FUTURE DIRECTIONS IN WARFARE: GOOD AND BAD
ANALYSIS, DUBIOUS RHETORIC, AND THE "FOG OF PEACE"

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PREFACE

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In the wake of yet another successful military campaign, ironies abound for U.S. military planners.\(^1\) In spite of a series of military successes in the decade or so following the end of the Cold War—e.g., the first Gulf War, the Kosovo campaign, the war in Afghanistan, and now the war in Iraq—there is no consensus on what kinds of military forces the U.S. ought to have to best meet its future security needs and how it ought to approach future conflict (i.e., how it should fight). Indeed, the real war in Iraq temporarily interrupted, but also accentuated and publicly surfaced, the bureaucratic and intellectual war that has been raging for some time now over the future direction of the U.S. military. Based on early returns, the war in Iraq seems to provide both main camps with grist for their mills. Starkly stated, the battle lines are being increasingly drawn between traditionalists and reformers. The former basically take a business-as-usual approach to the future, implicitly arguing that the world will change in incremental ways and that evolutionary improvements to existing weapon systems, military strategy, and operational art offer the best approach to meeting future U.S. security needs. The latter believe that fundamental changes in the world and advances in a number of key technologies both pose challenges to the traditional approach and present opportunities for doing things differently and more effectively in the future. The prescriptions of these “reformers” would generally lead to a different emphasis in the selection and design of weapon systems, changes in organizational structures, and alterations in basic military strategy and tactics.

There is, of course, a spectrum of views on these matters with shades of gray spanning some of the space between the warring camps and fringe elements at both extremes. Moreover, the debate within this administration has recently become quite personalized, especially as a result of the conflict in Iraq. The battle has been portrayed as one that pits Secretary of Defense Donald Rumsfeld and his civilian “defense intellectual” advisors against the senior military leadership,

\(^1\)I use the expression, “successful military campaign,” as opposed to “successful war” quite deliberately. The initial military campaign in Iraq appears to be one of the most successful in history. Whether the war will prove to be successful in larger geopolitical terms remains to be seen.
a split which immediately conjures up images and echoes of the acrimonious and very public schism during the Kennedy and Johnson administrations between former Secretary of Defense Robert McNamara, supported by his civilian “whiz kids,” and the uniformed military. However, although there is a ring of truth to that proposition in this particular case based on the specific individuals involved, it misrepresents and confuses the debate in a fundamental way. This is not a civilian-military issue. For example, one of the foremost spokesmen for the “reform” school is Admiral Bill Owens (ret), the former Vice Chairman of the Joint Chiefs of Staff. It is an institutional issue, though, with individual military services and other organizations trying to read the tea leaves and position themselves best for the unending internecine bureaucratic wars.

The language of the debate has not helped either. The rhetoric and jargon used in this debate tend to be overblown and distracting at best and downright misleading at worst. Table 1 includes some of the jargon that is currently in the vogue for discussing future concepts of military operations, force planning, and overall strategy. Some are merely irritating. Others are potentially misleading. Still others are important to understand correctly, but are easy for advocates of specific weapon systems, for example, to co-opt and deliberately misrepresent to support their own arguments. For example, the two entries in the first column of Table 1 get to the heart of the current defense debate. They both imply that the United States is going to have to do business differently if it wants to develop an effective military force for the future. Unfortunately, savvy bureaucracies can adapt very quickly to these kinds of threats. If weapon systems have to be “transformational” to be approved, then suddenly even 155-mm artillery pieces magically become “transformational.” Now, new artillery pieces may be many things—perhaps even a good idea—but transformational they are not! (Well, perhaps to Napoleon…) More to the point, who cares? The question should be: Is this a good idea? The jargon merely deflects and confuses the debate.

Similarly, a recent trade journal quoted Air Force Chief of Staff General John Jumper extensively on the need for a cultural revolution in the Air Force to replace “platform-based planning” with “operations-based planning.” (Canan,
2003). In other words, the focus should be on what the job to be done is and how best to do it, rather than on justifying specific programs. This is a laudable goal! However, a skeptic might be forgiven for being a tad suspicious when later in the same article, General Jumper uses this jargon to extol the virtues of two of the Air Force’s favorite programs, the F-22 and the Joint Strike Fighter. Now, perhaps General Jumper will be proven right, but if he is, the Air Force’s planning process must not be as broken as he says it is, since it produced those two fighter programs. A puzzlement.....

Table 1
Trendy Jargon and the “Fog of Peace”

<table>
<thead>
<tr>
<th>Potentially substantive, but easily coopted</th>
<th>“A pedantic reiteration of the obvious”</th>
<th>May or may not prove substantive or useful</th>
<th>Ambiguous—potentially dangerous</th>
<th>Defies description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revolution in Military Affairs (RMA) Transformation</td>
<td>Asymmetric warfare Effects-based targeting Intelligence Preparation of the Battlefield (IPB) Predictive Battlespace Awareness (PBA)</td>
<td>Network-centric warfare Omnipresence</td>
<td>Information dominance Information warfare</td>
<td>Netwar</td>
</tr>
</tbody>
</table>

The combination of jargon, personalities, and institutional battles collectively represents what I refer to as the “fog of peace.” With all due respect to Clausewitz—and acknowledging his legitimate concern about the “fog of war”—war can at least bring a certain clarity and focus to debates about weapon systems, military tactics, and strategy that can allow effective organizations to cut through the nonsense that constipates military bureaucracies in peacetime and help them focus on solving the problems at hand. By contrast, the fog of peace impedes the development of appropriate hardware and sensible operational concepts during the breathing spaces between wars when such innovations could, in principle, be most easily assimilated.

