Knowledge-Based Warfare:

A Security Strategy for the Next Century

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Supporting a *National Security Strategy of Engagement and Enlargement* requires that we have robust and versatile forces that can, in the words of the Bottom-Up Review (BUR), "credibly deter and, if required, decisively defeat aggression . . . by projecting and sustaining U.S. power in two nearly simultaneous major regional conflicts (MRCs)."[1] This presents the dilemma of how to sustain the BUR-required capability in the near term while recapitalizing forces for the future in an era of fixed or declining resources and rapidly changing technology. The situation is exacerbated by continuing commitments to operations other than war. In addition to consuming recapitalization resources, such operations test a hedge strategy which is implicit in preparing for major regional conflicts through a pattern of force employment in other types of conflicts.

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Official and independent studies reveal a mismatch between the size of the BUR force and projected funding levels to recapitalize the Armed Forces for the next century. The $242.6 billion authorization for FY97 continues the ten-year trend

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in reduced procurement, a 70 percent decline, and an overall budget reduction of 45 percent.[2] Gone is the Cold War strategy that so readily lent itself to quantitative, comparative determinations of force requirements. However, we extended the threat based BUR approach to strategy despite a growing suspicion that operations other than war—such as dealing with regional instability, revolution, or ethnic strife; proliferation of weapons of mass destruction; or future threats from information technologies or non-governmental actors or organizations—will be our most likely security challenges. It is questionable whether anything as large as a traditionally sized corps may indeed be deployed to meet them.

KBW enables us to leverage battlespace to achieve effects through precision employment of combat power

At the same time advances in information age technology have inspired speculation on how these capabilities can be combined with process and organizational change to create a fundamental metamorphosis in the conduct of war, namely, a revolution in military affairs (RMA). Information technologies and processes, when synthesized by operational art and new organizational concepts, present an opportunity for discontinuous change—a great leap in warfighting—from the industrial to information age. The solution to the near-term security dilemma may be to take advantage of the emerging RMA to harness information age technologies and processes to create a force which is able to respond in an uncertain security environment within the DOD budget.

Accomplishing this goal calls for a strategic vision shared by industry and government, and particularly among the services. This is essential for the services to develop a common warfighting philosophy and doctrine and to guide the process and organizational changes needed to create more capable and efficient forces. It is also required as a unifying concept to guide service investment in research, development, and acquisition. It would provide a coherent basis for building a plan that rationalizes defense spending, reducing stovepipe development and duplicative acquisition among the services. Knowledge-based warfare (KBW) is such a strategic vision.

The Strategic Vision

KBW is a process that provides superior situation awareness of the battlespace, allowing us to decide at a faster pace than an enemy. It enables us to leverage our battlespace knowledge to achieve discrete effects through precision employment of combat power. What differentiates KBW from other warfare is the synergism of combining advanced sensors, information technology, and analytic tools to process the information. This allows commanders to view shared information in the context of their battlespace, apply experience and judgment, and transform the information into battlespace knowledge. A capacity to collect data,

USS Shiloh, **Operation Desert Strike.**

U.S. Navy

process it into useful information, and place it in a battlespace context allows forces to achieve information superiority. It has been an abiding goal of commanders and decisionmakers—to know better in order to act faster and more shrewdly than an enemy and thus to be constantly ready. Now it may be possible. Leveraging knowledge can allow us to essentially operate in an adversary's decision cycle. Commanders can achieve discrete effects—disrupting power grids or denying communications links—instead of inflicting widespread damage. This strategy leverages information superiority to sustain strategic advantage.

In 15 to 20 years on the tactical and operational levels our forces will be able to focus less on destructive measures of attrition based, force on force warfare and more on various effects that include, but are not limited to, physical destruction on the battlefield as part of a planned strategy. On the strategic level, this information superiority could be used to orchestrate effects to achieve outcomes outlined in the commander's intent or campaign plans. The proactive use of information superiority opens a new vista of indirect measures for achieving political outcomes. Taking action early allows more options that are "nonlethal" and possibly even transparent to the target audience.

