"Technology and National Security: Risks and Responsibilities"

by

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Conference on Risk and Responsibility in Contemporary Engineering and Science:
French and U.S. Perspectives

France-Stanford Center for Interdisciplinary Studies
April 7-8, 2003

I. Introduction

I'm going to start off with an observation: today, the United States has the most powerful military force the world has ever known. I make that observation because I want to draw some consequences from it, consequences that include both benefits and risks. The first point I want to make about this observation is that technology, especially information technology, played a dominant role in achieving this state of affairs. I shall explain how that happened and, again, discuss some of the consequences of it. When this technology was being introduced into the military arena, in the 1970s and 1980s, there was considerable skepticism that it would really be effective. However, today, its benefits are well understood. What are not as well understood are some of the risks associated with this new technology. This, then, will be the subject of my talk today: benefits and risks of the new military technology and their implications for national security.

II. Historical Background

First, however, let me relate some historical background. In 1990, just as the Cold War was winding down, a regional war erupted. Iraq invaded Kuwait and threatened Saudi Arabia. The United States and its allies considered this threat so serious that we organized a coalition to defeat it. Iraq underestimated the resolve and capability of this coalition and, to Iraq's surprise,

the well-equipped Iraqi army of 500,000 men was routed in just five days by a military operation called Desert Storm. But not only the Iraqis, the entire world, including many in America, was surprised at the unprecedented effectiveness of the smart weapons and the stealth technology demonstrated for the first time in combat.

The American emphasis on technology in the Gulf War represented a complete change in military strategy from World War II. I cannot overemphasize this point. In World War II, we overwhelmed the German and Japanese military forces with the sheer numbers of tanks, aircraft, and ships. The principal factor in the Allied victory in World War II was not technology, but America's industrial might. The story of this amazing achievement is told brilliantly by Stanford historian David Kennedy. He relates that one plant alone, the Willow Run Plant in Michigan, was building one B-24 bomber every 63 minutes. At that rate, the entire fleet of today's B-2 bombers could have been built in one day.

I would like to pose a trivia question to you: at the peak of World War II, how many military aircraft were built in one year in the United States? The answer is that 100,000 military aircraft were built in the United States alone in the year 1944. This had a profound impact on Josef Stalin, who called World War II the "war of machines." He vowed that in the next war, the Soviet Union would win the war of machines. Indeed, at the end of World War II, when the United States and Britain dismantled their defense-related industrial capacity, the Soviet Union began to rebuild its military capacity. As a consequence, throughout the Cold War, the Soviet Union was building tanks and aircraft and guns at a rate of about three times that of the United States. Ominously, by the mid-1970s, the Soviet Union had achieved parity in nuclear weapons as well. So, by the mid-1970s, NATO and the United States were looking at a Soviet Union with parity in nuclear weapons and about a 3-fold advantage in conventional weapons. Many in the United States began to fear then that this development threatened deterrence.

So, we looked for some strategy to restore the conventional military balance. This effort was led by then-U.S. Secretary of Defense, Harold Brown, who held that position in the late

1970s. His approach was to develop high-technology systems that could give our military forces a qualitative advantage able to offset the quantitative advantage of the Soviet forces. Not surprisingly, this approach was called the “Offset Strategy.” At the time, I was Undersecretary of Defense for Research and Engineering and Brown gave me the responsibility and the authority to try to achieve this objective.

Let me tell you a story to try to give you a sense of how fearful we were in those days. Shortly after I started the job as Undersecretary of Defense in Research and Engineering, in 1977, I received a letter from an American citizen in which he stated what he thought the United States should do to counter Soviet conventional military superiority. The writer proposed that the U.S. build something that he called a “moon bomb.” The idea was quite simple; he spelled it out for us in detail. He said we should build a large rocket. The payload of the rocket would be a long strand of steel cable. One end of the cable would be attached to the Earth. Then the rocket would be launched in the direction of the moon, with the cable playing out behind it as it went toward the moon. When the rocket landed on the moon, a little robot would come out and attach the other end of the steel cable to the moon. So, we have this picture: here’s the moon and here’s the Earth, and we have this cable between them. Now, as the Earth rotated, it would pull the attached moon in toward it, and, in accordance with its design, do so in such a way that the moon would smash into the Soviet Union. This is true; I’m not making it up. My executive brought me the letter along with a critique written by one of the physicists on my staff, explaining that this whole idea was infeasible.

