U.S. Defense Industrial Base: National Security Implications of a Globalized World

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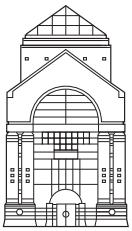

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The U.S. Defense Industrial Base: From the End of the Cold War to the Present

Jacques S. Gansler

First the Berlin Wall fell. Then the Soviet Union collapsed. In response, Americans demanded a "peace dividend." And the Nation's defense budget was cut by $100 billion, with the biggest impact on procurement of weapon systems (a 60 percent reduction, which some referred to as "unilateral disarmament").

Consolidation

As a result of the large "Reagan Defense Build-Up," and then the sudden end of the Cold War, there existed a huge excess of defense industrial capacity by the mid 1990s. The Nation had too many aircraft plants, shipyards, missile plants, etc. to support the greatly reduced demand. Thus, with encouragement from senior leaders in the Pentagon (especially when in 1993, then-Deputy Secretary William Perry announced, at the famous "last supper" with industry executives, the absolute need for consolidation) rapid defense industry consolidation began—with a vengeance, according to some. The government actually incentivized this behavior by allowing consolidation costs to be reimbursed as overhead costs, as long as savings to the government could be projected. And, of course, this consolidation was welcomed and was being stimulated by the denizens of Wall Street who made millions on each major merger or acquisition.

These mergers and acquisitions were occurring both horizontally (such as the McDonnell-Douglas and Boeing combination in the aircraft industry, or Hughes and Raytheon in missiles), and vertically (such as Loral by Lockheed, and Westinghouse by Northrop). In less than a decade, what had been well over 50 major defense suppliers (prime contractors and large subcontractors) had been consolidated into only a half-dozen, dominant defense firms.

The Justice Department and the Federal Trade Commission were increasingly concerned about the declining number of firms available for competition; but they allowed the consolidations due to the obvious shrinkage in the available business, and the acknowledged uniqueness of the defense market structure (normally, a monopoly buyer and only a very small number of oligopoly suppliers, fighting fiercely for the few, infrequent, major procurements). The regulators reasoned that if the only customer (the DOD) was satisfied with the limited competition, and if the cost of maintaining additional potential suppliers was prohibitive, they would not object to the consolidations on antitrust grounds. And the DOD assured them (as Secretary Perry had explicitly stated) that "we will only allow consolidations if it reduces costs to the DOD, and if adequate competition will still exist after the merger or acquisition."

Importantly, it was noted, there had always been fierce competition for DOD's aircraft engines, even when only two suppliers dominated the U.S. defense business (General Electric and Pratt & Whitney)—and with Rolls Royce available should they be needed. Thus, it was agreed that two or three competitors would be adequate for competition in each critical sector and that the shrunken defense market could not support more than that.

And this move, toward the DOD feeling "satisfied" with only 2 or 3 suppliers in each critical sector of the defense industrial base, continues today. In fact, the Pentagon's February 2005 Report to Congress on the adequacy of the defense industries' capabilities, stated that

of the "255 priority, critical technologies and components for warfighting capabilities" there were "over 800 companies with relevant [sic] industrial base capabilities." Of course, it must be recognized that these firms with "relevant capabilities" are not all capable of maximum, state-of-the-art performance. And the report went on to say that, currently, of these "priority critical, technologies," nine have been put on the protection or watch lists for concerns about a loss of U.S. technological leadership or of U.S. suppliers' insufficiency.

Clearly, the shrinkage of the defense industrial base now requires that DOD no longer simply assume (as was often the case in the past) that it will always have an adequate number of competitive suppliers available. Instead, it will have to closely monitor all of its critical technology areas to assure that an adequate number (at least two) high-performance suppliers continue to exist in each area; and, if necessary, take steps (such as an award of a next-generation research and development contract) to maintain the second U.S. source.

Another option, of course, is to consider a foreign source as the alternative supplier—especially in any area in which the U.S. market size is simply too small to support two domestic sources. The United States recognized and accepted this option when it made the decision to allow its two remaining, domestic aircraft landing gear suppliers to merge, while allowing a French-owned, Canadian-located firm to compete equally on all defense programs, including the obviously critical Joint Strike Fighter. However, such competitions between a U.S. source and a foreign source must be real, i.e., the foreign source must be allowed to win if their offer is more attractive. Otherwise, they will simply stop bidding, leaving the United States with a monopoly supplier in a critical area. Naturally, politics will attempt to play a role here, and steps must be taken to address this. For example some systems of a foreign design could be built in the United States (as will be done in the award of the "Presidential Helicopter" to a partnership of a U.S. and foreign firm, based on a proven foreign design; and, as will be done with an Army transport aircraft, where the only two competing teams are partnerships of U.S. and foreign firms: and where both bids are based on foreign designs).

It must be emphasized, at this point, that since U.S. defense strategy is based upon technological superiority, the primary purpose of assuring competition (whether all-domestic, or with foreign firms included) is to stimulate innovation. (Price reductions usually come along also, but they are a secondary consideration.) And, since small businesses are often the most innovative, the government can stimulate their entry into the DOD market through direct funding of their research and development (R&D). For example, through the Small Business Innovative Research (SBIR) program, DOD funds around $1 billion per year. Such funding of small business R&D is an excellent way to introduce competition at a relatively low cost.

