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Airborne Reconnaissance: The Leveraging Tool For Our Future Strategy

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AIRBORNE RECONNAISSANCE: THE LEVERAGING TOOL FOR OUR FUTURE STRATEGY

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ABSTRACT

Information, in the form of intelligence will be a critical element of our national power in future conflicts. One specific form of intelligence collection, airborne reconnaissance, can provide exceptional leverage for our future force structure. A strategy to task analysis, beginning with our national security strategy, produces some very specific missions for our reconnaissance architecture. From these tasks, or missions, flow the requirements for our reconnaissance systems. Our current reconnaissance architecture, however, has some critical requirement shortfalls from both a warfighter and systems perspective. Some of these shortfalls include the limited ability to locate mobile threats, the lack of all-weather, day/night capability, and the inability to monitor large areas for long periods of time. To correct these shortfalls, we must first analyze how reconnaissance can provide total situational awareness for our forces. Fusion of sensors and rapid dissemination of intelligence data are the keys to this awareness. Before we reach total or dominant battlefield awareness, however, major changes must occur in the current airborne reconnaissance architecture. Besides consolidating the myriad of duplicate systems, we must also look at ways to effectively integrate the new endurance unmanned aerial vehicles (UAVs) into our future reconnaissance structure. Some believe these UAVs, and their ability to provide near real-time intelligence directly to the warfighter, will provide the capability to "revolutionize" modern warfare. Yet, the warfighter must become much more involved in the requirements definition process for both the reconnaissance architecture and the new UAVs before we achieve total situational awareness on the battlefield. In addition, we must find ways to overcome the unnatural separation of intelligence, operations, and communications if want to truly leverage our forces.

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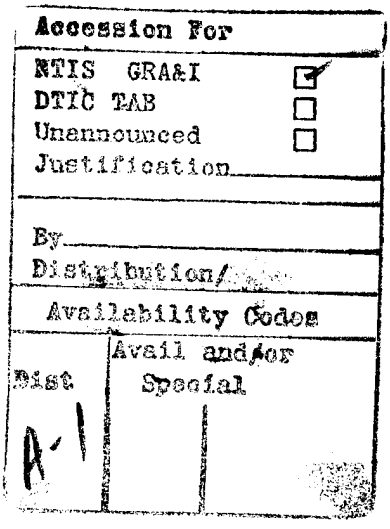

PREFACE

On 6 November 1993, Secretary of Defense William J. Perry established the Defense Airborne Reconnaissance Office (DARO). He chartered the DARO to meet present and future operational requirements by developing a unifying architecture for all joint Service and Defense-wide airborne reconnaissance systems. With this organizational change in the DoD, Secretary Perry established a new way to manage multi-service mission areas that could have a profound effect on the warfighter of the future. At DARO's request, this research will attempt to answer some questions about the future of airborne reconnaissance and its potential effect on national security strategy. With the proper use of emerging technologies, airborne reconnaissance can be a significant tool the warfighter can use to provide leverage for the smaller force of the future. In addition to airborne reconnaissance's effect on National Security Strategy, this paper will examine some obstacles within both the civilian and military intelligence complexes DARO must overcome to ensure the reconnaissance architecture of the future meets warfighter requirements.

TABLE OF CONTENTS

AIRBORNE RECONNAISSANCE: THE LEVERAGING TOOL

FOR OUR STRATEGY OF THE FUTURE

THE SCENARIO FOR FUTURE CHALLENGES

There are several ways we can modernize the structure of our military to win the battles of the future, but only one approach truly responds to the mixed demands of our national security strategy, persistent fiscal constraints, and the increasingly risk adverse nature of both our society and military. This approach involves three basic, although very complex, tenets. First, we must design our forces to collect all the information possible about potential adversaries. Second, we must shorten the time it takes the collected intelligence to reach the weapons system. Third, we must get the intelligence to the warfighter[1] in a user-friendly format that allows the warfighter to employ weapons in a timely manner.

Today's Situation. A U-2's signals intelligence equipment picks up an active enemy air defense radar. These signals cue the U-2's Advanced Synthetic Aperture Radar (ASAR) to image the area. Data is sent to ground processing systems and three hours later the finished product arrives in the hands of the Joint Force Air Component Commander (JFACC) at the Air Operations Center (AOC). Evaluation of the images indicate mobile surface-to-surface SCUD missile launchers moving through the area. The decision to attack the SCUDs is passed from the JFACC to a flight of F-15Es through the Airborne Command Control and Communications aircraft. The SCUDs, however, were launched and the launchers had moved before the F-15s arrived in the area.

Tomorrow's Situation. Two stealthy Unmanned Aerial Vehicles (UAVs) had been monitoring the area for more than four hours. These aircraft, which are larger than earlier reconnaissance UAVs, carry multiple sensors as well as precision-guided weapons. The sensors

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[1]I will use the term "Warfighter" to refer to a variety of operational personnel from the Unified Commander-In-Chief to the Joint Task Force Commander to a fighter aircraft flight-lead, etc.

detect the mobile missiles launchers and send the data directly to computers at the AOC. The computers use automatic target recognition software to confirm the target data and then ensure all rules of engagement are met. Then, the UAV launches weapons on the targets within minutes of detection—the strike is successful and information becomes power.

INFORMATION, INTELLIGENCE AND STRATEGY

Information and National Power. Information is an overarching category of data. Intelligence, a subset of this category, is composed of the data the enemy does not want us to know, because intelligence enables us to employ our instruments of national power more effectively. Intelligence flows from many sources and supports a diverse range of power instruments. This paper will explain why one particular intelligence source—airborne reconnaissance—deserves renewed emphasis if the United States wants to effectively employ the military instrument of national power in future conflicts. Thoroughly exploiting airborne reconnaissance will provide leverage for our entire force structure.

To understand the importance of airborne reconnaissance, we must perform an analysis progressing from national strategy to military tasks to understand what products we need from our reconnaissance assets. This analysis should highlight shortfalls in our capabilities as well as opportunities to improve our reconnaissance architecture. It will then review emerging technologies to see if they afford opportunities to fill those gaps. However, unless we make basic doctrinal changes in the way we establish requirements and define operational concepts for the reconnaissance architecture of the future, we will not be able to take full advantage of these opportunities. This study will offer ways to improve these critical processes.