Process

KBW depends on collection and analysis of information. An integrated command, control, communications, computer, intelligence, surveillance, and reconnaissance (C^4ISR) system affords a dynamic, distributed planning and information network that supports the decisionmaker, planner, and analyst as well as the commander and individual soldiers in the field. The conceptual process of KBW involves the following:

- Data, the raw input of our knowledge building process, is derived from space based, sea based, airborne, and unattended ground sensor systems, as well as electronic intelligence, measurement and signature intelligence, signals intelligence, human intelligence, and open sources. This data is the basis for creating information, adding to our knowledge base in the worldwide database of systems, and ultimately battlefield decisions.
- Taking advantage of our rapidly expanding computer processing power, analysts at combat information analysis centers such as the Defense Nuclear Agency (DNA) use dynamic modeling and simulation to put data into context for the warrior, producing decisionable information. These same tools enable warriors to conduct systemic, effects based planning.
- Decisionable information, a key product of this process, is information delivered to the right person at the right time in a usable format. It allows leaders to choose actions or effects to achieve desired outcomes.
- Forces, equipped with a variety of weapons and constituted to respond to a given set of missions, can focus on executing operations with a clear understanding of how their actions will help achieve a battlefield effect and support an associated strategic outcome.

U.S. Navy

U.S. Navy

Tomahawk missile launch.

Secretary of Defense Strategic Studies Group

In 1995 the Secretary of Defense formed the strategic studies group (SSG) to be comprised of one or two officers from each service who are selected to focus on strategic management issues for ten months. The officers assigned to this group must have demonstrated high flag or general officer potential; they receive senior service college and joint PME credit for their participation.

The first group was tasked "to investigate the opportunities and requirements generated by a full adoption of a precision strike regime and to develop a strategy for implementing the transition to such a regime." The results of that effort are found in the accompanying article on knowledge-based warfare which is derived from a report and briefing prepared by the six members of SSG I. Their findings were presented earlier this year to the Secretary, Chairman, and other senior civilian and military leaders.

- To assess the result of measures and ensure the validity of desired effects relative to strategic outcomes in a dynamic environment, constant monitoring and feedback are required, relying on the sensors or collectors that support a dynamic, adaptive process of conducting warfare.
- What makes all this possible is a robust C^4 system coupled with an accurate and high fidelity intelligence, surveillance, and reconnaissance system—C^4ISR.

What's New?

If Sun Tzu were asked what is novel about KBW, he might knowingly say "not much," but in fact there are differences. KBW puts the development of an integrated command and control architecture first, followed by weapon systems designed to operate within the C^2 framework. This reverses the trend of producing advanced weapons with no consideration for the C^2 architecture to employ them. A case in point is the initial deployment of the Tomahawk cruise missile to the fleet without provisions for the C^2 requirements of regional CINCs.

KBW not only can enhance capabilities but increase options for decisionmakers

Similarly, adopting KBW provides a construct for driving technological development and focus for research and development investment. This contrasts with the current process by which industry brings technology to the services in search of an application. Technology today propels the development of doctrine and operational concepts, frequently resulting in an appliqué of new technology on old processes and hardware. KBW initiates technology goals for industry through a coherent strategy and defined C^2 architecture into which future systems can be plugged.

KBW is a departure from the attrition of enemy forces in a linear battlefield that emphasizes physical destruction of targets to a nonlinear focus on effects and outcomes both in and outside the battlespace. It envisions a process that determines, predicts, and measures cascading effects across enemy systems of lethal and nonlethal precision measures.

