The Future of Defense Technology and the Lessons of History

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The United States has long relied on technology to secure military dominance, a strategy theorized through the "Revolution in Military Affairs" concept, initially conceived by Soviet defense theoreticians. The RMA concept was taken over by successive U.S. administrations, with diverse avatars, but with a remarkably constant strategic purpose: to impose American rules of engagement in the field of advanced technologies and to secure for the United States an unchallenged military dominance.

This reliance on technology has often been criticized as an *over*reliance, going much further than what could be considered an optimum use of defense money. As Gen. Vincent Desportes, latest commandant of the French National War College, puts it in his recent book, *La Guerre Probable* (Paris, 2008: *Economica*),

"Our forces' efficiency in crises is now much more a question of knowing how to think, how to do, and how to be, than of equipment per se." The criticism is twofold: Excess technology is seen as diverting too many defense dollars from more essential needs and, even more seriously, as diverting the warfighters' minds from more essential "arts of war." For Desportes, "The accumulation of technological capabilities might well be, if we do not pay attention, an accumulation of political impotence."

This is not new: The French have always been reluctant to fully embrace the RMA concept. But is it possible to think of a "proper" level of technology—a level that is just sufficient rather than overwhelming? What is the right level of investment in technology to get the optimum capability outcome? Ultimately, does technology simply follow the art of war, or does it follow a more autonomous path? In short, where is defense technology heading?

Technology and the Art of War

For sure, technology by itself doesn't fully define the characteristics of military warfare, but it certainly defines rather precisely the general fighting framework. Without doubt, the art of war before the introduction of artillery was different from the art of war afterwards, just as it was different before and after the introduction of armored vehicles, before and after the introduction of aircraft—and so on. It would be a serious mistake to think that one could free oneself from these technological mutations and think only in terms of political or moral force. The Mings thought that way in 15th century China, when they renounced a then-unquestionable naval dominance to turn their priorities to the control of their vast land empire, thereby discarding a naval technology that was very advanced compared to that of the Europeans. So did Toyotomi Hideyoshi's Japan, by banishing firearms at the turn of the 17th century and reverting to a more traditional Samurai-based military organization. Those ill-inspired decisions signaled for the two countries a stepping out of the running for global or even regional dominance.

If one neglects the technological factor, the *dialectique des volontés* (the confrontation of wills, as military strategist Général André Beauffre defined strategy) will very quickly degenerate into a confrontation of anachronisms. In both examples mentioned in the previous paragraph, the negation of technology can be explained, at least in part, by a denial of its possible social implications on the make-up of the military society of the time—as, for instance, fire weapons being perceived in Japan as a threat to the traditional dominance of the Samurai.

Likewise, at the turn of the 20th century, French military authorities failed to anticipate the consequences of industrial age warfare because they hadn't understood the lessons of the 1870 war against Prussia, when industrial-age innovations, such as railways or machine guns, had changed the face of military operations. In 1911, Joseph Joffre (at the time, commander-in-chief of the French Army) dismissed aircraft as "merely toys, without any possible military value." As World War II was approaching—failing to heed the lessons of the past—the French military authorities were blind to the possibilities offered by the new mechanized armored vehicles; and their blindness contributed vastly to the French rout in 1940, when Rommel's armored units penetrated the French lines.

Technology in the New Strategic Landscape

No question, technology matters. Take the Cold War—the ultimate technological war. The Cold War was never fought on the European traditional battlefield, though it was fought sporadically by "proxies" in the rest of the world; but it raged for approximately 50 years on the technological battlefield. The fight was about mastering nuclear-related technologies: the atom bomb, missiles, navigation systems, etc. Technology is the new essential art of war.

Today, we are witnessing a new strategic landscape taking shape. Classical geostrategic players, like a post-Maoist China or a neo-czarist Russia, are rising or being reborn. This global strategic landscape, blurred to our eyes for a while after the fall of the Soviet Union, is now assuming a shape that would have looked familiar to our great-grandfathers, who fought counter-insurrection wars from the Balkans to Persia.

What will be tomorrow's conflicts in this "new" landscape? A 2008 French white paper on defense and national security attempted to list the main probable types of conflicts. One thing is certain: At the upper end of the spectrum—the end that encompasses large, long-term investments to face these potential conflicts—the United States will, for the foreseeable future, set the pace.

Major conflicts in the future will be largely defined by technology—not exclusively, of course, but technology will play a defining role. We will do well not to forget the lesson we learned from the Asian emperors: It is not the ruler, from his exalted position in his palace, who controls the facts that will drive future conflicts; it's the technology.

The Pace of Technology

A fundamental question for those in charge of preparing their country's armaments for the long term is which technologies to invest in, and there is a general confusion within the defense community about this question. With technologies so numerous, so diverse, and so changing, any attempt at long-term preparation (say 20 to 30 years out) might seem to be pointless.

