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The Emerging U.S. System of Systems

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Conclusions

The things which give military forces the high fighting capability changing and these changes point toward a qualitative jump in our ability to use our military force effectively.

Probably relating to the way we plan, program and budget these things, we are ahead at least in seeing the individual pieces that make up the system of systems (the systems of systems) which the individual systems are building for our fighting forces.

The system of systems depends totally on the distribution of all the military services. This assumes a common appreciation of what we are building. Most importantly, it requires joint strategic and operational doctrine by which to organize, plan, plan and out military operations.

Revolutions Propel U.S. Military Toward Fundamental Change

Three simultaneous revolutions are propelling the U.S. military toward fundamental change. The first is the implosion of the Soviet Union, the end of the Cold War, the emergence of the United States as the sole military superpower. We are also experiencing a related revolution in the reallocation of resources from defense to domestic programs, which began a decade ago and accelerated with the demise of the Soviet Union. The third is what some call the revolution in military affairs (RMA). RMA is because of earlier investments, particularly in electronic and computational technologies, which give military forces the fighting capability, are changing and these changes point toward a qualitative jump in our ability to use military force effectively. It is this RMA which enables us to take full advantage of the opportunities posed by the first two revolutions, without compromising national security or position as a world leader.

What kind of changes are emerging as a result of the American RMA? They fall into three general categories, which for convenience we may call intelligence, command and control, and precision force:

Intelligence, surveillance, and reconnaissance (ISR) involves sensors and reporting technologies associated with intelligence collection, surveillance, and reconnaissance, as well as the new means by

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which we are able to do better than our own forces are doing.

Advanced C4I- command, control, communications, computer applications, and intelligence processing- the realm in which we convert the less than perfect understanding of a battle space and convert that understanding into missions and assignments designed to alter, control, and dominate that battle space.

Precision force- A broad concept, which the knowledge and order generated from the first two areas are translated into action and results.

It is easy to miss the powerful synergy which exists between ISR, C4I and Precision force. Look at table 1, a cross section of some of the weapons and systems in use or soon to be available to our fighting men and women. We tend to plan, program and budget for these things as if they were discrete capabilities. We are more adept at seeing the individual parts than the vast forest of military capability which the individual systems, because of their interactions, are building for our fighting forces. Fortunately, when you go to sea or into the field, the things that are actually happening, you can see early signs of how it all fits together. From this, you can envision how future systems in the hands of well-educated and trained officers, sailors, airmen and marines can be a qualitatively and quantitatively different military force for the country.

Table 1
Weapons and Systems in Use or Entering U.S. Military Inventories

ISR (sensors)	C4I	Precision Force
RWIKCS	GCOS	SRW
RIVER JUNCTION	MILSTAR	JSOW
EP-3E	JSIPS	TLAM(BLKR II) (II)
JSTAR S	DISIN	ATACMS(BA B A T
HASSA	JUDG I	SILAW
SBR R	C4I FRW	CAUCIM
TIER R2 2 +	TADU LJ J	HAVEE NAR P
TIER R3-3 -	TRAP P	AGM 130 S O
TARPS S	TACSAT	HAIRM
MTI I	JWICS	AIR HAWK K
REM BASS	MIDS	SACDPRM
MAGIC C	SONET	HELLFIRE B II
LANTE BIR N		

What is happening is driven in part by broad system architectures and joint operational concepts, in part by serendipity is the creation of a new system of systems. Merging increasing capacity to gather real-time, all-weather information continuously with increasing capacity to process and make use of this voluminous data builds the realm of dominant battle space knowledge (DBK). DBK involves everything from automated target recognition to knowledge of an opponent's operational plans and the network used to pursue them.

