Staff John Jumper said, "I can guarantee you I'm going . . . to make damn sure that we don't fall into some of the early developmental traps that we fell in with the F/A-22."[79] Unfortunately, the F-35 has experienced many of the same problems. For example, Senator John McCain (R-AZ) identified concurrent development, which describes overlap between the development phase and mass production, as the leading cause of the F-35's developmental cost overruns.[80] However, concurrency issues were not new: a 1995 GAO report highlighted concurrency in the F-22 program as a major developmental risk.[81] Massive cost overruns that

emerged in 2002 due to unanticipated avionics and structural problems validated those concerns. Today, concurrency issues are the primary reason that F-35 cost overruns have recently accelerated, with projected APUC increasing 17 percent from $113.6 million to $132.8 million in just one year. The total F-35 cost overruns experienced since EMD began in 2001 now exceed those that occurred in the F-22 program from the start of EMD through the end of production.[82]

More importantly, the F-35 is years behind schedule, and Air Force IOC will not occur until at least 2018.[83] Consequently, the service recently announced that it must invest in a service-life extension program for the F-16. Finally, further delays and cost overruns are likely; the F-35 EMD is years from completion; and Secretary of Defense Leon Panetta recently announced another delay in the F-35's development and acquisition timelines.[84] The feasibility of an all-fifth-generation fighter fleet remains uncertain.

The Air Force should not have been surprised by these program cost overruns and schedule delays, given its F-22 experience and the program's similarity to the F-35. That is, both are fifth-generation fighters; both are made by Lockheed Martin; and both planned high levels of concurrent development. Responding to a question about purchasing updated fourth-generation fighters in 2009 after significant F-35 developmental problems had come to light, Gen Richard Hawley (retired commander of Air Combat Command) testified that "if we had addressed this question 10 or 15 years ago, the answer might be yes."[85] However, he had testified 18 years earlier that (even upgraded) fourth-generation aircraft could not meet future requirements.[86] This appears to confirm that Air Force senior leaders were surprised by the F-35's developmental problems, but they probably also viewed additional fourth-generation fighter acquisition as a direct threat to fifth-generation fighter programs.[87] Regardless, the Air Force failed to implement the only solution that could have eased today's recapitalization problems—acquiring additional fourth-generation fighters.

The Navy's F/A-18E/F Super Hornet program ran concurrently with the F-22. Unlike the F-22, the F/A-18E/F was not designed to counter any specific threat. Rather, it addressed shortcomings of the original F/A-18, namely limited range and limited ability to carry unexpended ordnance back to the ship.[88] This was a much less ambitious developmental program than the F-22, lacking stealth, supercruise, or thrust vectoring. Low developmental risk contributed to completion of the F/A-18E/F very nearly on time and on budget.[89] As of 2008, the Navy's total program cost amounted to $46.3 billion for 493 F/A-18E/Fs ($93.9 million per jet) while the Air Force's total program cost came to $64.5 billion for 184 F-22s ($350.5 million per jet).[90] In other words, the Navy is buying 3.73 Super Hornets for the cost of a single F-22.

Because the Navy did not develop the F/A-18E/F to counter any specific threat, it effectively defended procurement based solely on recapitalization needs. Simply put, old airplanes must be replaced. Although aircraft in the Navy's fighter fleet are an average of seven years younger than those in the Air Force, the Navy is recapitalizing its fleet much more rapidly.[91] The Navy also uses F/A-18E/F acquisition to mitigate continuing F-35 developmental risk with 563 Super Hornets currently planned through FY 2014—and possibly more.[92] The Russians and Chinese adopted a similar strategy with the Su-27 fighter. The Su-30MKK and F-11 combine the basic Su-27 airframe with updated avionics and weapons. These Chinese aircraft represent the most capable potential adversaries for the Air Force, and officials have frequently cited them as justification for additional F-22 production.

## Conclusion

The ATF's overly specialized design constituted a fundamental flaw in the uncertain post–Cold War environment. The Air Force subsequently missed the best opportunity to adapt the F-22 when it issued the EMD contract without modification to ATF requirements. Throughout EMD, the service remained overly focused on the F-22 at the expense of A-10, F-15E, and F-16 recapitalization. When acquisition even-

tually shifted to the F-35, the Air Force largely ignored its F-22 experience and failed to plan for inevitable developmental problems with the F-35. Despite massive cost overruns and schedule delays, the Air Force continues to hope that the F-35 can solely recapitalize 1,770 aging F-15Es, F-16s, and A-10s. However, continuing developmental problems and the emerging national fiscal crisis threaten to undermine this strategy.

Although stealth is a powerful enabler for offensive systems, its greatest advantage lies in its ability to dramatically increase aircraft survivability against radar-dependent threats. Consequently, stealth's utility depends on the presence of those threats. By insisting on acquiring only stealth fighters (regardless of the cost), the Air Force assumes that future adversaries will not counter stealth technology and ignores the fact that many air combat operations continue to occur in low-threat environments. For example, allied fourth-generation fighters operated freely over large portions of Iraq (both in 1991 and 2003), Serbia, and Libya from the beginning of those conflicts. Future hostilities likely will continue this long-standing historical trend, and currently fielded stealth assets can mitigate risk to operations in high-threat environments where fourth-generation fighters are most vulnerable.

An all-stealth Air Force fighter fleet deserves reconsideration even today. Stealth technology demands significant trade-offs in range, security, weapons carriage, sortie generation, and adaptability. Stealth provides no advantage in conflicts such as those in Afghanistan or Iraq (since 2003), and (despite its obvious utility) it cannot guarantee success in future struggles with a near-peer adversary. Most importantly, the cost of F-22s and F-35s threatens to reduce the size of the Air Force's fielded fighter fleet to dangerously small numbers, particularly in the current fiscal environment. These facts suggest that the Air Force should reconsider its long-standing position that fifth-generation fighters are the only option for recapitalizing its fighter fleet. ✪

## Notes

1. Department of Defense, *Quadrennial Defense Review Report* (Washington, DC: Department of Defense, February 2010), 47, http://www.defense.gov/qdr/images/QDR_as_of_12Feb10_1000.pdf. A fighter wing equivalent is defined as 72 primary-mission aircraft designated for operational combat use, not including aircraft utilized for testing, training, and attrition reserve.

2. Senate, *"Air Force Tactical Aircraft Programs," Statement of Lt Gen Herbert J. Carlisle, USAF Deputy Chief of Staff, Operations, Plans, and Requirements, Department of the Air Force, to the Committee on Armed Services, Airland Subcommittee*, 112th Cong., 1st sess., 24 May 2011, 4, http://armed-services.senate.gov/statemnt/2011/05%20May/Carlisle%2005-24-11.pdf.

3. "Air Force Gen. T. Michael Moseley Transcript, Part One" [interview by Timothy Clark], *Government Executive*, 31 October 2007, http://www.govexec.com/dailyfed/1007/103107gg1.htm.

4. One hundred seventy-nine F-22s were built and funded through production monies, beginning with number 17. Earlier, 16 F-22s were built for dedicated test and evaluation purposes, but only eight of those were "production-representative." Throughout, the article refers to 187 total F-22s produced, including both "production" and "production-representative" aircraft.

5. General Accounting Office, *The Advanced Tactical Fighter's Costs, Schedule, and Performance Goals* (Washington, DC: General Accounting Office, January 1988), 15, http://www.gao.gov/assets/150/146085.pdf.

6. Bill Sweetman, *F-22 Raptor* (Osceola, WI: MBI Publishing Company, 1998), 10–11.

7. "Donald Rice Declares YF-22/YF119 a Winner in ATF Contest," *You Tube*, video file, 23 April 1991, http://www.youtube.com/watch?v=9kR9aTZ9W3s.

8. David F. Bond, "Risk, Cost Sway Airframe, Engine Choices for ATF," *Aviation Week and Space Technology* 134, no. 17 (29 April 1991). (All references to *Aviation Week and Space Technology* are derived from the LexisNexis Academic database.)

9. Sweetman, *F-22 Raptor*, 27.

10. Kevin N. Lewis, *Downsizing Future USAF Fighter Forces: Living within the Constraints of History* (Santa Monica, CA: RAND, 1995), 21–22, http://www.rand.org/pubs/monograph_reports/2006/MR480.pdf.

11. General Accounting Office, *F-15 Replacement Is Premature as Currently Planned* (Washington, DC: General Accounting Office, March 1994), 1, http://www.gao.gov/assets/220/219340.pdf. "Then-year" dollars represent the estimated cost as paid throughout program execution. All figures are then-year dollars unless otherwise noted and are rounded to one decimal place.

12. Senate, *Statement of Cindy Williams, Assistant Director, National Security Division, Congressional Budget Office, on Modernizing Tactical Aircraft, before the Subcommittee on Airland Forces, Committee on Armed Services*, 105th Cong., 1st sess., 16 April 1997, 12, http://www.cbo.gov/ftpdocs/42xx/doc4295/1997doc20-Entire.pdf.

13. General Accounting Office, *Changing Conditions Drive Need for New F/A-22 Business Case* (Washington, DC: General Accounting Office, March 2004), 6, http://www.gao.gov/assets/250/241714.pdf. APUC represents the total procurement cost divided by the number procured. It does not include research and development (including "preproduction" test aircraft) or facility construction. Procurement acquisition unit cost (PAUC) represents the en-

tire program's cost, including all research and development, program-specific support equipment, facility construction, and initial spare parts, divided by the number procured. Here APUC is calculated by dividing the production cost estimate by 648.

14. Eric V. Larson, David T. Orletsky, and Kristin Leuschner, *Defense Planning in a Decade of Change: Lessons from the Base Force, Bottom-Up Review and Quadrennial Defense Review* (Santa Monica, CA: RAND, 2001), 97, http://www.rand.org/content/dam/rand/pubs/monograph_reports/2007/MR1387.pdf; and House, *Statement of Lane Pierrot, Senior Analyst, National Security Division, Congressional Budget Office, on Aging Military Equipment, before the Subcommittee on Military Procurement, Committee on Armed Services*, 106th Cong., 1st sess., 24 February 1999, 11, http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/10xx/doc1096/022499.pdf.

15. John D. Morrocco, "U.S. Uses Gulf War to Frame New Strategy," *Aviation Week and Space Technology* 140, no. 3 (17 January 1994).

16. Air Force Personnel Center, accessed 12 September 2012, http://www.afpc.af.mil/.

17. Larson, Orletsky, and Leuschner, *Defense Planning*, 39.

18. General Accounting Office, *Status of the Air Force's Efforts to Replace the A-10 Aircraft* (Washington, DC: General Accounting Office, September 1988), 19, http://www.gao.gov/assets/150/146941.pdf.

19. Michael D. Williams, *Acquisition for the 21st Century: The F-22 Development Program* (Washington, DC: National Defense University Press, 1999), 111, http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA421919.

20. John D. Morrocco, "McPeak Sees Alternatives to Modernization Cuts," *Aviation Week and Space Technology* 141, no. 13 (26 September 1994).

21. Larson, Orletsky, and Leuschner, *Defense Planning,* 57. The A/F-X and Multirole Fighter technologies were rolled into the Joint Attack Strike Technology program, which in turn became the Joint Strike Fighter.

22. David A. Fulghum, "Pentagon to Kill A/F-X, Retain F-22," *Aviation Week and Space Technology* 138, no. 24 (14 June 1993). At Holloman AFB, New Mexico, F-22s replaced F-117s when the latter were retired in 2008.

23. John D. Morrocco, "F-22 to Have Limited Ground Attack Capability," *Aviation Week and Space Technology* 138, no. 22 (31 May 1993).

24. Department of Defense, *Report on the Bottom-Up Review* (Washington, DC: Department of Defense, October 1993), 28.

25. Fulghum, "Pentagon to Kill A/F-X."

26. Larson, Orletsky, and Leuschner, *Defense Planning,* 46.

27. David A. Fulghum, "Cost, Mission Disputes Jeopardize F-22," *Aviation Week and Space Technology* 140, no. 14 (4 April 1994); and David A. Fulghum, "Big F-22 Budget Drives Search for Flaws," *Aviation Week and Space Technology* 142, no. 15 (10 April 1995).

28. Merrill A. McPeak, *Selected Works, 1990–1994* (Maxwell AFB, AL: Air University Press, 1995), 224, http://ebooks.gutenberg.us/AU_Press_Collection/Books/McPeak/McPeak.pdf.

29. Ibid., 142.

30. Morrocco, "U.S. Uses Gulf War." According to General McPeak, "So for me the F-22 makes sense whether we have to fight the Russians or police Bosnian airspace or whatever" (ibid.).

31. General Accounting Office, *F-15 Replacement Is Premature*, 5.

32. Obaid Younossi et al., *Lessons Learned from the F/A-22 and F/A-18E/F Development Programs* (Santa Monica, CA: RAND, 2005), 4, http://www.rand.org/content/dam/rand/pubs/monographs/2005/RAND_MG276.pdf. Presently the F-22 can employ only older AIM-9M missiles rather than the newer AIM-9Xs (already fielded on F-15s and F-16s).

33. Fulghum, "Cost, Mission Disputes."

34. John D. Morrocco, "Lockheed Says Delay Would Hike F-22 Cost," *Aviation Week and Space Technology* 141, no. 9 (29 August 1994): 24.

35. David A. Fulghum and John D. Morrocco, "Deutch Demands Cuts, Services Scramble Anew," *Aviation Week and Space Technology* 141, no. 9 (29 August 1994).

36. Morrocco, "Lockheed Says," 24.

37. David A. Fulghum, "Expanding Roles May Shield F-22," *Aviation Week and Space Technology* 146, no. 1 (6 January 1997).

38. Ibid.

39. Ibid.

40. Assessments of actual capabilities are based on the author's experience as an F-22 pilot since 2002.

41. Fulghum, "Expanding Roles."

42. The author is referring to 18 F-15Cs fielded in 2000 with upgraded APG-63V2 radars, having very similar capability to the F-22's APG-77. Additional F-15Cs are being upgraded with the newer APG-63V3.

43. Fulghum, "Big F-22 Budget Drives."

44. William S. Cohen, *Report of the Quadrennial Defense Review* (Washington, DC: Department of Defense, May 1997), [79], http://hawk.ethz.ch/serviceengine/Files/ISN/32542/ipublicationdocument_singledocument/904a2c94-8ef7-4098-8b03-2edfc4b992aa/en/qdr97.pdf.

45. David A. Fulghum, "Critics Vow to Fight over Joint-STARS Cut," *Aviation Week and Space Technology* 146, no. 25 (16 June 1997).

46. Ronald O'Rourke, *Air Force F-22 Fighter Program: Background and Issues for Congress*, CRS Report for Congress (Washington, DC: Congressional Research Service, 16 July 2009), 9, http://www.policyarchive.org/handle/10207/bitstreams/1574_Previous_Version_2009-07-16.pdf.

47. Christopher Bolkom, *F-22A Raptor*, CRS Report for Congress (Washington, DC: Congressional Research Service, 5 March 2009), 6, http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA496273.

48. Robert Wall, "USAF Readies Strategy for Increased F-22 Buy," *Aviation Week and Space Technology* 153, no. 21 (20 November 2000).

49. David A. Fulghum, "Roche on Warpath," *Aviation Week and Space Technology* 158, no. 9 (3 March 2003).

50. Secretary of Defense Donald H. Rumsfeld, "Testimony Prepared for Delivery on the 2002 Defense Department Amended Budget to the House Appropriations Committee," 16 July 2001, http://www.defense.gov/speeches/speech.aspx?speechid=405.

51. Leslie Wayne, "Air Force Campaigns to Save Jet Fighter," *New York Times*, 13 January 2005, http://www.nytimes.com/2005/01/13/business/13fighter.html.

52. Amy Butler and David A. Fulghum, "SIT DOWN: Is Silence Golden? Not for the Pentagon, Say Critics, Who Accuse Civilian Leaders of Quashing Dissent," *Aviation Week and Space Technology* 162, no. 1 (2 January 2005).

53. Government Accountability Office, *Air Force Still Needs Business Case to Support F/A-22 Quantities and Increased Capabilities* (Washington, DC: Government Accountability Office, March 2005), 3, http://www.gao.gov/assets/250/245641.pdf.

54. David A. Fulghum, "Raptor's Edge," *Aviation Week and Space Technology* 170, no. 6 (9 February 2009). Exchange ratio refers to the number of enemy aircraft shot down for each loss of a friendly fighter.

55. S-300/Favorit (SA-10 "Grumble" / SA-20 "Gargoyle"), Jane's Defense and Equipment Technology, 23 December 2011, http://jdet.janes.com.

56. The F-15E, a multirole version of the air-to-air F-15C, retains most of the F-15C's air-to-air capabilities although it is heavier and less maneuverable. The Air Force uses the F-15E primarily for air-to-ground missions.

57. Fulghum, "Raptor's Edge."

58. Younossi et al., *Lessons Learned*, 4. This is an assessment of each aircraft's maximum range during subsonic cruise. Although the F-22 is more efficient than the F-15 or F-16 at supersonic speeds, supersonic flight significantly reduces the range of all three aircraft.

59. "Response to F-22 Washington Post Article by Jeff Smith," 10 July 2009, [1], http://hatch.senate.gov/public/_files/USAFResponse.pdf.

60. Michael Bruno and Warwick Graham, "Mulled to Death," *Aviation Week and Space Technology* 171, no. 4 (27 July 2009).

61. Younossi et al., *Lessons Learned*, 60.

62. Larson, Orletsky, and Leuschner, *Defense Planning*, 34–35.

63. Robert Wall, "F-22 Software, Cost Scrutinized," *Aviation Week and Space Technology* 152, no. 3 (17 January 2000).

64. Senate, *Statement of Cindy Williams*, 12. The JET EMD estimate ($18.7 billion) added to developmental/evaluation costs ($3.7 billion) equals $22.4 billion. The CBO and OSD CAIG estimated it slightly higher at $22.5 billion.

65. Gertler, *F-22 Fighter Program*, 9.

66. Senate, *Statement of Cindy Williams*, 12. Their respective estimates for production of 339 aircraft were as follows: Air Force ($48.3 billion), CBO ($65.7 billion), OSD CAIG ($64.4 billion), and JET ($61.2 billion). Interestingly, the CBO, OSD CAIG, and JET estimates from 1997 were within 10 percent of the actual APUC.

67. Gertler, *F-22 Fighter Program*, 10.

68. Ibid., 9.

69. Younossi et al., *Lessons Learned*, 10.

70. Department of Defense Selected Acquisition Report, *F-35 as of December 31, 2010*, 4, 15, http://www.fas.org/man/eprint/F-35-SAR.pdf. Figure 3 depicts 78 percent growth in the projected F-35 PAUC as reported in this selected acquisition report. For additional F-35 reports from 1996 through 2007, see http://www.dod.mil/pubs/foi/logistics_material_readiness/acq_bud_fin/09-F-1079_JSF_SARS_1996_Present.pdf.

71. Amy Butler, "Empty Nest," *Aviation Week and Space Technology* 173, no. 45 (19 December 2011): 61.

72. The Air Force maintains three operational active duty squadrons of F-15Cs although the Air National Guard now operates most of them.

73. David C. Aronstein, Michael J. Hirschberg, and Albert C. Piccirillo, *Advanced Tactical Fighter to F-22 Raptor: Origins of the 21st Century Air Dominance Fighter* (Reston, VA: American Institute of Aeronautics and Astronautics, 1998), 157.

74. General Accounting Office, *F-15 Replacement Is Premature*, 2. F-15s shot down 31 of the 33 Iraqi fighters downed during the Gulf War, and the worldwide F-15 fleet has a 104-to-0 record in air-to-air combat.

75. Lewis, *Downsizing Future USAF Fighter Forces*, 88. Twenty-eight percent of the US Air Force's air superiority fighter fleet deployed to Operation Desert Storm versus 63 percent of long-range attack, 41 percent of attack, 35 percent of multirole, and 57 percent of SEAD fleets.

76. Dr. Daniel L. Haulman, *USAF Manned Aircraft Combat Losses, 1990–2002* (Maxwell AFB, AL: Air Force Historical Research Agency, 9 December 2002), http://www.afhra.af.mil/shared/media/document/AFD-070912-043.pdf. Some evidence indicates that a US Navy F/A-18 was shot down by an Iraqi MiG-25 during the first Gulf War, but no official determination has been made, and evidence remains inconclusive. This is the only possible US loss in air-to-air combat since the Vietnam War.

77. Aronstein, Hirschberg, and Piccirillo, *Advanced Tactical Fighter*, 157–58.

78. Government Accountability Office, *DOD's Ability to Meet Future Requirements Is Uncertain, with Key Analyses Needed to Inform Upcoming Investment Decisions* (Washington, DC: Government Accountability Office, July 2010), 27, http://www.gao.gov/assets/310/308236.pdf.

79. David Bond, "Health of Stealth," *Aviation Week and Space Technology* 158, no. 9 (3 March 2003): 21.

80. "Floor Statement by Senator John McCain on the F-35 Joint Strike Fighter Program," website of Senator John McCain, Arizona, 5 December 2011, http://mccain.senate.gov/public/index.cfm?FuseAction=PressOffice.FloorStatements&ContentRecord_id=0FDCC4CC-EA5C-882C-25A3-DE5218AACB05. Senator McCain described excessive concurrency as "the grand, enormously expensive lesson of the Joint Strike Fighter program" (ibid.).

81. General Accounting Office, *Concurrency in Development and Production of F-22 Aircraft Should Be Reduced* (Washington, DC: General Accounting Office, April 1995), 2, http://www.gao.gov/assets/230/221075.pdf.

82. For the F-35 costs identified in this paragraph, see Department of Defense Selected Acquisition Report, *F-35 as of December 31, 2010*, 4, 15, 38. F-22 developmental cost and APUC both increased 56 percent from 1991 through 2007. The F-35 has already experienced 58 percent developmental and 81 percent APUC cost increases (compared to the 2001 baseline). However, at $125.2 million (APUC), the Air Force variant will be slightly less expensive than the other F-35 variants, compared to the overall program average of $132.8 million (APUC).