THE NATURE OF INTELLIGENCE AND RECONNAISSANCE

The Traditional View of Intelligence. Before performing a national strategy to military task analysis of airborne reconnaissance, we must first understand the basic nature of the intelligence process. Intelligence refers to the information a government needs to help it formulate and

implement policy to further its national security interests and to counter threats to those interests from actual or potential adversaries.[2] Intelligence activity consists of five elements: collection, analysis, covert action, counterintelligence, and dissemination of the information to the user.[3] National policy depends heavily on each of these elements. National military strategy in particular relies on the collection and analysis elements because these activities essentially feed target data to the weapons. Intelligence flows from many sources—reconnaissance is one of the major sources. Reconnaissance is a critical process in the collection element. Reconnaissance tools include both satellites and airborne platforms. Because of the stark difference in capabilities between satellite and airborne reconnaissance systems, we must make a distinction between these two types of reconnaissance tools. Although there are other components of collection, the military depends almost exclusively on reconnaissance to collect imagery intelligence (IMINT), signals intelligence (SIGINT), measurement and signatures intelligence (MASINT), and communications intelligence (COMINT).

The Need for a New View of Intelligence and Reconnaissance. A study of this type can quickly become mired in terminology. Theorists can debate the subtleties in the meaning of surveillance and reconnaissance. To simplify our efforts to analyze our future reconnaissance needs, I will use the following definitions:

Intelligence-	any form of information an adversary wants to protect. It can be in the form of signals, communications, imagery, etc.
Reconnaissance-	the act of collecting intelligence; synonymous with surveillance
Airborne Reconnaissance-	the act of collecting intelligence with an aircraft.
Satellite Reconnaissance-	the act of collecting intelligence with spaceborne platforms.

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[2]Victor Marchetti and John D. Marks, The CIA and the Cult of Intelligence (New York: Alfred A. Knopf, 1974) pp. 4, 12.

[3]Ibid.

Reconnaissance, therefore, collects the information, that once analyzed, provides the commander the intelligence he needs to control more of his battlespace.

THE RELATIONSHIP BETWEEN NATIONAL STRATEGY AND RECONNAISSANCE

Overarching Strategy Guidance. President Clinton's a National Security Strategy of Engagement and Enlargement offers several broad tenets that our national military strategy must be able to support. These tenets basically outline how our national security depends on our forces being able to: 1.) control the threat of nuclear proliferation; 2.) deter regional conflicts; 3.) provide a credible overseas presence; 4.) contribute to multilateral peace operations; and 5.) support counterterroism efforts.[4] Therefore, our national *security* strategy of engagement and enlargement will require our national *military* strategy to: 1.) balance national and global economic objectives with defense objectives; 2.) maintain U.S. influence to deter aggression in vital regions through a peace-time forward military presence; and 3.) sustain a posture to engage in high intensity major regional conflicts.[5]

The Future Demands of Our Strategy. Evident in our national security strategy is the high emphasis on cooperative, multinational solutions to future threats and challenges. Though the criteria are not clearly spelled out, President Clinton's national security strategy states "we need to vigorously apply clear guidelines for when to use military force in this era." Knowledge will be the key to selecting where, when, and how to intervene. Our reconnaissance tools must provide a large portion of this knowledge. Therefore implied in this strategy is renewed emphasis on the scope, quality and operational aspects of surveillance. Worldwide military operations will require our reconnaissance architecture to process large quantities of data, provide precise geolocation

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[4]William J. Clinton, A National Security Strategy of Engagement and Enlargement, The White House, February 1995.

[5]Report of the Defense Science Board Task Force on Global Surveillance, for the Office of the Under Secretary of Defense for Acquisition and Technology, December 1993. Classified publication, not for public release, 2-1.

data, and timely information on demand.

FUTURE CHALLENGES

Evolving Warfare. Not only has our approach to national security changed in the last few years, but so has the very nature of war. We may not fight future conflicts against clear, unambiguous enemies, nor will we be able accurately to predict where new conflicts will occur. The Secretary of Defense's *Defense Planning Guidance* asserts conflict may manifest itself as near simultaneous major regional conflicts (MRCs) requiring rapid deployment and action under uncertain environmental and political conditions.[6] Future conflicts could occur in such diverse operational environments as those we encountered in Iraq, Panama, Somalia, and Bosnia. The Persian Gulf War provided hints of what the next stage of warfare would resemble, but by no means did it exploit its characteristics. We often refer to that new type of war as "information warfare." Before we have fully developed the concept, "information warfare" has already become a trite expression, yet it is an accurate descriptor of the type of battles we may fight in the future. There is no doubt warfare is entering a new phase that may "upset the traditional balance between information and force" with firepower becoming an appendage of information.[7] Just as the nature of war is changing, so too is the size of the forces we will have to fight the next war.

Smaller Forces. Downsizing our military places a priority on intelligence's ability to identify and understand emerging threats and develop responses. During the Persian Gulf War, we employed eight Army divisions, six carrier battle groups, more than ten tactical fighter wings, three Marine Expeditionary Forces and two Marine Expeditionary Brigades. Today the entire force structure consists of only ten Army divisions, ten carrier battle groups, twenty fighter wing

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[6]William J. Perry, Defense Planning Guidance FY 1996-2001, 24 May 1994, Classified Publication not for Public Release, 3.

[7]Commander James A. Hazlett and Martin C. Libicki, "Do We Need an Information Corps?", Joint Forces Quarterly, Autumn 1993: 88.

equivalents, and three Marine Expeditionary Forces. If we are forced to allocate this force structure across two MRCs—even if they do not occur precisely at the same time—it becomes clear we will not have the quantity of forces in either MRC that we had in the Persian Gulf. Therefore, the forces we fight with in the future will be much more dependent on reconnaissance assets to leverage their capabilities. Deputy Secretary of Defense John M. Deutch outlined a major role for our future reconnaissance assets by stating that if we fight two MRCs, it will be essential to insert reconnaissance forces early into both conflicts to provide complete battlefield awareness.[8] Commanders will rely heavily on reconnaissance assets to provide dominant knowledge about their battlespace and act as a force multiplier.

INTELLIGENCE ARCHITECTURE OBJECTIVES

The intelligence and reconnaissance architecture consists of all our systems working together to provide the warfighter the information he needs, when he needs it. The types of information we will need to fight future wars and support military operations are quite varied. The complex composition of the information we require is the direct result of the diverse nature of the security threats we will face in the future. The foremost task of our future intelligence architecture is to provide early warning of any aggressive intentions of entities hostile to the U.S. We must also have the capability to learn immediately about any foreign political developments and technical activities regarding proliferation of weapons of mass destruction. Maintaining both an economic and miliary technical edge requires that we know about critical technology developments and certain international transfers of technology. Types of information of unique importance to our forward deployed military forces include threats that affect plans and operations, data on hostile weapons system characteristics, targeting data, and timely accounts of

[8]Policy Speech by the Honorable John M. Deutch, Deputy Secretary of Defense, on 3 Jan 95 at the National Defense University, Ft Leslie J. McNair, Washington D.C.

enemy force activities.[9] Providing this type of information is the objective of our information gathering system. The next critical step in our strategy to task analysis is to define the set of specific tasks of our intelligence architecture.