Another consequence of the rapid decline of the defense budget in the post–Cold War period, was that many large commercial firms—those that had the choice—simply sold off their defense divisions to the defense giants who were committed to stay in the business; for example, IBM sold their Federal Systems Division to Lockheed (by then, Lockheed-Martin), and Westinghouse sold their Defense operations to Northrop (which was, by then, Northrop-Grumman). Many observers (this author included) were disappointed by the DOD's loss of these commercially oriented, parent firms to the defense industrial base because of the loss of both their often-more-advanced technology, and their lower-cost-design orientation.

But these firms simply saw defense business as unattractive due to the low profit, excessive regulation, and shrinking market. In fact, by the mid-1990s, defense firms were themselves gathering data, and making the case that, even for them, defense business was becoming more and more unattractive (due to the lower profits being realized from the intense competition for the few procurements taking place; the heavy debt they were carrying from the acquisitions; and, of course, the shrinking defense business). And these industry claims were later substantiated by an independent Defense Science Board report on the ill-health of the defense industry in the post-Cold War period.

Some defense firms attempted to diversify into the commercial market; but their "culture" (particularly in terms of marketing, finance, and maximum-performance-at-any-cost engineering, which are all significantly different from the commercial world) made it very difficult to diversify. So, further defense consolidation appeared to be the only attractive path whereby, through consolidation, they believed they could capture a larger share of a shrinking market, and, simultaneously reduce the amount of competition in the defense market.

They also began to aggressively pursue the large and growing foreign military sales market (especially to the oil-rich Gulf states). And, by 1998 U.S. foreign arms sales reached $25 billion (certainly dominating the military-foreign-sales market). But, in general, defense firms simply hunkered-down and waited for the next, crisis-based cyclical build-up in the defense budget that history indicated was sure to come along. The only questions, they believed, were whether could they survive until then and when the build-up would come.

Eventually, of course, the horizontal integration of defense firms would have to come to an end, since the government would not allow consolidation from two firms to one (i.e., from a duopoly to a monopoly) in any critical defense sector. Both the DOD and the Justice Department demonstrated this policy by not allowing General Dynamics (who had previously bought Electric Boat) to buy Newport News, and thereby combine the only two nuclear submarine builders. So, the remaining choice for the big defense firms often was to move aggressively to buy-up lower-tier defense suppliers (the major subsystem and critical-component firms). However, when this reached the point of threatening to go from two to one suppliers in any critical sub-tier sector, again, the government had to step in—as it did in stopping the proposed Lockheed-Martin and Northrop-Grumman merger (not so much because of anticompetitive considerations at the prime contractor level, but because of the threat of creating monopoly suppliers at the critical lower tiers, and because of vertical-integration considerations). This proposed merger helped to make visible a growing concern regarding vertical-integration: namely, if one prime contractor owned or acquired the only (or even the acknowledged best) supplier of a critical subsystem, that would put them at a very significant competitive advantage against other primes who would not (as a result of the merger or acquisition) have access to that subsystem supplier on future, large weapon-system bids. Of course, the primes proposing the merger or acquisition of the lower-tier supplier usually argued that their acquired subsystem division would be a "merchant supplier" to anyone bidding against their parent firm, but this argument was not believed to be very credible.

Incidentally, this problem of "vertical integration" still exists today. It exists not in terms of a lack of multiple, subsystem suppliers, but in terms of the question "how does the government

assure that its selected prime contractor has picked the best of the possible subcontract suppliers, rather than the subcontractor that is now part of its own company (as a result of all of the prior acquisitions)?" In fact, this concern has forced the government to get much more involved with the prime contractor's "make-or-buy" decisions (on all major subsystems and critical-components) than it had been in the past. And, this issue has become an even greater concern as the government moves to the use of a "Lead Systems Integrator" on complex systems of systems. For example, on the Army's Future Combat System, the vertical-integration issue is now elevated by one level (to what had previously been the government's selection of a "platform" supplier) since this choice is now the responsibility of the Lead Systems Integrator.

Warfare Changes

While the massive consolidation of the defense industry, in the post-Cold War period, was largely being driven by the declining defense budget, a second major structural change in the industry was being driven by the changing nature of projected future warfare. Facilitated by the commercially led information era, there was a "revolution in military affairs" taking place —one in which the traditional weapons platforms (ships, planes, tanks, etc.) were no longer the central elements of the battlefield. Rather, future military strategy would be based on "information dominance"; and the implementation would be achieved by many, distributed, highly intelligent sensors, combined with many, distributed, precision "shooters," all linked together ("fused") through advanced, secure, global, command, control, and communications systems. Thus, the critical skills needed from industry were systems integration and information technology. Prime contractors, to win major system awards—or, more recently, systems-of-systems awards—would have to change from being suppliers of ships, planes, tanks or missiles to being "systems integrators," simulating, optimizing, and selecting the best mix of sensors and shooters, and effectively integrating them all, for various warfighting scenarios. This shift (from platform supplier to system integrator) is truly a major structural change (some might say a cultural change) for the few remaining prime contractors of the defense industry. Yet, to satisfy their stockholders and large production workforce, they still have to answer the question, "How do I keep my factories full?"—especially when, in many cases, the firm's consolidations did not result in their integrating the various factories that they acquired through their acquisitions. (For example, Lockheed Martin still builds the F–22 fighter aircraft in Georgia and F–35 fighter aircraft in Texas; Boeing still builds aircraft in Missouri, Washington, and California; Northrop Grumman still builds ships in Mississippi and Virginia; while General Dynamics still builds them in Maine and Connecticut.) Clearly, with the reduced defense budgets, to achieve the economies-of-scale that mergers and acquisitions promised, many of these duplicative plants needed to be closed down (rather than run at low volume). But, of course, that is politically very difficult, so it usually wasn't done.