83. Senate, *"Air Force Tactical Aircraft Programs,"* 9.

84. Christopher Drew, "Military Contractors Brace for Cutbacks," *New York Times*, 26 January 2012, http://www.nytimes.com/2012/01/27/business/military-contractors-brace-for-cutbacks.html.

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**Lt Col Christopher J. Niemi, USAF**

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# Personnel Recovery

## Strategic Importance and Impact

Col Lee Pera, USAF
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*America's greatest asset is its people.*

—President Barack Obama


The breaking news from countless media venues in March 2011 was captivating and compelling: while taking part in coalition operations in Libya, a US Air Force F-15E, call sign Bolar 34, had gone down east of Benghazi. The two crew members had ejected into a chaotic battle between the despotic Libyan regime and opposition forces supported by the coalition. As our nation prayed for the two Airmen, President Barack Obama heard a briefing on the event and monitored the situation as rescue forces from a US Marine task force in the area and opposition ground forces quickly dashed in to

recover both men. In many ways, this heartwarming story resembled accounts of other rescues performed in earlier conflicts. The saga of Bolar 34 joined the lore of rescue missions that grace the proud history of our nation.[1]

As this vignette highlights, such dramatic rescue events, referred to as personnel recovery (PR), quickly capture the attention of the American people. However, the body of writing on these missions has mostly focused upon specific events and their operational or tactical aspects. They accentuate the substantial effort that the US Department of Defense (DOD) expends to rescue or assist in the recovery of those American citizens, members of the military, and even allied personnel who are missing, isolated in enemy-controlled territory, or detained. Such efforts are warranted because Americans—the very flesh and blood of our great country, who volunteer to serve our nation—are our most important "resource."

This article takes a broader look at this mission, primarily in terms of its strategic importance or impact, and demonstrates how PR has engaged and sometimes challenged many of our presidents, their executive subordinate organizations, and our military leaders. It offers our leaders at all levels of command a concise essay on PR, giving them an opportunity to better understand its challenges and the role they may play in its processes. Furthermore, the article points out to them situations in which they may need to become directly involved and the effect that PR may have on their commands or organizations. Overall, it seeks to ensure that leaders at all levels have the knowledge necessary to handle these events. Toward that end, the article analyzes PR at the strategic level of war, examines current national and DOD policy on PR, reviews the evolving threats to our people, presents historical vignettes that illustrate how PR has had a strategic effect in specific instances, and shows how the DOD's PR community has evolved from and with these events. Lastly, it assesses the impact of PR by presenting an amalgamation of noted lessons, which can prove useful in addressing the emerging threats and future challenges to PR.

## Personnel Recovery at the Strategic Level of War

Joint Publication (JP) 1-02, *Department of Defense Dictionary of Military and Associated Terms*, defines the strategic level of war as one "at which a nation, often as a member of a group of nations, determines national or multinational (alliance or coalition) strategic security objectives and guidance, then develops and uses national resources to achieve those objectives."[2] The president and his senior leaders provide *strategic direction* to the nation by communicating the necessary overarching guidance, which defines strategic interests through the publication of the *National Security Strategy* (*NSS*) and the *National Military Strategy of the United States of America* (*NMS*). They also use *strategic communication* to engage key audiences both domestically and internationally to "create, strengthen, or preserve conditions favorable for the advancement of United States Government interests, policies, and objectives."[3]

Emphasizing a whole-of-government approach to our international affairs, the *NSS* presents four enduring national interests:

- The security of the United States, its citizens, and U.S. allies and partners;
- A strong, innovative, and growing U.S. economy in an open international economic system that promotes opportunity and prosperity;
- Respect for universal values at home and around the world; and
- An international order advanced by U.S. leadership that promotes peace, security, and opportunity through stronger cooperation to meet global challenges.[4]

President Obama undergirds these interests with the enduring statement that "America's greatest asset is its people."[5] Most assuredly, they are our key resource—one that we will use to achieve our strategic objectives. Keying upon those points, the *NMS* recognizes that all Americans who serve in our military forces do so by choice:

> The all-volunteer force will remain our greatest strategic asset and the best example of the values we represent. . . .
>
> . . . As the challenges we face require a Joint Force that is flexible, agile, and adaptive, it emphasizes people as much as platforms. . . . By successfully contributing to America's security and prosperity, we will continue to advance our Nation's enduring interests well into the 21st Century.[6]

Neither document specifically mentions PR. However, since we have optimized it to protect our "greatest asset," PR is clearly an *implied task* that directly supports our nation's global influence. As further explained by Brig Gen Kenneth Todorov, USAF, and Col Glenn Hecht, USAF, retired (both career rescue officers), "PR protects human capital and denies an adversary the operational and strategic advantages of exploitation."[7]

Our warrior ethos, which comes from this belief, is ingrained with the expectation that we will "Leave No One Behind" and that "Someone Will Come." The American people share this ethos, fully expecting that if any of our personnel are isolated or detained, we will make every effort to get them back. This enduring moral imperative remains an essential element of the way that our nation fights its wars.[8] The American people also understand that in war, we expect to take losses. They will accept those losses if they believe that the cause we are fighting for is worth the cost. But we must remember the powerful words of Gen James Jones, USMC, former commander of European Command: "The military must have a 'social contract' with the troops and must never see them as expendable."[9]

## Personnel Recovery Policy

According to current national policy guidance for PR found in National Security Presidential Directive 12, *United States Citizens Taken Hostage Abroad*, "The taking of US citizens hostage anywhere overseas is a violation of federal [US] law. The policy of the United States is to work diligently to free US citizens held hostage abroad, unharmed."[10] All US government agencies must engage in a whole-of-government,

coordinated response to this challenge. In December 2008, an update to this directive identified hostage taking and kidnapping as growing trends designed to threaten destabilization of developing societies and established national policy for response to hostage taking and PR.[11]

DOD Directive (DODD) 3002.01E, *Personnel Recovery in the Department of Defense* (2009), the latest version of evolving DOD policy on PR, directly supports national policies and interests:

> Preserving the lives and well-being of U.S. military, DoD civilians, and DoD contractor personnel authorized to accompany the U.S. Armed Forces who are in danger of becoming, or already are, beleaguered, besieged, captured, detained, interned, or otherwise missing or evading capture (hereafter referred to as "isolated") while participating in U.S.-sponsored activities or missions, is one of the highest priorities of the Department of Defense.[12]

It also provides an overarching definition of PR as "the sum of military, diplomatic, and civil efforts to prepare for and execute the recovery and reintegration of isolated personnel." The directive expands the classification of isolated personnel by including "and others designated by the President or Secretary of Defense."[13] DODD 3002.01E mandates that each of the military services, US Special Operations Command (USSOCOM), and the geographical combatant commands shall, in its own unique way, be prepared to carry out this mission.[14]

Each service has developed distinct tactics and techniques to perform PR, based upon doctrinal guidance in JP 3-50, *Personnel Recovery*, republished on 20 December 2011. The Air Force and Navy have traditionally focused upon search and rescue and combat search and rescue, whereas the Army uses air and ground forces for this mission. The Marines conduct tactical recovery of aircraft and personnel missions. USSOCOM forces also can conduct PR with their joint assets in direct-action missions for hostage rescue or can employ unconventional assisted recovery capabilities. We have utilized all of these tactical procedures/missions during recent conflicts. The DOD-wide performance of PR with both dedicated and designated forces is well established and validated.[15]

## A Dangerous World

We must protect our strategic interests from global dangers, including competing nation-states with traditional militaries. Add to that the specter of terrorism—ancient in its form but increasingly evident and willfully and wantonly practiced by a morphing hydra of nonstate organizations or hostile elements such as the narco-terrorists in Latin America or the violent extremist organizations operating worldwide. A leader of one of the latter groups declared, "We believe that the worst thieves in the world today and the worst terrorists are the Americans. . . . We do not have to differentiate between military and civilian. . . . They are all targets." The author of this statement, Osama bin Laden, may be gone, but his minions and "true believers" fight on, and with them, we are decisively engaged.[16]

In terms of PR, this is a clear paradigm shift. Historically, we have considered our military aircrews and special operations forces as those most at risk. Now we must assume that all of our people are potentially in danger worldwide. Our national leaders recognize this change. Former deputy secretary of defense Gordon England prepared communications guidance for PR in which he underlined the broad scope of this increased danger in several clarion precepts:

> Captivity, detention, and illegal seizure of U.S., allied, and coalition personnel and citizens for exploitation purposes is a relentless and increasing threat to our collective security. . . . Adversaries bolster their credibility and cause by placing a premium on personnel and citizens from the U.S., its allies, and coalition partners. . . . The adversaries' desired effect is to:
>
> 1. Gain strategic advantage from a tactical event by weakening our national will and adversely affecting our free and open society.
>
> 2. Influence international partners to withdraw from U.S.-backed coalitions and make concessions for the return of captive, detained, or illegally seized personnel or citizens.
>
> 3. Degrade the U.S. international and domestic image by creating a sense of weakness and inability to resolve the crisis, in turn increasing the adversary's image of strength and legitimacy of cause.

4. Affect operational resources by diminishing human capital and the will to fight, while limiting freedom of travel and access.

5. Raise the risk of [US government] crisis response and limited contingency operations to increase the operational cost and deter U.S. involvement in operations abroad.[17]

This timely, focused guidance defines the new paradigm and invites a sober review of our nation's ability and propensity to perform this mission. To help us in this endeavor, we call upon the rich and extensive history of PR.

## Representative Personnel Recovery Vignettes

This section reviews a representative collection of specific events and conflicts that exhibit strategic impact. In every instance, senior national leaders were directly involved in one form or another. The history describes how our PR community evolved into its current form—a key PR event itself.

### *Royal Air Force, Great Britain, 1940*

One of the most notable events involved the dilemma facing Great Britain in 1940 as Germany unleashed its air forces upon that country in a series of strategic attacks in preparation for a ground-force invasion. The Royal Air Force (RAF) launched its fighter forces to defend the nation. Between 10 July and 10 August, it lost 220 pilots, killed or missing, most of them over the waters of the English Channel. As losses continued to mount, Prime Minister Winston Churchill clearly understood that unless his commanders could stanch this slow drain of the nation's best aviators, the strategic advantage could tip to Germany. He directed his commanders to take action. The RAF fighter pilots were not just a critical resource but a strategic center of gravity.[18]

The government had already begun programs to increase pilot production and transfer pilots from other commands and had drafted directives to limit air combat over the North Sea and English Channel as

much as possible. However, the British could not completely eliminate these battles. They had a sea-rescue force although it proved insufficient for the immediacy of the need at hand. Air commanders quickly developed a structure for a larger joint RAF / Royal Navy rescue organization. Within the next year, as the joint rescue force matured, air-sea rescue saved 444 aircrew members, successfully husbanding a critical resource that directly contributed to the strategic defensive efforts of the RAF.[19]

This action produced secondary and long-term effects. As the US Army Air Forces began to deploy overseas, the commander, Gen Henry "Hap" Arnold, saw the efficacy of the RAF example and formed rescue squadrons for duty in all theaters of war. These units, which had recovered nearly 5,000 American aircrew members, represented the embryo that would eventually become the Air Rescue Service of the US Air Force when it became a separate service in 1947. However, we could not account for tens of thousands of Americans (specifically, 73,681) lost in the war.[20]

### *Korea, 1950–53*

From June 1950 to July 1953, the United States, as part of a broad coalition under United Nations (UN) mandate, engaged the invading forces of North Korea and, later, Communist China. The US Air Force, Navy, and Marine Corps all deployed rescue units equipped with various fixed-wing aircraft and newly developed helicopters. This technological breakthrough allowed for the recovery of downed aircrews and ground personnel from almost any location, showing how evolving technology could be utilized for the recovery mission. The Air Force, Navy, and Marine Corps units recovered 254, 364, and 33 allied personnel, respectively. Very concerned about captured Americans, Presidents Truman and Eisenhower insisted that any cessation of hostilities provide for the return of all personnel, as specified in Article 3 of the armistice agreement. Subsequently, the Koreans released 4,428 American military

members. We continue to conduct recovery operations for the 7,947 Americans still listed as missing from that conflict.[21]

As our troops returned home, though, disturbing stories began to surface, pointing to misconduct on the part of many individuals held prisoner. Some of them succumbed to brainwashing and were used by the enemy as propaganda tools or for political exploitation. Debriefings and analyses determined that 192 people were chargeable with serious offenses against their fellow prisoners. Secretary of Defense Charles Wilson recommended development of a code of conduct to train all personnel at risk of becoming isolated or captured. President Eisenhower concurred, signing Executive Order 10631, which created the code that directed the conduct of our personnel as prisoners of war (POW) or who otherwise find themselves in a situation where they must survive, evade, resist, or escape (SERE). In response, all services began SERE schools for their personnel.[22]

### *U-2 Incident, Soviet Union, 1960*

President Eisenhower would be bedeviled by another PR event. On 1 May 1960, a US U-2 reconnaissance aircraft piloted by Francis Gary Powers took off from the military airfield at Peshawar, Pakistan, to photograph strategic missile sites in the Soviet Union, where air defense forces shot it down.[23] Powers parachuted from the aircraft. Unfortunately, the nearest rescue forces, more than 1,000 miles away in Europe, had neither the training nor equipment to perform such a rescue, so Powers was quickly captured.[24]

Unaware of his fate, the US government issued a press release stating that an American aircraft had "gone missing" over northern Turkey because of oxygen-equipment problems. Premier Nikita Khrushchev declared that a spy plane had been shot down over the Soviet Union but did not mention the capture of the pilot. A spokesman for President Eisenhower reinforced the earlier statement by adding that the Soviet claim might concern the same aircraft but that "there was absolutely

no . . . deliberate attempt to violate Soviet airspace. There never has been."[25]

On 7 May, Khrushchev's announcement that his forces had recovered the pilot alive, as well as substantial portions of the aircraft, deeply embarrassed the Eisenhower administration. The president planned to attend a summit two weeks later with Khrushchev and other top world leaders in Paris, where they would possibly reach agreement on key issues such as a disarmament treaty, a ban on nuclear weapons testing, and the status of Berlin, still unresolved from World War II. After arriving, though, Khrushchev demanded an apology from President Eisenhower, who refused, so Khrushchev boycotted the conference, negating any agreements and destroying goodwill that had developed between the two leaders. In this case, the lack of an available recovery capability limited larger strategic capabilities with political and diplomatic implications.[26]

### *Southeast Asia, 1961–75*

During the long involvement in Southeast Asia, four American presidents found themselves deeply engaged in war, and all had to deal with PR in some capacity. In the early years, the State Department was responsible for Americans on a country-by-country basis, and when enemy forces captured a few US military and civilian personnel, American diplomats tried "gentle persuasion" to gain their release. After the signing of the Geneva Accords on Laos in 1962, the United States removed all of its military from that country, which then returned all captured personnel.[27]

As US emphasis shifted to South Vietnam, more Americans—both military and civilian—were taken prisoner. Diplomatic efforts proved insufficient, and when the number of American military personnel began to increase, the US military introduced conventional rescue forces into the theater, directed by a joint rescue coordination center (JRCC).[28]

As the war expanded, an ever-increasing number of American Airmen became incarcerated in North Vietnamese prisons. Noting the insufficiency of diplomatic efforts, senior leaders in the DOD ordered creation of the joint personnel recovery center (JPRC) in Saigon as a subcommand of Military Assistance Command Vietnam (MACV). Acting as a clearinghouse for intelligence on American POWs, it could also request that assets of the MACV Studies and Observation Group be used to conduct rescue operations when feasible.[29] However, the JPRC had no operational control over any tactical assets. In most cases, recovery forces were not available quickly enough to respond to perishable intelligence. Additionally, the JPRC could not operate in Laos without ambassadorial approval. Until its inactivation in 1972, the center successfully orchestrated the recovery of several hundred Vietnamese and Korean soldiers but no Americans.[30]

By 1968, after more than 400 Americans had been taken prisoner, the wives and families of many of these men began to speak out about their harsh treatment and political exploitation by the enemy. Organizations such as the League of Families became very powerful lobbying entities that forced the US government to address POW issues and that met with representative groups to voice their concerns. Because Presidents Johnson and Nixon had to respond to pressure from this league and other groups, the North Vietnamese saw the political value of holding US prisoners, as had the North Koreans in the earlier conflict.

In November 1970, President Nixon approved an operation by US military forces to rescue American POWs held at the Son Tay prisoner camp, 30 miles northwest of Hanoi. Theater rescue forces conducted a well-planned, -rehearsed, and -executed mission. Unfortunately, the prisoners there had been moved, so none were recovered. However, the raid forced the North Vietnamese to centralize all US prisoners and treat them better.[31]

As America began to withdraw from the war and initiated peace negotiations with the North Vietnamese, the status and release of the POWs became a primary issue, as it had in Korea. At one point, Presi-

dent Nixon publicly stated that he would not completely withdraw US forces from Vietnam until Hanoi had released all POWs.[32] Article 8 of the treaty, finally signed in Paris on 27 January 1973, contained specific language detailing the release of all American POWs. Subsequently, the North Vietnamese freed 591 Americans, military and civilian, but more than 2,400 Americans remained unaccounted for in the theater.[33]

Residual US military forces remained in-theater, mostly in Thailand. As the North Vietnamese Army overran South Vietnam, Cambodia, and Laos in 1975, these forces supported noncombatant evacuation operations from Saigon, South Vietnam, and Phnom Penh, Cambodia. In May, when pirates seized the American ship SS *Mayaguez* near Koh Tang Island, Cambodia, President Gerald Ford ordered a recovery operation for the crew and ship, fearing a replay of the North Korean seizure of the US Navy ship *Pueblo* seven years earlier. He and his senior advisers closely monitored the subsequent operation, which recovered the crew and ship. However, four helicopters were destroyed and 41 US personnel killed—an unsatisfying end to a long and divisive war.[34] The United States learned many lessons concerning the need to preposition recovery forces in any conflict, the reality of political and diplomatic limitations on recovery operations, and the undeniable fact that the American people did not deem lightly those lost and that they expected our military forces to maintain a rescue capability.

### *Seizure of the US Embassy, Iran, 1980*

In November 1979, radical followers of Imam Ayatollah Khomeini in Iran overthrew the Shah, Mohammad Reza Pahlavi, seizing the American Embassy in Tehran and 53 Americans. President Jimmy Carter directed that the military take *all* actions to free the hostages. Through the winter and spring, diplomatic efforts abounded but to no avail. Secretary of Defense Harold Brown directed Maj Gen James Vaught, USA, to "prepare a plan and train a force to rescue American citizens illegally held in Iran."[35]

Naming the project Operation Eagle Claw, Vaught developed his assigned service elements into a joint task force. The US Navy supplied eight RH-53D heavy-lift helicopters, launched from ships and flown by US Marine pilots. They would fly to a landing zone designated Desert One, deep in Iran. Air Force MC-130s would land with an Army assault element that would then transfer to the helicopters for movement to the suburbs of Tehran. The Soldiers would seize the American Embassy and move the hostages to a nearby soccer stadium. Then the helicopters would land in the stadium and ferry the hostages and Soldiers to another remote airfield where Air Force cargo aircraft would land and recover all personnel.[36]

When diplomatic efforts failed, President Carter authorized the execution of Eagle Claw. On the evening of 24 April, the helicopters lifted off the deck of the USS *Nimitz* and headed for Desert One. En route, though, they encountered a terrible dust storm, and two aircraft experienced mechanical problems, returning to the *Nimitz*. The other six pressed on. Upon arrival, a third crew reported that their aircraft was severely broken. Because the mission required six helicopters, Col Charles Beckwith, USA, the on-scene-commander, aborted it. As the Soldiers and Airmen scrambled to organize their departure, one of the helicopters collided with an MC-130. The resulting explosion and fire killed eight Americans and seriously wounded five more. The failed mission dealt a devastating blow to the United States' prestige and image around the globe.[37]

President Carter directed formation of another task force for a second attempt. He also continued diplomatic efforts to secure release of the hostages. However, the Iranians were unrelenting, believing that they could weaken Carter and possibly extract concessions from him as he faced reelection in November. Although his administration reached an agreement with the Iranians for the return of the hostages, the failure to rescue them severely damaged President Carter politically. According to *Time Magazine*, "For Carter in particular, and for the US in general, the desert debacle was a military, diplomatic,

and political fiasco."[38] His national approval rating, 75 percent when Iran seized the hostages, plummeted to 20 percent after Desert One. In November he lost the presidential election to Gov. Ronald Reagan of California. Postelection polls indicated that fully 50 percent of voters voted *against* Carter rather than *for* Reagan.[39]

We can draw another major strategic implication from these events—that the United States would have to prepare itself to deal with an ominous revolution in the Islamic world led by a cabal of leaders who saw the West in general and the United States in particular as the "Great Satan." Consequently, the United States maintained a task force organized for the second attempt. When Congress subsequently directed an entire reorganization of the US military to facilitate activation of USSOCOM on 16 April 1987, that task force was an integral, core element of the new command.[40]

### *Operation Desert Shield/Storm, 1990–91*

On 2 August 1990, Iraqi military forces invaded Kuwait. President George H. W. Bush ordered a strong US response and began building a coalition to stop the Iraqis from continuing into Saudi Arabia and to force them to leave Kuwait eventually. He also specified that casualties be held to a minimum.[41]

When all diplomatic and economic efforts to evict the Iraqis failed, Gen Norman Schwarzkopf, USA, the theater commander, initiated combat operations to do so. The entire campaign lasted six weeks. To limit losses, the air forces aggressively attacked the Iraqi air defense forces. Additionally, the better-designed post-Vietnam aircraft equipped with radar-jamming devices and precision-guided weapons gave the better-trained aircrews enhanced capability to avoid those air defenses.[42]

Lt Gen Charles Horner, USAF, the joint force air component commander, who had responsibility for theater rescue, formed a JRCC to coordinate necessary actions. However, he did not receive any Air Force rescue squadrons to perform the tasking. Because of command

reorganizations and the transfer of the most capable helicopters to USSOCOM, the Air Force's Air Rescue Service squadrons were equipped with old, operationally limited Vietnamese-era machines. Consequently, the helicopter and ground assets of the USSOCOM component of US Central Command—deployed to Saudi Arabia and Turkey—conducted the recovery missions. However, in some cases, this arrangement did not work smoothly, generating delays in recovery efforts. During the conflict, the Iraqis shot down 43 coalition aircraft, and one Army truck inadvertently drove into enemy territory. A total of 89 coalition troops were involved in these incidents, 48 killed in the isolating event and eight rescued. Thirty-two became POWs, and one was missing. Analysis indicated that as many as eight more individuals were recoverable, but US forces did not rescue them because of overall problems with command and control and an inability to locate the survivors quickly. The enemy exploited many of these troops for propaganda purposes. At the cessation of hostilities, General Schwarzkopf met with Iraqi commanders to set the terms and conditions of the cease-fire, making his first directive the return of all allied POWs and remains. The Iraqis quickly complied, handing over everyone except for one missing aviator, whose remains were eventually found and returned from Iraq in 2009.[43]

In response to the deficiencies noted in the conflict, the Joint Services SERE Agency (JSSA), was activated at Fort Belvoir, Virginia, on 15 November 1991 as a field operating agency of the Air Force. Its personnel begin working with combatant commands to develop both theater escape and evasion plans as well as plans and procedures for recovery of isolated personnel. The JSSA helped develop a requirement that each combatant command create a standing JRCC, with the personnel, equipment, and authorities necessary to command and control available rescue forces. In 1993 Secretary of Defense Dick Cheney activated the Defense POW / Missing Personnel Office, authorized and directed to oversee and manage issues concerning POWs and personnel missing in action and to craft necessary policy. It worked closely with the JSSA for what would become known as PR.[44]

### *Blackhawk Down, Somalia, 1993*

In response to a humanitarian disaster unfolding in Somalia in August 1992, President Bush directed the US military to initiate Operation Provide Relief as part of a larger UN effort. Americans delivered supplies for an estimated 3 million starving people as warring factions battled for control of the nation. The president directed the Marines and Army to carry out an operation labeled Restore Hope, deploying a combat force to work with other coalition forces to establish peace and stability.