I would like to dispel what I think is nothing more than a myth: what many analysts allege to be a general and exponential acceleration of the influx of new defense technologies. The myth doesn't stand up to serious scrutiny. Anyone who looks in depth into the evolution of defense technology

MAJOR GENERAL (ARMAMENT CORPS) ROBERT RANQUET

Major General Robert Ranquet was commissioned in 1974 as a lieutenant in the Armament Corps of the Defense Procurement Agency (DGA) of the French Ministry of Defense. After completing master's degrees in naval architecture and nuclear engineering, he served as manager of the nuclear propulsion department of the French navy's primary shipbuilding unit, the Brest division of the Directorate for Naval Construction (DCN), where he was in charge of maintenance for "Le Redoutable" class SSBN propulsion systems.

In 1984 he joined DCN Indret as the head of the Material Research Center. He moved in 1989 from this position to serve as head of the nuclear propulsion department, in charge of development and design of naval nuclear reactors. In this position, he managed the development of nuclear plants for the "Le Triomphant" class SSBN and the "Charles de Gaulle" aircraft carrier. In 1992 he was promoted to deputy director of DCN Indret, in charge of research and development activities. In this position, he initiated numerous international partnerships with British and U.S. firms, within the framework of the "Horizon Frigate" European project.

In 1994 Ranquet was assigned as a special assistant to the director for Atlantic/Europe cooperation at the International Affairs Directorate of DGA Paris and in 1995 was an exchange student at the Industrial College of the Armed Forces at Fort Lesley J. McNair in Washington, D.C., before joining the French Embassy as deputy armament attaché, becoming armament attaché in October 1996. In this position, he was the personal representative of the head of the French DGA to the United States.

Upon his return to France in 1998, Ranquet was assigned for two years to the new Center for Higher Armaments Studies as the head of the Strategic Research Department and the executive director of the new Defense Science Council, which he helped to create. In this position, he initiated many new projects, such as the Acquisition Strategy Laboratory.

He joined the Directorate for Test and Evaluation Centers in 2000 as the director of the Arcueil Research Center and in the following year was promoted to the rank of brigadier general in the Armament Corps.

In 2003 Ranquet was appointed as deputy director for strategic affairs (policy). In this position, he served as the French negotiator in the creation of the European Defense Agency and as the French representative to the NATO senior political executive group on missile defense. He was also in charge of many international and strategic dossiers, including nuclear deterrence policy and the *2008 White Book on Defense and National Security*. He was promoted to the rank of major general in 2005.

In 2008 he was appointed as special assistant to the General Council for Armament, the senior acquisition and technology advisory board to the prime minister.

Ranquet in 2010 was appointed to his current position, deputy director of the Institute for Advanced Studies of National Defense—the highest French academic institution for defense and security, under the prime minister's office. Ranquet's military and civilian education includes: Ecole Polytechnique, Paris; the National Higher School of Advanced Technology, Paris; the National Institute of Nuclear Science and Technology, Saclay; and the Industrial College of the Armed Forces, Washington D.C.

His awards include the French Legion of Honor and the National Order of Merit.

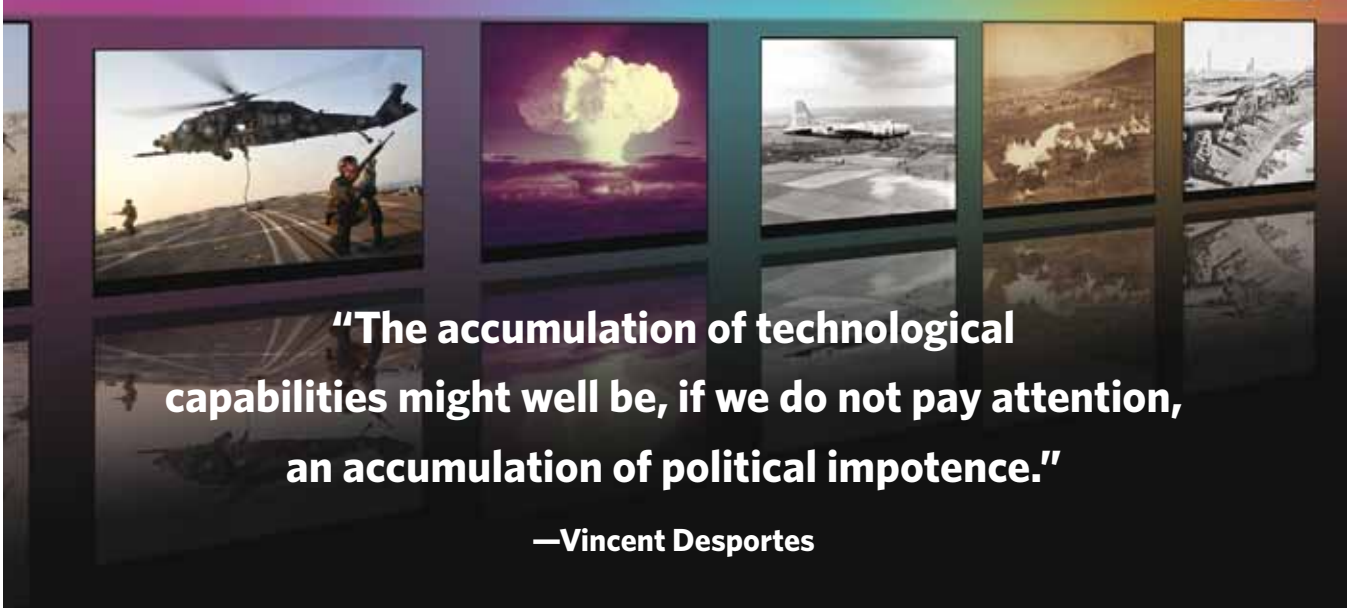
over just the last 150 years (leaving aside the more remote past) will see waves of technology development at a pace that is no less than the pace we witness today. Think of the megawave of the Industrial Age technologies (steel, mechanics, and chemicals) at the end of the 19th century; then the waves of electricity, motor vehicles, aircraft, radar, electronics, nuclear energy, laser technology, and so on—wave upon wave of technological advancement without interruption, at a speed that we tend to discount today.

