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Future War:

WHAT TRENDS IN AMERICA'S POST-COLD WAR MILITARY CONFLICTS TELL US ABOUT EARLY 21ST CENTURY WARFARE

by
Christopher J. Bowie
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ANALYSIS CENTER PAPERS

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EXECUTIVE SUMMARY

The attack on the United States and the war that has been visited upon us highlights a fundamental condition of our circumstances: we cannot and will not know precisely where and when America's interests will be threatened, when America will come under attack, or when Americans might die as the result of aggression. We can be clear about trends, but uncertain about events.

Secretary of Defense Donald H. Rumsfeld
Quadrennial Defense Review Report
September 30, 2001

This paper examines the performance of U.S. armed forces in three major post-Cold War military conflicts (Iraq in 1991, Kosovo in 1999, and Afghanistan in 2001) to identify commonalities and associated trends that may have implications for the conduct of warfare in the early 21st century. Skeptics on the value of "lessons learned" from the three wars typically emphasize the unique characteristics of each war and the unlikely prospects that such conditions will apply in the future. In contrast, we believe that disparities in the size, scope, and overall prosecution of each conflict strengthen the likelihood that trends in common areas across all three wars will characterize future conflicts.

Our methodology is similar to that employed by long-range planners—looking for significant areas of commonality (and leverage) across widely different future scenarios. However, instead of speculating on alternative futures, we searched for commonalities and associated trends in three wars that have already occurred. Our selected scenarios are not hypothetical but rooted in factual evidence. Accordingly, they should be valuable in discerning trends that have emerged in the American way of war over the last decade.

We examined three main areas for trends: the security environment, military capabilities, and key technologies. Dividing our work into these three categories introduces some complications, as some issues overlap and the categories themselves are broadly defined. But the approach taken in this study provides a useful framing edifice from which to analyze trends likely to characterize U.S. involvement in early 21st century warfare. They are:

POLITICAL-MILITARY SHIFTS IN THE SECURITY ENVIRONMENT

- **The migration of conflict toward Asia.** Connect the dots representing the geographic areas of armed conflict in Kosovo, Iraq and Afghanistan, and the locus of those points suggests a shift from the European region that dominated U.S. Cold War military planning toward Asia, a region of vast economic import and diverse security challenges. One astute observer of military affairs recently observed: “For nearly half a century, the American military organized itself to fight a short, extremely intense battle in Europe from large fixed bases dispersed over relatively short distances. Whatever a future war in Asia might look like, that will not be it.”
- **The primacy of *ad hoc* military coalitions.** In the Cold War, the United States relied heavily on formal alliances, such as NATO, for collective security. In the Gulf and Afghanistan conflicts, the coalitions formed to defeat aggression resulted from an *ad hoc* approach to secure international support for U.S.-led military operations. Thus, rather than the long-term “marriages” that typified

Cold War alliance formation, future coalitions will be characterized as a series of temporary liaisons—with some partners proving more faithful than others.

- **A new political currency measuring the contributions of coalition partners.** Again, in contrast to the Cold War, allied contributions have come, for the most part, in the form of political support and access to facilities rather than combat firepower. Trends in coalition capabilities indicate that widening disparities in military capabilities will cause future allies to fall further behind the United States, although specialized intelligence and military niche capabilities (such as special operations forces) will remain valuable.
- **An amplification of the anti-access/area denial problem.** Evidence from the three conflicts underscores the potential for military “showstoppers” arising from political issues, the tyranny of distance, and infrastructure constraints. The need to conduct offensive operations could entangle efforts to obtain political access while the vast reaches of Asia feature a much lower base density and less developed infrastructure compared with Europe and the Middle East. Although military anti-access threats were minimal in these conflicts, improved adversary capabilities could further complicate future U.S. power projection.
- **The ability of adversaries to undermine the threat and use of force.** In each of the three conflicts, adversaries sought to deter attack with threats calculated to heighten perceived U.S. sensitivities to casualties and to exploit instances of collateral damage to evoke international condemnation and weaken coalition resolve. Failing that, they sought to reduce their vulnerability to coalition military actions through a variety of means (air defenses, camouflage, concealment, deception, dispersal, mobility, and hardened and deeply buried facilities). Weapons of mass destruction (WMD) also cast a shadow in all three conflicts. The consistency of these adversarial approaches suggests that the United States will face similar challenges in the future.

MILITARY CAPABILITIES ENABLING NEW WAYS OF WARFARE

- **An “order of magnitude” increase in battlefield situational awareness.** Two prominent consequences of increased situational awareness and their implications for time-critical strike operations in the future warrant particular mention: (1) the rapidly improving speed at which targets can be generated and prosecuted by a combination of battle management, sensor, and strike platforms, compressing what has become known as the “kill chain”; and (2) the blurred distinction between command and control and the execution of military operations, resulting from real time operational snapshots of the battlefield and the intervention of senior leaders (both civilian and military) in issuing targeting guidance. The latter trend is resulting in the creeping centralization of both command and execution, as command echelons in the rear reach forward to the battlefield in near-real time. Owing to the enhanced political content of armed conflict in a world of high-speed information, evidence from these conflicts indicates that centralized execution will now accompany centralized control.
- **A move from deliberate to adaptive planning, and the concomitant execution of dynamic military operations.** A legacy of the Cold War, the deliberate planning process instills an institutional predilection for scripted as opposed to dynamic military operations. However, the nonlinear and fluid operating environments that will characterize future battlefields necessitate renewed emphasis on both adaptive planning and dynamic military operations. The combined experiences of planners and operators in *Desert Storm*, *Allied Force*, and *Enduring Freedom* underscore this point. In the Gulf War, for example, 20% of targets were selected after aircraft launch, whereas over Kosovo, 43% of the targets were selected once the aircraft were airborne. In Afghanistan, 80% of the carrier-based sorties were launched without pre-designated targets.
- **A dramatic decline in U.S. casualties compared with previous conflicts.** Throughout the three conflicts, U.S. combat losses were

statistically insignificant, despite adversary objectives to cause high casualty rates as a means to achieve conflict termination. The reasons for this lie in a combination of new operational capabilities, highly survivable combat platforms, and guidance to limit the vulnerability of U.S. forces.

- **An increasing emphasis on extended range operations.** This is an outgrowth of the access problem and the migration of conflict to distant and remote regions of the world. Throughout the Cold War, U.S. planners developed concepts of operation based on the premise that forward operating bases would be available to launch and sustain combat operations. From the Gulf War to Afghanistan, trends suggest that premise to be increasingly risky and, as such, must be hedged against to guarantee U.S. abilities to project firepower over long distances.
- **The diminishing role of heavy ground forces.** Whereas rapidly deployable, highly maneuverable ground forces that can leverage the effects of modern precision weaponry are integral to dynamic military operations against elusive enemies—as witnessed most recently in Afghanistan—there is a mismatch between the capabilities of slow-moving and late-deploying heavy ground forces and the demands of the future operating environment. Moreover, the ways in which the United States delivers firepower to the battlefield have fundamentally changed. On this point, Secretary Rumsfeld observed in October 2002: “Looking at what was overwhelming force a decade or two decades ago, today you can have overwhelming force, conceivably, with lesser numbers because the lethality is equal to or greater than before.”

TECHNOLOGIES ENHANCING U.S. MILITARY ADVANTAGES

- **The increasing dominance of precision weapons.** Precision-guided munitions (PGMs) emerged as the centerpiece of a revolutionary style of modern warfare. The clear trend since the Gulf War is that precision-guided weapons represent a steadily increasing percentage of munitions delivered: about 8% in Iraq, 30% in Kosovo,

and 60% in Afghanistan. Other trends are the increasing number of PGMs delivered per sortie and the increasing percentage of PGMs that can be delivered in adverse weather (from 13% in the Gulf War to almost 90% in Afghanistan). Notably, all three conflicts witnessed strained inventories of precision weapons, particularly long-range standoff weapons. Finally, the trends suggest the promise of new capabilities stemming from increased payload fractionation (larger loads of smaller guided weapons) and mass precision (rapid delivery of large numbers of PGMs in short time periods).

- **The increasing quantity and quality of sensors and their integration into systems and networks.** The shift toward “network-centric warfare” is pushed by the promise of information dominance and battlefield situational awareness. Underpinning this promise are technologies to create network-centric architectures consisting of high-quality sensors and rapidly transmitted data streams that will be fused and integrated at command and control centers. Conflicts since the Gulf War witnessed modest forms of integration of command and control, intelligence, surveillance, and reconnaissance (C2ISR) assets. In the future, trends in sensor technology toward less expensive, more capable, and lighter sensors will support intelligence-quality sensors networked around the battlefield. Assuming that data streams from multiple sources can be integrated in a timely fashion—a tall order—future commanders will enjoy even greater situational awareness to employ their forces more effectively.
- **The increasing importance of stealth aircraft and electronic countermeasures.** From the Gulf to Kosovo and, to a lesser degree, in Afghanistan, low observable aircraft were employed with remarkable success and revolutionary impact. Low observable technologies applied to combat aircraft have allowed them to operate with relative impunity against sophisticated air defense systems. The ability of stealth aircraft to operate independently has reduced, to some extent, the requirement for large strike packages laden with supporting

escort aircraft. Electronic warfare assets were critical in enabling non-stealthy aircraft—the mainstay of the current force structure—to survive in non-permissive threat environments. Continued emphasis on air power-centric campaign plans will ultimately demand renewed investment in stealth and electronic countermeasures.

- **The increasing use and utility of unmanned aerial vehicles (UAVs).** Since the 1950s, the U.S. has invested over \$25 billion (in FY98 dollars) developing and fielding UAVs, primarily for intelligence, surveillance, and reconnaissance missions. This sizeable investment has resulted in unmanned systems that demonstrated their operational utility over the battlefield, enabled by advances in satellite guidance and communications, computerized flight control systems, and sensor technologies. Indeed, in each of the three conflicts examined, unmanned systems assumed new roles, due in large part to improvements in range, endurance, on-board sensors, and data transmission. Used initially as decoys during the Gulf War, by 2001 UAVs had evolved into sophisticated, air-breathing, hunter-killer platforms.

In summary, the U.S. has fielded impressive capabilities to meet the military challenges of the immediate post-Cold War era, up to and including the war on terrorism. However, the road ahead appears ever more challenging, both in terms of the diversity of our future adversaries and the military capabilities they will acquire. Our trend analysis suggests strongly that, to better prepare for uncertain events in a hostile security environment, the U.S. will need to invest in concepts, capabilities, and technologies to sustain its competitive advantages on the future battlefield. These trends were demonstrated to varying degrees in the Gulf War, over the former Yugoslavia, and most recently in Afghanistan. What will ultimately be required, we believe, is an agile, access-insensitive military force that can project sustained, precise, and survivable military power across great distances, with little preparation or reliance on external political or military support.

I. INTRODUCTION

Since the end of the Cold War, the United States has engaged in three substantial armed conflicts. In 1991, the U.S. led a coalition of powers to force the Iraqi army to retreat from occupied Kuwait and to restore that country's independence. In 1999, the U.S. and NATO conducted an air campaign to halt the ethnic cleansing of Kosovar Albanians by the Serbian government, eventually toppling Slobodan Milosevic's regime. In 2001, responding to the terrorist attacks on the World Trade Center and the Pentagon, the U.S. and its coalition partners defeated Afghanistan's terrorist-sponsoring Taliban regime and destroyed the al Qaeda infrastructure in that country.

These military interventions have not brought about a lasting peace. Indeed, the U.S. remains militarily committed in Iraq, the former Yugoslavia, and Afghanistan, and will remain engaged for many years to come. The war on terrorism, moreover, is expected to require a sustained effort, consisting of sporadic but intense combat operations against transnational terrorist organizations. Consequently, it is ever more likely that the U.S. will employ military force in additional contingencies over the next decade or two. While no one can accurately predict where U.S. forces will be deployed in the future, there is considerable interest in what future warfare might entail and, more importantly, how state and non-state actors will fight one another on the battlefields of the early 21st century. Traditionally, this has been left for futurists to ponder in provocative far-reaching studies.¹ Other scholars have emphasized the import of factual evidence, rooted in military history, in their descriptions of future warfare.²

Of these two approaches, we believe a retrospective look at recent military conflicts can be

valuable in describing and explaining trends likely to be evident on future battlefields. With this in mind, we examined the performance of U.S. armed forces during three major post-Cold War military conflicts (Iraq in 1991, Kosovo in 1999, and Afghanistan in 2001) with an aim toward identifying commonalities and associated trends that may have implications for the conduct of warfare in the early 21st century. In particular, we set out to answer the following questions:

- What political-military trends have significantly impacted the use of U.S. military force?
- What trends in U.S. force employment have emerged over the last decade?
- What trends in technology have contributed to U.S. dominance on the post-Cold War battlefield?

We recognize that looking backward is not universally seen as a useful technique to develop observations on the conduct of future warfare. There is, after all, the overused adage that the military continually prepares to fight the last war. A corollary to that aphorism might be phrased, "Little can be learned from past conflicts owing to their unique nature." We would be the first to agree that the three conflicts examined here are quite unique, but our research leads us to take issue with the premise that comparative historical experience is of marginal utility in thinking about future warfare.

In particular, we disagree with the two fundamental arguments often cited to support the claim that little can be learned from *Desert Storm*, *Allied Force*, and *Enduring Freedom*: (1) that the conflicts were *sui generis* owing to a range of variables such as climate, terrain, adversary capabilities, warning and build-up time; or (2) that each

¹ See Ralph Peters, *The War in 2020* (New York: Pocket Books, 1991); and Alvin and Heidi Toffler, *War and Anti-War* (New York: Warner Books, 1993).

² See, for example, Robert D. Kaplan, *The Coming Anarchy* (New York: Vintage Books, 1999); and Martin Van Creveld, *The Transformation of War* (New York: Free Press, 1991).

conflict did not exercise or test the range of military concepts and capabilities existing in the current force that might be critical in other conflicts. In the case of *Desert Storm*, for example, Jeffrey Record concluded that the conflict possessed an exceptional character, describing it as “a set of circumstances so fortuitous that it is highly unlikely it will ever be duplicated again.”³ A similar theme was echoed in a General Accounting Office (GAO) report on the Gulf War air campaign. It concluded that “*Desert Storm’s* lessons are limited in some regard because the environmental and military operating conditions for aircraft and weapons system performance are unlikely to be repeated outside Southwest Asia...”⁴ And a Department of the Navy report included this observation: “Lessons should be interpreted in light of the *Desert Shield/Desert Storm* scenario and in some cases may be less applicable generally. For example, we did not test our open ocean concepts.”⁵

Skeptics also judged that the other two conflicts offered minimal guidance for the future. Operation *Allied Force*, as the NATO war in the Balkans was titled, clearly demonstrated unique characteristics. It represented NATO’s first extended use of military force, and was the first major armed conflict conducted by a coalition for humanitarian purposes against a state persecuting its own citizens within its borders.⁶ The use of air power alone to prosecute the war, combined with the declaration that ground forces would not be introduced, added to the singular nature of the war over Kosovo. Pundits criticized this apparent imbalance before, during, and after the air campaign. In a June 2002 interview, for example, Deputy Secretary of Defense Paul Wolfowitz asserted that “you don’t win wars just

from the air. I would have to say I was astonished that we accomplished as much as we did in Kosovo without ground forces, and I think that was a fluke.”⁷

More recently, the overwhelming success of *Enduring Freedom* is frequently tempered with admonitions that the conflict presented unique challenges to U.S. forces that will not be replicated in the future. The conflict featured extended range air operations, special operations forces, proxy ground forces, and air mobile light infantry to overthrow the Taliban regime and dismantle the al Qaeda organization in Afghanistan. The lack of friendly forward air bases in the region from which to launch Air Force tactical fighters also resulted in the majority of the sorties taking off from aircraft carriers, and the bulk of the weapons being dropped by long-range bombers.⁸ Unsurprisingly, Air Force leadership concluded that the campaign in Afghanistan, in which ground-based fighters played a minor role, could not serve as a paradigm for future conflicts. “First of all,” stated Air Force Secretary Jim Roche, “[Chief of Staff General] Johnny Jumper and I both agree, and we’ve reaffirmed: this is not like any other, and the next one isn’t going to be like it.”⁹

No doubt about it, these were three very different wars. They were fought for different objectives with dissimilar forces against disparate enemies that varied markedly in size, power, organization, training, equipment, and morale, in strikingly different terrain, and in significantly varied climates. Nonetheless, when we look at these conflicts and variables across the board, their very diversity supports our argument that commonalities and associated trends do have explanatory value in studies of future warfare.

³ U.S. Department of the Navy, *U.S. Navy in Desert Shield/Desert Storm*, (1997). Available online at: <http://www.history.navy.mil/wars/dstorm/index.html>.

⁴ U.S. General Accounting Office, *Operation Desert Storm: Evaluation of the Air Campaign* (Washington, D.C.: Government Printing Office, 1997), p. 34.

⁵ *U.S. Navy in Desert Shield/Desert Storm*.

⁶ Benjamin Lambeth, *NATO’s Air War for Kosovo: A Strategic and Operational Assessment* (Santa Monica: RAND Corporation, 2001), p. 219.

⁷ Peter Boyer, “A Different War,” *The New Yorker*, 1 July 2002. The text of the interview transcript is available at: http://www.defenselink.mil/news/Jul2002/t07022002_t0618ny.html.

⁸ In *Enduring Freedom*, carrier-based fighters delivered 24% of the weapons, bombers delivered 70%, and land-based fighters about 6%. See William Arkin, “Weapons Total from Afghanistan Includes Large Amount of Cannon Fire,” *Defense Daily*, 5 March 2002.

⁹ “Air Force Secretary Teaches Lessons of Afghanistan,” *Defense Week*, 8 July 2002, p. 1. On the other hand, some interpretations have suggested that the Afghan war is neither a model for future warfare nor an anomaly, but “an orthodox air-ground theater campaign in which heavy fire support decided a contest between two land armies.” The lessons to be learned, according to one scholar, are that the wars of tomorrow “will continue to require skilled, motivated forces on the ground, in strength.” See Stephen Biddle, *Afghanistan and the Future of Warfare: Implications for Army and Defense Policy* (Carlisle: U.S. Army War College, 2002), p. xi.

OBJECTIVE AND METHODOLOGY

This paper examines the performance of U.S. armed forces in the three major post-Cold War military conflicts to identify common areas and associated trends that have implications for future warfare. To accomplish this objective in a reasonable amount of time and space, we established some artificial boundaries and limited the scope of our work. Of these, the most important to emphasize is our focus on relatively high-intensity combat operations, as we considered U.S.-led military campaigns in Iraq, over Kosovo, and in Afghanistan. Although at times we refer to U.S. military experiences in the 1990s that span the conflict spectrum, our mandate is to examine trends in military contingencies approximating the “major theater wars” that served as illustrative force planning scenarios over the last decade.¹⁰ In discussing the issue of invading Iraq, Deputy Secretary Wolfowitz observed in December 2002: “You’ve got to be prepared for the worst case... It would be a terrible mistake for anyone to predict with confidence what the course of a war is going to be.”¹¹

As Wolfowitz pointed out—and history has illustrated so painfully—predicting the future is not a high-confidence enterprise. Since the end of the Cold War, the Northrop Grumman Analysis Center has conducted various studies of future warfare to advise our company and our customers of what the future might hold in state-of-the-art warfare.¹² But predicting any future is approached with low confidence. Such speculative endeavors involve significant degrees of uncertainty, so much so that long range visions of

future warfare prove increasingly less actionable as errors are magnified over time. Therefore, we chose to restrict our future vision here to a relatively modest timeframe—we suspect the trends demonstrated over the last 10 years are probably good for another 10—relying on methods of description and explanation rather than prediction.

With this in mind, we employed a scenario-based methodology to facilitate our short-term snapshot of the future battlefield. From the standpoint of business planning, the decision-scenario approach articulated by Peter Schwartz in his 1991 book, *The Art of the Long View*, has proven a useful technique.¹³ This method employs building alternative future scenarios to help senior managers learn about outcomes they might otherwise fail to consider, while providing an appreciation for the future value of present decisions.¹⁴ The U.S. Air Force *Innovation Task Force* used an alternative futures approach in the mid-1980s, constructed four plausible visions of global conflict, and selected capabilities that appeared valuable for future investment in each of the contrasting scenarios.¹⁵ In the 1990s, the force-sizing approach adopted in the Pentagon also relied on the generation of two nearly-simultaneous major regional wars to codify threat assumptions against which the adequacy of the planned force could be validated.¹⁶

The methodology utilized here is similar to that adopted by long-range planners. However, rather than generating plausible alternative scenarios, we are looking to past conflicts in our search for

¹⁰ Some readers may question why we did not include operation *Just Cause* that overthrew the Noriega dictatorship in Panama in 1989. In fact, *Just Cause* provided many useful antecedents for subsequent operations, particularly in the way it applied synchronized, integrated, multi-dimensional, and overwhelming force against a multiplicity of enemy capabilities to collapse the Panamanian Defense Force’s will and ability to resist as rapidly and completely as possible. However, when we selected our conflicts for analysis, we noted that the brief duration and limited scope of the operation provided a less definitive view of trends in warfare than the larger and longer conflicts we finally selected.

¹¹ Thomas E. Ricks, “Projection on Fall of Hussein Disputed,” *The Washington Post*, 18 December 2002, p. A17.

¹² In 1993-1994, the Analysis Center conducted four “Future of War” sessions to advise and guide management decision-making on future investments and acquisitions. The resulting alternative futures supported a strategic decision to remain in the defense business, and to seek acquisitions moving the company away from being platform dominated to a more information-centric portfolio of competencies. In 1995 we helped develop “strategic market thrusts” for the newly formed Northrop Grumman Corporation, including surveillance and precision strike, information warfare, and advanced battle management. An Analysis Center study on “State-of-the-Art Warfare in the Early 21st Century,” completed in 1996, concluded that the revolution in military affairs would move at a much slower pace than anticipated and emphasized the importance of system integration to hasten that transformation. These efforts were led by Jim Roche, Chip Pickett, and Barry Watts.

¹³ Peter Schwartz, *The Art of the Long View: Planning for the Future in an Uncertain World* (New York: Vintage Anchor Publishing, 1996).

¹⁴ The decision-scenario technique was originally developed by Pierre Wack. Edward Neland was credited for pioneering it as well while preparing Shell Oil’s management for the 1973 oil crisis. Its intent was to accept uncertainty, understand it, and incorporate “major shifts in the business environment that make whole strategies obsolete” into the company’s thinking. See Pierre Wack, “Scenarios: Uncharted waters ahead,” *Harvard Business Review*, (September-October 1985), pp. 139-150.

¹⁵ U.S. Department of the Air Force, *Innovation Task Force Report* (1986).

¹⁶ See Christopher J. Bowie et al., *The New Calculus: Airpower’s Changing Role in Joint Theater Campaigns* (Santa Monica: RAND Corporation, 1993) for an overview of such an analytic approach.

insights into what combat operations will look like in the early 21st century. Our selected contingencies are not hypothetical but rooted in factual evidence. Accordingly, they should prove valuable not only in discerning trends that have emerged in the American way of war over the last decade, but also in underscoring strategic realities, military capabilities, and enabling technologies that have relevance for the near future.

Finally, our analysis was informed using a mix of primary and secondary sources. To the extent possible, we reviewed available official unclassified literature and supplemented it with memoirs, analyses, and media reports to identify common areas and define a list of candidate trends. To winnow the list further, we rehearsed our hypotheses during a series of interviews and briefings with subject matter experts in the Army, Air Force, Navy, Marine Corps, Office of the Secretary of Defense, defense industry, and policy research organizations. Using their feedback, we selected the most salient trends and proceeded with supporting research and analysis. While there is a fair degree of subjectivity to this process, we believe that what follows provides a useful framing edifice to analyze the evolving American way of warfare in the early years of this century.

ASSUMPTIONS

From the outset, we need to make our assumptions transparent. The most obvious is that U.S. military forces are likely to be engaged in armed conflict over the next decade or more. The fact that we are examining three major conflicts occurring over the last decade is evidence enough that the near-term security environment will not likely be a peaceful one. Our previous studies have convinced us that armed conflicts will occur with uncertain frequency, and predictions as to where, when, and against whom U.S. forces will

be engaged are speculative at best.¹⁷ Currently, U.S. military forces are prosecuting a global war on terrorism, and President Bush has made it clear that the war will be a lengthy one. Finally, at this writing, there are increasing signs that the U.S. will initiate military operations to remove the current regime in Iraq, possibly in early 2003.¹⁸

Second, we assume that revolutionary technologies will not outdate the trends evident in the conflicts examined here, at least not within the next 10 years. Prior Analysis Center work that examined the complex connections between technological advance and fundamental change in combat dynamics also confirmed the difficulties involved in forecasting whether specific technological advances would revolutionize combat interactions. For example, Barry Watts documented that even in relatively mature combat areas, such as air-to-air engagements, hardware and software advances that appeared revolutionary when initially fielded often had surprisingly little effect on combat outcomes.¹⁹ On the other hand, precision-guided munitions have had a dramatic impact on combat operations. However, their revolutionary potential was largely ignored after the first widespread use of such weapons in Vietnam. The full implications of PGMs were not realized until two decades later during the Gulf War.

Moreover, scholars examining the “revolution in military affairs” with an historical frame of reference argue that technical breakthroughs are not sufficient in themselves to bring about an entirely different way of warfighting. This view of military transformation is based largely on events during the interwar period, when it was observed that “revolutions” took hold only when new concepts of operation were developed and new organizations formed to exploit technological breakthroughs.²⁰ Ultimately, these organizational

¹⁷ Michael Howard, *The Invention of Peace: Reflections on War and International Order* (New Haven: Yale University Press, 2001), p. 1. According to Howard: “War, armed conflict between organized political groups, has been the universal norm in human history.”

¹⁸ See Ricks, “Projection on Fall of Hussein”; Greg Jaffe, “Number of U.S. Troops in Gulf is Expected to Nearly Double,” *The Wall Street Journal*, 18 December 2002, p. A4; and Michael R. Gordon, “U.S. Asks NATO Nations to Offer Forces for an Iraq Campaign,” *The New York Times*, 5 December 2002, p. A21.

¹⁹ Barry Watts, *Clausewitzian Friction and Future War*, McNair Paper 52 (Washington D.C.: National Defense University, 1996). Available online at: <http://www.clausewitz.com/CWZHOME/Readings.htm>. The basic argument is that the human dimension of combat can overshadow or restrict purely technical advances in weapons capabilities.

²⁰ See, for example, Williamson Murray and Alan Millet, eds., *Innovation in the Interwar Period* (New York: Cambridge University Press, 1999).

and doctrinal changes combine to form a new way of warfare which takes time to evolve and mature—perhaps 20 or 30 years.²¹ Our near-term look into the future of war does not, therefore, envision a technology-driven revolution.²²

Third, we assume that the trends revealed here have applicability across the conflict spectrum. An overarching feature of all three wars is that they were waged against relatively small state and non-state actors. Although U.S. ground troops deployed to the Gulf and fighter squadrons employed against Serbia approximated forces sized to fight a major theater war, the adversary's capabilities, particularly in Afghanistan, were clearly less than that of a first-rate military power. Therefore, doubts could be reasonably expressed regarding the value of a study that discerns trends from conflicts with second- or third-rate militaries. At first glance, these capabilities may imply that further preparations are needed for conflicts at the lower end of the conflict spectrum, but how useful will they be in confronting an emerging regional near-peer competitor? For that matter, how do we account for the war on terrorism and the capabilities needed to prosecute it successfully?

Our answers to these legitimate queries point to the scalability of the trends described. We focus on strategic shifts, military capabilities, and enabling technologies that appear useful across the conflict spectrum and against a range of adversaries. For example, the exponential improvement in situational awareness witnessed in command and control centers, from the “Black Hole” in the Gulf War to the Combined

Air Operations Center (CAOC) directing the war in Afghanistan, should be applicable in the battlefield management of U.S. military forces against any foe. Indeed, the diversity of the three conflicts examined here, as well as those we anticipate in the future, argues for capabilities suitable to both high-intensity conflicts *and* smaller-scale contingencies.²³

Fourth, we assume a favorable imbalance between U.S. military capabilities and the lesser capabilities of future adversaries, and that the imbalance will encourage adversaries to seek asymmetric approaches (as force multipliers) to offset it. In the aftermath of the Gulf War, U.S. rivals were cautioned not to fight the U.S. on its terms, but to find, attack, and exploit an “Achilles’ heel.”²⁴ Therefore, the United States must prepare itself for an enemy unlikely to confront its strengths head-on, but one inclined to pursue indirect approaches against perceived weaknesses. As examined in Section II, all three adversaries acted to undermine both the credibility of the threat of conventional military force and its utility. Despite the popularity of “asymmetry” as a Washington buzzword, we agree with Colin Gray’s observation that all of America’s wars have been “asymmetrical”: “[T]here are no identical belligerents, with identical forces, who behave identically.”²⁵ Given the asymmetry inherent in future warfare, our task is to search for trends in recent military conflicts describing those adversarial actions, and point to areas in which the United States can increase its competitive advantage.

