Adapt or Die

The US Military's Responsibility to Protect America by Leading the Transformations in Science and Technology

Newt Gingrich
with
Ronald E. Weisbrook, Captain, USN

In The past 200 years, America evolved from a third-rate power to become the unrivaled global superpower based on the rapid scientific and technological advances of the nineteenth and twentieth centuries. These revolutions in science and technology triggered more profound changes than had been experienced in the previous 6,000 years.

These ongoing and accelerating revolutions in science and technology will continue to be dominant features of the next 30 years for our military, our national security system, and our society. It is essential for American national security and for the survival of Western civilization that the United States continues to be on the leading edge of innovative thinking and scientific breakthroughs. It is imperative that our nation's military officers appreciate, most especially, that the failure of American society to lead in science and technology could result in American defeat on the battlefield. History is littered with great powers that watched their preeminence pass to others as they failed to adapt to scientific and technological change. The American military officer, therefore, has a special responsibility to do all within his or her capability to lead America and keep it the leading power in science and technology on the planet.

Newt Gingrich is former Speaker of the US House of Representatives. Under his leadership, Congress passed welfare reform, the first balanced budget in a generation, and the first tax cut in 16 years. Recognized internationally as an expert on world history, military issues, and international affairs, the former Speaker serves as a member of the Defense Policy Board, is the longest-serving teacher of the Joint Flag Officer Warfighting Course for major generals, and teaches officers from all five services as a distinguished visiting scholar and professor at the National Defense University.

CAPT Ronald E. Weisbrook is currently assigned to the Office of Global Maritime Situational Awareness. Previous assignments include Director of Aircraft Development on the Joint Strike Fighter Program and commanding officer of Navy fighter and aircraft test squadrons. He is a graduate of the Air Command and Staff College and the USAF Test Pilot School. Captain Weisbrook cowrote this article while serving as the Navy Federal Executive Fellow at the American Enterprise Institute where he supported Mr. Gingrich.

Technological and Geopolitical Realities of the Twenty-first Century's Rapid Scientific and Technological Advances

The twenty-first century is continuing to build upon the advances of the past 200 years. We are entering a period where nanotechnology and high-speed computing capability, coupled with massive database storage, shape the near-term future. But this is just the beginning; we should anticipate that we will see more technological innovation in the next 30 years than we have seen in all of American history.

This assertion is based on the extensive studies of Alvin and Heidi Toffler, experts at the National Science Foundation, MIT, Georgia Tech, NASA, and elsewhere. It is an objective fact that there are more scientists alive today than at any other time in history. These scientists have better instrumentation and greater computational capacity than ever before—and both are improving every day. Scientists are now globally linked to each other through the Internet and e-mail and to the global market economy by licensing, royalties, and venture capital. As a result, we can expect four to seven times as many scientific discoveries and technological innovations in the next 30 years as in the previous 30.

For instance, in the early 1970s, the lunar landing modules of the Apollo missions used an onboard computer of approximately 40-kilobyte capability—less than the computer capacity of a UPS delivery truck. Now we speak casually of gigabytes and terabytes. The sixth-generation wireless handheld being launched by Microsoft has the power of a laptop computer. Project that rate of growth 30 years into our future, and you can sense just how profoundly different our world might well be!

If the current rate of knowledge creation is four times faster than that of the previous 30 years, then planning for 30 years hence is equivalent of being in 1880 and trying to plan for today. Imagine trying to conceptualize in an era of pre-airplane, pre-motion picture, pre-mass-produced automobile, preradio, and—above all else—precomputer. If you asked someone in 1880 what would most influence warfare in the next 30 years, nobody would say that German Nicholas Otto's work with internal combustion engines would revolutionize all warfare by 1915 or that, in 1903, the work of the two Wright brothers in Ohio would shape the outcomes of war in the twentieth century.

If the rate of change accelerates to seven times faster than today, as some predict, then trying to grasp the sum total of knowledge and technological change in the year 2037 would be like someone in 1660 attempting to accurately predict what our world would be like today. Try to imagine a doctor in London in 1660, who has been taught that bubonic plague is caused by "bad humors" in the air, trying to apply—let alone grasp—microbiology, CAT scans, or endoscopic surgery.