When President Bill Clinton assumed office in January 1993, he continued the mission. However, one local faction led by Mohamed Farrah Aidid resisted calls for a peaceful resolution and became increasingly confrontational.[45] Clinton ordered the deployment of a US special operations joint task force of 500 troops, which attacked a building in Mogadishu on 3 October to capture a key Aidid leader and his subordinates. As the Soldiers assaulted the building, Somalis swarmed to the site and engaged the task force, killing 18 Americans and wounding 73. Additionally, they shot down two helicopters—prophetically, the rescue helicopters for the mission. Somalis overran the crash sites, killed all of the Americans except CW3 Michael Durant, mutilated the bodies of the dead Americans, and dragged them through the streets.[46]

Americans reacted with shock and anger because they had not realized that "mission creep" had drawn our Soldiers into direct combat. "We came here to feed people," screamed *Time Magazine*. "The US will help the U.N. peacekeepers as it can, but the US will not allow itself to become another fighter-killer among factions in the streets and alleys of Mogadishu." The *New York Times* was blunter, declaring, "Somalia, time to get out!"[47]

As President Clinton sought a diplomatic solution to the unfolding debacle, he dispatched a senior aide to Somalia to arrange the release of CW3 Durant. The House passed a resolution calling upon the president to secure the immediate return of all military members held by the enemy, recover the remains of all those killed, and begin a with-

drawal of all US forces from Somalia.[48] Senator John McCain (R-AZ) said that no military mission existed in Somalia, adding, "Someone ought to tell [the president] . . . it's time to bring the troops home." The *Cincinnati Enquirer* added, "Escalating casualties and fighting are wasting US lives in Somalia." The criticisms became so acrimonious that Secretary of Defense Les Aspin was forced to resign.[49] President Clinton announced a withdrawal plan for all US forces as his envoy quietly arranged for the release of Durant with a warning to the Somalis that delay could possibly generate the need for a much more violent American response. Aidid agreed to release him.[50]

Sensing that the American people had developed an aversion for casualties, President Clinton adopted that view—one reflected in future uses of military force. Rather than casualties, however, the American people abhorred the loss of our men and women for no useful purpose, as explained by General Jones earlier in this article.[51] Public support for the Somalia effort had clearly waned. In a Yankovich Partners survey of 7 October that asked whether Americans approved of US troops in Somalia, 36 percent of the respondents said yes, and 60 percent said no. Responding to a question that asked them to identify an important goal of the United States in Somalia, 96 percent said, "Making sure US Soldiers taken prisoner are released," and 89 percent said, "Bringing US troops home as soon as possible."[52] Obviously, the American people did not believe that our actions in Somalia were worth the cost. In this incident, the lack of a sufficient recovery capability degraded our realization of larger strategic goals.

## An Evolving Personnel Recovery Community

By 1996 the JSSA had evolved into the focal point for PR and was working directly with the combatant commands and Joint Staff. It sponsored a conference at which everyone understood that PR referred to everything—training, equipage, doctrine, organization, and so forth—done to facilitate the recovery of personnel. In response to requests from the combatant commands, the agency began classes to

train personnel to serve in the theater JRCCs, subsequently renamed joint search and rescue centers (JSRC). The JSSA also held a series of conferences to develop a truly joint standard for the SERE training of personnel in all services. During the year, President Clinton signed the Missing Persons Act, which directed the Defense POW / Missing Personnel Office to "establish policies, which shall apply uniformly throughout the Department of Defense, for personnel recovery (including search, rescue, escape, and evasion)."[53] Within a year, the department had published DODD 2310.2, *Personnel Recovery*, which established DOD policy for PR, and spawned several subordinate and specially focused directives. In a parallel effort, the Joint Staff drafted and published three joint doctrinal publications—JP 3-50.2, *Doctrine for Joint Combat Search and Rescue*; JP 3-50.21, *Joint Tactics, Techniques and Procedures for Combat Search and Rescue*; and JP 3-50.3, *Joint Doctrine for Evasion and Recovery*, which established a joint standard for PR. These documents defined a structure for a theater PR plan and presented joint tactics, techniques, and procedures. Combined with DODD 2310.2, they reflected a great deal of historical experience analyzed and consolidated to supply an evolving standard for all of the DOD.[54]

### *Two Rescues in Serbia, 1999*

In March US military forces joined in combat operations against Serbia as part of an effort by the North Atlantic Treaty Organization (NATO) to compel that country to cease its campaign of ethnic cleansing in the Kosovo region of the former Yugoslav Republic. NATO leaders feared that a large number of casualties would act as a strong constraint on the operation and decided to limit their initial actions to an air campaign. President Clinton understood this constraint. In approving American participation, he said that "there are risks in this military action—risks to our pilots and the people on the ground. . . . I do not intend to put our troops in Kosovo to fight a war."[55]

On the fourth night of the operation, a US Air Force F-117 was shot down about 30 miles northwest of Belgrade. Again, the United States had dispatched a significant PR task force from USSOCOM, consisting of a team of helicopters modified with state-of-the-art navigation and communications equipment, numerous supporting aircraft, and a mature command apparatus. The helicopters launched from a forward base in Bosnia. As enemy forces closed in around the survivor, the rescue force flew through a layer of fog and retrieved the pilot.[56]

Although the Serbians exploited images of the F-117 wreckage, the air campaign continued. Six weeks later, another aircraft, a US Air Force F-16, was shot down at night in Serbia. A similar rescue task force sallied forth and recovered the pilot. During the short conflict, no Americans were unaccounted for.[57] As in previous conflicts, US forces exploited evolving technology and improved training that gave PR sufficient capability to limit US losses and support the larger strategic operations.

### *Evolution of the Personnel Recovery Community Continues*

On 1 October 1999, in an action to enhance oversight of the PR mission area, the JSSA combined with the Air Force–assigned Joint Combat Search and Rescue Agency to become the Joint Personnel Recovery Agency (JPRA), which had a much broader charter. Specifically, it would act as the DOD's office of primary responsibility for PR and serve as the "principal DOD Agency for Joint Personnel Recovery support." Additionally, it was assigned to Joint Forces Command at Norfolk, Virginia, whose commander served as the DOD's executive agent for PR. Almost immediately, JPRA personnel became involved with the combatant commands, participating in training exercises, making staff-assistance visits, and conducting mission-area assessments. The JPRA also placed command representatives at each combatant command headquarters and at the Joint Staff in the Pentagon. These individuals had access to the command senior leaders and staffs and worked with them steadily on PR matters. They scripted several PR

tasks within the Universal Joint Task Lists, used to develop training programs and insert PR planning considerations into the Joint Operation Planning and Execution System, utilized to write operational plans and orders. Furthermore, the JPRA steadily expanded its training capability, developing classes for rescue forces as well as the commanders and their staffs. The courses specifically dealt with risk mitigation—the process of balancing risk to personnel with carrying out the overall operational mission. The JPRA created the Personnel Recovery Education and Training Center to oversee and conduct this training and education. By the end of 2001, the center had trained 1,298 personnel for assignment to recovery forces, planning cells, operational centers, or JSRCs in the various service staffs or combatant commands. This evolutional process itself was a significant PR event.[58]

### *Operation Enduring Freedom, 2001, Ongoing; and Operation Iraqi Freedom / Operation Odyssey Dawn, 2003–11*

In response to the horrific events of 11 September 2001, US forces rapidly deployed to US Central Command for operations in Afghanistan. President G. W. Bush directed that the campaign not begin until PR forces were in place. Initially, those forces were assigned to special operations helicopter units deployed to Uzbekistan and Pakistan. However, within two months, US Air Force rescue teams replaced them. Further, many of the personnel serving in the various PR command and control centers had graduated from the JPRA training courses.[59]

In March 2003, President Bush directed US Central Command to conduct combat operations against Iraq. PR planning was fully integrated into the campaign plan. Each service component and the special operations forces deployed or designated forces to conduct PR. Three US Air Force rescue task forces of HH-60s, HC-130s, and pararescue Airmen deployed. The US Army, Marine Corps, and Navy also had designated recovery task forces and elements with their forces.[60]

Most personnel who served as PR representatives on the various combatant staffs or in the renamed JPRC or subordinate headquarters

were trained by the JPRA and fully conversant with the steadily updated policies and doctrine of PR. Through May 2003, US forces conducted 81 PR missions that recovered 109 personnel and rescued eight POWs. Moreover, the United States accounted for all personnel.[61]

Nevertheless, combat operations did not end in either theater, and PR forces remained engaged in both arenas as enemy forces steadily attempted to take Americans prisoner. Perhaps no such instance proved more poignant than the disappearance of PFC Keith Maupin, USA, taken in a convoy ambush in Iraq in April 2004. Peter Schoomaker, Army chief of staff, spoke of him frequently to keep his commanders concentrated on PR. Maupin's remains were found in March 2008 and returned to his family.[62]

Throughout the long conflicts, service components conducted PR missions in support of their operations in both theaters. US military operations ended in Iraq in December 2011, and a full accounting of our PR activities there is under way. However, as of March 2012, only one US military and three DOD contractors remained unaccounted for in Iraq and Afghanistan—a stunning accomplishment compared to the number of missing personnel during the long war in Southeast Asia.[63]

## *The Evolution Continues*

Constantly learning from the ongoing operations, the JPRA and Defense POW / Missing Personnel Office steadily worked with all portions of the PR community to improve the disparate aspects of the effort. In 2002 the National Security Council published the earlier-noted National Security Presidential Directive 12—the government-wide policy guidance for PR. Subsequently, the Joint Staff updated JP 3-50, which consolidated all three of the publications initially written in the mid-1990s. Further, in 2009, DODD 2310.2 was updated and then replaced by DODD 3002.01E, *Personnel Recovery in the Department of Defense*, 16 April 2009, which now offers the DOD's current overarching PR policy. Thus, the evolution is ongoing.

### *Bolar 34, Libya, March 2011*

This event, mentioned at the beginning of this article, deserves a fuller narrative. In response to a UN resolution directing military action to stop the actions of Libyan leader Mu'ammar Gadhafi, President Obama directed the US military to conduct Operation Odyssey Dawn as part of a larger UN air campaign. Again, the action would not involve American ground forces. Like President Clinton, President Obama acknowledged that the campaign could place American Airmen at risk but felt that the gain justified the costs: "We're confident that not only can the goals be achieved, but at the end of the day the American people are going to feel satisfied that lives were saved and people were helped." On 19 March, US and NATO forces began striking Libyan targets to impose a no-fly zone for Gadhafi's aerial units and to protect the Libyan people.[64]

Three nights later, the Air Force F-15E went down. Secretary of Defense Robert Gates and President Obama received notification of the incident and updates as they became available. In support of the operation, the US Marine Corps 26th Marine Expeditionary Unit, operating off the Libyan coast, quickly rescued the pilot. Libyan opposition forces recovered the weapon systems officer and later passed him over to US control. President Obama received word of the recovery. Conceivably, if Gadhafi's forces had captured the two men, paraded them before the press, and possibly executed them, those actions could have significantly altered Americans' support of Libyan operations, as happened almost 18 years earlier in Somalia.[65] However, that did not happen. At the cessation of combat operations on 31 October 2011, the United States had accounted for all military and civilian personnel in that operation.[66]

## Impact

The previous vignettes, though varied, contain a common message: PR, or a lack thereof, can have a strategic impact and a number of con-

sequences. This fact is especially applicable as we deal with the clear paradigm shift that now puts our people at risk worldwide. However, within the larger context, several other subordinate points can serve as noted lessons.

First, all incidents of the kind mentioned above engage senior national leaders. As observed in our experiences in Southeast Asia, political or diplomatic considerations can limit PR. History also shows us that PR events can prove unpredictable and quickly evolve into international scenarios in which the hostile elements holding our troops can exploit them for political advantage, a phenomenon first identified in Korea and certainly relevant today. Additionally, PR events can have a domestic political effect. PR forces can limit our losses, prevent the exploitation of our troops, and—as shown in the British example, Operation Desert Storm, Serbia, Operation Enduring Freedom, Operation Iraqi Freedom, and the Bolar 34 mission—stop the erosion of national will. Furthermore, in the U-2, Iran, and Somalia events, PR capabilities can enable or limit other strategic capabilities or operations. As the Libya example makes clear, there is no doubt that our national leaders understand the moral imperative of PR. It is also evident that at the tactical level, the Soldiers, Sailors, Airmen, and Marines who actually have to carry out the mission share that understanding, as demonstrated by their efforts at Koh Tang Island and in Serbia and Libya. However, several examples—the RAF in World War II, the U-2 incident, and the Mogadishu vignettes—suggest that at intermediate levels, PR planning and preparation were not as robust as they needed to be for the existing conditions and threats.

The evolution of the PR community was intended to address those shortfalls. Based upon difficult lessons learned in the cited events as well as others, this evolution exploits maturing technology and stresses specific, focused training for personnel who may become isolated, for commanders and staffs, and for recovery forces. We have now institutionalized PR planning in policy, doctrine, and practice—planning that emphasizes the necessity of having PR forces in place prior to the

initiation of military operations. It supports either unilateral operations or actions as part of coalitions and alliances.

Interlaced with and because of these events, the DOD's PR capability has evolved steadily and positively, and the macro results speak for themselves. At the end of our involvement in Southeast Asia, more than 2,400 US personnel were missing. Searches for them continue today. After Desert Storm, the remains of the sole missing American have been returned. We can account for all personnel from our operations in Bosnia, Serbia, and Libya. Currently, after 10 continuous years of conflict in Iraq, Afghanistan, and the Horn of Africa, we list one military and three DOD civilian contractors as missing.[67] That is a huge shift in results, and although analysis must fully explain this evolving development, it appears to reflect and parallel the efforts made to improve and institutionalize PR. This process recently received further reinforcement when the JPRA was reassigned from the inactivating Joint Forces Command and designated a Chairman's Controlled Activity under the chairman of the Joint Chiefs of Staff with the Joint Staff J7 as its lead directorate.[68]

However, significant challenges remain. The DOD's PR capabilities have grown dramatically, but they cannot maintain continuous coverage worldwide. Additionally, the department does not necessarily always have the authority to operate outside a combat area. In fact, in most parts of the world, the lead US agency is the Department of State, its embassy led by a chief of mission (COM) (usually an ambassador but possibly someone of lower rank) responsible for US citizens in that particular country. The COM may have to rely on host-nation support to provide authority and capability. The necessary nation-to-nation relationships can prove unique and problematic, suggesting that US personnel in areas beyond quick DOD response represent a potential *strategic vulnerability* that could lead to more tactical incidents with potentially strategic consequences.

This implies that we need to do much more at the COM and interagency levels. Recent COM-led efforts to create a proper combination

of responsibility, authority, and capability in Iraq suggest the way forward and may offer a format for a comparable PR structure for Afghanistan when US forces depart that theater. This is a fertile area for further analysis and debate. Moreover, it should include vigorous discussion of how the DOD's PR assets can be integrated into the efforts of the COM and other interagency partners for an all-encompassing, whole-of-government approach as prescribed by National Security Presidential Directive 12.[69]

However, at this juncture, we remain heavily involved in Afghanistan. Certainly, we recognize the existence of adversaries—both conventional and asymmetric—throughout the world. In response we continue to mature our PR capability, arguably the best in the world. President Obama addressed this issue squarely after the rescue of an American and a Danish hostage in Somalia in January 2012: "The United States will not tolerate the abduction of our people, and will spare no effort to secure the safety of our citizens and to bring their captors to justice. This is yet another message to the world that the United States of America will stand strongly against any threats to our people."[70]

Such capability and propensity are timely and necessary. They meet the expectations of the universal value held by Americans that the United States will make "every effort" to recover our serving sons and daughters if they become isolated on the battlefield or captured by hostile forces. In that effort, our PR community helps undergird our enduring national interests and directly supports President Obama's declaration, mentioned previously, that "America's greatest asset is its people." That is the strategic importance and impact of personnel recovery. ✪

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Colonel Pera (USAFA; MS, Embry-Riddle Aeronautical University) is the director of the Joint Personnel Recovery Agency, aligned under the Joint Staff as a Chairman's Controlled Activity and located at Fort Belvoir, Virginia, with subordinate units at three other sites. He is responsible for coordinating and directing all personnel recovery (PR) activities with geographic commanders, service chiefs, and other governmental agencies as well as multiple Cabinet offices. Additionally, he advises them on reintegration, operational POW/MIA issues, code of conduct, combat search and rescue, and other PR-related matters. Colonel Pera is a graduate of Air Command and Staff College, Joint Forces Staff College (Joint Professional Military Education II), and Air War College.

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# A Culminating Point for Air Force Intelligence, Surveillance, and Reconnaissance

Col Jon Kimminau, PhD, USAF, Retired

> *The natural goal . . . therefore is the turning point. . . . If one were to go beyond that point, it would not only be a useless effort which could not add to success. It would in fact be a damaging one.*
>
> —Clausewitz, *On War*

> *The culminating point is the point in time and space at which a force no longer possesses the capability to continue its current form of operations.*
>
> —Field Manual 3-0, *Operations*, February 2008

> *"Would you tell me, please, which way I ought to go from here?"*
> *"That depends a good deal on where you want to get to," said the Cat.*
> *"I don't much care where—" said Alice.*
> *"Then it doesn't matter which way you go," said the Cat.*
> *"—so long as I get SOMEWHERE," Alice added as an explanation.*
> *"Oh, you're sure to do that," said the Cat, "if you only walk long enough."*
>
> —Lewis Carroll, *Alice's Adventures in Wonderland*

In 2012 Air Force intelligence, surveillance, and reconnaissance (ISR) finds itself at a culminating point—a place where the demand, disposition, and development of current capabilities, arrayed against future requirements, force some critical decision making. After a decade of war, the service is well postured to operate in permissive environments, deploying sufficient airborne ISR with up to 65 combat air patrols (CAP) and enough processing, exploitation, and

dissemination (PED) capacity to meet war-fighter and national-level needs. However, in the absence of objectively determined joint requirements, continuing demands for additional CAPs are unsustainable. Additionally, a variety of the Department of Defense's (DOD) independent ISR projects driven by joint urgent operational needs to satisfy a considered shortfall for today's fight calls for review. Funding is becoming scarcer, and evolving defense strategy mandates an accounting of capabilities necessary across the spectrum of military missions, especially the ability to characterize nonpermissive environments. If that were not enough, the information architectures (also known as "info-tectures") that must support previous investments are daunting and may not measure up to undergird the newest capabilities, particularly the need for bandwidth and information sharing.

In this accounting, one must recognize that Air Force ISR enables military missions across the board but remains a key component of the national intelligence community (IC), which is also undergoing radical changes mandated by the Intelligence Reform and Terrorist Prevention Act of 2004. The establishment of the Office of the Director of National Intelligence and the accompanying structural and policy initiatives are broadening and deepening the interdependence of IC members. Demands for information sharing exist at strategic (United States to coalition and allies), operational (IC to interagency, state, local, and tribal), and tactical (IC among its members) levels. We enjoy greater integration of products and services, from the president's daily brief, to the Library of National Intelligence, to counterterror and counterproliferation centers and task forces, to joint and interagency intelligence operations centers deployed abroad. Furthermore, we are developing responses to presidential directives, intelligence tradecraft standards, training and education, and product evaluation and personnel certification standards for intelligence analysis. As they experience tremendous infrastructure and budgetary pressures, the Air Force and the other services struggle to keep up with the rest of the IC.

In recognition of the changing security environment and the need to understand and present the Air Force's ISR enterprise as a holistic set of capabilities—not a narrowly prescribed set of remotely piloted aircraft system CAPs—in June 2011 the secretary of the Air Force (SECAF) authorized a comprehensive review of that enterprise. He directed that it establish where the service's ISR is today, where it should be in 2030, and how the Air Force balances current capabilities with future requirements against the backdrop of significant limits on resources. This review, led by the Air Force deputy chief of staff for ISR, in partnership with Headquarters Air Force and lead major commands (MAJCOM), delivered a number of fundamental insights, near-term recommendations, and follow-on SECAF-directed tasks to posture the enterprise for 2014 and beyond. Fundamentally, the Air Force ISR enterprise exists to answer questions. The service provides information superiority, first by understanding the nature of the questions asked by decision makers and then by identifying the best ways to combine resources to supply answers. To better leverage and integrate our capabilities in air, space, and cyberspace, the Air Force needs to invest in reliable information architectures, improved sensors, and platforms and analyst tools, all enabled by analysts trained and educated to transform information from multiple sources into intelligence. To grasp the full scope of this culminating point for Air Force ISR, we must understand the SECAF's ISR review and the rationale for the follow-on tasks.