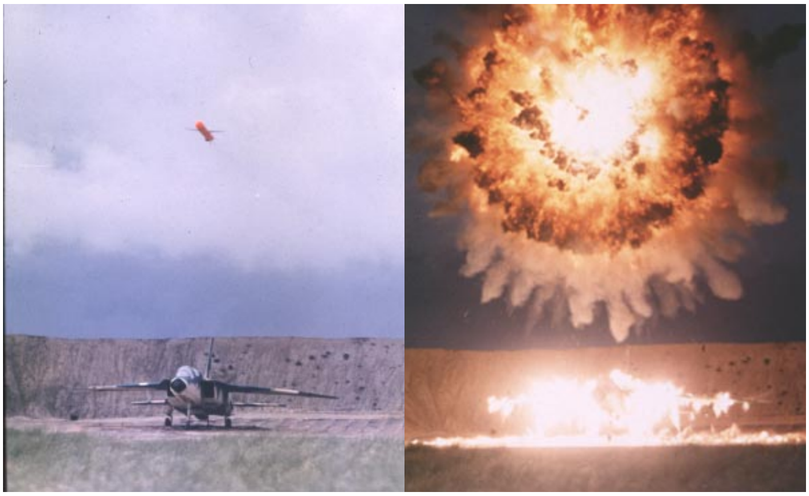
Decisionable information provided via a distributed network empowers individual warriors, blurring the distinction among the strategic, operational, and tactical levels. Lone soldiers, armed with a knowledge of desired effects and outcomes coupled with a superior battlespace awareness, will be able to affect strategic outcomes. Decisionable information and the processes that produce it create an opportunity for faster, more informed decisions at the policy level, more rapid planning and execution by warriors, and more timely adaptation of security processes. Timely adaptation is a deliberate byproduct of real-time monitoring, feedback, and analysis of measures which are taken by warriors in the battlespace. The result is to speed up the whole security process, from precrisis monitoring through execution of chosen courses of action to crisis termination.

KBW stresses controlling the tempo of battle, allowing commanders to leverage superior knowledge to engage at the time, place, and pace of their choice. Time thus becomes a measure of effectiveness for security processes. Parallel war is the ultimate expression of this procedure. Combining dominant battlespace knowledge with the ability to simultaneously attack all key targets with precision measures across the spectrum of an enemy's systems in a relentless, high tempo, and very lethal assault yields the explicit capability to bring a sophisticated industrialized society to its knees in short order and an implicit capability to hold a massed force hostage.

KBW brings a new mind set to planning and information sharing. It embraces dynamic, interactive, collaborative planning with an emphasis on systemic, effects based targeting geared to desired strategic outcomes. This is coupled with the parallel distribution of information, from the decisionmaker to soldier, with intelligent agents to sort decisionable information. It places greater emphasis on data analysis and creates more decisionable information and ultimately knowledge.

KBW Implications

Opportunities offered by KBW have significant implications for national security strategy. It not only can enhance capabilities but increase options for decisionmakers, who utilize knowledge derived from a common base to apply political, diplomatic, and economic measures to avoid using force. This may solve our current dilemma



DOD

TLAM dispensing submunitions.

by facilitating the transition to a more capable, efficient force that can deter large scale conventional conflict and offering policymakers tools to help shape the future security environment.

The *Gulf War Air Power Survey* concluded that the precision guided munitions (PGMs) of Desert Storm fame were up to a hundred times more effective than the dumb bombs that were used in Vietnam.[3] Army studies concluded that precision guided artillery rounds that sense and destroy armor are up to 15 times more lethal than unguided rounds against the same target. Using these systems in the context of a shared picture of the battlespace—a common reference system—can multiply their contribution to enhancing combat capability.

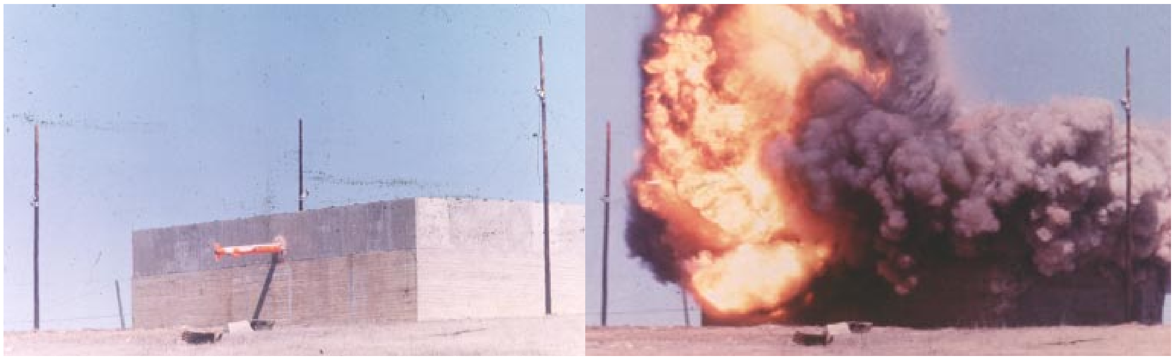
By implication, combat units can be organized into smaller task-organized elements that are more mobile than units today. They will have equal or greater capability. They can operate within an enemy's decision cycle since they will leverage information to accelerate the pace of operations. Because these units are networked on an information system, they can fulfill multiple taskings on a nonlinear battlefield and be mutually supporting. Forward staffs can be reduced and commanders can use the information network to reach back to out-of-area staffs and exploit resident expertise in analysis centers such as DNA, U.S. Strategic Command, and selected laboratories such as Lincoln and Lawrence Livermore. Smaller sized units, increased lethality, and reduced forward staffs can surge the reduction effect on logistics and acquisitions that will result in increased agility and decreased vulnerability, in part due to a shrunken logistics footprint. This generates a force that can conduct high intensity parallel warfare, simultaneously hitting an enemy's political, military, and industrial infrastructure on all levels. It also does more with less. The overall force structure can be reduced since smaller units will be more capable than larger ones; some combat support functions such as intelligence will be subsumed by operations; and staff and support functions can be consolidated into fewer "centers of excellence" or combined career fields in support of multiple fielded forces by a robust network. In addition to a geometric reduction in logistics and acquisition costs, smaller forces translate into a diminished infrastructure for training and maintaining forces and fewer resources for recruiting, training, and sustaining personnel.