Finally, we assume a degree of subjectivity in adjudicating what constituted a noteworthy trend

²¹A.W. Marshall, Director of Net Assessment, Office of the Secretary of Defense, “Revolutions in Military Affairs,” statement prepared for the Subcommittee on Acquisition and Technology, Armed Services Committee, U.S. Senate, 5 May 1995. See also James R. Fitzsimonds and Jan M. Van Tol, “Revolutions in Military Affairs,” *Joint Force Quarterly*, (Spring 1994), pp. 24-31.

²²Nevertheless, we should acknowledge at this point that the pace of global technological development will likely accelerate over the next 10-15 years, the U.S. is well positioned to maintain its leadership in the military application of that technology, and some of these advances may have implications for the investment in technologies and capabilities advocated here. Among the most commonly mentioned are wireless communications, image understanding, micro-electro-mechanical systems, nanotechnology, and directed energy weapons. These technologies may well result in smaller and smarter weapons, reduce kill chain timing, and increase battlefield situational awareness, reinforcing some of the trends presented in this analysis. For a discussion of these technologies, see U.S. Central Intelligence Agency, *Global Technology Scenarios Through 2015*, (2001); and James J. Richardson and Stephanie L. Tennyson, *Out of the Box and Into the Future: A National Security Forecast* (Arlington: Potomac Institute, 2001).

²³A comparison with Israel’s defense planning for its unique security dilemma may be useful in this regard. Faced with omnipresent internal terrorists and more conventional external threats, Israel is tailoring its defense investments to develop means useful in a large conflict as well as in an insurgency. Included among its priorities are multi-role weapons, missile defenses, intelligence gathering, precision weaponry, and unmanned aircraft. See David Fulghum and Robert Wall, “Israel Pursues High Tech Despite War Costs,” *Aviation Week and Space Technology*, (24 June 2002), p. 78.

²⁴Those weaknesses can range across the spectrum of conflict, from terrorism to weapons of mass destruction. See Robert W. Chandler and John Backschie, *The New Face of War* (McLean: Amcoda Press, 1998).

²⁵Colin S. Gray, “Thinking Asymmetrically in Times of Terror,” *Parameters*, (Spring 2002), p. 14. For a study that takes the concept more seriously, see Kenneth F. McKenzie, Jr., *The Revenge of the Melians: Asymmetric Threats and the Next QDR*, McNair Paper 62 (Washington, D.C., National Defense University, 2000); and Ivan Arreguin-Toft, “How the Weak Win Wars,” *International Security*, (Summer 2001), pp. 93-128.

and what did not. In the process, we uncovered some trends that, while they were not significant factors in the conflicts we examined, should not be discounted. For example, planners would be wise not to undervalue the importance of air-to-air capabilities in future warfare based on the few air-to-air engagements that transpired during operations *Desert Storm*, *Allied Force*, and *Enduring Freedom*. One might make similar conclusions about the import of theater ballistic missile defense that was important militarily and politically in the Gulf War but absent in Kosovo and Afghanistan. We were also unable to document the increasing dependence of air, ground, and sea-based military operations on space-based assets—although tracking the use of global positioning systems from ground forces in the Gulf War to direct attack munitions in Afghanistan may serve as a useful surrogate. Nor does the absence of urban warfare in post-Cold War military conflicts absolve planners from considering urban combat in future operating environments.²⁶ Presumably there are other “dogs that did not bark” during these wars that did not make it into our trend analysis. These issues deserve further study.²⁷

ORGANIZATION

This monograph explores key trends in three broad areas: the security environment, military force employment, and technologies that enable new forms of warfare. Dividing our work into these categories introduces some complications, as some issues overlap and the categories themselves are broadly defined, but organizing

the study in this fashion provides a useful framework for analyzing key trends in modern warfare.²⁸

The first section focuses on political-military shifts in the post-Cold War security environment that will impact the planning and conduct of U.S. military operations in the future. Highlighted trends include: the migration of conflict toward Asia; the primacy of *ad hoc* military coalitions; a new political currency to measure the contributions of allies to military coalitions; an amplification of the anti-access/area denial problem; and the promise of adversarial actions to undermine the threat and use of force.

The second section then identifies important trends in military force employment. Identified as salient trends here are: the great increase in situational battlefield awareness; the move from deliberate to adaptive planning, and the concomitant execution of dynamic military operations; the dramatic decline in U.S. casualties compared with previous conflicts; an increasing emphasis on extended range operations; and the diminishing role of heavy ground forces.

Finally, the third section will highlight key technology trends that will enable new forms of warfare, with particular emphasis on the increasing utility of precision weapons; the increasing quantity and quality of sensors and integrated sensor networks; the increasing importance of stealth aircraft and electronic countermeasures; and the growing use and utility of unmanned aerial vehicles.

²⁶Some argue that urban warfare might characterize a future conventional conflict with Iraq. See “Iraq Plans to Tangle American Invasion Forces in Urban Street Fighting, Experts Say,” *The New York Times*, 26 August 2002, p. A1.

²⁷ Other notable “trends” not covered here include information operations, civil-military, inter-agency, and joint service cooperation, and post-conflict operations.

²⁸Trend analysis is a well-established methodology used in various disciplines. In considering trends in future warfare, the Office of Net Assessment in the U.S. Department of Defense suggested that trends should be persistent and non-reversible, extend over long periods of time, reflect a broad spectrum of conflict, and should not be limited to technology.

II. POLITICAL-MILITARY SHIFTS IN THE SECURITY ENVIRONMENT

The end of the Cold War in 1989 did not meet with universal agreement on what it meant for the international security environment or what it implied for U.S. foreign and defense policy.²⁹ Looking back, however, the strategic shifts in the security environment affecting past U.S. military engagements and influencing future wars are more transparent. This section highlights four political-military trends that our analysis suggests will significantly impact the planning and execution of U.S. military operations in the future:

- The migration of conflict toward Asia;
- The primacy of *ad hoc* military coalitions and the consequent role of coalition partners in military operations;
- An amplification of the anti-access/area denial problem; and
- The ability of adversaries to undermine the threat and use of force.

THE MIGRATION OF MILITARY CONFLICT TOWARD ASIA

Connect the dots representing the geographic areas of armed conflict in the former Yugoslavia, Iraq, and Afghanistan and the locus of those points denotes a shift away from the European region that dominated military planning before the Cold War. To be sure, the United States had global interests during its competition with the Soviet Union, fought two proxy wars on the Asian periphery against Soviet-supported North Korea and Vietnam, and gradually expanded its

strategic vision to encompass the oil-rich Persian Gulf. But with the threat removed from central Europe, the U.S. focus has now moved unequivocally to the East, as articulated most recently in the 2001 Quadrennial Defense Review Report (QDR):

In particular, Asia is gradually emerging as a region susceptible to large-scale military competition. Along a broad arc of instability that stretches from the Middle East to Northeast Asia, the region contains a volatile mix of rising and declining regional powers. The governments of some of these states are vulnerable to overthrow by radical or extremist internal political forces or movements. Many of these states field large militaries and possess the potential to develop or acquire weapons of mass destruction. Maintaining a stable balance in Asia will be a complex task. The possibility exists that a military competitor with a formidable resource base will emerge in the region. The East Asian littoral—from the Bay of Bengal to the Sea of Japan—represents a particularly challenging area.³⁰

In essence, the QDR simply recognized a consensus echoed in various geographic, political, and economic analyses of the post-Cold War international environment: the course of the twentieth century was determined primarily in Europe, whereas the 21st century will be the “Pacific Century.”³¹ Validating such a thesis is beyond the scope of this paper, but common comparisons emphasize the growing economic and military importance of the Asian region. Overall, U.S. trade with Asia is twice that of Europe and, despite trade deficits, foreign trade with Asia continues to be increasingly robust. China is

²⁹ See, for example, Francis Fukuyama, “The End of History?” *The National Interest*, (Summer 1989), p. 3; and Fukuyama, “A Reply to My Critics,” *The National Interest*, (Winter 1989/90), p. 21.

³⁰ U.S. Department of Defense, *Quadrennial Defense Review Report*, [QDR], (2001). Available online at: <http://www.defenselink.mil/pubs/qdr2001.pdf>.

³¹ Kishore Mahbubani, “An Asia-Pacific Consensus,” *Foreign Affairs*, (September/October 1997), pp. 149-158.

now the fourth largest economy in the world and continues to expand. With expanding trade, investment, telecommunications, and travel, the interdependence between the U.S. and Asia will continue to increase. In the meantime, potential military flash points such as the Koreas, the Spratly islands, Taiwan, the Philippines, and Indonesia all point to the need for flexible U.S. military options in the event that forceful intervention is required in defense of those interests and objectives.

But flexible military options demand a robust basing infrastructure that may not be attainable in Asia and which, for geographical reasons alone, will look much different from the integrated infrastructure of Europe. “For nearly half a century,” Eliot Cohen noted, “the American military organized itself to fight a short, extremely intense battle in Europe from large fixed bases dispersed over relatively short distances. Whatever a future war in Asia might look like, that will not be it.”³² Similarly, the QDR acknowledges the necessity of pursuing basing and infrastructure agreements with partners in the region:

The density of U.S. basing and en route infrastructure is lower than in other critical regions. The United States also has less assurance of access to facilities in the region. This places a premium on securing additional access and infrastructure agreements and on developing systems capable of sustained operations at great distances with minimal theater-based support.³³

The QDR is silent on when, where, and to what extent U.S. forces will be forward based in Asia, but future alignments will be part of an emerging global posture with the goal to “render forward forces capable of swiftly defeating an adversary’s military and political objectives with only modest reinforcement.”³⁴ Should U.S. intervention become necessary in this regard, the enabling force will draw from capabilities both in and out of the theater. According to the QDR, these

capabilities will include a “new combination of immediately employable forward stationed and deployed forces; globally available reconnaissance, strike, and command and control assets; information operations capabilities; and rapidly deployable, highly lethal and sustainable forces.”³⁵ Also key to this new global posture, the QDR explains, are capabilities and forces located in the continental United States and in space, including long-range strike aircraft and special operations forces to leverage forward forces, strengthen conventional deterrence, and support pre-emptive strikes.

THE PRIMACY OF *AD HOC* MILITARY COALITIONS

The role played by America’s political and military allies has shifted quite dramatically since the end of the Cold War. Allies in Europe were united by membership in the NATO alliance. Pledged to a common cause, they trained and equipped to interoperable standards, and viewed their homeland and the battlefield to be one and the same. Although initial post-Cold War formulations of military strategy and force planning failed to account for allied contributions and warfighting capabilities—the *Bottom Up Review* in 1993, for example, does not mention them—increased attention was paid to what the allies could bring to the fight during the last three armed conflicts.³⁶

However, allied military contributions have declined significantly from those planned for Cold War battlefields. Indeed, their contributions today are, for the most part, better measured in terms of political support and access to facilities rather than firepower. Whereas during the Cold War, the U.S. and its European NATO partners were united in common cause against the Soviet Union, the often mercurial relationship between America and its military allies now seems better characterized as a series of temporary

³² Eliot Cohen, “Defending America in the Twenty-First Century,” *Foreign Affairs*, (November/December 2000), p. 45.

³³ QDR, p. 4.

³⁴ *Ibid.*, p. 25.

³⁵ *Ibid.*

³⁶ The 1993 *Report on the Bottom-Up Review [BUR]* was the second major force structure review in the 1990s that aimed to define a defense strategy, forces, and resources appropriate for the post-Cold War era. For more on the *BUR* and defense planning in general during this period, see 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: RAND Corporation, 2001).

partnerships—with some of its partners proving more reliable than others.

When President George H. Bush articulated his views on the use of military force in support of U.S. foreign policy in 1993, he posited that, in the post-Cold War world, multilateral support was desirable but not essential.³⁷ This was a dramatic departure from the past. Although the U.S. had occasionally acted unilaterally during the Cold War—for example, the 1986 air attack on Libya—by and large the U.S. conducted itself as a staunch advocate of collective security and multilateralism.³⁸ Since the end of the Cold War, however, two noticeable patterns have emerged in managing coalition warfare: (1) the *ad hoc* approach to coalition-building for contingency operations; and (2) the U.S. need for diplomatic or economic, rather than military support from its allies. Both patterns are clearly reflected in allied contributions to coalition military operations in Iraq, Kosovo, and, most recently, Afghanistan.

Before the Iraqi invasion of Kuwait in August 1990, only the United Arab Emirates (UAE) asked the U.S. to demonstrate its military commitment to the region. The other Persian Gulf states feared that such a move might provoke the conflict.³⁹ After the invasion, when the U.S. announced it would act militarily to reverse Iraqi aggression, assembling a broad *ad hoc* coalition to legitimize the intervention became essential. In a series of demarches, the U.S. engaged key countries in the Middle East including Egypt, Syria, Saudi Arabia, and Turkey. Equally important was obtaining access to Saudi Arabia to prepare for and launch the attack to expel Iraqi forces from Kuwait.⁴⁰ Although troops from other countries, particularly France and the United Kingdom,

participated in the ensuing air and ground operations, the bulk of the heavy lifting was conducted by U.S. military forces.

In Kosovo, the United States did not face the task of putting together an *ad hoc* coalition but, rather, keeping it together. Engaged in the Balkans since the end of the Cold War, NATO had become increasingly frustrated in dealing with Slobodan Milosevic and the genocidal violence in Bosnia and Croatia. When diplomatic negotiations failed to bring peace to Kosovo, NATO members resolved in March 1999 to use force to compel the Milosevic regime to cease the repression in Kosovo.⁴¹ That is not to say, however, that the alliance remained steadfast in its resolve throughout the conflict. Certainly the German, Italian, and Greek governments had serious reservations about the military option, and might have vetoed the entire operation had they envisioned a 78-day air bombardment and the prospect of a ground invasion. Throughout the campaign, NATO's cohesion hung in the balance, inviting repeated Serbian efforts to divide the member states.⁴²

With NATO's credibility at risk, maintaining the coalition throughout the air campaign became an objective unto itself.⁴³ Yet trepidation over alliance maintenance was driven far more by the need to preserve the political legitimacy of the air campaign than the useful but modest resources that NATO countries brought to the air war over the former Yugoslavia. For example, out of the total 28,018 weapons delivered against targets in Kosovo, Montenegro, and Serbia, the total non-U.S. allied contribution was a meager 17%.⁴⁴ As it turned out, this was perhaps a desirable outcome, as there were transaction costs in managing the allied air campaign. The coalition provided

³⁷ Richard Haass, *Intervention* (Washington, D.C.: Carnegie, 1994), p. 16.

³⁸ This does not imply that the Cold War structure of alliances was the norm in the international political system. The Second World War's U.S., U.K., and U.S.S.R. alliance was a purely expedient arrangement against a largely *ad hoc* Axis alliance of 1939-1945. See Stephen M. Walt, "Why Alliances Endure or Collapse," *Survival*, (Spring 1997), pp. 156-179.

³⁹ Haass, p. 32.

⁴⁰ See Roland Dannreuther, *The Gulf Conflict: A Political and Strategic Analysis*, Adelphi Paper 264 (London: International Institute for Strategic Studies, Winter 1991/92), p. 27.

⁴¹ See *Strategic Survey 1999/2000* (London: International Institute for Strategic Studies, 2000), p. 105.

⁴² *Ibid.*, p. 104. See also John E. Peters et al., *European Contributions to Operation Allied Force: Implications for Transatlantic Cooperation* (Santa Monica: RAND Corporation, 2001).

⁴³ Eliot Cohen, "Kosovo and the New American Way of War" in *War Over Kosovo*, eds. Andrew J. Bacevich and Eliot Cohen (New York: Columbia University Press, 2001), p. 51.

⁴⁴ U.S. Air Force, *Air War Over Serbia Fact Sheet*, 31 January 2000, p. 6.

the legitimacy perceived as necessary for the U.S. and its partners to intervene in the internal affairs of a sovereign state (even if it was ruled by a despotic regime). But the premium paid for this imprimatur came in the form of constraints on the conduct of the air campaign. Gen. Wesley Clark, who at the time was NATO's Supreme Allied Commander Europe (SACEUR), described specifically how differences in campaign objectives can impact the prosecution of the war and the selection of specific targets:

On this issue we were exposing what I came to understand as a fundamental difference within the alliance on the nature of the campaign. The United States was increasingly committed to the idea of strategic strikes, going after the heart of Milosovic's power. The Europeans, or at least the French and a few others, were more interested in limiting the strikes to Kosovo, trying to hit ground forces, and avoid actions that might antagonize or damage Serbia further.⁴⁵

Perhaps in recognition of this experience, the U.S. did not seek out coalition partners to fight alongside American forces in Afghanistan, but instead seized on securing an *ad hoc* international mandate to prosecute a global war on terrorism. To this end, by March 2002, the United States received 46 declarations of support; NATO invoked Article V of the Washington Treaty for the first time in its history, declaring that an attack on any NATO member equated to an attack on them all; and over 136 countries offered some sort of military assistance.⁴⁶

Once again, however, the support the United States needed from its allies was not military, but economic and diplomatic. Financial actions freezing the assets of suspected terrorist organizations were important, as were increased law enforcement cooperation and financial assistance

to Afghanistan. Military contributions from other nations, such as the U.K.'s commandos, and special operations forces from Australia and New Zealand, provided needed specialized capabilities, but in the main were eclipsed by the U.S. commitment in manpower and firepower. Operating in one of the world's most remote regions, U.S. and allied forces were also aided considerably by the establishment of forward bases in Uzbekistan, Kyrgyzstan, and Tajikistan.⁴⁷ The addition of these Central Asian states to the expanding list of America's *ad hoc* allies reaffirmed the emerging trend in U.S. efforts to manage allied contributions to coalition military campaigns: seek international support and access to facilities while selectively inviting allies to participate in planning and conducting U.S.-led military operations.

This need for selectivity is due largely to a widening disparity between U.S. military capabilities and those of its principal allies.⁴⁸ Simply put, many prospective partners have relatively little to offer militarily. This trend in relative U.S. military superiority appears to be accelerating, with little prospect that the allies will fund the modernization programs to narrow the gap. The Gulf War provided the first glimpse of this capabilities gap, with the U.S. demonstrating the dividends resulting from investments in information technology, systems integration, stealth technologies, and precision weapons. While U.S. capabilities continued to improve in the 1990s, NATO forces remained incapable of performing the type of operations American forces conducted in 1991. For example, NATO leaders acknowledged that the European members of the alliance could not have undertaken the mission in Kosovo without U.S. participation.⁴⁹ In the wake of Afghanistan, where the U.S. conducted the air war almost unilaterally, the United States urged its allies to

⁴⁵ Wesley K. Clark, *Waging Modern War* (New York: Public Affairs, 2001), pp. 237 and 399. In the clash over deploying NATO forces to head off the Russian occupation of the airfield at Pristina, Clark concluded that "NATO commands were like puppets, with two or six or sometimes dozens of strings being pulled from behind the scenes by the nations themselves, regardless of the formalistic commitment of forces."

⁴⁶ According to a U.S. Department of Defense publication, "International Contributions to the War Against Terrorism," 35 nations were contributing support of one kind or another as of June 2002. Available online at: <http://www.defenselink.mil/news/jun2002/d20020607contributions.pdf>. See also Paolo Pasicolan and Balbina Y. Hwang, *The Vital Role of Alliances in the Global War on Terrorism*, Backgrounder #1606 (Washington, D.C.: Heritage Foundation, 2002).

⁴⁷ Maria Utyaganova, "American Military Base in Kyrgyzstan Receives Mixed Reaction," *Central Asia Caucasus Analyst*, (February 13, 2002). Available online at: http://www.cacianalyst.org/2002-02-13/20020213_Kyrgyzstan_Base.htm. See also Kenley Butler, "Uzbekistan's Alliance with the United States," in *America's Response: Regional Issues and Implications*, Center for Non Proliferation Studies, (October 2001). Available online at: <http://www.cns.miis.edu/research/wrc01/uzbek1.htm>.

⁴⁸ For more on this point, see David C. Gompert, Richard L. Kugler, and Martin C. Libicki, *Mind the Gap: Promoting a Transatlantic Revolution in Military Affairs* (Washington, D.C.: National Defense University Press, 1999); and, more recently, Myron Hura et al., *Interoperability: A Continuing Challenge in Coalition Air Operations* (Santa Monica: RAND Corporation, 2000).

⁴⁹ U.S. Congressional Research Service, Kosovo: *Lessons Learned from Operation Allied Force*, (1999). Available online at: <http://www.fas.org/man/crs/RL30374.pdf>. Shortfalls were noted in PGMs, laser designators, secure communications, IFF, electronic warfare, heavy airlift, aerial refuelers, and night-vision capability.

emphasize priorities such as special forces and low density, high demand (LD/HD) systems, or to pool their forces and develop national specializations.⁵⁰

The factors that have caused this gap to develop are not easily ameliorated. The United States spends over 60% more on defense than its European allies, and that spread is widening. In investment accounts, the gap is even wider—the U.S. outspends Europe in procurement and R&D by a two-to-one margin. The European position is worsened further by the fractionation of its investment among multiple nations. Meanwhile, the United States is transforming its military into an information-intensive, manpower-lean force, while European investments in similar transformational initiatives remain quite modest. With few opportunities available to close this gap, it is likely that the United States will depend on its European allies less and less for military contributions during a future war.

AN AMPLIFICATION OF THE ANTI-ACCESS/AREA DENIAL PROBLEM

Although the Cold War ended more than a decade ago, many of the plans, concepts, and forces that underpinned U.S. power projection are still with us. Among them is planning based on lengthy deployment schedules, as well as dispatching forces to forward bases with robust infrastructure, akin to the main operating bases that characterized Western Europe. Indeed, this is exactly how the United States prepared for the Gulf War when, over approximately six months, great quantities of warmaking materiel were transported to launch *Desert Storm*. But adversaries draw lessons from combat too, and the post-Gulf War consensus was that a future opponent would take every conceivable measure to deny U.S. abilities to build up a regional presence in preparation for a counter-offensive. As such,

this “anti-access” capability—using political and military means to thwart the deployment of U.S. military forces into a region—has emerged as a critical area in current Pentagon planning.

In 1997, Congress commissioned a distinguished group of strategists and retired senior military officers known as the National Defense Panel (NDP) to review U.S. military strategy in conjunction with the ongoing Quadrennial Defense Review.⁵¹ The NDP formally laid out what would become known as the “anti-access” challenge:

The cornerstone of America’s continued military preeminence is our ability to project combat power rapidly and virtually unimpeded to widespread areas of the world. Much of our power projection capability depends on sustained access to regions of concern. Any number of circumstances might compromise our forward presence (both bases and forward operating forces) and therefore diminish our ability to apply military power, reducing our military and political influence in key regions of the world. For political (domestic or regional) reasons, allies might be coerced not to grant the United States access to their sovereign territory. Hostile forces might threaten punitive strikes (perhaps using weapons of mass destruction) against nations considering an alliance with the United States...

Even if we retain the necessary bases and port infrastructure to support forward-deployed forces, they will be vulnerable to strikes that could reduce or neutralize their utility. Precision strikes, weapons of mass destruction, and cruise and ballistic missiles all present threats to our forward presence, particularly as standoff ranges increase.⁵²

Debate over the NDP’s conclusions has dominated defense policy discussions ever since. In the first QDR, completed in 1997, defense planners warned that adversaries would probably employ weapons of mass destruction against deploying U.S. forces: “In particular, the threat or use of chemical and biological weapons (CBW) is a

⁵⁰ Philip Shishkin, “U.S. is Pushing European Allies to Revamp Outmoded Militaries,” *The Wall Street Journal Europe*, 24 April 2002, p. A3. The organization and structure of these three campaigns cannot be viewed in isolation from the other multinational operations through the decade. These operations other than war (OOTW) missions from Haiti to Bosnia to Somalia saw the competing interests of political legitimacy, burden sharing, and operational efficiency come to a head. Many nations sought to contribute to gain goodwill of the United States, and the United States sought to have as many nations as possible involved to strengthen political legitimacy. While some coalition partners contributed in real terms to these operations and reduced U.S. commitments, others added to the burden rather than sharing it.

⁵¹ See U.S. Department of Defense, *Transforming Defense: National Security in the 21st Century*, (1997). Available online at: <http://www.dtic.mil/ndp/FullDoc2.pdf>. Members of the NDP included Ambassador Richard Armitage, General Richard D. Hearney (USMC, Ret.), Admiral David E. Jeremiah (USN, Ret.), Robert M. Kimmitt, Dr. Andrew F. Krepinovich, General James McCarthy (USAF, Ret.), Dr. Janne E. Nolan, and General Robert W. RisCassi (USA, Ret.).

⁵² *Ibid.*, pp. 12-13.

likely condition of future warfare, including in the early stages of war to disrupt U.S. operations and logistics.”⁵³ The most recent QDR elevated concern for future anti-access strategies even further, emphasizing that “projecting and sustaining U.S. forces in distant anti-access or area-denial environments and defeating anti-access and area-denial threats” would be a high priority operational objective in wartime.⁵⁴

Given this emphasis, what do the three wars considered here tell us about anti-access trends? For analytic purposes, we reduced the access problem to three critical focus areas: politics, geography and infrastructure, and enemy military threats to forward bases.⁵⁵

The Political Dimension of Anti-Access

Whether American forces are based overseas or in the continental United States, the U.S. needs to gain political approval from foreign nations to use their territory and airspace during conflict. Foreign bases from which U.S. forces operate in peacetime are also subject to continuing constraints and pressures, even from close allies, and access rights can constitute a pressure point in negotiations. Now, more than ever, U.S. policy is to develop strong relations with host countries to minimize the threat of political access problems. Political access constraints typically depend on the type of mission the U.S. plans to conduct from host nation bases. Airlift, refueling, surveillance missions, covert special forces assistance, and naval port visits gain approval from a host country far more easily than deploying ground forces or conducting strike operations.⁵⁶ The host country’s level of perceived threat also plays an important role in determining whether or not to grant access.

During the Gulf War, various nations previously reluctant to permit a large scale U.S. presence on their soil reversed that policy following Iraq’s invasion of Kuwait. Still, the United States encountered several political access difficulties in deploying its forces to the Gulf. Throughout the deployment, Spain required individual clearance requests for each flight. For a time, France allowed only two aircraft per hour through its airspace. Portuguese, Italian, and German actions also slowed airlift flows.⁵⁷ Saudi Arabia initially refused to allow the Army and Marine Corps to conduct gunnery training or permit B-52 basing.⁵⁸ But overall, political access problems did not have a major impact on the conduct of the war.

In subsequent crises in the Gulf, however, political problems have surfaced on a recurring basis:

- In the September 1996 Irbil crisis, when Iraqi forces attacked the Kurds in northern Iraq, Saudi Arabia and Turkey refused permission to conduct offensive operations from their soil with the 100 USAF fighters based in those nations. Jordan refused to permit the United States to deploy 30 fighters to that nation.⁵⁹ Because the target was located beyond the range of carrier-based aircraft, the U.S. was forced to use cruise missiles launched from bombers and ships to strike unrelated air defense sites in southern Iraq.⁶⁰ Access problems continued to bedevil the U.S. in the aftermath of the crisis. Kuwait agreed to host eight F-117 strike aircraft but delayed in permitting U.S. Army force deployments, causing additional diplomatic embarrassment.⁶¹
- In the December 1998 *Desert Fox* strikes against Iraq, half of the forward-based USAF fighters in the Gulf—about 60—could not be

⁵³ U.S. Department of Defense, *Report of the Quadrennial Defense Review [QDR]* (1997). Available online at: <http://www.defenselink.mil/pubs/qdr/sec3.html>.

⁵⁴ *QDR* (2001), p. 30.

⁵⁵ For an overview of the access problem, see David A. Shlapak et al., *A Global Access Strategy for the U.S. Air Force* (Santa Monica: RAND Corporation, 2002).

⁵⁶ Recent Turkish refusal to host substantial numbers of U.S. ground forces in the event of war with Iraq underscores this point. See Karl Vick, “After Calls on Turkey, U.S. Put on Hold,” *The Washington Post*, 8 January 2003, p. A14; Umit Enginsoy and Burak Ege Bekdil, “Turkish Indecision Delays U.S. Iraq War Plans,” *Defense News*, (6 January 2003), p. 6; and Michael R. Gordon and Eric Schmitt, “Turkey Saying No to Accepting G.I.’s in Large Numbers,” *The New York Times*, 4 December 2002, p. A1.

⁵⁷ U.S. Department of the Air Force, *Gulf War Air Power Survey [GWAPS], Volume III, Part 1, Logistics* (Washington, D.C.: Government Printing Office, 1993), p. 85.

⁵⁸ Michael Gordon and Bernard Trainor, *The General’s War: The Inside Story of the Conflict in the Gulf* (New York: Little, Brown, and Co, 1995), pp. 61–63.

⁵⁹ John F. Harris and R. Jeffrey Smith, “Why Clinton’s Response Fell Far From the Site of Saddam’s Aggression,” *The Washington Post*, 4 September 1996, p. A1.