The purpose of this paper is to address the problems of preparing for future war in this challenging environment. First, I will briefly summarize the environment that U.S. war planners currently face in preparing for future
conflicts. However, I will not attempt to address the most important and interesting question of all: namely, what U.S. grand strategy ought to be in the post-Cold War world. Rather, I will limit myself to positing a spectrum of generic conflicts in which the United States might become involved and trying to define what particular military problems each might pose. Then, I will examine some of the technical and operational solutions available to deal with some of these problems, in the process describing particular challenges involved in implementing different approaches. Finally, I will briefly address some of the challenges that the analytical community faces in providing policy makers with useful insights that can help them evaluate the various options.

THE EXTERNAL ENVIRONMENT: THE POSSIBLE NATURE OF FUTURE CONFLICT

It is a testament to the eccentricity of the world as it continues to evolve since the end of the Cold War that the U.S. is even particularly concerned about: defense planning. It emerged from the Cold War as not only the world’s only remaining superpower, but as some have put it, the world’s only “hyperpower,” dominating the rest of the world not only in military strength, but also in economic power and cultural clout. Some have speculated that current U.S. dominance in the world is unprecedented in human history. Indeed, any defense planner in history would kill—literally—to have the U.S. defense problems. For example,

- The U.S. not only has the largest defense budget in the world; it’s defense budget is larger than those of the next several highest-spending nations combined. Moreover, most of those nations are—or at least were—nominal U.S. allies.
- The U.S. spends more on critical information-related technologies—i.e., command control, communications, computers, intelligence,

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2 See, for example, (Bernstein; April 14, 2003). European observers view this situation, which some refer to as “hegemonic internationalism,” with alarm.
surveillance, and reconnaissance ("C4ISR")—than any other nation in
the world spends on defense.

• The U.S. has more state-of-the-art fighter aircraft than the rest of the
world put together.

Couple that scale of commitment to the military with benign neighbors, large
oceans, an absence of serious enemies since the end of the Cold War—until the
rise of Al Qaeda and its fellow travelers—and one would appear to have a
defense minister’s dream.

Of course, it’s not that easy. First, the U.S. has to overcome its Cold War
legacy. That is easier said than done. Almost all of the major weapon systems
and support systems (e.g., intelligence collection systems) currently in the U.S.
inventory were conceived and developed during the Cold War for a world that
no longer exists. In some cases, the transition has been relatively easy; in other
cases, less so. Similarly, institutions have to change and adapt as well. Some of
those changes have actually happened rapidly. Others have not and, in still
other cases, changes have occurred, but those changes have been off-target.
Regardless of the past, there needs to be a clear focus on what future U.S. needs
are, and that has been elusive in an increasingly volatile world. Finally,
notwithstanding the sheer mass of the U.S. military establishment, resources
available for defense are both finite and shrinking, which inevitably means that
choices will have to be made.

The Cold War Legacy

The dominant reality of the Cold War was the nuclear confrontation
between the United States and the Soviet Union. The history is well-known. Key
factors influencing U.S. security strategy and their practical manifestations
included the following:

• The world appeared to be a relatively tidy place, albeit a very
dangerous one. It was dominated by two major power blocks which
were separated by ideology, history, aspiration of national power, and
force of arms: the United States and the Soviet Union and their
respective allies and proxies around the world. The network of entangling alliances produced conflicting pressures. On the one hand, the influence of the two nuclear superpowers tended to keep at least some local quarrels in check lest they get out of hand and escalate to global confrontation. On the other hand, it risked exactly that: making local conflicts almost anywhere potentially of interest to both superpowers and, therefore, potential "flash points."

• U.S. military planning was dominated by two major concerns: preventing a surprise large-scale Soviet nuclear attack on the United States and preventing or countering a Soviet invasion of Western Europe. The only way anyone could think of at the time to prevent a Soviet attack on the United States once the Soviet Union developed secure, reliable nuclear forces with intercontinental range was to threaten to retaliate in kind. That had a variety of implications for military planning:
  - U.S. nuclear forces had to be able to survive an attack and respond quickly, in some cases on a few minutes notice.
  - Offense dominated defense.
  - A command and control system was needed that could either survive an attack itself or allow decisions to be made and attack orders to be transmitted before Soviet weapons could destroy it. It also had to be foolproof enough to prevent unauthorized or accidental launch of nuclear weapons.
  - That meant attack plans had to be scripted in advance. The detailed nature of such plans meant that the planning process was very lengthy and arduous and plans—once created—were relatively inflexible.
  - Attack warning systems had to be reliable and foolproof. Although some of these systems sought to verify the identity of the attacker, as a practical matter, the whole preplanned process would only work if the attackers were known with confidence in advance.
Countering a Soviet invasion of Western Europe was a rather bizarre and complex business because of the politics of NATO and the technology available at the time. Since NATO was outmanned and outgunned by the Soviet Union and its Warsaw Pact allies, NATO's problem was increasing its effective firepower. 

Meanwhile, the United States aggressively pursued new types of conventional weapons as alternatives to nuclear weapons. These included precision-guided submunitions that would allow a single weapon to kill a number of armored vehicles, just as nuclear weapons did, as well as larger precision-guided weapons to destroy individual buildings, including hardened bunkers. This R&D led directly to some of the precision-guided weapons that are in the U.S. inventory today.

Attacking large numbers of moving vehicles with conventional weapons required better ways to find, identify, and locate them accurately. That led to development of new generations of surveillance systems. The Joint Surveillance Targeting and Attack Radar System (JSTARS) aircraft was conceived during this era for use in Europe, although it was not actually fielded until the first Gulf War. R&D on “stealthy” radars, that could be used without giving away the radar’s position also began during the later stages of the Cold War with use in the European theater in mind.

As in the strategic world, war plans for Europe were largely scripted set pieces based on an assumed Soviet attack strategy.

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3Actually, the European members of NATO weren’t much interested in that. They preferred to rely on the threat of large-scale U.S. nuclear retaliation against the Soviet Union to deter a Soviet invasion of Western Europe. Making that credible to the Soviet Union and acceptable to the United States in a world where the Soviet Union could destroy the U.S. with a nuclear attack was a problem that NATO continually tried to finesse. Improving NATO’s capability to defeat a massive armored invasion directly was part of that finesse.