The logistics anchor desk (LAD) which supported Joint Endeavor in Bosnia illustrates the potential reduction in logistics requirements with KBW. The Army has the lead in developing this system, which provides access to authoritative data, contains responsive planning tools, and lets logistics staffs collaborate in planning. One of the most used tools in LAD is the knowledge-based logistics planning shell (KBLPS), which utilizes artificial intelligence tools to develop and analyze transportation and supply distribution. When the Army was preparing to establish the intermediate staging base in Hungary, the standard for their facilities was the ability to handle 10,000 soldiers. KBLPS showed that the number would not exceed 6,000. Thus not only was the physical size of the staging base reduced, so were support requirements for meals, water, and beds. Just imagine the compounding effects if knowledge-based systems pervaded our operations.

Deterrence

The devastating capability of KBW is a conventional complement to our nuclear deterrent. An enemy who clearly realizes our superior capacity to conduct high intensity, parallel warfare will most likely be deterred from large scale conventional aggression, thus reducing the need for a large force structure. Events in Bosnia in autumn 1995 may provide insight into this potential future. Precision air strikes in conjunction with diplomatic and other measures achieved the desired effects: termination of the bombardment of Sarajevo and convincing Serb troops to remove their weapons. Subsequently, 13 Tomahawk land attack missiles, part of a broader air campaign and coupled with diplomatic and economic measures, disrupted Serbian C^2 systems. The point was clear: We had both superior knowledge of Serbian systems and the ability and political will for precision attack. Serbian forces were vulnerable. Their grasp of our capability and will, coupled with political and diplomatic measures, helped achieve our desired outcome, cessation of hostilities.

TLAM striking fixed facility.



DOD

The deterrent potential of KBW is not limited to large scale conventional conflict. With its adoption, we may be able to add to force structure savings by exploiting knowledge-based systems to proactively shape our security environment. Abilities that contribute to superior knowledge of the battlespace can also enable policymakers to act sooner to contain or even deter a crisis.

Preventive Defense

KBW also extends the concept of preventive defense. It provides a potent tool to promote stability and thwart aggression in a chaotic world through the extension of a knowledge umbrella, analogous to the nuclear umbrella proffered during the Cold War.

Superpower competition during the Cold War produced a cult of secrecy where knowledge held was power. Since then information has become a commodity to exploit in achieving national objectives, much as military aid, training, and foreign sales now bolster alliances. In the future our contribution of knowledge to an alliance or coalition may be more critical than past endowments of forces and manpower and could be the basis for forming affiliations. Sharing knowledge can help optimize resources by enabling our partners to act decisively without any direct involvement by our forces. It can also strengthen partnership arrangements and military to military contacts through security dialogues based on an awareness of our plans and intentions. In shifting to an information age industrial base, our knowledge-based system will encourage allies to adopt systems that enable them to "plug and play" under our knowledge umbrella. As partners plug into this umbrella, the opportunity increases to access their unique data sources to build our knowledge base.