Economic globalization adds another multiplier effect to scientific and technological change. The fall of the Berlin Wall not only ended the Cold War but also opened the world economy to those countries shifting from economically isolated communist dictatorships to free-enterprise democracies. This, combined with the rise of the economies of both China and India, has generated a demand for innovation and a worldwide focus on scientific and technological development, fueled and fanned by the advent of the Internet and workflow software that allow worldwide connectivity and collaboration.

A reasonable assessment of this state of affairs is that, at a minimum, two-thirds of the new science will come from outside the United States. This dispersal of knowledge creation across the planet represents a fundamental change from the last 200 years in which the industrial revolution allowed Great Britain to dominate the nineteenth century, while the twentieth century became the "American Century" due to our technological and scientific prowess. With these thoughts in mind, we must ask ourselves whether by the year 2050 it will be said that the twenty-first is another American Century or if another region or nation, perhaps even one hostile to us, will lay claim to this leadership.

Overlaying this discussion about the explosion in science and technology in the twenty-first century are the geopolitical realities of our time. China and India are rising economic powers that are rapidly becoming more significant military players in international affairs. China specifically raises concerns as it rebuilds and modernizes its military capability. Fueled by rising oil and natural gas prices, Russia has reawakened from its post–Cold War slumber to become, once again, more active and forceful on the international scene. The European Union adds a new dynamic in the international economic scene and as a union presents a much larger economic—and regulatory—force to be reckoned with than any of its singular member countries. Alliances among rogue dictatorships such as Iran, Syria, North Korea, and Venezuela, along with transnational terrorist groups such as al-Qaeda and Hezbollah, create unique challenges to the sovereignty and survival of America and its allies.

Societal Constraints in a Changing World

America's Flawed Educational System

In 1998 the United States Commission on National Security in the 21st Century (the Hart-Rudman Commission) was established to look at the entire range of US national security policies and processes required in light of a new world emerging from the collapse of the Soviet Empire. That new world encompassed not only the changed geopolitical reality after the Cold War but also the significant technological, social, and intellectual changes that were emerging. In its final report, dated 15 February 2001, it fully recognized the significance, threat, and challenge to the United States that the explosion of science and technology represented:

> Americans are living off the economic and security benefits of the last three generations' investment in science and education, but we are now consuming capital. Our systems of basic scientific research and education are in serious crisis, while other countries are redoubling their efforts. In the next quarter century, we will likely see ourselves surpassed, and in relative decline, unless we make a conscious national commitment to maintain our edge.[1]

The commission concluded that basic scientific research was underfunded and that a complete failure and breakdown in math and science education existed within the United States. It went on to conclude that the inadequacy of the research and education systems was a greater threat to national security than any potential conventional war that one might imagine.[2]

This report came out 18 years after the Reagan administration published *A Nation at Risk*, which warned that the failure in education was a major threat to America.[3] Our response as a nation to both of these reports has been dismal. To move forward, the focus of our strategic planning efforts must include how we can begin to influence and shape the military. Even more importantly, however, both the federal government and the American people must respond to the magnitude of challenges that the explosion of science and technology poses for America.

As a nation we are failing in education in the critical subjects that are needed to stay relevant in a world faced with an explosion in science and technology. *Windows of Opportunity*, published in 1984, put forth several educational concepts that are still as relevant today as they were then. It suggested that the educational system must fundamentally change to one focused on learning, not teaching. In addition to the old "three R's" of reading, writing, and arithmetic, it must be based on the fundamentals that today include computer literacy and information management, defined as *triliteracy* by Alvin and Heidi Toffler. All the tools of society and technology must be embraced in the educational process, including partnerships with the business community. Finally, the higher education system must be challenged to become more intellectually open and conducive in encouraging students to develop a positive attitude toward lifelong learning about their rapidly changing world.