Let's consider one simple example. The Wright brothers made the first powered flights in 1903; the first experiment of flying an aircraft from a ship took place in 1910; and the first operational raid by aircraft launched from an aircraft carrier happened in 1918 (the Tondern attack by *HMS Furious*). It took no more than 15 years to bring about a major technological and operational revolution. In comparison, think of the time between the first tentative drafts of the Dassault Rafale (the latest generation French jet fighter aircraft) in 1977 to its introduction into service in 2000. The same could apply to nearly all major modern combat systems.

What we have been witnessing for a couple of decades is not a major, ongoing technological revolution—it is simply the massive influx on the battlefield of information and communication technologies that were invented in the 1940s to 1950s: the transistor by William Shockley in 1947 and the first general-purpose computer (the ENIAC) in 1946.

What of the Future?

One technological breakthrough alone doesn't make a military revolution. It takes the convergence of several breakthroughs to create a decisive step forward. For instance, one could consider that the network-centric warfare that appeared (according to some analysts) during the first Yugoslav War (1991) and according to others, during the second Gulf War (2003), is a remote consequence of several older breakthroughs: the radio (1909), computers (1946), and satellites (1957). It is the encounter of various factors, usually scientific and technological ones first, which make new things possible; and only afterwards, military and political factors, which leverage new possibilities offered by technology and open the way for major breakthroughs.



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—Vincent Desportes

What are the technological breakthroughs of the future likely to be? That's a good question. Attempts to predict technology breakthroughs have been disappointing. Many experts have been consulted, and many white papers and other studies of future trends have been written. The results have been indecisive. We repeatedly hear that the next field in which we will see major breakthroughs will be the intersection of nanotechnologies and biotechnologies in genetics. But we have been hearing that for years now, and we are still waiting. That shouldn't come as a complete surprise to us: The time interval between a scientific discovery and an actual technology coming to the battlefield is remarkably constant—about 25 years.

It is very possible that nanotechnologies and biotechnologies will bring extraordinary breakthroughs for defense. But even if it were to happen tomorrow, it would be after an extremely long latency period: Nanotechnologies officially appeared with the tunnel microscope in 1981; and as for the bio/gene technologies, DNA was discovered in 1944.

A Different Danger

Let us go one step further. It is possible that, far from living in a time of continuously accelerating defense technology evolution, we actually live in a time of relative drying up of those technologies. Whether this is true is no minor question; it implies major consequences for countries, like the United States and many other western nations, that base their grand strategy on maintaining their technological edge. A drying up of technology would rapidly translate into a global leveling of many nations to a more or less equalized technological level, a situation in which there would no longer be any comparative advantage for any nation. We would find ourselves in a situation where not only would there be no new technologies appearing (at least, none comparable to the major innovations of the recent past), but technologically advanced nations would also have to spend more and more to obtain only marginal military capability advantages. At the same time, on the other end of the spectrum, emerging actors could increase their capabilities with very limited investment.

Such is the situation today in Iraq and Afghanistan with improvised explosive devices (IEDs). With simple equipment and crude technologies (mobile phones and basic explosives), the insurgents are able to establish enough of a level playing field to gain some maneuvering room against vastly better equipped military forces. According to some sources, the United States has already spent more on the fight against IEDs in Iraq and Afghanistan than on its involvement in the Manhattan Project during World War II. The outcome has obviously not been in the right proportion.

In such a situation, the only way to retain superiority would be through quantity, just as the United States outran Germany during World War II in a quantitative armaments race. But can the United States or medium-sized European powers like the United Kingdom or France outrun a strong competitor, such as, for example, China? And if they can outrun it today, how long will they be able to continue to do so? And at what cost, in a world where defense technology would be more or less equally available to all?

So where is defense technology going? No one can say for sure. Will defense technology in the future continue to be the differentiator between those who master the latest innovations faster than the others? Or will it have, on the contrary, an effect of global equalization? If the second hypothesis prevails, then one can foresee that war will be mostly about human will, rather than about technology. But can we risk our future on that hypothesis? Can we risk lowering our guard on defense research and technology?

If we heed the lessons of history, the answer is an unequivocal "no." The march of technology has continued unabated, and those who have failed to include it in their plans have done so at their own peril and have frequently contributed to their own defeat.

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