4Others, such as the weapons used extensively in the Iraq war that rely on the Global Positioning System (GPS) satellites for position fixes, came along later. GPS was also conceived during the Cold War, but met with little enthusiasm, generally because of the perceived vulnerability of the satellites to attack by the Soviets.
• Guerilla warfare became a concern during the Cold War as well. Successful communist-led guerrilla wars in China and Cuba suggested to some that “wars of liberation” were the wave of the future in the conflict between East and West, especially in the Third World. Guerrilla wars appeared to some to be the only “safe” kinds of wars in an era where larger-scale conflicts might escalate into a massive nuclear exchange. Moreover, guerrilla wars seemed to offer the superpowers ways to operate through proxies, presumably reducing the risk of a direct confrontation. The U.S. grappled with little success with how to prepare and plan for guerrilla conflicts, although it did substantially expand its use of special operations forces.\(^5\)

The End of the Cold War: Sea Change, Ripples, and Tsunamis

The end of the Cold War changed the world drastically. The dissolution of the Soviet Union, the apparent end of communism, the end of the Warsaw Pact, and the fall of the Berlin Wall followed immediately by the political reunification of Germany stood the old world network of political and military relationships on its head. Most importantly, the United States and the former Soviet Union, while perhaps not yet ready to declare themselves bosom buddies, at least concluded that they had no quarrels serious enough to go to war with each other over and perhaps could even be partner in some international endeavors.

“A kinder, gentler ‘New World Order’?” Practical manifestations began appearing immediately. Both the United States and the Soviet Union in its last days—and later Russia, after the Soviet Union’s demise—took a series of bilateral and unilateral steps to reduce their nuclear arsenals and, hopefully, the risk of nuclear war. Both countries agreed to reduce their strategic nuclear forces by thousands of warheads and reduce the alert levels of large portions of their nuclear forces. The United States went further and essentially eliminated all of its tactical nuclear weapons except for a handful of aircraft-delivered bombs

\(^5\)The war in Vietnam, which was part guerrilla war and part major conventional conflict, was, of course, a disaster for the United States. However, the U.S. military did learn some lessons
deployed in Europe. The Army basically got out of the nuclear business. The Navy retained the dominant strategic role, but its aircraft and surface fleet shifted entirely to conventional weapons. The Air Force retained vestiges of its nuclear capability—a few hundred ICBMs and some bombers with a dual nuclear-conventional mission—but nuclear weapons moved from its basic raison d'être to an operational and institutional back water. Thus, the end of the Cold War not only appeared to eliminate most—although by no means all—of the danger of a large-scale U.S.-Russian nuclear war, but also fundamentally changed the internal bureaucratic politics of the U.S. military services decisionmaking processes on major weapon systems priorities.

The dissolution of the Warsaw Pact—and the eventual assimilation of the former Eastern European members of the Warsaw Pact into NATO—along with the financial collapse of Russia’s ground and tactical air forces rendered NATO’s concern for defeating a massive armored invasion moot. Indeed, there was an issue regarding all the technology, weapons systems, and tactical concepts developed that had been developed to meet that threat: Were they still relevant in the post–Cold War world? There was also, of course, the political issue of what role, if any, NATO had in the post–Cold War world. It was already on shaky ground, and the recent war in Iraq may have put the stake through NATO’s heart.

The first Gulf War was undoubtedly the high water mark for the optimistic view of the post–Cold War world. It had everything to make the U.S.’ life easy:

- A villain (i.e., Saddam Hussein) straight out of central casting
- An overt act of aggression (i.e., the invasion of Kuwait) that left others without even a fig leaf to justify supporting Iraq
- The possibility of a very real long-term strategic threat to not only the Gulf region, but the rest of the world (i.e., an aggressive Iraq made richer by even more oil and armed with nuclear weapons and other weapons of mass destruction).

that improved its performance years later in other conflicts.
• An adversary that used old Soviet equipment and military doctrine: It was perhaps the only country in the world that faced the United States with a hollow version of the threat that it had prepared its military for decades to defeat.

• An enemy leadership that made every possible strategic and tactical mistake, including grossly misunderstanding and underestimating its enemy.

• An Iraqi military force that had the good sense to largely capitulate rather than be slaughtered in a hopeless war.

To meet this inept threat, the first President Bush responded by masterfully crafting an international military and political coalition that included, among others, Russia, various European nations (even France), a number of Arab nations (even Syria), and others in addition to dependable U.S. allies, such as Britain and Australia. The military campaign was a great triumph. The “New World Order” must have appeared to President Bush to be almost at hand.

“*And God said, ‘Ha!’*” It was not to be. The New World Order wasn’t. Although the relative power of the United States has continued to increase in almost all areas, the world has become much more chaotic and arguably more dangerous. The problems are partly military and partly political. For example:

• Old animosities (e.g., Israel and the Palestinians, the Balkans, India and Pakistan) have resurfaced with a vengeance as the constraints imposed by the Cold War alliances have relaxed.

• Genocidal wars and ethnic conflicts have created humanitarian crises that established world powers and organizations have not handled well.

• Absent effective sanctions or alternative security arrangements, the dangers of nuclear proliferation and the likelihood of actual nuclear use appear to be growing. For example, India and Pakistan have
"come out of the closet" with a series of overt tit-for-tat nuclear tests\(^6\) and have faced off in escalating crisis in the long-standing dispute over Kashmir. North Korea has been rattling nuclear sabers again, and others may follow suit and join the nuclear club as well, producing the kind of global proliferation that analysts and policymakers have long feared. Moreover, the traditional inhibitions of nuclear states in helping others acquire nuclear weapons appear to be eroding. For example, states like North Korea may view exporting nuclear technology to others as both a business venture and a policy card to play against others. Even worse, nuclear states, may either come under the direct control of terrorists or be willing to supply them with nuclear weapons. Pakistan is the obvious candidate if the current government were to lose control.