Immigration and Visas: Current Limits on Importing Brainpower

One of the phenomena that allowed America to overtake England and become a leader in science and technology in the second half of the twentieth century was the contributions of immigrants. Three waves of immigrants that came to the United States led us to possess an artificially high proportion of the world's best scientists during that time.

The first wave was the result of a Nazi Germany that drove a generation of world-class Jewish and anti-Nazi scientists out of Europe. The likes of Albert Einstein, Edward Teller, Niels Bohr, and thousands of other well-trained scientists and future scientists fled the Nazis as they destroyed freedom in Europe. Additionally, the New School in New York actively sought out intellectuals who were dismissed from teaching and government positions by Hitler and Mussolini, viewing itself as a place of refuge for European immigrant scholars and intellectuals.

The second wave arrived as the result of communism. Another generation of scientists fled Eastern and Central Europe, including notably talented mathematicians such as German scientist Wernher von Braun, who was instrumental in developing American missile and space programs. In dozens of fields, these European scientists provided a level of talent and knowledge that accelerated American leadership in many scientific fields.

The final wave resulted from a combination of war, political instability, and poverty in the third world. Many of the brightest students on the planet came to the United States for their graduate education and then stayed.

It would not be farfetched to assert that without these immigrants the United States would not have won the race to develop the atomic bomb (of the 86 major scientists working on this program, 22—over 25 percent—were foreign immigrants, and nine of these were Nobel Prize winners), would not have led in space exploration, and would not have revolutionized communications and computer technologies.

As the global marketplace increases global wealth and the standard of living, we are seeing a commensurate increase in educational performance—particularly in scientific and technological disciplines. The United States still leads the world in the number of premier academic institutions, but other countries are raising their performance standards. In 2006, a *London Times* survey of higher education cited that the United States had 54 universities ranked in the top 200 of the world, but China (including Hong Kong) had 11.[4] Similarly, while US universities still attract many of the world's brightest students into their graduate and doctoral programs, they no longer remain in the United States to contribute to our capabilities after graduation in the numbers that they once did. Now many take the knowledge and skills they learn here to their homelands where they compete against us.

Since 9/11, the attitude of the United States has changed significantly with respect to foreign nationals who wish to immigrate. Unfortunately, the current visa system is not conducive to inviting or allowing individuals needed to keep us on the cutting edge of science and technology to enter the United States. America must still lean on foreign intellectuals for the very reason that was highlighted in the Hart-Rudman Commission report. This problem was highlighted in April 2005 by Bill Gates, who stated that Microsoft is having difficulty filling jobs because of tight visa restrictions on foreign workers, inferring that visa restrictions are keeping too many bright, educated people from working in this country.[5]

We must understand that immigration policy is not only about closing the door to those who intend to harm us, but that it is also about encouraging the best and brightest to come to America where they can be free to learn, work, and profit while the nation as a whole benefits by their presence. For this reason, H-1 visas for scientifically and technically educated people should be increased.

The Two Cultures: Antitechnological Bias in America

C. P. Snow argued in a 1959 lecture entitled "The Two Cultures" that the Western world was increasingly splitting into opposing intellectual traditions: one which understood the humanities but was ignorant of science and mathematics, and another which was immersed in the sciences but had relatively little knowledge of the humanities and social sciences.[6] In *Windows of Opportunity*, the contention is made that the United States began suffering an acute case of Snow's Two Cultures syndrome with the Free Speech Movement. The Civil Rights and anti-Vietnam movement added to the crisis, and by the late

1970s America was caught up in an epidemic of technological abhorrence—a "New Age Ludditism" led by much of the intellectual, political, cultural, and media elites. This antitechnology movement thus became a justification for not mastering the mathematics and sciences that are so crucial to America's future. This resistance persists today and has become culturally ingrained. If such thinking is not profoundly reversed soon, we will lose the race for scientific and technological leadership. The models by which our government, society, educational systems, and military functioned during the Industrial Revolution gave us the edge for survival in 1945. The model even worked throughout the Cold War with some modifications, but it will not give us security 30 years from now—or, for that matter, even today.