## The Secretary of the Air Force's ISR Review

On 22 June 2011, the SECAF issued the terms of reference for the ISR review, which would "conduct a comprehensive AF ISR review to provide context for and inform senior leader decisions on AF ISR capability development."[1] The terms of reference were coordinated with key Air Staff and MAJCOM staffs prior to the SECAF's signing the document, with the understanding that the coordinating staffs would be

integral to the review.[2] The SECAF mandated that the "results of the review be available for leadership consideration by 15 Sep 11."[3]

The coordinated staff package for the SECAF indicates that the review sought "to provide the SECAF, Chief of Staff of the Air Force (CSAF), and senior USAF leaders an analytically-based, scenario-informed AF ISR compendium which provides a baseline compilation of capabilities that enable AF ISR missions."[4] The baseline used air, space, and cyberspace as the means not only to categorize identified capabilities but also to highlight how the Air Force's ISR enterprise uses the global communications infrastructure across all domains to enable execution of the ISR mission. Additionally, the baseline specifically highlighted information PED capabilities to detail how Air Force ISR delivers actionable information to decision makers. The review's in-depth analysis of ISR mission execution contrasted the service's ISR enterprise capabilities with approved analytic scenarios, thereby exposing needs for and gaps in ISR capability and highlighting how integration of capabilities produces synergy in execution of the mission. Finally, the study emphasized areas that warrant further analysis and offered recommendations for the Air Force's ISR priorities that could inform discussions about planning and programming. Ultimately, the review represents an integrated core function master plan analysis for globally integrated ISR, one that successfully paves the way towards the 2030 vision (see briefing slide on the next page).[5]

The review team would fulfill this challenging charter by concentrating on in-person research visits to all of the MAJCOMs and agencies involved in the ISR enterprise, both as executors and consumers. These intensive meetings involved a candid sharing of facts and observations concerning current capabilities, operations in the field, demands from the perspective of both resources and future strategy, and indications of preferred and possible futures. Team members consolidated and rigorously analyzed the findings and gaps, reviewing them with participants as well as the Air Staff's deputy chiefs of staff. After this 90-day effort, three broad findings emerged.

## A View of the Future: The 2030 Air Force ISR Enterprise

- Offers a seamless, open-architecture, all-domain, sensor-agnostic, "go-to" information source integrated with Air Force command and control architectures
  - Characterizes any target set (air, space, cyber, or terrestrial) as a "network" to enable effects-based targeting and assessment
    - Persistently accesses target sets by necessary means
    - Collaboratively plans all-domain ISR operations as a single entity
  - Demands trained/equipped analysts with critical-thinking skills
  - Needs secure, reliable, and sufficient information pathways
- Provides fully integrated operations in a networked world
  - Includes operators and intelligence professionals working as a fused team in all domains
  - Requires improving the way we think, train, and operate

*Success in war depends on superior information. ISR underpins every mission that the DOD executes.*

(Adapted from US Air Force/A2, briefing, subject: SECAF ISR Review Road Show [unclassified version], slide 4, December 2011.)

### *The Air Force Is Well Postured to Conduct ISR Operations in Permissive Environments*

The explosive growth in our ISR capabilities over the past decade has met national needs. We are well on the way to reaching 65 CAPs with MQ-1/9 remotely piloted vehicles, augmented by a variety of manned systems (including Liberty MC-12 aircraft) and quick-reaction forces. The Air Force continuously improves its ISR to consolidate gains. However, we must keep in mind some important caveats. First, this enterprise largely operates in a permissive environment, and signifi-

cant concerns exist regarding viability in challenged and denied environments. Second, we might loosely describe the current force as a "surge" force. That is, we have yet to determine the most efficient long-term or steady-state infrastructure, including numbers, balance between manned and remotely piloted aircraft, and considerations of training, basing, and total force. Lastly, the core of our present capability is airborne; by consensus we have not yet fully incorporated our space and cyber ISR capabilities into the enterprise.

- We still require a mix of manned and remotely piloted platforms.
- Nontraditional ISR (NTISR) will provide more information than ever, but we must improve information-transfer mechanisms.
- Space situational awareness involves more than missile warning and avoiding collisions with objects.
- The cyberspace domain offers incredible opportunities to enable military operations.

### *We Expect Air Force ISR to Operate across the Spectrum of Operations, Humanitarian Assistance, and Disaster Relief through Major Conflict*

Although most of the past decade has seen a counterinsurgency emphasis in operations, we have also made excursions into homeland- and coalition-based crises; the only unexercised operations are large-scale, conventional conflicts. Our experiences have shown the necessity of robust, reliable, and secure information architectures and communications that enable all of our operations. We have sufficiency today but realize that we are not yet ready for tomorrow. Alongside the information architecture requirements, our ability to PED information on ever-shorter timelines demands focused efforts. The expanding volume of data from ISR collection, coupled with greater technological capability, has forced us to adapt organizations, manning, and training as well as exploitation, analysis, and reporting processes. The latter three in particular represent expanding requirements for analyst training

and improved tool suites to reduce time spent on routine data manipulation and monitoring, and to increase it in collaboration, knowledge production, and actionable intelligence. Current operations have also allowed us to adapt how we plan and task our ISR capabilities—both collection platforms and the necessary PED. However, by consensus we must evolve to "mission-driven exploitation" and find the means to apportion, allocate, and task ISR efficiently in full-spectrum operations, especially all-domain antiaccess / area denial operations. Doing this well means that we must integrate command and control (C2) of ISR with other Air Force and joint C2 architectures to realize maximum return on investment.

- Information architectures should account for and integrate PED requirements.
- We need to develop C2 holistically, maintain consistency across domains, consider whole capabilities, and refrain from tying ourselves to individual platforms.
- We should base C2 of ISR and PED resources on information, products, and services rather than link them to platform apportionment.
- Multidomain tipping and cueing can radically change a situation.
- The Air Force should characterize the full spectrum of potential targets in all domains.
- Analysts need training and tools to enable the full capability of PED.

### *The Demand for Air Force ISR Is Increasing Worldwide and Warrants Prioritization*

An anecdote familiar to many senior leaders concerns a numbered air force commander's use of a single slide in 2007 to accentuate a point about ISR. This slide (used effectively in many meetings) depicted a startling contrast between the growth in ISR CAPs and a rough order-of-magnitude measure of combatant command and national ISR requirements. Specifically, for every increase in ISR capability (CAPs in-

crease), the documented needs grew at a greater, expanding rate. This fact underscored what we previously treated as a useful exaggeration: the never-ending appetite for ISR. By 2011 the need for ISR had expanded, and it had arguably become more highly valued—considered the coin of the realm for planning and executing the DOD's and other national agencies' missions. The review team pointed to the Air Force as the lead service for joint PED—by a wide margin—and noted some external expectation that the service's contribution would increase in the future. Due to these factors, the pending rebalance towards the Pacific in national strategy—while we simultaneously maintain effectiveness in the Mideast and other operations—means that we must consider how to prioritize ISR capability, doing so in terms of operations (authorize, apportion, and allocate) as well as resources and policy (organize, train, and equip.)

- Antiaccess / area denial should be a key part of the Air Force's concerns.
- We must refine the global demand from combatant commands and holistically develop future ISR capability to account for requirements and to leverage all domains.
- We should emphasize policy development with respect to multilevel security, thus enabling coordination and collaboration—both within the United States and with coalitions.
- We need to acknowledge persistent ISR as a critical characteristic for air, space, and cyberspace—not just air.

The findings of the review covered considerable airspace. Collectively, they drove near-term recommendations to the secretary and follow-on SECAF tasks to inform the direction of the Air Force's ISR enterprise for the long term. We must address these recommendations and tasks in order to realize the ISR vision embodied in "A View of the Future: The 2030 Air Force ISR Enterprise," the briefing delivered to the service's senior leaders and accepted by the SECAF.[6] Based on the findings, the recognized need to rebalance capabilities for the future, and co-

ordination with the staffs at Headquarters Air Force and the MAJCOMs, on 28 December 2011 the SECAF directed seven follow-on tasks.[7]

## Tasks Directed by the Secretary of the Air Force

### *Conduct an Analysis of Information Architecture to Frame Air Force Discussions on the Architecture of the Future*

As recently as two decades ago, intelligence—for the most part—remained product oriented, delivered in material forms (e.g., books, charts, photos, overhead slides, articles, and artifacts). Now it has become not only mostly digital but also dynamic with interactive delivery, to the extent that we more often refer to ISR as products *and services*. Similarly, in the past the links between collection and analysis—or between sensors and PED—were electronic but self-contained, part and parcel of the particular, individual ISR system. Today, the connections consist of multiuse fiber and communications pathways, and systems acquired already depend upon a communications architecture not part of the acquisition. The information-architecture communications enterprise supplies the bandwidth, routing, distribution, and security that links platforms, sensors, operators, PED, and the myriad of ISR consumers. It is the "long pole" in the tent for the future of ISR.

This task frames the Air Force's discussion on information architecture for the purpose of surveying current, near-term, and midterm modernization/integration efforts and plans in order to identify the requirements for that architecture's future capabilities. Rather than limit itself to any of the arenas of C2, ISR, or space situational awareness, it will include all information requirements. Air Force Space Command serves as the lead for this task.

### *Acquire and Develop Framework Tools to Enable Capability-Based Planning and Analysis of the Air Force ISR Enterprise's Platform, Sensor, and PED Requirements to Feed Core Function Master Plans*

Air Force developmental planning is in the midst of a transformation, one that links strategic planning to capability-based planning and analysis for the service's 12 core functions. Those strategic, developmental plans are core function master plans, with globally integrated ISR the plan behind the Air Force's ISR enterprise. The ISR review identified the massive issues involved in conceptualizing, analyzing, testing, and prioritizing ISR capabilities related to people, platforms, sensors, and PED. If we wish to advance the enterprise towards the 2030 vision, we must have tools and systems to support our planning and analysis.

This task addresses how to better inform trade-space decisions concerning multidomain and multimission Air Force ISR. We need to develop holistic capability-based planning and analysis tools and data models to inform trade-off decisions about sensor, platform, automated PED, and communications architecture capability for our current and future needs. The investment of effort will go towards refining tool requirements, selection of tool candidates, development and customization of data models, and performance of ongoing "what-if" analyses. Though focused on tools to support the globally integrated ISR core function lead integrator, the recommendations from this effort will support multiple integrators. The Air Force Deputy Chief of Staff for Intelligence, Surveillance, and Reconnaissance (AF/A2) serves as the lead for this task.

### *Develop a Road Map for ISR Automated Tools and Analyst Visualization Tools*

The ISR review capitalized on nearly a decade of other studies, commission inquiries, and after-action reports, together with their observations and recommendations concerning all aspects of ISR. An observation that spans all of these has to do with intelligence analysis—the cognitive or thinking activity that converts processed information into

intelligence through the integration, evaluation, interpretation, and prediction of all-source data to deliver intelligence products and services in support of known or anticipated user requirements.[8] Four critical needs recur with regard to intelligence analysis: (1) *training* and professionalizing analysts, (2) increasing and even amplifying the *collaboration* and teaming of analysts, (3) using *automation* to reduce the time that analysts spend on mundane monitoring and routine data manipulation, and (4) increasing analysts' *visualization* and creativity with data and information. At the heart of all PED requisites are intelligence analysts and their tools and systems. If we mean to transform our PED for the future, we must tackle the core task of people-dependent analysis.

This task involves two major facets. The first is an effort to gather, review, and prioritize all recommendations for ISR enterprise analysis tools or systems to shape our fiscal year 2015 planning along three dimensions: automation (connecting data to data), collaboration (connecting people to people), and visualization (connecting people to data.) The second entails an intensive effort to go behind the term *road map* and refine the Air Force's processes for technology insertion, development, testing, and operational demonstration of analysts' tools. Doing so would improve how we identify their needs and potential solutions to quickly deploy the best "bang for the buck." AF/A2 serves as the lead for this task.

### *Develop a Distributed Common Ground System Road Map with Specific Measures to Implement Service-Oriented Architecture and the Ability to Synergize PED for All Air, Space, and Cyber Platforms and Sensors*

Arguably the Air Force has the broadest vision among the joint partners for what the distributed common ground system (DCGS) is today and can become, with respect to the ISR enterprise. That vision embraces a globally distributed, regionally focused PED system that is sensor agnostic, robust, and survivable—one that encompasses air,

space, and cyberspace. Today's Air Force DCGS equates to globally distributed, regionally focused PED for most of our airborne platforms and sensors. The current baseline system comprises both proprietary and government systems that require significant lead time for the integration of new software capabilities. Other prominent studies buttressed the ISR review by strongly recommending that the DCGS migrate to an open-software architecture (service-oriented architecture [SOA]) which facilitates technology insertion and collaborative software development. Central to a SOA system is the idea of an inventory of applications that operators can access to perform all aspects of planning, direction, collection, processing, exploitation, analysis, production, and dissemination. We can rapidly add, modify, and update these applications in a SOA, thereby eliminating the effects of proprietary systems and long lead times.

This task seeks to develop specific actions to move the Air Force's DCGS to a SOA cloud architecture, aligned with the service's DCGS strategic vision and the Defense Intelligence Information Enterprise of the Under Secretary of Defense for Intelligence. It includes the tasks of completing, coordinating, and improving the Air Force's DCGS vision, in addition to identifying the acquisition requirements and phases that will move the current system to a SOA with no interruption in service to our war fighters. AF/A2 serves as the lead for this task.

### *Develop an Air Force Targeting Road Map to Outline Requirements That Satisfy Target-Folder-Development Support to War Fighters, Including Space and Cyberspace Target Sets*

Targeting has a rich history as a specialized operation of ISR and as an expertise of the Air Force at the strategic level. According to Air Force Doctrine Document 3-60, *Targeting*, it is "the process for selecting and prioritizing targets and matching appropriate actions to those targets to create specific desired effects that achieve objectives, taking account of operational requirements and capabilities."[9] The ISR review exposed a deteriorating situation for targeting. Specifically, since the late 1990s,

the combination of force restructuring, operational needs in a counter-insurgency environment, and service and DOD efficiency initiatives contributed to the atrophy of targeting capabilities across the board. Another critical factor, however, exerted a compounding influence. During that same time period, technological advances and new platforms, sensors, and munitions similarly transformed targeting requirements—the classic targeting folders and weaponeering process had changed into something both digital and dynamic. The result, underscored by experiences in Odyssey Dawn (the operation to enforce United Nations Security Council resolution 1973 in Libya), is that Air Force targeting now lacks sufficient capacity to remain effective within the context of future planning scenarios. Moreover, the development of targeting capabilities is ad hoc and reflects neither the expansion of targeting into space and cyber domains nor the nuances of emerging targeting concepts.

This task endeavors to set a direction for reinvigorating the Air Force's targeting enterprise to address unmet air, space, and cyberspace targeting demands. It will drive changes in targeting concepts of operations; tactics, techniques, and procedures; and training, including improved integration with joint force targeting mechanisms and coalition warfare. Air Combat Command, home of the Air Force Targeting Center, serves as the lead for this task.

### *Develop a Nontraditional ISR Road Map to Include Platform and Sensor Mix, Requirements for Communication Pathways, Development of Concepts of Operation, and Demands for Personnel Training*

According to an anecdote, in the fall of 2002, an F-16 pilot and an intelligence officer found themselves grappling with how to coordinate the use of information from nonreconnaissance and nonsurveillance weapons systems and platforms, asking themselves what they should call this mission. The answer: NTISR.[10] A decade later, the concept still describes any sensor (one not primarily used for ISR) employed as

part of an integrated collection plan developed at the operational level for preplanned, on-call, ad hoc, and/or opportune collection. NTISR has gained prominence in today's environment due to technological advances—the ability to pack ever-more advanced electronics into platforms such as the F-22—and to technological multifunctionality (think of a cell phone that can communicate, schedule, record, calculate, photograph, take local temperature, and locate itself by means of the Global Positioning System). Together, these advances indicate that literally any platform or system in our inventory may be capable of contributing to intelligence collection. If we can simply plan how to do it and link it into the ISR enterprise, we may create a multiplying effect on our ISR operations at reduced additive cost. This is why the ISR review identified NTISR as a potential "game-changer."

This task sets a clear vector for the development of NTISR, addressing the full spectrum of potential capabilities of tactical platforms, including the "realm of the possible." Air Combat Command serves as the lead for this task.

### *Develop a PED Apportionment Model and Associated Road Map That Models Manpower Based on Air-, Space-, and Cyberspace-Fused Information Requirements—Not Apportioned Platforms*

For many years, we have generally calculated the manpower necessary for a large ISR system as an ideal package of bodies (analysts, maintainers, managers, and reporters) multiplied by the average number of platforms assigned or attached to a base unit. Within this steady-state foundation, when ISR platforms were allocated/apportioned to theater commanders, we assumed that we had PED resources available and in place. The last decade of operations showed that those calculations and procedures amounted to more than a problem—the dynamic nature of taskings, the growth in number of platforms, and the distributed nature of PED ground systems made it nearly impossible to tie PED resources directly to particular platforms. Since 2007 the joint community (particularly the Joint Functional Component Command

for ISR under US Strategic Command) has been developing ideas for a different apportionment system, one that associates PED "resource units" to war fighters' information needs instead of one that drives allocation by platform. But this is a difficult problem, and even by 2011 we had not implemented a clear, joint-coordinated solution.

This task builds a way ahead, complete with plans of action and milestones, for enabling efficient allocation and apportionment of PED for airborne sensors and platforms. Additionally, it will encompass the allocation/apportionment of PED for space and cyber sensors as well as platforms. Altogether, the model seeks to enable apportionment of PED resources based on information requirements and associated information products, moving away from the model that ties manpower to airborne (or particular) platforms apportioned. AF/A2 serves as the lead for this task.

## Conclusion

These seven SECAF tasks do not represent all the recommendations given to Air Force leadership; other near-term recommendations received approval and are in progress today. Instead, the tasks constitute the follow-on, top-priority, demanding problems that we must address soon if we want the Air Force's ISR enterprise to manage current operations successfully, navigate resource limitations, embrace shifts in national strategy, and progress towards a new vision—doing all of this simultaneously. The tasks demand quarterly updates to the SECAF, and a one-year deadline (the end of calendar year 2012) for completion.

In warfare, military leaders who had the foresight and wisdom to recognize a culminating point in battle and make the appropriate changes in forces and actions at the right time and place enjoyed success. The tremendous progress of the Air Force's ISR in the last decade, together with new resource constraints, a rebalancing of defense strategy and force posture, and continuing requirements of the current fight, presented Air Force leadership with its own culminating point

for ISR in 2011. In response, the SECAF and his staff have put into action a multipath program that will inform the program objective memorandum for fiscal year 2015 and set the long-term Air Force ISR enterprise way ahead. This is the story and legacy of the Air Force's ISR Comprehensive Review of 2011. ✪

## Notes

1. Hon. Michael B. Donley, Staff Summary Sheet (signed), 22 June 2011; and Hon. Michael B. Donley, *Intelligence, Surveillance, and Reconnaissance Review Terms of Reference* (Washington, DC: Secretary of the Air Force, 22 June 2011).

2. The staffs included those of the following organizations: Chief of Staff of the Air Force; Under Secretary of the Air Force; Vice Chief of Staff of the Air Force; Assistant Vice Chief of Staff of the Air Force; Air Force Executive Action Group; Air Force Deputy Chief of Staff for Personnel; Air Force Deputy Chief of Staff for Intelligence, Surveillance, and Reconnaissance; Air Force Deputy Chief of Staff for Operations; Air Force Chief of Warfighting Integration and the Chief Information Officer; Air Force Deputy Chief of Staff for Plans and Programs; Air Force Deputy Chief of Staff for Analyses, Assessments, and Lessons Learned; Air Force Historian; Assistant Secretary of the Air Force (Acquisition); Air Force Reserve Command; Air National Guard; Air Force Global Strike Command; Air Combat Command; Air Force Materiel Command; Air Force Space Command; and Air Force Special Operations Command.

3. Donley, *Review Terms of Reference*, 1.

4. Donley, Staff Summary Sheet.

5. Ibid.

6. US Air Force/A2, briefing, subject: SECAF ISR Review Road Show (unclassified version), slide 4, December 2011.

7. Hon. Michael B. Donley to key Headquarters Air Force deputy chiefs of staff, deputy undersecretaries, and MAJCOM commanders, memorandum, 28 December 2011.

8. This definition, which captures common elements from multiple DOD and intelligence community definitions of analysis, has its primary basis in Joint Publication 2-0, *Joint Intelligence*, 22 June 2007, http://www.dtic.mil/doctrine/new_pubs/jp2_0.pdf, and the tier-two concepts of joint capability area battlespace awareness.

9. Air Force Doctrine Document 3-60, *Targeting*, 8 June 2006 (incorporating change 1, 28 July 2011), 1, http://www.e-publishing.af.mil/shared/media/epubs/afdd3-60.pdf.

10. Lt Col Lewis D. Hill, USAF, retired, "An Airman's View of NTISR," *Air Land Sea Bulletin* 2007-3 (September 2007): 5–6, http://www.alsa.mil/library/alsb/ALSB%202007-3.pdf.