- More and more countries that lack the mean to develop nuclear weapons could (or already have) developed chemical and biological weapons. Terrorist groups are likely to follow suit.

- International terrorism has become a much more virulent and dangerous factor in international affairs, as demonstrated tragically by the 9/11 attacks on the United States. Al Qaeda and its fellow travelers collectively represent anew kind of terrorist threat: a network of organizations motivated by religion and culture, well-financed, well-trained, and equipped with modern technical and organizational skills.

- The crumbling of existing alliances and the old order, the usual competing interests among individual nations, the persistence of old problems (e.g., poverty, ethnic strife, disease, territorial disputes), and the rise of new forces (i.e., militant Islam) coupled with the increasing

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\(^6\)India had, of course, detonated a "peaceful" nuclear device in 1974, but that test did not either satisfy its security needs or earn it a "place at the table" as a full-fledged member of the nuclear club and world power.
dominance of the United States in world affairs has created a new level of anti-Americanism throughout the world.\(^7\)

Thus, in spite of its successes, the United States faces a series of challenges to its security, many of which are different from those for which it planned its military forces in the past. Table 2 summarizes some of those differences.

Table 2
U.S. Defense Planning Problems During the Cold War and in the Post-Cold War World

<table>
<thead>
<tr>
<th>Cold War Era</th>
<th>Post-Cold War World</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Political Environment</strong></td>
<td><strong>Implications for Military Planning</strong></td>
</tr>
<tr>
<td>Largely bipolar: U.S. and allies; Soviet Union and allies</td>
<td>Heavy emphasis on nuclear forces:</td>
</tr>
<tr>
<td>- Ideological conflict</td>
<td>- Strategic</td>
</tr>
<tr>
<td>- Interests collided</td>
<td>- Offense dominated</td>
</tr>
<tr>
<td>- Risk of massive nuclear war</td>
<td>- Large, capable forces</td>
</tr>
<tr>
<td>Rapid alliance structure</td>
<td>- Emphasis on surviving an attack and responding quickly</td>
</tr>
<tr>
<td>- Kept “lid on”</td>
<td>“Stealth” plans (known enemies; rigid, preplanned options)</td>
</tr>
<tr>
<td>Risked superpower confrontations</td>
<td>- Tactical</td>
</tr>
<tr>
<td>Wars of “national liberation”</td>
<td>- Counter to Soviet conventional advantage</td>
</tr>
<tr>
<td>- Nationalistic</td>
<td>- Massive and widespread forces</td>
</tr>
<tr>
<td>- Ideological spin</td>
<td>- Rapid plans</td>
</tr>
<tr>
<td>Cold War legacy:</td>
<td>Conventional forces</td>
</tr>
<tr>
<td>- Massive nuclear forces</td>
<td>- World-class opponents: large, capable forces</td>
</tr>
<tr>
<td>- Large surface navy</td>
<td>- Emphasis on defense against armor and major air attacks</td>
</tr>
<tr>
<td>- Large, modern air force</td>
<td>- Need technological advantage</td>
</tr>
<tr>
<td>- Fighter emphasis</td>
<td>- Aggressive R&amp;D on advanced conventional weapons and related systems</td>
</tr>
</tbody>
</table>

Perhaps most important is the war on terrorism that President Bush announced in response to the 9/11 attacks. Unlike the other post–Cold War conflicts in which the U.S. chose to involve itself, this one was forced upon us, and the stakes are high: win or die. The United States must cope with these problems in a time of fiscal austerity, increasing demands on its defense.

\(^7\)Is it really any surprise that others envy, resent, fear, and hate the “toughest, richest, and coolest kid in the neighborhood?”
resources, shrinking military forces, and a reduced U.S. military presence overseas, at least until recently. How to do that is at the heart of the current debate on how the United States should approach its defense needs in the future and decide what kind of military force it needs.

DEFENSE DEBATES: PREPARING THE U.S. MILITARY FOR FUTURE CONFLICTS

Even in its dominant military position, the United States military establishment has to adjust to cope with the new problems while not neglecting some of the traditional ones. It has to make these adjustments in a time of fiscal austerity when competition among the services and defense agencies is increasingly intense. Moreover, even with a permissive administration, pressures on the defense budget will grow, especially in a slow economy. Choices will be required, and those choices will be difficult to make and enforce.

A Need for Revolutionary Change?

There are basically two options: The first could be described as "business as usual, only smaller " in which the services do basically what they are doing now but on a smaller scale. That keeps programs and institutions intact and is certainly the easiest path to take. The second is to change fundamentally the way the defense establishment does business, altering programs and organizations to be more responsive to future needs. This reform movement has been variously described as trying to produce a "revolution in military affairs" (RMA) or, in Secretary of Defense Rumsfeld's words, a "transformation." The battle has been growing in intensity. There has been considerable speculation that the U.S. victory in the war in Iraq will strengthen the Secretary's hand in his internal battles over transforming the U.S. military along the lines suggested by RMA advocates. On the other hand, the war in Iraq could also bolster the arguments of the traditionalists.

Coined by Andrew Marshall, long-time director of the Office of Net Assessment in the U.S. Department of Defense, the phrase "Revolution in Military Affairs" connotes a drastic change in military affairs resulting from a
combination of technological change and operational and organizational innovation. Marshall’s hypothesis that a new revolution in military affairs may be in progress or just around the corner is based on the proposition that a number of critical technologies are maturing about now that, if taken together and applied properly, might change the way wars are fought. Whoever is quickest to recognize and exploit such a revolutionary potential could radically alter the military equation in world politics. If the United States fails to exploit the RMA, others might, thereby improving their military positions considerably, perhaps at the expense of U.S. interests. Accordingly, most of the attention concerning a possible RMA has focused on how the United States might best exploit it, particularly in view of the internal and external pressures already extant to reshape the U.S. military establishment in fundamental ways.