Maintaining Dominance

Current government systems and policies are not conducive to ensuring the United States maintains its leadership in a rapidly changing world. Military leaders cannot shy away from this challenge. To succeed in ensuring the United States survives in the future, they must take part in elevating the discussion and force the country to think through the implications of these challenges despite the resistance of bureaucracies and the opposition of those who want to hide from the challenge.

It may mean proposing innovative ideas to reinvigorate our focus on math and science education. It may mean becoming immersed in policy discussions that may influence our competitive advantage within the world economy, such as tax, regulatory, or trade policy, ensuring all future policies are vetted to determine their impact on national security. It may mean championing and proposing increases to funding for nondefense basic research and development. However, it must mean proposing and supporting innovative ideas to energize the private sector to become more engaged in advancing technology, such as a prize-based system for the first successful manned trip to Mars and back. Not only do such prize systems historically conquer challenges far more quickly and more cheaply than bureaucratic models, but they are also a great way to capture the imagination of society, especially the young, and advance science and technology.

Adopting New Innovations Faster

The current military procurement and doctrine development process is not conducive to a world experiencing a rapid growth in science and technology. This has not always been our history. We must recapture the urgency and capability of past national mobilization efforts to ensure success as we confront the challenges of the future.

To win the Civil War, Lincoln mobilized the North. The Union Army went from a standing army of little more than 20,000 men to one million strong. Production capacity ramped up to meet the challenge of equipping and sustaining this new army, thus enabling the North to defeat the South in four years. Even as the war was fought and won, the Northern economy boomed and within two years launched itself into the great technological project of the nineteenth century—the building of the transcontinental railroad.

Confronted with a two-theatre world war, Franklin Delano Roosevelt again called upon the United States' superior technological and industrial capability. In 1938, Portugal fielded a stronger army than ours. In the span of only four years, we built and equipped a powerful force and achieved victory. The Army grew from a size of roughly 200,000 to over eight million. Over 63,500 new naval ships were constructed for the US Navy, Coast Guard, and Army. More than 300,000 military aircraft were produced for the US military and its Allies.[7]

Compare this history with the present day. In 1981, the US Air Force first developed the requirement for the replacement of the F-15. The result was the F-22 that became operationally deployable in December 2005. That development cycle was six times the length of American participation in World War II.

Another example is the Army's Future Combat Systems (FCS). The FCS concept originated in the 1980s and was envisioned to network 18 discrete tactical brigade systems comprised of ground platforms, unmanned aircraft, robots, and reconnaissance platforms, allowing brigades to disperse at the battalion and company levels. An initial memorandum of agreement was signed in early 2000 to begin the conceptual design phase, with intent to initially deploy the system in the 2015 time frame. In short, today's acquisition programs—the nexus of technology, science, and economics—fall far short of our nation's needs if we are to compete in an increasingly complex future. Our programs have become too costly, too complex, and too lengthy to cope with cost-effective, innovative, and fast-paced competitors.

Modernizing Strategy and Doctrine

Commensurate with the ability to integrate advances in science and technology into fielded systems is the ability to advance strategy and doctrine at the same pace. In the past, we have quickly seized upon advances in technology and developed a doctrine to exploit them. For instance, the American Navy embraced the capability of the submarine during World War II and developed a strategy and doctrine that changed the nature of warfare at the time into a theatre-wide campaign of attrition. However, recent events still show how cumbersome the system can be. Six years after 9/11, the military has still not produced a definitive updated contingency plan to fight and win the global war on terror. A revised counterinsurgency manual was not published until early 2007, some four years after the start of Operation Iraqi Freedom.[8]

Urban warfare will be the dominant form of physical conflict for the foreseeable future. In this asymmetric fight the enemy deliberately hides among innocent—and often intimidated—civilians. We have made enormous investments in winning control of the ocean, air, space, and the high-tempo conventional war. However, is our system responsive enough to allow us to focus science and technology on this problem and agile enough to quickly field systems and develop the doctrine to dominate this new urban form of warfare?