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**Let us know what you think! Leave a comment!**

# Realizing the Potential of Analytics

## Arming the Human Mind

Maj Robert D. Folker Jr., USAF
Capt Kyle Benjamin Bressette, USAF

> *The collection systems worked more or less. But, there were no analysts capable of interpreting the data, since the Army had moved to maximum automation—and the automated systems were not programmed for so unexpected a contingency as a deployment to an African backwater.*
>
> —Ralph Peters, *The War in 2020*

### The Analytic Gap

The terrorist attacks of 11 September 2001 (9/11) exposed an analytical deficiency within the intelligence community.[1] However, the US Air Force has invested in expanding collection capacity, as evidenced by the 375 intelligence, surveillance, and reconnaissance (ISR) platforms added since 9/11.[2] More remarkably, the increase in ISR platforms has come at a time when the total Air Force inventory has decreased by 500 aircraft.[3] ISR platforms such as the RQ-4, MC-12, and MQ-1 directly address an important element of ISR—but at the cost of other critical elements, such as intelligence analysis. Air Force Doctrine Document 2-0, *Global Integrated Intelligence, Surveillance, & Reconnaissance Operations*, defines global integrated ISR as the "cross-domain synchronization and integration of the planning and operation of ISR assets; sensors; processing, exploitation and dissemination systems; and, analysis and production capabilities across the globe to enable current and future operations."[4] However, today's investment in collection capacity does not address the mounting limitations of intelligence analysis initially highlighted by the 9/11 Commission in 2004.[5]

## Defining Automated Analysis and Analytics

Because the imbalance between collection capacity and intelligence analysis has prevented realization of true global integrated ISR operations, key Air Force leaders are promoting investment in automated analytical programs as a means of removing this disparity.[6] This article considers automated analysis the utilization of algorithms to transform a series of collected data into a usable intelligence product. Analytics can handle immense amounts of data by using preprogrammed models to produce decisive, actionable results.[7] This procedure has boosted profits in the private sector by influencing consumers' buying decisions and conducting Wall Street transactions in microseconds, processing more information and acting more quickly than a stock analyst.[8] Consequently, the intelligence community is exploring analytics as a means of managing large quantities of data, identifying patterns, and developing products to anticipate the activities of future adversaries.[9] A report by the Center for Strategic and International Studies revealed that an analytics program drawing on data from public databases and airline reservation codes could have identified all 19 of the 9/11 hijackers for further investigation before that fateful date.[10] Such examples have driven key leaders to look at analytics as a possible solution to the present analytical deficiency. Nevertheless, the use of analytics is not without peril. We must judiciously approach investing in analytics to improve intelligence and must fully understand its advantages and limitations. Closing the gap will involve matching analytic technology with the skill set of the intelligence analyst, thus optimizing the concept of global integrated ISR operations promoted by the Air Force.

## Considerations for Analytics

Evaluating the potential of analytics must start with a determination of what the technology promises—specifically, accurate and tailored intelligence products that rapidly utilize large quantities of collected data. Incorporating analytics into intelligence assessment offers an ap-

pealing solution to our analytical shortfall because it closely mimics the system and technology-intensive solutions, which successfully enhanced collection capacity.

Research conducted by the Massachusetts Institute of Technology regarding the relationship between automation and humans revealed that automation may significantly affect a user's situational awareness.[11] Analytics can decrease the occurrence of common human biases, including confirmation bias and assimilation bias.[12] However, it may introduce a new form—automation bias, which describes the human tendency to accept an answer generated by an automated system, even in the presence of contradictory information.[13] The likelihood of such bias increases with the complexity of the task performed by the automated system, primarily because the user has difficulty determining the major factors and processes that generate the automated solution.[14] Without this understanding, the user cannot reliably and confidently determine the accuracy of that solution. Further, the effects of an adversary's cyber attack on our automated systems could go unnoticed, directly affecting the accuracy and reliability of global integrated ISR operations as a whole. The concept of automation bias raises a critical question: will more use of analytics close the gap between collection and analysis at the cost of increased bias?

A second significant risk associated with automated analysis and analytics concerns the lack of analytical agility associated with the coded algorithms. The term *analytical agility* denotes the ability of analysts, human or automated, to adapt their processes, given the introduction of new evidence or a paradigm shift. Analytically agile analysts and systems can quickly adapt assumptions and processes to changing information or new environments. Conversely, those who lack such agility dismiss new evidence or label new information incorrectly to remain within preestablished concepts. For a classic example of an individual without analytical agility, we need only look to the Cold War analyst who ignored the changing paradigms of global terrorism that led up to and followed the events of 9/11.

We must consider the significance of analytical agility when we evaluate the utility of increased analytics within global integrated ISR operations. Developing the algorithms that comprise analytics can prove time consuming. Additionally, humans do the programming, influenced by their own biases and assumptions they believed accurate and reliable at the moment of creation. Historically, we can attribute many intelligence failures to a lack of imagination or analytical agility necessary to identify new major factors and prevent surprise.[15] Analytics designers should be careful not only to look for previously observed signatures but also to consider emerging signatures or a possible change in the importance of an adversary's existing signatures. Otherwise, analytics may hinder the discovery of evidence or misinterpret the contextual relevance of evidence that could lead to realization of an alteration in enemy tactics. Assumptions will change; therefore, we must update coding quickly to keep pace with a dynamic opponent.

Even without considering the fiscal constraints of modern military budgets, simply adding more human analysts can never match the expansive collection capacity of the Air Force. Innovative technology solutions such as analytics have been profitable in the private sector and may have even greater potential value for intelligence. However, we must consider and weigh such risks as automation bias and a paucity of analytical agility if we wish to invest effectively and improve the analytical capability resident within global integrated ISR operations.

## Recommended Investment Strategy

Effective investment in these operations should concentrate on closing the gap between the Air Force's current collection and analytical capabilities. Complete reliance on analytics and automated solutions to improve intelligence, however, represents a dangerous approach to solving that problem. The impact of automation bias and insufficient analytical agility associated with analytics could sideline human analysts, relegating them to rubber-stamping an automated assessment that reflects little understanding of accuracy or implications. But

launching additional analysts who have no training in leveraging analytics effectively against an ever-expanding reservoir of data is an even bleaker proposition. Instead, Air Force leadership must develop a balanced investment strategy that includes analytics and, more importantly, the training of all-source human intelligence analysts in exploiting various techniques that will allow them to understand, operate, and optimize collection sensors and automated tools.

In spite of recent efforts to incorporate different analytical techniques into the core curriculum of the technical training school for intelligence officers and enlisted professionals at Goodfellow AFB, Texas, most ISR professionals (with the possible exception of graduates of the USAF Weapons School and the Air Force Advanced Analysis Course) are not adequately conversant in basic analytical methodologies. The latter include problem restatement, red teaming, weighted ranking, computation of conditional probabilities, hypothesis testing, and utility analysis. These courses provide a comprehensive set of tools for conducting objective, thoughtful analysis. Without this training, most intelligence analysts have to rely on their intuition, whereas effective leveraging of an automated system demands an understanding of its foundational principles and methodologies. Thus, we can maximize the capabilities of analytics only by offering training in specific analytical techniques coded in the programming of analytics. Expanding such training to include the methodologies and techniques of analytics would cost much less than a new collection system and, arguably, would produce better results.

This dual-pronged strategy will yield analytically astute, independent intelligence analysts poised to optimize the potential of analytics and realize the full capability of global integrated ISR operations. Integrating these analysts with analytics recognizes that we cannot pursue either path separately as the sole solution. Even though the speed of analytics permits the processing of more data, the human mind—even with its limitations—can supply the requisite analytical agility and imagination (a formidable task for analytics alone). Thus, productive

consolidation of these pursuits can occur only if one is trained and equipped to manage an effective arsenal of analytical capabilities. Training intelligence analysts to better exploit various structured, analytical methodologies and investing in analytics will enable enhanced understanding, exploitation, and targeting of the adversary; improve the management of collection capacity and sensor employment; more effectively derive meaning from the collected data; strengthen the assessment of ISR effectiveness; and facilitate informed decision making—the ultimate objective. ✪

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# Lightning Strikes and Thunder Claps

## The Strategic Bomber and Air Superiority

Maj Wade S. Karren, USAF

> *The lesson from the last war that stands out clearly above all others is that if you want to go anywhere in modern war, in the air, on the sea, on the land, you must have command of the air.*
>
> —Adm William F. "Bull" Halsey

The bomber has occupied the center of Air Force doctrine since the advent of airpower redefined power projection. In 1926 the US Army's Training Regulation no. 440-15, *Fundamental Principles for the Employment of the Air Service*, stated that airpower "should be used offensively, primarily to secure the control of the air, and, secondarily, to disrupt and delay enemy communications and ground establishments."[1] The primary function became known as air superiority. Even during the early days of aviation, the importance of aerial bombardment in establishing air superiority became readily apparent. As the bomber's attributes of range, payload, and precision matured over a number of major conflicts, the establishment of air superiority over enemy territory—together with the efficiencies associated with this process—developed as well. Today, high-technology capabilities make an adversary's air defenses difficult to defeat. Although the bomber's attributes have decreased the amount of time needed to attain air superiority, they are no longer sufficient to overcome modern defenses. The heavy bomber's ability to strike critical command and control (C2) nodes, severely damage enemy airfields, and degrade air defenses with great precision early in a conflict can still give the United States a distinct and overwhelming advantage. However, if we wish to maintain a capable bomber force as well as remain competitive in a contested environment, both modernization and acceleration of

the speed of offensive operations must become a strategic and operational imperative. Unfortunately, air superiority historically has been more closely associated with the fighter force while bombers have played their crucial role in relative obscurity since the end of World War II. In a high-technology conflict, the rapid attainment of air superiority will prove essential. Our strategic bombers (the B-1, B-2 and B-52) not only display national intent and resolve but also provide overwhelming strength to ensure that the US military can establish the highest degree of air superiority in the shortest amount of time.

> *Of all qualities in war it is speed which is dominant, speed both of mind and movement—without which hitting-power is valueless and with which it is multiplied.*
>
> —B. H. Liddell Hart

Joint Publication (JP) 3-30, *Command and Control for Joint Air Operations*, defines air superiority as "that *degree of dominance* in the air battle of one force over another that permits the conduct of operations by the former and its related land, maritime, and air forces at a given time and place *without prohibitive interference* by the opposing force" (emphases added).[2] This definition allows us to describe air superiority as a sliding scale of dominance in the air domain—not a binary value. It can vary from a very low to a high degree of dominance. During the early stages of a major conflict, we characterize the degree of air superiority as a finite space and time period within an operating area. As the length of time and the size of the operational space over which a country can maintain air superiority become greater, so does the degree of dominance. Admiral Halsey rightly pointed out that obtaining command of the air as quickly as possible should be the primary goal of every conflict.

JP 3-30 defines air supremacy as the "degree of air superiority wherein the opposing air force is *incapable of effective interference*" (emphasis added).[3] This denotation allows us to describe air supremacy as a binary value. That is, whereas air superiority is a function of a finite

time and a defined place, air supremacy is a function of infinite time across a defined space. Attaining the latter, however, is no easy task. We must remember that establishing either air superiority or air supremacy does not guarantee victory, but without them the conflict can become extremely costly. We could even consider the quick, efficient attainment of air superiority a maxim of modern airpower. Sun-Tzu reiterates this imperative: "In joining battle, seek the quick victory. If battle is protracted, your weapons will be blunted and your troops demoralized. . . . Hence, in war[,] prize the quick victory, not the protracted engagement. There has never been a state that has benefited from an extended war."[4] Sun-Tzu's words reverberate even today in high-technology warfare. More than likely, the conflicts of tomorrow will involve shorter reaction times and multiaxis approaches, making the rapid achievement of air superiority especially important.

Using strategic bombers and their large precision payloads to destroy enemy air defenses and airfields moves the degree of dominance closer to air supremacy in much less time. The absence of these aircraft would add significantly to the time necessary to gain a decisive advantage in the air and would expose other assets to greater risk since they would have to fly more sorties and extend the duration of the conflict. Clearly, the range, payload, and precision that modern strategic bombers bring to the fight accelerate the attainment of air superiority.

Prior to World War II, military officers engaged in heated debates regarding proper employment of the bomber. Stanley Baldwin's famous speech of 1932 to the British Parliament in which he declared that "the bomber will always get through" reflected the notion that one might win a war without a high degree of air superiority.[5] Overwhelming numbers of aircraft made the attainment of air superiority a fait accompli. Gen Dwight D. Eisenhower confirmed this idea, observing that the Normandy landings proceeded from "the conviction that, through an overpowering air force . . . the German's defenses could be beaten down or neutralized, his communications so badly impaired as to make counterconcentration difficult, his air force swept from the

skies."[6] Although General Eisenhower in this instance speaks of an operating environment closely approaching air supremacy, the allies paid a heavy price to attain and maintain it.

For Eighth Air Force during the war, a lower degree of air superiority over certain areas of German territory for a specified time resulted in the loss of approximately 6,000 of its bombers and the lives of more than 26,000 of its Airmen.[7] Twenty-five years later in Vietnam, the United States learned the same lesson about air superiority over enemy territory, losing 15 B-52s to enemy fire, along with hundreds of other aircraft.[8] These numbers speak to what can happen when the quality of air superiority is not sufficient to prevent substantial loss of life, which raises the question of how we measure that quality. Specifically, by using quantifiers such as aircraft loss rates per sortie, we can determine the inadequacy of air superiority in these conflicts. In the Vietnam War, it suffered from both technological and political constraints on strategic targeting. The proper usage of strategic bombers against airfields, air defenses, and C2 nodes could have improved the quality of air superiority, resulting in considerably fewer losses of aircraft and aircrews in that conflict. Perhaps the war would have ended differently had the United States commanded the air domain and used airpower appropriately to create air supremacy.

In contrast, during Operation Desert Storm, B-52Gs helped achieve air superiority with air strikes against four airfields and highway landing strips. These raids, along with B-52H cruise-missile attacks against key Iraqi C2 nodes, allowed coalition forces to attain a high degree of air superiority with blinding speed and conduct overwhelming attacks against the Iraqi military from the air. Without the heavy bomber, these strikes undoubtedly would have taken much longer, employed many more aircraft, and likely lengthened the conflict. Despite flying an astonishing 29,300 combat sorties, the US Air Force lost only 14 aircraft (a loss rate of .048 percent), none of which were bombers.[9] Desert Storm highlighted the valuable contributions of the bomber's range, payload, and persistence to the air superiority team. The lessons

learned in Iraq opened a new chapter regarding how best to implement air superiority as an airpower team, foreshadowing the events of Operation Allied Force.

After 78 days of bombing over the Balkans in 1999, the heavy bomber once again played a starring role in air superiority. Although not perfect, the combined use of B-1s, B-2s, and B-52s once again produced a decisive advantage for the North Atlantic Treaty Organization—one so apparent that some parties believed it might obviate the need for ground forces. The bombers hit C2 nodes and severely damaged nine of the 17 airfields. With the introduction of the Joint Direct Attack Munition, guided by the Global Positioning System (GPS), B-2 stealth bombers destroyed 33 percent of all targets in the first eight weeks.[10] These damaging strikes degraded Slobodan Milošević's airborne interceptor force and forced his 1970s-era air defenses to operate autonomously. The Serbian air defense did successfully engage three aircraft but could not deny the allies unfettered use of airpower.[11] Most important during this conflict was the first use of GPS-aided precision weapons and the increased use of long-range cruise missiles. Bombers proved that they could assist in establishing air superiority by delivering a large payload with extraordinary accuracy, at extended range, with an effect greater than any other in the history of air warfare. Allied Force also demonstrated that precision weapons could decrease collateral damage and increase targeting efficiency. Both of these characteristics proved essential to achieving a high degree of air superiority as quickly as possible, and the bomber force could play a critical role in that core function. The technological breakthroughs associated with the strategic bomber during this operation changed the way air forces established air superiority in future conflicts.

Operation Iraqi Freedom offers a notable example of the bomber's contribution to the US Air Force's primary mission. Although B-1s, B-2s, and B-52s flew only a fraction of the sorties during Iraqi Freedom, they dropped most of the munitions, a significant percentage of

which came into play shortly after the "shock and awe" cruise-missile attacks of 20 March 2003. Utilizing complex jamming equipment and substantial precision payloads, heavy bombers—supported by fighter aircraft—accessed the contested airspace over Iraq and helped attain air superiority without any losses.

Perhaps the best example of the bomber force's part in air superiority occurred during recent actions associated with Operation Odyssey Dawn. On 19 March 2011, B-2 stealth bombers departed Whiteman AFB, Missouri, to strike 45 hardened aircraft shelters in Libya. Similarly, B-1 bombers left South Dakota, transiting the ocean to strike munitions shelters, combat aircraft, and vehicle maintenance facilities.[12] The range, payload, and persistence of the B-1s and B-2s severely damaged Mu'ammar Gadhafi's air defenses and greatly aided the allies in gaining a high degree of air superiority over Libya after just 13 days—without a single aircraft lost to hostile fire. The bomber forces executing the long-range, global-strike mission entered into the next evolution in airpower when they demonstrated the feasibility of implementing air superiority without forward-deployed platforms.

The advantages of a strong strategic bomber force are well known and documented throughout history. Bombers alone cannot win air superiority, but the combination of a strong strategic bomber force and an agile fighter force can do so as quickly and efficiently as possible. Together they embody the true application of airpower. Air Marshal Sir Arthur "Bomber" Harris aptly observed that "victory, speedy and complete, awaits the side which first employs air power as it should be employed."[13] The strategic bomber force represents a critical part of employing airpower properly. As the United States faces cuts in its defense budget, China and Russia have recently shown that they realize the importance of strategic bombers to national defense, reflected in China's development of the H6-K and in comments by President Vladimir Putin: "Russia needs a new strategic bomber and will develop it despite high costs."[14] Both of these examples show that rising global

powers consider this aircraft a critical component of their application of airpower and national security. The United States should take note.

> *In order to assure an adequate national defense, it is necessary—and sufficient—to be in a position in case of war to conquer the command of the air.*
>
> —Gen Giulio Douhet

By controlling the air, airpower enables other applications of military force to operate efficiently, with greater freedom of movement and security. Like combined-arms warfare, achieving and maintaining air superiority as quickly as possible at the correct time and place is a team sport. The US Marine Corps understands the importance of controlling the air domain over the battlefield, so much so that the Corps controls and vigorously defends its own organic air superiority team within the structure of the Marine air-ground task force. However, when confronting large-scale conflicts, the nation will require the full services of all five branches of the military. A few key, well-chosen players can attain air superiority by themselves, but a combined team from across the airpower spectrum, including strategic bombers, can do so more quickly. In high-intensity conflicts, the bomber force offers the overwhelming firepower necessary to establish air superiority without delay.

Since 1926 air superiority has been airpower's primary mission. During conflicts of the past 70 years, the heavy bomber has proven vitally important to the national security of the United States. Its projection of military force over long ranges with massive payloads remains unmatched. Through the efficiencies of global precision attack and declining aircraft loss rates, the bomber has demonstrated its great value in helping achieve air superiority time and again. Using relatively few sorties to bring a flexible, overwhelming military force to bear in a short period of time makes the strategic bomber a superb deterrent and air superiority asset. It meets both the public's and politicians' expectations that the military conclude conflicts in short order. Even in light of recent budget reductions, the United States would be ill advised

to overlook the support, funding, and modernization of the strategic bomber force as the focal point of American airpower. A lack of commitment to modernize and sustain these aircraft will impair our ability to bring wars to a quick end, will expose US forces to unnecessary risks as they seek to establish air superiority, and could threaten our national security objectives. The strategic bomber is foundational to the efficient implementation of air superiority, which in turn supports the national military strategy's objective to "deter and defeat aggression" wherever it may occur.[15] ✪

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# THE EVOLUTION OF AIR FORCE TARGETING*

Capt John R. Glock, USAF

*The choice of enemy targets is the most delicate operation of aerial warfare.*
—Giulio Douhet, 1921

*The key to air power is targeting and the key to targeting is intelligence.*
—Col John Warden, 1990


*Reprinted from *Airpower Journal* 8, no. 3 (Fall 1994): 14–28.

FROM THE ALPHA to the omega, targeting has been the essence of air power.[1] People who have written about or employed aerospace power have long recognized the importance of targeting. They have understood that successful application of air power depends on targeting. This article examines three themes. First, it traces the evolution of Air Force targeting. Second, it shows that Air Force targeting has been a driving force in the development of air intelligence. The final theme is the Air Force's leadership in air targeting.

## World War I

From their earliest days, aerospace planners have pursued the idea of the "strategic" application of air power. German Zeppelin raids on London in 1917 are probably the first known uses of air forces beyond direct support of ground operations.[2] While the material effects of these raids were minimal, the effects on the conceptual role of air power were tremendous. During this period, the US developed its concept for strategic bombing against commercial centers and lines of communications. In November 1918, then-Maj Edgar S. Gorrell developed (and had approved) the first strategic bombardment plan for the Air Service, American Expeditionary Forces (AEF).

Gorrell's objective was to "drop aerial bombs upon commercial centers and the lines of communications (LOC) in such quantities as will wreck the points aimed at and cut off the necessary supplies without which the armies in the field cannot exist."[3] To achieve this result, planners required targets. To determine these targets, airmen systematically analyzed critical enemy industrial centers and LOCs to ascertain which should become targets.[4]

However, the war ended before the AEF could fully execute the plan.[5] The [World War I] US Bombing Survey concluded that the Air Service needed to identify critical targets to support a systematic plan for air operations. The survey stated that

> the greatest criticism to be brought against aerial bombardment . . . as carried out in the war of 1914–1918 is the lack of a predetermined program carefully calculated to destroy . . . those industries most vital in maintaining Germany's fighting force.[6]

It recommended that

> a careful study should be made of the different kinds of industries and the different factories of each. This study should ascertain how one industry is dependent on another and what the most important factories of each are. A decision should be reached as to just what factories if destroyed would do the greatest damage to the enemy's military organization as a whole.[7]

Another lesson from the war was that dedicated, trained individuals (knowledgeable of air power) are needed to undertake this careful study. The Intelligence Section of the General Staff (G-2) created an Air Intelligence (A-7) subsection. Then–1st Lt Alfred T. Bellinger, a G-2/A-7 staff officer, reported that there were some who believed that the "work of air intelligence belonged properly to the Air Service. . . . Supporters of this theory [believed] it was necessary for an intelligence officer to have technical knowledge of aviation for the proper performance of his duties."[8] Immediately following World War I, Gen William ("Billy") Mitchell identified the need for (target) intelligence officers at the staff and unit level. He saw the need for these officers "to compile and maintain all information of value in the preparation of bombing missions, an indexed file of photographs, and a stock of maps and charts showing bombing targets and intelligence concerning them."[9]

*Immediately following World War I, Gen William ("Billy") Mitchell (first row, center) identified the need for target intelligence officers at the staff and unit level.*

World War I taught us that successful application of air power requires a predetermined plan calculated to destroy the enemy's will and war-sustaining capability. Achieving this goal requires systematic analysis to determine which targets if destroyed would do the greatest damage to the enemy. An organization with a constant focus on air targeting is needed to undertake this kind of systematic study. This organization needs to maintain files of information about potential targets as well as requisite target materials. From the beginning, the Air Service took the lead in air targeting. It not only developed the first concepts for the offensive use of air forces, but also for the intelligence support required.