⁶⁰ “Missiles Had to Travel Far, Saudi Arabia and Turkey Refused to Let Air Bases Be Used in Attack,” *Orlando Sentinel*, 4 September 1996, p. A5.

⁶¹ Neil MacFarquhar, “Mideast Coalition Shows Strain; Kuwait puts U.S. Plan on Hold; White House Says Saddam Has Yet to Meet Terms of Ultimatum,” *The New York Times*, 16 September 1996, p. A1.

employed because Saudi Arabia and the United Arab Emirates objected. Combat aircraft operating from Kuwait and Oman took part in the operation. However, Saudi Arabia and the UAE did allow support operations, such as tanker refueling sorties.⁶²

Political access issues were equally present in the Kosovo conflict and, to some degree, influenced how NATO air operations were actually conducted. Indeed, the linkage between access and airpower employment in the Balkans first surfaced in October 1995 when the Italians, apparently irritated by their limited political influence over air strikes against Bosnia, attempted to improve their negotiating position by refusing base access to U.S. F-117s.⁶³ Later, in 1999, there was concern that Italian domestic opposition would prevent the use of the crucial NATO air base at Aviano. Five days after the start of operations, Italian authorities insisted to Gen. Clark that unless the coalition focused its air power efforts against the Serbian forces committing atrocities in Kosovo, Italy would deny access to its facilities. As one might expect, Clark acceded to Italian demands and focused the air campaign on Serbian ground forces.⁶⁴ France also denied use of its air space for UK-based B-52s carrying cruise missiles, forcing the bombers to fly around Spain and across the Mediterranean to deliver their weapons.⁶⁵

Although the United States had not developed formal basing arrangements in countries neighboring Afghanistan prior to *Enduring Freedom*, the commander of USAF forces in Europe (USAFE), Gen. Gregory Martin, observed that many nations supporting U.S. combat operations in Afghanistan had participated in U.S. training

conferences and operations, greatly facilitating access to airspace and bases.⁶⁶ Following the Washington D.C. and New York attacks in September 2001, the United States made multiple requests to Pakistan, including unrestricted access to Pakistani airspace and bases. Approval was granted almost immediately.⁶⁷ In return, the United States pledged \$800 million in aid, assistance in eliminating Pakistan's foreign debt, and reconsideration of the previously blocked F-16 sale.⁶⁸ The U.S. also eliminated economic sanctions related to the Pakistani nuclear program that blocked the provision of credits, military sales, economic assistance, and loans to Pakistan. To support *Enduring Freedom*, the United States successfully obtained access to other Central Asian nations and developed 13 bases in and around Afghanistan; associated costs have not been revealed.

Political access difficulties were also encountered elsewhere. In the buildup to combat operations, Saudi Arabia signaled that it might not permit the United States to employ its new command and control center at Prince Sultan Air Base to direct offensive air operations.⁶⁹ A few months later, the Saudi government floated rumors that Riyadh might ask the United States to remove its forces and personnel,⁷⁰ and the United States has built a similar facility in Qatar to reduce dependence on the uncertain Saudi position.⁷¹ The long-term viability of U.S. bases in central Asia has also raised concerns. Because Osama bin Laden's terrorist tactics were prompted in part by the presence of U.S. forces in Saudi Arabia, U.S. forces concentrated at bases in Central Asia might also be subjected to attacks by Islamic and nationalist forces.

⁶² Douglas Jehl, "No Strikes from Saudi Soil: About 60 U.S. Fighters Grounded," *The New York Times*, 19 December 1998, p. A3.

⁶³ Daniel Williams, "Italy Seeks Bigger Role on Diplomatic Stage; Rome Uses Bosnia as Leverage to Boost Status, but Internal Troubles Hamper Effort," *The Washington Post*, 11 October 1995, p. A27. Details on the strike operations can be found in Craig Covault, "Air Power Alters Bosnia Equation," *Aviation Week and Space Technology*, (4 September 1995).

⁶⁴ This change in targeting strategy caused friction between Clark and his subordinates, and in particular with USAF Lt. Gen. Michael Short, the designated Joint Force Air Component Commander (JFACC). See Christopher J. Bowie, *The Anti-Access Threat and Theater Air Bases* (Washington, D.C.: Center for Strategic and Budgetary Assessments, 2002), pp. 34-35.

⁶⁵ General John Jumper, "Global Strike Task Force: A Transforming Concept, Forged by Experience," *Aerospace Power Chronicles*, (Spring 2001), p. 28.

⁶⁶ General Gregory Martin, Air Force Association Speech, Orlando, FL, 14 February 2002.

⁶⁷ Bob Woodward, *Bush At War* (New York: Simon & Schuster, 2002), p. 59.

⁶⁸ Judy Keen, "Bush lauds new partnership with Pakistan," *USA Today*, 14 February 2002, p. A10.

⁶⁹ Vernon Loeb and Dana Priest, "Saudis Balk at U.S. Use of Command Post; Powell Seeks Reversal of Policy; Refusal Could Delay Airstrikes at Terrorists," *The Washington Post*, 23 September 2001, p. A20.

⁷⁰ David B. Ottaway and Robert G. Kaiser, "Saudis May Seek U.S. Exit; Military Presence Seen as Political Liability in Arab World," *The Washington Post*, 18 January 2002, p. A1.

⁷¹ Michael Sirak, "USA Looks to Expand Bases in Oman and Qatar," *Jane's Defence Weekly*, (12 April 2002), p. 15.

Although political access issues were resolved successfully in all three conflicts, they loom large over U.S. war planning for a future attack on Iraq. In November 2002, Saudi Arabia's apparent unwillingness to provide access to bases in the Kingdom was such that initial U.S. war plans presumed that fighters based there would be unavailable for combat. Instead, the war plan was tailored around a U.S. deployment of five divisions and five aircraft carriers to the region, showcasing again the impact of political access constraints on force employment options.⁷²

The Geographical and Infrastructure Dimension of Anti-Access

The emerging strategic focus on Asia, with its vast distances and lack of suitable infrastructure, magnifies the importance of “access insensitive” forces, such as aircraft carriers and long-range bombers that do not require close-in regional basing. Past U.S. military operations in Asia illustrate this point. In the early stages of the Vietnam conflict, for example, carrier-based naval forces provided about half the strike sorties flown in both North and South Vietnam until the base infrastructure was sufficiently developed to handle a larger quantity of land-based fighters.⁷³ The same held true for more recent operations in Afghanistan. Because of the lack of basing infrastructure within effective fighter range of Afghanistan targets, the United States relied primarily on carrier-based naval forces and bombers to provide striking power during offensive operations. Overall, the bomber force delivered 70% of total weapons, carrier-based fighters about 20%, and land-based fighters about 10%.⁷⁴

Future operations will likely continue to confront the tyranny of distance and infrastructure constraints encountered in Afghanistan. The

airfield database maintained by the National Imagery and Mapping Agency (NIMA) provides some insights into Asia's infrastructure.⁷⁵ Asia contains 14% of the world's airfields (excluding Russia, China, and North Korea). In comparison, the North American continent—a substantially smaller geographical area, particularly when considering the oceans separating many areas in Asia—contains 32% of the world's airfields, while Western Europe—an even smaller area—contains 18%.⁷⁶

Table 1 illustrates the issue quite starkly by comparing Asia with two other key regions: Western Europe and the Middle East/Persian Gulf. Airfield density in Asia runs about one-fourth to one-third that of these two other key regions.⁷⁷ The density of hardened airfields with protective shelters for reducing the vulnerability of deployed aircraft stands at about one-fifth that of Western Europe or the Middle East/Persian Gulf.

Table 1. Base Density in Three Regions

Region	Airfields (per million sq. NM)	Hardened Airfields (per million sq. NM)
Asia	15.4	2.9
Middle East/Persian Gulf	37.8	14.0
Western Europe	55.4	13.6

Source: Christopher J. Bowie, *The Anti-Access Threat and Theater Air Bases*.

Constructing a network of facilities in Western Europe and the Gulf sufficient to support U.S. power projection forces took decades of sustained effort. Developing a similar infrastructure in Asia could take even longer. Moreover, Asia's vast size suggests that pre-positioned assets and facilities may not be in the right spot to provide the support needed for future conflicts. Given these huge distances, the United States could expend

⁷² William Arkin, “Planning an Iraqi War but Not an Outcome,” *The Los Angeles Times*, 5 May 2002, p. M1. As of this writing, such conservatism in planning for access denial seems prudent. See “Saudi Says U.S. Can't Use Facilities for War,” *The Washington Post*, 4 November 2002, p. A16; and Patrick E. Tyler, “No Decision on Letting U.S. Use Bases, Saudi says,” *The New York Times*, 5 November 2002, p. A14.

⁷³ Statistical data from C. Bernard Barfoot, *An Overview of CV TACAIR Operations in the Vietnam War* (Alexandria: Center for Naval Analysis, 1994).

⁷⁴ Bombers and carrier-based fighters together flew 88% of the sorties and delivered 94% of the munitions. Bombers delivered 46% of the precision-guided weapons; carrier-based fighters 43%; and land-based fighters about 10%. Bombers also delivered over 7,000 unguided weapons. Analysis derived from Arkin, “Weapons Total from Afghanistan.”

⁷⁵ See also Zalmay Khalilzad et al., *The United States and Asia: Toward a New U.S. Strategy and Force Posture* (Santa Monica: RAND Corporation, 2001), pp. 57-89.

⁷⁶ Bowie, *The Anti-Access Threat*, pp. 71-72.

⁷⁷ For an overview of the operational suitability of airfields in the Middle East, see William D. O'Malley, *Evaluating Possible Airfield Deployment Options: Middle East Contingencies* (Santa Monica: RAND Corporation, 2001).

enormous resources on developing regional infrastructure and still “get it wrong.”⁷⁸

The high cost of developing basing infrastructure is also a significant complicating factor. A single USAF air base in Europe was conservatively estimated to cost roughly \$1.5 billion in current year dollars.⁷⁹ Base structure development in Saudi Arabia—a single country with a much smaller land mass than Asia—was estimated to cost about \$30 billion.⁸⁰ Constructing bases in multiple Asian locations could cost several times that amount. Moreover, Saudi Arabia and NATO had the resources to fund most of this base development, but few countries in South, Central, and East Asia possess such wealth. Obtaining approval to invest U.S. resources for overseas base development would also confront domestic political opposition, as Congress is typically more supportive of investment in local, rather than overseas, bases. Overall, distance and infrastructure constraints will place new emphasis on “access insensitive” forces in future Asian conflicts.

The Military Anti-Access Dimension

Anti-access military threats consist of air defense systems to deny access to regional air space; mines, submarines, and naval combatants to interdict shipping lanes, disrupt sealift, and generally threaten friendly naval and amphibious forces and operations; and deep-strike systems and weapons of mass destruction to hold forward bases and forces at risk while intimidating regional U.S. allies. As Deputy Secretary of Defense Wolfowitz remarked in November 2001 regarding operations in Afghanistan:

Although our access to Afghanistan has improved steadily and most recently spectacularly, we have been forced by circumstances to operate from very great distances, and this against an enemy whose active efforts to deny us access have met so far with little success. It's only a shadow of what

a more determined, more advanced enemy could do.⁸¹

In none of the three conflicts did adversaries succeed in preventing U.S. force deployments. Therefore, we cannot document a trend that hostile military capabilities might deny access to U.S. military forces in the future. The worldwide proliferation of military capabilities, however, including sophisticated air defense systems and deep-strike weapons, suggests that the minimal military opposition the U.S. and its allies have faced in the last three major campaigns will grow in quantity and quality in the future.⁸²

In sum, the experiences of U.S. forces deployed overseas in the last three major conflicts suggest that the trend of anti-access/area denial needs to be considered seriously. Since the Gulf War, the United States has encountered a series of political and geographic constraints on its ability to position and employ its forces with maximum effect. At the least, such constraints have added cost, risk, and inconvenience; at worst, access denial has caused the U.S. to abandon prudent courses of military action and to pursue less effective substitutes. That these constraints, to include an emerging array of military anti-access capabilities, will continue to plague U.S. forces in the future is a certainty. Their ultimate effect on achieving warfighting aims may depend considerably on how successful the U.S. is in developing forces and operational concepts that can overcome these hurdles.

INCREASING ADVERSARIAL ACTION TO UNDERMINE THE THREAT AND USE OF MILITARY FORCE

Iraq suffered a shattering defeat in the Gulf War. Its vaunted air defense system was degraded and dismantled. Its air force was forced to flee piecemeal to Iran and its small navy was

⁷⁸ The need to develop an overseas basing architecture with a high degree of operational and logistical flexibility is explored in Paul S. Killingsworth et al., *Flexbasing: Achieving Global Presence for Expeditionary Aerospace Forces* (Santa Monica: RAND Corporation, 2000).

⁷⁹ M.B. Berman with C.L. Batten, *Increasing Future Fighter Weapon System Performance by Integrating Basing, Support and Air Vehicle Requirements* (Santa Monica: RAND Corporation, 1983), p. 1.

⁸⁰ The then-year dollar cost of the Saudi contracts let in the mid-1970s came to \$14 billion. Current year dollars would be several times this amount. Robert G. Kaiser and David Ottaway, “Marriage of Convenience: The U.S.-Saudi Alliance,” *The Washington Post*, 11 February 2002, p. A1.

⁸¹ Remarks by Deputy Secretary of Defense Paul Wolfowitz at the IFPA-Fletcher Conference, 14 November 2001.

⁸² For a summary of the range of adversary anti-access threats, see Bowie, *The Anti-Access Threat*, pp. 37-51. See also John Stillion and David Orletsky, *Airbase Vulnerability to Conventional Cruise-Missile and Ballistic-Missile Attacks: Technology, Scenarios, and US Air Force Responses* (Santa Monica: RAND Corporation, 1999).

destroyed. And its demoralized ground forces either surrendered *en masse* or fled the battle area. But Iraq's defeat was not total. Iraqi Scud missiles rained on targets in Saudi Arabia and Israel, mines laid in the northern Persian Gulf nearly sank two U.S. Navy ships, and low-level air defenses inside Iraq proved particularly persistent. During the culminating phase of allied military operations, many of the elite Republican Guard divisions managed to escape from Kuwait with their equipment. Finally, and perhaps most ominously, Iraq succeeded in shielding its vast clandestine network of facilities for WMD research and development.

That Iraq managed to accomplish this in spite of U.S. military actions ultimately spurred professional military thought—even cooperation between states—on how to undermine the threatened use of U.S. conventional force in future conflicts. In one prominent example, Yugoslav defense specialists in 1998 met with Iraqi military officers in Baghdad seeking to learn more about ways to degrade the effectiveness of U.S. air operations.⁸³ More recently, in 2002, Yugoslav air defense officers traveled to Iraq to assist in defending against a potential U.S. attack.⁸⁴

Analysis of the three conflicts indicates that some Iraqi successes were evident in enemy strategies adopted in both the Serbian and Afghanistan conflicts. In this section, we review attempts by Iraq, Serbia, and the Taliban regime in Afghanistan to weaken U.S. domestic support for combat operations, to fracture alliances, and to degrade the effectiveness of military operations.⁸⁵ Overall, the three adversaries consistently sought to deflect attack with threats calculated to heighten perceived U.S. sensitivities to casualties; to exploit instances of collateral damage to evoke international condemnation and weaken coalition resolve; to reduce their vulnerability to offensive strikes through a variety of means (air defenses, camouflage, concealment, deception, dispersal, mobility, and hard and deeply buried facilities);

and to stoke the fear of escalation and use of weapons of mass destruction. Given the wide differences in the characteristics of these three wars, the consistencies in adversary strategies and concepts lend credence to the notion that these same issues may recur in future conflicts.

Perceived U.S. Sensitivity to Casualties

All three adversaries believed that the United States was sensitive to combat losses and attempted either to deter U.S. actions or limit force employment options by emphasizing the prospect for significant American casualties. In part, this perception grew out of assessments of the Vietnam War, when mounting U.S. casualties proved crucial in turning American public opinion against the conflict.⁸⁶ More recently, lessons drawn from the U.S. withdrawal from Beirut following the bombing of the Marine barracks in 1983, and from Somalia following the loss of U.S. troops in 1993, were often cited by opponents as testaments to their efforts to weaken American domestic support for military operations abroad. For example, in reference to the Somali operation, Osama bin Laden stated in a 1998 interview:

They [Islamic soldiers] had thought the Americans were like the Russians, so they trained and prepared. They were stunned when they discovered how low was the morale of the American soldier. America had entered with 30,000 soldiers in addition to thousands of soldiers from different countries around the world.... As I said our boys were shocked by the low morale of the American soldier and they realized that the American soldier was a paper tiger. He was unable to endure the strikes that were dealt to his army, so he fled, and America had to stop all its bragging.... After a few blows, it forgot all about those titles and rushed out of Somalia in shame and disgrace, dragging the bodies of its soldiers.... I was in Sudan when this happened. I was very happy to learn of that great defeat that America suffered, so was every Muslim.⁸⁷

⁸³ Lambeth, p. 18.

⁸⁴ Stephen Grey and Tom Walker, "Saddam Gets Air Defence Advice from the Serbs," *The Sunday Times* (London), 6 October 2002, p. 22.

⁸⁵ These are all possible elements of adversary counter-coercive strategies, the overall aim of which is to exploit U.S. and major world power weaknesses. See Daniel Byman and Matthew Waxman, *The Dynamics of Coercion: American Foreign Policy and the Limits of Military Might* (New York: Cambridge University Press, 2002).

⁸⁶ On the general issue of U.S. casualty sensitivity, see Eric V. Larsen, *Casualties and Consensus* (Santa Monica: RAND Corporation, 1996).

⁸⁷ John Miller interview with Osama bin Laden, May 1998. Transcript available online at: www.pbs.org/vgbh/pages/frontline/shows/binladen/who/interview.html.

Citing U.S. experiences in Vietnam, Saddam Hussein's objective was to foster images of massive U.S. casualties in the act of dislodging Iraqi forces from Kuwait. As one captured Iraqi general revealed, Hussein believed that "Americans would not be able to stand the loss of even hundreds of soldiers, that Iraqis were prepared to sacrifice thousands."⁸⁸ To do this, Hussein's forces constructed elaborate defensive lines, consisting of belts of barbed wire, mines, and fire trenches filled with crude oil, fortified with 150 battalions of tube and rocket artillery. The Iraqi plan envisioned saturating coalition ground forces stalled in front of the belts with shell and rocket fire to inflict heavy casualties.⁸⁹

Similarly, Yugoslav strategy since World War II had been to draw an adversary into its territory and then inflict significant losses through hit-and-run partisan/guerrilla operations. In the absence of a ground threat, however, Serb forces dispersed and hid from air attack to outlast the political will of the fractious NATO alliance. U.S. commanders clearly recognized that alliance cohesion was NATO's most vulnerable area and was constantly threatened by casualties, attrition, and collateral damage. Moreover, combat losses could enable Serbia to wait out the alliance. Gen. Clark warned his commanders that "[t]he first measure of merit is not to lose aircraft, minimize the loss of aircraft." Clark later explained in his wartime memoirs:

I was motivated by a larger political-military rationale: if we wanted to keep this campaign going indefinitely, we had to protect our air fleet. Nothing would hurt us more with public opinion than headlines that screamed: 'NATO LOSES TEN AIRPLANES IN TWO DAYS.' Take losses like that, divide it into the total number of aircraft committed, and the time limits on the campaign would be clear. Milosevic could wait us out.⁹⁰

Finally, the Taliban "hide and wait" strategy was similar to that pursued by both Iraq and Serbia—inflict as many casualties as possible on U.S. forces. The strategy was to camouflage, conceal, and disperse Taliban military units as a prelude to inflicting high casualties on arriving U.S. ground forces—a strategy similar to that employed successfully by the Mujahedin against the Soviets.⁹¹ Taliban commanders would taunt their Northern Alliance opponents with predictions of death when the Americans attacked. But the lethal combination of air power, precision weapons, and special operations forces laid waste this strategy. One analyst observed later that "[t]hey were fighting an air force they could not see." Precision weapons proved effective against Taliban hiding places, preventing them from riding out the bombing and, in the end, Taliban and al Qaeda forces suffered far more casualties than the United States.⁹²

Collateral Damage

Adversaries attempted to exploit collateral damage and civilian deaths in all three conflicts to gain sympathy, separate the United States from its allies, and reduce the effectiveness of U.S. and allied/coalition air operations. In the process, senior U.S. decision-makers (both military and civilian) were encouraged to assume greater roles in the target selection and approval process. The implications of this "reach forward" are discussed in more detail in Section III.

During the Iraq conflict, the United States attempted to minimize collateral damage for humane reasons and political concerns. One Arab official noted, "If the United States attacks civilian targets, you will lose the war. It will be seen as the infidels slaughtering Arabs. Saddam can get away with it, but you can't."⁹³ The potential that civilian deaths would fracture the

⁸⁸ Gordon and Trainor, p. 185. The impact of this and similar rhetoric on U.S. public support for the Gulf War is explored in John Mueller, *Policy and Opinion in the Gulf War* (Chicago: University of Chicago Press, 1994).

⁸⁹ Robert Scales, *Certain Victory* (Dulles: Brassey's, 1997), p. 270.

⁹⁰ Clark, p. 183.

⁹¹ For more on this strategy as employed against the Soviets, see Artyom Borovik, *The Hidden War: A Russian Journalist's Account of the Soviet War in Afghanistan* (New York: Grove Press, 1990).

⁹² Edward Cody, "Taliban's 'Hide and Wait' Strategy Failed," *The Washington Post*, 23 December 2001, p. A12.

⁹³ Christopher Dickey, "Rope-a-Dope in Baghdad," *Newsweek*, (4 February 1991).

coalition was foremost in the minds of U.S. officials. A ten-page “no fire” list forbade any damage to mosques, hospitals, schools, and cultural sites.⁹⁴ Statements from U.S. officials during combat reflected the painstaking tasks American planners assumed in selecting targets, weapons, and attack routes. President George H. Bush declared: “I’d like to emphasize that we are going to extraordinary, and I would venture unprecedented, lengths to avoid damage to civilians and holy places.... We are doing everything possible and with great success to minimize collateral damage....”⁹⁵

The Iraqi government worked hard to exploit mistakes or unintended casualties, publicizing civilian deaths, and exaggerating death tolls. And mistakes occurred. In Najaf, 50 houses were damaged and reporters were called in to view the dead. In Al Dour, 23 houses were flattened and many civilians killed. A bridge attack in Nasiriya killed 50 noncombatants, and an errant bomb hit a hospital in Kuwait City, killing several foreign medical personnel. Basra neighborhoods were hit several times, killing several hundred Iraqis. The Iraqi government consistently exploited these attacks, providing video of those killed and allowing the wounded to be interviewed. Radio Baghdad broadcasts proclaimed that the coalition had bombed scientific, economic, cultural, medical, civilian, and holy sites. While Human Rights Watch estimated that between 2,000-3,000 Iraqi civilians were killed during the conflict, Iraq claimed that allied bombing had taken 7,000 innocent lives.⁹⁶

For the first four weeks of operations, U.S. air targeteers managed to avoid major collateral damage. But on 13 February, an F-117 struck the Al Firdos bunker in Baghdad, which U.S. planners believed was sheltering Iraqi Intelligence Service

personnel. The penetrating precision weapon not only killed some Iraqi intelligence personnel, but also hundreds of civilians who had taken shelter in the bunker. The Iraqi government sensationally exploited this incident, leading the White House and Joint Chiefs to rein in the air campaign and demand high-level approval of any proposed air attack on Baghdad.⁹⁷ Thus, the political fallout from the attack managed to achieve what Iraqi air defenses could not: curtailing air strikes on Baghdad. From Gen. Colin Powell’s viewpoint, a few more events like Al Firdos and the coalition would have come apart.⁹⁸ Concern over inflicting excessive casualties in strikes against the retreating Iraqi army also played a role in the U.S. decision to halt operations before destroying the fleeing Republican Guard.⁹⁹

Collateral damage constraints played an even more dominant role in the Serbian operation owing to similar concerns about alliance cohesion.¹⁰⁰ A fundamental difference of opinion led to immediate friction in the alliance. The United States wanted to conduct strategic strikes to go after the heart of Milosevic’s power, while many European leaders wanted to avoid attacks that would severely damage Serbia.¹⁰¹ Obviously, civilian deaths could inflame world opinion and lead to additional pressure on the United States to curtail bombing. A RAND study of the air campaign concluded that “pressures to avoid civilian casualties and unintended damage to nonmilitary structures were greater in *Allied Force* than in any previous campaign involving U.S. forces.”¹⁰²

The issue of collateral damage preoccupied Gen. Clark, the *Allied Force* military commander. He remembered the attack on the Al Firdos bunker and how it had impacted the air campaign. He accordingly sought to avoid such a problem in

⁹⁴ Rick Atkinson, *Crusade: The Untold Story of the Persian Gulf War* (New York: Houghton-Mifflin Co., 1993), p. 225.

⁹⁵ Human Rights Watch, *Needless Deaths in the Gulf War: Civilian Casualties During the Air Campaign and Violations of the Laws of War*, (1991). Available online at: <http://www.hrw.org/reports/1991/gulfwar/>.

⁹⁶ *Ibid.*

⁹⁷ See Wayne W. Thompson, “After Al Firdos: The Last Two Weeks of Strategic Bombing in *Desert Storm*,” *Air Power History*, (Summer 1996), p. 52.

⁹⁸ Gordon and Trainor, pp. 324-327.

⁹⁹ See John G. Heidenrich, “The Gulf War: How Many Iraqis Died?” *Foreign Policy*, (Spring 1993), pp. 108-125.

¹⁰⁰ On the subject of constraints, coercion, and the Kosovo air operation, see Daniel L. Byman and Matthew C. Waxman, “Kosovo and the Great Air Power Debate,” *International Security*, (Spring 2000), pp. 5-38.

¹⁰¹ Clark, p. 237.

¹⁰² Lambeth, p. 136.

Serbia.¹⁰³ Once past the pre-designated target set, almost every proposed target proved controversial for one reason or another. For the U.S. approval chain, each target needed to be individually analyzed for its military value and the possibility for collateral damage. Using overhead imagery and computer modeling of each weapon type against various physical target characteristics, planners attempted to predict infrastructure damage and risks of unanticipated civilian casualties.¹⁰⁴ The target then underwent additional review in Washington and finally ended up on President Clinton's desk for approval. NATO executed a similar process.¹⁰⁵

Collateral damage concerns exerted a powerful influence over the conflict. For example, early in the campaign, Washington disapproved NATO plans to strike eight bridges, apparently because the Joint Staff believed that too many civilians would be killed.¹⁰⁶ Ben Lambeth observes in his book that a “nontrivial” number of sorties were cancelled before launch or disapproved before weapons release out of concern for collateral damage. Some U.S. officers referred to these targets as “morally hardened.”¹⁰⁷

Despite these attempts, civilians were killed and Yugoslav authorities, like the Iraqis in 1991, attempted to drive wedges within the NATO alliance and curtail air operations by exploiting civilian deaths and exaggerating losses. Although it backfired psychologically at home, the Serbs publicized almost every incident, attempting to make the front pages of the Western press. Commander of Allied Forces in Southern Europe, Adm. James Ellis, observed that NATO public affairs efforts were “not a shining moment for the U.S. or NATO. The enemy was better at this than we were...and far more nimble.”¹⁰⁸ NATO typically proved unable to respond

quickly to Serb attempts to exploit collateral damage or U.S. targeting errors. The most famous example of the latter was the bombing of the Chinese embassy, which for a time severely strained U.S.-Sino relations. Meanwhile, concerns over collateral damage also resulted in a White House decision to stop using cluster weapons to avoid negative publicity. For the entire conflict, Serb officials claimed a civilian death toll ranging from 1,200 to 5,000. After extensive on-scene investigations, Human Rights Watch concluded that about 500 civilians were killed—on average about six per day.¹⁰⁹

The Taliban government employed similar propaganda strategies during *Enduring Freedom*. According to Afghan reporters, the Taliban routinely altered media reports to inflate civilian casualties (and minimize their own losses). For example, just over three weeks into the campaign, the Taliban claimed 1,500 to 1,600 civilians had been killed. Western media frequently published Taliban casualty reports with the caveat that the loss totals were unconfirmed, but the Arab and Muslim media reported them as fact. An Afghan reporter noted, “Our bosses called this the war against the Christian crusaders. They thought that if the people were told that the Americans were deliberately bombing civilians, they would rise up and kill the invaders.”¹¹⁰ To some degree, the Taliban succeeded in these efforts. In Pakistan, tens of thousands of protestors stormed through Quetta and Karachi.¹¹¹ Thousands of Pakistanis also joined Taliban ground forces.¹¹²

U.S. officials noted in press briefings that the same sorts of procedures employed in *Allied Force* to minimize collateral damage were also employed in *Enduring Freedom*. President George W. Bush made low collateral damage a key criterion to avoid inflaming public opinion in

¹⁰³ Clark, p. 238.

¹⁰⁴ Ibid., p. 238.

¹⁰⁵ Ibid., p. 201.

¹⁰⁶ Ibid., p. 225.