It clearly has not been so far. We are suffering from a failure of political imagination, bureaucratic rigidity, and timidity rather than a failure of technology. It is incumbent upon senior Department of Defense civilian and military leaders to realize that the current red-tape-ridden system—in which it took 23 years to build an additional runway at the Atlanta International Airport—will virtually guarantee that the United States will suffer defeat in the competition for the future. We must solve the problem of getting the procurement and doctrine development process to fit in the development time of science and technology.

In addition to developing prize-based systems, as previously mentioned, a parallel "Team B" doctrine and procurement system should be implemented to find low-cost innovative systems and approaches that would enable it to defeat more expensive, more slowly evolving forces. This Team B should have the ability to procure systems off the shelf and in a variety of ways outside current rules and legislation. The Team B advisory committee should include a number of entrepreneurial CEOs who have actually used the new approaches successfully. As a general rule, in a science- and technology-based entrepreneurial free market, one should expect more choices of higher quality at lower cost—consider the evolution of televisions, cell phones, personal computers, and the cost of food. In all of these free-market areas, the pressure of competition, the rapid innovation by entrepreneurial startups, and the rapid adoption of better solutions consistently supplied the customer with better choices at lower cost. These systems have involved iterative experimentation with an acceptance of legitimate failures, leading to new knowledge and new understanding in moving toward the ultimate goals of radically more successful systems. Edison's estimated 49,000 experiments to invent the electric light and the Wright brothers' consistent acceptance of five or six crashes a day as the necessary cost of learning enough to invent the airplane exemplify this combination. Innovation of this type should be the goal of the Team B operation; it should start with at least $5 billion a year and be challenged with fielding systems and teams that can actually defeat the regular forces and equipment of the current system. For major areas of development, there should be force-on-force competitive investments. For example, the Team B system should be resourced to develop an unmanned aviation unit designed to compete head-to-head with traditional manned systems to see if it is possible to actually defeat the current force with a totally new and different design.

We cannot assume the shackles that are imposed on our current system will also be a constraining factor on our competitors or foes—in fact, we can assume that the constraints imposed on our system will confer an advantage upon our adversaries. As the global market expands vertically and horizontally, more of the world will engage in science. More new knowledge and technology will be created elsewhere as a result. As stated earlier, we should expect that two-thirds of future breakthroughs will be developed outside the United States. However, this is not a new phenomenon. Prior to 1500, China was the center of scientific knowledge in the world. From 1500 to 1940, Europe was the center. The United States has only been the center of scientific endeavor for the past 60 or so years.

As a society and a government, we must ensure that we are actively scanning the world for new knowledge. This effort is as important as our other classical intelligence-gathering activities but can be accomplished much more easily by utilizing scientists in the public domain. All worldwide scientific publications and proceedings from international scientific conferences should be translated within 90 days and put into a database developed to be easily searched by American scientists. American scientists need to become extremely active in international conferences by traveling in order to observe and learn from new developments. Visiting scholar programs, along with funding of sabbatical programs for American scientists to work in foreign laboratories, should be expanded so that a greater exchange of information may be achieved.

Protecting America against New Technological Vulnerabilities

Advances in information technology and software have opened areas of new vulnerabilities. Foreign organizations are continually probing both government and private corporations. Today, the most dangerous spies are sitting somewhere in China using computers to try to hack into the Web sites of not only government agencies but also those of private corporations, such as Boeing and Lockheed-Martin, searching for new technological and industrial capabilities. This increased threat to our national security must be a continued focus of our intelligence and counterintelligence activities. Every effort must be made to avoid being surprised as a nation by guarding our scientific and technological advances.

An additional problem generated by this global economy is that systems in the United States rely more and more on foreign-produced parts and software. Vigilance must be increased to ensure back doors or Trojan horses are not present in critical systems with pieces obtained from foreign countries.