## Interwar Years

As a result of the lessons from World War I, the Air Service (later the Air Corps) recognized it needed to more fully develop its concepts for the employment of air power. Through the interwar period, the Air Service Tactical School (ASTS)—later the Air Corps Tactical School (ACTS)—continued to develop the concept of strategic bombing. The instructors recognized targeting as an integral part of bombardment.[10] By 1926 many airmen considered bombardment the most important role for air power. The predominance of bombardment led to an increasing emphasis on targeting. Then-Maj Donald Wilson, an instructor at the ACTS, believed that attacking a few critical targets would disrupt an enemy's economy. These targets, if successfully destroyed, would have a twofold effect. First, the enemy's industrial complex could not sustain its fielded forces. Second, the effect on the day-to-day lives of the civilian population would be so disruptive that they would lose faith with their government and military and force the national leadership to

sue for peace.[11] According to then-Lt Haywood Hansell (one of two officers assigned to help Major Wilson), one of the principal tenets upon which the school based its strategic doctrine stated:

> Proper selection of vital targets in the industrial/economic/social structure of a modern industrialized nation, and their subsequent destruction by air attack, can lead to fatal weakening of an industrialized enemy nation and to victory through airpower.[12]


*Through the interwar period, the Air Corps Tactical School continued to develop the concept of strategic bombing and recognized that targeting was an integral part of bombardment.*

*Prior to World War II, the Air Corps made no provision for air intelligence training. Gen Ira C. Eaker, commander, Eighth Air Force, reported that "intelligence represents the section of activity in which we are weakest."*

By the 1930s the Air Corps had developed a doctrine based on the belief that air power could achieve victory by breaking the enemy's will and capability to fight. It would accomplish this by

> destroying organic industrial systems in the enemy interior that provided for the enemy's armed forces in the field; and paralyzing the organic industrial, economic, and civic systems that maintained the life of the enemy nation itself.[13]

This doctrine led to an even greater need for target intelligence. According to Hansell, the ACTS believed strategic intelligence was "vital to the planning and conduct of strategic air warfare."[14] He continues,

> Much of the value of the bombing offensive, should there be one, would of necessity rest on intelligence data and the conclusions planners gleaned from it. In truth these specific questions were beyond the competence of the Tactical School. Strategic air intelligence on the major world powers would demand an intelligence organization and analytical competence of considerable scope and intelligence and complexity.[15]

Yet during the lean years of the "all-pilot Air Corps," when the Air Corps was struggling for its survival, there was no time or inclination to train officers in combat intelligence.[16] Despite the clear lessons of World War I, the Air Corps entered the Second World War without an intelligence organization capable of conducting systematic studies of potential enemies and recommending vital targets whose subsequent destruction would lead to victory. The Air Corps still relied on Army G-2 to maintain sufficient data and target materials to support both the planning and conduct of air operations.

## World War II

On the eve of World War II, the Army Air Corps had a well-developed doctrine, but Army G-2 was not providing the intelligence support needed to turn doctrine into operations.

> The American airman entered the war with a rather well-developed body of doctrine on how the airplane should be employed . . . but it was evident from an early date that the AAF [Army Air Forces were] poorly prepared for waging a strategic campaign against Germany, or any other enemy, because of the paucity of organized intelligence on the target itself.[17]

In 1940 Gen H. H. Arnold recognized that the Air Corps was not receiving the intelligence it needed to establish requirements or to plan operations. He requested and received permission to establish an air intelligence organization under the chief of the Air Corps. Then-Major Hansell was the first chief of the Strategic Air Intelligence Section, A-2. His section performed economic-industrial-social analyses. It analyzed and described the vital and vulnerable systems, selected targets, and prepared target folders.[18] In July 1941 General Arnold assigned Major Hansell to the new Air War Plans Division (AWPD). The initial effort of the division was to prepare the Army air section of the "Joint Board Estimate of United States Over-All Production Requirements."[19]

However, when war began, the Army Air Forces (AAF) still had inadequate intelligence to plan and conduct combat operations and lacked a systematic method for selecting targets. Prior to World War II, the Air Corps made no provision for air intelligence training.[20] Gen Ira C. Eaker, commander of the Eighth Air Force, reported in March 1942 that "intelligence represents the section of activity in which we are weakest."[21] Then-Col George

C. McDonald, chief of Eighth Air Force intelligence, recalled that no one provided intelligence "in any useful form at the beginning of the war—we went into the field empty handed in this respect."[22] While there was an Air Intelligence Section, there was still no organization capable of doing the systematic analysis required for proper targeting. There were no trained target intelligence officers. Just as important, we still had not developed the data base of potential targets and built the target materials needed to support our air forces.

During the fall of 1942, AWPD-42, Requirements for Air Ascendancy, was under discussion at the highest level, and as the discussion progressed, the plan's limitations in the field of target analysis became the more readily apparent. The AAF had accumulated a vast amount of data on Germany. However, no rational system for target selection existed. General Arnold established the Committee of Operations Analysts (COA) in December 1942 to overcome this shortfall. For the first time the United States had a single organization responsible for the collection and analysis of intelligence for the purpose of air target selection.[23] Air planners used the target selection done by the COA as the basis for the Combined Bomber Offensive against Germany and for the strategic campaign against Japan. This group eventually evolved into the first Joint Target Group. The deputy assistant chief of the Air Staff for targeting headed this organization. Also in 1942, the AAF created a school to train air intelligence officers. Another outgrowth of the attempt to find a systematic approach to target selection was the creation of a data base of potential targets. It was called the Bombing Encyclopedia,[24] and was the forerunner of the Basic Encyclopedia (discussed later) that we use today.

By 1944, most planners in the AAF recognized the importance of intelligence to air operations. General Hansell, in his memoirs, stated:

> I believed foreign industrial analysis and targeting was the sine qua non of strategic air warfare. Without such intelligence and analysis there could be no rational planning for the application of airpower. Douhet's statement to [the] effect that the selection of objectives and targets was the essence of air strategy was patently true.[25]

General McDonald, USAF director of intelligence, was even more specific about what type of intelligence when he said that "target intelligence is the basic requirement because a Strategic Air Force is nothing more than a large collection of airplanes unless it has a clear conception of what to use its planes against."[26] Just as the (World War I) bombing survey had done, the United States Strategic Bombing Surveys (USSBS) emphasized the importance of target selection to the planning and conduct of operations. The USSBS stated:

> The importance of careful selection of targets for air attack is emphasized by [our] experience. Our strategic intelligence . . . at the outset of the war was highly inadequate. . . . [I]f a comparable lack of intelligence should exist at the start of a future national emergency, it might prove disastrous. . . . The present shortage of trained and competent intelligence personnel give[s] cause for alarm and require[s] correction.[27]

Two world wars showed that the proper selection of vital targets is critical to the successful application of air power. Selection of targets is dependent on a systematic study of available intelligence. Without such intelligence and its systematic analysis there can be no rational planning for the application of air power. An organization with a high degree of analytical competence is required to perform this targeting function. It requires competent,

trained personnel who understand the capabilities and limitations of intelligence as well as aerospace forces. These individuals must have access to a current data base and the knowledge to use it. Finally, as the USSBS states, the lack of this ability at the beginning of a future national emergency might prove disastrous!

## Korean War

Five years after World War II, the prophetic words of the USSBS were realized. Despite the lessons of two world wars and the warnings contained in the [World War I] Bombing Survey and the USSBS, we did not possess the organization, intelligence personnel, data base, or target materials needed to support the application of aerospace forces on the Korean peninsula.[28] We were even less prepared to target North Korea in the opening moments of the Korean conflict—the precise time when air power may have proven most decisive—than we were for Germany before World War II.

Prior to the outbreak of war, there was no organization in the Air Force maintaining and analyzing the North Korean target base. The existing data base on North Korea was inadequate. In part, this was due to the Far East Command's (FEC) lack of contingency plans for war with North Korea.[29] A Far East Air Forces' (FEAF) report highlights these shortfalls:

> The probability of fighting in Korea largely had been overlooked in the years following World War II. As a result, we had practically no ready target intelligence. . . . [We] found [ourselves] without a targeting system capable of fulfilling the requirements. . . . However, an even more serious deficiency was the small amount of Korean targeting which had been accomplished. . . . The latter stemmed from several basic causes, the most obvious of which was the small number of intelligence personnel who had been assigned to FEAF.[30]

Only 53 targets in North Korea had target folders, and these were out of date. In addition, there were no current target materials on Korean targets. There was even a lack of basic imagery products. The FEAF Bomber Command stated that the available imagery, when it did exist, was of poor quality.

The problem of inadequate numbers of trained intelligence personnel to support the targeting function continued throughout the war. Two separate studies were conducted to evaluate the effectiveness of the Air Force in Korea. Both reports indicated that the outbreak of the war had created an immediate shortage of intelligence personnel. They also pointed out that inadequate training made these shortages more acute. The shortage was so acute that FEAF had to draft flying officers to perform intelligence functions. As late as July 1952, the FEAF Bomber Command "lacked sufficient personnel to handle any large day-to-day quantity of targets."[31] The FEAF report states that

> the Korean campaign provided more than enough evidence to bolster the contention that neglect of intelligence training during peacetime is a serious mistake, if that point had not already been made powerfully clear at the outset of World War II. The FEAF was woefully lacking in competent Combat Intelligence Officers.[32]

General Headquarters Far East Command (GHQ FEC) assumed responsibility for targeting. The chief of staff established the GHQ Target Group on 14 July 1950 and made it responsible for target nominations. However, the GHQ Target Group was not capable of performing this task. The work of this group was neither systematic nor thorough. It resulted in information of questionable value. Of the 220 primary and secondary targets that the group nominated, 20 percent did not even exist.[33] The remaining targets were often unsuitable for attack by aircraft. Finally, of the

targets that did exist and that were suitable for attack by aircraft, many were not supported with adequate imagery or information. Eventually, FEAF took on a greater portion of the target-nomination process, and gradually became the theater-targeting body. It was responsible for nominating targets that were the basis for air campaigns meeting the needs of the FEC.[34] However, it was two years before there was a fully integrated joint targeting effort.

The lack of trained analysts affected two additional areas: combat assessment and weapon recommendations. The FEAF Report on the Korean War indicates that there were very few studies conducted on the results obtained from our bombing. It states, "If a more extensive effort had been devoted to [combat assessment], a more accurate appraisal of the value of [our] target plans would have resulted."[35] The report also indicates that there was little effort made to make weapon recommendations. Just 10 days before the armistice, the FEAF director of intelligence was finally able to establish a Vulnerability Division.

> The mission of this Division was to provide effective and economical weapon recommendations. If this Division had been established earlier it undoubtedly would have contributed to a more efficient accomplishment of FEAF's mission in the Korean War.[36]

FEAF lessons learned stated:

> Although we had failed to stockpile targeting materials on Korea prior to the outbreak of hostilities, a greater initial deficiency was a lack of a targeting system. . . . Our hastily improvised targeting program . . . suffered from a lack of trained and experienced intelligence officers. . . . [This] resulted in a lack of sufficient enemy reaction studies, and an inability to provide complete weapon recommendations. . . . The inability to perform these vital targeting functions caused us to over-estimate the results of several air campaigns.[37]

It went on to say that

> good target research must include physical vulnerability studies and weapons selection recommendations [and that] a truly effective targeting program must . . . be initiated before fighting starts.[38]

Our experiences gained during the Korean conflict reinforced the lessons learned in both world wars. Once again we saw that the proper selection of vital targets is critical to the successful application of air power. Selecting these targets requires an organization with trained, experienced personnel, who must be familiar with both the operations and intelligence worlds. In an effort to correct deficiencies existing at the start of the Korean conflict, the Air Force created the targets officer career field in 1954. It also enlarged the scope of the data base of potential targets to include many more potential enemies. Also, at the request of the Joint Chiefs of Staff, the Air Force became the executive agency for the Department of Defense's (DOD) Air Target Materials Program (ATMP) in 1953. This was done to ensure the adequacy of air targeting materials. The Air Force's ability to do targeting had made great progress since the days of Gorrell.

## Vietnam Conflict

Unfortunately, much of the progress the Air Force made in the fifties was lost in the early sixties. One of President John F. Kennedy's first acts was to restructure the DOD. Kennedy and Secretary of Defense Robert S. McNamara wanted to make the department more efficient and flexible. One way of doing this was to centralize functions that were not service-specific. One of these functions was intelligence. In 1962 the Defense Intelligence Agency (DIA) took over much of the intelligence work previously

done by the services. One of these areas was the maintenance of the targeting data base. DIA also became responsible for the ATMP and the Tactical Target Materials Program (TTMP). Unfortunately DIA (and the Air Force) largely ignored conventional targeting applications in the nuclear age. The Air Force would soon feel the results of both the centralization of intelligence and the neglect of conventional operations.

Some believe the centralization of the targeting functions within a national agency was imprudent. Maj Gen George Keegan, the Seventh Air Force deputy chief of staff for intelligence in 1968–69, said, "Years ago, the mission of targeting was taken away from the Department of the Air Force and passed to the Defense Intelligence Agency, where it simply died."[39] At the beginning of our involvement in Vietnam, the Air Force did not have an adequate targeting organization to support our combat operations. As one lesson learned states:

> The targeting function is an essential element in the effective employment of fighting forces. . . . [T]he Second Air Division intelligence organization could not provide adequate planning and execution support to the rapidly escalating air operations.[40]

The situation was very similar to that of the Korean Conflict. The Basic Encyclopedia provided targeteers and planners with basic infrastructure and industrial installations. Pacific Command (PACOM) planners were able to identify 94 targets in North Vietnam. PACOM Operation Plan 37-64 contained a Strike Plan Target List with these targets arranged into four attack options. Each option provided for escalation of the conflict. The objectives of the war being constrained as they were, the US was forced to attack "in-country" targets. Because the Air Force did not have a target-

ing organization capable of supporting this, "[Military Assistance Command, Vietnam] MACV J-2 developed its own organization, the Target Research and Analysis Center (later renamed the Combined Intelligence Center, Vietnam [CICV]), to accomplish the in-country targeting task."[41]

During the battle for Khe Sanh (Operation Niagara), MACV relinquished control of targeting. The Air Force created an ad hoc targeting organization to effectively use air assets. The Seventh Air Force deputy chief of staff for intelligence (DCS/I), augmented by TDY personnel, established an intelligence control center. This center represented the first major Air Force contribution to the in-country targeting effort. In March 1968 the Air Force recalled the TDY personnel. This recall terminated the operation of the intelligence control center, effectively conceding de facto control of targeting back to MACV. This again limited the Air Force to providing on-call fire support to the ground forces in Vietnam, just as we had in Korea.[42] "The Air Force quickly found itself woefully short of targeting personnel. By 1969 [the] Air Force had just about exhausted its cadre of experienced targeteers fighting the war. The void was filled with 'CBPO' targeteers with little or no experience."[43]

The war effort was negatively impacted by a shortage of intelligence personnel and their lack of training.

> Although the Air Force had been in SEA [Southeast Asia] since late 1961, adequate intelligence personnel resources were still unavailable when the rapid buildup began. . . . The buildup began at a time when the Air Force was actually reducing manpower resources in response to budgetary and gold flow constraints. . . . [T]he lack of adequate formal and technical training for intelligence personnel adversely affected the intelligence missions in SEA.[44]

There were many positive lessons from Vietnam. Air Force doctrine recognized that target intelligence is essential to aerospace operations.

> The role of intelligence support in the effective employment of tactical air forces is of critical importance. Targeting is the key function and includes exploitation of all intelligence sources for target development, material production, target analysis, recommendations for strike and strike assessment.[45]

Sixty-three percent of the intelligence chapter in AFM 2-1 is devoted to targeting. Air Force intelligence also learned critical targeting lessons. It realized that it was not sufficient to just assign intelligence officers to targeting positions. Intelligence officers needed formal targeting training. In 1974 the Air Force again took the lead by establishing the Armed Forces Target Intelligence Training Course. This course trained Army, Navy, and Air Force officers in the capabilities and limitations of all services' weapons systems supporting air operations. It also trained students in analytical methodologies for selecting, prioritizing, and recommending targets meeting the commander's objectives and guidance. Graduates of this course were unique because they possessed an understanding of air operations, as well as intelligence operations. They provided the critical link between the two communities.

## The Gulf War

The Gulf War was the first operational test of this link. Building on nearly eight decades of history and lessons learned, the Air Force entered the Gulf War more prepared to apply aerospace forces than at any time in the past. Even with these preparations there were problems. Air Force targeting officers did not provide

the support that decision makers, planners, and aircrews required. Some of these problems were institutional, some resulted from changing concepts of air power employment, and others were systemic within the intelligence bureaucracy. We will examine a few of these. The purpose is not to provide apologies or to lay blame. Rather, it is to identify the unique capability trained targeting officers can bring to the application of aerospace forces.

In 1990 an Air Force targeting element supported each unified command. In February 1990 Central Command (USCENTCOM) directed its Air Force component (Ninth Air Force/CENTAF [US Air Forces, Central Command]) to update the air plan for Operational Plan (OPLAN) 1002-90. In support of this request, the 9th Tactical Intelligence Squadron (TIS) Target Intelligence Division[46] began target development for the draft OPLAN. Air Force targeting officers took the objectives that the air planners provided and identified target systems to meet them. These targeting officers researched known installations and developed lists of potential targets. They used these lists to produce the *Iraqi Target Study*, which was published on 15 June 1990.

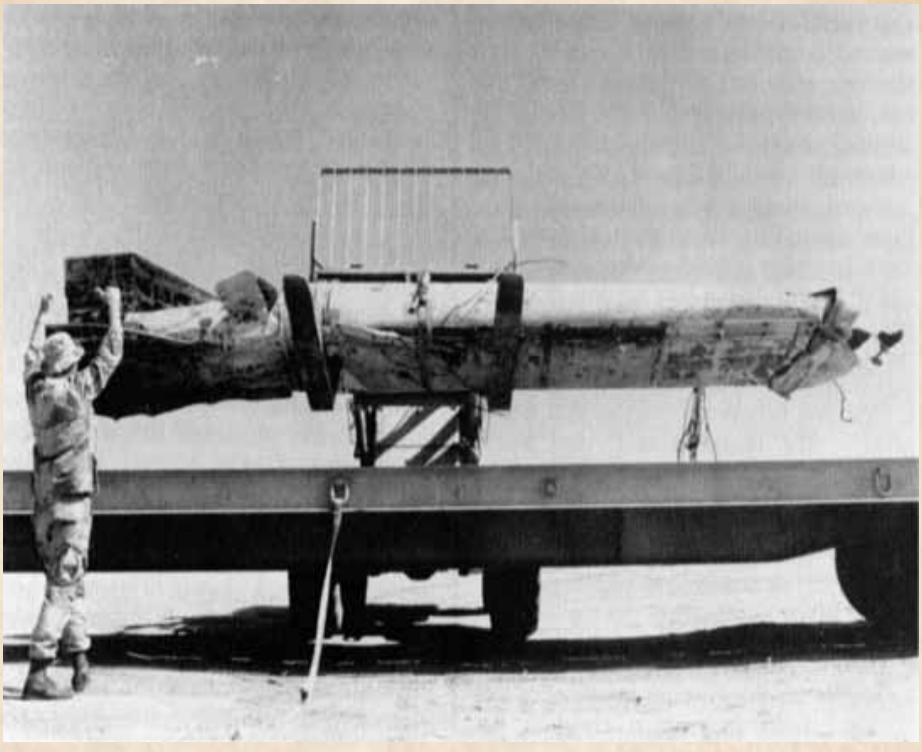
Two recurring problems hampered these targeting officers. First was the inadequacy of the installation data base. DIA maintains a worldwide installation data base known as the Automated Installation File (AIF). This file is a system used to store, manipulate, and retrieve target intelligence. Ideally it has information on every installation or place of potential military significance. However, 40 percent of the targets struck during the Gulf War were not in this data base in July 1990. The number of targets in some critical categories grew by several hundred percent. In addition to listing installations, the AIF should contain vital

targeting information such as construction data and identification of critical components. Unfortunately, many of the AIF records fell far short of providing the information necessary for accurate targeting.[47]

The second problem that the 9th TIS targeting staff encountered was the lack of necessary imagery and supporting target materials. Of the 218 targets that the 9th TIS identified, there was imagery of only 90. Of these 90, only 30 had target materials. At the initiation of the crisis 24 percent of the installations identified in Iraq had target materials. Of the targets actually struck during the war, only 11 percent had target materials on 2 August 1990. In a 29 August 1990 DIA memo to the deputy director for foreign intelligence, the DIA chief of targets acknowledged that DIA had "issues to resolve and problems to fix [with availability of target materials] after the crisis."[48] In addition to the basic shortage of target materials at the beginning of the crisis, many were of questionable utility due to their currency.[49] The average date of production was 1982, with the oldest produced in June 1973—17 years before the crisis.[50]

Despite these problems, the contributions of Air Force targeteers should be apparent. Ninety-seven percent of the targets in the 9th TIS *Iraqi Target Study* (produced a month and a half prior to the Iraqi invasion) were struck during Desert Storm. By comparison, 93 percent of the 12 August 1990 Air Staff target list and only 30 percent of the targets in the July 1990 CENTCOM Joint Target List were struck during the war.[51] More than four months prior to the invasion, the 9th TIS identified information and imagery shortfalls that would impact combat operations if not satisfied.