THE TASKS OF OUR INTELLIGENCE ARCHITECTURE

Intelligence Missions and Tasks. Intelligence missions logically flow from the objectives of our intelligence architecture discussed above. Because reconnaissance alone cannot provide all the information needed, we must continue to rely on traditional human sources to provide much of the information to make policy decisions and conduct planning. Yet, there is much the warfighter says he needs from future reconnaissance systems. To understand better what we need from our reconnaissance architecture, we must understand the various intelligence mission areas.

Peacetime Missions. Intelligence missions during peacetime include data collection activities that provide indications and warning of all adversary deployments activities. Peacetime intelligence provides a continuous update of the enemy order of battle including force location, weapon characteristics, equipment, and combat status. Our intelligence systems must provide the information we need to maintain a contingency target list. Finally, we must have an intelligence architecture in place that provides timely information about enemy technological developments, or any advancements that will decrease the capability of our own forces.

Wartime Missions. Wartime intelligence missions fall into two broad categories. The first is battle management which consists of the processes that analyze enemy force disposition, movement, and intent and form the basis for operational planning. The second category is battle execution which is the direct or indirect application of firepower against enemy targets. Specific intelligence wartime missions include:

- Indications and Warning (I&W) - Intelligence activities intended to detect and report time-sensitive information on any foreign developments that could threaten

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[9]Defense Science Board, Global Surveillance, 2-3.

the U.S. or its allies[10]

- Intelligence Preparation of the Battlefield (IPB) - A systematic approach to analyzing the enemy, weather, and terrain to determine and evaluate enemy capabilities, vulnerabilities, and probable courses of action[11]
- Targeting - The process of selecting targets and matching the appropriate response to them[12]
- Battle Damage Assessment - The process of determining the effects of attacks on targets[13]

Warfighter Requirements. From the intelligence missions flow specific tasks. Any mission usually requires the completion of a specific set of tasks. Many sources have attempted to quantify the tasks the warfighter needs a future reconnaissance architecture to accomplish. In general terms there is good information available to help us define the specific tasks of reconnaissance. Specific warfighter requirements include:

- Accurate intelligence of the enemy, available in near-real-time
- Near-real-time, user friendly, dissemination and exchange of intelligence at all levels
- Detection and neutralization of weapons of mass destruction and other critical targets
- Increased use of unmanned systems in dangerous or exposed areas[14]

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[10]As Defined in Joint Publication 1-02, 12.

[11]As defined in U.S. Army Field Manual 34-130, 26.

[12]Defined in Joint Publication 1-02, 16.

[13]Joint Pub 1-02, 16.

[14]This list is a composite of two studies. The first was a Defense Science and Strategy formulated by the former Vice Chairman of the Joint Chiefs of Staff, Admiral

In 1994, the Defense Science Board (DSB) expanded these requirements. The Board believes to support the types of military operation outlined in the DoD Bottom Up Review, intelligence architecture must also:

- Provide very broad area coverage
- Be able to access any area of the world
- Provide all-weather, day-night coverage
- Be able to identify fixed, moveable, and mobile targets
- Have the ability to penetrate foliage and the ground[15]

These were all areas where the DSB thought the United States lacked significant capability. Major General Pat Hughes, the current Director of Intelligence for the Joint Chiefs of Staff, offered two more intelligence tasks he believed were critical to the success of our weapons systems. First, our new precision guided munitions (Joint Direct Attack Munition, Joint Stand-off Weapon, and cruise missiles) will require very accurate geolocation data for the target if these weapons are to be effective. Second, General Hughes reiterated an old adage that says its not intelligence until its in the hands of the warfighter—or in today's world until it's in the central computer of the aircraft or the electronically programmable read-only memory of the weapon. Quite simply, the major task of our intelligence systems is to meld the inputs from all collection sources and then give the warfighter what he needs, when he needs it. The ultimate goal being to decrease the time and space between the intelligence and the weapon.

Summary—Strategy to Task for Intelligence. Our national security strategy translates into

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David E. Jeremiah. This document lists the top warfighting capabilities needed for the future. The second study was actually a survey conducted by the Deputy Under Secretary of Defense for Advanced Technology's office. This survey asked the various CINC's what advanced capabilities they would most like to see in future systems.

[15]Defense Science Board, Global Surveillance, Architectural Annex, 4.

our military strategy and in turn into warfighter requirements. These requirements point to specific tasks for our intelligence architecture. Summarizing these major tasks will give us a good basis to start the second major portion of this essay, the analysis of our capabilities. Our national security strategy will require our military forces to respond to many types of situations in many parts of the world. These situations could range from peacekeeping to two near simultaneous MRCs. To meet the challenges of those situations, our intelligence architecture must:

- Cover broad geographic areas for long periods of time
- Provide the right intelligence to the appropriate warfighter at the time he needs it
- Be able to operate in any type of weather, day or night
- Provide accurate data to meet the targeting requirements—and capabilities of our advanced weapons

Do we have the capabilities we need to carry out these tasks?

OUR CURRENT INTELLIGENCE ARCHITECTURE AND IT'S SHORTFALLS

Intelligence Architecture Components. Our reconnaissance architecture consists of satellites, aircraft, and human sources. Human intelligence, while essential, is not part of the reconnaissance architecture. Satellites are a major component of the architecture and contribute to all the intelligence tasks discussed above through photographic and radar imagery as well signals collection. In terms of the non-satellite components, the defense-wide airborne reconnaissance architecture consists of more than 38 platforms and systems. These have the capability to conduct IMINT (U-2R), SIGINT (RC-135, EP-3, U-2R, etc.), tactical reconnaissance (F/A-18D, F-14, UAVs, etc.), processing and exploitation (various imagery collection and processing systems), and command and control (E-3A AWACS, E-8C JSTARS).