III. The Development of IT-Based Weapons Systems

In spite of really good suggestions like the “moon bomb,” I decided instead to base the Offset Strategy on information technology, a field in which the United States, even in those days, had a commanding lead. Very early in my tenure, I went to an organization called DARPA, the Defense Advanced Research Projects Agency, for detailed briefings on the advanced

sensors and smart weapons that were to be the basis of the Offset Strategy. In attending these briefings at DARPA, I was introduced to an audacious new research project called “Harvey.” Some of you may remember that, years ago, there was a play about an invisible rabbit called Harvey. Since the new research project envisioned an “invisible” aircraft, the people at DARPA called it “Harvey.” The plan was to create an entirely new way of configuring aircraft that would make them immune to attack by radar or infrared by making them invisible to these systems. (By the way, the stealth airplanes were never intended to be invisible to the eye, but rather to radar and infrared, which is the key point.) I saw immediately that this so-called stealth technology, if successful, would give the U.S. Air Force an overwhelming advantage, which in turn would leverage the effectiveness of our ground and naval populations. So, I told the DARPA director that he would have all the resources needed to prove out the concept as quickly as possible. Within six months, the project team had a successful flight of a scale-model aircraft, which served as a convincing proof in principle. We put the program in what was called “deep security” and brought in the Air Force to work jointly with DARPA to define, develop, and build a new fighter-bomber, with the goal of achieving operational capability in four years. I don’t know how many of you have worked for the aerospace industry, but four years from concept to operation is an unheard-of time scale, but that was the goal we set for ourselves. The full-scale development of the program, which came to be called the F-117, was begun in the fall of 1977, and initial operational capability was achieved in the fall of 1981, so the goal of four years was achieved.

Although the F-117 was in some ways the most dramatic part of this new technology, the ultimate success of this Offset Strategy really depended on three closely related components. The first was a new family of intelligence centers that could identify and locate in real time all the enemy forces in the battle area. These systems would give what battlefield commanders call “battlefield awareness,” sometimes called situational awareness. Secondly, there was a new family of munitions that could strike the targets as they were identified. These systems came to

be called “smart weapons.” And finally, there was a new way of designing aircraft and ships that would allow them to evade sensors such as radar, and these systems, of which the F-117 was the first, came to be called “stealth.” Taken together, we call this a “system of systems,” and this new system of systems was developed with the highest priority during the late 1970s, produced in the early 1980s, and entered into the force in the late 1980s, just in time for Desert Storm. The results were nothing short of spectacular.

IV. Benefits of the New Systems

Now, I want to explain why these new systems, especially the new intelligence systems, gave the allied military forces such an overwhelming advantage. The key to their success, I believe, was the unprecedented battle awareness enjoyed by the allied commanders in their platoons. Battlefield awareness has been achieved for centuries by sensors that locate and identify units in the battle area, and through communication nets that report these locations to the commanders. And for centuries, the primary means of battlefield awareness was cavalry, using eyeballs as the sensors, and horses to carry the information back. Occasionally carrier pigeons would be used instead of horses. The first great advances in battlefield awareness were not made until World War II. There, aircraft were equipped were high-resolution cameras that gave rather detailed information on enemy positions. In fact, if you look today at the aerial reconnaissance pictures taken in World War II, you will be amazed at their quality. But remember, the battlefield commanders saw those pictures typically one to two days after they were taken, not at the time they were taken. So, the photographs gave them an accurate picture of where the enemy forces were a day or two earlier, not where they were at the time they were viewed. And of course, the photos were weather-dependent.