¹⁰⁷ Lambeth, p. 139.

¹⁰⁸ Admiral James Ellis, “Full Dress Blue” briefing, undated.

¹⁰⁹ Human Rights Watch, *Civilian Deaths in the NATO Air Campaign*, (2000). Available online at: <http://www.hrw.org/reports/2000/nato/index.htm>. HRW noted that there was some evidence that Yugoslav forces used refugees and displaced civilians as human shields and thus might share some of the blame.

¹¹⁰ David Zuchino, “In the Taliban's Eyes, Bad News Was Good News,” *The Los Angeles Times*, 3 June 2002, p. A1.

¹¹¹ Pamela Constable, “Anti-U.S. Sentiment Spreading in Pakistan: Growing Street Protests Precede Visit by Powell,” *The Washington Post*, 15 October 2001, p. A1.

¹¹² Susan B. Glasser, “Pakistani Families Confront Toll of Forbidden Holy War; Son's Decisions to Defy Government Often Prove Fatal,” *The Washington Post*, 2 December 2001, p. A26.

the Islamic world. This led to delays in decision-making—not only weapon selection but also fuse-settings were subject to high-level review—and apparent reductions in effectiveness. According to the press, this resulted in missed opportunities during the first six weeks to kill senior Taliban and al Qaeda officials, including Mullah Omar. As one Air Force officer commented, “We knew we had some of the big boys. The process is so slow that by the time we got the clearances, and everybody had put in their two cents, we called it off.”¹¹³ Additionally, the Taliban deliberately mixed in with civilians to avoid being targeted. One U.S. official noted: “Our mores in America are, we don’t kill innocent people. We have extreme sensitivity to that. For people to say we missed opportunities, that to me oversimplifies the situation.”¹¹⁴ The Taliban moved soldiers and military hardware into civilian neighborhoods, mosques, and cultural sites. Whole villages were employed as human shields. “They’ve gotten smarter every day. They know what we say we’re not going to hit—and they go there,” observed another U.S. official.¹¹⁵

Given this consistent pattern, future opponents will attempt to increase the chances of collateral damage by commingling military and civilian assets while exploiting civilian deaths in the same manner as the Iraqi, Serbian, and Taliban governments. In recent years, for example, Iraq has constructed civilian housing over several of its bunker complexes to increase the probability of civilian deaths in the event of U.S. strikes against these facilities.¹¹⁶

Efforts to Degrade Military Effectiveness

Dispersal, Camouflage, Concealment, Deception, and Mobility. In the Gulf War, Iraq employed dispersal, camouflage, concealment, deception, and mobility to reduce the effectiveness of U.S. and coalition air power. Before the onset of coalition military operations, Iraq moved key instrumentation from air defense command posts and removed computer equipment from oil refineries for post-conflict recovery and reconstitution. Iraqi engineers also emptied water reservoirs and filled them with oil to maintain POL supplies.¹¹⁷ At the same time, Iraq successfully applied camouflage, deception, mobility, and dispersal to preserve its ballistic missile force; coalition forces reportedly did not succeed in destroying a single mobile missile launcher.¹¹⁸

Furthermore, Iraq concealed the true scale and nature of its WMD development facilities. Although U.S. intelligence before the conflict concluded that Iraq possessed 23 such facilities, post-war UN inspections revealed 252 sites.¹¹⁹ Iraqi air defense forces opposing operations *Northern* and *Southern Watch* over the past decade further refined mobility, deception, and concealment techniques to blunt U.S. air power. An Air Force pilot assessed that the Iraqis were “getting really smooth. They can pick up and move in an hour or so. They can fire a missile, break down and leave before we can get in and drop a bomb.”¹²⁰

During *Allied Force*, Serbian forces also successfully employed camouflage, concealment, deception, dispersal, and mobility to reduce their

¹¹³Thomas E. Ricks, “Target Approval Delays Cost Air Force Key Hits,” *The Washington Post*, 18 November 2001, p. A1.

¹¹⁴Toby Harnden, “Fall of the Taliban: US ‘wasted’ 10 chances to Kill Senior Targets,” *The Daily Telegraph*, 19 November 2001, p. 13; and Ricks, “Target Approval Delays.” See also Elaine M. Grossman, “Key Command Banned Nearly All Attacks on Afghan Roads, Bridges,” *Inside the Pentagon*, (9 January 2003), p. 1.

¹¹⁵Bradley Graham and Vernon Loeb, “Taliban Dispersal Slows U.S.: Enemy Moves to Civilian Centers, Complicating Airstrikes,” *The Washington Post*, 6 November 2001, p. A1.

¹¹⁶David Fulghum, “War Planning for Iraq Continues on Target,” *Aviation Week and Space Technology*, (23 September 2002), p. 22.

¹¹⁷Gordon and Trainor, pp. 180-184.

¹¹⁸William Rosenau, *Special Operations Forces and Elusive Enemy Ground Targets* (Santa Monica: RAND Corporation), pp. ix and 29-44. It should be noted that official U.S. post-war studies have neither confirmed nor discounted claims that SOF teams managed to locate and destroy some mobile missile launchers in western Iraq. The authors are indebted to Barry Watts for clarifying this point.

¹¹⁹Chandler and Backschie, pp. 216-222.

¹²⁰John Diamond, “Iraqis Put Air Defenses in Areas Off-Limits to Jets,” *The Pittsburgh Post-Gazette*, 17 July 1999, p. A5.

vulnerability to allied air attack. While prosecuting the Serb assault into Kosovo, Serb forces dispersed and concealed their tanks and vehicles in villages and forests.¹²¹ Digging in and hiding had constituted the heart of Yugoslav doctrine since World War II, and Serb forces proved masters at blending into the terrain. Elements of the Serbian air defense system, such as radars and surface-to-air missile launchers, were moved routinely to frustrate allied targeting, thereby allowing the Serbs to maintain air defenses sufficient to continuously complicate and threaten allied air operations.¹²²

To further compound allied targeting problems, the Serbs made tank decoys out of tetra-pak milk cartons and artillery pieces out of stovepipes (complete with infrared signatures), used smoke to hide targets, and employed camouflage materials to hide military equipment from NATO air forces. Post-conflict analyses indicated that many tanks believed destroyed were most likely decoys.¹²³ Worst case estimates suggest that coalition air power may have destroyed only 58 pieces of equipment in contrast to the 744 pieces NATO claimed soon after the conflict.¹²⁴ Of Serbia's 25 known mobile SA-6 batteries, NATO spokesmen confirmed that only three had been destroyed.¹²⁵ The official USAF account of the air war over Serbia concluded: "The Air Force must continue to investigate new technologies and techniques for locating hidden or dispersed ground force elements with targeting quality accuracy, and rapidly passing that data to the 'shooters.'"¹²⁶

The Taliban and al Qaeda employed similar techniques in Afghanistan with varying degrees of success. The Taliban adopted a strategy similar to the one the Mujahedin had used so successfully against the Soviets: hide in the terrain and then wait to inflict losses on the invader. The strategy

enjoyed mixed results, as Taliban fielded forces proved increasingly vulnerable to precision weapons: "We couldn't gather in large groups because that made a target. We were waiting for our comrades to tell us what to do, but there was nothing to do but hide."¹²⁷ However, much of the Taliban and al Qaeda leadership evaded capture and remains at large. In addition, some experts speculate that the terrorist organization may have learned from their Afghanistan experience, realizing the perils of centralizing the majority of its organization and training facilities in a single country. Future terrorist organizations dispersed throughout multiple nations may be far more difficult to hunt down and destroy.

Clearly, these sorts of techniques will be adopted in the future. For example, ballistic and cruise missile systems can be fired from mobile launchers, thereby enhancing survivability through dispersal and mobility. Other examples of deception abound. Preparing for their surprise nuclear tests in May 1998, for example, the Indians reportedly utilized their knowledge of U.S. reconnaissance satellites, in combination with a period of frequent sandstorms, to conceal their activity. An Indian nuclear researcher subsequently stated, "It's not a failure of the CIA. It's a matter of their intelligence being good, our deception being better."¹²⁸

Hardened and Deeply Buried Facilities.

Hardened and deeply buried facilities aid in deception campaigns by concealing activities from surveillance systems while simultaneously affording protection from air strikes. Such facilities are particularly useful for resources that cannot be effectively dispersed or concealed, such as command and control sites or weapons production facilities. Following the Israeli air strike against the Osirak nuclear facility in 1981, Iraqi engineers built a series of deep underground

¹²¹ Lambeth, p. 27.

¹²² Rebecca Grant, *The B-2 Goes to War* (Washington, D.C.: IRIS Press, 2000), p. 82.

¹²³ Lambeth, pp. 130-131.

¹²⁴ See John Barry and Evan Thomas, "The Kosovo Coverup," *Newsweek*, (15 May 2000). The effectiveness of air power in destroying Serbian ground forces continues to generate some debate. For examples, see Stephen T. Hosmer, *Why Milosevic Decided to Settle When He Did* (Santa Monica: RAND Corporation, 2001); and Bruce R. Nardulli et al., *Disjointed War: Military Operations in Kosovo, 1999* (Santa Monica: RAND Corporation, 2002).

¹²⁵ Lambeth, p. 111.

¹²⁶ U.S. Department of the Air Force, *The Air War Over Serbia* (Washington, D.C.: Headquarters U.S. Air Force, 2000), p. 49.

¹²⁷ Romesh Ratnesar, "Grading the Other War," *Time Magazine*, (14 October 2002), p. 38.

¹²⁸ John Diamond, "CIA Searching For Answers Behind its India-Nuclear Failure," *The Associated Press*, 16 May 1998.

bunkers that exceeded Warsaw Pact standards for surviving nuclear bursts.¹²⁹ Iraq contracted out much of this work. Yugoslav engineers built a series of special “bomb proof” bunkers—nicknamed “Yugos” by U.S. targeteers—for the Iraqi air force. Yugoslavia also constructed hardened shelters for the air defense command posts.¹³⁰ Overall, Iraq hardened much of the country’s military facilities to reduce its vulnerability to air attack.

Some Iraqi installations were buried at a sufficient depth to be invulnerable to U.S. “hard-case” penetrating weapons. One prominent example was the 12 room bunker constructed 50 feet beneath the guesthouse of the presidential palace in Baghdad. The main entrance was a three-ton steel door, the walls were made of lead-lined concrete six feet thick, and the design allowed 25 people to survive in the bunker for a year without resupply.¹³¹ After the war started, the USAF developed and fielded a 4,700 lb. penetrating weapon that became known as the GBU-28. Consisting of an artillery barrel filled with explosives and fitted with laser guidance, the GBU-28 was developed, tested, and deployed in about six weeks. Two GBU-28s were airlifted into theater and delivered by F-111 fighters in the closing stages of the Gulf War. One may have penetrated a similar bunker and killed many Iraqi senior military officials. In recent years, Iraq has reportedly constructed additional underground complexes in and around Baghdad, presumably of strength sufficient to withstand large U.S. penetrating weapons.¹³²

At the behest of Marshall Josip Tito after World War II, Yugoslavia built an extensive series of bunkers designed to shelter military forces if the country came under nuclear attack. Yugoslav

planners also envisioned using the bunkers as command centers to direct partisan/guerrilla operations against enemy invaders. In the following decades, Yugoslavia built dozens of deeply buried, hardened bunkers around the nation, particularly in mountainous Bosnia-Herzegovina. These bunkers had multiple backup systems for communications and power. The Mount Avila bunker, located a few miles southeast of Belgrade, was a multi-story facility buried 100 feet deep. It was capable of supplying the entire Yugoslav general staff with communication equipment, medical facilities, living quarters, and sufficient food to last for months.¹³³

Yugoslavia also built huge shelters on the Dalmatian coast to protect naval vessels, although these were judged to be vulnerable to modern precision-guided weapons.¹³⁴ Similar hardening efforts were applied to aircraft bases. For example, USAF aircraft repeatedly attacked a bunker facility at the Pristina airfield in Kosovo. Yet, following the conflict, the Serbs towed 11 MiG-21s out from the bunker (which had obviously not been penetrated) and flew the aircraft back to Serbia.¹³⁵ In addition, Serb hardening of air defense systems—underground command sites and buried landlines—frustrated NATO efforts to disrupt the Serb air defense network.¹³⁶

Most recently, Taliban and al Qaeda forces employed a large set of caves and bunkers developed following the 1979 Soviet invasion of Afghanistan. At Tora Bora, enemy forces took shelter in approximately 200 separate caves.¹³⁷ The Zhawar Kili cave complex near the Pakistan border covered nine square miles with 70 interconnected caves and tunnels, providing miles of protected space.¹³⁸

¹²⁹ Richard P. Hallion, *Storm Over Iraq* (Washington, D.C.: Smithsonian Institution Press, 1997), p. 131.

¹³⁰ Gordon and Trainor, p. 107.

¹³¹ Dickey.

¹³² Fulghum, “War Planning for Iraq,” p. 22.

¹³³ Paul Richter, “Bunker-Busters’ Aim at Heart of Leadership; Weapons; NATO uses special bombs to attack Yugoslav military’s underground command posts,” *The Los Angeles Times*, 5 May 1999, p. A16.

¹³⁴ *Ibid.*

¹³⁵ See comments by Maj. Gen. Charles Wald, USAF, *DoD News Transcript*, 11 June 1999. Available online at: http://www.defenselink.mil/news/Jun1999/t06111999_t0611asd.html.

¹³⁶ Lambeth, p. 106.

¹³⁷ Anthony Cordesman, *The Lessons of Afghanistan: Warfighting, Intelligence, Force Transformation, Counter-Proliferation, and Arms Control* (Washington, D.C.: Center for Strategic and International Studies, 2002), p. 20.

¹³⁸ Steve Vogel, “Al Qaeda Tunnels, Arms Cache Totaled; Complex Believed Largest Found in War,” *The Washington Post*, 16 February 2002, p. A27. Pictures of the complex are available online at: <http://www.globalsecurity.org/military/world/afghanistan/zhawar-kili.htm>.

Similar facilities are proliferating around the world. Following the Gulf War, Libya began building the massive Tarhuna complex 60 km southeast of Tripoli, apparently to produce and store chemical weapons. This nine-square mile facility is buried in the side of a mountain; internal blast doors shield its three tunnel entrances; and 100 feet of sandstone and reinforced concrete protect its six miles of tunnels.¹³⁹ Iran has constructed a series of tunnels on its southeast coast to protect its force of ballistic missiles and, working around the clock, is rapidly building other underground shelters.¹⁴⁰ Officials from U.S. Central Command (CENTCOM) described the purpose of the tunnels as “storage or forward deployment facilities for missiles or missile related equipment.”¹⁴¹ The Russians, who constructed vast shelter complexes during the Cold War, continue to build an underground city complex in the Urals.¹⁴² China has constructed underground shelters to protect its mobile ballistic missile forces threatening Taiwan.¹⁴³ North Korea (which has a long tradition of burying key complexes) has reportedly excavated up to 22 facilities beneath its numerous mountains to house its nuclear weapons industry.¹⁴⁴

As indicated by U.S. combat experience in all three conflicts, it is very difficult to estimate the purpose or size of underground facilities. For example, U.S. forces were stunned at the extent of the Zhawar Kili cave complex near Khost and the Pakistan border when ground forces began exploring the area.¹⁴⁵ In addition, the effects of strikes against such facilities often remain unknown. Based on the evidence from these three conflicts and activity worldwide, the presence of hardened and deeply buried facilities will continue to characterize future conflicts.

Persistent Low-Level Air Defenses. All three conflicts featured adversary attempts to protect their air space from U.S. and allied/coalition aircraft.

In the Iraq and Serbian conflicts, the lethal combination of airborne early warning aircraft (the E-3A and E-2C), advanced air superiority fighters (F-14, F-15, F-16, and F/A-18), and modern air-to-air missiles quickly eliminated any fixed-wing interceptor threat. The Taliban launched no fighters.

Trends in ground-based air defenses appear more worrisome. Iraqi air defenses capable of threatening aircraft at medium and high levels were disrupted and eliminated within a few days by coalition tactics, stealth aircraft, and air defense suppression assets. Yet, as has been the case historically, U.S. and allied forces were unable to eliminate low-altitude air defenses such as anti-aircraft artillery (AAA) and man-portable SAMs. During the Soviet invasion of Afghanistan, Stinger missiles are reported to have downed 269 Soviet helicopters and aircraft with only 340 missiles (though such reports may be exaggerated). And more recently in Chechnya, man-portable SAMs are estimated to have caused 66% of Soviet aircraft losses.¹⁴⁶ Although U.S. countermeasures appear to have gained the upper hand against older models, modern infrared (IR) man-portable missiles have greatly increased lethality with the development of advanced seekers resistant to traditional counter-measures such as flares.

Overall, the large number and dispersed nature of these systems made it impossible to eliminate these threats in the Gulf War, leading military commanders to direct flights at medium and high altitudes to minimize vulnerability. This, in turn, greatly reduced the effectiveness of aircraft armed with unguided ordnance—the vast majority of U.S. and allied aircraft in the Gulf War—by greatly reducing their bombing accuracy.

Quite possibly, meetings between Iraqi air defense experts and their Serbian counterparts before *Allied Force* also provided Serb planners

¹³⁹Douglas Waller, “Target Gaddafi, Again,” *Time Magazine*, (1 April 1996), p. 46; and “Pressure Forces Libya to Abandon Plan for Chemical Weapons Plant,” *The Chicago Sun Times*, 19 April 1996, p. 33.

¹⁴⁰Dr. William Schneider, Testimony to National Security Committee, U.S. House of Representatives, 16 July 1998.

¹⁴¹“Pentagon Stays Cool on Iranian Tunnel Threat,” *Jane’s Defense Weekly*, (8 May 1996), p. 4.

¹⁴²“U.S. Struggling to Counter Underground Arms Caches,” *The Phoenix Gazette*, 15 November 1996. Out of print, p. # unavailable.

¹⁴³Bill Gertz, “China Places Second Missile Base Near Taiwan,” *The Washington Times*, 15 March 2001, p. A1.

¹⁴⁴“Secret nuclear cities of world’s pariah state,” *The Guardian Unlimited Observer*, 29 December 2002, p. D1.

¹⁴⁵See Footnote 138.

¹⁴⁶Steven J. Zaloga, “Air Defense Missiles: Recent Trends in the Threat,” *Journal of Electronic Defense*, (November 1998), pp. 37-43.

insight into maintaining more effective air defenses. Overall, Serbian air defense systems, of 1960s vintage, were no more capable than Iraq's. In terms of radar-directed SAMs, Serbia possessed about 40 single-rail SA-2 launchers, about 50 four-rail launchers for SA-3s, and 25 SA-6 launchers. As to low-level air defenses, Serbian forces possessed about 850 IR-guided SAMs and thousands of anti-aircraft guns. But Serbian air defense forces, learning lessons derived from Iraqi experience, employed these forces far more effectively to maintain a "threat in being." Elements of the Serbian air defense system, such as radars and SAM launchers, adopted Iraqi tactics employed against *Northern* and *Southern Watch* air operations. The Serbs moved to frustrate allied targeting, allowing them to maintain a significant air defense threat and requiring allied commanders to devote a considerable percentage of sorties to defense suppression. The Serbs also fused radar data from disparate locations to reduce vulnerability, using radars in the northern part of the country to detect in-bound NATO aircraft, and to cue air defenses in the south.¹⁴⁷

The cumulative effect of these operations is evident in the burgeoning demand for electronic warfare platforms to provide tactical jamming for strike aircraft. In the Gulf War, approximately 4% of total combat sorties were electronic warfare missions, flown by EA-6Bs and EF-111s.¹⁴⁸ In contrast, USAF and USN combat aircraft flew nearly 12,000 sorties in *Allied Force*,¹⁴⁹ of which roughly 1,318 (11%) were EA-6B electronic warfare sorties.¹⁵⁰ Also instructive here is a com-

parison of the quantities of EW aircraft deployed in SEAD (Suppression of Enemy Air Defense) operations during *Desert Storm* and *Allied Force*. In the case of the former, the U.S. deployed 88 SEAD/EW aircraft out of a total U.S. fighter/bomber force of 1,078—about 8% of the force.¹⁵¹ Data on the total U.S. air combat force for Serbia is not publicly available, but the USAF alone deployed 64 F-16CJs (the current version of the Wild Weasel) out of a total fighter/bomber force of 232—about 27% of the force.¹⁵² Overall, in the Gulf War, 10% of coalition sorties (both electronic warfare and missile shooters) were devoted to suppressing and destroying enemy air defenses.¹⁵³ In comparison, the most comprehensive overview of the Serbian air war states that 35% of total allied combat sorties in Serbia were directed against enemy air defenses.¹⁵⁴

This increased effort did manage to minimize aircraft loss rates, with the U.S. loss rate calculated at .02% in Serbia compared with .05% in Iraq.¹⁵⁵ But again, allied aircraft chose to operate at medium altitudes to minimize the threat posed by Serbian low-altitude air defenses. UAV loss rates, however, were a sobering 250 times higher than manned aircraft, in part because these systems operated within range of the low-level air defenses. The Serbs, having learned from previous allied UAV operations in the mid-1990s, also appeared to employ special tactics to shoot down these aircraft.¹⁵⁶ In Afghanistan, Taliban missile defenses were quickly eliminated, although low-level threats persisted and U.S. aircraft were compelled to fly at medium altitudes throughout

¹⁴⁷ Lambeth, p. 106.

¹⁴⁸ Total U.S. and allied combat sorties include air interdiction, close air support, defensive counter-air, offensive counter-air, suppression of enemy air defenses, and reconnaissance. Total Gulf War sorties were 70,556, of which 2,918 were designated EW missions. See *Gulf War Air Power Survey [GWAPS], Volume V: A Statistical Compendium and Chronology* (Washington, D.C.: Government Printing Office, 1993), pp. 232-233.

¹⁴⁹ Lambeth, p. 61 and *Air War Over Serbia Fact Sheet*.

¹⁵⁰ "LD/HD: The EA-6B & JSTARS in Allied Force," briefing prepared by the Northrop Grumman Analysis Center, March 2000. Indeed, as the only tactical jammer left in U.S. aircraft inventories, 26 EA-6B *Prowlers* were eventually deployed to participate in *Allied Force*, most of which were based at Aviano, Italy. In the end, the *Prowlers* averaged 22 sorties/day and a sortie duration of 4-7 hours. Their aircrews spent roughly 90 hours per month in the cockpit conducting the EA-6B's three principal missions: (1) stand-off jamming of "kill boxes"; (2) escort and modified escort jamming for strike packages; and (3) direct support for stealth missions (F-117 and B-2).

¹⁵¹ 48 F-4G Wild Weasel, 18 EF-111 and 33 EA-6Bs were deployed in Southwest Asia as of January 1, 1991. Statistics from *GWAPS, Vol. V*, pp. 27-28 and 44. Aircraft counted do not include *Proven Force* assets in Turkey.

¹⁵² *Air War Over Serbia Fact Sheet*, p. 6.

¹⁵³ Total EW and SEAD sorties in the Gulf War came to 8,478 out of a total U.S. and coalition combat sortie count of 70,556 (includes air interdiction, close air support, defensive counter-air, offensive counter-air, suppression of enemy air defenses, and reconnaissance). Data taken from *GWAPS, Vol. V*, pp. 150 and 232-233.

¹⁵⁴ Lambeth, p. 64-65.

¹⁵⁵ Two losses for 9,211 fighter/bomber sorties in Serbia compared with 38 losses for 65,357 penetrating combat sorties in the Gulf. From *Air War Over Serbia Fact Sheet*, p. 6 and *GWAPS, Vol. V*, pp. 150 and 232-33.

¹⁵⁶ Tim Ripley, "UAVs Over Kosovo—Did the Earth Move?" *Defense Systems Daily*, (1 December 1999), p. 34. Available online at: <http://defence-data.com/features/fpages/34.htm>. For example, until allied fighters made such operations too dangerous, the Serbs employed helicopters to fly alongside a UAV, allowing the crew to employ door-mounted guns to shoot it down.

most of the campaign. When U.S. helicopters operated at low level within range of enemy forces, such as in operation *Anaconda*, they suffered battle damage and losses from enemy fire.

A key issue for the future is whether the pervasive threat posed in low altitude environments can be extended to medium and higher altitudes with the proliferation of advanced SAM systems such as the SA-10. Compared with previous generation SAMs, the SA-10's radar suite is more powerful and resistant to jamming; the system is equipped with multiple missiles and is easier to relocate; and the missiles themselves feature longer-range, higher speed, and greater agility. Lt. Gen. Michael Short, *Allied Force* air component commander, admitted:

I can tell you what I worried about every day and I can tell you what General Clark worried about every day—that somehow Mr. Milosevic would find a way to float an SA-10 or SA-12 up the Danube River, put it together and bring it to bear as a part of this conflict. If that had happened, it would have profoundly changed the balance of the threat and our ability to maintain air superiority.¹⁵⁷

To put this threat in perspective, USAF Gen. Richard Hawley, the commander of Air Combat Command during *Allied Force*, noted that B-1Bs (and other non-stealthy aircraft) could not operate survivably in the face of “double digit SAMs,” even when employing advanced decoys and other countermeasures.¹⁵⁸ Fortunately, to date, the proliferation of such systems has been limited, largely owing to their high cost.

Finally, we should note that this trend is evident in Iraqi preparations for another confrontation with the U.S. and its allies. As noted previously, teams of Iraqi intelligence officers visited Yugoslavia in the aftermath of *Allied Force* to understand and assess methods the Serbs used to overcome NATO's superior weaponry and protect its military forces from air attack. According to

Gen. Clark, the most significant of these measures “was the ability of Yugoslavia's air defenses to foil NATO electronics by using different radar frequencies and profiles, and by using ‘passive tracking’ systems that do not give off radiation.”¹⁵⁹ We should therefore expect future adversaries to attempt to draw lessons from past conflicts as they seek to identify and exploit weaknesses in the application of U.S. military power.

Weapons of Mass Destruction

Weapons of mass destruction—nuclear, chemical, and biological—were present in all three conflicts to varying degrees and, as expected, emerged as a critical issue of concern for both U.S. policymakers and potential opponents. WMD accordingly will likely form a focal point in future conflicts. These weapons are regarded as force multipliers for weaker nations when dealing with American conventional superiority. As was widely reported, a top Indian military official noted in the aftermath of the Gulf War: “[T]he lesson of *Desert Storm* is don't mess with the United States without nuclear weapons.”¹⁶⁰

Such weapons have the potential to destroy or disrupt forward deployed U.S. conventional forces, strike at the American homeland, increase the power and prestige of possessing nations, and deter U.S. intervention and the willingness of neighboring nations to provide basing for American forces—all at a low relative cost compared with conventional forces. This combination of attributes has stimulated proliferation of these weapons around the world. As Serbian president Slobodan Milosevic noted in May 1999: “I think your strategic thinkers are also beginning to understand that missiles and other sophisticated weapons will not always be the monopoly of high-tech societies. And with the example it is now setting, we can see the day when lesser nations will be able to retaliate. The development of these weapons is taking place so

¹⁵⁷ Comments by Lt. Gen. Michael Short at the seminar, “Operation Allied Force: Strategy, Execution, Implications,” sponsored by the Eaker Institute for Aerospace Concepts, 16 August 1999.

¹⁵⁸ Adam J. Herbert, “Former ACC Chief Says USAF Should Move to Larger, All B-2 Bomber Fleet,” *InsideDefense.com*, (17 October 2001). See also David Bond, “Vulnerable Bomber,” *Aviation Week and Space Technology*, (23 December 2002), p. 23.

¹⁵⁹ Slobodan Lekic, “Iraq Said to Study Air Strike Defenses,” *The Washington Times*, 16 November 2002, p. A16.

¹⁶⁰ Cited in Robert W. Chandler, *Tomorrow's War, Today's Decision* (McLean: AMCODA Press, 1996), p. 149.

fast there is not a single spot on the planet that cannot be reached. America can be reached from this part of the world.”¹⁶¹

Before the Gulf War, Iraq possessed an array of chemical and biological agents and had been actively seeking nuclear weapons for several decades. It possessed or experimented with multiple delivery means: ballistic missiles, the long-range “super gun,” and even unmanned aerial vehicles. Serbian forces also possessed chemical weapons.¹⁶² Fortunately, in both cases, Iraqi and Serbian leadership proved unwilling to escalate. In Afghanistan, concerns about WMD were heightened over evidence of collaboration between Pakistani nuclear scientists and reported al Qaeda attempts to purchase nuclear weapons for terrorist strikes against the United States. Post-war intelligence revealed al Qaeda efforts to develop chemical and biological weapons as well. Vice President Cheney soberly noted in 2002 that “(d)eliverable weapons of mass destruction in the hands of a terror network, or a murderous

dictator, or the two working together, constitute as grave a threat as can be imagined.”¹⁶³

As was seen in the Gulf War and Afghanistan, the U.S. attempted to destroy weapons, WMD research facilities, and means of delivery to reduce the threat to coalition forces. Unfortunately, successfully prosecuting such attacks offers enormous challenges. As noted earlier, the U.S. discovered after the Gulf War that Iraq’s network of facilities proved much larger than initially estimated.¹⁶⁴ Similar problems confronted U.S. operations in Afghanistan. The extent of al Qaeda development of WMD remained a mystery until coalition ground forces entered the country. These significant problems will continue to confront U.S. forces in conflicts against adversaries armed with WMD. Attacks against an adversary’s WMD, if only partially successful, also run the risk of driving an enemy to employ such weapons before losing them. It therefore appears that the mere specter of WMD employment will continue to influence U.S. decision-making and policy.