Complicating this desire to achieve efficiency in defense plants, is the redundancy that exists between facilities in the private sector and those maintained by the government (from laboratories, through arsenals, to maintenance depots) for work similar to that done in the private sector. And, of course, these large (sole-source) public-sector facilities are strongly protected by their representatives on Capitol Hill. For example, one law says that at least

"50 percent of all maintenance work on defense equipment must be done in government facilities" regardless of their cost or performance.

Globalization

Another major structural impact of the post–Cold War era on the defense industry, was that of globalization. Even before the Cold War ended, but with increasing intensity since then, the commercial world has been thinking and acting in view of the global market, both in terms of production and consumption. And even in defense, at the parts-supplier level, essentially all U.S. weapon systems were becoming increasingly dependent upon parts from offshore (for example, semiconductors from Japan or precision glass from Germany). This was being driven, primarily, by the higher performance of these foreign sources, but also by their lower costs. However, studies were being done to show that even though there was a growing dependency on these foreign parts, there was not a corresponding U.S. vulnerability—depending upon the number of potential suppliers, the number of countries in which they were located, and particularly, whether there was a potential U.S. supplier as a fall-back alternative. And there was no need to be concerned about a violation of the Buy American Act, since that only applied to the end items and not to subcontracts or parts.

There were two other significant multinational considerations in this post-Cold War time period, one military, the other economic. On the military side, from a geopolitical perspective (far more than from a military one), it became increasingly clear that the United States would not be entering any future military operation without a coalition of allies. So, with the battlefield made up of mutually interdependent, interconnected, distributed sensors and shooters from multiple countries, it was clear that it would be in the U.S. interest to ensure that each country involved in the coalition would have the best possible technology (which was usually U.S. technology); and that all equipment had to be designed and tested to be interoperable among the coalition partners, in order to be militarily effective. (For example, in Kosovo, full interoperability was not the case; U.S. and Dutch planes flew next to each other, yet they could not communicate in a secure mode, thereby greatly reducing their effectiveness and increasing their mutual vulnerability.) Thus, critical U.S. military technology needed to be shared with our allies, and by the end of the 1990s this was increasingly recognized by both the U.S. State and Defense Departments; leading to a new, White House-announced policy in early 2001 on increased technology-sharing with our allies (known as the "Defense Trade and Security Initiative"). Of course, a clearly-stated condition for this U.S. technology-sharing with our allies was that they needed to effectively implement strict controls over further third-party transfers of the technology.

The other, perhaps more traditional, argument for greater multinational consideration of the defense industry structure was economic. Namely, if the U.S. defense budget was down and each of the European countries were cutting its defense budget (in many cases even more), then, to gain efficiencies, countries should share development costs and have common production lines (for economies-of-scale). As a result of this thinking, numerous transatlantic programs were initiated, from radios (MIDS), to missile defense systems (MEADS), to aircraft (Joint Strike Fighter). And, consistent with the commercial industry globalization trend, as well as the rapid global spread of technology in the information age, the major defense industrial

firms (on both sides of the Atlantic) began to aggressively enter each other's markets, often in transatlantic partnerships and frequently through acquisitions. The most notable of these was the aggressive U.S. acquisition program of BAE Systems (the dominant UK defense firm), first by buying Tracor, then Sanders, and, most recently, United Defense. These "crown jewels" of the U.S. defense industrial base now make BAE Systems (a "UK firm") one of only six remaining U.S.-based, major defense contractors (along with Boeing, Lockheed Martin, Raytheon, General Dynamics, and Northrop Grumman). And, who is to say what nationality BAE Systems really is. While its headquarters is in London, it has as many American employees as British employees, and it currently is between 51 and 54 percent owned by U.S. investors.

Competitive Sourcing

A last significant defense industry structural change for this period was the result of the fact that the world-class commercial firms (in both the pre- and post-Cold War periods, and with increasing intensity) were outsourcing a significant share of their non-core work, both to domestic and offshore sources. Companies found that not only were costs significantly reduced when work was competitively outsourced to other firms (whose core-competence was in the business area being outsourced), but that their own firm's overall corporate performance was also significantly improved. Thus, in the highly competitive, post-Cold War defense environment, U.S. defense industry also began to take advantage of this trend (with, of course, security requiring domestic sources) and began to outsource non-core business functions (particularly "back-office" operations). However, the government itself was initially reluctant to move in this direction for a variety of reasons, mostly, fear of losing jobs and/or fear of losing control over the activity. Nonetheless, as the government work force was reduced along with budgets (with the civilian workforce having been cut by 40 percent), within the Pentagon this alternative became more and more attractive to senior department managers. Naturally, recognizing an opportunity for a bigger potential market, the defense industry began to push for increased outsourcing of all government work that was "not inherently governmental." However, in the interests of fairness to the government workforce, and because they (in fact) may be able to do the work both better and cheaper if pressed by competition, there was a strong move to run public/private competitions (known as "competitive sourcing"). In literally thousands of examples of DOD public/private competitions, the results showed that no matter who won (and the public sector actually has been winning a majority of these competitions), the average price of performing these non-inherently governmental functions (that had previously been done by government employees on a sole-source basis) were reduced 30 to 40 percent as a result of the introduction of competition. And, importantly, the performance was improved significantly! So, with results like that, and with dollars short, it is no wonder that both Democrat and Republican administrations supported the concept of competitive sourcing of non-inherently-governmental work. In fact, when George W. Bush came to office he made it one of his top five Presidential Management Initiatives. And, with well over 800,000 federal jobs classified as "not-inherently-governmental" (about half of the civilian workforce in 2001), it obviously got the attention of defense industry. As a result, many of the major firms either set up or acquired outsourcing and/or services divisions. Then, with military downsizing and increased outsourcing, and with increased DOD