Airborne Reconnaissance—Designed for Another Age. The major shortfall of our reconnaissance architecture—evident in both the satellite and airborne platform components—is that it was designed for the cold war threat of the former Soviet Union. The U-2—today's

mainstay of airborne reconnaissance—was built to provide the U.S. information about Soviet intercontinental ballistic missile programs. The aircraft directly supported President Dwight Eisenhower and the Joint Chiefs who were convinced the Russians were preparing for a preemptive nuclear strike against the U.S.[16] The overall effectiveness of our reconnaissance architecture began to decline in 1960, when Francis Gary Powers was shot down in a U-2 over Sverdlovsk. The U-2 and the rest of our airborne architecture had become vulnerable to lethal airborne defense systems. Today air defense systems are much more effective and widely proliferated. As threats and forces decline, we no longer have access to many of the forward operating bases we depended on to launch and recover reconnaissance aircraft. Most importantly, our reconnaissance systems were not designed to provide the mobility required for today's joint task force operations.[17]

Satellite Reconnaissance Invaluable But Limited. Our reconnaissance satellites provide continuous global access in an internationally acceptable fashion, but their orbits are very predictable and their coverage is intermittent. Generally, they cannot get closer than 100 nautical miles to their target—geosynchronous satellites must be 22,400 miles high.[18] As with many of our airborne reconnaissance systems, our satellites were generally designed to monitor fixed sites in the Soviet Union. They were not designed with the flexibility to observe regional conflicts throughout the world. Satellites often suffer from a mindset that has dubbed them "national assets." This reflects a bureaucratic distinction formed in 1947 when the duties of the various service department intelligence agencies were separated from common functions the CIA would provide

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[16]Ben R. Rich and Leo Janos, Skunk Works (Boston MA: Little, Brown, and Company, 1994), 122.

[17]Defense Airborne Reconnaissance Office, Integrated Airborne Reconnaissance Strategy, Classified publication not for public release, 4-5.

[18]Abram N. Shulsky, Silent Warfare-Understanding the World of Intelligence (Washington: Brassey's (US), Inc. 1991), 28.

for everyone. The term national refers to a set of machines the President has reserved for national strategic operations or peacetime policy making.[19] As a result, most satellite imagery is still highly sensitive and, even today, the imagery is not always released much below the CINC level. Early successes with satellite imagery caused the CIA to project the image of omniscience. Officials came to believe in the absolute integrity of technical imagery. They firmly believed a picture is a picture—the object is defined strictly by our capacity to observe it. We made the mistake of taking intelligence data through very small keyholes and extrapolating it to a much larger reality.[20] Therefore, today, as the world changes, we have a misplaced confidence in satellites.[21]

Overall Architecture Shortfalls—Warfighter Perspective. Major studies have determined there are serious deficiencies in our present reconnaissance architecture when we examine it in the context of our national security strategy.[22] These current deficiencies are reflected in the following warfighter requirements:

Higher Quantity—Greater Quality: The final report on the conduct of the Persian Gulf War concluded there will be a greatly increased demand for high quality intelligence at the theater and tactical commander levels—intelligence focused directly on those needs.

Broad Area Coverage—Long Dwell: To fill these need there is a requirement for broad area synoptic coverage. The Defense Airborne Reconnaissance Office's (DARO) *Integrated*

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[19]Angelo Codevilla, Informing Statecraft--Intelligence for a New Century (New York: The Free Press, MacMillan Inc. 1992), 118.

[20]Codevilla, Informing Statecraft--Intelligence for a New Century, 120.

[21]From an interview with Lt Gen Ervin Rokke, former Director of Air Force Intelligence and now President of the National Defense University.

[22]The Defense Airborne Reconnaissance Organization conducted a functional analysis of our capability to conduct the basic reconnaissance missions. The April 1992 final report to Congress, Conduct of the Persian Gulf War, discussed the lessons learned from our reconnaissance operations. The Defense Science Board conducted a summer study on Global Surveillance.

Acquisition Strategy noted that the only system we have for broad area coverage is the U-2R and its image processing time can run from four to 48 hours. The DARO assessment also noted we need systems that can stare at a broad area for long periods to find and monitor mobile targets.

All-Weather, Day or Night: We have a limited number of systems that can look through weather. This is a serious deficiency for any regional contingency we may face. Major areas of the world are covered by clouds 80 to 90 percent of the time.

Need for Near Real-Time Data: Near real time data is needed to find and destroy mobile targets. All of our reconnaissance systems today require some processing of their data, which in turn delays dissemination to the warfighter.

Effective, Comprehensive Dissemination: Dissemination could be the major shortfall of our entire reconnaissance architecture. Having broad area coverage that provides near real-time imagery will do nothing for the warfighter if he does not receive what he needs when he needs it. The focus of our acquisition efforts has always centered on platforms and sensors. We've neglected the means to get the data to the persons controlling the weapons. During the Persian Gulf War, imagery was rarely distributed below the higher levels of command. Armored brigade commanders told stories of unexpectedly driving into the middle of a formation of Iraqi tanks only to find out the maps showing the location of every one of those tanks had been prepared and never delivered.

Improved Accuracy: Advanced technology precision weapons have dramatically increased the need for high resolution imagery with significantly improved geolocation accuracy. New weapons such as the Joint Direct Attack Munition and the Joint Stand-Off Weapon need a level of geolocation accuracy of battlefield objects that our current reconnaissance systems cannot meet.

Improved Battle Damage Assessment Capability: The demand for battle damage

assessments during the Gulf War well exceeded current capabilities. This shortfall could severely affect operational planning and targeting. Near real-time data would significantly improve our ability to target, observe and assess, and restrike as necessary.

Exploitation Systems: DARO's assessment noted we have a major shortfall in resources to exploit the vast amounts of imagery we collect.

Concern for Casualties: There will be a heightened sensitivity to casualties in future conflicts—from both the enemy and friendly fire.

Each one of these shortfalls in our reconnaissance architecture are directly attributable to specific system deficiencies.

Shortfalls—Systems Perspective. There are numerous deficiencies in our reconnaissance systems that limit their ability to meet warfighter requirements. The report on the Persian Gulf War concluded that the only reason commanders had significant intelligence data was because our airborne reconnaissance systems provided support well beyond their primary mission design.[23] The U-2, which became operational in 1956, is an excellent example of this point.[24] DARO's assessment concluded there are desirable attributes our current systems lack and future reconnaissance system must have. These attributes are *commonality, interoperability, modularity,* and *scalability.* Our systems today have very few of these attributes. Most of our systems are very "stovepiped" within each service. For example, the SIGINT sensor for the U-2R can only be used on the U-2 and only in conjunction with only one specific type of ground station. Currently there is a lack of common data links, common ground stations, and a common distribution architecture for intelligence data. This prevents sharing data among services. More importantly, we have very little capability to fuse data from a variety of sensors or sources into one coherent picture. There is

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[23]Conduct of the Persian Gulf Conflict, A final report to Congress, Secretary of Defense, January 1992.

