Selling Military Transformation: The Defense Industry and Innovation

by Peter J. Dombrowski, Eugene Gholz, and Andrew L. Ross

Even while it focused on the early stages of the war on terrorism, the Bush administration strongly reaffirmed the commitment to military transformation that had marked its first months in office. The ongoing war may even have heightened its interest in pursuing transformation, particularly the contributions that advances in information technologies can make to military effectiveness. In his December 2001 speech at the Citadel, President Bush renewed his campaign promise to support the long-term process of military transformation. The president stressed “the need to build this future force while fighting a present war.”\(^1\) He spoke glowingly of real-time intelligence and targeting, precision munitions, and the operational successes of rapidly deployed prototypes such as Predator unmanned aerial vehicles (UAVs), and he committed his administration to expanding the nascent advanced technology programs.

While the realization of President Bush’s vision in part depends on organizational changes in the armed forces to help them fight in new, information-oriented ways, it also depends on the acquisition of new weapons and communication technologies. Many transformation advocates,

\(^1\) President George W. Bush, “President Speaks on War to Citadel Cadets” (http://www.whitehouse.gov/news/releases/2001/12/20011211-6.html).

Peter J. Dombrowski is an Associate Professor in the Strategic Research Department of the Center for Naval Warfare Studies at the Naval War College. Eugene Gholz is an Assistant Professor at the Patterson School of Diplomacy and International Commerce at the University of Kentucky and a Consultant on the Naval War College’s Defense Industry After Next Project. Andrew L. Ross is a Professor in the Strategic Research Department of the Center for Naval Warfare Studies at the Naval War College and the Director of the Naval War College’s Defense Industry After Next Project. The authors thank VADM Arthur K. Cebrowski, USN (Ret.) and Dr. Alberto Coll for their support of the Defense Industry After Next project, and Michael Desch, Harvey Sapolsky, and Thomas Mahnken for their comments on earlier versions of this article. The views expressed here are those of the authors and do not necessarily represent the views of any department or agency of the U.S. government.

© 2002 Published by Elsevier Science Limited on behalf of Foreign Policy Research Institute.
if not the U.S. armed forces, share the president’s vision, and defense contractors apparently stand ready to sell wares to the government to support the future “American Way of War.” But what are the implications of military transformation for the nation’s defense industrial firms? Does military transformation require defense industrial transformation?

We use the case of naval transformation to help to understand two key relationships: the effect of the military’s demand for innovation on the defense industry and the effect of the state of the defense industrial sector on the military’s ability to transform. First, we summarize the network-centric warfare (NCW) vision for naval transformation and its requirements for innovative equipment. NCW is a joint vision that harnesses capabilities from all services; it is applicable to warfare on land, air, or sea, and, therefore, allows us to draw inferences about military transformation generally. Next we draw upon Clayton Christensen’s work in *The Innovator’s Dilemma* to generate insights into the relationship between technological innovation and industrial organization in the defense sector. We then analyze three sectors of the defense industry—shipbuilding, unmanned aerial vehicles (UAVs), and systems integration—that are critical for both naval and military transformation. Finally, we suggest how the military might achieve transformation by capitalizing on political and technical relationships with the defense industrial base and with Congress.

**Visions of Future Warfare**

The U.S. military is awash in visions of transformation. Each service has a vision of what has become known as the “military after next,” and together they have cooperatively written a set of joint documents describing the ways and means of America’s future dominance. NCW began as a guide for the transformation of today’s navy into the navy-after-next, but it has now become the watchword for joint transformation as well. The goal is to exploit information technologies to shift from platform-centric to network-centric operations. In the current, platform-centric model of operations, individual military assets (e.g., ships, aircraft, etc.) engage enemy targets head-to-head; in the future, a decentralized network of forces will share

---


4 *Joint Vision 2020* projects that in twenty years information superiority will enable the U.S. military to focus on dominant maneuver, precision engagement, focused logistics, and full-dimensional protection to defeat America’s adversaries.

information in order to engage targets more efficiently, precisely, and quickly from greater distances and from all directions.