operations—first, for the war in Bosnia, and then Afghanistan and Iraq—demands for industry support increased significantly, not only at home, but with an increasing number of defense contractors actually working in the war zones. And this introduced a whole variety of interesting industry issues, such as: are these contractors covered by the Geneva Conventions? Are they allowed to be armed? Whose control are they under? These and other problems have yet to be fully resolved.

Post 9-11-01

What has been described above were the major U.S. defense industry trends in the so-called post-Cold War era; but on September 11, 2001, a new era began. The United States was at war. It was a very different kind of war (against "terrorists"), but, nonetheless, one for which the Nation's voters would clearly support greatly increased defense expenditures. And grow they did! While defense research, development and procurement had started to rise at the turn of the century (in recognition of the "procurement holiday" and the resultant equipment aging of the 1990s), the defense budget literally exploded after 2001. And then the enormous supplemental defense budgets to cover the wars in Afghanistan and Iraq just compounded the growth. So, from 2001 to 2005, even in the presence of large administration-ordered tax cuts, there was a huge increase in the defense budget; and, correspondingly, there was far less concern (by the administration, the congress, the DOD, defense industry, and even the public) about economic considerations. At the macroeconomic level, this is seen today in the poor financial condition of the country, namely the enormous and still growing deficit and a correspondingly poor trade balance. At the weapon-system level we see it in the high and growing costs of individual weapon systems. And, on the international level, we see it in the extreme protectionist measures being pushed in Congress. For example, in 2004 the House of Representatives passed a new version of the Buy American Act that would have required every part, in every U.S. weapon system, to be made in America and on U.S.-made machine tools. This action, I estimate, would have not only lowered the performance of U.S. weapons, but at least doubled the cost of each weapon! Fortunately, the Senate didn't pass it.

Another, very troubling recent trend , undoubtedly being driven by the high operating and support costs of the war in Iraq, is the significant shift away from early-stage research to near-term developments and procurements. A quick look at the fiscal year 2006 President's research budget is all that is required to see that we have made the choice to "eat our seed corn" and give up our historic, long-term defense strategy of technological superiority. Here, it must be emphasized that the issue of importance is not the total R&D budget, but the "R" (the research) part. The unfortunate shift has been to fund more short-term development at the expense of long-term research (for example, the Army research budget submitted for FY 2006 is 21 percent below the 2005 level).

This shift away from research funding is particularly troubling when combined with the growing shortage of scientists and engineers in America and the attraction of the commercial world for them. This is especially troubling considering that over half of the graduate students in these fields, at U.S. universities today, are foreign students (many of whom have historically stayed, and become our leading innovators, as U.S. citizens). Yet, we are making it increasingly difficult for them to come here; and then difficult for them to do research

here (especially if the research is "dual use"), since we are increasingly classifying such work and putting other restrictions on foreign student involvement (such as calling it "deemed export" if they use equipment in performing their university research that is restricted from foreign export).

Increased Regulation

The last of the recent impacts on the defense industry's future is the likely effects brought on by the "Darlene Druyun procurement scandal." I worry that this incident will have a potentially significant, adverse reaction, that—through a movement toward far greater regulation of the defense industry—will dramatically set back (under the heading of "acquisition reform") all of the positive steps to improve defense weapons and services acquisition that have occurred over the last two decades. This increase in regulation will create further, large cost increases in weapon systems, as well as build high barriers-to-entry for commercial firms (especially those in the lower-tier supplier base) to do defense business (as a result, for example , of requiring government-unique and highly specialized cost accounting requirements, as well as government-unique procurement regulations). Numerous studies have shown that such increased regulation, and isolation from the commercial industry (and even from best commercial practices), cause a significant increase in the acquisition costs of defense goods and services, as well as a slowing down of the acquisition process (with the resultant delay in getting state-of-the-art equipment to the fighting forces). And, of course, increased regulation greatly discourages world-class commercial suppliers from entering the defense market, and removes the future potential (through the use of "flexible" manufacturing) of integrated civil/military production lines that would offer great cost savings, as well as crisis-surge potential (through rapidly shifting the work from civil to military). All of this is clearly contrary to the DOD's future need for low-cost, high-performance technology, as well as for rapid and flexible industrial responsiveness.

Conclusion

In summary, the period since September 11, 2001, has been in many ways a reversal of the prior decade of the post-Cold War era. Defense budgets have skyrocketed, and defense industry profits are way up (the average return-on-investment for the top four defense firms in 2004 was 9.6 percent, versus comparable large commercial firms in the range of 6.69 percent to 7.3 percent). But, with the Nation's debt build-up, and the public tiring of supporting the war in Iraq, as well as the growing moves toward protectionism and a potential return to excessive regulation, the future trends for the U.S. defense industrial base are very much uncertain. For the Nation's future security, I believe these potentially adverse trends warrant very close scrutiny, and—if necessary—preventive actions.