The growing capacity to infuse DBK into all our forces will be coupled with the real-time awareness of both the status and the understanding of what they can do with their growing capacity to apply force with speed and accuracy and precision. This means we will increasingly make the right force to the most promising target of action at both the tactical and operational levels of warfare. Further, we will have an increasing capacity to apply force faster, with more precise weapons and over greater distances. The advances in ISR will allow us to know the effects of our actions and understand what those effects mean with far more fidelity than anything we have experienced to date. This will give our forces a great fighting advantage. This battle assessment, in turn, will make subsequent actions more effective. As a result, we will be able to operate within the opponent's decision cycle. This new system of systems capability, combined with joint doctrine designed to take full advantage of these new fighting capabilities is at the heart of the RMA. It emphasizes a joint perspective because the systems of systems depend primarily on the well-orchestrated contribution from all the military services. This requires a common appreciation of what we are building and, most importantly, requires common strategic and operational doctrine by which to plan and carry out military operations.

The RMA is inevitable. But the speed at which it comes depends on our willingness to embrace these

changes in our policy, planning and programming decisions. By accelerating the transition, we could actualize the RMA perhaps decades before any other nation. This is important for many reasons; one of the most significant is that it will ensure our ability to protect ourselves while enhancing our ability to shape the international environment rather than simply react to it.

This, then, is the essence of the argument in favor of accelerating the RMA. RMA is a bold vision and a controversial one. Vision counts, they are what move us forward and provide us the means to deal with an unknown future. However, the professional military should not defy their vision unless it holds up to honest critique. Let us examine the five most thoughtful criticisms that have been raised.

Opponents Fight Back

The conflicts we face will remain competitors among things, things and adaptive human beings. We need to recognize that many future opponents will do things and intelligently to counter our capabilities. The systems of systems give us.

History is replete with examples of how advances in military technology were eventually countered or matched. Yet history also has intriguing examples of sea revolutions in military affairs—Guderian's blitzkrieg, Hill's vision of amphibious warfare, and the early revolution in air to land. None of these provided dominance in all areas of military operations; and, the edge they provided ultimately eroded. But it was good to have the edge, not only because it paid off in conflict, but also because it gave leverage when implementing foreign policy.

I believe the inherent character of the systems of systems provides an edge in the competition of conflict. The technology it rests upon emphasizes its flexibility and adaptability. It will enable the U.S. military to know more about the flow of conflict than an opponent and to operate within the decision cycle of that opponent. It will allow American forces to fight with means of war faster on a battlefield (traditional or otherwise) and allow them to be more adaptable and flexible than an opponent. In other words, the coming RMA starts from the fundamental assumption that wars are human contests that reward innovation, learning, adaptability, and flexibility.

Relying on Technology is a Achilles Heel

Reliance on "information" technologies—the kind of sensors, data processing and communications subsystems that appear in battle—creates the inherent vulnerability of such technologies to offensive information warfare, or "hacking."

There is, to be sure, great danger in relying on military systems that have exploitable flaws. Indeed, the characteristic that gives any system its potency is that the parts of a system enhance the effectiveness of one another—also makes them susceptible to catastrophic failure if one of their central parts can be corrupted. Yet there are some aspects of the systems of systems that ought to alleviate, if not refute, these concerns.

First, the people implementing the systems are far from ignorant of the danger of inherent flaws. A great deal of thought, planning, money, and continual effort goes into reducing or hypothesizing potential vulnerability. We won't wait until someone else finds a vulnerability before we will think and work continually to find and eliminate it first.

Second, the computer and communications technologies on which the systems of systems are based are

becoming less, not more, susceptible to the various forms of corruption and interference. A race will always exist between those who try to ensure the security of information-based systems and those who seek to overcome their security measures. Yet, the trend favors the defense. In part, this is because of the relative "hardness" of the new generations of communications equipment. Fiber optic cable, for example, has physical characteristics that make it inherently more difficult to "tap" surreptitiously.

Third, there is a robust redundancy to the emerging American system-of-systems. This redundancy works against the possibility of breaking the whole system. It also means that if there are ways of successfully attacking parts of the system, the overall system would not collapse but rather generate "work arounds" or gracefully degrade. In one sense, this is faint praise; we don't want the system-of-systems to degrade at all. In another, it suggests that an opponent would be impotent before he could defend against, counter, or defeat the capabilities we use against him.

Clearly, none of this is cause for complacency; we need to continually bear in mind potential vulnerabilities and work hard to find and end them. Neither can a compelling case be made that the vision is flawed logically or that moving to the system-of-systems carries more practical risk than sticking with the *status quo* and traditional way of doing things.