Air Force targeting officers were also available to support planners in the area of weapon recommendations and critical element analysis. They recommended the optimum mix and number of weapons, fuzing, and critical elements throughout the war. In some cases, strategic planners chose to disregard this information. The planners often thought the recommendations were too conservative. Three examples should illustrate this point.[52] In August 1990 CENTAF targeting personnel recommended that bridges only be attacked by aircraft using precision guided munitions (PGM). Initially, this advice was ignored. Based on unacceptable results, planners shifted to using PGMs against bridges. Also in August, targeting officers estimated that a particular target would require more PGMs than planners thought it should. This target type was struck but never penetrated during the war. At the end of the war it was fully functional. (In January 1993, as part of Operation Southern Watch, this same target was struck using the number of weapons recommended by the targeting staff. The result this time was the functional destruction of the facility.) Finally, on 19 January 1991, a targeting officer recommended using CBU-89s and CBU-87s against mobile Scuds. Following the recommended strike, there was a break of 60 hours before the Iraqis launched another Scud against Israel and more than five days before there was another mass launch. We will never know if this was a result of this strike or not. Planners switched back to PGMs in an effort to achieve physical destruction instead of using an area denial strategy to achieve a functional kill.



*Following the strike by CBU-89s and CBU-87s against mobile Scuds (above) recommended by a targeting officer, there was a significant break in time before another mass launch. We will never know whether or not this hiatus was the result of the strike since planners returned to the use of PGMs.*

Targeting officers were not as successful in providing essential combat assessment information. One reason for this was a lack of training. The former Armed Forces Targeting Course provided only five hours of instruction on combat assessment. Exercises also provided little training. Usually there was no poststrike imagery to work with; scripting cells had no model to generate combat

assessments; and briefers failed to realistically account for limited collection assets, weather, and the general fog of war.

Desert Storm raises fundamental questions about the effectiveness of targeting. Were targeting officers always right? No. Did they provide the best support possible? No. Is there significant room for improvement before the next war? Emphatically yes! Vietnam helped forge targeting as the critical link between operations and intelligence. The lessons from Desert Storm should be used to further temper and strengthen this vital linkage.

## Today

Unfortunately, the prevailing trend is not to strengthen this linkage, but to eliminate it. The global geopolitical situation has changed. One result is the downsizing and restructuring of the military services. The Air Force decided, after much thought, to eliminate the targeting officer career field. This decision was based on budgetary and manpower constraints. Part of the rationale was that it appears more cost-effective to maintain generalists at the expense of trained specialists. One question may remain unanswered until the next war: Is it more effective? The Navy has reached far different conclusions about the need for targeting. The Navy, which prior to the Gulf War did not teach targeting at its intelligence school, now teaches more hours on targeting than does the Air Force.

Since the end of the Gulf War, many have written about the war's lessons. Most authors have addressed how precision weapons and stealth platforms have altered the nature of warfare. This masks another more critical lesson—the importance of targeting.

Not only have most authors failed to address the significance of targeting, they have also failed to see how greater precision requires even greater and more detailed target analysis. In each conflict we have seen our weapons accuracy improve. We have gone from Saint-Mihiel, France, to Ploesti, Rumania, to the Wonsan locomotive shops in North Korea, to the Paul Doumer bridge in North Vietnam, to the ventilation shaft of the Iraqi air force headquarters. An enduring lesson learned about delivery accuracy during the last eight decades is that the greater the accuracy of our weapons, the more accurate we need our targeting to be.

In 1992 Congress encouraged the Secretary of Defense, heads of military services, the chairman of the Joint Chiefs of Staff, and the director of the DIA to make resources available for a Joint Target Training Program. For the first time since 1918, the Air Force has not taken the lead in a targeting program. Although the Air Force has the greatest experience in joint air targeting and the preponderance of air assets, it has taken a backseat in the future of joint targeting. The Navy is the executive agent for the new Joint Target Training Program, which is located at the Navy and Marine Intelligence Training Center.

## Conclusion

This article has presented three themes. First, air targeting is fundamental to the application of aerospace forces. Second, the evolution of Air Force targeting has in part driven the development of air intelligence. Finally, the Air Force has historically taken the lead in air targeting.

We have seen that from the very beginning of aerospace planning, there was a need to systematically identify critical targets based on the wartime objectives. World War II validated the views of the Air Corps Tactical School and led to the creation of a single, wartime organization responsible for the collection and analysis of intelligence for the purpose of air target selection. The Korean War dramatically emphasized that a truly effective targeting program must be initiated before the fighting starts. It also reinforced the lesson that the requirement is not for generic intelligence personnel but for trained and experienced professionals capable of making target and weapon recommendations and then analyzing the results of these strikes. After the Korean War, Air Force intelligence created the target intelligence career field, and the DOD made the Air Force the executive agent for the ATMP. The Vietnam conflict reconfirmed the lessons of previous wars. Further, it highlighted the need for specialized training in targeting functions. Following the Vietnam conflict, the Air Force took the lead in target training by establishing the Armed Forces Target Intelligence Course—the first course ever developed to train personnel in essential targeting functions.

The Air Force offers the quickest, longest-ranged, and most flexible force available to the nation. As we continue to draw down, our power-projection capabilities will become even more vital in protecting US interests.[53] While efficiency may be a peacetime measure of merit, effective targeting remains crucial to applying aerospace power. Targeting remains one of the easiest and most cost-effective means of preserving our diminishing resources before the first weapon is committed.[54] Yet the Air Force is in danger of forgetting that targeting is a unique, critical function. It has al-

ready eliminated the only comprehensive course in the DOD dedicated to air targeting and relinquished the lead in the development of the Joint Target Training Program.[55] Future application of aerospace power will likely suffer. As we draw down, these decisions will have a negative impact on our country's ability to respond to regional conflicts in a timely and decisive manner. The inherent range and speed of aerospace forces provide "global reach"; however, *without "global targeting," we will greatly reduce our "global power!"*

We stand at a crossroads in the development of aerospace power. The path we choose will have as profound an effect on its future as did the early debates on the fundamental roles of aerospace power. We can continue to build on the lessons of the past and reestablish Air Force targeting before our current expertise fully erodes. Or we can ignore these lessons, only to learn them again at the expense of aircrew lives. We need only look to our predecessors—the Gorrells, Mitchells, Arnolds, Hansells, Stratemeyers, Momyers, and Glossons to find the direction we should go at the operational level. *"AIR POWER IS TARGETING AND TARGETING IS INTELLIGENCE!"*[56]

Notes

1. The contributions of all the services are included in the collective terms *air power* and *aerospace power*.

2. The first military use of powered aircraft for bombing was in 1911. Italian pilots threw 4.4-pound bomblets from their aircraft against Libyan forces. Besides resulting in the first claim of collateral damage to a hospital, the need for better bombs and target materials was identified. Robin Higham, *Air Power: A Concise History* (New York: St. Martin's Press, 1972), 21–23.

3. Edgar S. Gorrell, "Early History of the Strategical Section," ed. Maurer Maurer, in *The U.S. Air Service in World War I* (Washington, D.C.: Government Printing Office, 1978), vol. 2, 143.

4. Given the accuracy of bombing at this point, only installations needed to be identified. The ability to identify critical elements at installations would not be needed until the Vietnam War.

5. Between 12 June 1918 and 11 November 1918, US bombers dropped 275,000 pounds of bombs on railyards, factories, bridges, command posts, troop concentrations, lines of communication (LOC), and so forth.

6. "U.S. Bombing Survey," in Maurer, vol. 4, 501.

7. Ibid., 502.

8. Ibid., vol. 3, 215.

9. "Mitchell: Provisional Manual of Operations," in ibid., vol. 2, 279.

10. Maj T. D. Milling, "The Air Service Tactical School: Its Function and Operation," Langley Field, Va., Air Service Tactical School, 1924.

11. Robert T. Finney, *History of the Air Corps Tactical School, 1920–1940* (Maxwell AFB, Ala.: Air University, 1955), 31.

12. Haywood Hansell, *The Strategic Air War against Germany and Japan* (Washington, D.C.: Office of Air Force History, 1986), 10.

13. Ibid., 11.

14. Ibid.

15. Ibid., 19.

16. Harold B. Hinton, *Air Victory: The Men and the Machines*, with a foreword by Barton K. Yount (New York: Harper & Brothers Publishers, 1948), 145–46.

17. William A. Goss, "The AAF," in Wesley Frank Craven and James Lea Cate, eds., *The Army Air Forces in World War II*, vol. 6, *Men and Planes* (Washington, D.C.: Office of Air Force History, 1983), 40.

18. Hansell, 21–22.

19. The AWPD input was known simply as AWPD-1. While technically a requirements document, it was really a blueprint for our air operations plan against Germany.

20. Thomas H. Greer, "Other Training Programs," in Craven and Cate, vol. 6, 687.

21. Alfred Goldberg, "Establishment of the Eighth Air Force in the United Kingdom," in ibid., vol. 1, *Plans & Early Operations, January 1939 to August 1942*, 624.

22. Robert Frank Futrell, "US Army Air Forces Intelligence in the Second World War," in Horst Boog, ed., *The Conduct of the Air War in the Second World War* (New York: St. Martin's Press, 1988), 539.

23. Arthur B. Ferguson, "The CBO Plan," in Craven and Cate, vol. 2, *Europe: TORCH to POINTBLANK, August 1942 to December 1943*, 352–54.

24. The Bombing Encyclopedia was the first effort to automate the handling of the vast amount of information needed to provide target recommendations for every country in the world. See James Lowe, "Intelligence in the Selection of Strategic Target Systems," lecture, Air War College, Maxwell Field, Ala., 1946, 13–15.

25. Hansell, 22.

26. George C. McDonald, "The U.S. Air Force Intelligence Prior to and During World War II and Today," lecture, Air War College, Maxwell Field, Ala., 1947, 5.

27. *The United States Strategic Bombing Surveys (European War) (Pacific War)* (Maxwell AFB, Ala.: Air University Press, 1987), 39, 117.

28. The advent of nuclear weapons led many to believe that targeting was not a required discipline. There was no need to analyze the enemy target sets when we were going to bomb whole cities. According to Futrell, there was a belief in the USAF Directorate of Intelligence during the late 1940s that "targets should be working for the Directorate of Plans." Much of the intimate relationship of air intelligence and air operations was lost during the rapid demobilization of the wartime intelligence force. Futrell, "US Army Air Forces Intelligence in the Second World War," 547–48.

29. *United States Air Operations in the Korean Conflict, 25 June–1 November 1950* (Maxwell AFB, Ala.: Air University, 1952), 84.

30. *FEAF Report on the Korean War*, Far East Air Forces report, 26 March 1954, vol. 2, 141.

31. *United States Air Operations in the Korean Conflict, 25 June–1 November 1950*, 52–53.

32. *FEAF Report on the Korean War*, vol. 2, 142.

33. *United States Air Operations in the Korean Conflict, 1 July 1952–27 July 1953* (Maxwell AFB, Ala.: Air University, 1956), 10.

34. *FEAF Report on the Korean War*, vol. 2, 142.

35. Ibid., 144.

36. Ibid., 146.

37. Ibid., 147.

38. Ibid.

39. Robert Frank Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force*, vol. 2, *1961–1984* (Maxwell AFB, Ala.: Air University, 1989), 304.

40. *USAF Intelligence Activities in Support of Operations in Southeast Asia, 1 January 1965–31 March 1968* (Maxwell AFB, Ala.: Air University, 1972), 8.

41. Ibid.

42. Ibid.

43. Thomas E. Lee and Samuel M. Taylor, "Air Force Intelligence Enhancement Program," technical note, Bolling AFB, D.C., Air Force Intelligence Service, 1985, 4.

44. Ibid., 29–31.

45. Air Force Manual (AFM) 2-1, *Tactical Air Operations—Counter Air, Close Air Support, and Air Interdiction*, 1969, 8-1.

46. In wartime, 9th TIS (now the 609th AIS) became CENTAF Intelligence.

47. John Heidrick, "9TIS/INT Planning Procedures for Internal Look-90 and Operation Desert Shield," undated paper provided to the author for the Gulf War Air Power Survey (GWAPS); and memorandum for record, Col James R. Blackburn, USAF/INT, subject: Targeting/MC&G Support to DESERT SHIELD (U), 17 October 1990. (Secret) Information extracted is unclassified.

48. DIA memo from chief, Target Intelligence Directorate, to deputy director, Foreign Intelligence, subject: Overall Perspective on Target Materials Available at Crisis Initiation, 29 August 1990.

49. The ATTG was the basic target material at this time. Figures taken from CENTAF, 15 June 1990, and CENTCOM, 27 June 1990, target list and the *Consolidated Tactical Target Materials Catalog*.

50. *Consolidated Tactical Target Materials Catalog (TTMC)* (Langley AFB, Va.: 480 Tactical Intelligence Group, 1990).

51. Looking at the issue from the standpoint of what percentage of the total targets struck was identified in various lists prior to the war, one finds that the percentages for 9th TIS, CENTCOM, and the Air Staff were 43, 22, and 19, respectively.

52. All examples are based on the author's experiences. The second example is corroborated by Col David Deptula, one of the air campaign planners for Desert Storm, in an interview conducted by Dr Barry Watts, and the third is recounted in DOD's *Final Report to Congress on the Conduct of the Persian Gulf War* (Washington, D.C.: Government Printing Office, 1992), 166.

53. Secretary of the Air Force Donald B. Rice, *The Air Force and U.S. National Security: Global Reach—Global Power*, white paper (Washington, D.C.: Department of the Air Force, June 1990).

54. Thomas E. Lee, "Targeting—The Key to Effective Air Power" (Thesis, Armed Forces Staff College, 1975), 47.

55. According to the draft memorandum of agreement for the Joint Target Training Program (JTTP), it is intended to ensure that all DOD targeting personnel serving in joint and service targeting positions will have a common knowledge base reflecting current joint targeting terms, tactics, techniques, and procedures. *It is not intended to train targeteers.*

56. Buster C. Glosson, "Impact of Precision Weapons on Air Combat Operations," *Airpower Journal* 7, no. 2 (Summer 1993): 8.

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**Leading with Honor: Leadership Lessons from the Hanoi Hilton** by Lee Ellis. Freedom Star Media (http://freedomstarmedia.com/), 1735 Buford Highway, Suite 215-332, Cumming, Georgia 30041, 2012, 256 pages, $22.99 (hardcover), ISBN 978-0-9838793-0-5.

I have visited the infamous Hoa Loa Prison in Vietnam, which American prisoners of war (POW) called the Hanoi Hilton, and have never forgotten the experience of observing the conditions endured by our POWs. It held me in its grip and has never let go. Recently I read Lee Ellis's *Leading with Honor: Leadership Lessons from the Hanoi Hilton*, an absolutely first-rate book that had a similar impact on my impressions of POW life. With this well-researched study, Ellis has added immensely to our understanding of the POW experience, using his extraordinary insight to provide the reader with powerful lessons in leadership and a portrayal of life under the harshest prison conditions imaginable. The author's five years, four months, and two weeks (1,955 days) of POW captivity constitute the basis of his chilling yet fascinating story.

The key to the book, which includes an excellent foreword written by fellow POW and US senator John McCain, lies in its treatment of the role of leadership and explanation of how it can be duplicated. In a deeply perceptive and thoughtful manner, Ellis demonstrates that leading with honor deals with placing service to others ahead of self-interest. This type of exemplary leadership, most often demonstrated by POW leaders, calls for clear vision, strong character, and the ability to instill confidence and purpose in others. It often entails making great personal sacrifice and enduring terrifying, brutal torture such as beatings, being suspended by the arms, forced sleeplessness, confinement in darkness, extended periods of kneeling, and other instances too heartbreaking to mention. Ellis clearly indicates that as he and his companions fought for survival against an enemy who attempted to isolate, divide, and subdue them, they risked and suffered torture to sustain each other. How did these men manage to persevere? Accord-

ing to the author, "We were definitely a band of brothers, and we leaned on each other in difficult times" (p. 77).

Without books, television, magazines, newspapers, or other forms of information or entertainment, these POWs turned to each other as their only source of learning, encouragement, and inspiration. Ecumenical church services conducted in the prison extended consolation and much-needed solace by offering the prisoners messages of hope and urging them to disdain self-pity, hold fast to their blessings, and reflect on their good fortune at being alive. Keeping the faith, as reflected in their discussion of Psalms 1, 23, and 100, remained their central focus and sustained their hope that they would one day come home to their families, friends, and country. The men also kept in mind the Boy Scout Oath, which "was a powerful force in the POW camps, reinforcing [their] military training on the principles of duty, honor, responsibility, and faithfulness . . . : On my honor I will do my best to do my duty to God and my country" (p. 87). Further, they passed along Rudyard Kipling's inspirational poem "If," tapping it out in code through the cell walls and throughout the prison, and kept their minds active by organizing an education program consisting of languages, mathematics, history, and other subjects of mutual interest. Ellis also pays tribute to the wives of POWs, such as Sybil Stockdale (wife of Vice Adm James B. Stockdale), who lobbied senior government officials such as President Richard Nixon and Secretary of State Henry Kissinger to gain more support in helping other wives uphold and strengthen the cause of POWs and individuals missing in action.

On balance, *Leading with Honor* contends that leadership is not easy; if it were, everyone would do it. Indeed, the difficulty itself makes leadership great. Ellis's thesis suggests that, with dedication and effort, people can learn leadership—a concept both simple and complex. To further this learning process, he provides a series of lessons he learned as a POW, dividing them into the book's two parts: "Leading Yourself" and "Leading Others," accompanying their chapters with what he describes as "Foot Stompers." "Leading Yourself" includes the chapters

"Know Yourself," "Guard Your Character," "Stay Positive," "Confront Your Doubts and Fears," "Fight to Win," and "Bounce Back." The second part, "Leading Others," offers the chapters "Clarify and Build Your Culture," "Over-Communicate the Message," "Develop Your People," "Balance Mission and People," "Build Cohesive Teams," "Exploit Creativity," "Treasure Your Trials and Celebrate Your Successes," and "Free the Captives." The "Foot Stompers" appear at the end of each of these 14 chapters, helping summarize the key points.

In this personal, passionate, and moving work, Lee Ellis has succeeded brilliantly in communicating a story bursting with POW life in a horrible prison in faraway Vietnam over 45 years ago. He emphasizes communications, teamwork, and innovation—three key leadership ingredients that emerged from his ordeal, which, according to Ellis, anyone can learn and put into practice. Moreover, he points to resilience as a way of life for the Vietnam POWs, whose mission is embodied in "six powerful words: resist, survive, and return with honor" (p. 131). In this objective, they succeeded admirably.

I was especially impressed by a most revealing outcome that the author addresses. That is, "the human body, mind, and spirit can endure and overcome far more than one might expect" (p. 82). A strong commitment to duty can help see us through the most difficult of hardships. This, coupled with the support of others and undying faith and hope, constitutes a formula for surviving life's most challenging circumstances. Winston Churchill once said, "If you have an important point to make, don't try to be subtle or clever. Use the pile driver." *Leading with Honor* uses a pile driver to tell its story, making many points that today's leaders can employ. If you read only one book this year, make it this one. You owe it to yourself and to those who so nobly served and will not be forgotten.

**Dr. Richard I. Lester**
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**Eisenhower 1956: The President's Year of Crisis—Suez and the Brink of War** by David A. Nichols. Simon & Schuster (http://www.simonandschuster.com), 1230 Avenue of the Americas, New York, New York 10020, 2011, 368 pages, $28.00 (hardcover), ISBN 978-1-4391-3933-2; 14 February 2012, 336 pages, $16.00 (trade paperback), ISBN 978-1-4391-3934-9.

Young Egyptians demonstrate in the streets. Britain and France conduct military operations in North Africa. Israel attacks Gaza. Americans endure election politics while Westerners worry about the flow of oil from a Middle East in turmoil. This is not the fall of 2012. It is 1956, during the presidency of Dwight D. Eisenhower as described by David Nichols in his recently published book *Eisenhower 1956*. For either the student of history or the layman hungry for a good story, Nichols chronicles a busy year of decision making by an administration bombarded by concerns about a new world war with the Soviets and struggling to balance old relationships around the world. At the center of so much tumult during this one year, US president Dwight "Ike" Eisenhower faces a time when the Soviets enlarge their role in an increasingly bipolar world while former European colonies rebel against Western influences. Nichols describes how Eisenhower understood these forces and their intersections in the context of the Cold War that he feared could become catastrophically hot. The author challenges the reader to comprehend how so many critical events occurred in such a short period of time and found their way to Eisenhower's shoulders.

Specifically, Egypt nationalizes the Suez Canal after 100 years of ownership by the British and French, who respond with an attack against Egypt contrary to US advice. Israel, ever ready for an opportunity to seize more land from its neighbors, joins them and attacks the Egyptians in the Sinai. Egypt responds by sinking ships in the Suez Canal to block all traffic, cutting the flow of oil to Europe. So far, it's a busy year. But there's more.

Ike's concerns multiply when the opportunistic Soviets back the Egyptians. Now the United States faces a military clash between the

Russians and the British/French. The terms of the new NATO treaty require America to aid the Europeans. Eisenhower explicitly warns the two European allies not to take military action in Egypt, but they ignore him. Do they now expect Ike to confront the Russians in Egypt on behalf of European colonialism? "No," says Ike. "The French and the British do not have an adequate cause for war" (p. 205). And neither does Israel, he adds.

Then another front opens. A student-led rebellion in Budapest, Hungary, captures the world's attention with the first use of the term *freedom fighters* and offers the prospect of Hungary's escaping the Iron Curtain and rejoining Western Europe as a free country. However, 4,000 Soviet tanks and 16,000 Red Army soldiers brutally suppress this short-lived attempt to throw off Moscow's imposed communist rule. The Iron Curtain becomes more threatening as the Soviets feel abler to stand their ground. Western Europe finds itself in further peril. But there's still more.

Chaotic 1956 is also a presidential election year. The Democratic candidate for Ike's job, Adlai E. Stevenson II, cannot resist hurling the usual political invectives at the president, criticizing Ike for not helping our British and French "allies," the Hungarians, and the Israelis, as well as failing to take other geopolitical actions—for none of which Stevenson either bears responsibility or faces consequences. The narrative, pieced together from Nichols's research of primary source documents of the time, shows that Ike wisely decided it was in America's best interest not to support European action in Egypt, especially in light of the threat of a larger conflict with the Soviets escalating to nuclear war.