The Future of the U.S. Defense Industrial Base: National Security Implications of a Globalized World

Pierre Chao

Since its inception, the U.S. defense industrial base has operated in an environment shaped by the processes of globalization. In fact, industrialization and globalization have been closely interlinked phenomena over the last 150–200 years. Certainly, the level of integration has waxed and waned over time, but some form of global interaction has always been present. Globalization is, therefore, not something to be accepted or denied; it is part of the economic landscape. The goal for policymakers should be to understand the phenomenon of globalization, to prepare the industrial base for it, and to harness it for the benefit of the Nation.

The Waves of Globalization Impacting the Defense Industrial Base

Depending on the analyst, the world is experiencing either its second or third major wave of global integration. Tom Friedman, in his book *The World is Flat*, claims we are in the third era of globalization. Globalization 1.0 was from 1492 to the early 1800s and was characterized by countries globalizing; Globalization 2.0 was from 1820 to 2000 and was characterized by companies globalizing; and Globalization 3.0 began in 2000 and will be driven by individuals going global.[1] Historian Robbie Robertson defines the three waves of globalization as 1500 to 1800, based on the globalization of trade; 1800 to 1945, driven by industrialization; and 1945 to present, based on the post-war "architecture of a new world order."[2] Other observers, in particular world systems analysts, take a longer view and identify multiple cycles of global integration throughout history. The Roman Empire is identified as a period of greater "global" interaction. The spread of Islam in the 7th and 8th centuries has been identified as a globalization process that linked European, African, Middle Eastern and Asian peoples into a globe-spanning network.[3] The Mongol Empire of 1200–1350 managed to unify the entire Eurasian landmass, permitting a period increased "global" trade, cultural exchange and technology transfer. This Eurasian network also facilitated the spread of the Black Plague, a vivid reminder that globalization has its downsides as well as its benefits.

The U.S. defense industrial base has been subject to slightly different waves of globalization. The first era of globalization for the defense industry parallels the broader wave driven by industrialization and corporations a la Friedman and Robertson (1800s to 1945). The trade flows, technology transfers, and exchange of talent between the defense industries of Europe, North America, and Asia during that period were staggering in relation to today. The munitions, shipbuilding, and nascent aircraft industries comprised the core of this global network. Names such as Krupp, Armstrong, Vickers, Schneider, Du Pont, U.S. Steel, Wright, Curtiss, Fokker, DeHavilland, Boeing, Douglas, Lockheed and Grumman became famous, and in some cases infamous, during this period.

The next great wave of globalization relevant to the U.S. defense industrial base recently began with the fall of the Berlin Wall and the end of the Cold War. The anomalous period, in many ways, has been the intervening 45-year period from 1945 to 1990. It was unusual because it marked a time when the global defense industry was divided into two major, disconnected blocs and it was a period that began with the U.S. defense industry unchallenged in the world. World War II left major centers of aerospace/defense competence, such as the French,

German, Italian, Dutch and Japanese industries, shattered. Other European aerospace/defense competitors such as the Poles, Czechs, and Russians were locked behind the Iron Curtain. Even the once dominant British aerospace/defense industry was burdened by the legacy of the Second World War—the strategy of dispersing facilities and building shadow factories across the United Kingdom in response to the Nazi bombing campaigns resulted in gross excess and inefficient capacity. Thus, for the first 20–25 years of the post-World War II period, Europe and Japan were focused on rebuilding their defense industries and the UK struggled to rationalize its industry. Even after the rapid demobilization of America's "arsenal of democracy," U.S. industry still loomed large compared to the rest of the world in the 1950s and 1960s. For example, by the early 1950s the U.S. military aerospace industry was out-exporting the UK industry two-and-a-half or three to one, compared to the pre-war situation where the U.S. and British aerospace industries sold an equal amount in the export market.[4] Given the strong starting position, it was inevitable that the U.S. (defense and broader) industry would lose ground and market share as the rest of the world rebuilt itself.

The reintegration of the two big economic and philosophical blocs, capitalist and formerly communist, into one global system is the defining characteristic of this post-Cold War wave of globalization. The opening of "new" markets in Eastern Europe, Russia and China has brought 1.6 billion people into the global economy—new consumers, but also new sources of competition and labor. It has provided access to new sources of capital. And it has injected into the global economy the ideas (the intellectual property) of entire populations that were once trapped behind the Iron Curtain.

What's Different This Time?