It Applies Only to the Last War

Some argue that the system-of-systems may work only in a conflict similar to Desert Storm, with relatively open terrain, an inept opponent, and enough time to amass an overwhelming force. Future conflicts may take place in terrain less open, against a motivated force astutely led. Urban areas, jungles, and mountains are as likely to be future battlefields as open deserts. Under these circumstances, it is argued, the system-of-systems is less applicable, and relying on it in place of a more "traditional" force is unnecessarily risky.

However, the system-of-systems applies *across* the full spectrum of conflict. It promises a better, although different, way of doing things. Americans will always seek to use military force with speed, precision, effectiveness and minimal risk to our personnel. The dispositions, movements, and capabilities of an opponent's forces may be easier to discern in open desert than in downtown Mogadishu or triple-canopied jungles. But this is no reason to refrain from trying to discern enemy characteristics. The fact is that the system-of-systems will give us far better capacity to do this, and with greater effectiveness and lower risk than we currently have. Furthermore, it is obvious that it would be highly advantageous to the nation if we found alternatives to the large manpower base and force structure which was the hallmark of our military forces during the Cold War. The system-of-systems and RMA holds out the promise that in the not too distant future the pointed end of the spear may be smaller, far sharper and able to pierce the opponents jugular vein on the first throw.

The System-of-Systems Reduces the Fog and Friction of War

Conflict is chaotic, confusing, and messy. We will never have *perfect* understanding of a battlefield, our systems and weapons will never work flawlessly *all the time*, and the forces we ask to wage war will never do everything correctly *every time*.

The system-of-systems does not offer omniscience or omnipotence. It has demonstrated the ability to reduce the fog and friction of war and promises to do even more so in the future. What counts in war is the relative influence on the opposing side of what some have called the fog and friction of conflict. The side that can reduce the effect of that fog and friction significantly, relative to its opponent, will win.

It's Not Broken, Don't Fix It

There is considerable agreement within the Department of Defense and the services on the central issues: that we ought to continue to develop our capacity to understand the battle spaces in which we may operate, to improve joint operations, and to continue to pursue new technologies. The real issue is the rate at which we should move and which technologies and force structures to favor.

The amount of money needed to accelerate the achievement of the vision is not substantially more than most of the programs that drive the RMA are already funded. They will reach fruition relatively soon, and not all of them should necessarily be accelerated. The significance is, after all, a function of their interaction. Accelerating some but not others may give only marginal gains. Some simply cannot come any faster no matter how much money we might have available to devote to them.

At the center of the debate is whether we should shift resources from some programs and the forces associated with them and give to others. Making trade-offs is something that we have done. The rationale used for making them in the past, we used the perception of the threat that we developed new capabilities to keep ahead of our competitors; the Soviet Union. The realization that things inside the military were broken and needed fixing in the Department went through such a period of inspection after Vietnam.

Now, however, neither of these rationales is particularly relevant: there is no peer competition and we won the last war. So the Obama's razor has changed. Today's rationale is to maintain an adequate defense today while building superiority for the 21st century. What the American people will support and the economy can sustain over the long haul.

The system of systems is emerging as the result of these rationales. It is increasingly ambiguous and dangerous world where coalitions will probably and perhaps replace alliances and nations will look for U.S. leadership. The smart, flexible, mobile, effective force for the system of systems will build makes sense.

Recommendations

The RMA is inevitable. But the speed at which it adapts depends on recognition of what is emerging and a willingness to embrace the change in our policy, planning and programming decisions. By accelerating the transition, we would actualize the RMA perhaps decades before any other nation.

The amount of money needed to accelerate the introduction of the system of systems is not substantially more than most of the programs that drive it are already funded. The center of the debate is whether we should shift resources from some programs and the forces associated with them and increase others. The trade-offs are nothing new. What is new is the rationale used for making them. The Obama's razor's force of defense has changed. Today's rationale is to maintain an adequate defense today while building superiority for the 21st century. What the American people will support and the economy can sustain over the long haul.

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