Those two limitations were dramatically illustrated in the Battle of the Bulge, when the Germans, under cover of bad weather and radio silence, achieved complete, and I mean *complete*, tactical surprise over the Americans. As his forces were being overrun, one of the

American division commanders called his intelligence officer to find out what was going on. The intelligence officer responded with a statement that is famous in army history. He said, “Sir, I’m sorry, but we don’t know what the hell is going on.”

The major advance, however, in battlefield awareness during World War II was the development of radar. Radar was so widely used and so effective that it became a high-priority counter measure for disrupting the opponent. And in a related effort, the interception of radio reports was critical to the crucial struggle that existed between encrypters and decrypters over whether transmitted radio information would be understood. It is not an exaggeration to assert that the British decrypters played a key role in the defeat of the German submarines, at a time when submarine attacks had effectively stopped the lifeline between the United States and Britain. And in the Pacific, American decryption played a key role in the defeat of the Japanese navy. In particular, it was the essential ingredient in the American victory at the Battle of Midway, which was the turning point of the Pacific War.

I want to stop and give you an ~~one little~~ anecdote about Midway. This is a true story about how that particular success happened. The Americans were reading decryptions of the Japanese naval code within an hour or so after the messages were sent. But, in addition to the encryption, the Japanese encoded their messages, that is, they used code terms for what it was they were sending in their transmissions. And so ~~But~~ we were getting ~~these~~ messages that indicated that ~~the~~an attack was to take place at “AF,” but we didn’t know what “AF” was code for~~was~~. But~~,~~ we had it narrowed down to four possibilities, of which Midway was one. For each of those four ~~reports~~possibilities, we sent out a communication message, an unencoded communication message, basically as a decoy to get the Japanese to reveal their code language. The one for Midway read, “Emergency, we have run out of water.” Within an hour after we sent that message, we picked up an encrypted Japanese naval code that said, “AF has run out of water.” So, we ~~now~~then knew that the attack was to take place at Midway in the Pacific.

Well, notwithstanding individual victories like this, the allied victory in World War II was, as I said, primarily due to America's industrial might, simply wearing down the enemy with enormous quantities of airplanes and tanks and guns. By the 1970s, it was clear that producing huge quantities of weapons through our industrial might was not a winning strategy for the Cold War. The United States did not want to repeat the common mistake of making preparations to fight "the last war". And so, we made the cornerstone of the Offset Strategy the development of a new class of powerful sensors: the sensors were cameras, as in World War II, but also TV, infrared, and imaging radars. The platforms for these sensors were airplanes and ships, as in World War II, but also satellites and drones. Most importantly, and often overlooked, is the fact that the sensors were connected by radio links to provide information in real time, not 24 to 48 hours late. Some examples are AWACS, which precisely locates all aircraft in the battle area, and JSTARS, which precisely locates all ground vehicles in the battle area. The American commander in Desert Storm, who had both of these resources, knew at all times, for every place in the battle area, exactly where every Iraqi airplane and every Iraqi ground vehicle was located. That's a huge advantage. The Iraqi commander, on the other hand, only knew what he could learn by looking out of his foxhole.

Here is a homey analogy to explain why this difference is so important. I'm going to take Bob and Elizabeth and two other people from the front row here, and the five of us are going to go over to the campus gymnasium and practice basketball for one hour. This evening, we're going to play the Stanford basketball team, and we are going to win -- because the rules of the game will be that the Stanford team has to play with blindfolds on and our team does not. So, under these rules, we will win, even against a superior team. Of course, the situation in both wars in Iraq is that the coalition forces were superior even without the great advantage in intelligence, so these two wars were essentially no contest.