New markets, new competitors, and new sources of labor, capital, and ideas—there is nothing particularly unusual about these elements and they have certainly been easily absorbed in the past by the global economy. This wave of globalization has three unique characteristics, however:

- The network of relations is currently "denser" than in prior rounds of globalization. The major globalization waves since 1500 have been based on networks of elites, governments and corporations. As Tom Friedman notes, however, this round is about the individual globalizing. It is a far more "bottom up" process and the sheer number of people, organizations and groups that are interacting on a global scale for the first time in history is unprecedented. The downside is that individuals like Osama bin Laden, a 14-year-old Russian hacker, or a Chinese farmer who keeps chickens in his house can morph into the global threats of terrorism, cyber-crime, and the avian flu.
- In this round of globalization, not only are the links denser but the "pipes are fatter." In the past, globalization was achieved through fairly thin connections. In the eras of proto-globalization, like the Mongol Empire, it was achieved via the trade caravans of the Silk Route and the Indian Ocean trade. In 1913, at the height of the British Empire and the industrialization-driven wave of globalization, trade in manufactured products hit a peak of 12 percent of global GDP. That figure was passed in the 1970s[5] and today manufacturing trade is 20–25 percent of global GDP. Capital flows as a percent of GDP hit a peak of 9 percent in the early part of the 1900s, while today capital flows represent

about 28 percent of global GDP.[6] The telecom bubble of the late 1990s resulted in 39 million miles of fiber optic cable being laid (enough to circle the globe 1,566 times),[7] providing the infrastructure for greater information flows. According to almost any metric used, the world is more integrated than in prior periods.

- The third difference is a byproduct of the "denser networks" and the "fatter pipes": information, technology and change propagates faster today than during any other period. In the era of proto-globalization, China held onto the monopoly of silk production for several thousand years until silkworms were smuggled to the West in the 6th century AD.[8] In the last round of globalization, the United States held onto the monopoly of nuclear weapons for four years in the late 1940s. Today, bootleg copies of the most recent Star Wars movie were available on the internet within hours of its theatrical release. The greatest challenge for governments and policymakers is this rapid pace of change brought on by globalization. The inability of government to react to the shifting global landscape as quickly as the business community or individuals remains the greatest source of tension in the system.

The Industrial Response to Globalization

It can be argued that the business community has delivered the most predictable response to the phenomenon of globalization. The drivers of corporate behavior are simple and time-tested—the continuous search for markets, capital, labor, and, ultimately, profits. The most nimble governments have been able to devise policies that leverage these drivers, shape corporate behavior, and harness globalization.

The search for new markets has been attracting almost every sector of the economy to the countries of the former Soviet Union, Eastern Europe and Asia. In particular, the notion of 1.1 billion Chinese shifting from a peasant, agrarian-based population to a middle-class, urban population has been particularly alluring. An industrializing China is generating the demand for every manner of raw materials, industrial goods, consumer products and high technology. Both Airbus and Boeing predict that Asia, and China in particular, will be the fastest growing air travel market for the next 20 years.[9] On the other hand, in the defense sector, the United States is the "new" and attractive market. The U.S. defense budget has grown impressively since the late 1990s and is currently $465 billion, representing about half the world's military spending and over three-quarters of the world's defense R&D spending.[10] It should be no surprise that every major defense company in the world is trying to access the U.S. market. The desire to be physically close to these new customers has been one driver behind the off shoring of facilities to Asia and other markets, and behind the establishment of U.S. operations by European defense firms.

The opening of new markets to the global economy has also introduced new competitors. In the last wave of globalization, it was Japan and the Asian Tigers (Taiwan, South Korea, Singapore and Hong Kong) that became global competitors in the automotive, machine tool, consumer electronics and high technology markets. In this round, all eyes are on an industrializing China, India and Southeast Asia. In the last 20 years, Canada and Brazil have become major aerospace powers through their development of regional jet aircraft. In the defense market, it is the United States that has benefited from the introduction of new competition. In the

1980s, the Soviet Union and the United States each had one-third of the military export market. By 2000, the United States had 50–55 percent of the export market for defense goods, with most of the gains at the expense of the Russians/former Soviet bloc countries.

The search for human capital has manifested itself in a variety ways in the globalizing economy—the legal and illegal migration of low-cost labor into more developed economies, for example. Israel benefited immensely in the 1990s from the migration of highly educated Russian Jews. India's large population of low-cost, well-educated and English speaking people has made it a central actor in this wave of globalization. One changing dynamic has been the ability to access human capital without the need for migration or movement, thanks to the global telecommunications infrastructure laid during the last decade. In the aerospace and defense worlds, Western companies now have direct access to Eastern European and Russian technical and engineering talent (throughout the Cold War the only flows were the occasional defectors). Today, for example, Boeing and Airbus have a Moscow Design Center to tap into world-class aerodynamicists. China has been relying on Russian engineering talent to improve its defense technologies for decades now.

The access to a global labor pool also means access to a world of ideas and innovation. For the aerospace/defense community this global environment returns the industry to familiar territory. Since its inception, the aerospace/defense sector has been one of the most global industries of the economy and has always relied on the considerable interchange of intellectual capital and people. A quick survey of the key elements of current U.S. military technological superiority reveals a plethora of foreign technology and technical talent. The development of atomic bomb was based upon a group of German Jewish scientists who fled Nazi Germany. An Irish immigrant invented the modern submarine. Space launch and intercontinental missiles were also thanks to a group of German scientists. The jet engine and the tank were British inventions. Stealth technology was the result of a Lockheed Skunk Works engineer coming across an obscure Soviet algorithm.[11] This tradition has continued to today. The Army's M1A2 Abrams tank uses a German 120mm cannon and British armor technology; and the Stryker armored vehicle is a Swiss design. The Marine's new howitzer is a British design. The President's next helicopter will be an Anglo-Italian design. America's next generation Atlas space launcher uses a Russian rocket engine, while the next generation F–35 Joint Strike Fighter uses British engine technology. All but one of the bidders in the Navy's new Littoral Combat Ship program is using foreign hull designs or technology.[12] The links between the U.S. and European industry are clearly deeper and broader than is commonly perceived.