The RMA concept itself has evolved (pun and irony intended) over the years, but it has always included some combination of the following:

- Precision strike
- “Dominant maneuver,” including speed and agility
- Effective use of information technologies (including “information warfare”)
- Stealth
- Increased use of space systems
- New kinds of vehicles, especially unmanned air vehicles (UAVs)

Some of this is now becoming almost old hat. Precision strike is a fact, as the war against Iraq proved yet again. Stealth has also been with us for a long time now, although who wins the long-term competition between stealth and defensive countermeasures remains an open question. U.S. ground forces certainly demonstrated speed and agility in the Iraq war, although the debate about the need for heavy ground forces remains unresolved.

The critical element in going farther is the effective use of information. Except for pathological cases, destroying targets is no longer much of a problem if they can be characterized correctly and located accurately. However, finding and identifying them can be, as recent combat experience has demonstrated yet
again. That means surveillance and reconnaissance improvements are likely to be the “enabling” capabilities that permit the U.S. military to make the next leap in capability.\footnote{Flexible, rapid, adaptive planning is the other high payoff area.}

**Improved Surveillance and Reconnaissance**

The United States’ massive investment in surveillance and reconnaissance buys a substantial amount of capability, as the left-and column in Table 3 suggests. The United States has the capability to observe and characterize large areas worldwide over a period of time and develop, within limits, both general and specific intelligence information about most potential adversaries.\footnote{There are obviously limits to how deep and broad this understanding can be based on ISR observation alone. Even if the data can be collected, there are limited resources available to analyze the data. That is particularly an issue for future operations, since identifying potential geographic areas of future interest is harder than it once was. Also, there are limits to what can be inferred directly from surveillance data. During the Cold War, the U.S. observed some apparently interesting facilities in the Soviet Union for years—even decades—and only found out what was really going on much later.}

In tactical situations, both the national intelligence collection systems and various tactical military ISR systems can provide a substantial amount of additional information that is useful to military planners and operators, as Table 3 suggests. In general, the current systems can provide the basic information necessary to locate and attack most fixed surface targets with reasonable precision (although not necessarily to determine optimal aim points for precision-guided weapons, since those may depend on the internal structure of the facility, which may not be visible to external sensors), periodic "snapshots" of particular areas of interest (e.g., airfields, invasion routes, storage sites, troop staging areas) that may provide targeting information or help battlefield
Table 3
Capabilities and Limitations of Current and Possible Future U.S. Reconnaissance Systems:
Most of the Remaining Problems are Difficult

<table>
<thead>
<tr>
<th>Current U.S. Capabilities</th>
<th>Achievable With Known Technologies</th>
<th>Will Require New Approaches — Some May Be Too Hard</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Over an extended period of time:</td>
<td>• Precision location of emitters</td>
<td>• Identification</td>
</tr>
<tr>
<td>- General order-of-battle</td>
<td>• Detection of man-made objects under foliage</td>
<td>- Targets under foliage</td>
</tr>
<tr>
<td>- Detection, location, and characterization of most overt, fixed facilities</td>
<td>• Detection, ID, and precision tracking of large formations of combat vehicles</td>
<td>- Some moving targets in competing traffic</td>
</tr>
<tr>
<td>- General characterization of the country</td>
<td>• Detection and limited characterization of shallow buried objects</td>
<td>- Under camouflage</td>
</tr>
<tr>
<td>• In tactical situations:</td>
<td>• Continuous monitoring of known facilities</td>
<td>- Combatants vs. noncombatants (range of conditions)</td>
</tr>
<tr>
<td>- Characterization and general location of emitters</td>
<td></td>
<td>- Individual vehicles, individuals</td>
</tr>
<tr>
<td>- Precision targeting: Information on known fixed targets</td>
<td></td>
<td>- using clever tactics</td>
</tr>
<tr>
<td>- Periodic “snap shots” of known facilities and specific areas</td>
<td></td>
<td>- in heavy traffic</td>
</tr>
<tr>
<td>- Crude detection and tracking of moving vehicles</td>
<td></td>
<td>- even under favorable conditions for difficult vehicles</td>
</tr>
<tr>
<td>- All-weather day/night ability for detection and limited characterization of most targets</td>
<td></td>
<td>- Inside structures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- At night or in bad weather</td>
</tr>
</tbody>
</table>

| Key Sensor Improvements                                                                 |
|• All the “easy” problems have already been solved                                      |
|• Fixed targets in relatively good shape                                                 |
|• Inherent limitations to intelligence collection and analysis                           |
|• Refinements (e.g., better MTI)                                                          |
|• New types of sensors                                                                    |
|   - FOPENradar                                                                           |
|   - MSII/HSI                                                                            |
|   - Ground-penetrating radar                                                            |

commanders better understand what the enemy is doing, and some relatively rudimentary capability to detect and track moving vehicles.

That is actually a lot of capability. However, there are important shortfalls, too. For example, current U.S. surveillance systems have little or no capability to:

• Detect, identify, and track most moving targets with precision.
• Detect and identify targets that are hidden under foliage or camouflage or in buildings or shelters.
• Sort out moving targets of interest from competing traffic.
• Detect and characterize underground facilities.
• Identify difficult targets at night or in bad weather.

Unfortunately, these kinds of problems come up routinely in a variety of military operations. All are difficult to solve. In fact, a general observation about
the current state of U.S. reconnaissance capability and options for improving in the future is that all of the "easy" problems have already been solved. All that remain are difficult.

The remaining problems can be divided roughly into two categories. The middle column in the Table 3 shows a set of problems that appear to be solvable with technology that is in hand. For example, radar technologies exist that should greatly improve the capability of ISR systems to detect, identify, and track large formations of distinctive vehicles (e.g., moving armored divisions) with precision. Similarly, foliage penetration (FOPEN) radar has matured to the point where detecting manmade objects in forests is probably practical, and multi- and hyper-spectral (MSI and HSI, respectively) sensors may greatly improve this ability to identify some classes of targets, perhaps including hidden weapons of mass destruction. The issues with these systems are whether they can be implemented practically and whether the additional capability justifies their cost.