Factors for Success

Kenichi Ohmae suggests that sound strategic planning is based on determining what he has called key factors for success.[4] These are considerations that allow organizations to capitalize on competitive advantage in specific areas to sustain strategic advantage. What does it take to realize KBW? The answer is enabling technologies, process engineering, and organizational change.

KBW is as much a thought process for considering warfighting in the future as an array of technologies. It thus becomes a construct to drive technology to provide data collection, analysis, and information dissemination systems critical to achieving the common picture of the battlespace that is in turn essential to information superiority. This contrasts with current acquisition processes which rely upon industry to bring out new technology for which the services develop operational applications, integrating it into existing notions of force structure and operations or applying it to existing systems to improve capabilities. KBW opens the door to explore not only technologies, but processes and organizations that will sustain our strategic advantage.

The enabling technologies that help form a common picture of the battlespace and provide decision tools for commanders in the field are also vital to enabling a new warfighting capability. First, it is critical that we develop a digital world map, accurate to one meter in latitude, longitude, height, and depth. This will provide a common reference system which will serve as the index for analyzing time-tagged sensor data and as the basis for a shared picture of the battlespace. Common geographic references will accelerate correlating sensor data with ground truth, thereby allowing us to automatically fuse data gathered by separate sensors, and streamline C^2. Operational planning and execution which uses a common reference system will also improve the targeting and delivery of PGMs and precision employment of "dumb" or imprecise systems. This digital map will be the foundation for a geo-spatial data base that will allow automatic fusion of data from various sources based on time and geographic location. Such reliable geo-location is the keystone to information systems designed to support the KBW concept.

There are many technical challenges to creating an accurate three dimensional map. It will call for advances in information processing, precision navigation, and time control. The sheer size of the database needed to maintain an accurate digital world map will require innovative approaches to data handling and dissemination. Research is in progress that could contribute to this objective. The Defense Mapping Agency is working with industry on a promising idea for data warehousing. A concept known as anchor desks to disseminate information may also be helpful. Advances in precision navigation technologies like the wide area global positioning system (GPS) enhancement and systems like the tightly coupled GPS/INS (inertial navigation system) which is incorporated in the Advanced Research Projects Agency (ARPA) GPS guidance package will facilitate exploitation of geo-spatial data and may help update the geo-spatial data base through use of sensors guided by these navigation technologies. Finally, exploiting this data will require time control in the form of a very accurate time standard and advances in information processing to permit using time-tagged geographic points as addresses in a geo-spatial data base, essentially hanging time-tagged sensor data on a digital world map.

> **electro-optical sensors slated for deployment on UAVs can image 11,000 square nautical miles a day**

Second, with advanced multispectral and hyperspectral sensors, a digital world map and associated precision navigation and time standards will facilitate automated change recognition, or ACR, using computer technology to help identify physical and behavioral changes. This is vital because more data is collected today than can possibly be examined and archived. For example, the electro-optical sensors slated for deployment on the DarkStar and Global Hawk unmanned autonomous vehicles (UAVs) can image 11,000 square nautical miles a day. Moreover, a single UAV could produce enough 8x10 glossy prints in a 24-hour period to cover three football fields. ARPA studies indicate that automated change recognition systems could reduce the imagery which an analyst must examine by a factor of 1200:1.[5]

Conducting change recognition at the pixel level will reduce the amount of band-width that is needed to disseminate imagery. If the dissemination system only sends the digital data required to show change on information already archived at forward sites, the amount of data being moved across the communications infrastructure will drop dramatically.

An automated change recognition system should capitalize on the technology of time tagged data processing exploited to support it like the Navy cooperative engagement capability (CEC) that fuses data from multiple radar sensors into a real-time target track. An ACR system combining all these capabilities would be sophisticated enough to detect physical changes like massing of forces or behavioral changes such as increased communications traffic on a particular line. We can use accurate time to correlate sensor data to detect changes in either minutes or seconds. This ability to recognize changes in physical or behavioral patterns could become the trip wire for indications and warning systems and enable automated collection and subsequent analysis of base data for effects based modeling. Automatic change recognition is essential to an adaptive process or knowledge-based system.

Effects Based Planning

Third, battlespace awareness would help forces determine the effects of actions in combat. This would require analytic tools and computer systems that provide commanders with a common picture of the battlefield. It would also call for tactical and operational level sensor systems that can respond to combat commanders in near-real-time. One advance in this direction is the concept of operations used by the NATO Implementation Force (IFOR) in Bosnia which links Predator UAV sensors to the joint surveillance and target attack radar system (JSTARS) to provide real-time video of the data depicted on moving target indicator systems.