Today, the Defense Department strategy has evolved from Offset Strategy to RMA, (Revolution in Military Affairs), (what Secretary of Defense Donald Rumsfeld now calls

"Transforming Strategy.") Today's strategy is not, of course, focused on the Soviet Union, because it no longer exists, but on deterring hostile regional powers. This is a very different situation because this evolution of technology was developed for a different reason at a different time. Most significantly, today, rather than the skepticism we faced in the late-1970s, our military leadership is totally committed to this technology and has used it with great effectiveness ever since Desert Storm. Indeed, it has turned out to be more flexible and resilient than any of us imagined in the late 1970s. It was used with great effectiveness in Bosnia, Kosovo, Afghanistan, as well as Desert Storm. And the latest evolution in this technology is being used today in the ongoing war with Iraq, now in its third week. And while that war is far from over, and there are still dangers and perhaps surprises ahead, it does seem clear that the new technology continues to confer an overwhelming advantage on the side that has it over the side that does not.

Desert Storm, looking back now, was more than a decade ago. Obviously, we are not the only ones who have learned a lesson from Desert Storm. So, why have the other nations not emulated the systems first demonstrated in Desert Storm? I have thought about that some, and I'll give you my best guess on why they haven't. I'd start off by saying, "it ain't so easy," to use the vernacular. While the technology does use commercially available components, it is not just a matter of going down to the local electronics store and buying some hardware and bolting it onto tanks and airplanes. Effective application of this new technology requires very sophisticated systems engineering so that the information systems are integrated into the existing weapon systems. It requires equally sophisticated military training, both in the field and by using computer simulations. And it requires the military to develop entirely new tactics, doctrine, and logistics. And for whatever reasons, only the United States military has made this full investment during the last two decades.

V. Risks Associated With the New Systems

Up to this point, I've described the history and some of the benefits of this new technology to the military. Now, I'd like to step back for a moment and consider several of the problems and risks associated with it. The first one is fairly obvious: its advanced technological capabilities make it harder for American forces to operate with allies in coalition warfare. That was demonstrated for the first time in Kosovo, to the pain, confusion, and embarrassment of everybody concerned, but it is still true today. That, of course, is a potential operational problem, but it is also an indirect, but important, cause of the strains in our alliances, which are already under quite significant political pressures.

A second potential risk is that hostile forces will try to disrupt the communications links to computers that are at the heart of this system and therefore the heart of our military today. This strategy, sometimes called cyber-warfare, would involve a combination of jamming the communication links, physically attacking the nodes of these links, and "hacking" our computers. All of these things have been done in various ways at various times, but the combination of these directed against an army in the field could be quite devastating.

Our challenge, then, in using this technology, is at least twofold. First, we must continue to develop systems that stay ahead of the threat, and secondly, we must develop fixes for existing systems that reduce their vulnerability to disruption. One example of the latter is the modification underway to the Global Positioning Satellite. This modification will make it harder for an opponent to jam the airborne Global Positioning Satellite receivers that are so critical to many of our surveillance systems today. This is just an example of the kind of vulnerability one has to deal with.

A third risk is that nations hostile to the United States, realizing that they cannot stand up to our conventional military forces, will be stimulated to develop weapons of mass destruction, ironically, as an offset to our capabilities. We're not the only ones who can think of offsetting strategies. In fact, the most serious unintended consequence of our military technology is the move to weapons of mass destruction on the part of Third World nations. Today, the greatest

threat to the United States, and, indeed, the greatest threat to the world, is the ongoing proliferation of weapons of mass destruction, and in particular, the proliferation of nuclear weapons. In 1994, the United States had a crisis with North Korea, which was not well reported in the newspapers, and many of you may not be aware of it. We came very, very close to what would have been a quite bloody war that would make the current war with Iraq seem small by comparison. Our actions then were designed to stop the development of nuclear weapons in North Korea. A new crisis could arise now that we have discovered a second covert nuclear program in North Korea. So, Iraq is making the headlines today, but by far a bigger problem in terms of the threat of nuclear weapons, is already confronting us in North Korea, and that will have to be faced seriously in the near future.