¹⁶¹ Arnaud de Borchgrave, “We Are Willing to Die to Defend Our Rights,” *The Washington Times*, 1 May 1999, p. A8.

¹⁶² Federation of American Scientists, “Chemical Agents in the Former Yugoslavia,” (2000). Available online at: <http://www.fas.org/nuke/guide/serbia/cw/index.html>. The Serbs reportedly possessed sarin, sulfur mustard, the psycho-chemical incapacitant BA, CS, Tabun, soman, VX, and phosgene.

¹⁶³ Remarks by Vice President Richard Cheney to the Veterans of Foreign Wars, 103rd National Convention, 26 August 2002. Available online at: <http://www.whitehouse.gov/news/releases/2002/08/20020826.html>.

¹⁶⁴ The United States believed the Iraqis had 23 WMD facilities. UN inspections subsequently revealed that the total number of facilities was 252. See Chandler and Backschie, pp. 216–22.

III. MILITARY CAPABILITIES ENABLING NEW WAYS OF WARFARE

Looking retrospectively at selected U.S. military operations in the immediate post-Cold War era, we identified four political-military trends that will most significantly impact U.S. force applications in combating future forms of aggression and terror in the first decade of the 21st century and, quite possibly, beyond. With the conflict spectrum becoming increasingly diverse, both in terms of the sources and nature of emerging threats, the clashes that will ensue between the U.S. and future adversaries also will be characterized by *how* the U.S. might employ its military capabilities. Hence, the purpose of this section is to focus more specifically on identifying salient trends in force employment. As was the case in the prior chapter, we base our observations on a comparative view of U.S.-led military operations in Iraq, Kosovo, and Afghanistan, under the assumption that the trends highlighted will prove valuable to predictive assessments of future warfare.

Our analysis revealed five key trends in force employment that will shape the future conduct of U.S. military campaigns:

- An order of magnitude increase in battlefield situational awareness;
- A move from deliberate to adaptive planning, and the concomitant execution of dynamic military operations;
- A dramatic decline in U.S. casualties compared with previous conflicts;
- An increasing emphasis on extended range operations; and
- The diminishing role of heavy ground forces.

PERSISTENT SITUATIONAL AWARENESS OVER THE BATTLEFIELD

Of all the categories of military capability considered over the last three major engagements, the partly fulfilled promise of technological omniscience in the battlespace has dramatically transformed the command and control of U.S. forces in combat. Although we remain cognizant of Clausewitzian logic and acknowledge the timeless trends of fog and friction inherent in warfare,¹⁶⁵ we nevertheless remain impressed by marked increases in battlefield situational awareness possessed by commanders at the strategic, operational and tactical levels. Indeed, a key participant in the command and control of allied air forces over Afghanistan cited an “order of magnitude” increase in overall battlespace awareness between operations *Desert Storm* and *Enduring Freedom*.¹⁶⁶

More specifically, we view two related trends with particular interest, as both pertain to the consequences of increased situational awareness over the battlefield:

- The rapidly increasing speed at which targets can be generated and prosecuted by a combination of battle management, sensor, and strike systems, compressing what has become known in the air operations community as the “kill chain”; and
- A blurred distinction between command and control and the execution of military operations, a trend resulting from real time operational snapshots of the battlefield and the intervention of senior leaders in issuing targeting guidance.

¹⁶⁵ Watts.

¹⁶⁶ NGAC staff interview with senior Air Force leader.

Progress Toward Increased Compression of the Kill Chain

During the Cold War, prescient military thinkers in the Soviet Union laid the conceptual groundwork for a “reconnaissance-strike complex” and of a “military-technical revolution,” both of which inspired American interests in a “revolution in military affairs.”¹⁶⁷ In theory, the concept argued for intelligence, surveillance, and reconnaissance (ISR) systems to find, identify, and track military targets, aided by command and control assets to bring the weapons to bear effectively against those targets. But, in practice, the concept depended on enabling information technologies to facilitate collecting and quickly disseminating data essential to long-range target acquisition and attack—an area in which the U.S. enjoyed an enormous advantage over the Soviet Union. In the words of Eliot Cohen: “If the key to future warfare would be the rapid processing of electronically acquired information, how could a society that was virtually incapable of manufacturing a simple personal computer keep up in the technological race?”¹⁶⁸

Quite clearly, the Soviet Union could not keep pace with U.S. progress in establishing and exploiting these electronic linkages, as demonstrated by the overwhelming U.S. competitive advantage against Soviet tactics and technologies employed by the Iraqis during the Gulf War. Enabling this advantage is an overarching and constantly improving command and control architecture (if not yet truly integrated, joint, or interoperable), complete with information technology solutions to facilitate near-real time decision making. This architecture is, in turn, supported by a constellation of space-based assets, manned and unmanned air-breathing platforms, and ground sensors. As discussed in more detail in Section IV, trends observed in the three

conflicts examined here highlight the promise of increased numbers and improved quality of intelligence-gathering sensors (particularly all-weather, high resolution radars), and dramatic improvements in collecting, processing and disseminating “precision information” to achieve “precision effects” on the battlefield.¹⁶⁹

However, progress toward increased kill chain compression was uneven in the 1990s. For example, it took days, even weeks, to provide *Desert Storm* targeteers with mensurated coordinates (latitude, longitude, and altitude) for cruise missile targeting.¹⁷⁰ Considerable time also elapsed between target generation, attack execution, and bomb damage assessment (BDA). Quite often, air commanders in the theater relied on CNN or other public media for information about the timing and success of their air strikes. On the first day of the air campaign, USAF Lt. Gen. Charles Horner had one of his planners watch television to judge the results of the opening attacks. When the Iraqi station went off the air, Horner confirmed that the strikes against the telecommunications center had been successful.¹⁷¹ But one could hardly place such methods of judging results in the category of reliable battle damage assessment. As one F-15E pilot complained, “I got more information and more specific mission results from listening to radio broadcasts from the BBC than what I got through CENTAF channels.”¹⁷²

Shortfalls in tactical reconnaissance exacerbated the problem of battlefield awareness, with Air Force RF-4Cs in limited supply and Marine Corps RF-4Cs squadrons already disbanded. To circumvent the cumbersome procedures and rigid hierarchies that slowed the information flow to battlefield commanders, workarounds were devised. The “Black Hole” planning cell in Riyadh used the STU-III secure phone/fax to

¹⁶⁷ See the work of Mary C. Fitzgerald on this topic, notably “The Soviet Military and the New Technological Operation in the Gulf,” *Naval War College Review*, (Autumn 1991), pp. 16-43.

¹⁶⁸ Quoted in Gary Stix, “Fighting Future Wars,” *Scientific American*, (December 1995), p. 92.

¹⁶⁹ We are indebted to Barry Watts for reminding us that precision weapons are useless without precision information on a target and the effect(s) sought in striking that target. Similarly, a Russian aviation expert observed: “In terms of high-precision weapons, the most important thing is the management of target coordinates. These are required in three dimensions. The systems which will provide the coordinates includes space and reconnaissance aircraft, unmanned aerial vehicles (UAV) and operational intelligence.” Douglas Barrie, “Russia Considers Net Impact,” *Aviation Week and Space Technology*, (23 December 2002), p. 54.

¹⁷⁰ NGAC staff interview with senior official, 2002.

¹⁷¹ Atkinson, p. 40.

¹⁷² U.S. House of Representatives, *Defense For a New Era: Lessons of the Persian Gulf War* (Washington, D.C.: Government Printing Office, 1992), p. 38.

receive target development and damage assessment from Washington-based intelligence organizations, and at one point resorted to reviewing F-117 and F-111 strike videos to extract time-sensitive intelligence. But even then, target damage data would be received, at best, a day later, while interpreting it at the operational level prompted frequent debates and caused further delays. Meanwhile, in-theater intelligence organizations were left unaware of these workarounds. Adequate coordination with tanker, electronic countermeasures, and reconnaissance aircraft was virtually non-existent, resulting in a loss in sorties and combat effectiveness.¹⁷³

Years later, in 1999, situation awareness was only modestly improved for commanders directing *Allied Force*, moving beyond what was once characterized as “BDA by commercial television” during the Gulf War to “swivel-chair integration,” in which battle managers sought to integrate by themselves the various streams of data fed from stove-piped means and modes of transfer. An incremental improvement at best, it was certainly better than the situation commanders confronted in the Gulf War, when data streams from sensors typically could be sent only to line-of-sight ground stations. In the case of Joint STARS—the prototype airborne ground surveillance system—the theater air commander had to leave his headquarters and travel to the ground station to view the radar display.¹⁷⁴ In contrast, during air operations over Kosovo, satellite links allowed data streams from Predator, Joint STARS, RC-135s, and U-2s to be transmitted directly to command centers.

During *Allied Force*, what was later described as an “inefficient targeting process” also hampered kill chain compression.¹⁷⁵ Because NATO planners had anticipated a short-lived bombing campaign, a well-organized target generation and

review process was not established beforehand. What sufficed instead during the first six weeks proved extraordinarily time consuming and was subject to review and veto by NATO member states, thereby limiting the number of targets that could be struck and resulting in what some critics later termed “*ad hoc* targeting.”¹⁷⁶

Also evident was the absence of critical command and control functions, which might have facilitated prosecuting fleeting targets of opportunity. In his analysis of the campaign, Ben Lambeth of RAND observed that, on the first night of the war, “there was no assigned strategy cell, no flexible targeting cell, no established guidance, apportionment and targeting process, and no BDA team in place.”¹⁷⁷ The end result was a kill chain cycle that, in the words of one official, “three to four hours is the best we can do” from identifying the target to delivering a weapon.¹⁷⁸ As Lambeth points out, there was no data link to transmit near-real time information to strike assets for time-sensitive targeting missions. Although platforms such as Joint STARS, Predator, U-2, and the RC-135 could transmit data directly to controllers in the Combined Air Operations Center (CAOC) in Vicenza, Italy, battle managers were often unable to utilize these data streams in a timely fashion.¹⁷⁹

Despite these obstacles, the kill chain cycle was significantly compressed during *Allied Force*. Whereas in *Desert Storm*, the targeting cycle for the Tomahawk Land Attack Cruise Missile (TLAM) took days, in *Allied Force* the cycle was reduced to 101 minutes, and to double-digit minute response times during *Enduring Freedom*.¹⁸⁰ There are numerous reasons to explain this feat, including streamlined shipboard launch procedures and reduced mission planning requirements owing to improved guidance systems on the Tomahawk. But airborne platforms

¹⁷³Thomas A. Keaney and Eliot Cohen, *Gulf War Air Power Survey [GWAPS] Summary Report*, (Montgomery: Air War College, 1993), p. 231.

¹⁷⁴Scales, p. 168.

¹⁷⁵Lambeth, p. 186.

¹⁷⁶Ibid., p. 181.

¹⁷⁷Ibid., p. 211.

¹⁷⁸Roy Bender, “Allies Still Lack Real-Time Targeting,” *Jane’s Defense Weekly*, (7 April 1999), in Lambeth, p. 165.

¹⁷⁹The Air Force Kosovo “lessons learned” report documented that ISR systems operated autonomously. “Each collected and reported independently on separate reporting systems. This caused the air operations center to be filled with more than 60 separate displays, each with different information. That presented an incoherent view of the battlespace.” David Fulghum, “Network Warfare: Hope and Hype,” *Aviation Week and Space Technology*, (11 November 2002), p. 33.

¹⁸⁰Mike Mullen, “Capture the Vision,” *United States Naval Institute Proceedings*, (April 2002), p. 37.

were also able to respond more quickly, due to technology improvements that beamed actionable sensor data directly to the cockpit. One such technology improvement is called “RainDrop,” a precise positioning tool allowing targeteers to relate an image provided by a sensor (U-2, satellite, Global Hawk, and Predator) to a NIMA (National Imagery and Mapping Agency) data base, generating a mensurated set of three-dimensional coordinates within minutes. Data can then be relayed to a ship or an aircraft to deliver a precision weapon guided by the space-based global positioning system (GPS). In many cases, the response time was less than 20 minutes from target generation to target destruction, resulting in significant improvements in sortie effectiveness.¹⁸¹

Ironically, the problem with situation awareness in Afghanistan was, perhaps, that too many people were aware of battlefield developments—leading to layers of decision-making that extended, rather than compressed, the kill chain. For example, one report noted that U.S. forces had top Taliban and al Qaeda leaders in its gun sights many times, but was unable to get clearance from higher headquarters to attack them before they dispersed.¹⁸² On one documented occasion, the decision to attack a target positively identified by real time imagery from a Predator UAV was overturned by CENTCOM officials in Tampa, who wanted a second source of target verification. Similar tensions between command staffs and operators in the field are likely to occur in future conflicts as well, particularly as data flows and real time imagery provide senior leaders (both civilian and military) with an incentive to increase their participation in both the control and execution of military operations.

Increased Centralization in Control and Execution

The amount of data travelling over communication networks during *Enduring Freedom*—perhaps 10 times greater than during the Gulf War—clearly gave commanders and warfighters

more real time surveillance, intelligence, and targeting information than in any previous military conflict. Although at times there were gaps in the aggregate operational picture of the battlefield, advances in computers and secure satellite communications since the Gulf War have made it increasingly possible to manage military conflict from a great distance. Therein lies an important trend—the increased centralization of the control and execution of U.S. military operations.

Centralized control bordering on centralized execution has been an issue in modern U.S. civil-military relations since the Vietnam War, when civilian leaders at the highest levels insisted on approving, and in some cases actually selecting targets in North Vietnam for attack. Largely in reaction to this experience, American authorities increasingly empowered the combatant commander in the field with operational command and control of U.S. military forces in theater. Despite this delegation of authority, chain-of-command issues encountered during the Gulf War simply underscored the increased reliance of forward-deployed commanders on rearward military staffs and organizations for battle management guidance and support. Hence the need for technologies, such as the STU-III secure telephone and video teleconferencing, to enable the exchange of critical information between organizations. This migration of data represented the origins of a trend toward increased centralization in control and execution. Indeed, the *Gulf War Air Power Survey (GWAPS)* notes: “[T]he dependence of modern military organizations on vast amounts of information, and the relative ease with which communications technology could disseminate that information, meant that supporting authority would, in some measure, trickle out of the theater.”¹⁸³ Because the command staff in Riyadh relied so heavily upon large staff organizations thousands of miles away to generate key inputs to battle management, the *GWAPS* team concluded that the prevalence of such distant influence might be part of a broader trend. The past two wars suggest that they were right.

¹⁸¹ Milan Vego, “What Can We Learn From Enduring Freedom?” *United States Naval Institute Proceedings*, (July 2002), p. 31. First used to support the JDAM attacks during *Allied Force*, RainDrop became the preferred method used by targeteers in *Enduring Freedom*, providing the majority of ground coordinates used for precision-guided weapons. DoD and NIMA field over 750 RainDrop systems.

¹⁸² Ricks, “Target Approval Delays.”

¹⁸³ Keane and Cohen, p. 248.

Supporting this trend are heightened sensitivities to the laws of war, and in particular legal guidance as to what constitutes a legitimate military target.¹⁸⁴ Thus, whether it is the law or technology that drives increased centralization in command and control, incentives still exist for senior political and military leaders to increase their involvement in operational and tactical planning and execution. In his study of *Allied Force*, Lambeth observed that Gen. Clark had the option to delegate controlling authority of the air campaign to his Joint Task Force Commander, Adm. Ellis in Naples, or his air component commander, Lt. Gen. Michael Short, in Aviano. “Instead,” Lambeth writes, “Clark elected not only to shoulder his diplomatic burdens as NATO’s supreme commander, but also to conduct the air war himself from Brussels....”¹⁸⁵ As coalition politics and legal rules of engagement imposed constraints on the conduct of air operations, frequent video teleconferencing among senior leaders encouraged them to expand their influence. Gen. Short believed the use of video conferencing “improperly allowed senior leadership to reach down to levels they did not need to be involved in.”¹⁸⁶ Similarly, Adm. James Ellis observed that videoconferencing invited “senior leadership to sink to past comfort levels... discipline is required to remain at the appropriate level of engagement and command.”¹⁸⁷

Not surprisingly, videoconferencing and other real time communications links only increased interactions between commanders and planners

located at CENTCOM headquarters in Tampa, in the Pentagon, and at forward locations in Southwest Asia. Indeed, Gen. Tommy Franks, CENTCOM combatant commander, never felt compelled to deploy forward into the theater, observing that “[t]he technology available to us here allows us to do things we never have been able to do, and we wouldn’t necessarily have that if we moved the headquarters forward.”¹⁸⁸ Even more impressive is the fact that Franks enjoyed access to more information, more quickly, than perhaps any other military commander in history. Electronic map displays updated him by the minute, tracking the positions of every military unit, ship and aircraft involved in the war. Also available were live video from Predator drones (some controlled from CONUS), moving target indications from Joint STARS radar, and a variety of multi-intelligence, multi-integrated displays.¹⁸⁹ In short, while there were complaints that it was difficult to coordinate operations in remote locations in Afghanistan—some 7,000 miles and nine time zones away—this was due more to the circadian nature of human decision-making cycles than to the technology of near-real time situation awareness that defies human endurance. Owing to the high political content of armed conflict in a world of high-speed information and the capability to transmit information over global distances in the blink of an eye, there is a high probability that centralized execution—a key military trend in these three conflicts—may be here to stay.¹⁹⁰

¹⁸⁴Richard Betts observed that one of the most striking features in the last two wars is the direct role lawyers played—he dubs them “tactical commanders”—in approving targets. See Betts, “Compromised Command,” *Foreign Affairs*, (July/August 2001), p. 129.

¹⁸⁵Lambeth, p. 193.

¹⁸⁶Interview with Lt. Gen. Mike Short, *PBS Frontline*, 22 February 2000, in Lambeth, p. 192. Gen. Short might also be accused of centralized execution if the story is accurate of the father directing his son, operating an A-10 over Kosovo, to acquire a target that Gen. Short could see on a video image, but his son in the cockpit could not.

¹⁸⁷Ellis.

¹⁸⁸Ron Martz, “From Tampa, Franks on Top of the War: Separation Allowed by Technology,” *Atlanta Journal-Constitution*, (18 April 2002), p. D1. Nevertheless, in an exercise named “Internal Look,” U.S. Central Command recently experimented with a Deployable Joint Command and Control (DJC2) capability based in Qatar in December 2002. The DJC2 system is designed to provide links between subordinate commands in the field and CENTCOM headquarters. See Stephen Trimble, “First Deployable HQ Makes Debut in Qatar,” *Aerospace Daily*, (5 December 2002), p. 3; and Trimble, “Internal Look Gives Deployable HQ First Real-World Challenge,” *Aerospace Daily*, (30 October 2002), p. 4.

¹⁸⁹Thomas E. Ricks, “Beaming the Battlefield Home: Live Video of Afghan Fighting Had Questionable Effect,” *The Washington Post*, 26 March 2002, p. A1.

¹⁹⁰The *Millennium Challenge* experiment, sponsored by U.S. Joint Forces Command (USJFCOM) and held in September 2002, analyzed the effects of global networks on traditional chains of command. According to the director of joint experimentation at USJFCOM: “Results of the experiment suggest that commanders should learn to be comfortable with new challenges to the chain of command....” See Stephen Trimble, “Networks Turning Chain of Command to Web of Command, Officer Says,” *Aerospace Daily*, (21 November 2002), p. 5. Clearly, both technical and operational challenges remain in allowing worldwide military operations to be planned and controlled from a single location in the U.S. See also Phillip S. Mellinger, “Planning for the Next Little War,” *Armed Forces Journal International*, (April 2002), pp. 38-42; and Price Bingham’s letter in response, *Armed Forces Journal International*, (June 2002), p. 4.

INCREASED EMPHASIS ON ADAPTIVE PLANNING AND FLEXIBLE FORCE EMPLOYMENT

The order of magnitude leap in situational awareness has encouraged a second major trend, characterized here and in defense planning documents (most recently in the 2002 Defense Planning Guidance)¹⁹¹ as a move from deliberate to adaptive planning and from rigid to increasingly flexible force employment. While defense planners have for years argued for a move away from “off-the-shelf” plans to a more adaptive process emphasizing the fast-paced nature of crisis action planning, the information revolution is accelerating this shift, not only in pre-conflict planning but also in the execution of combat missions.

The legacy of deliberate planning is proving difficult to discard. Throughout the Cold War, and even for most of the 1990s, U.S. defense policy was shaped largely by hypothetical conflict scenarios, which in turn were used to size the force structure. Between 1953 and 1989, the plausible invasions of Western Europe and South Korea preoccupied U.S. defense planners. Later, following the demise of the USSR and the Persian Gulf War in 1991, notional conflicts with Iraq and North Korea served as “illustrative planning scenarios” to guide U.S. force planning. These scenarios, enormously detailed and focused on operational planning factors such as the enemy order of battle and the time-phased deployment of U.S. forces, became powerful force-sizing constructs. To be sure, the U.S. military conducted a number of successful combat operations in the 1990s that fell outside of the canonical scenarios. But even then, little progress was made in overcoming the rigidity that made it increasingly difficult for the military to adapt quickly to non-standard contingencies.¹⁹² This was evident most recently in the wake of the terrorist attacks on 11, September 2001, when the Bush administration

was pressed to formulate a strategy for military operations in Afghanistan. According to Bob Woodward:

The military, which seemed to have contingency plans for the most inconceivable scenarios, had no plans for Afghanistan, the sanctuary of bin Laden and his network. There was nothing on the shelf that could be pulled down to provide at least an outline. This was not a surprise for the secretary of defense. Now [Rumsfeld] turned to [General Richard] Myers with a message: When I’ve asked to see various plans, I’ve not been happy with what I’ve seen. They are neither imaginative or creative. Clearly the plans are old and have been on the shelf for too long.¹⁹³

We would be remiss in not acknowledging the utility of deliberate planning, as the process of developing operational plans in advance of contingencies normally include useful discussions of campaign objectives, the sequence in which these objectives are to be met, and the forces required to meet them—at least in theory.¹⁹⁴ As the quote above suggests, however, the deliberate planning process also instills an institutional predilection for *scripted* military operations at the expense of *dynamic* military operations. A RAND study conducted in 1994 supports this observation and links the absence of planning adaptiveness—particularly profound during the Cold War—to a strong institutional reluctance to use military force without first exhausting all other policy options and then reconciling political with military objectives when armed conflict is unavoidable. The view that military force should only be used overwhelmingly to defeat aggression further complicated matters, as planning for contingencies that fell short of major theater warfare were largely resisted. Of additional concern was the political feasibility of deploying light and flexible “tripwire” units to demonstrate U.S. resolve without repeating the *Task Force Smith* debacle during the first stages of the Korean War.¹⁹⁵ Ironically, it was the Iraqi invasion of Kuwait which reinforced

¹⁹¹ Press backgrounder by senior U.S. Department of Defense official on the 2002 Defense Planning Guidance, 10 May 2002. Available online at: http://www.defenselink.mil/news/May2002/t05102002_t0510dpg.html.

¹⁹² See Paul K. Davis, “Institutionalizing Planning for Adaptiveness,” in Paul K. Davis, ed., *New Challenges for Defense Planning* (Santa Monica: RAND Corporation, 1994), pp. 73-100.

¹⁹³ Woodward, *Bush at War*, p. 25. Note that General Richard Myers, USAF, was at the time the Vice-Chairman of the Joint Chiefs of Staff.

¹⁹⁴ We are indebted to David Ochmanek for pointing out that deliberate planning and dynamic military operations are not mutually exclusive enterprises, and that first-rate militaries should be expected to plan deliberately in anticipation of armed conflict(s) and still conduct dynamic military operations when that conflict(s) occurs.

¹⁹⁵ Davis, p. 78. He argues, for example, that the Kuwait invasion probably would have been deterred if the U.S. had deployed light forces into Kuwait backed by tactical air in Saudi Arabia.

the need for the U.S. military to begin to move beyond canonical Cold War scenarios and embrace more adaptive approaches to military planning.

In the minds of U.S. planners, Iraq did not conform to Cold War images of the enemy, that of a Soviet-style military mobilizing for a *blitzkrieg*. The experience, as a result, inspired a trend in military policy circles toward treating each conflict as so unique that it requires *ad hoc* planning.¹⁹⁶ In this vein, the Gulf War was a “prototypical example of a nonstandard scenario.”¹⁹⁷ Indeed, the surprise attack and the lack of warning time for *Desert Shield/Desert Storm* are among the reasons that war has been considered unique. Nevertheless, U.S. Central Command was able to use an off-the-shelf planning document—Operations Plan 90-1002—to prepare for and execute a concept of operations to oust Iraqi forces from Kuwait.¹⁹⁸ With nearly six months to deploy overwhelming combat power and train its forces for the counteroffensive, there was plenty of time to adjust the plan to reality. Yet, once the air war started, it became apparent that the Air Tasking Order (ATO), as a scripted plan for servicing targets, was not flexible enough to cope with a changing battlefield and support dynamic military operations.

The ATO...was effective in managing the volume of sorties generated to concentrate coalition air power against Iraq, especially during the pre-planned structured stages of the campaign.... After the first two days, late completion of the ATO impacted operations. As hostilities progressed and key targets had been struck (with delayed BDA) the ATO proved increasingly unresponsive to rapidly moving events.... The ‘kill box’ concept was an improvement, as it allowed decentralized target selection and coordination with airborne assets for real time target priorities...¹⁹⁹

The Air Force might disagree with this contention, arguing that the ATO facilitated a scheduled flow of sorties, some of which were retargeted either before or after takeoff. Nevertheless, in *Desert Storm*, approximately 80% of the targets attacked were selected before the aircraft left their base or ship. The remaining 20% included time-sensitive targeting priorities, the most famous of which later became known as “the great Scud hunt.” Owing to the political significance of Iraqi missiles launched at Saudi Arabia and Israel, considerable effort was dedicated to attacking Iraqi mobile Scud launchers, but enemy deception and “shoot-and-scoot” tactics negated these strikes. The fact that 20% of all F-15E sorties flown during the war were apportioned to Scud hunting, all to negligible military effect, brought the killing of mobile targets to the forefront of desired future capabilities.

While the Air Force pursued these capabilities in the 1990s, air operations over Kosovo enjoyed little success when it came to destroying elusive targets.²⁰⁰ *Allied Force* further revealed a systemic weakness in the dynamic command and control of air operations against time-critical targets, a situation aggravated when NATO emphasized the “flex targeting” of Serbian fielded forces in Kosovo. And, to make matters even worse, NATO failed to establish a smooth mechanism to develop, review, and approve an expanding target list throughout the various levels of NATO command and responsibility.²⁰¹ The subsequent scramble to streamline the planning and targeting process, when it became apparent that the air war would be a lengthy one, led USAF commander (and future USAF Chief of Staff) Gen. John Jumper to argue that the Air Force needed to start thinking of the air operations center as a “weapons system,” with an aim to improve the planning and managing of an air campaign.²⁰²

¹⁹⁶D. Robert Worley, “Learning to Cope with Asymmetry’s Uncertainties,” unpublished paper supporting the Army/Marine Corps Warfighter Working Group, 21 May 2001. Worley also notes a trend from permanent to temporary commands.

¹⁹⁷Davis, p. 73.

¹⁹⁸Woodward, p. 8.

¹⁹⁹Vice Admiral S.R. Arthur, “Quick Look—First Impressions Report,” 21 March 1991. Available online at <http://www.history.navy.mil/wars/dstorm/ds6.htm>. Targeteers designed “kill boxes,” 30 nautical miles on each side, as the operating areas for attack aircraft. A designated target might be inside the box; “pop-up” targets within the box would also be subjected to attack.

²⁰⁰For more on this point, see Alan Vick et al., *Aerospace Operations Against Elusive Ground Targets* (Santa Monica: RAND Corporation, 2001), pp. 11-28.

²⁰¹Lambeth, p. 186.

²⁰²Ibid., p. 202.