Fourth, effects based planning must be supported by those automated decision tools that can model our forces as well as enemy systems within the context of a commander's battlespace. For effects based planning and analysis, commanders need detailed, interactive models of enemy military, industrial, and political infrastructures. Modeling this concept is a planning and analytical tool that accurately depicts the intercourse among enemy economic, political, military, and social structures and predicts the impact of operations on many target sets in these categories. Modeling will allow us to select weapons or forces most commensurate with our objectives.

System models are the basis for effects based planning. One is Adversary software from the National Security Agency which overlays an enemy's known communications infrastructure on a map so that commanders can assess the impact of disrupting particular nodes. Future models of enemy systems must predict the effects of a planned operation and link them to broader strategic outcomes. The development of accurate systems models poses analytic and technological issues. Because of their magnitude they will require advances in the symbiotic, chaos theory, fuzzy logic, and mathematical bases. For commanders to accurately evaluate courses of action, such models must reliably represent effects and be interactive among land, sea, and air components. Modeling systems to a degree necessary to conduct effects based planning will require a worldwide database of systems to help commanders and decisionmakers clearly understand the impact of operations. Systems models will be the tool to exploit our knowledge of the battlespace in order to react at a pace and intensity that renders an adversary incapable of meaningful response.

Process Engineering

To help combat forces an integrated C4ISR system must produce decisionable information. This calls for a deliberate process engineering effort to determine what information is needed by whom, when, and in what format. We now have a communications, information, and intelligence infrastructure that purports to conduct some of these functions. Process engineering in this context will have to involve the users. They must be educated on the intelligent application of technology and how it can be tailored to their needs. Too often operators have defined preliminary needs and allowed technologists, systems engineers, or analysts to define final information structures. Users thus were not getting what they needed or were being buried in unwanted data.

C4ISR personnel, organizations, and processes must now be defined as integral to combat

Process engineering will form the foundation for a cultural change in information sharing. To support forces that must operate autonomously inside a sophisticated enemy's decision cycle, we must construct an infrastructure that allows for the parallel dissemination of information—its simultaneous distribution to all the parties who require it for planning or execution. In this context, commanders can have full confidence that all their forces will have access to the same information at the same time, and in a format that allows them to take action. Parallel dissemination will also enable them to engage in collaborative planning and interact with a centralized battle management system. It will also facilitate central command and coordination of forces with the distributed or decentralized execution of operations.

Changing processes for information collection, analysis, and dissemination is a daunting intellectual challenge. An analogous process change has been going on in the commercial sector since the microprocessor made desktop computers a reality in the early 1970s. Much of the turmoil in corporate restructuring reflects changing information processes. In the military this is further aggravated by the fact that lives depend on the accuracy and timeliness of information.

Finally, the measure of effectiveness for this process engineering will be time—how fast accurate information is delivered to those who need it. Operating inside an enemy decision cycle is a key advantage of KBW. Leveraging decisionable information will allow a commander to control the time and tempo of a conflict, forcing an enemy to react to the commander's initiatives.

Organizational Change

The technology and process changes discussed thus far will have an organizational impact. One of the most profound will be our perception of what constitutes combat. C4ISR is a combat function in the information age. This is not to imply that the infantryman, pilot, or submariner has a diminished combat role. Rather, C4ISR personnel, organizations, and processes—traditionally regarded as combat support—must now be defined as integral to combat. This change must occur across the board: conceptually, operationally, and institutionally in the ways in which we organize, train, equip, and fight forces. This has significant implications for organizations, careers, training, command, acquisition, and where we invest defense dollars.

As a consequence of knowledge-based warfare, operations will absorb many functions we associate with intelligence. Future operators must interact with knowledge-based systems in order to conduct effects based planning and execute operations. By necessity, these operators will be intimately familiar with the collection, analysis, and dissemination of information needed to employ advanced munitions. This also implies giving the development and deployment of C4ISR systems a priority equal to that of new weapons since the Armed Forces will leverage the information from C4ISR to employ their weaponry. In the future battlespace, information dominance may be key to victory, and a robust C4ISR system is the key to information dominance.