Finally, the pursuit of international capital has been accelerated in this latest round of globalization. Much has been made of the fact that, in the broader economy, a significant portion of the U.S. deficit is currently being financed with Asian and European capital (half of the U.S. treasury debt is held by foreigners versus 5 percent in the 1960s).[13] In the defense sector, European governments have been privatizing their state-owned defense businesses and turning to private capital to finance them. In the 1980s the UK privatized British Aerospace (now BAE Systems) and Rolls Royce. In the last decade, France's Aerospatiale (now EADS), SNECMA and Thales; Italy's Finmeccanica; and Russia's Irkut (maker of Sukhoi fighters) have all seen stock market listings. Today, half of BAE System's shareholders are non-UK (mostly U.S.); so is it an

American or British company? Bofors of Sweden, the gun maker that was founded during the Thirty-Years War 350 years ago, was acquired by United Defense of America, which was just acquired by BAE Systems. Is Bofors Swedish because of its location or American because of its direct ownership or British because of the ultimate ownership by BAE Systems or American because half of BAE Systems' shareholders are American? The fungible nature of global capital flows is straining traditional notions of nationality, even in the defense sector where nationality has been so important.

Two assessments can be made of the overall impact on the defense-industrial base of this latest round of globalization. The first observation is that the level of international integration has risen across the entire industry. Every sector of the defense industry has become more global than it was 20–30 years ago, even recent bastions of nationalism such as naval shipbuilding. This is particularly true for the lower tiers of the defense industry, which have been at the forefront of globalization. The search for new points of competition has been the central dynamic driving the systems and subsystem providers into the global market place. What is the point of having teams of engineers developing the next generation hydraulic pump, avionics suite or landing gear unless there is a program/platform to put it on? In the face of fewer domestic programs being started, the aerospace/defense supplier base has gone global to look for opportunities. The Canadian and Brazilian regional jet manufacturers were greatly aided by international systems providers—certainly not initially by Boeing or Airbus. SNECMA, the French engine and systems manufacturer, has the U.S. Air Force as its largest customer. It is primarily this growing interaction at the system and subsystem level that has raised the overall level of globalization for the defense industry.

That being said, the second observation is that the level of globalization varies widely by industry segment. As we have noted, the commercial and military aerospace sectors are amongst the most globalized in the industry. Almost every future fighter and commercial aircraft design is being undertaken as a collaborative project and they all contain systems and subsystems provided by international suppliers. The burgeoning homeland security sector is another inherently global market—not only are the underlying technologies being developed internationally, but there is a logic to ensuring that homeland security products are widely distributed throughout the world (and interlinked) in order to solve the problem of terrorism.

Other sectors can be described as moderately global. The armored vehicle sector, which until recently was a very nationalistic market, has recently undergone a wave of international integration. Today, there are two trans-Atlantic armored vehicle groupings centered around General Dynamics (which owns the American M–1 tank business, the Canadian GM Defense armored vehicle business, the Spanish Santa Barbara Sistemas tank operations, the Swiss MOWAG armored vehicle business, and the Austrian Steyr armored vehicle operations) and BAE Systems (which owns the British Alvis armored vehicle and Vickers Defence tank operations, the American United Defense armored vehicle business and the Swedish Hagglunds armored vehicle operations). The space launch market can also be described as moderately global as it has certainly internationalized over the last 30 years (the creation of Ariane and the reintegration of the Russian industry), but the classified space side of the market has remained understandably nationalistic.

The naval shipbuilding industry, as previously noted, has also become more international in this round of globalization. As with other industry sectors, globalization in shipbuilding has been primarily at the system and component level; for example, a small American manufacturer provided the aircraft elevators for a French aircraft carrier and the next-generation British aircraft carrier will be designed by an Anglo-French team. However, relative to other defense industry sectors, shipbuilding still remains a nationalistic market. The really interesting case is information technology. In the general economy, the information technology and software industry is extremely global—so much so that it can be claimed it is driving the current wave of globalization. However, in the military world, the defense IT market remains extremely nationalistic as security conscious governments demand that software be written by domestic employees. This understandable policy is creating a growing disconnect between the commercial IT and the defense IT world that will eventually perpetuate a crisis that governments will have to address.

The Policy Response to Globalization

The central point to be made regarding globalization and governments' response is that "one size does not fit all." In fact, the areas of greatest tension or strain occur when governments attempt to implement policies that are either disconnected from the underlying realities or are misapplied. For example, having a 100 percent (or even 50 percent) "buy domestic" rule on cobalt, a critical mineral used in aircraft engines, would not work for the simple fact that all the sources of cobalt are outside the United States.[14] An example of a misapplied policy would be applying traditional efficiency metrics (those appropriate for manufacturing) to basic research; for example, 90 percent failure on a defense contractor factory floor is grounds for an inspector general investigation, while 90 percent failure by DARPA should be the norm.

The goal therefore becomes to look for areas of policy disconnects, where government policy is under strain either because the underlying landscape is changing due to globalization or "one size fits all" mentality is causing a misapplication. This exercise should be conducted at all levels of policy.

At the strategic level, there are significant strains currently being generated as the Pentagon attempts to shift resources away from traditional, peer competitor threats to the new challenges of irregular warfare, catastrophic events, and disruptive threats. The latter two strategic challenges, catastrophic (a bioterrorism event or an act of nuclear terrorism) and disruptive (the invention of a new technology that would obviate stealth, for example), are inherently global problems. The catastrophic challenge of the post-September 11 era will only be met by being forward leaning, engaging the world and being a global actor. The disruptive challenge, essentially a science and technology problem, is answered by scanning the world for the best technologies available.