A particular understanding of the late twentieth-century shift from the industrial age to the information age drives the NCW vision. Widespread socio-economic changes should revolutionize the conduct, if not the nature, of war.\(^6\) In particular, the increasing use of networks for organizing human activities is expected to reshape the way American forces train, organize, and fight.\(^7\)

Network-centric operations are expected to bring four key benefits: increased speed of command, self-synchronization, advanced targeting, and greater tactical stability. A network of sensors will provide shooters and commanders with “unmatched awareness of the battle space,” because no one will depend only on what can be seen from a particular geographic location.\(^8\) With everyone having access to that integrated knowledge base and drawing from a shared set of procedures (doctrine), warfighters will be able to “self-synchronize” their activities to accomplish a commander’s intent, speeding up decision-making and minimizing the risks of miscommunication. The ability of American forces to react will give them a key advantage in military effectiveness.

The sensor network’s improvement of intelligence, surveillance, and reconnaissance capabilities, combined with enhanced precision-guided munitions, will also increase the ability to destroy targets using fewer shots. That economy will help small U.S. forces to impose a disproportionate effect on adversaries. Finally, with sensors, shooters, and their supporting infrastructure geographically dispersed within an overarching network, fewer American assets will be vulnerable to an enemy attack on particular platforms or geographic areas. Smaller, lighter, faster, less complex nodes (i.e., platforms) linked by networks will present adversaries with fewer high-value targets, a transformation summarized in military parlance as “improved tactical stability.” NCW’s promise to achieve greater effects using smaller, more dispersed groups of American forces is highly consistent with the post-Cold War strategic requirement for rapid deployability and with the American people’s strong desire to minimize the risk of friendly casualties.

**The Acquisition Component of Military Transformation**

The Bush administration wants to ensure that organizational constraints will not inhibit transformation, and it has created an organiza-
tional advocate for the process within the Pentagon. In November 2001 it named retired Vice Admiral Arthur Cebrowski, the “father of NCW” and former president of the Naval War College, the first Director of Force Transformation. Cebrowski has made it clear that military transformation will require major changes not only in doctrine and organization but also in the equipment that the services buy.⁹

Systems for the military after next are now in their research or early development phases: some new technologies will have to be invented, and others will have to be applied in the unique military context. If the weapon and sensor platforms that will be the nodes of NCW are to be smaller, lighter, faster, and less complex, then platform manufacturers will have to build smaller, lighter, faster, and less complex ships and aircraft. If massing fires rather than forces requires advances in precision guidance and battle management computing, then munitions manufacturers will have to build new types of munitions for NCW. If the network is to provide a common operational picture that facilitates self-synchronization and efficient employment of ordnance, then military computer and communications suppliers will have to build a reliable, jam-resistant, secure, high-bandwidth network with tremendous data processing and display capability. As a result, the actual implementation of transformation depends on the defense industrial base. Transformation proponents must take into account technological and industrial capabilities and limitations if their visions are to become reality. Who can supply the innovations that will support NCW?

**Which Firms Innovate?**

Commercial industry’s apparent lead in network and other information technology might suggest that the most efficient path to military transformation will involve suppliers outside the traditional defense industry—either established commercial technology firms or entrepreneurial start-ups. Yet careful analysis of military–industrial relationships and the sources of innovation shows that the existing defense industrial base is relatively well positioned to support the network aspects of military transformation. Ironically, NCW is most likely to upset the industrial organization and best practices among the builders of weapons platforms. Disruptive transformation will be felt primarily by the builders of nodes rather than the builders of the network.

Most research on innovation emphasizes the challenges of creating new technological concepts (“Who thinks of innovations?”) and of adapting

---

organizations to capitalize on new technologies ("How do inventions become usable products?"). To think about the implications of NCW for the defense industry, however, we needed a theory of innovation that would answer a different question: which firms are likely to supply innovations? Specifically, are the existing defense contractors the best source of supply for the necessary equipment, or will the defense acquisition community need to draw upon new suppliers?

Recent work by Clayton Christensen of the Harvard Business School, most prominently his book, The Innovator’s Dilemma, explains the rise and fall of established firms using the distinction between sustaining and disruptive innovations. The key insight is that firms with established customer relationships are very good at producing “sustaining innovations,” but those same firms do not contribute “disruptive innovations.” According to Christensen, disruptive innovations generally require new suppliers.