Recommendations

Initial steps on the road to transition include the following:

- *Make an integrated C4ISR system the highest investment priority of research, development, and procurement—equal in status to deployment of improved weapons systems.* We already have invested heavily in a capable inventory of precision and conventional weapons systems. We must be able to achieve information superiority to assure victory in the future battlespace.
- *As ultimate arbiters of change, it is essential that the services adopt KBW as a warfighting philosophy.* Each

U.S. Air Force (Carol Floyd)

NORAD/SPACECOM command center, Cheyenne Mountain.

service has a vision of its place in future warfare. KBW is a unifying concept that all the services should adopt. A shared vision is critical to guide service acquisition, doctrine development, and cultural change. Without it we risk dissipating an historic opportunity to exploit our asymmetric technological advantage to extend strategic dominance in the information age.

■ *Immediately introduce the concept of KBW to soldiers, sailors, marines, and airmen at all levels of professional military education.* The Chairman and service chiefs can be the flag-bearers, but broad support from within the services is crucial, especially in the education process. Change is occurring now, but the basic transformation implied by KBW will come with the generation that is entering the military today. In addition to warfighting skills, we must teach them the impact of rapid advances in information technologies on warfare.

■ *We must encourage this new generation to debate the merits of KBW, explore the changes in organization and process that emerging technologies bring, and experiment with those changes.* We have a rare opportunity where there is no clear and present threat to our national survival. This is the time for innovation and calculated risks.

The United States is in a unique position as the sole "superpower" in a post-Cold War world. It is also blessed with a healthy economy, preeminent military, and information leadership. KBW represents a logical evolution from an industrial age, threat based strategy to an information age, capabilities based strategy. This capitalizes on a growing "informational" base, which now is supplanting our industrial base in economic significance, and an educated population that includes a new generation which is growing up with the digital revolution. In our laboratories, field tests, and exercises we must risk failing now to succeed on tomorrow's battlefield.

The strength of a hedge strategy—as implicit in BUR—is that it retains a force structure recognized as preeminent in the post-Cold War era. The fruits of a large scale investment in an industrial age force are a global recognition of unmatched U.S. capability which has helped deter large scale regional adventurism. Having a robust force structure in place also provides the luxury of a measured approach to incorporating costly or risky new systems. Technologies need not be incorporated until proven and there is reasonable assurance they will enhance existing capabilities.

The irony of a conservative hedge strategy is that it poses the greatest security risk in the long term. Its intent is to maintain the military edge of the Cold War and Gulf War. This has been accomplished at the expense of recapitalization for the very forces that are key to a hedge strategy. The risk of this approach is block obsolescence of combat hardware, a hazard that grows with each year as recapitalization funds are used to maintain current readiness. A possibly greater danger is that an enemy may bypass industrial age forces and leap straight into dramatically more effective information age capabilities. Not hindered by a large investment in older systems, such an enemy could develop a dominant new capacity reminiscent of *Blitzkrieg*.

A transition strategy focused on the information advantage would not only yield immediate military improvements but benefit the growing "informational" base of our economy. The savings from not recapitalizing industrial age hardware, and reductions in force consistent with the absence of a near term threat to the Nation, could be used to accelerate the development of KBW. Growth in capabilities from this type of warfare is key to retaining strategic dominance. Early development and fielding of the substance of KBW may be an effective barrier to an enemy who cannot afford or is technically unable to develop a similar capability. At a minimum, it will allow us another decade or two of peace and stability. **JFQ**

NOTES

[1] William J. Perry, *Annual Report to the President and the Congress* (Washington: Government Printing Office, March 1996), p. 5.

[2] James Kitfield, "Fit to Fight?" *National Journal*, vol. 28, no. 11 (March 16, 1996), p. 582.

[3] See Thomas A. Keaney and Eliot Cohen, *Gulf War Air Power Summary Report* (Washington: Government Printing Office, 1993).

[4] Kenichi Ohmae, *The Mind of the Strategist: The Art of Japanese Business* (New York: McGraw-Hill, 1982).

[5] "Battlefield Awareness, Program Overview," SDSSG briefing by Taylor W. Lawrence, Information Systems Office, Advanced Research Projects Agency (February 1996).