Gen. Jumper understood the need for flex targeting for all strike platforms in general but particularly for the B-2 bomber, which launched its combat missions over Serbia from Whiteman AFB, Missouri—a 14-hour flight. The B-2 could plan an attack on a SAM position known hours earlier but adjust its sights on the movable target before weapons release using its radar to update the GPS-guided bomb. Gen. Jumper visited the B-2 crews to discuss the requirements of flex targeting and was pleased with the result. “On the first night, these guys, with the new process at work, knocked out two SA-3 sites that we had given them only a couple of hours out from the targets.”²⁰³

In *Allied Force*, the USAF estimates that 43% of aimpoints were targeted after aircraft launched.²⁰⁴ Air operations in Afghanistan again confirmed the strategic, operational, and tactical advantages of dynamic command and control. Approximately 80% of U.S. Navy sorties were provided with targets after launch, almost doubling the percentage rate from *Allied Force*. Indeed, the need for “flexibility” in conducting dynamic military operations was underscored by Secretary Rumsfeld in his testimony before Congress in May 2002:

I'd like to mention a couple of lessons from Operation Enduring Freedom.... First is flexibility. The war in Afghanistan was not a war that the U.S. forces had planned to fight. There was no war plan on the shelf. There were no pre-positioned stocks of equipment or basing agreements with neighboring countries.... U.S. forces will be confronted with future surprises, for which they will also require flexibility. U.S. forces must not only have a flexible mindset, they will also need capabilities that are more flexible and capable of adapting to a wide variety of circumstances.²⁰⁵

A DRAMATIC DECLINE IN U.S. CASUALTIES

A third major trend evidenced in the three conflicts is the dramatic decline in U.S. casualties as compared with previous large-scale U.S. military operations. The United States suffered 34,000 dead during the three years of the Korean War, with 58,158 killed in Indochina between 1961 through 1975. In contrast, U.S. forces suffered 146 killed over 45 days of combat during the Gulf War, or a fatality rate of 3.2 per day. With simple extrapolation, the 146 killed in the Gulf equates to roughly 17,760 dead over a 15-year span, or about 30% of the combat losses suffered in Vietnam.

In *Allied Force*, U.S. forces suffered no losses; in *Enduring Freedom*, 16 U.S. personnel were killed between October 2001 and August 2002.²⁰⁶ Combat losses on the part of adversaries, however, remain unverified. The most comprehensive public analysis of Iraqi losses in *Desert Storm* concluded that a total of 1,500 Iraqi soldiers were killed and about 3,000 wounded (with civilian casualties reaching 2,500-3,000 at the maximum).²⁰⁷ Serbian military losses have not been revealed, but civilian deaths were estimated at 500.²⁰⁸ Taliban and al Qaeda military losses are unknown (some estimates claim 5,000 dead); civilian casualties are estimated at 500. Overall, U.S.-led forces achieved remarkable military results with very few friendly casualties. Indeed, one needs to go back far in history (such as the Battle of Omdurman in 1899 or the Spanish campaigns against the Incas and the Aztecs in the sixteenth century) to find such favorable exchange ratios.²⁰⁹

The U.S. military has a long tradition of substituting firepower for manpower but, even with such efforts, casualty counts in Korea and

²⁰³ Gen. John P. Jumper, “Jumper on Airpower,” *Air Force Magazine*, (July 2000), pp. 41-43. See also Rebecca Grant, *The B-2 Goes to War* (Arlington: IRIS Press, 2001), pp. 78-82.

²⁰⁴ Data provided in an interview with Dr. Rebecca Grant, IRIS Independent Research, 23 September 2002.

²⁰⁵ The Honorable Donald Rumsfeld, Testimony before the Senate Armed Services Committee, 16 May 2002. Available online at: <http://www.defenselink.mil/speeches/2002/s20020516-3secdef.html>.

²⁰⁶ “U.S. Casualties in OEF since October 2001,” *The New York Times*, 21 December 2002. Note that an additional 23 Americans died in accidents.

²⁰⁷ See John Heidenrich, “The Gulf War: How Many Iraqis Died?” *Foreign Policy*, (Spring 1993), p. 124, for an analysis of Iraqi military losses; and Human Rights Watch, *Needless Deaths*, for an assessment of civilian casualties.

²⁰⁸ Human Rights Watch, *Civilian Deaths*.

²⁰⁹ In the battle of Omdurman in 1899, Mahdi forces suffered 10,000 dead and 16,000 wounded. British forces suffered 48 dead and 382 wounded. At the battle of Cajamarca in 1532, 168 Spanish soldiers “crushed a Native American army 500 times more numerous, killing thousands of natives while not losing a single Spaniard.” Jared Diamond, *Guns, Germs and Steel* (New York: W.W. Norton, 1999), p. 75.

Vietnam numbered in the tens of thousands. Are these declining U.S. casualties indicative of a trend? The reasons for such low loss rates lie in the emergence of new operational capabilities, superior and survivable military platforms, and guidance from U.S. political and military leaders to limit the exposure of U.S. forces to hostile fire.

The Impact of New Operational Capabilities

In all three conflicts, the U.S. engaged the enemy from relatively safe distances and with its unparalleled comparative advantage: the overwhelming use of air power to coerce and/or destroy the enemy. This, in turn, resulted in lopsided victories on the ground, to the point where conventional ground forces are now viewed as more valuable for their ability to maneuver and fix targets on a non-linear battlefield than for their organic firepower. Indeed, with the exception of a 100-hour ground operation in *Desert Storm* and the limited counterinsurgency operations against remnant Taliban and al Qaeda forces in Afghanistan, the U.S. did not commit significant ground forces to engage the enemy, whereas in both Korea and Vietnam, ground forces were in constant engagement (or the threat of engagement) for years.

Hence, throughout the three wars considered here, the U.S. relied more heavily on aircraft to deliver firepower which, in the case of Serbia and Afghanistan, reduced the number of personnel exposed to enemy fire. To employ aircraft survivably, the United States used tactics to minimize the threat. Aircraft flew at medium and higher altitudes to reduce exposure to pervasive and persistent low-level threats. Precision weapons in growing numbers allowed properly equipped aircraft to strike effectively from these safer altitudes. Stealth aircraft and cruise missiles also allowed commanders to strike targets in heavily defended areas with reduced risk to personnel. Finally, expanded roles for UAVs provided commanders with capabilities to acquire battlefield intelligence and, in the case of Afghanistan,

deliver ordnance at lower altitudes without exposing personnel to risk.

U.S. forces also succeeded in engaging adversaries outside the range of many of their weapons, denying the adversary the ability to bring firepower to bear on American forces. In the Gulf War, U.S. air forces largely flew above the effective range of Iraqi air defense units that had not been destroyed or suppressed, inducing rampant fear and psychosis among surviving units.²¹⁰ On the ground, U.S. tanks engaged at night with systems outranging Iraqi armor. Later, in operations over Kosovo and Serbia, air power centric military campaigns reduced the number of American systems and personnel at risk, while operating aircraft at higher altitudes reduced the number and scale of potential threats. Finally, in Afghanistan, Taliban and al Qaeda forces were simply incapable of engaging U.S. aircraft delivering precision weapons (referred to once by a Taliban supporter as “an infidel army perched up in the skies”).²¹¹ U.S. Special Forces, typically operating outside effective enemy engagement ranges, targeted many of these weapons.

Highly Survivable Combat Platforms

Stealth technology employed in all three wars greatly reduced adversary capabilities to detect, track, and engage U.S. aircraft. Meanwhile, non-stealthy aircraft were equipped with threat-warning receivers and countermeasures (flares, chaff, and jammers) to react to threats. Supporting aircraft were also on hand to enable choreographed combat missions in non-permissive threat environments, with electronic warfare aircraft and anti-radiation missiles suppressing SAM and AAA threats to strike packages. Similarly, on the ground, lightweight composite body armor saved many lives. M-1A1 Abrams tanks were equipped with composite ceramic and steel “Chobham” armor, the capability to identify and engage enemy armor at night over extended ranges while on the move (Iraqi tank crews were typically reduced to firing at muzzle flashes),²¹²

²¹⁰For more on this point, see Stephen T. Hosmer, *Effects of the Coalition Air Campaign against Iraqi Ground Forces in the Gulf War* (Santa Monica: RAND Corporation, 2002). The original classified version of this study was completed in 1993.

²¹¹Susan B. Glasser, “Pakistani Families Confront Toll of Forbidden Holy War; Sons’ Decisions to Defy Government Often Prove Fatal,” *The Washington Post*, 2 December 2001, p. A26.

²¹²U.S. Department of Defense, *Conduct of the Persian Gulf War*, (1992). Available online at: <http://www.fas.org/man/dod-101/ops/docs/cpgw.pdf>

and key survivability features such as compartmentation to reduce the chances that armor penetration would kill the crew.²¹³ In *Desert Storm* (the only one of these wars to feature a tank battle), there were instances where U.S. tanks suffered direct hits with minimal or no casualties.²¹⁴

Guidance to Limit the Vulnerability of U.S. Forces

Finally—and a factor that should not be underestimated—U.S. decision-makers deliberately sought to avoid casualties. This was due primarily to the widespread perception held among U.S. political and military leaders, as well as by our adversaries, of the impact that American casualties could have on public support for conflict. A legacy of the Vietnam era, when mounting U.S. casualties combined with the lack of clear objectives resulted in gradually eroding public support for the war, casualty rates have a demonstrated impact on public opinion. One study indicated that the perceived stakes involved in the conflict at hand often are most important in weighing friendly losses. Conflicts for limited ends or unclear objectives can quickly lose support if casualties are incurred (as was the case of Somalia in 1993) and the political leadership cannot credibly explain the reasons for those losses.²¹⁵ Edward Luttwak has observed that, following the Vietnam War, “when senior Pentagon officials and military officers discuss how the United States might intervene...the likelihood of combat and the probable magnitude of U.S. casualties are invariably dominant in their deliberations.”²¹⁶

The “Vietnam syndrome,” as it is still called today, quickly surfaced following Iraq’s invasion of Kuwait. Saddam Hussein’s promise of a “Mother of all Battles” engendered a debate in

Washington about whether and how to pursue a war. Given the prospect of high U.S. casualty rates during the ground offensive and Saddam’s perceived insensitivity to Iraqi casualties, the first Bush Administration undertook a public relations campaign to convince Americans of the value of driving Iraq from Kuwait—even if it cost thousands of American lives.²¹⁷

Similarly, casualty concerns factored into military preparations for the war. Before hostilities commenced, USAF Brig. Gen. Buster Glosson, who ran the “Black Hole” air operations center, told aircrews: “The outcome of the war is not in question. The only issue is how many body bags we’re going to send back across the Atlantic. The bottom line is that there’s not a damn thing worth dying for in Iraq. Nothing.”²¹⁸ The “Vietnam syndrome” was also evident in wartime planning, when the air campaign in Iraq was extended beyond original plans to maximize the combat degradation of heavily entrenched Iraqi forces in Kuwait. This decision was due in no small part to the potential for high U.S. casualty rates in conducting offensive operations against the Iraqi ground force.

In the end, casualty considerations did inhibit the conduct of the air campaign. In the aftermath of a large daylight raid of 90 aircraft (Attack Package Q) over Baghdad, which encountered heavy enemy opposition and resulted in the downing of two U.S. F-16s, coalition planners chose to limit future strikes on Baghdad. Package Q’s losses, as well as related collateral damage, caused Lt. Gen. Horner to rely on stealth and smaller strike packages escorted by jammers and defense suppression assets to attack targets in Baghdad.²¹⁹ Since stealthy F-117s comprised only about 2.5% of the force

²¹³ Scales, p. 270.

²¹⁴ For example, an Iraqi T-72 round hit an M-1 in the rear of its turret, penetrating the armor and detonating the ammunition in the compartmented storage area, setting off about 30 main-gun rounds. However, the blast escaped through the blowout panels and the M-1’s fire suppression system kept the fire at bay long enough for the crew to escape. Overall, of the 1,772 M-1 tanks engaged in operations, only 18 were hit and damaged or destroyed. *Conduct of the Persian Gulf War*, pp. 750-751.

²¹⁵ Eric V. Larson, *Casualties and Consensus: The Historical Role of Casualties in Domestic Support for U.S. Military Operations* (Santa Monica: RAND Corporation, 1996).

²¹⁶ Edward N. Luttwak, “A Post-Heroic Military Policy,” *Foreign Affairs*, (July/August 1996), p. 36.

²¹⁷ As one measure of the concern over casualties, the production of body bags—“human remains pouches”—had been accelerated and more than 16,000 had been stockpiled for the war. See Gordon and Trainor, p. 183.

²¹⁸ Atkinson, p. 65.

²¹⁹ *U.S. Department of the Air Force, Gulf War Air Power Survey [GWAPS], Operations and Effectiveness, Volume II* (Washington D.C.: Government Printing Office, 1993), p. 176.

and electronic warfare aircraft were in short supply, this decision greatly reduced the coalition's military and political effectiveness.²²⁰

Concerns over casualties also determined how the U.S. military would fight in *Allied Force*. In his remarks to the American public at the outset of the air operation, President Clinton placed clear boundaries on the U.S. contribution to NATO's military campaign: "I do not intend to put our troops into Kosovo to fight a war."²²¹ With this statement, Clinton declared that Kosovo did not merit the death of American servicemen and women. To some extent, the Serbs capitalized on this hesitancy, continuing ethnic cleansing operations while concealing and dispersing ground forces in Kosovo. Without a credible ground threat, Serbian units were not compelled to mass forces defensively to repel an invasion.

As one might expect, the tragic events of September 11, 2001 have dampened casualty sensitivity among political and military decision-makers, at least to some extent. Referring to the 1993 Mogadishu debacle, Gen. Peter Pace, USMC, the current Vice Chairman of the Joint Chiefs of Staff, revealed that "[w]e were told to circle the wagons and not get Americans hurt.... If people think you're going to sit there and you're afraid to attack, they're going to pick at you. 9/11 changed the American mind-set.... We're going to take the war to the enemy."²²² Thus far in Afghanistan, casualty rates have been remarkably low during what has amounted to a high-technology manhunt for remnant Taliban and al Qaeda forces.

Throughout these three conflicts, U.S. combat losses remained very low, an achievement all the more remarkable in light of adversary objectives to kill as many Americans as possible. Will this trend continue into the future? The answer depends on U.S. guidance and/or reluctance to place its forces in harm's way; the use and availability of U.S. and proxy ground forces; success in protecting aircraft; and how adversaries respond to U.S. force deployments (such as fielding and delivering weapons of mass destruction).

EXTENDED RANGE OPERATIONS

The fourth military trend—the increasing emphasis on extended range operations—stems from the anti-access/area denial challenge and the migration of conflict to distant and remote regions of the globe. For many years, the United States planned its tactical air forces assuming the availability—and relative invulnerability—of forward operating bases. From the Gulf War to Afghanistan, trends suggest those assumptions are no longer assured and must be hedged against to guarantee U.S. abilities to project firepower over long distances.

During the Cold War, the U.S. concentrated primarily on two theaters: Europe and Korea. The resulting global basing architecture had a powerful influence on the design and limits of U.S. power projection capabilities. The relatively short distances from U.S. forward bases to likely engagement zones resulted in an emphasis on tactical fighter/attack aircraft with unrefueled operating ranges of 350-500 nautical miles (NM). From bases in Western Europe and Korea, these ranges placed most Warsaw Pact and Korean military targets within striking distance.

Following the Soviet invasion of Afghanistan and the 1979 Iranian revolution, the U.S. developed contingency plans to defend Persian Gulf oil fields from a potential Soviet drive through Iran. Such plans stimulated a renewed search for bases, host nation support, and access to facilities among Gulf allies such as Oman and Saudi Arabia. But it also introduced a new emphasis on range, owing to the geography of the region.²²³

Aside from geography, access and force protection issues have also led to a surge in extended range operations. In the Gulf War, F-117s and F-111s routinely flew 900-1000 NM sorties from their bases in southwest Saudi Arabia to Iraq. B-52s flew about 2400 NM from Diego Garcia to the Straits of Hormuz (and in the first day of the air campaign, from CONUS) to deliver conventional cruise missiles. Carrier aircraft in the Red Sea mounted 600 NM sorties against

²²⁰ Cruise missiles were also employed to maintain pressure on Iraqi leadership during the day.

²²¹ David Halberstam, *War in a Time of Peace: Bush, Clinton, and the Generals* (New York: Scribner, 2001), p. 423.

²²² Evan Thomas et al., "One Year Later: Four Lives, Their Faith And Fears," *Newsweek*, 9 September 2002, p. 36.

²²³ For an overview, see Christopher J. Bowie, *Concepts of Operations and USAF Planning for Southwest Asia* (Santa Monica: RAND Corporation, 1984).

Iraq. F-15s flew lengthy, 10-hour missions to conduct combat air patrols on the Iraq/Iran border to intercept fleeing Iraqi aircraft.

Although, at first glance, distances would appear shorter in Europe, operations against Serbia witnessed even longer average mission radii than in Iraq.²²⁴ Aircraft based in Italy had to cover distances of only 300-350 nautical miles, but F-15Es operating from the UK routinely flew missions of 1000 NM radii. UK-based B-52s flew combat missions of 2500 NM radii or more because France denied them overflight rights. B-2s originating from the U.S. mainland mounted the first sustained intercontinental bombardment campaign in history, routinely flying 33-hour, 9300 NM roundtrip missions from Whiteman AFB in Missouri to targets in Serbia.

Aircrews were subjected to even longer missions to reach Afghanistan during *Enduring Freedom's* initial months. B-2s flew six 44-hour missions from Whiteman to Afghanistan (with recovery in Diego Garcia), the longest bombing missions in history. B-1Bs and B-52s flew from Diego Garcia to Afghanistan, routinely delivering precision weapons over distances of 2500 NM. Air Force F-15Es flew from Kuwait to Afghanistan and back—a distance of 3000 NM. And carrier-based aircraft routinely flew 700 NM radii sorties.

In addition to area denial and access issues, requirements for time-sensitive targeting and combat patrol missions have also encouraged longer sortie duration and a greater need for loiter endurance, particularly for air crews operating short-range aircraft. In *Desert Storm* and *Allied Force*, U.S. fighters often orbited for hours waiting for a fleeting target to appear. Bombers armed with the Joint Direct Attack Munition (JDAM) did much of the same in *Enduring Freedom*.²²⁵ These new stressful demands—on both aircrews and aircraft—will likely characterize future air operations, particularly as enemies employ increased mobility and deception

to minimize their vulnerability to U.S. air power.

Figure 1 illustrates this trend for marked increases in sortie duration, evident by the number of aerial refueling sorties flown as a percent of total sorties. In *Desert Storm*, total tanker sorties amounted to about 12% of total sorties, whereas during *Allied Force*, tanker sorties increased to almost 20%. To support persistent air operations over Afghanistan, tanker sorties increased to about 25% of total sorties flown during *Enduring Freedom*—more than double the percentage of the campaign against Iraq. This suggests that future conflicts, particularly those in access-sensitive and remote areas, will demand renewed investments in aerial refueling and long-range strike platforms, the combination of which will ensure U.S. power projection capabilities.

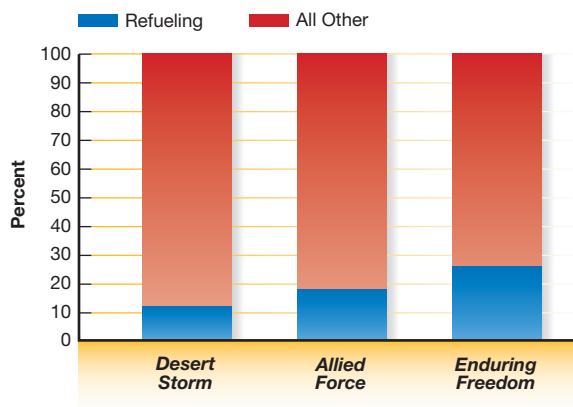


Figure 1: Tanker Sorties as a Percent of Total Sorties Flown²²⁶

Larger long-range aircraft can reduce some of the pressure on the future tanker force. Simple physical principles dictate that larger aircraft are inherently more efficient than smaller aircraft. For example, a B-2 stealth bomber is approximately three times more efficient than an F-15E when measuring the amount of fuel required to carry a single JDAM one mile. Similar ratios hold for other large aircraft compared with fighters.²²⁷ The trend in long-range operations should,

²²⁴ See *Air War Over Serbia*, p. 12, for discussion.

²²⁵ Keith B. Richburg and William Branigin, "Attacks from Out of the Blue: US Airstrikes Hit Taliban Military Targets and Morale," *The Washington Post*, 18 November 2001, p. A24.

²²⁶ Data for *Desert Storm* from *GWAPS, Vol. V*. Data for *Allied Force* from *Air War Over Serbia Fact Sheet*. Data for *Enduring Freedom* from The White House, "Operation *Enduring Freedom*: One Year of Accomplishments." Available online at: <http://www.whitehouse.gov/infocus/defense/enduringfreedom.html>.

²²⁷ A B-2 burns fuel at an average rate of about 55 lbs. per mile of flight, while an F-15E burns at an average rate of 17 lbs. per mile of flight (calculated by taking maximum fuel and dividing by total distance flown—fuel efficiency at altitude would be better for both aircraft). One B-2 carries sixteen 2,000 LB JDAMs, so it takes 1.5 lbs. of fuel to transport one JDAM one mile. One F-15E carries four 2,000 lb. JDAMs, which means it takes 4.4 lbs. of fuel to transport one JDAM one mile.

therefore, increase the value of long-range, large-payload aircraft. Data from the three conflicts bear this out. Figure 2 illustrates both the number of aircraft and weapons delivered. In general, the bomber force delivered an increasing percentage of total weapons (32% in the Gulf War, about 50% in *Allied Force*, and about 70% in *Enduring Freedom*). In the Afghan conflict, the inherent efficiency of larger aircraft is most starkly revealed: land-based and sea-based fighter aircraft flew 90% of the sorties, but accounted for 30% of total weapons expended.

THE DIMINISHING ROLE OF HEAVY GROUND FORCES

A final, somewhat controversial, military trend is the diminishing role of heavy ground forces in the three wars examined here. Whereas deployable, highly maneuverable ground forces that can leverage the effects of modern precision weaponry are integral to dynamic military operations against elusive enemies—as witnessed most recently in Afghanistan—there is a mismatch between the capabilities of slower-deploying heavy ground forces and the demands of the future operating environment. This is not to say, however, that we cannot envision roles for heavy ground formations against similarly equipped adversaries over favorable terrain and when sufficient time and lift is available for deployment, as might transpire in a future confrontation with Iraq. Already, in preparation for such a conflict, the battle staffs of the U.S. Army V Corps (consisting of the 1st Armored Division and the 1st Infantry Division) have been deployed to Kuwait. Yet, while heavy ground units will inevitably be part of another attack on Iraq, trends suggest their role on the future battlefield will decline as the U.S. relies on other, more deployable means to import heavy and sustained firepower.

Secretary Rumsfeld recently noted: “Looking at what was overwhelming force a decade or two decades ago, today you can have overwhelming force, conceivably, with lesser numbers because the lethality is equal to or greater than before.”²²⁸

This trend is underscored further in Figures 3 and 4. Figure 3 compares the composition of force deployments in each of the three conflicts considered. It highlights an obvious but important fact: the deployed force in the Gulf War was about nine times larger than the forces deployed in *Allied Force* and *Enduring Freedom*. Figure 4 reduces the scope even further by comparing the forces deployed in each operation, revealing that land-based air and maritime components formed a substantially greater percentage of the deployed force in *Allied Force* and *Enduring Freedom* than in *Desert Storm*.

In view of the migration of future conflict to distant and remote areas, these graphs suggest strongly that maritime and air expeditionary forces, more so than ground forces, will form the mainstay of future U.S. power projection capabilities. The reasons for this appear relatively straightforward: maritime forces are less dependent on forward basing than either land-based air or ground forces. Moreover, both maritime and land-based air forces typically can bring combat power to bear more quickly than ground forces, have a much smaller logistical footprint in theater, and will incur lower casualty rates than conventional ground force options. Although heavy ground forces have been deployed to Southwest Asia for possible military operations against Iraq in early 2003, the strategic responsiveness of these combat units will remain an open question in evaluating deployment options for future conflicts.²²⁹

²²⁸ Ibid.

²²⁹ For more on this point, see Alan Vick et al., *The Stryker Brigade Combat Team: Rethinking Strategic Responsiveness and Assessing Deployment Options* (Santa Monica: RAND Corporation, 2002).

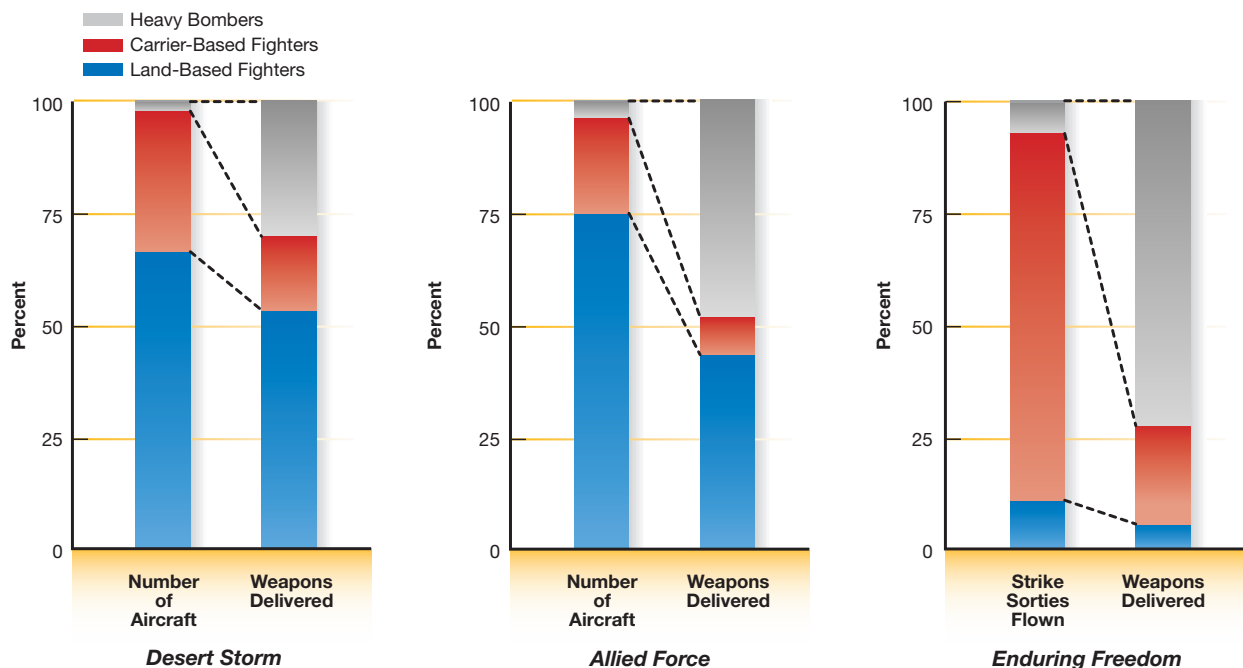


Figure 2: Contributions of U.S. Large and Small Aircraft in Three Wars²³⁰

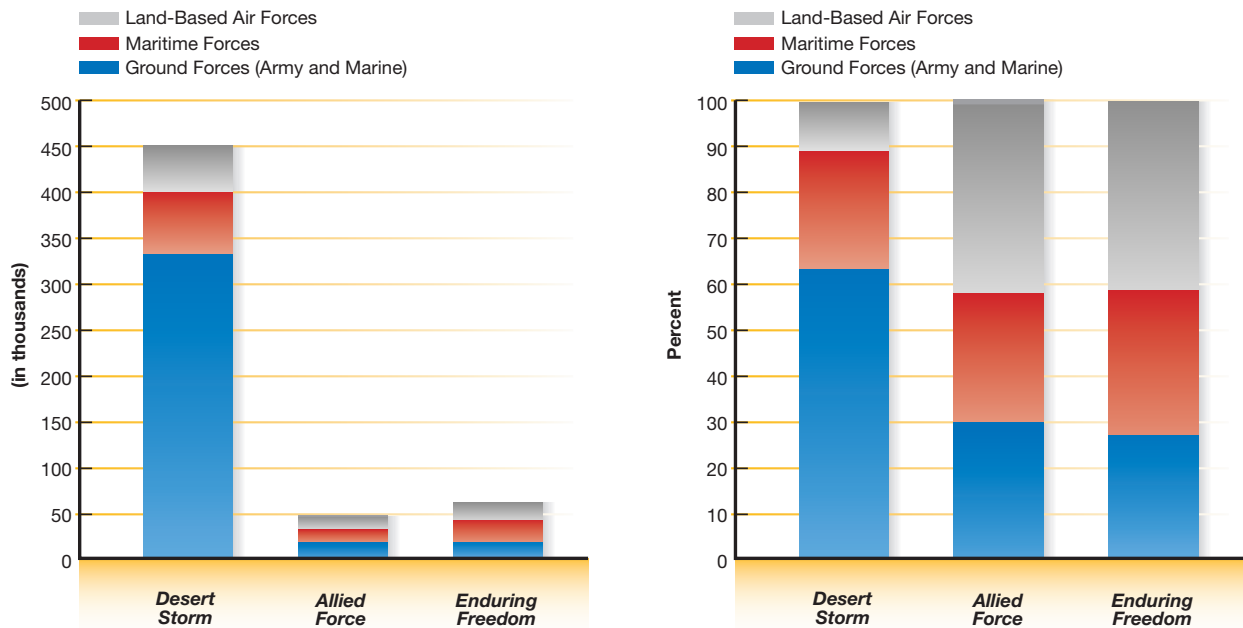


Figure 3: Deployed Forces in Three Wars²³¹

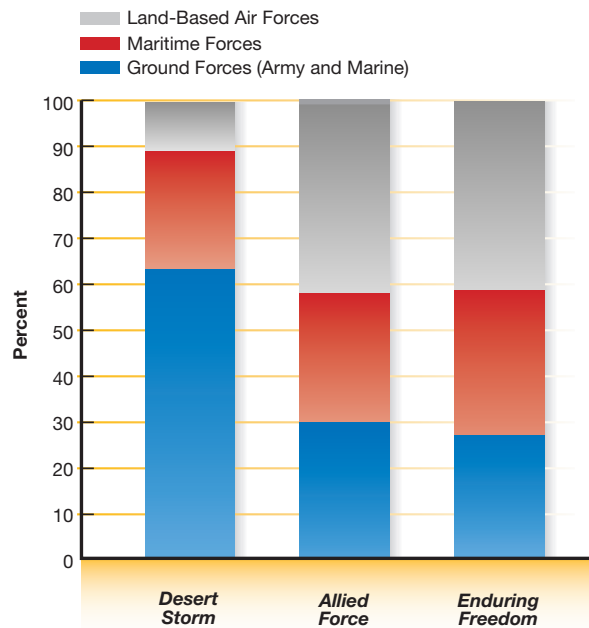


Figure 4: Deployed Forces by Component²³²

²³⁰ GWAPS, Vol. V; Air War Over Serbia Fact Sheet; and William Arkin, "Weapons Total From Afghanistan."