The right-hand column includes more challenging problems. Most of these will require new approaches to solve, and some may not be solvable at all. Most involve identification of targets under difficult conditions, and most involve moving targets of relatively challenging varieties (e.g., small numbers of important targets, such as mobile missiles, using clever tactical and taking advantage of opportunities to hide and otherwise confuse hunters). The issue for the United States in addressing these problems is determining how much it is worth investing trying to solve them, given the inherent technical risks.

New Operational Concepts: “Omnipresence” As An Example

While improved technology can make military forces more effective when employed in familiar ways, it could have vastly greater impact if it opened up possibilities for new ways to operate military forces. For example, Figure 1 shows one operational concept that we have been considering for some time as a possible solution to the so-called “fleeting target” problem (i.e., targets such as mobile missiles that stay hidden most of the time, move periodically when it is convenient for them, and then hide again). We refer to the concept as
Figure 1—A Different Operational Concept? “Omnipresence”

“omnipresence” (at the risk of adding yet another bit of jargon to the already excessively long list of such cliches) simply to be descriptive. The idea is to provide continuous surveillance of the theater, primarily to detect, identify, and track mobile targets as soon as they start to move, and then to have strike systems available close enough at hand to destroy the targets before they can hide again or do whatever it is that they do (e.g., launch missiles). In principle, there are a number of ways to implement such a concept. The key ingredients include:

- Long-endurance surveillance platforms equipped with suitable sensors that can survive and maintain a continuous presence over an enemy’s homeland.
- Communications links with adequate capacity to move the necessary data wherever it needs to go in a timely manner, even in a jamming environment.
- Automated processing capability to help analyze all the reconnaissance data in real time.
• Command and control arrangements that allow quick enough decisions to permit forces to attack fleeting targets effectively.
• Weapons and weapons platforms that can respond as quickly as they need to to destroy time-urgent targets.

Some of these requirements sound deliberately vague. That's because the actual details still have to be worked out, and an extensive set of trades needs to be made. (I will show some sample results later.) However, there are a couple of interesting observations that can be made almost immediately.

First, to achieve the necessary endurance and survivability against a well-armed adversary, there are really only two likely candidates: large, stealthy UAVs or large numbers of surveillance satellites. *Neither kind of system will evolve naturally from existing surveillance and reconnaissance systems.* Figure 2 shows why. The left side of the chart shows a representative set of existing and planned airborne surveillance platforms. They have the endurance and basic sensor capability to do the job, and apparently did provide effective, persistent surveillance during the recent war in Iraq. However, they could not survive against modern air defenses. Doing that would require very different kinds of vehicles, as the right side of the chart suggests.

That means an evolutionary system development process will not work. However, the alternative is both expensive and risky. That is why difficult decisions will be required. In particular, the Air Force will have to decide if it is willing to take the risk of retiring its current systems quickly to help pay for new advanced systems such as stealthy UAVs or new satellites. (Our analysis showed that getting rid of the existing large surveillance aircraft as quickly as possible is the key to keeping overall costs under control.) The pressures against doing that will be immense. There is, of course, the option of maintaining the current systems until well after the new ones have been deployed and have had a chance to prove themselves. While intuitively appealing, that approach would be very expensive and, therefore, unlikely to fly. What is more likely to happen
Figure 2—Alternative Future Options for Persistent Surveillance Are Strikingly Different

if all of the components of the bureaucracy are left to their own devices is that, rather than choose among them, the Air Force would decide to do a little bit of everything—e.g., a small number of new satellites, a few of the old aircraft, a small number of new-large commercial derivative aircraft, and a modest number of large (probably nonstealthy) UAVs. That kind of logrolling coalition approach might keep all the players onboard. However, in terms of providing real capability at an affordable price, it could be a disaster. The force would still be very expensive, but would not have enough of anything to be really effective if the United States were challenged by a competent opponent. That is the problem that the fog of peace can cause.

The weapons platform choices involve similar trades. Ideally, the weapons platforms have to have the endurance and survivability to match that of the surveillance systems. That tends to favor bombers over fighters. It also favors large, stealthy UAVs. Interestingly, the evolutionary leap to armed UAVs
has already happened with the use of armed Predators in Afghanistan and Iraq. If the U.S. were to opt for large, stealthy UAVs for surveillance and reconnaissance applications, those same vehicles could easily evolve into weapons–carrying UAVs just as Predator did. The result, however—an Air Force without manned fighters—would be anything but evolutionary in an organizational sense.

Finally, "omnipresence" may not have to be universal to work. Figure 3 suggests notionally that there could be tradeoffs between persistent surveillance capability and persistent "shooters." Under some conditions, both might not be necessary. In fact, there is operational precedent for the cases shown on both axes. For example, in Bosnia, relatively crude and intermittent surveillance coverage was sometimes adequate because of the high density of "shooters" that could both verify that contacts really were targets of interest and destroy them if appropriate. On the other hand, in Afghanistan, there were apparently instances where Predator reconnaissance UAVs were able to keep vehicles in track for so
long that strike aircraft could come from great distances away and still kill the
targets successfully. Thus, an extensive set of trades could be required to
determine the best overall approach.

A “Slow-Motion Revolution?”

When one tries to decide how “revolutionary” some of the new
technologies and operational concepts are, a striking fact is the glacial pace at
which some of the changes have occurred. For example, precision strike
certainly sounds revolutionary, but if so, it must be a slow-motion revolution.
Precision strike has been coming for decades. Laser-guided bombs were first
used during the Vietnam War. Since then, analysts have more or less taken for
granted that fixed targets and many types of moving targets were vulnerable to
attack by precision-guided weapons. However, as Table 4 shows, it was not until
the first Gulf War some two decades later that the U.S. used precision-guided
weapons in substantial numbers, and it was not until the second war with Iraq
that the U.S. had adequate inventories of precision-guided weapons. Thus,
planners had plenty of time to assess the implications of precision strike and
prepare for it.