[24]Rich, Skunk Works, 122.

no true cross service relationship in platforms, sensors, or ground stations. Another very disturbing system shortfall is the total neglect of tactical reconnaissance by service force planners. The U.S. Air Force has no tactical reconnaissance platforms—the result of the retirement of all RF-4s. The Navy has limited tactical airborne reconnaissance pods that can be loaded on an F-14. The Army has a limited number of UAVs to support their needs. This very limited tactical reconnaissance capability leaves the Fleet/Corps/Combat AF/Marine Expeditionary Force Commander with very few assets the he can call on to fill immediate, time sensitive requirements. During Operation Provide Comfort over Northern Iraq, we had to rely on foreign sources for 100% of our tactical reconnaissance. Because of the extremely limited number of E-8 Joint Surveillance Target Attack Radar System Aircraft (JSTARS), we also have very limited capability to monitor moving targets. None of our systems can provide our forces continuous broad area coverage over denied airspace. This is the major system deficiency in our architecture.

Summary of Lacking Capabilities. In simple terms what does this analysis say about our reconnaissance architecture today? First, we have an architecture that was designed and built to counter a monolithic cold war threat. A major element—the U-2—was never designed to penetrate heavily defended airspace. Second, our satellites, while quite capable, have limited coverage capability and generally fly predictable orbits. They are not capable of finding and monitoring mobile threats across a wide range of regional contingencies. Third, we have very few systems with all-weather, day/night capability. We also cannot cover large areas, for long periods and provide intelligence in a timely enough manner to affect the outcome of the battle or engagement while it is underway. Finally, and most importantly, we lack an adequate architecture to process, exploit, and disseminate—to the appropriate levels—all the data we will collect. There are several possible ways to answer these shortfalls. One way would be to add iterative modifications to current systems. That approach would only forestall the fact that our architecture is becoming antiquated. The real answer is to look at revolutionary new concepts. Under Secretary of Defense

Dr. Paul W. Kaminski recently stated that we will need to replace many platforms within the Services in the near future, but we will not necessarily do it. Instead, he described how we will have to look at entirely new capabilities and approach matters in an entirely different way.[25]

THE SEARCH FOR NEW CONCEPTS

Foundations for New Concepts. As we begin the search for new concepts of how to conduct reconnaissance operations, we should once again look back to the tasks and objectives that fall from our national security strategy. To meet that strategy, we will most likely have to spread reconnaissance assets across the globe. Economics dictates we will not have all the forces we want. Lessons from the Persian Gulf War also indicate that we will not have all the time we want to transport, position, and rehearse our forces. In future battles it is unlikely we will have " instant" air superiority. The requirement to engage in two MRCs will also require us to fight in phases. These phases, outlined in the DoD Bottom-Up Review include: 1.) halt the invasion; 2.) build up our combat power while reducing the enemy's; and 3.) defeat the enemy. While reconnaissance forces will play a critical role in each of these phases, they will provide the most leverage during the first or second phase of the conflict. This will be the time we have the least amount of forces in place, but need the most information. So any new concepts we develop must optimize the ability of our reconnaissance force to operate effectively early in the conflict.

Leverage as a New Concept. Leverage—in military terms—means using a small, highly effective entity (system, force, etc.) to accomplish what would normally require many more of a less effective entity. In the process, the less effective entity is now free to cover other missions. Since, in the future, we will have to do more with a smaller force, a leveraging asset is essential. An example of an area we could leverage is suppression of enemy air defenses (SEAD). This

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[25]Speech by the Honorable Paul G. Kaminski, Under Secretary of Defense for Acquisition and Technology, given at the Industrial College of the Armed Forces on 27 January 1994. The speech was for public release.

mission generally requires a large number of expensive manned aircraft to enter denied airspace and destroy the enemy's air defenses. However, an emerging technology known as a high altitude unmanned aerial vehicle (HAE UAV) has the capability to overfly this denied airspace, locate the targets, and supply the information in near real-time to an Army Tactical Missile System (ATACMS). The ATACMS use smart submunitions to make precise attacks on enemy defenses that previously required an extensive manned effort. This allows the manned forces to destroy more targets in the less defended areas that might not have been attacked because of lack of assets. In theory, our strike forces now have less defenses to contend with overall and they now become more effective—the force is multiplied. A sufficient number of these UAVs with a mix of sensors can provide our forces a significant amount of knowledge over a large battlefield area.

The Leverage of Situational Awareness. The Vice Chairman of the Joint Chiefs of Staff (VCJCS), Admiral William J. Owens, looks for leverage in revolutionary warfighting capabilities. He challenged several agencies to see how we could approach the battlefield differently if we had "dominant battlefield awareness" over a specified area.[26] What would we do differently if we had awareness of everything possible about the enemy short of his intentions, including the location of all his emitters, headquarters, armor, mobile missiles, etc. The basic result of this type of situational awareness means we would be able to strike the targets we choose when it is most appropriate to do so[27]. We could attack mobile missiles when they move; aircraft as they leave reenforced bunkers; or strike enemy communications just as we begin offensive operations. At the request of the VCJCS, both the Institute for National Strategic Studies and the Office of the

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[26]Admiral Owens' views on this subject come from interviews with various organizations including Secretary Defense's Office of Net Assessments, and the J-2 and J-8 directorates within the Joint Staff.

[27]This information comes from discussion with Dr. Stuart Johnson of the Institute of National Strategic Studies and with Commander Jan Van Tol of the Office of the Secretary of Defense (Net Assessments).

Secretary of Defense (Net Assessments) have been looking at this challenge. While both these offices's studies are still in the preliminary stages, the initial thoughts are that such knowledge will improve the Probability of Kill of our weapons, allow us to prioritize targets, increase the simultaneity of operations, and increase the overall tempo of operations. Hence, such knowledge is a significant leveraging tool. Yet it isn't knowledge until it is in the hands, or the mind, of someone who has the capability to use it. Dominant battlefield awareness must get to the shooter (the person controlling some weapon)—and then to the weapon—in a timely manner and useable format.