A primary reason for the ongoing war with Iraq was our government's fear that the Iraqis were developing nuclear weapons and belief that they had developed biological and chemical weapons. People have asked me, "Why should we care?" Particularly, why should we care about nations that use weapons of mass destruction if they do not have means of delivering them to the United States? None of them today has a long-range missile capable of striking the United States. The danger to the United States is that these weapons could be delivered not by missiles, but by unconventional means: in trucks or in freighters that sail into our harbors. The most immediate threat to the United States is that a hostile power will make chemical and biological weapons available to terrorists. I focus on chemical and biological weapons instead of nuclear ones, because the former already exist in many places, as opposed to nuclear, where the international community has been successful at dissuading many countries from developing those capabilities.

A few years ago Dr. Ashton Carter and I wrote a book entitled *Preventive Defense*. Chapter 5 was entitled "Catastrophic Terrorism," and in that chapter, we predicted that the United States would suffer a catastrophic terrorist attack in a few years and outlined the steps necessary to minimize the risk of such an attack. But we also predicted that because those

prescribed actions were expensive and inconvenient, they would not be taken until after the first attack. Unfortunately, both forecasts turned out to be correct. Now, with the attacks on the World Trade Center and the Pentagon having occurred, the public and the government are getting serious about dealing with terrorist threats, and we understand that 9/11 may not be the worst terrorist attack we experience. We know that terrorists are trying to get chemical weapons, biological weapons, and even nuclear weapons. There can no longer be any doubt that if terrorists get their hands on them, they would use them. When considering the threat of terrorists and unstable nations together, the proliferation of these weapons represents the greatest danger to the world today.

VI. Review

To review, during the Cold War, the United States developed a remarkable new military strategy called the Offset Strategy. It called for developing a new military capability based on information technology, including the new stealth technology. That has become the basis for America's military capability and is now called RMA, standing for Revolution in Military Affairs, or, by some, a Transformation Strategy. Although it was developed to defeat the massive military capability of the Soviet Union, it has proven to be remarkably flexible. It was effective in the regional war with Iraq, it has been the basis of the limited wars and peacekeeping actions in Bosnia and Kosovo, and it played a critical role in the surprisingly quick military successes in Afghanistan. Today, it is playing a central role in the military successes to this point in Iraq.

But, along with the benefits of these military technologies come very real risks. These new systems will add to the already-serious strains on alliances. There is a risk that these systems will be attacked by cyber-warfare. There is a risk that hostile nations will be stimulated to develop nuclear weapons or other weapons of mass destruction as an offset to our conventional superiority. And, the most serious, there is a risk that weapons of mass destruction developed by unstable nations will fall into the hands of terrorists.

VII. Conclusion

To conclude, let me briefly discuss a risk that I have not yet mentioned. Every nation in history that has achieved the dominant capability in its military forces has faced the risk that it will come to regard war as relatively cost-free. If they act on this belief, it could lead to a global-scale catastrophe. This brings to mind a discussion I had with Prime Minister Rabin just one month before he was assassinated. As you may know, Prime Minister Rabin was not only the Prime Minister of Israel, but he was also its Defense Minister. When Yitzhak Rabin came to Washington, aside from meeting with the President, he also met with me when I was Secretary of Defense. At one point, while we were musing over some of this revolutionary military technology, he said, “You know, the United States is the only nation in the history of the world that has had dominant military power and has not used it for imperialistic purposes.” I reflected on that and realized that he was right, but I also reflected on how proud I was that we had not used that dominant military power for imperialistic purposes. But, along with that sense of pride, I also had a sense of foreboding, for I knew that one of the greatest challenges to the United States in the years ahead would be to continue to use our power with restraint and to resist the temptation to use it for imperialistic purposes.