Sustaining innovations are defined by improvements in product quality measured by familiar standards: they offer new, better ways to do what customer organizations have been doing using previous generations of technology. No matter how complex, technically radical, or resource-intensive, sustaining innovations almost never drive established suppliers out of business; instead, they tend to reinforce the success of leading firms. Suppliers and customers both understand how to update strategic plans to capitalize on sustaining innovations; they can cooperate on defining the technical and market requirements for new products.

Disruptive innovations, on the other hand, often perform less well at first, measured by the traditional standards. These new technologies establish a trajectory of rapid performance improvement that, building on experience gained in fringe or niche markets, overtakes the quality of the old market-leading product even when measured by traditional performance standards. The trajectory of technological progress is extremely difficult to predict for a new type of product, and customers’ technical staffs are often concerned with the product’s initially inferior performance. Since established firms, therefore, often reject disruptive innovations, these most often come from new firms.

This framework for discussing innovation does not apply to the defense sector in exactly the same way as it is usually applied in commercial industries. While most customers resist scientists’ and start-up firms’ proposals based on disruptive technologies, at least some military customers support transformation. The question is how the different components of the defense industrial base will react to the demand for network-centric capabilities. In sectors where the demand is for disruptive technologies, it

---

is more likely that the acquisition community will have to find new suppliers; where the demand is for sustaining technologies, established defense contractors should be best suited to support the transition to NCW.

Our exploration of the defense industrial implications of NCW focuses on three sectors: shipbuilding, UAV, and information technology/systems integration. These sectors were selected for three reasons. First, they span the NCW network and node components. Secondly, they include both sectors whose role in transformation is unique to the naval case and sectors whose role cuts across joint and service visions. Thirdly, the role of information technologies is on prominent display in all three areas.

**Shipbuilding**

The navy’s “Big Six” shipyards—General Dynamics’ Bath Ironworks, Electric Boat, and National Steel and Shipbuilding Corporation (NASSCO); and Northrop Grumman’s Avondale, Ingalls, and Newport News facilities—are well suited for “sustaining innovation.” This penchant is evident in the industry’s distinctly evolutionary approach to the development of the new large-deck, nuclear-powered aircraft carrier (CVNX) as well as in its recent proposals for a next-generation attack submarine (SSN), which are clearly modifications of the current *Virginia*-class design. Yet despite this preference among suppliers, NCW advocates include disruptive innovations in the requirements that they set for the next generation of ships. Shipbuilding may well be the part of the defense industrial base that is most changed by military transformation. To develop the nodes for NCW, transformation advocates may need to supplement the work by the Big Six shipyards with contracts with other shipyards that do not currently sell to the navy.

Focusing on networks rather than nodes, NCW proponents make the case for smaller, faster, lighter, and ultimately, less complex platforms. They push for “Streetfighters” (small combatants), fast lift, and in some cases, small-deck aircraft carriers. Yet, the quality metrics for such platforms differ from those for the current generation of warships. Most classes of American warships have been multi-role and, thus, require the complex integration of subsystems within relatively large hulls. Moreover, political incentives have pushed the navy to build smaller numbers of larger, more capable (and more expensive) ships rather than larger numbers of smaller, less capable (and less expensive) ships.11

Network-centric ships, if built, would introduce new metrics. They are intended to be deployed in relatively large numbers to facilitate “swarming” and “self-synchronization,” and they will serve as nodes in the network or “system of systems” comprising not just the navy but the joint

---

force and intelligence communities as well. The requirement for larger numbers necessitates less expensive ships and new manufacturing processes emphasizing economies of scale. Ideally, the new ship designs would be modular so that they could be optimized for missions in one environment and then rapidly reconfigured for other missions. In short, shipbuilders will be asked to build ships with different qualities and capabilities than they have worked on since the birth of the modern U.S. Navy.