A classic example of such a Trojan horse activity was undertaken by the United States during the Reagan administration. In his book *At the Abyss*, Thomas C. Reed describes an operation undertaken by the CIA against the Soviets. The CIA had obtained intelligence on critical technology the Soviets were trying to buy, such as advanced computer hardware and software. It had also developed a plan in cooperation with industry to sell the Soviets software that would fail or malfunction after a period of time, including programs designed to control the Soviets' natural gas pipelines. There was also an effort to develop slightly defective ball bearings for pumps. These developments were disguised as contraband high-tech materials, and the Soviets bought them through illegal sources. The net result was that when the deliberately faulty equipment malfunctioned, the controlling functions of the pipeline were destroyed—creating the largest nonnuclear explosion and fire ever seen from space.[9] We must remain vigilant to ensure our government, economy, and military do not suffer a similar fate.

It is inevitable that scientific and technological advances will occur outside the United States in the future. These advances may come as a result of information stolen from the United States. Military leaders must accept this as a fact and develop strategies and processes to recapture this knowledge and to protect our secrets. This may mean partnering with educational institutions or the National Science Foundation to develop programs to mine the worldwide knowledge base. Revamping security, intelligence, and foreign-procurement policies may be required. However, processes and systems must be developed to keep abreast of new knowledge and to protect our advancements.

Even as we work to keep abreast of the global intellectual activity in the areas of science and technology and bolster efforts to protect our advances, we can never be 100 percent certain of our enemy's capability. We must assume that he will be clever, determined, and courageous. The twentieth century is filled with examples of successful surprises, even against alert and observant countries. These surprises may be tactical, strategic, or technological.

At the beginning of World War II the United States did not fully understand the advances the Japanese had made in aviation warfare, both technologically and tactically. Gen Douglas MacArthur was convinced the Japanese were using German pilots because he could not imagine that Japanese pilots could wipe out his air force in the Philippines in four hours. Additionally, while America knew of the Japanese "Zero" because it had been used in China—some American pilots supporting the Chinese air force had even faced them—there was no analysis about them being capable of flying off their carriers. Their appearance over Hawaii was thus a complete and total surprise.

Similarly, at the end of World War II, we knew that the Soviet Union was working on building an atomic bomb. In 1945–46, we believed it would take the Soviets at least 10 to 15 years to complete the project. They accomplished the feat in 1949, thanks to their intelligence gathering and our failure to safeguard our secrets. Sputnik, another example of our intelligence failure, gave the Soviet Union a publicity advantage for which we were unprepared.

Finally, the Yom Kippur War in 1973 came as a complete surprise to the Israelis. Throughout the year, Egypt had been threatening war. Israel's intelligence service and its government, however, did not think any risk of war existed during the Ramadan and Yom Kippur holidays as both religious festivals prohibit warfare. Israel was generally surprised by both the timing and the size of the attacks.

In all of these events, both the United States and Israel had the capability to recover. Likewise, today we must have the same ability to recover from potential surprise attacks. However, military leaders must never forget that our opponents will be clever, determined, and courageous while they think strategically through the process of what actions and policies can be developed to deal with this future growth in science and technology. As we move forward, we must develop an overmatch and enough redundancy so that "after the surprise" we can still win. The Israelis were forced on the defensive for two days in the Yom Kippur War. Yet, because of their superior technology, training, and tactics, they were able to recover, push back both the Syrian and the Egyptian armies, trap the Egyptian Third Army, and then finally force a cease-fire within the following three weeks.

Understanding That Leading in Science and Technology Is a Societal Challenge

We cannot reverse these trends by solely focusing on government reforms; we must also work to change society. If we try to rest on our past accomplishments, remain hesitant to move forward, or attempt to back away from the challenge, we will be left behind. To be successful, we must recognize what present trends mean for our future and take action to change course to ensure our leadership and security for that future. We cannot afford to follow strategies formulated for the past; scientific, technological, and economic trends that are shaping the future will require new approaches. For example, our schools today combine an agricultural-era 10-month school year (with the summer off for harvesting) with an industrial-era model based on a Monday-to-Friday workweek using 50-minute sessions conducted by a "foreman" at the front of the room. Additionally, we talk of placing computers in the classroom rather than placing the classroom inside the computer. We have not yet grasped that learning outside the school system is embedded in the computer and on the Internet and is available on demand with a great deal of customization for each learner. Our near-term focus needs to be on laying the foundations for government and societal systems that will be required to meet this daunting challenge.