Fusion and Dissemination—The Key to Dominant Awareness. As we look at technologies to enhance reconnaissance capabilities and leverage our forces to meet our national strategy, the one area that gets overlooked is the means to fuse intelligence data, process it into a useable format and disseminate it to the shooter. Unlike any paradigm of the past, the target acquisition and shooting functions must be fully integrated—they cannot be separate functions. This approach is critical to our success whether we rely on satellites, U-2s, or UAVs to collect intelligence. The need for this fusion emanates from lessons both we and our enemies learned during the Persian Gulf War. We should not depend on gaining the intelligence dominance over future enemies that we did over Iraq. We can expect future enemies to take numerous actions to disguise his movements and forces. No longer may one type of sensor be enough to give a true picture of what is going on, but rather it will most likely require the fusion of several types of sensors. The complete enemy situation may not become clear until we fuse data from a variety of sensors into a concise picture. By fully embracing this concept we will be well on our way to achieving dominant battlefield awareness.

OUR PATH TO TOTAL KNOWLEDGE OF THE BATTLESPACE

Selecting Systems to Form the Architecture. As we come to understand reconnaissance shortfalls, look for new ways to leverage our forces, and devise an architecture to provide the

warfighter a complete picture, certain gaps in our capabilities keep surfacing. They include:

- Be able to survey broad areas for long periods of time, during day or night, in all types of weather
- Have some capability to penetrate denied airspace
- Have a mix of sensor capabilities
- Exploit, fuse, and disseminate data to the shooter *when* he needs it

We must follow a very disciplined process to design an intelligence architecture to meet these challenges. As we build this architecture, we must consider two major constraints. First, the reconnaissance architecture of the future will emerge from our current architecture. Until our current systems reach the end of their life-cycle there is no overwhelming need to replace them. Second, cost will also be a major requirement in any new systems we procure.

Where Do We Find Leverage—Satellites or Airbreathing Platforms. The major contributor to leverage is capability. Cost can also affect leverage—if the system is too expensive, it may be impossible to purchase the quantity required and commanders may be reluctant to employ it in high threat situations. What types of systems will then fill some of the gaps in our reconnaissance architecture? Our tendency here may be to look first to new or more satellite systems to fill these gaps. While it is true that satellites offer the best means for denied area coverage, they do not offer the cost advantage nor the revolutionary capabilities to leverage our forces. Each reconnaissance satellite can cost more than $1 billion and more than $250 million to launch. [28] Unless we deploy the satellites in sufficient quantity, we will not be able to fill the gap of broad area, long dwell coverage. Another critical satellite limitation is that they still are not viewed as an active contributor to the battlespace environment. Satellite imagery is still closely controlled by a process that says their main purpose is to provide strategic peacetime data for the National

[28]Costs come from discussion with RAND Corporation staff and the Defense Science Board Global Surveillance Summer Study.

Command Authorities. During the Gulf War, commanders complained they could not get a photograph out of satellite channels that was less than a day old.[29] Commanders must, therefore, effect a major change in intelligence doctrine to meld satellites into a system capable of rapidly fusing and disseminating intelligence directly to the warfighter. Thus, limited satellite coverage coupled with limited access to their data requires DoD leadership to look to other types of reconnaissance systems to provide the needed leverage.

THE LEVERAGE OF AIRBORNE RECONNAISSANCE

The Defense Airborne Reconnaissance Office and the Future Reconnaissance Architecture. On 6 November 1993, Secretary of Defense William J. Perry created the Defense Airborne Reconnaissance Office (DARO) to unify existing airborne reconnaissance architectures.[30] DARO's challenge was to assess airborne reconnaissance needs through 2010 and develop a strategy to meet those needs in a timely and efficient manner. If DARO can succeed at this task, then our future reconnaissance architecture will have the capability to provide significant leverage. However, the task will not be simple. During the Persian Gulf War, we deployed 33 unique IMINT systems (14 of which were not interoperable), 18 different SIGINT systems, three radar intelligence systems, and three MASINT systems. In all we deployed 85% of our reconnaissance systems to meet a portion of the overall requirements of one major regional contingency.[31] Dissemination processes were so poor commanders found it easier to re-task a collection platform than locate the data in the theater data base.[32] How well DARO transforms these current systems and processes into the reconnaissance architecture of the future may determine a large part of our success in future battles.

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[29]Codevilla, Informing Statecraft--Intelligence for a New Century, 277.

[30]DARO, Integrated Airborne Reconnaissance Strategy, i.

[31]DARO, Integrated Airborne Reconnaissance Strategy, iii.

[32]DARO, Integrated Airborne Reconnaissance Strategy, iii.

The Path to the Future Reconnaissance Architecturee. DARO's approach to building the future reconnaissance architecture is to:

- First consolidate existing duplicate systems
- Integrate systems—maximize interoperability
- Iteratively enhance existing systems
- Field the objective architecture of the future

These steps will allow DARO to take a phased approach to developing a new reconnaissance architecture. The approach will optimize existing systems while maturing the technologies that will provide revolutionary capabilities. Once the new technologies are mature, DARO can make decisions about which systems to replace. For example, we must replace the U-2 that became operational in 1956. While no UAV we have today can match the capabilities of the U-2, we only have a limited number of these aircraft left. We must start planning to replace, or exceed, its capabilities. However, we must learn from our approach with the SR-71 that we should retire no system until its replacement is both feasible and affordable. DARO must be ever on the lookout for the new technologies that will provide the best combination of cost and capabilities to fill the gaps in our requirements and provide significant leverage. Today, there is one emerging technology that has the potential to fill many of the reconnaissance shortfalls and provide the leverage to meet national security and warfighter requirements—a new generation of high-altitude, endurance UAVs.

THE REVOLUTIONARY CAPABILITIES OF ENDURANCE UAVs

Early Debates. UAVs offer a capability that the United States has toyed with in the past, but never really embraced. One version of UAV, the AQM-34, flew 3,435 missions over North Vietnam.[33] In 1969, the U.S. launched the first of four supersonic D-21 drones to photograph

[33]Anthony M. Thornborough, Spy Skies-Three Decades of Airborne Reconnaissance (London: Arms and Armour Press, 1993), 37.

missile sites in China, but only one of these flights resulted in the safe return of its film.[34] Several high altitude UAVs were developed as early as 1977 as replacements for the U-2, but were cancelled when the DoD decided to produce additional U-2Rs.[35] In the Persian Gulf War, tactical UAVs such as the Pioneer proved quite effective, flying more than 300 sorties, losing only one aircraft.[36] Yet, the predominant view of UAVs seems to be they have utility over very high-threat airspace, but because of their unreliability they can not replace manned aircraft. There is speculation a planned UAV replacement for the SR-71 may have suffered from this view. This manned versus unmanned debate has raged at various times within Air Force. Today, however, a merging confluence of realties demand that we abandon these types of debate and develop UAVs to provide the leveraging factor we need for the future. The Army alone seems to have embraced the UAV and tactical versions designed for the JTF are its top priority reconnaissance system.