The problem is that the close customer–supplier relationship between the navy and the Big Six shipyards may serve to delay and unnecessarily prolong, if not undermine, the process of naval transformation. Commercial yards in other countries are now pushing technological boundaries with new hull designs, production processes, and propulsion systems. Innovative designs such as the Visby, La Fayette, Jervis Bay, Westpac Express, and Triton come from Swedish, French, Australian, British, and other overseas shipyards. Such developments have not escaped the notice of visionaries convinced that military transformation is the only way to maintain U.S. naval supremacy in the twenty-first century. The question is whether transformation proponents can find partners within the existing industry to force new thinking onto an entrenched system. Our research suggests that they face an uphill battle, but that innovation partners can be found, often under the rubric of “advanced concepts” within industry.

What will happen to the shipbuilding industry if the navy does pursue network-centric platforms? Would the Big Six yards be able to develop and build the new platforms sought by transformation advocates—Streetfighter, Sea Lance, Crossbow’s Sea Archer (or a Corsair) and Sea Quiver, and a high-speed lift vessel? The simple answer is “yes.” It would be painful for the yards, which would not be able to transfer the full value of their sunk investment in physical and human capital to the new uses. But it also seems clear that the Big Six have the managerial, engineering, and workforce skills necessary to shift gears. They must, however, shift gears—and doing so will be trying. The established yards have close, trusted relationships with their military customers, and their familiarity with naval concepts of operations should help them to respond to changing customer requirements as military transformation changes operational doctrine.

The recent decision to transform the program to develop the next class of destroyer, formerly known as DD-21, into the Future Surface Combatant Program, now designated the DD(X), may provide an interesting test of this analysis. Two industrial teams (“Blue” and “Gold”) are competing in a high-stakes game “to produce a family of advanced technology surface combatants, not a single ship class.” The program will encompass everything from relatively small littoral combatants to the next-generation cruiser.12

While shipbuilders in the past have developed systems integration expertise

---

adept at packing many complex technologies into a single hull, the designers of the navy-after-next need a skill set more reminiscent of a multi-product high-tech firm—more like a commercial aircraft or automobile manufacturer. The need for both familiarity with military operations and also new kinds of systems integration and naval architecture expertise may yield some innovative partnership arrangements in the shipbuilding industry, as the DD(X)'s Blue and Gold teams already seem to be demonstrating.

Unmanned Aerial Vehicles

NCW is likely to rely on unmanned vehicles—aerial, surface, and underwater—for a number of purposes. The UAV sector has received the most emphasis in the past (as it will in this article), but it has only produced a few UAVs that have progressed beyond the laboratory prototype stage. NCW promises to expand the market for UAVs in many roles. They may act as long-endurance communication relays (supporting the network), as small, inexpensive, fast-moving, hard-to-detect sensors (nodes to support a common operational picture), and as platforms for delivering precision strikes against targets that are too difficult or dangerous for manned platforms to reach. Through those diverse uses, military transformation for the first time will establish core performance metrics for the UAV industry.

Growth in the UAV market will not require a typical disruptive innovation. Defense firms have a long history of producing unmanned systems—from Vietnam-era versions of contemporary UAVs to cruise missiles. Boeing, General Atomics, and Northrop Grumman have already developed significant UAVs, and they may at least initially have a lead in developing future weaponized UAVs. Some quality metrics for such systems are well-known, although many high performance UAV technologies are still immature. But because almost none of the past efforts at UAV design have entered full rate production, current defense aerospace manufacturers do not have much investment in UAV-related customer relationships. So far, the industry's comfort level with producing UAVs appears to exceed the military's comfort level for using them. At the same time, however, growth in established firms' commitment to UAVs may be hampered by their historical attachment to manned platforms.

Unlike the shipbuilding sector, in which established foreign and commercial suppliers have experience that might be relevant to transformation-oriented performance standards, the UAV sector does not feature producers outside the mainstream defense industrial base that are better prepared for transformation than the large American prime contractors. As a result, military acquisition organizations may look to start-up companies for UAVs. Unfortunately, UAV start-ups in the past have proven uncomfortable with the military's specialized operational requirements or unable to design...
manufacturing facilities to move beyond the prototype phase. Military transformation is most likely to solve ‘start-ups’ problems by buying UAVs from established members of the defense industrial base that have partnered with or acquired start-up technology firms. That pattern was followed when missiles became an important part of defense procurement in the 1950s and 1960s: established aviation companies augmented their in-house missile capabilities through acquisitions. Today, it would provide a graceful way for the defense industrial base to adapt to new demands of military transformation.