At the level of acquisition policy, if there is a desire for the U.S. military to have the best technology at the lowest price, it will push industry toward globalizing for all the reasons described. On the other hand, if there is a willingness to pay higher prices and to devote a greater proportion of the GDP to the military, then it may be possible to have all-American products. This is the true trade space.

Creating the right policy responses to the challenges of globalization requires several key actions:

- Determine what is strategic, what provides an asymmetric advantage, in order to identify what sectors of the economy or defense-industrial base should be strengthened or defended. As any military strategist would point out, an attempt to defend everything ends up defending nothing. Without an assessment of what is strategic, it becomes impossible to prioritize. A situation then develops where government resources are spent protecting the anchor chain,[15] ball bearing,[16] and bus industries,[17] and yet little is done about the semiconductor industry (see Senator Lieberman's 2003 white paper).[18]

  In addition to assessing what is strategic, it is also important to understand the value chain of each industry sector. What provides the critical competitive advantage? Is it important to strengthen/protect the raw component, the process, the machinery that manufactures the product, the subsystem providers or the integrator? Understanding what is value added, once again, permits a better allocation of scarce resources.

  Finally, understanding the technology cycle is important. The appropriate policy will differ based on how rapidly the technology is changing. It may not be necessary to strengthen/defend a technology with short development cycles because an investment in the next generation could recover the competitive position. The fact that Japan had the world's fastest supercomputer by the mid-1990s following a decade of targeted government industrial policy in 1980s caused a considerable amount of angst in the United States. Japan held the top spot for only 2 years (1995–96), then regained the position of manufacturing the world's fastest supercomputer in 2002, and just lost it again to the United States in 2005.[19] A technology with very long cycles, however, may require closer monitoring, because it may not be possible to regain a lost leadership position. It would take decades for the United States to create a viable competitor in the regional jet market place.

- Replenish the seed corn through investment in research and development. There are two strategies to adopt in response to globalization: have the best industrial policy in the world and guess correctly each time what sector to defend or not, or have a robust economy that has a deep and wide pool of human, physical, and intellectual capital that is dynamic enough to reallocate resources and meet the next challenge. Since the first strategy is impossible to sustain over time, an incorrect guess is inevitable. The abysmal failure of the Soviet command economy should be evidence enough. Central to the second strategy is investment in research and development that allows the economy to "run faster." It requires investment in basic technology, product innovation, and process innovation. One of the major issues the defense industry is facing is the growth in military software projects. Major systems like the Army's Future Combat System will require over 30 million lines of software code (as big as Microsoft XP and hitting ctrl-alt-delete in the middle of a battle is not an option). If the size of software projects has expanded tenfold but software generation productivity has only improved fourfold, it becomes very clear that there is a major crisis on the way. Furthermore, this represents a situation where the commercial sector does not have an incentive to solve the problem,

because, unlike the defense sector, it has an escape hatch by leveraging globalization and offshoring software programming to lower cost countries like India. The defense sector is left to its own devices in this case, which represents an ideal area for government investment in process innovation.

- Align incentives with areas that matter to business. Unrealistic "sticks" will generate very bad behavior. Creating a provision that forces the purchase of domestic goods, if those products do not exist in the United States, will inevitably force industry to cheat and break the law. Equally, telling a European company they cannot sell to the U.S. military if they sell to China is a meaningless threat if they are already barred from the American market for other reasons. "Carrots" that incentivize the wrong things are also useless. In order to shape industry's behavior it is critical to understand what motivates business. It is ironic that it was a communist government that established, in the finest capitalist tradition, a set of interlocking incentives (tax subsidies, world-class housing provided to engineers, extensive stock options for scientists, government-funded industrial parks) to attract the semiconductor industry to China. Given the opportunity to lower manufacturing costs by 30 percent, it would almost be a breach of fiduciary duty not to open up a semiconductor lab in China. Contrast that with a visa policy that makes it more difficult for top, international, technical talent to travel to the United States.
- Use the full range of tools available. Bearing in mind the key point that in a globalizing world one size does not fit all, it becomes critical to be creative and use all the possible policy responses. In some cases, this requires redefining the landscape, for example, by changing the definition of a trusted person or who is an ally. If the issue is single sources of supply, it could involve diversifying the supplier base even more globally under the premise that the United States will not go to war with everyone. Or, if the issue is that semiconductor manufacturing is moving to China, perhaps the answer is not building a trusted foundry in the United States, but to develop a mechanism to do anonymous buying so the supplier does not know where the chips are going (creating a disincentive to tamper with the product). It may involve thinking about traditional parts of the defense industrial base in a different way. The arsenals and depots possess interesting capabilities; perhaps they could play a larger role in manufacturing obsolete parts (the diminishing sources of manufacturing supply problem). The central point is simply that complex problems require creative answers.

Embracing change is fundamental to surviving the globalizing environment of today. It is particularly critical for government to do so, because it will be in industry's nature to adapt to this changing environment. The challenge will be for policymakers to keep up with all this change, let alone get ahead of it and shape industries' behavior. Becoming more nimble and creative is not an option; it is a necessity.

Endnotes

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