Table 4 shows a number of similar trends as well. Operation Desert Storm
was the first conflict in which modern (i.e., very accurate, small) cruise missiles
were used, although such weapons had been either under development or
actually in the inventory for decades. Similarly, the JSTARS aircraft, a converted
Boeing 707 aircraft equipped with a large radar to detect and track moving
ground targets, was used in combat for the first times during Operation Desert
Storm, although officially it was still in development. JSTARS was conceived
during the Cold War to help stop a Warsaw Pact ground offensive. By the time it
was finally ready for use, the Cold War was over, and only the U.S. seemed
capable of conducting massive armored invasions. However, the U.S. found
other things for JSTARS to do.
### Table 4

**Key Elements of Recent Conflicts**

<table>
<thead>
<tr>
<th>The first Gulf War</th>
<th>Bosnia</th>
<th>Afghanistan</th>
<th>Iraq War (Early Returns)</th>
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<tbody>
<tr>
<td>Operation Desert Storm</td>
<td>First use of Predator UAVs (still experimental)</td>
<td>First use of Global Hawk UAVs (still experimental)</td>
<td>First massive use of precision-guided weapons</td>
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<tr>
<td>• First significant use of</td>
<td>• JSTARS—special operations collaboration</td>
<td>• First combat use of B-2²</td>
<td>Largest ever use of special operations forces</td>
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<td>stealthy aircraft (F-117) in a</td>
<td>• Used surveillance as bargaining tool</td>
<td>• First use of armed Predators³</td>
<td>Used heavy armor against irregulars</td>
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<tr>
<td>major conflict¹</td>
<td></td>
<td>• First successful large-scale campaign</td>
<td>Significant adaptive planning</td>
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<tr>
<td>• First &quot;space war&quot;</td>
<td></td>
<td>without artillery or heavy armor</td>
<td>Greater use of Global Hawks; large-scale UAV use</td>
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<td>– GPS (ground forces)</td>
<td></td>
<td>(&quot;airpower + special forces&quot;)</td>
<td>First use of sensor-fused weapons (antiarmor submunition)</td>
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<td>– Communications</td>
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<td>• Routine use of internet-like communications in field</td>
<td>All U.S. aircraft able to launch laser-guided bombs and GPS-guided weapons</td>
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<td>– Near real-time intelligence</td>
<td></td>
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<td>First successful intercept of a ballistic missile in war</td>
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<td>• First large-scale use of</td>
<td>Kosovo</td>
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<td>Largest employment of reconnaissance aircraft in history (persistent 24/7 coverage)</td>
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<td>modern cruise missiles</td>
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<td>• First use of JSTARS (still</td>
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<td>experimental)</td>
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<td>• First operational diversion of</td>
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<td>bombers in flight for armor</td>
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<td>interdiction</td>
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<td>But:</td>
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<tr>
<td>• SCUD hunt failed</td>
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<td>• Hunt for Saddam Hussein failed</td>
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<tr>
<td>• Couldn’t find WMD</td>
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<td>• Plans still rigid</td>
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<td>Problems:</td>
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<tr>
<td>• Targeting irregular forces</td>
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<td>and small units (ID)</td>
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<tr>
<td>• SAM suppression</td>
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¹The F-117 made its combat debut in the U.S. invasion of Panama.
²B-1 bombers were used extensively as well. B-1s were first used in Operation Desert Fox in Iraq.
³First use of armed UAVs since Vietnam.

Other new surveillance systems had a similar history. New UAVs, Predator and Global Hawk, were both pressed into service in Bosnia and Afghanistan, respectively, before they were officially declared operational.

Meanwhile, other Cold War weapon systems, such as the B-1 and B-2 bombers, finally saw their first military action, as did new weapon systems, such as the Joint Direct Attack Munition (JDAM), a GPS-guided bomb that became the mainstay of the U.S. precision weapon force in the Iraq war. Overall, recent U.S. combat history suggests several general trends:

- Major weapon systems take a long time to deploy and seem well-understood, at least on paper, and sometimes are nearly obsolete before they ever reach the field.
- Perhaps surprisingly, operational art and even service culture can change much more quickly, particularly during a period of nearly
continuous war of the sort that the United States has experienced over the last decade or so.

- Modifications to existing systems can be accomplished much more quickly to facilitate new operational concepts, but only if there is pressure to make it happen.
- The language of the debate can mask what is actually happening. Combat, however, generally clarifies the issues.

Dangers Ahead?

All seems to be going extraordinarily well for the United States militarily these days, although “winning the peace” and nation-building continue to pose vexing challenges. It has been winning decisively in major military campaigns. However, it could be dangerous to become overly sanguine. First, the United States has not yet been tested against a competent, well-equipped adversary, so it cannot be certain how robust and effective its technology and tactics really are. In that vein, enemies could exploit new technologies and implement their own versions of the RMA. Of particular concern could be the following kinds of technical and operational innovations used by enemies:

- GPS jammers
- Small, mobile communications jammers
- Countermeasures to sensors (e.g., decoys, improved camouflage)
- Modern light anti-armor weapons operated by irregular forces
- Improved shoulder-launched surface-to-air missiles
- Better sensors on long-range SAMs and airborne interceptors
- Better ground-based tracking sensors to use against air vehicles
- More extensive development of cruise missiles, probably with GPS guidance, possibly with nuclear warheads
- Computer hacking
- Use of crude UAVs to deliver chemical and biological weapons
- Use of commercial imaging satellites to collect reconnaissance data
• Use of medium-power lasers, commercial optical telescopes, and satellite data available on the Internet to interfere with U.S. satellites
• Various kinds of “low-tech” techniques to mount terrorist attacks on the United States

Next, the U.S. has not been able to solve some problems in its military campaigns so far. Some examples include:
• Locating and destroying or capturing weapons of mass destruction
• Locating and capturing or killing enemy leaders, such as Saddam Hussein or Osama bin Laden
• Sorting out irregular and paramilitary forces from civilians and friendly militias
• Defeating ballistic missiles
• Defending against unconventional terrorist attacks

It is unclear who will win in this competition, but the United States cannot afford the luxury of assuming that enemies will not find ways to react effectively to offset its military dominance.