For most of American history, our national leaders have been able to develop plans and strategies from positions of either parity or superiority compared to any potential competitor. From 1870 on, the United States has been the largest economy in the world. As a result, we assumed that we would be at least equal or superior to anyone else on the planet with respect to science and technology. Subsequently, our strategic thinking assumed we could drown our competitors or enemies with our industrial capacity.

For the first time since we surpassed Great Britain around 1870, America could be on the edge of losing both our economic and scientific advantages. Now we compete with the growing economies of China and India, whose populations are vastly larger than our own. To these economic challenges, Americans will have to remain at least four times more productive as there are four times as many Chinese or Indians as Americans. If we work diligently, we may keep pace with the booming Chinese and Indian economies. If we do nothing, the US economy will certainly fall to at least a distant third.

One of the realities of the closing of the gap in dominance in the area of science and technology between the United States and other global competitors is that a breakthrough anywhere in the world could be used against the United States. History has shown that a sudden shift in capability can lead to a shift in power. This phenomenon is best seen historically with the Japanese.

Japan undertook an effort beginning in 1887 to build the Japanese Imperial Navy. This was accomplished with the help of the British in the areas of training and ship development. Initially, the Japanese fleet was built in England, but soon Japanese ships were being built in Japan based on British designs. The final step was building ships based on Japanese designs that were better than anything afloat and led to the most decisive naval engagement of the twentieth century, the Battle of Tsushima in May 1905. The Japanese devastated the Russian fleet, capturing or destroying 31 of 38 Russian ships while suffering no losses of their own. In essence, this was a technological, scientific, and economic transfer. The British ship designs represented the technology, the Japanese development of indigenous designs and shipbuilding techniques was scientific, and the defeat of the Russian forces opened the Pacific to Japanese economic competition against European powers. Japan rose from a medieval country in the last half of the nineteenth century to a modern country defeating czarist Russia in 1905.

The same can be said about the rise of Japanese airpower. Japan embraced the new technology and understood its strategic and tactical significance as a force multiplier. This is especially true with respect to the naval airpower demonstrated at Pearl Harbor. An alternate history novel, *Pearl Harbor: A Novel of December 8th*, puts forth the notion that had the Japanese fully embraced the strategic and tactical significance of airpower, the attack on Pearl Harbor may have been even more profound. Ultimately, it might have changed the overall dynamics of the war. It was very fortunate for the United

States that the Japanese assigned the Pearl Harbor attack to a battleship admiral who did not fully understand the instruments he commanded.

It is imperative that as we think through how to effect changes to the systems that drive our government and society, we do so with the implicit understanding that we are now living in a much more competitive and hostile global market and one in which our competitive advantage is being challenged daily by both friend and foe alike. A breakthrough anywhere in science and technology could turn into a breakthrough against us.

In *Carnage and Culture,* Victor Davis Hanson argues that since the time of the Greeks, Western civilization has held military dominance, in part, due to its culture. He contends that Western values of capitalism, scientific inquiry, open debate, individualism, and rationalism together form an extremely lethal form of warfare that has been the West's asymmetric strength as its civilizations came to dominate civilizations that did not embrace such values. With this strength, Alexander defeated over 300,000 Persians with a force of 16–20 thousand.[10] We must remember that this type of annihilation can defeat Western civilization if our society falls behind and fails to adopt and embrace societal advances. For example, in 1939 industrial Germany's Wehrmacht decimated the Polish cavalry—and later the entirety of the largely agrarian Polish society—because of Poland's reluctance to advance.

True annihilation occurs when one society gets out of sync with the competitive societies of its era. It is not just a force-on-force issue. A society must be able to sustain the totality of a campaign. It must not only move forward culturally, but it must also embrace and keep pace with scientific and technological advances. A society that cannot educate its children, one that cannot produce equipment, or one that cannot develop technology can easily become a victim on the wrong side of the knowledge and power equation. As Americans, we must not let ourselves go down this path.