²³¹ The chart is derived from the following numbers:

	Desert Storm	Allied Force	Enduring Freedom
Ground Forces (Army and Marine)	333,084	14,665	16,000
Maritime Forces	67,851	13,810	25,000
Land-Based Air Forces	48,679	20,751	25,000

Data for Desert Storm from GWAPS, Vol. V, p. 51 for deployed forces on 16 January 1991. Data for Allied Force from Air War Over Serbia Fact Sheet, p. 2. Data for Enduring Freedom from the Honorable Donald Rumsfeld, Annual Report to the President and the Congress (Washington D.C.: Office of the Secretary of Defense, 2002), pp. 118 and 140. Available online at: <http://www.defenselink.mil/execsec/adr2002/index.htm>. No data available for USN and USMC, so the authors estimated Marine numbers at 4,000 (assuming two Marine Expeditionary Units were deployed) and Navy numbers at 25,000 (assuming three carrier battle groups at 7,000 personnel each and another 4,000 for other ships and headquarters staff).

²³² Ibid.

IV. TECHNOLOGIES ENHANCING U.S. MILITARY ADVANTAGES

This section identifies four key technology trends that impacted the conduct of military operations in the three conflicts examined here and, more importantly, lend to our understanding of U.S. force applications in future conflicts. Advances in precision weaponry are perhaps the most dominant trend and, to be sure, will be featured along with related trends in munitions development and modes of delivery. Equally important are trends in sensor development and integration (between platforms and systems) expected to enable network-centric warfare, an emerging operational concept that relies on high quality sensors and increased automation in the speed, distribution, and integration of data. Also noteworthy here is the combination of stealth and electronic warfare, first showcased in the Gulf War, that increases the survival and effectiveness of U.S. airpower in high-threat environments. Finally, the three conflicts underscore the potential of unmanned aerial vehicles and their military utility above future battlefields.

THE INCREASING UTILITY OF PRECISION WEAPONS

It is no exaggeration to observe that the increased use of air-delivered precision weaponry, as seen in the three conflicts, heralded a new chapter in the American way of war.²³³ That is not to say, however, that the technological push for such weapons is a recent phenomenon. Indeed, military history is filled with attempts to develop increasingly accurate weapons as a means to

exploit a comparative firepower advantage on the battlefield. For examples, one might think of the English longbowmen at the Battle of Agincourt, or perhaps the advances in naval gunnery prior to World War I, which enabled capital ships at the Battle of Jutland to strike at long ranges and with increasing accuracy.²³⁴ However, these were not “smart” weapons, in that the capabilities of the launch platform determined their accuracy; their flight paths could not be changed once fired.

When the German *Luftwaffe* sank the Italian battleship *Roma* using FX1400 guided bombs in 1943, the ability to guide weapons during flight opened up the potential for aircraft to deliver weapons with much greater accuracy. Hence, any target within range of aircraft could presumably be attacked with a much higher probability of hitting the target. Ultimately, the U.S. would deploy aircraft-delivered guided weapons during World War II. Army Air Forces delivered radio-controlled weapons against bridges in Burma during that conflict, and improved versions were used in the Korean War.²³⁵ Later, in Vietnam, the USAF and USN used laser designators and other aids to guide aircraft-delivered ordnance to their targets, with an exponential increase in accuracy. Equipped with these new precision guided munitions (PGMs), between 1968 and 1972, the USAF delivered 28,000 laser and electro-optical guided weapons.²³⁶ However, in spite of PGM performance in Vietnam, the implications of precision weaponry did not become fully apparent until the 1991 Gulf War.

²³³The classic work on this subject is Russell F. Weigley, *The American Way of War: A History of United States Military Strategy and Policy* (Bloomington: Indiana University Press, 1973). The *GWAPS* report questioned whether Desert Storm was a revolution in warfare and concluded that, while the signposts for dramatic change were evident, the revolution was not yet at hand. Eliot Cohen has argued that the war over Kosovo, with air-delivered precision weapons and zero U.S. casualties, “crystallized” that change. See Cohen, “Kosovo and the New American Way of War,” pp. 38-62.

²³⁴John Keegan, *The Face of Battle* (New York: Viking Penguin, 1976); and Jon Tetsuro Sumida, *In Defence of Naval Supremacy: Final Limitation, Technological Innovation, and British Naval Policy, 1889-1914* (New York: Routledge, 1993).

²³⁵Wayne Thompson, *To Hanoi and Back: The USAF and North Vietnam, 1966-1973* (Washington D.C.: Office of Air Force History, 2000), p. 233.

²³⁶*Ibid.*, p. 219.

Indeed, from Vietnam through the end of the Cold War, American air planners relied on a concept of operations where aircraft penetrated at very low altitudes (under the radar) to deliver unguided ordnance accurately using on-board electronics and visual cues. Advocates of this approach, which enjoyed broad support in both the USAF and USN, argued that such a policy was far more cost effective than outfitting tactical aircraft with expensive precision weapons, as cheap general purpose bombs were thought to produce equivalent effects at much lower costs. This logic—that it was better and cheaper to use smart airplanes and dumb bombs—prevailed until the outbreak of the Gulf War.²³⁷

Given this preference, it is not surprising that only a very small percentage (roughly 3%) of the USAF's total combat force available at the time of the Gulf War was capable of delivering laser-guided bombs.²³⁸ Compared with the Air Force, the U.S. Navy deployed roughly the same number of PGM-capable aircraft, but did not procure enough laser guidance kits to conduct sustained operations.

Nevertheless, the contrast between precision and unguided weapons was a stark one. *GWAPS* concluded that precision-capable aircraft were at least 13 times more effective in the number of targets

attacked,²³⁹ and analysis concluded that precision weapons delivered by stealthy aircraft (F-117s) were 26 times more effective.²⁴⁰ If a single aircraft with PGMs was equal to or more capable than about 20 aircraft with unguided ordnance, then the 100+ aircraft delivering PGMs during the opening phase of the Gulf War were much more effective than the other 1100 combat aircraft deployed throughout the conflict.

As one might expect given this performance, investments in precision weapons (as well as in the delivery systems needed to employ them) since *Desert Storm* have led to their increased usage, as evident later in operations *Allied Force* and *Enduring Freedom*. Table 2 illustrates this trend in terms of total munitions expended during each of the three conflicts.

The steady rise in the average number of PGMs delivered per sortie also underscores the fact that precision guided weapons have intensified modern air campaigns. Figure 5 reveals that air operations over Kosovo and Afghanistan were much more significant, in terms of intensity, than commonly believed. In *Allied Force*, strike aircraft delivered approximately 0.73 PGMs per sortie, as opposed to 0.32 PGMs per sortie in *Desert Storm*, an increase of over 128%. Similarly, strike aircraft delivered, on average, 1.66 PGMs per

Table 2. Increasing Percentage of Munitions are Precision Guided

	Conflict		
	<i>Desert Storm</i> 1991 ²⁴¹	<i>Allied Force</i> 1999 ²⁴²	<i>Enduring Freedom</i> Oct 2001-Feb 2002 ²⁴³
Total Air Delivered Weapons	227,648	23,644	17,459
Total Precision-Guided Air Delivered Weapons	17,644	7,057	10,548
% of PGMs	7.7%	29.8%	60.4%

²³⁷ In the words of the Air Force Chief of Staff, dumb bombs were “cheaper than hamburger” on a pound for pound basis. Human Rights Watch, *Needless Deaths*.

²³⁸ The USAF fielded about 40 fighter wing equivalents at the close of the Gulf War, each with 72 Primary Authorized Aircraft. If one counted aircraft that could deliver Maverick (A-10 and some F-16s), the number of PGM-capable aircraft increased greatly. However, the 125 lb. warhead on the Maverick greatly limited the flexibility and utility of these weapons.

²³⁹ *Gulf War Air Power Survey [GWAPS], Volume II, Part 2: Effects and Effectiveness* (Washington, D.C.: Government Printing Office, 1993), pp. 352-353.

²⁴⁰ David A. Deptula, *Effects-Based Operations: Change in the Nature of Warfare* (Arlington: Aerospace Education Foundation, 2001), pp. 10-11. Deptula did his calculations based on aimpoints attacked (targets may comprise multiple aimpoints). Twenty F-117s attacked 37 aimpoints, while 41 non-stealth, non-PGM aircraft attacked only 3 aimpoints. Equalizing the number of stealth aircraft indicates that 41 F-117s could have struck 76 aimpoints—about 26 times more.

²⁴¹ See *GWAPS, Vol. V*, pp. 553-554. U.S. forces delivered 210,004 general-purpose bombs, 9,342 guided bombs, 2,039 anti-radiation missiles, 5,448 air-to-surface missiles, 333 cruise missiles, and 482 helicopter anti-tank guided weapons (Hellfire and TOW).

²⁴² *Air War Over Serbia Fact Sheet*, p. 6. The U.S. and allied forces delivered 28,018 total weapons, of which U.S. forces delivered 23,315 (83%). To these totals, we added 329 cruise missiles (TLAM and CALCM). Data on the types of allied munitions delivered is not available at this time. Of the 4,703 weapons delivered by allies, the British Royal Air Force delivered 1,011, of which 26% were precision guided munitions. See Rt. Hon. Geoffrey Hoon, Secretary of State for Defence, *Kosovo: Lessons from the Crisis* (London: British Ministry of Defense, June 2000). Available online at: <http://www.mod.uk/publications/kosovo-lessons/contents.htm>.

²⁴³ Arkin, “Weapons Total From Afghanistan.”

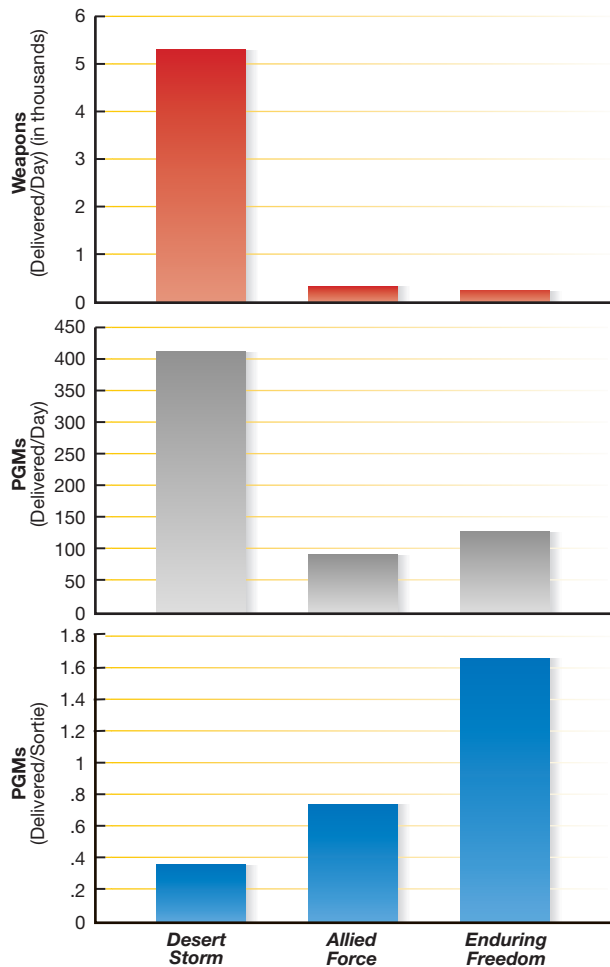


Figure 5: Munitions Trends in Three Wars

sortie in *Enduring Freedom*, or more than double the amount delivered two years earlier in *Allied Force*. These impressive increases are due in large part to four key factors: (1) larger inventories of PGMs; (2) more PGM-capable aircraft; (3) increased demand to employ PGMs out of concern for accuracy and effectiveness; and (4) the employment of large-payload bombers capable of mass precision strikes. Indeed, during *Allied Force*,

B-2 stealth bombers accounted for roughly 10% of the precision guided munitions delivered on targets in Serbia; in Afghanistan that percentage rises to an astonishing 46% when JDAM strikes by B-52s and B-1Bs are included.²⁴⁴

To further appreciate how PGMs have radically transformed modern air warfare since 1991, three supporting trends require specific mention: (1) the emergence of an all-weather capability enabled by satellite-aided navigation; (2) the rise of precision standoff weapons such as TLAM; and (3) advances in payload fractionation resulting from the miniaturization of munition bodies.

Developing an All-Weather Capability

One reason the U.S. military did not embrace PGMs in the wake of Vietnam was that laser-guided and electro-optical weapons required a clear line-of-sight to the target and, as such, its acquisition could be disrupted by cloud cover or smoke. The only all-weather strike weapons available in the late 1970s and early 1980s used elaborate terrain mapping data for targeting that required time-consuming flight planning. Soon after the Gulf War, however, the U.S. military accelerated the deployment of two GPS-guided weapons—the Joint Direct Attack Munition (JDAM) and the Joint Standoff Weapon (JSOW). Although these weapons could not provide the same accuracy as laser and electro-optically guided munitions, they were characterized as “near-precision” and could be employed in any weather.

Table 3. Increasing Percentage of PGMs Can Be Delivered in Adverse Weather

	Conflict		
	Desert Storm 1991	Allied Force 1999	Enduring Freedom Oct 2001-Feb 2002
Total PGMs Delivered	17,644	7,057	10,548
Number of Adverse Weather PGMs	2,372 ²⁴⁵	1,728 ²⁴⁶	9,225 ²⁴⁷
Adverse Weather PGMs as % of Total PGMs	13.4%	24.4%	87.4%

²⁴⁴Ibid.

²⁴⁵Includes HARM missiles, TLAM, and CALCM. See *GWAPS, Vol. V*, pp. 553-554.

²⁴⁶Includes 743 HARM missiles, 329 TLAM and CALCM cruise missiles, 652 JDAM, and 4 GAM-113 heavy penetrators. *Air War Over Serbia Fact Sheet*, p. 6.

²⁴⁷Includes Wind Corrected Munitions Dispensers (WCMD), JDAM, GBU-37, and TLAM. Arkin, “Weapons Totals for Afghanistan.”

The B-2 stealth bomber delivered the first generation of GPS-guided weapons during *Allied Force*, and the value of all-weather delivery capability proved especially critical. During the first eight weeks of operations, the B-2s flew only 3% of the strike sorties, but struck 33% of the targets because poor weather prevented other aircraft with line-of-sight dependent weapons from being employed. What is striking in Table 2 is the rapid acceleration of this new technology's employment. The percentage of all-weather weapons used in Afghanistan more than tripled compared with *Allied Force* only two years earlier.

The Impact of Precision Standoff Weapons

Another trend in precision weapons is the steady emphasis on standoff weapons, and in particular, conventionally armed unmanned cruise missiles for long-range strike. The origin of the cruise missile can be traced to World War II, when Germany became the first nation to employ them in combat. But their poor accuracy greatly limited their military utility. In the 1950s, the U.S. developed a wide array of sea-based and land-based land-attack cruise missiles, primarily to support nuclear deterrence. It was not until the late 1970s, however, that terrain-mapping guidance technology provided sufficient accuracy to open the prospect of employing conventionally armed cruise missiles. Eventually, the U.S. Navy fielded the Tomahawk Land Attack Missile (TLAM) in the mid-1980s, followed in turn by the USAF "Secret Squirrel" program, which refitted a small number of Air Launched Cruise Missiles (ALCMs) with conventional warheads.

The Gulf War witnessed the first U.S. operational use of conventional cruise missiles to attack land targets—the Navy's TLAM and the Air Force's Conventional ALCM (CALCM). Since the weapons had not been employed in previous combat operations, many senior *Desert Storm* commanders had substantial doubts about relying on these new weapons during the opening phase of the air campaign.²⁴⁸ However, their well-publicized success in the Gulf War

transformed the TLAM into the weapon of choice for punitive military raids in the 1990s, among them attacks on Iraq (1993, 1996, and 1998), Afghanistan (1998), and Sudan (1998).

Why was this the case? Cruise missiles offered a unique capability: to strike rich target sets at long ranges with near precision, all without risking the lives of the aircrew. With this capability, cruise missiles vastly increased the striking power and range of surface ships and submarines. In the August 1998 strikes against Afghanistan and Sudan, the long reach of cruise missiles allowed a single Navy battle group to strike two separate continents simultaneously. Meanwhile, air-launched cruise missiles allowed aircraft to strike from outside the range of enemy defenses and thus minimize potential risks.

Yet, owing to high production costs, cruise missiles represent a luxury item in U.S. munitions inventories. The TLAM program unit cost is approximately \$3.0 million (in \$FY03).²⁴⁹ Striking the same number of aimpoints attacked in the Gulf War (42,000) with TLAMs, for example, would cost over \$120 billion in current dollars.²⁵⁰

Unfortunately, reducing the cost of standoff weapons has proven difficult, as there appears to be an unbreakable correlation between range and cost. For this reason, projecting power with cruise missiles in a protracted campaign is simply unaffordable, particularly in light of the successful use of relatively inexpensive GPS-guided munitions. For example, the JDAM costs roughly \$20,000 per unit in current dollars—substantially less than the cheapest standoff weapon. So for the price of a single TLAM, the U.S. could procure 150 JDAMs. Cruise missiles are, therefore, extremely valuable for striking a limited number of well-protected high-value targets, but are not cost-effective for sustained large-scale operations.

Advances in Payload Fractionation

Within the past few years, considerable effort has been expended on increasing PGM delivery rates

²⁴⁸ Gordon and Trainor, p. 115-117.

²⁴⁹ Historical RDT&E and procurement costs taken from Ted Nicholas and Rita Rossi, *U.S. Missile Data Book, 2001* (Fountain Valley: Data Search Associates, 2000). TLAMs were first delivered in 1983. Subsequent TLAM deliveries averaged about 238 per year (with an average annual expenditure of about \$700 million).

²⁵⁰ Costs could obviously be reduced if buy rates were increased, but because cruise missile usage results in attrition of the air frame, guidance package, and engine, costs will always be significantly higher than unpowered weapons.

by fractionating aircraft payloads and introducing smaller precision weapons. Aside from lessening the logistical burden associated with transporting heavy munitions, developing smaller precision weapons offers the potential to substitute accuracy for explosive weight.²⁵¹ Following *Allied Force*, the USAF accelerated a program to increase the number of JDAMs a B-2 could deliver by developing new racks and adding guidance kits to 500 lb. bombs. Thus, a B-2 that could previously deliver sixteen 2,000 lb. JDAMs will soon be able to deliver eighty 500 lb. weapons, vastly increasing the number of aim points that can be attacked per sortie. The USAF has also accelerated the development of the Small Diameter Bomb (SDB), a 250 lb. GPS-guided weapon offering even greater potential payload fractionation. Currently, the F/A-22 is designed to carry two 1,000 lb. bombs internally, as opposed to the F-35 (formerly known as the Joint Strike Fighter) and its designed capability to carry two 2,000 lbs. internally. In contrast, the F/A-22 is designed to internally store and deliver eight SDBs, and the F-35 at least double that. Large payload aircraft like the B-1 or B-2 could carry several hundred such weapons.²⁵²

Ultimately, fielding these smaller precision weapons will result in impressive increases in their delivery rate. Already, the potential fruits of payload fractionation have been demonstrated in Afghanistan when the USAF and USN delivered 100 JDAMs in 20 minutes. During the Gulf War, in contrast, the average hourly rate of precision weapons delivery stood at about 16 per hour. In the future, similar delivery rates will not require an increase in overall force size, demonstrating that precision can substitute for mass and greatly increase lethality. The potential implications of mass precision are still not understood, but may portend a significant outgrowth of the precision revolution. In essence, the U.S. may soon develop the capability to conduct a decisive blow against adversaries with small precision weapons designed to strike thousands of targets within a few hours.

ENABLING NETWORK-CENTRIC WARFARE: MORE, BETTER, AND INTEGRATED SENSORS AND SENSOR NETWORKS

The rush for increased integration of sensors and networks—to enable what is known increasingly as “network-centric warfare”—is motivated by the promise of information dominance and battle-field situational awareness. Underpinning this promise are technologies to create network-centric architectures consisting of high quality sensors and rapidly transmitted data streams that will be fused and integrated at command and control centers. The objective is to “successfully combine data from many intelligence-gathering sensors—while compensating accurately for all the different types of physics and time latencies involved—and use the product to present a single, unified picture of the battlefield.”²⁵³

While network-centric warfare remains an objective in defense policy circles, each of the three conflicts examined here provided ample demonstrations of new sensors for intelligence, surveillance, and reconnaissance activities. Many of these sensors were outfitted on existing air-breathing ISR platforms, such as the E-3A AWACS (for detecting enemy air activity and directing friendly fighters); the RC-135 and EP-3 aircraft (for detecting and locating enemy radar and radio emissions); and the U-2 (for providing strategic reconnaissance and wide-area surveillance). At the same time, new manned and unmanned ISR platforms have appeared in the force structure, the most prominent of which is the E-8 Joint STARS.

Regarded as a highly capable ISR and battle management platform, Joint STARS is outfitted with a 24-foot “canoe” housing a synthetic aperture radar that can detect moving targets and provide high-resolution radar imagery of selected areas. It also possesses a ground moving target indicator (GMTI), capable of detecting moving targets over an area 10,000 times greater than the same radar attempting to provide a high resolution image. “The ability to target vehicles in a large

²⁵¹For additional discussion, see Bowie, *The Anti-Access Threat*, pp. 27-30.

²⁵²It remains to be seen whether the SDBs will have the accuracy to allow them to be used to replace a single larger weapon such as 1,000 or 2,000 lb. guided bomb units. Currently, SDBs without a terminal seeker are not likely to be more accurate than current JDAMs, and in war games operators tend to drop four on a designated aim point that formerly received a single larger weapon. A terminal seeker would ameliorate this problem, but it will also increase overall unit cost.

²⁵³David A. Fulghum, “It Takes a Network to Beat a Network,” *Aviation Week & Space Technology*, (11 November 2002), p. 28.

area,” as one air-to-ground (AGS) surveillance expert recently noted, “makes it possible to destroy an enemy’s ability to fight effectively and do so much faster—using far fewer and lighter forces—and at less risk than traditional attrition-oriented warfighting.”²⁵⁴

The capabilities provided by Joint STARS were illustrated in several incidents during the Gulf War. On the night of 29 January 1991, Joint STARS detected Iraqi armored forces moving toward Al Khafji, allowing coalition forces to locate and target them with devastating air attacks.²⁵⁵ Later, during the Coalition ground offensive, which took place during the worst weather of the war, GMTI surveillance quickly exposed Iraqi efforts to reposition their forces, providing advancing coalition forces with the information needed to defeat the Iraqi maneuver before it could create a serious threat. A Joint STARS image brought forward to the tactical command post of General Fred Franks, the commander of the Army’s VII Corps that conducted the main attack around the Iraqi western flank, confirmed his decision to turn his force eastward and attack the Republican Guard divisions in their new positions. This decision placed the VII Corps at precisely the right position in relation to the enemy and facilitated the ensuing rout.²⁵⁶ And, when Iraqi forces began withdrawing from Kuwait, GMTI provided timely information alerting the coalition that a large-scale withdrawal had begun.

Conflicts since the Gulf War witnessed modest forms of C2ISR integration, links that facilitated data exchanges between a multitude of sensors, multiple-sensor platforms, and geographically disparate command and control centers. Enabling this were three technology sub-trends: advances in smaller, low-cost and high-quality sensors; outfitting multiple sensor suites on manned and unmanned ISR platforms; and exponential increases in data transmission rates. Fielding

these new technologies led, in turn, to increased situational awareness. Over Kosovo, the Predator unmanned air vehicle (UAV) conducted surveillance missions with a SAR, offering resolution similar to the larger radar on the U-2. Later, over Afghanistan, Predator and Global Hawk UAVs—both with powerful SARs—expanded the coverage area that the U-2 and Joint STARS initially provided. The UAVs are also multi-sensor platforms. A Global Hawk can take a high-resolution radar image and provide electro-optical and infrared pictures of the same area within seconds. During the Gulf War, in contrast, developing multiple images of a target site took days, even weeks.

Finally, increases in computational power and the availability of satellite data links have accelerated data transmission from sensors to users. For example, the computational power on-board Joint STARS increased 200 times from the Gulf War to Serbia. By enhancing on-board imagery processing and data compression, this power boost increased both data volume and quality to the user. Similarly, satellite links provided rapid transmission of data pre-processed by on-board sensor platforms. Whereas in 1991 sensor data transmitted over line-of-sight links encountered routine delays, by 1999 U-2 imagery was transmitted by satellite to the United States, analyzed, and promptly relayed electronically to the CAOC in Vincenza, Italy.²⁵⁷ Data from platforms could also be beamed directly into command centers. UAVs were able to transmit near-real time imagery back to the CAOC, while the older systems were consigned to sending imagery back to control stations or over limited distances.²⁵⁸ These capabilities increasingly provided battle commanders access to data at a rate traditional intelligence distribution chains could not match.

In sum, the increasing number of quality intelligence sensors, the availability of multi-sensor platforms, and the capability to process, analyze,

²⁵⁴ Price T. Bingham, “Head Off The Vehicles,” *Aviation Week and Space Technology*, (23 December 2002), p. 8.

²⁵⁵ Atkinson, p. 212. See also Price T. Bingham, *The Battle of Al Khafji and the Future of Surveillance Precision Strike* (Arlington: Aerospace Education Foundation, 1997).

²⁵⁶ See Fred Franks, Jr. and Tom Clancy, *Into the Storm: A Study in Command* (New York: G.P. Putnam’s Sons, 1997), pp. 274-400. Specific comments regarding Joint STARS came from an NGAC staff interview with General Franks, 16 July 1997.

²⁵⁷ Tom Bowman, “High Technology Lets NATO Keep Eye, Ear on Yugoslavia; U.S. Spy Planes Can Monitor Radio Messages by Troops,” *The Baltimore Sun*, 2 May 1999, p. 23A.

²⁵⁸ Ripley.

and distribute data quickly over vast distances has led to at least an order of magnitude increase in situational awareness and the capability to conduct operations more flexibly and rapidly. Overall integration of increasing data flows still remains a challenge, but technological solutions are being actively pursued.²⁵⁹ In the future, trends in sensor technology toward less expensive, more capable, and lighter sensors will support intelligence-quality sensors networked around the battlefield. Moreover, outfitting the F-35, F/A-22, and F/A-18E/F with active, electronically-scanned radar arrays will multiply the number of high-quality sensors on the battlefield. Assuming these data streams from multiple sources can be integrated in a timely fashion—a tall order—future commanders will enjoy even greater situational awareness to employ their forces more effectively.

THE INCREASING IMPORTANCE OF STEALTH AIRCRAFT AND ELECTRONIC COUNTERMEASURES

Stealth—using technology and tactics to lower a platform’s signature, thereby making it less detectable to sensors seeking its presence—is unarguably one of the most significant advancements in U.S. combat aircraft performance since the Cold War. From Iraq to Kosovo and, to a lesser degree, in Afghanistan, low observable aircraft were employed with remarkable success and revolutionary impact. Low observable technologies applied to combat aircraft have allowed them to operate with relative impunity against sophisticated air defense systems, enabling them to deliver paralyzing attacks on the first night of the war. The ability of stealth aircraft to operate independently has also reduced the requirement for devoting considerable resources to escorting attack aircraft. Non-stealthy fighters and bombers typically need more assistance from multiple additional aircraft providing defense suppression, dedicated support jamming, fighter cover and radar warning.²⁶⁰

Stealth critics are fond of pointing out, however, that even low observable aircraft have benefited from supporting, if not direct, electronic countermeasures when transiting through hostile air-space. That is true to a limited extent, but the weight of electronic warfare during the conduct of three major air wars has been in support of the overwhelming majority of Air Force, Navy, and Marine Corps attack aircraft that are not stealthy. Because these aircraft will form the bulk of the U.S. force structure for years to come, investments in electronic jamming, in addition to electronic and infrared self-protection systems and stealth, will continue to be required. Trends established in these areas during America’s post-Cold War conflicts are therefore worthy of our attention.