PROBLEMS OF ANALYSIS

Analysis has the advantage of helping answer policy questions without having to go to war to get empirical evidence. The most useful analytical tool is simply clear thinking. However, some aspects of the analysis are quantifiable, and for these, formal mathematical models can be constructed.

Evaluating weapons effectiveness and doing force-level calculations are routine. What is not so routine is handling information properly, especially critical surveillance and reconnaissance information. Figure 4 shows an analytical process and a set of specialized models that we have developed and used in a series of studies to construct an intelligence, surveillance, and reconnaissance (ISR) force structure to support a campaign plan and compliment a force of weapon systems. Basically, the ISR model takes the output of the
Figure 4—Analytical Approach for Evaluating ISR Force Mixes

campaign model and calculates the ISR force structure required to provide the information necessary to execute each part of the campaign plan successfully.

Figure 5 shows the kind of results the ISR model produces. It compares a member of different ISR force structures in terms of targets covered (i.e., the number of targets of each type for which the ISR systems provide adequate information to allow successful attacks) and cost. (Note in this particular case how much better the stealthy UAV and satellite forces do than current and similar systems. Note also that the UAV forces are much cheaper than the alternatives.)
Figure 5—Example of Analytical Results from the ISR Model

Analyzing more advanced operational concepts, such as “omnipresence” (which involves trades between shooter and surveillance platforms, and between dedicated surveillance platforms and shooter platforms with their own sensors), requires additional engagement models. Figure 6 shows sample results from a particular case. It shows the power of persistent continuous surveillance and how hard it is to compensate for surveillance coverage gaps with sensors on strike aircraft.

Figure 7 brings the whole process full circle, comparing various integrated ISR-strike forces at the campaign level. This particular case again demonstrates the power of continuous surveillance in engaging fleeting targets. It also shows how, in this particularly demanding case, the U.S. bomber force isn’t really big enough to do the job.
Figure 6—An Example: Integrating Surveillance Systems and Strike Aircraft

- Improved B-2
- Sanctuary - Qatar orbit
- Flying CAP inside Iran

Figure 7—Highly Dynamic Targets Require Continuous ISR Coverage
There is at least one important analytical issue that current models do not handle well. Standard aircraft survivability models calculate attrition during a series of discrete sorties. If aircraft are used to provide continuous, persistent surveillance, these methods are not really valid. Instead, the surveillance platforms are constantly exposed to defenses and are always potentially vulnerable. Both sides will go through an adaptive learning process, each continuously adjusting to the actions of the other. How that competition comes out will largely determine the viability of the whole concept, so developing suitable analytical methods to model the offense-defense interactions correctly is an important challenge.

There is an interesting cultural aspect to the analysis process. Analysis tends to be years, even decades, ahead of the weapons acquisition process. Of course, that is as it should be, since analysis is supposed to inform weapons acquisition decisions, among other things. On the other hand, the differences can affect analysts’ perceptions of what issues need to be addressed. For example, we have considered the sensor-fused weapons that were used for the first time in the war in Iraq to be out-dated and relatively ineffective for many years. Our studies were calling for more effective submunitions 15 years ago. Thus, it is hard to remember sometimes that the real world hasn’t quite caught up with us yet. Similarly, the war in Iraq was the first time that the United States has not run out of precision-guided weapons prematurely in a conflict. Our studies over the last 10-20 years have consistently pointed out the need for massive inventories—1000s or even 10s of 1000s—of high-quality weapons. This was the first time a real war was really fought with what we considered adequate stockpiles of weapons, which meant that—for once—we might have had a fighting chance for our model results to replicate what happened in the real world.

On the other hand, changes in operational art and the nature of particular classes of conflicts can sometimes change much more rapidly than the analytical community can react. That raises the danger of modeling with great precision exactly the wrong war. Thus, a considerable challenge for the analytical
community is keeping current with the nature of war and the state of operational art.

SUMMARY OF OBSERVATIONS

In adapting the U.S. military to cope with the set of challenges that the early 21st century will pose, the U.S. defense establishment is going to have to be more flexible than in the past. Fortunately, it starts from a position of great strength. However, surprises such as the 9/11 attacks can occur again, and the military establishment must be ready to reinvent itself to the degree necessary to deal with surprises.

It is reassuring that the U.S. military has demonstrated a capacity in a whole series of conflicts over the last decade to adapt effectively and use its forces with skill and flare. The U.S. has been able to develop weapons (e.g., the “bunker buster” bombs in Desert Storm and the so-called “MOAB” bomb just prior to the Iraq war) almost literally overnight when the occasion demanded. Thus, the “clarity of war” can indeed overcome the “fog of peace” at times. The operational adjustments during combat have been even more impressive, suggesting that even large bureaucracies can be adaptive when the need arises.

On the other hand, the real test will come with longer-term, larger scale system procurement efforts in which there are more stakeholders and competing interest to accommodate (and absent the threat that a real battlefield enemy poses). It is unlikely that the whole defense establishment will behave monolithically. Some parts will adapt more readily than others.

One of the first major challenges will be surveillance and reconnaissance, where new systems are necessary if the U.S. is to overcome the remaining shortfalls in its war-fighting capability and those new systems are potentially very expensive. The proper set of systems will be difficult for the relevant bureaucracies to accept, promote, and absorb. An even greater test will be whether armed UAVs will actually replace manned fighters at some point. The decision will measure the capability of analysis to cut through the “fog of peace.”
REFERENCES