The Leverage of UAVs. Many have characterized the UAV as the single platform that will transform warfare.[37] Secretary of Defense William J. Perry has stated "there is a need for a tactical reconnaissance vehicle to supply real-time eyes in combat theaters....I doubt that these will be manned airplanes." He goes on to say that UAVs are more economical and militarily feasible than the older U-2 and SR-71 type aircraft and as a result, he doesn't see these earlier types of aircraft in our future.[38] New high altitude (above 60,000 ft), long endurance (24 hours on station) UAVs

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[34]Rich, Skunk Works, 269-270.

[35] Thornborough, Spy Skies-Three Decades of Airborne Reconnaissance, 39.

[36]Defense Airborne Reconnaissance Office, Unmanned Aerial Vehicles Program Plan, April 1994, 2-1, 2-2.

[37]This view comes from discussions with Maj Gen Pat Hughes, J-2 Director of Intelligence. It is also expressed by Terry M. Ryan, professional staff member of the Congressional permanent select committee on intelligence in a December 1994 interview in National Defense.

[38]Rich, Skunk Works, 349-350.

should offer the best alternative to fill the shortfalls in our reconnaissance architecture. They also offer one of the best solutions available to fuse the discipline of reconnaissance to that of weapons employment. These vehicles can monitor as much as 40,000 square nautical miles of area per day and provide the broad area coverage and long dwell capability we lack. The altitude alone will provide the HAE UAV a certain degree of survivability; however, versions are being developed with stealth capabilities. These characteristics will allow us to put sensors over denied airspace without risking a pilot. This UAV will also have defensive system capability. Versions of the HAE UAV will also have a low observable airframe design capable of penetrating enemy airspace for very high priority missions. The primary sensor planned for these UAVs is a synthetic aperture radar which will provide the day and night all weather coverage required. Emphasizing the fact that fusion and dissemination is the key to leverage, the prototype endurance UAVs are being bought as a package with the communication links and ground stations. The HAE UAV known as Tier II+ had one other very important requirement mentioned earlier by Under Secretary of Defense Kaminski—cost. The requirement was a cost not to exceed $10 million per vehicle.[39] The next step in achieving reconnaissance leverage occurs under the advanced concept technology demonstration program, run by the Deputy Under Secretary of Defense for Advanced Technology. Under this program, once the prototype systems are completed, the UAV package will be handed to the warfighter to test its utility and recommend improvements.

UAVs and the Confluence of Trends. It will be up to the warfighter to see if new types of UAVs will provide him better capability to meet the do-more-with-less trends of our national security strategy. It will also be up to the warfighter to see if these systems can meet the trend to revolutionary capabilities often discussed by VCJCS Owens. In addition, our acquisition process will have to help the contractor meet the emerging trend of setting cost as a requirement. Yet, just

[39]This cost requirement was provided by DARO. All other system performance characteristics are "goals."

meeting these trends and building an extremely capable UAV will not guarantee the future leverage we need. There are certain doctrinal or paradigm changes we must make before we approach total knowledge of the battlefield. OPTIMIZING THE REQUIREMENTS PROCESS TO ACHIEVE RECONNAISSANCE LEVERAGE

Technology Alone Offers No Leverage. Historically, there has always been an arduous path to get a new technology out of the laboratory environment and into the hands of the warfighter. High-altitude endurance UAVs, their communications links, and required ground stations will be no different. While UAVs can be a revolutionary tool in and of themselves, they must be integrated with the rest of the intelligence and reconnaissance architecture before they will be effective. There are several areas of concerns the intelligence community, the Joint Staff, the CINCs, and the acquisition community must address. These areas include specific UAV system requirements, consolidation of the present reconnaissance structure, and new employment doctrine.

The Need for Warfighter to Help Define UAV Requirements. It is very easy for someone to say I want a UAV to image 40,000 square miles a day and send the pictures back real-time to the bridge of a ship, to a battalion commander, or even to the cockpit of an aircraft. Processing, transmission, and storage of this data could instantly overwhelm any information architecture we could design. It may also overwhelm the warfighters. Moreover, there is only limited amounts of intelligence that would be useful in the cockpit of an aircraft during a mission. Instead the CINCs must help define the type of information they need at various levels along with the timeline of when they need it. Type of data and timeline of need can be determined by analyzing what part of the conflict the various levels of command are concerned with and what degree of control they need.[40] The types of control and information requirements can loosely be defined as:

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[40]Fred Frostic, Air Campaign Against the Iraqi Army in the Kuwaiti Theater of Operations (Santa Monica: RAND for Project Air Force, 1994), 26.

- Force control- establishes the weight of the effort in a conflict. Sets the structure of and allocates the assets for a large scale operation. Intelligence requirements may be immense, but the data can generally be hours to even days old since force control takes place before the actual operations.
- Battle control- adjusts the weight of effort in response to the changing situation as operations progress. Still requires large amounts and wide-ranging types of data, but the timeline compresses to hours or even minutes.
- Engagement control- directs specific missions and forces to specific targets. Forms the bridge between target acquisition and weapons employment. Data is usually well defined and quite specific and the timeline may be down to seconds.

Satellite systems must supply most of the information needed for force control before air superiority has been established. This phase will require vast amounts of imagery, SIGINT, COMINT, and HUMINT for planning. A combination of satellites and airborne systems will provide the intelligence for battle control. The intelligence in this phase will decrease in volume and detail, but it will need to be more timely than the data satellites can provide. In the Persian Gulf War, airborne systems played the largest role in this area.[41] Airborne systems will have to provide almost all the intelligence for engagement control. Data in this phase will generally just consist of target movement and location, but should arrive at the weapon systems in near real-time.