Operation *Desert Storm*

Although the F-117 stealth “fighter”—in actuality, a single-seat bomber that attacks only ground targets—was employed in combat in Panama, it first encountered a sophisticated air defense system on the opening night of *Desert Storm*. On that and subsequent nights, airborne stealth worked exceptionally well, leading the authors of *GWAPS* to select “stealth/low observability” as one of the five technologies that worked best in the Gulf War.²⁶¹ Indeed, the stealthy F-117 was regarded as “the single greatest technological advance fielded in *Desert Storm*,” due in large part to a record 1,299 sorties without any battle damage, but also for its precision and combat efficiency.²⁶² According to *GWAPS*, the F-117 flew only 2% of total attack sorties but struck almost 40% of the strategic targets. Moreover, the F-117s’ deep strike capability enabled them to disrupt and destroy the Iraqi integrated air defense system. In post-conflict analysis, *GWAPS* concluded that Iraqi air defenses never recovered from those first attacks as the F-117 paved the way for the use of non-stealthy aircraft in follow-on strikes.

²⁵⁹The Network Centric Collaborative Targeting [NCCT] project has been described as the first Air Force step into network-centric warfare. See Fulghum, “It Takes a Network.”

²⁶⁰See Benjamin S. Lambeth, *The Transformation of American Air Power* (Ithaca: Cornell University Press, 2000), pp. 155-158.

²⁶¹Keaney and Cohen, pp. 223-234. The other four were laser-guided bombs (precision), aerial refueling (range), the high-speed anti-radiation missile (precision), and the STU-III secure telephone (situational awareness).

²⁶²U.S. Department of the Air Force, *Gulf War Air Power Survey [GWAPS], Volume IV, Weapons, Tactics, and Training* (Washington, D.C.: Government Printing Office, 1993), p. 243.

It is not clear from available evidence whether the EF-111 electronic warfare aircraft supporting the F-117s on the first night of the air war were more effective than stealth in protecting the aircraft. Although *GWAPS* sided with the latter, it can be assumed that even indirect support assisted in suppressing and distracting enemy radars. But it is also true that stealthy strikes were conducted autonomously, not only by F-117s in *Desert Storm* but later by B-2s in Kosovo and Afghanistan.

The need for stealth and the amount of electronic warfare support required for the non-stealthy fleet depends on the sophistication and integration of enemy air defenses, and on the skill with which they are employed. As concluded in the *GWAPS* report:

[E]lectronic countermeasure support contributed substantially to Coalition effectiveness by denying early warning and tracking data to enemy integrated air defense system (IADS) operators and by disrupting the firing solutions of enemy anti-aircraft weapons. EA-6B support was considered essential for every Navy and Marine strike.²⁶³

During *Desert Storm*, 27 EA-6Bs operated from aircraft carriers in the Red Sea and the Persian Gulf, with an additional 12 Marine EA-6Bs based in Bahrain. Throughout the air war, EA-6Bs escorted USN and USMC tactical aircraft, jamming Iraqi radars during strike and refueling operations. In fact, the unavailability of electronic jamming aircraft was often considered sufficient reason to abort a mission. In all, the *Prowlers* flew 1,630 sorties and fired 150 anti-radiation missiles during the war, forcing Iraqi radars to shut down or to operate in ineffective modes.

Meanwhile, the USAF relied on 24 EF-111 aircraft to meet its electronic countermeasure requirements, in standoff, penetration, and

close-in jamming roles. The *Ravens* flew 1,105 sorties without a combat loss and were considered a major contributor to the general ineffectiveness of Iraqi air defenses and the subsequent low loss rate of allied aircraft. *GWAPS* cited an after-action report concluding that Iraqi air defense capabilities were seriously impaired or completely denied by EF-111 radar jamming.²⁶⁴ Nevertheless, EW shortfalls in the Air Force, which had traditionally relied more on aircraft carrying self-protection pods rather than dedicated jamming aircraft, resulted in the frequent borrowing of EA-6Bs from its sister services to accompany Air Force attack aircraft.²⁶⁵

Operation Allied Force

One reason the EA-6B proved so essential in *Allied Force* was that the Air Force, based on bureaucratic and budgetary arguments, retired the EF-111 in 1998.²⁶⁶ As a result, when NATO aircraft began bombing over the former Yugoslavia in late March 1999, the tactical jammers available consisted of about 90 EA-6Bs split among 19 USN and USMC squadrons. Ultimately, more than 10 of those squadrons were deployed to support *Allied Force*, including some aircraft redeployed from *Northern Watch* operations over Iraq. In short, the performance of the EA-6B during *Allied Force* was described as “absolutely important to the air operation” in the U.S. Department of Defense’s official after-action report.²⁶⁷

During the conflict, the available EA-6B aircraft and their aircrews were stretched to the limit—the perennial low density, high demand problem.²⁶⁸ The Serbs had learned from the Iraqi experience in the opening days of the Gulf War and operated their integrated air defense system sporadically, thereby requiring a sustained tactical jamming effort far greater than that anticipated at the war’s onset. As a result, NATO aircraft were

²⁶³ *GWAPS*, Vol. IV, p. 94.

²⁶⁴ *Ibid.*, p. 96.

²⁶⁵ Keaney and Cohen, p. 197.

²⁶⁶ The small fleet of 42 EF-111s became very expensive to maintain when the F-111s were retired. Former Air Force Chief of Staff General Mike Dugan has also pointed out that proponents of manned aircraft dedicated to the jamming mission had been gradually excluded from top operational and acquisition posts. See James A. Kitfield, “Another Look at the Air War that Was,” *Air Force Magazine*, (October 1999), p. 43.

²⁶⁷ U.S. Department of Defense, *Kosovo/Operation Allied Force After Action Report*, (2000), p. 66. Available online at: <http://www.defenselink.mil/pubs/kaar02072000.pdf>.

²⁶⁸ See Robert Haffa and Barry Watts, “Brittle Swords: Low-Density, High-Demand Assets,” *Strategic Review*, (Fall 2000), pp. 42-48.

forced to fly through active SAM engagement zones on a daily basis. The EA-6Bs flew 1,318 total sorties to support roughly 12,000 combat sorties which resulted in only two aircraft (including a stealthy F-117), and no aircrew, lost to enemy fire. Nearly the entire available EA-6B inventory was tasked to support a small contingency against a relatively unsophisticated adversary equipped with outmoded air defenses. Rather than trending away from electronic jamming support, as the Air Force had hoped after the Gulf War, modern wars—even relatively small ones—suggest that additional EW assets will be in great demand in the future.

Penetrating the Serbian air defense network during *Allied Force* also underscored the comparative advantages of stealth aircraft. Only the B-2, in its combat debut, was able to evade the integrated air defenses on the first night of the war and strike highly defended targets with near-precision and in spite of adverse weather.²⁶⁹ A pool of six available aircraft launched 45 sorties during the war—less than one percent of total strike sorties. Yet, astonishingly, these 45 sorties accounted for 11% of all precision munitions delivered.²⁷⁰ Based on this performance, the Pentagon's Operation Test and Evaluation (OT&E) report on the B-2 observed that the "B-2s damaged a higher percentage of their targets than any other aircraft participating in combat operations."²⁷¹ With a payload of GPS-aided JDAMs, the B-2 afforded NATO air planners an unprecedented all-weather capability to acquire elusive targets, such as moveable air defense radars, and attack the most highly defended areas at night. Owing to their low observability and the lingering air defense threat, only the B-2s and F-117s were sent against targets in heavily defended Belgrade—a repeat of the decision made during the Gulf War to restrict air attacks over Baghdad to the F-117.

Operation *Enduring Freedom*

The war in Afghanistan against the Taliban was, like the war in Yugoslavia, one fought primarily in the air. But it was also waged against a far less capable adversary, in terms of air defense and tactics, than the Serbs or even the Iraqis. Therefore, the need for stealth and electronic jamming was considerably less in *Enduring Freedom* than the two previous conflicts. But it would be wrong to conclude that Afghanistan has reversed the trend.

Although targets in Afghanistan remained out of range for short-range land-based fighters, the B-2 participated in the first strikes on the Taliban to destroy air defense assets and SAM sites. Moreover, the highly survivable B-2 enabled the U.S. to strike targets deep in the north prior to establishing the search and rescue infrastructure needed to support non-stealthy airborne operations. The Taliban lacked weapons systems with the reliability, range, and guidance systems to threaten high-altitude bombers and, after the initial attacks on air defenses, waves of B-1s and B-52s were able to penetrate, loiter, and strike with impunity. At lower altitudes, however, the threat was not eradicated and non-stealthy aircraft such as carrier-based fighters and B-1Bs still required EA-6B jamming support. And, because the EA-6B's range was limited due to the extreme distance—about 700 miles—between Kabul and the carriers in the Arabian Sea, the B-1s were not sent to attack deep targets because they would be deprived of jamming support.

Not surprisingly, the demand for stealth and electronic jamming was significantly decreased after the first few days of the air war. The B-2 turned the long-range strike mission over to its non-stealthy ancestors and, with U.S. air supremacy over Afghanistan assured, the EA-6B shifted to jamming enemy land communications and assisting in the campaign against enemy ground forces.²⁷² However, the relatively relaxed pace of

²⁶⁹ Grant, pp. 75-78

²⁷⁰ Lambeth, *NATO's Air War for Kosovo*, p. 91.

²⁷¹ U.S. Department of Defense, Department of Operational Testing & Evaluation (DOT&E), FY1999 Report to Congress. Available online at: www.dote.osd.mil/reports/FY99/99TOC1.html.

²⁷² See Hampton Stephens, "Prowler Praised for Tactical Jamming Role in Afghanistan," *Inside the Air Force*, (1 November 2002).

deploying stealth and standoff jamming during *Enduring Freedom* does not undermine the low density, high demand status assigned them in the 1990s. During the Gulf War, only 4% of the total combat sorties flown were electronic warfare sorties (EA-6Bs and EF-111s).²⁷³ In Kosovo, U.S. forces flew a total of 12,000 combat sorties,²⁷⁴ of which 1,318 were electronic warfare sorties—almost triple the percentage in the Gulf War.²⁷⁵

Clearly the aging EA-6B force is too small to meet the nation's future electronic jamming requirements, particularly when advanced threats or simultaneous conflicts are considered. Nor has the nation, in producing only 59 F-117s and 21 B-2s, reaped sufficient benefits from the enormous investments made in airborne stealth. The performance of these platforms and systems across the three wars argues for their future importance and for providing the resources necessary to ensure that these capabilities are available when needed.

THE INCREASING USE AND ROLES FOR UNMANNED VEHICLES

The final trend considered here is the increased use of unmanned aerial vehicles for ISR and strike missions. Historically, interest in unmanned systems was motivated by the requirement for strategic reconnaissance flights over the Soviet Union, particularly after Soviet air defenses were successful in shooting down a U-2 in May 1960. U.S. intelligence agencies were most interested in developing these systems, such as the D-12 Oxcart drone, to obtain imagery to support their intelligence estimates. With the advent of space surveillance systems, however, intelligence interest flagged, but the military services continued their pursuit. Overall, since the 1950s, the U.S. has invested over \$25 billion (\$FY98) in developing and fielding unmanned aerial vehicles (UAVs), primarily for ISR missions.²⁷⁶

Eventually, this sizeable investment resulted in unmanned systems which, when finally enabled by advances in satellite guidance and communications, computerized flight control systems, and sensor technologies, demonstrated their operational utility over the battlefield. Indeed, in each conflict examined, unmanned systems assumed new roles, due in large part to improvements in range, endurance, on-board sensors, and data transmission. Used primarily as decoys during the Gulf War, by 2001 UAVs had evolved into sophisticated air-breathing ISR platforms with an organic strike capability.

From the Gulf War to Kosovo

Because of their limitations, unmanned systems were used primarily to spoof Iraqi air defenses and serve as decoys. At the outset of the air campaign, the USAF and USN employed target drones to confuse and disrupt Iraqi air defenses. Following the initial F-117 and cruise missile strikes, Navy A-6s launched 25 Tactical Air Launched Decoys and USAF ground crews launched 44 BQM-34C target drones. Thinking the decoys and drones were incoming strike packages, Iraqi air defenses turned on their radars and engaged them, only to be attacked by radiation-homing missiles. The USN and USMC also used the Pioneer unmanned drone for limited reconnaissance missions. In all, the Pioneer conducted 313 sorties averaging about three hours each.²⁷⁷ A short-range, remotely piloted vehicle, the Pioneer provided television imagery through a data link back to its control station. Many of these sorties provided spotting and near real-time battle damage assessment for U.S. Navy battleships employing their 16-inch naval rifles; others provided surveillance when other sensors were not available.

In the buildup to *Allied Force*, U.S. forces employed the newly fielded Predator A, derived

²⁷³ Combat sorties include air interdiction, close air support, offensive counter-air, reconnaissance, and electronic warfare. The Gulf War total was 67,357, of which 2,918 were EW-related. See *GWAPS, Vol. V*, pp. 232-33.

²⁷⁴ *Air War Over Serbia Fact Sheet*, p. 6. This figure comprises both total fighter and bomber sorties.

²⁷⁵ *Ibid.*, p. 8, and "LD/HD: The EA-6B and JSTARS in Allied Force."

²⁷⁶ Investment data provided to the authors by Col. Thomas Ehrhard, USAF. Despite this considerable investment, an aide to Secretary of Defense Rumsfeld recently lamented on the slow progress in developing UAVs, observing that "we would have been far ahead of where we are today if the department had consistently kept a strong focus and desire to make this technology work." See "Wasted Time," *Aerospace Daily*, (16 December 2002), p. 2.

²⁷⁷ Federation of American Scientists, "Pioneer Short Range (SR) UAV." Available online at: <http://www.fas.org/irp/program/collect/pioneer.htm>.

from the CIA-developed Gnat 750, to support peacekeeping operations in Bosnia from July to October 1995. The Predator offered slightly increased speed over the Pioneer (110 knots versus 95 knots), 450% greater payload (450 lbs. versus 100 lbs.), and eight times the endurance (40 hours versus five hours). Three Predators, equipped with a color video camera and an electro-optical/infrared camera, conducted 128 missions each totaling 850 hours (and with 6.6 hours average endurance—more than double what the Pioneers averaged in *Desert Storm*). One Predator was lost to enemy fire; another due to engine failure.²⁷⁸ In November 1995, the Predators, still in limited supply, were fitted with synthetic aperture radars and redeployed to Bosnia to provide detailed radar images in adverse weather. By May 1998, Predators had logged more than 600 sorties and 3800 flying hours over Bosnia.

During *Allied Force*, the U.S. deployed seven Predators, about 20 Hunters (an Army short-range UAV), and a Navy Pioneer detachment.²⁷⁹ The allies also provided a mix of UAVs to support combat operations, such as the German CL-289 drone, the British Phoenix, and the French Crecerelle. Overall, U.S. and allied UAVs flew 469 missions, an average of six per day, many more than in the Gulf War and with more capable sensors and increased endurance.²⁸⁰ While they were incapable of wide-area surveillance and were thus limited to providing real time views of small patches of terrain, the Hunters and Predators could transmit near-real time imagery back to command and control facilities, where it was used to provide a “second set of eyes” on targets. This development stood in stark contrast to the Pioneer and Crecerelle, which could only send video back to a control station, and the CL-289 and Phoenix, which could only transmit infrared imagery over limited distances. Commanders, moreover, were willing to expose UAVs to low-level air defenses to acquire time-sensitive intelligence. The near-real

time capability of the Phoenix and Hunter proved extremely useful in this regard. As one British officer commented: “We in Britain have traditionally shied away from providing real-time video for senior commanders to prevent them from micro-managing things, but the lesson of Kosovo is unless you have real-time you will be sidelined.”²⁸¹

Yet, UAVs were plagued with reliability problems, as evidenced by a per sortie loss rate that was 285 times higher than manned aircraft. The reported 27 UAVs lost during the 78-day air campaign equated to a per sortie loss rate of 5.7%, as compared with 0.02% for the fighter and bomber force.²⁸² Even then, there was no public outcry when one of the UAVs crashed. USAF Chief of Staff General Michael Ryan observed: “[UAVs] go out there and die for their country—and we don’t mourn.”²⁸³ Toward the end of the campaign, the Serbs had also become proficient in specialized anti-UAV tactics, which had been honed in encounters with UAVs over Bosnia earlier in the 1990s.

From Kosovo to Afghanistan

In the spring of 2000, U.S. interest in Osama bin Laden’s activities in Taliban-controlled Afghanistan led to a plan to conduct Predator surveillance missions over the country to gather intelligence. Basing rights were negotiated with Uzbekistan and surveillance missions began in September 2000. The Predators provided real time imagery of activities in terrorist training camps. On several occasions, Predators tracked what appeared to be the movements of bin Laden and his security entourage. But, in the end, bin Laden’s movements were so unpredictable that Predators could not provide an exact location to enable a cruise missile strike. Added to this frustration were concerns about the political upheaval that would ensue. UAV operations ended by mid-October 2000.

²⁷⁸ Kenneth Munson ed., *Jane’s Unmanned Aerial Vehicles and Targets* (London: Jane’s Information Group, 2002), p. 239.

²⁷⁹ David R. Gust, “Hunter UAV in Kosovo,” briefing for the Association of Unmanned Vehicle Systems International, 14 July 1999. Available online at: <http://www.fas.org/irp/program/collect/docs/auvsi/sld001.htm>.

²⁸⁰ *Air War Over Serbia Fact Sheet*, p. 6.

²⁸¹ Ripley.

²⁸² *Ibid.*

²⁸³ “Notes from the AFA Air Warfare Symposium,” *Inside the Air Force*, (February 12, 1999).

CIA officials then considered whether it was possible to conduct armed surveillance missions with the Predators, to improve their chances of attacking bin Laden in the event his whereabouts could be determined. Learning that the USAF had successfully reconfigured the Predator for hunter-killer missions by equipping it with a laser designator and Hellfire missiles, the CIA moved to deploy the armed Predators in the hunt for bin Laden. With this new capability, Predator controllers then conducted mock hunter-killer missions at a mud complex built in an American desert. "Because of that development," one U.S. official later acknowledged, "we were able to launch our Predator into Afghanistan."²⁸⁴ Ultimately, inter-agency disagreements would delay their deployment over the issue of command and control. After the September 11, 2001 terrorist attacks, the issue was quickly resolved and the armed Predators deployed as part of *Enduring Freedom*.²⁸⁵

On 7 October, an armed Predator located the Taliban leader, Mullah Omar, but military leaders were unable to receive approval in time to strike the building with the drone's two Hellfire missiles. Later, in mid-November, a Predator pinpointed the location of senior al Qaeda officials, including the organization's operations chief Muhammed Atef, and relayed real time imagery to military officials. U.S. Navy F/A-18s were quickly dispatched to strike the building, and the Predator used its Hellfire missiles to attack the occupants as they fled the building.²⁸⁶ On another occasion, a Predator was cued by a Joint STARS aircraft to monitor a small convoy, which had stopped in front of a hotel for an apparent gathering of al Qaeda officials. U.S. Air Force F-15Es quickly moved into position and attacked the hotel; the Predator then tracked fleeing Taliban vehicles and destroyed them with its

Hellfire missiles.²⁸⁷ In all, Predators are reported to have fired 40 Hellfires during Afghanistan operations.²⁸⁸

Aside from imagery sent back to command and control facilities, Predators also beamed imagery directly to aircrew in attack aircraft. One battlefield innovation was to equip AC-130 gunships with on-board monitors for attacks on targets under surveillance. The results exemplified the potential for increased kill chain compression. On one occasion, in mid-January 2002, a Predator viewed a gathering of suspected al Qaeda fighters near the Zawar Kili cave complex in eastern Afghanistan. An AC-130 gunship was provided with the UAV's television imagery as it approached the area, avoided ground fire, and struck the target.²⁸⁹ In another operation, a Predator alerted an AC-130 to a threat by providing the gunship with live color video of al Qaeda fighters armed with man-portable anti-aircraft missiles.

Although still in development, the Global Hawk UAV was also deployed to support Afghanistan operations.²⁹⁰ Global Hawk's wide area surveillance capabilities portend future trends in UAV development. Compared with the Predator, the Global Hawk features an extended radius of action and deployment options due to a 300% increase in speed (342 knots versus 110 knots); a much larger payload (2,000 lbs. versus 450 pounds); and a more sophisticated sensor suite that includes a powerful synthetic aperture radar as well as high-resolution electro-optical and infrared sensors. The Global Hawk is also capable of orbiting at higher altitudes (65,000 versus 26,000 feet) for a similar period (36 hours versus 40 hours). Finally, the Global Hawk does not require remote piloting from a ground station; its computerized flight control system enables it to

²⁸⁴ "U.S. Practiced Attacks with Drone in Early 2001," *The Associated Press*, 21 June 2002.

Available online at: <http://www.usatoday.com/news/attack/2002/06/21/predator-practice.htm>.

²⁸⁵ Neil King, Jr. and David S. Cloud, "In the Crosshairs: CIA Drones Spotted Bin Laden in Camps But Couldn't Shoot," *The Wall Street Journal*, 23 November 2001, p. A1.

²⁸⁶ Kenneth Chang, "A Crafty, Deadly Predator," *The New York Times*, 23 November 2001, p. B3.

²⁸⁷ Stephen Grey, "How the US Killed Al Qaeda Leaders By Remote Control," *Sunday Times* (London), 18 November 2001, p. A4.

²⁸⁸ Munson, p. 240.

²⁸⁹ Richard J. Newman, "From Up In The Sky," *U.S. News and World Report*, (25 February 2002), p. 18.

²⁹⁰ Mark Strass, "Global Hawk Begins Operations In Afghanistan," *Defense Daily*, (27 November 2001).

take off, orbit and land autonomously. Once in flight, ground controllers simply use satellite data links to alter its orbit.

What General Franks, CENTCOM commander, found particularly noteworthy about the performance of the Global Hawk was its ability to conduct persistent surveillance over a fluid battlefield: “[It] flew sorties approaching 30 hours in duration and imaged over 600 targets during a single mission over Afghanistan.”²⁹¹ Together, the Predator and Global Hawk combined to form an extremely effective ISR capability: the high-altitude Global Hawk providing wide-area situational awareness while the low altitude

Predator supplied tactical surveillance. Overall, four Predators and two Global Hawks were lost due to enemy action or system failures. However, the military value of these systems more than compensated for the UAV loss rate. Secretary of Defense Donald Rumsfeld observed in February 2002: “We do not have enough of these aircraft [UAVs]. There isn’t a week that goes by that General Myers and I are not confronted by a combatant commander in some part of the world who is asking for additional unmanned aerial vehicles and, in fact, we are forced to deny them because there are simply not enough to go around.”²⁹²

²⁹¹ Statement of General Tommy R. Franks, Combatant Commander, U.S. Central Command, to Armed Services Committee, U.S. House of Representatives, 27 February 2002.

²⁹² Marc Selinger, “UAV Shortages Leave Commanders’ Requests Unmet, Rumsfeld Says,” *Aerospace Daily*, (6 February 2002), p. 2.

V. CONCLUSION

What can America's post-Cold War conflicts tell us about the future of war?

First, we argued that we could identify, and perhaps learn from lessons from the three major post-Cold War military conflicts. We agree that these wars are *sui generis* but, based on our analysis, we disagree with those who conclude that the conflicts examined here were so unique that we cannot learn from the collective experience. The United States, at this writing, may be on the verge of launching a military strike against Iraq. Although such a conflict will certainly not repeat the campaign and consequences of the 1991 war, many similar strategic calculations, military forces, and technological capabilities will exert powerful influences on how the U.S. will conduct military operations against its decade-long nemesis. Moreover, a retrospective look at how those calculations, forces, and capabilities evolved and were showcased in prior military operations should provide useful insights into the vagaries of future conflicts, large and small, either against Iraq or other foreign enemies.

More to the point, we argued that while the wars examined here were quite different, we could nevertheless point to a combination of strategic, military, and technological thrusts that were manifested in operations *Desert Storm*, *Allied Force*, and *Enduring Freedom*. On this basis, we proceeded to explore these thrusts, discern salient patterns, and present them here as trends most likely to persist and impact the conduct of future warfare in the early 21st century. The ensuing analysis was informed by a methodology frequently used in the art of long-range planning and premised on the predictive value of scenario development to identify key factors that might exert powerful shaping influences over future actions. Yet, while most long-range planners

ponder alternative futures to build their assessments of the emerging environment, our trend analysis is rooted in factual evidence from three relatively high-intensity post-Cold War conflicts.

With this in mind, our examination of the wars in the Persian Gulf, over Kosovo, and in Afghanistan leads to the following conclusions.

Strategically, the U.S. way of warfare, as exhibited over the last decade, is no longer compatible with the clash of interstate armies that prevailed during the Cold War. Indeed, as opposed to Cold War conceptions of warfare, involving large armies and superpower struggles over geopolitical interests, the strategic center-of-gravity has shifted eastward toward the vast reaches of Asia. That shift has been accompanied by a fundamental change in the way the U.S. relates to existing and potential allies: a tendency to favor temporary relationships and seek *ad hoc* coalition partners for U.S.-led military campaigns, with coalition partners valued more for their political and diplomatic support than their participation in military operations. Meanwhile, our future adversaries (to include rogue states, non-state actors, and possibly a rising peer competitor) are poised to seek ways to undermine the threat and use of U.S. force, with specific aims to exploit perceived U.S. sensitivities to casualties, manipulate international public opinion and, failing that, degrade U.S. military effectiveness on the battlefield. In parallel, future adversaries can be expected to exploit the multifold dimensions of the access challenge by confounding U.S. abilities to project and sustain military power in the region of conflict. Most ominously, recent events indicate that future adversaries will likely possess, threaten to use, and possibly employ weapons of mass destruction, the mere probability of which

will deter some courses of action, limit basing options in theater, compel U.S. forces to focus first on WMD counterforce missions, and frustrate campaign-level force employment options.

Militarily, we have seen a dramatic shift away from the scripted operational plans that characterized rehearsals for Cold War conflicts, to a very fluid, nonlinear and dynamic battlespace in which targets are generated while attack platforms are en route. Yet the embrace of adaptive planning and dynamic military operations in defense policy circles must also account for factors that will complicate U.S. power projection in the future. Among them is the extended reach required to strike targets in denied or remote regions of the globe. Added to this is the elusive character of enemy combat forces and, more specifically, ambiguous target sets populated by fleeting targets of opportunity and masked by deception. Offsetting these factors, to some extent, is the order of magnitude increase in situational awareness that enables commanders—local, regional and global—to view the battlespace and intervene in near-real time (particularly when ongoing operations have the potential for collateral damage and political fallout). Trends in battle management indicate that this tendency toward centralized execution is a growing reality. Finally, the most prominent force employment trends include an increased role for air and naval forces to project power quickly from a distance, a diminished emphasis on slow-moving, heavy ground forces requiring a large regional footprint in favor of agile fixing forces, and continued measures to lower the risk of U.S. casualties.

Technologically, the dominant trend in military conflict has been the use of precision munitions. Using precise weapons not only guarantees striking targets with unprecedented accuracy, but also minimizes the potential for collateral damage and offers the promise of cost-effective force employment options. With that said, however, precision weapons are of little use without precision information. Therefore, PGMs have been increasingly coupled with improved targeting guidance

enabled by a growing number of high-quality sensors, leveraged by stealth and electronic jamming (permitting the penetration of hostile airspace), and facilitated by unmanned vehicles in both ISR and hunter-killer roles.

What policy implications and investment streams are suggested by these trends? While the Analysis Center has long speculated on the direction and weight of strategic and budgetary vectors for internal Northrop Grumman audiences, we hesitate—lest we evoke images of advocacy—to do so in detail here. Our corporate responsibility is analysis and not business development. We therefore offer this study as a framework for policy debates on military transformation and related discussions of the conduct of warfare in the early 21st century. A final word of caution, though: while the U.S. has fielded impressive capabilities to meet the military challenges of the immediate post-Cold War era, up to and including the war on terrorism, the road ahead appears ever more challenging, both in terms of the diversity of our future adversaries and their military capabilities. Our trend analysis suggests strongly that, in order to adequately prepare for what is becoming an increasingly hostile security environment, the U.S. must invest in concepts, capabilities, and enabling technologies to sustain its competitive advantages on the future battlefield, all of which were demonstrated to varying degrees in the Gulf War, over the former Yugoslavia, and most recently in Afghanistan. We have enumerated the most critical force attributes here: **access insensitive** and **persistent; highly survivable; networked and situationally aware; precisely targeted** and **informed**; and **increasingly unmanned**.

In conclusion, based on this trend analysis, the U.S. will be best served by the creation of an agile, access-insensitive military force that can project sustained, precise, and survivable military power across great distances with little preparation or reliance on external political or military support.

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