Winning the Future: Core Elements of Strategic Leadership in Science and Technology

Revolutions in science and technology will be the dominant feature of the next 30 years. There will be a four- to seven-fold growth in science and technology, and two-thirds of it will be produced outside the United States. Senior military leaders must take an active role in ensuring that we move society and the government forward to avoid even the slightest possibility of falling behind our competitors and opponents.

Our strategic thought process needs to focus upon developing a foundational system capable of meeting this challenge by mandating much broader thinking and trying to influence the thought process and policy in areas outside the traditional military spheres of influence. Changes must be made across both the public and private sectors. To be successful, we must fundamentally rethink the societal base, the educational system, the industrialization process, and the visa system. For instance, developing a high school JROTC program that focuses on math and science and pays students a monthly stipend would be an investment equal to the follow-on for the B-2.

Senior leaders must focus on how we can force American society to become capable of sustaining the relative advantage that we have enjoyed in the areas of science and technology for the last 200 years. We must learn to apply the forthcoming revolutions to solve our problems and to defeat our enemies strategically, operationally, and tactically. There are five underlying core elements that should dominate this strategic thought process. We must

1. assume the future will be defined by a global market and any breakthrough anywhere can be a breakthrough against us;
2. force thinking through the implications of these changes despite the bureaucracies and the cultural-political opposition;
3. get the procurement and doctrine development systems to accelerate to meet the development time of science and technology;
4. discover what new knowledge is being developed around the world, while at the same time protecting American advancements; and
5. assume our opponent will be clever, determined, and courageous and that a surprise is likely, and therefore we must develop an overmatch and redundancy in both national and homeland security so we can win "after the surprise."

If we fail at this challenge and lose the relative advantage we have relied upon, no amount of clever military procurement will offset our gradual decay. During the darkest days of our Civil War, Pres. Abraham Lincoln wrote that "the dogmas of the quiet past are inadequate to the stormy present. The occasion is piled high with difficulties and we must rise with the occasion. As our case is new, we must think anew and act anew. . . . We must disenthrall ourselves and then we shall save our country."[11] His words are as relevant today as they were in 1862. Leading the world in science and technology is the fundamental challenge of American national security for our generation. SSQ

Notes

1. United States Commission on National Security/21st Century, phase 3 report, *Road Map for National Security: Imperative for Change*, 15 February 2001, ix.
2. Ibid.
3. D. P. Gardner, ed., *A Nation at Risk: The Imperative for Educational Reform* (Washington, DC: Government Printing Office, 1983).
4. London *Times Higher Education Supplement*, 16 October 2007.
5. David A. Vise, "Gates Cites Hiring Woes, Criticizes Visa Restrictions," *Washington Post*, 28 April 2005, EO5.
6. C. P. Snow, "The Two Cultures" (Rede lecture series, Senate House, Cambridge, UK, 7 May 1959). Published in Snow, *The Two Cultures and Scientific Revolution* (New York: Cambridge University Press, 1959).
7. On the mobilization for the US Army, see http://www.army.mil/cmh-pg/documents/mobpam.htm; for the increase in Navy ships, see http://www.coltoncompany.com/shipbldg/ussbldrs/wwii.htm; and for aircraft production, see http//afhra.maxwell.af.mil/aafsd/aafsd_pdf/t079.pdf.
8. Field Manual 3-24/Marine Corps Warfighting Publication 3-33.5, *Counterinsurgency*, 15 December 2006.
9. Thomas C. Reed, *At the Abyss: An Insider's History of the Cold War* (New York: Random House Pub., 2004).
10. Victor Davis Hanson, *Carnage and Culture: Landmark Battles in the Rise of Western Power* (New York: Anchor Books, 2002).
11. Abraham Lincoln, "Second Annual Message [State of the Union address], December 1st, 1862," John T. Woolley and Gerhard Peters, The American Presidency Project (Santa Barbara, CA: University of California), http://www.presidency.ucsb.edu/ws/?pid=29503.