The simplest explanation for why UAVs are not already established in the military’s inventory despite technical capacity to produce such systems is that they “have never had the degree of operational user support necessary to allow their procurement in sufficient quantities.” Early UAV work was driven by tactical battlefield needs (the Lightning Bug in Vietnam, for instance); more recently, interested congressional leaders such as Senator John Warner (R-Va.) have provided some UAV funding in the face of Pentagon disinterest. Industry continues to take the lead in developing new concepts for employing UAVs in combat; customer resistance will remain because UAVs threaten missions normally assigned to manned assets. Thus, early in 2001 proponents of the U-2, the P-3, and other manned intelligence, surveillance, and reconnaissance (ISR) assets argued against proposals by UAV advocates to purchase more unmanned systems.

Operation successes in Afghanistan, the Gulf War, and the Balkans demonstrate the utility of UAVs. Moreover, the perception of military leaders that the American public is tolerant of American casualties increases pressure to develop sensor and weapon systems that operate with lower human risks. Most important, UAVs can fulfill some critical operational requirements of military transformation.

As transformation advocates and planners envision new missions for UAVs, however, they will finally develop a full array of performance standards for the UAV segment of the defense industrial base. Even relatively successful current projects face significant “capabilities gaps.” For example, at present UAVs require intense human operator participation, which limits their usability, and they are vulnerable to enemy attacks and countermeasures and exhibit limited fault tolerance, making them prone to crash. Similar problems are certain to emerge as requirements for UAVs that fire weapons (called Unmanned Combat Aerial Vehicles, or UCAVs) work their way through the acquisition system for the first time. Firms will need to (i) develop command-and-control systems for all types of UAVs that will allow them to operate in a battlespace populated with manned systems and (ii) provide future warfighters with confidence that UCAVs will be able to distinguish legitimate targets from noncombatants. Partnerships among

---

established defense contractors, start-up UAV specialists, and in-house experts in military operations will set the pace for unmanned vehicles’ contribution to military transformation.

**Information Technology and Systems Integration**

It is tempting to presume that innovations in defense information technology—particularly those applied in the command-and-control, communications, sensor, and systems integration realms—will be more “disruptive” than innovations in other sectors. Military leaders are looking for ways to apply the tremendous advances in commercial information technology, highly visible in defining the “new economy” in the 1990s, to military missions. Surprisingly, our analysis finds that current defense-oriented suppliers of systems integration capabilities and network equipment are likely to dominate their segment of the network-centric defense sector.

Since early in the Cold War, the defense industry has sought to develop high-bandwidth, secure, jam-resistant communications that combine with sensitive, multi-spectrum sensors to aid in rapid decision-making based on incomplete data under high-stress conditions. Acquisition efforts dating back at least to the SAGE integrated air defense system of the 1950s have involved radical leaps in both hardware and software technology along all of these metrics.

For the navy, the well-known AEGIS fleet air defense system has engaged the defense industry (APL, RCA, and Sperry, for instance) in very much the sort of work that NCW will entail. AEGIS requires powerful radar, advanced data processing, high-speed computer control, and precision-guided weapons. AEGIS’ recently fielded descendant, known as the Cooperative Engagement Capability, allows multiple ships to link up in an advanced network, with one ship’s sensors providing targeting data to another ship’s weapons—much like NCW’s vision of a common operational picture. Many of the key facilities for AEGIS development and deployment are now owned by bigger defense firms as a result of the 1990s industry consolidation (e.g., Lockheed Martin now owns the former RCA plant in Moorestown, N.J.), but the skills and factories remain part of the established defense industrial sector. Those organizations will contribute to the network-centric navy by applying faster computers, more advanced software algorithms, and new display technologies to sustain the established trajectory of innovation.