In true political fashion, Ike also endures criticism for his age and health, along with "his" failed Middle East policy, which includes aid to Egypt for its Aswan Dam project on the upper Nile and which might have prevented the Suez crisis. Congress, however, blocks this initiative, motivated by its own narrow interests—among them, limiting Egypt's competition with the American South in the cotton market. On top of

everything else, Ike suffers a heart attack and then undergoes intestinal surgery. This would be a hell of a year for any man in American history.

Despite concerns about his health, Eisenhower's age and experience are assets. At 66 he has accumulated plenty of experience in handling crises, having planned and led Operation Overlord in 1944, accepted the surrender of the Germans in 1945, and ended the Korean War in 1952. Consequently, he is a far more capable leader in a crisis than any carping politician. Ike's calm, grandfatherly public demeanor disguises all of his emotions, which he vents in private. The American people pick the right man for the time, and Ike handily wins reelection. Having defeated Stevenson and the Democrats, he then takes on the French, British, Israelis, and finally, the Russians. His recovery from the heart attack does not slow him down.

Ike recognizes the British and French rationale for attacking Egypt for what it is—the last gasps of a colonial mind-set that will lead only to more clashes around the world. Eisenhower also understands that President Gamal Abdel Nasser of Egypt is expressing his people's desire to control their own land. Nevertheless, the French, British, and Israeli actions, along with the US Congress's lack of foresight, put on hold for another quarter of a century Eisenhower's efforts in 1956 to establish Egypt as an American ally. In that year, without American approval and military aid, the French and British have to back down and leave Egypt while the Israelis withdraw from the Sinai. The Soviets then diffuse their rhetoric and threats. Eisenhower, the West Pointer and combat general who delivered Western Europe from Nazi bondage in 1945, becomes the Middle East peacemaker in 1956.

Eisenhower's health is indeed an issue. Nichols provides day-to-day updates from his research of diaries and logs, noting that Ike's heart attack and recovery took longer than publicly admitted and that most details of his health problems were withheld from the press. His cardiologist becomes a significant presence in his entourage during 1956. Yet, while the world boils around him, Ike remains the calm in the storm. Few people have ever faced so much in so short a time, in terms

of health and duty, as did this man who emerged from a humble, simple, rural Kansas background to become president of the United States. Divulging a little-known part of American history, this book gives readers an understanding of an era, a man, and the issues of his time. Certainly this reviewer now has greater respect for Eisenhower and a deeper appreciation for his role in history.

Given a historian's hindsight of half a century, not all of Ike's actions escape criticism, and Nichols leaves room for such musings and questions. However, we cannot fault Dwight Eisenhower for an effort that kept us out of more war, perhaps a nuclear war, with the phlegmatic, unpredictable, and secretive Soviets while he brought a crisis in the Middle East to a peaceful conclusion. The casual reader will find much of value in *Eisenhower 1956*, from pivotal history to sheer human drama. Similarly, today's student of this era now has an excellent resource for facts and stories pertaining to the American, military, and Middle Eastern history of the time—and Eisenhower was a significant part of it all.

*Postscript*: The Soviets built the Aswan Dam and stayed in Egypt until the 1980s. In the city of Aswan, the Russian engineers' quarters—a high-rise concrete apartment located on a bend in the Nile—is now a hotel favored by American tourists, with a fantastic view looking north along the Nile. In 1957 the Egyptians, with international help, cleared the Suez Canal of the war's debris and now operate this conduit of international commerce efficiently and without interruption. Its revenues helped pay for the Aswan dam and other Egyptian civil works projects. Included in frequent, regular, and unimpeded transits of the canal today are US Navy warships and carrier task forces sailing to and from the Arabian Gulf, Indian Ocean, and other parts east. Regarding the confrontation over the Suez Canal, Ike was right.

**Maj Thomas F. Menza, USAF, Retired**
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**7 Deadly Scenarios: A Military Futurist Explores War in the 21st Century** by Andrew F. Krepinevich. Bantam Dell, a division of Random House (http://bantam-dell.atrandom.com/), 1745 Broadway, New York, New York 10019, 2009, 334 pages, $27.00 (hardcover), ISBN 978-0-553-80539-0; 2010, 400 pages, $16.00 (trade paperback), ISBN 978-0-553-38472-7.

Andrew Krepinevich's *7 Deadly Scenarios* looks into possible futures of the United States. As he painstakingly points out in the introduction and conclusion, the book does not predict the future but offers "a sobering picture of the difficult challenges the United States . . . *may* confront in the not-too-distant future" (emphasis added) (p. 285). Readers should keep this caveat in mind since some of the notional events have not occurred in accordance with the author's timeline—a fact that might otherwise tend to diminish the validity of the scenarios.

The seven scenarios are "The Collapse of Pakistan," "War Comes to America," "Pandemic," "Armageddon: The Assault on Israel," "China's 'Assassin's Mace,'" "Just Not-on-Time: The War on the Global Economy," and "Who Lost Iraq?" Each follows a logical progression of events that leads the United States and the world to the brink of war or social collapse. Themes common to the scenarios include the changing role of the US military and of the United States in general. Specifically, challenges of the twenty-first century will demand more flexibility from the US military, which will only rarely fight wars for which it has prepared and trained. Similarly, Asian and Middle Eastern countries will increasingly test the United States' customary position at the center of the global balance of power. Trends of the last 10 years lend justification to these themes.

Well qualified to write on this subject, Krepinevich is president of the Center for Strategic and Budgetary Assessments and a distinguished visiting professor at George Mason University's School of Public Policy. A West Point graduate who served 21 years as an Army officer, he earned MPA and PhD degrees from Harvard University and lectures at Ivy League schools and military colleges around the world.

Krepinevich has made good use of both his academic credentials and military experience in writing this outstanding, sobering study.

By resisting the temptation to predict the future, the author has produced a unique, readable, and realistic book that avoids the speculative pitfalls of related efforts. Though similar to a Tom Clancy novel, *7 Deadly Scenarios* is more firmly grounded in reality insofar as any of its scenarios could actually take place. For example, in "China's 'Assassin's Mace,'" Krepinevich speaks about China's growing antiaccess/area-denial (A2/AD) capabilities and how that country might use them to challenge the United States. In a speech to senior cadets at the US Air Force Academy, former secretary of defense Robert Gates talked about the United States' plan to address A2/AD. Moreover, a simple Google search of the AirSea Battle concept reveals both the authenticity of this threat and US efforts to negate it.

Even this impressive study has a few shortcomings, such as the lack of discussion of the instability in North Korea. Surely the tension between nuclear-armed neighbors that has lasted 61 years merits some attention. Furthermore, Krepinevich's use of invented news articles, journals, or books of the future adds little to the book, unlike his effective use of historical events to explain why he thinks something will happen a certain way. For example, in "Armageddon: The Assault on Israel," the author's incorporation of the conflict between Israel and Hezbollah in 2006 adds a great deal to the validity of his arguments. Similarly, the discussion about the need for strategy or the resistance to change in the military, based on examples from World War II, is much stronger because of the historical accuracy of the facts presented. These few flaws, however, do not detract from *7 Deadly Scenarios*, whose warnings of things that "might be" have much relevance to all branches of the service.

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**Drugs and Contemporary Warfare** by Paul Rexton Kan. Potomac Books (http://www.potomacbooksinc.com), 22841 Quicksilver Drive, Dulles, Virginia 20166, 2009, 194 pages, $31.96 (hardcover), ISBN 978-1-59797-256-7; 2009, 194 pages, $15.96 (softcover), ISBN 978-1-59797-257-4.

*Drugs and Contemporary Warfare* is a comprehensive visualization of how drugs play a role in warfare, within armed forces, and as a source of funding for terrorists and illicit activities. Author Paul Rexton Kan, an associate professor at the US Army War College, Carlisle, Pennsylvania, has written extensively about the blurred territory of irregular warfare, drugs, and criminality that we need to understand.

My reading of this book coincided with a recent event. In October 2011, federal authorities uncovered an attempt to murder the Saudi ambassador to the United States, alleging that the Iranian government enlisted a Mexican drug cartel to carry out the covert plot, which involved drugs as partial payment for the assassination. The Iranian attempt to "hire" the cartel by providing opiates is an archetype of the kinds of new threats Dr. Kan discusses—threats that include an intricate web of drugs and drug trafficking; a mix of warlords as well as criminal and political actors; covert operations; and the flow of money that paves the way.

Having selected the role of drugs in terrorism and asymmetric warfare as a key theme, the author demonstrates how terrorists use the sale of drugs to transfer financial resources undetected by the authorities (since no money goes through the banking system). Street profits from such sales also fund terrorist activity. In particular, Dr. Kan highlights terrorists' attraction to dealing in different forms of amphetamines, a refined, high-value drug made domestically and having advantages over both marijuana (which requires space to grow and whose bulk makes large-scale trade problematic) and heroin (susceptible to interception by authorities at border crossings).

Additionally, Dr. Kan addresses several ethical dilemmas, such as confrontations with child soldiers so drug-intoxicated that they make easy targets. These underage soldiers commit atrocities and shoot at anyone who opposes them. Do we consider them children or combatants? Rather than gun down children, members of a British unit in Sierra Leone risked their own lives and were captured after finding themselves in the hands of a crowd of intoxicated, undisciplined irregulars. The Special Air Service, composed of British elite forces, extracted them, losing one member of the unit but killing more than 150 of the enemy.

The eye-opening chapter "Sober Lessons for the Future: The Dynamics of Drug-Fueled Conflicts" (pp. 93–116) gives readers an idea of what the United States, its military, and law enforcement agencies are up against. Here, Dr. Kan examines our efforts to build nations out of collapsed autocracies, showing how warlords together with drug-trafficking and criminal organizations can exploit such attempts; he also exposes as a myth the notion that democracy is always the answer for such countries. Dr. Kan points out that a rapid transformation of government can backfire when, for example, the old military elite of the failed regime is allowed to stay in place for the new regime. However, the removal of older institutions in the absence of stable replacements creates a vacuum that drug traders, extremists who use drugs as a source of revenue, and an illicit economy can quickly fill.

In the final chapter, "Shaky Paths Forward: Strategies and Approaches in Drug-Fueled Conflicts," the author lays out several ways of dealing with these challenges, analyzing both their strengths and weaknesses. Though well presented, the chapter may leave some readers with questions about the feasibility of the strategies, especially individuals who have the impression that a country cannot exercise sufficient control over terrorists, drug cartels, and other illicit enterprises to fully implement the suggested approaches.

I highly recommend *Drugs and Contemporary Warfare*, a timely book that offers readers a thorough explanation of how the diminishing sep-

aration of warfare and drugs affects national security. Any member of the armed forces will appreciate its coverage of drugs as a factor at all levels, from policy to violent conflicts.

**Jan Kallberg, PhD**
*Richardson, Texas*

**Flying from the Black Hole: The B-52 Navigator-Bombardiers of Vietnam** by Robert O. Harder. US Naval Institute Press (http://www.usni.org/navalinstitutepress), 291 Wood Road, Annapolis, Maryland 21402, 2009, 336 pages, $34.95 (hardcover), ISBN 978-1-59114-359-8.

A B-52 navigator during 1968–71, author Robert Harder wrote *Flying from the Black Hole* in response to the fact that navigators in general and B-52 navigators/bombardiers in particular have received little recognition for the importance of their craft and their contribution to the Vietnam War. With that in mind, he examines the role of B-52s in ending the war by means of the bombing campaigns of December 1972 directed against Hanoi and Haiphong—the so-called 11-day war. Although Harder did not fly during that time, he does describe those missions in sufficient detail to satisfy even the most curious of readers.

The account begins with the first two days of the Hanoi bombing raids but then shifts to the sequence of events that an individual must endure to become a combat B-52 navigator/bombardier. Specifically, the author describes navigator/bombardier training at Mather AFB, California; initial training in the bomber at Castle AFB, California; and assignment to one of Strategic Air Command's (SAC) operational B-52 bases in the United States.

Harder also pays considerable (perhaps too much) attention to the different types of bombing equipment installed on the B-52, pointing out the difference between the older AN/ASQ-48 bombing and navigation system (on the aircraft's C and D models) and the more sophisticated AN/ASQ-38 system (on the E through H models). This distinc-

tion proved important in the daily lives of SAC flyers in that crews on the C and D models flew "iron bombing" missions from Guam and Thailand bases while crews on the newer models remained in the United States for most of the Vietnam conflict "standing" daily nuclear ground alert.

Additionally, the book offers both an annotated chronological listing of the numerous air campaigns in which B-52s participated from 1965 through October 1972 and a narrative about the aircraft's three major operating bases—namely, U-Tapao, Thailand; Andersen AFB, Guam; and Kadena AB, Japan. From the late 1960s to early 1970s, aircrews experienced the distinctive lifestyles and flight missions associated with each of these bases at some time during their 179-day temporary duty assignment to Southeast Asia as they unleashed the destructive power of the B-52s.

After providing a mission-by-mission account of the bombers' participation in Operation Linebacker II—the bombing of Hanoi and Haiphong in December 1972—Harder concludes with a survey of the B-52 in military conflicts since Vietnam, including Operation Desert Storm. He describes avionics upgrades, the "retirement" of the D and G models, and the reduction of the number of H models. This final section, which contains a whirlwind of information, quickly informs the reader that a limited number of B-52s are still flying—even after 40 years of service.

I enthusiastically recommend this enjoyable book to all individuals interested in aviation history (especially that of the Vietnam War), B-52 operations, the Air Force in general, and SAC in particular. I found *Flying from the Black Hole* true to the facts as I knew them and a great read.

**Col Joe McCue, USAF, Retired**
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**After Khomeini: Iran under His Successors** by Saïd Amir Arjomand. Oxford University Press (http://www.oup.com/us/), 198 Madison Avenue, New York, New York 10016, 2009, 280 pages, $24.95 (hardcover), ISBN 978-0-19-539179-4.

The impact of Ayatollah Khomeini's life on shaping modern-day Iran is well known. Less well known is how his death may have influenced the Iran of today more than his life ever did. Khomeini used radical, unprecedented interpretations of Shi'ism to secure his power over the nascent theocracy of Iran. This tack, along with his charismatic leadership and religious credentials, helped him stabilize the inchoate post-revolution government of the Islamic Republic of Iran. In *After Khomeini: Iran under His Successors*, author Saïd Amir Arjomand makes a cogent argument that the inability of Ayatollah Khomeini to transfer power to an individual with leadership attributes and religious credibility tantamount to his own set the stage for political upheaval in the Iranian government. Arjomand posits that the absence of the stabilizing conditions of Khomeini's reign created a power vacuum, and that political and power battles ensued which have yet to be resolved. As the author's tale unfolds, readers will uncover far more than the requisite details of the inner workings of one of the world's most closed governments. They will find themselves on a journey that begins with promises of secularization and modernization but ends with the rise of Islamic hard-liners and Mahmoud Ahmadinejad.

The most fascinating aspect of the book, especially from a US perspective, is Arjomand's presentation of the variety of reform movements prevalent in the years following Ayatollah Khomeini's death. Most readers will be surprised to learn how two successive presidents—Akbar Hashemi-Rafsanjani and Mohammad Khatami—sought significant social, diplomatic, economic, and government reforms that urged greater openness and better international relations. Although Western nations would have encouraged and welcomed these reform movements, the efforts were vitiated by a combination of foreign distrust and misunderstanding—and by subversive acts coordinated by

conservative clerics and government hard-liners. These reactions not only caused the reform movements to fail but also putatively helped Sayyed 'Ali Khamenei, Khomeini's successor as leader, consolidate his power base as loyalties gravitated to him in return for his efforts to repudiate the two presidents' work. Equally enthralling, in an attempt to rid the government of reform supporters, these acts paved the way for the elections of hard-liners such as Ahmadinejad in 2005.

The organization of the book employs a mix of chronology and emphasis on different subject matters—all germane to the analysis. This structural choice works to great effect to provide the reader a sense of the significance of each chapter's topic and context without burdening the narrative with an overabundance of detail that would satisfy strict adherence to the element of time. The organizational scheme also benefits the subject matter because of Arjomand's astute recognition of the need to take a step back and enumerate the many unique aspects of Khomeini's reign, thus promoting better understanding of the turmoil that followed it. Only with that knowledge can the reader appreciate the implications of government choices, the rise and fall of prominent clerics and politicians, and the clerical obviation of the reform movements—all of which the author underscores in the book's chapters.

The erudite Saïd Amir Arjomand, a professor of sociology at Stony Brook University, takes a pedagogical approach to his subject. Though certainly achieving its didactic ends, this technique at times works to the detriment of the author's gripping prose. This quibble aside, *After Khomeini* is a must-read for anyone involved with Iranian politics or anyone who seeks to better understand a country that many consider an enemy of the United States. Preconceived notions steeped in memories of the Iranian hostage situation and of Khomeini's intransigent anti-Western views may shatter as the pages of this book unfold, yielding ideas of opportunities and hope that may replace ideas of fear and misunderstanding vis-à-vis the Iranian Republic of Iran. The story, however, does not offer any conclusive evidence that suggests the aforementioned possibility; rather, Arjomand perceptively suggests

that "we are very much in the midst of the post-revolutionary transformation of Iran, and any summary would impose an arbitrary closure on a continuous and open development" (p. 207)—all the more reason that we should stay engaged rather than dismiss Iran. Reading *After Khomeini* is a great way to begin.

**Maj Michael A. Thomas, USAF**
*Monterey, California*

**The Accidental Guerrilla: Fighting Small Wars in the Midst of a Big One** by David Kilcullen. Oxford University Press (http://www.oup.com), 198 Madison Avenue, New York, New York 10016, 2009, 384 pages, $27.95 (hardcover), ISBN 9780195368345; 2011, 384 pages, $17.95 (softcover), ISBN 9780199754090.

Despite some limitations, David Kilcullen's *The Accidental Guerrilla* is a valuable addition to counterinsurgency (COIN) literature. He offers an effective and relevant synthesis of theories of conflict in the contemporary security environment to explain how the *takfiris* (al-Qaeda and its Islamic jihadist terrorist allies and sympathizers) rely on what he terms the "accidental guerrilla syndrome" in fighting the United States (p. 28). Also fundamentally sound is Kilcullen's argument that al-Qaeda and its ilk establish a base in a poorly administered or battle-torn area; incur the wrath of the United States and its allies by exporting terrorism and violence; and then provoke a response that angers the locals, thus producing more allies for the takfiri cause. He succinctly and accurately explains how these antagonists conduct a protracted fight, one centered on provoking a disproportionate military response that alienates the local population while al-Qaeda and its allies intimidate and isolate those people from America and its allies, with the goal of "bleeding the United States to exhaustion and bankruptcy" (p. 29). At the same time, his concept of a global takfiri threat as a new phenomenon in asymmetric warfare may be exaggerated. Rather, the author's key intellectual contribution probably lies in assessing well-known and long-standing patterns of low-intensity conflict, arguing that

a nation can find itself engaging multiple asymmetrical threats simultaneously. Given these attributes, one best sees Kilcullen's work as an introduction to basic principles and a general guide to the conduct and implementation of a COIN strategy. For a more elaborate discussion of the operational specifics and tactical aspects of COIN, one should consider *The Accidental Guerrilla* a building block for additional sources.

The case studies offered by Kilcullen on Indonesia, Iraq, and Afghanistan are substantive and meaty, although the attempt to link local resistance movements to a global takfiri threat requires more development and explication. Inclusion of the Indonesian case helps break the limitations of an analysis restricted to the American experience in the Iraq war and Afghanistan. This case study shows Kilcullen at his best, featuring in-depth research as well as extensive practical and theoretical knowledge of and experience with the subject matter. Moreover, he masterfully connects his thesis of the accidental guerrilla to American experiences in both Afghanistan and Iraq. The "quasi" case concerning terrorism in Europe, however, is misplaced and poorly executed, failing to make clear whether the subject matter is terrorism, insurgency, or a mixture of the two. It provides no credible explanation of how an insurgency could emerge in Western Europe, largely due to the absence of a discussion of the socioeconomic context, social history, demographic analysis, cultural conflict, and failure of European state institutions to meet a burgeoning Muslim immigrant population.

The conclusion offers sensible and prudent policy prescriptions, albeit none of them are particularly new. Of course the key is that when dealing with military establishments geared toward high-intensity interstate conflict, one often forgets the lessons of COIN and counterterrorism until the rude surprise of the next engagement. For this reason, his discussion of fostering, employing, and retaining time-tested COIN practices is laudable. Wisely, though, he emphasizes that "counterinsurgency in general is a game we need to avoid wherever possible" (p. 268). Indeed, the most successful COIN operations may very well be those of prevention or those in which states or governing bodies

take the necessary political, economic, and institutional reforms *prior to* the emergence of conflict. The treatment of terrorism as a threat involving specific actors, as opposed to a grand global war against the phenomenon of terrorism, is skillful and sensible. Finally, of specific note and appreciation is his methodological section, which discusses the limits and potential shortcomings of his research, rooted as it is in Clifford Geertz's "thick description" work in cultural anthropology (p. 304). For example, Kilcullen points out that he gleans much of his research from those natives able to speak English, who may have a very different view from those who do not, especially in an insular tribal society like Afghanistan or, for that matter, in some poor suburban Parisian *arrondissements*.

For the Air Force, extrapolations from his observations provide guidance on the potential for future technological development, as well as the promise and overall limits of the service in COIN operations. Central to the contribution of the Air Force in low-intensity operations is the movement toward precision that dates back to the Cold War. The stress on minimization of collateral damage as a best practice in low-intensity conflict places this service arm in an excellent position to neutralize threats without offending the local population or global audience that represents the enemy's recruiting pools. That is, as an instrument for reducing the danger of creating accidental guerrillas, the Air Force offers an absolutely essential contribution to the exercise of counterterror and COIN operations, ranging from national technical means to the employment of precision-guided munitions in targeted "smart strikes." However, because low-intensity conflicts involve counterterrorism and COIN, the Air Force will play a subsidiary role in these conflicts, with only a relatively small portion of the service participating at any given time. Even more, as evidenced by the sharp political backlash in Pakistan and the possible takfiri recruiting tool stemming from counterproductive drone strikes that went awry due to Clausewitzian friction and faulty intelligence, technical precision and proficiency can

only partially mitigate the unintended consequences that produce what Kilcullen so accurately terms the *accidental guerrilla*.

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