The Need to Define Near Real-Time Intelligence. The warfighter must determine all the specifications for the intelligence during each of these control phases before we can determine the most appropriate types of UAVs, sensors, and dissemination systems for the future reconnaissance architecture. Sensor definition is one important area that requires warfighter input. For example,

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[41]Frostic, Air Campaign Against the Iraqi Army in the Kuwaiti Theater of Operations, 31.

the primary sensor planned for the high altitude endurance UAV is a synthetic aperture radar. Yet the one sensor many commanders relied on in the Persian Gulf War was the moving target indicator (MTI) radar on the JSTARS aircraft. Since JSTARS will not penetrate denied airspace, MTI sensors may be more important to some warfighters then an imaging radar during portions of the battle. Just as important as the sensors, however, is the specific content of the intelligence data. It varies greatly with the Service, mission, and threat. Air Force F-15Es tasked to attack mobile SCUD launchers may need a real-time radar image of the target area. Studies have also shown this image must have equal resolution as the sensor used to provide terminal weapon guidance.[42] An Army tank battalion may not need images, but rather the digital locations of enemy armor. A Corps Commander may need real-time MTI radar reports of enemy troop movements. Therefore, designers of a real-time reconnaissance architecture will need very specific warfighter inputs before they can determine what to build. Since the Advanced Research Projects Agency (ARPA)—an agency somewhat outside DoD—is managing the two newest developmental UAV programs (Tier II+ and III-), we must ensure the we task the warfighter to explain exactly what he needs.

Joint Requirements Oversight Council and Warfighter Role in Present System Consolidation. The VCJCS supports the DARO acting as the single focal point for all airborne reconnaissance issues. This means DARO must function as the final arbiter for all matters that involve present reconnaissance systems—U-2R, RC-135, EP-3, etc.—as well as the Tier UAV programs. One example of the types of decision DARO may have to make at some point is to retire either the RC-135 or the EP-3 since they perform similar function. Another example may be what to do if one Service decides to pull out of a joint program as happened with a system known as the Joint Services Imagery Processing System. When these types of issues arise, DARO can collect data and make recommendations, however, the real decision authority should rest with the

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[42]From the GOLDPAN Demonstration Report on Air Combat Command Project 93-057F.

Joint Requirements Oversight Council (JROC) which the VCJCS heads. JROC involvement is essential since DARO is trying to build the reconnaissance architecture of the future and must make decisions about systems that affect all Services. Most importantly, DARO must make sure its decisions will provide the warfighter the capabilities needed. It should be the responsibility of the JROC, not DARO, to make the decisions about force structure. To make these decisions, however, the JROC must take on the responsibility for making decisions about programs that are not major defense acquisition programs (referred to as Acquisition Category 1D). Assuming this responsibility will help DARO decide where to apportion limited funds and develop an investment strategy to build the future reconnaissance architecture. For example, the DARO's major initiatives for 1996 resulted in a compromise with the Services as to how to prioritize funds among new engines for U-2s, endurance UAVs, the Army's HUNTER UAV, and dissemination systems. The JROC could provide a warfighter perspective that would rise above Service parochialism.

BLENDING INTELLIGENCE AND OPERATIONS TO ACHIEVE LEVERAGE

The most ominous obstacle to achieving the leverage we need to meet our security strategy is composed of two very unnatural separations in the world of intelligence. The first of these is the artificial barrier that seems to exist between satellite intelligence and the warfighter. This separation largely is the result of the satellite functions—from acquisition to on-orbit operations—still operating in a cold war mode. Satellite reconnaissance systems were designed to provide the National Command Authorities data about Soviet weapon programs and this mindset still limits the dissemination of information today. Even though satellites are optimized for reconnaissance of fixed targets, there is much they have to offer today's warfighter. Their SIGINT capabilities offer innovative ways to target weapons . There are situations where satellite IMINT sent directly to the warfighter could prove invaluable. Satellite intelligence, however, will remain of limited utility—primarily only during force control planning—until we decide to view all forms of intelligence as just another logistical entity the warfighter needs to win a battle. Satellite

intelligence must become just one more point on the continuum of information the warfighter must have—and it must be made available when he needs it. The warfighter must also bear some of the responsibility for this problem since there is almost a cultural resistance on his part to integrate satellite intelligence into his operations since he does not "own" the assets. The mere fact this essay had to debate which systems—satellites or airborne platforms—could best fill reconnaissance shortfalls further highlights this problem. Realizing there are many customers for satellite intelligence, we must ensure the warfighter has some input into the satellite requirements process and is allowed to offer suggestions on ways to improve the dissemination of satellite intelligence. Again our goal must be to shorten the time and space dimensions between the information and the weapon.

The second unnatural separation we must overcome is between the functional areas of intelligence, operations, and communications. These functions are separated on every staff from the Joint Staff to the Joint Task Force. As technology improves, our warfighters and their weapons have much more capability to use and greater requirements for vast amounts of intelligence than at any point in history. Yet, intelligence, operations, and communications are still largely organized into vertical stovepipes in almost all joint organizations as well as in each Service. A real-world example of this separation is that the next generation of precision guided weapons require target data with accuracy beyond the capability of our intelligence systems. Better fusion of intelligence and operations could avoid these future disconnects. This type of organization only serves to increase the time and space between the information and the weapon. In contrast, we could say the optimum weapon systems or warfighter entity has the self-contained ability to acquire intelligence, process the information and use it to employ weapons. While this optimum system may be some years off in the future, we can leverage the forces of today by shrinking the separation between the intelligence and the weapon. This can only be done if no longer consider intelligence, operations, and communications as separate functions. Today we have the capability

to put intelligence from a U-2 into the cockpit of an F-15, the turret of a tank or the bridge of a ship. Soon, UAVs can be quickly retasked to support operations as the battlefield changes and centers of gravity shift. To make these processes effective, the intelligence analyst, the weapons operator and the communication specialist, must all know each others job equally well. They must also be organized, trained and equipped to operate as one unit.

LEVERAGING THE FUTURE

Information is a major instrument of national power. As our national security strategy engages us around the world, the power of the instrument grows. Information manifests itself as intelligence as we attempt to develop a military strategy to match the demands of our national security. Intelligence has specific tasks to complete and requirements to meet if we hope to conduct a myriad of regional operations or two near simultaneous regional conflicts. The architecture that provides that intelligence has certain shortfalls both in terms of what the warfighter wants and what current systems can provide. More importantly, new concepts such as dominant battlefield awareness significantly increase our intelligence demands. New airborne reconnaissance systems such as the high-altitude endurance UAVs provide the first glimpse at how we can leverage existing systems and meet the demands of our strategy and the new concepts. Yet, while new systems offer significant leverage, the greatest area to gain leverage is in how we define requirements for these new systems and how we integrate them into the overall reconnaissance architecture. Old concepts from the cold war still must finally be replaced with new visions. We can win the next war much more quickly if we come to understand that intelligence of any form and from any source must be as readily available to the warfighter as his weapons. Intelligence and communication processes and systems must fade into the world of operations until the time and space between information and the weapons is negligible.

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