Furthermore, the leading commercial IT firms are unlikely to be as responsive as the established defense industrial suppliers to the military’s technical and investment demands. In the dedicated defense sector, firms’ principal means of profit and revenue growth is winning additional defense contracts. But for successful commercial IT firms, the prospect of a DoD contract may not be worth enough to command management attention or to justify much effort to customize a commercial product.
Even a substantial increase in military sales would not make much difference to the business base of a Microsoft or Sun Microsystems. While the commercial market leaders are happy to sell to military customers, they rationally limit their pursuit of government contracts. Their willingness to invest in defense-dedicated products is likewise limited. As a result, few commercial products find their way into military systems. The core network-oriented hardware and software for military transformation are likely to be supplied by established defense firms such as Lockheed Martin and Logicon and by defense-oriented start-ups such as Solipsys. Defense-oriented firms developed the required technical expertise over the course of the Cold War, and they have the necessary focus on the military customer to work on military transformation.

In addition to the demand for defense-oriented IT products, NCW will rely on sustaining innovation in another way. Military transformation will reinforce the American defense industry's dependence on systems integration skills—particularly “systems of systems” integration. During the Cold War, technical advisory organizations were established to link military objectives to defined technical requirements that could be written into contracts for major acquisition projects. Those same skills are vital for the planning and acquisition phases of military transformation.

This task emphasizes a very specific kind of integration skill. Prime contractors like Boeing, Lockheed Martin, and Raytheon are expert at tying various components, often supplied by subcontractors, into a single mission-capable weapons platform. But the real stress in NCW will be on architecture or “system of systems” integration. This “high-level” systems integration works during the design and procurement planning process to establish network interface standards and to allocate operational roles among different weapons platforms.

Architecture systems integration involves decisions among technical alternatives: for example, hardware versus software solutions to a given problem, or the decision whether to transmit raw or processed data across the network. Because those trade-offs may involve substantial budgetary shifts among weapon system development projects—often shifts of resources from one prime contractor to another—manufacturers' judgments of alternative systems of systems integration solutions must be considered suspect. If transformation advocates do not separate systems of systems integration from platform-level systems integration, a scandal—or even just the appearance of impropriety without any direct evidence of malfeasance—could derail the entire transformation program.

During the Cold War, dedicated systems integration houses evolved to support major projects specifically to avoid such a scandal. Federally-funded research and development centers (FFRDCs) like the Aerospace Corporation, MITRE, and the Applied Physics Laboratory exist separately from the production-oriented prime contractors to support the acquisition of
complex, interlinked weapon systems—the kind of acquisition effort that will be required for NCW.

FFRDCs promise as part of their contractual relationship with the government not to engage in production, which alleviates the potential conflict of interest. Some tensions inevitably remain between production firms and the FFRDCs. Producers naturally complain about systems integration houses’ role on particular projects, because the advisors’ job includes raising awkward criticisms of the prime contractors’ technical approach. Nevertheless, production contractors should broadly support systems integration institutions. Upfront technical advice and coordination (especially if paid for mostly from the military infrastructure budget rather than from specific projects’ budgets) will help to keep transformation programs on schedule and budget, which is in the interest of both buyers and sellers. The advocates of military transformation should capitalize on the institutional protection afforded by the unique role of FFRDCs—just as their Cold War predecessors did for previous generations of complex acquisition projects. That special expertise, along with prime contractors’ experience with the performance metrics needed for military networks, will make the traditional defense industrial base the best source of information technology systems to implement military transformation.

Conclusion

Defense planners serious about military transformation must address industrial issues sooner rather than later. Military transformation is a lengthy and difficult process under the best of circumstances, and as noted by the congressionally mandated 2001 Quadrennial Defense Review, it “is not a goal for tomorrow but an endeavor that must be embraced . . . even while we are engaged in a war on terrorism.”

Military transformation will be less disruptive for industry than many expect at first glance. Leading sectors of the post-industrial economy are unlikely to displace established defense firms. While visionaries usually emphasize the network side of military transformation, any major defense industrial changes are likely to come among the manufacturers of nodes. NCW has the greatest potential for revolutionary change in the shipbuilding sector. Existing shipbuilders may have to radically rethink their product lines and production processes, while firms that do not currently supply the U.S. military, including second-tier shipbuilders and broad-spectrum systems integrators like Boeing, Raytheon, and Lockheed Martin, may begin to compete for ship contracts. A similar dynamic applies in the UAV sector, with two differences. First, although large defense contractors such as General Atomics and Northrop Grumman dominate current UAV production, they do not have the long production history of the major shipyards, and the

14 p. IV and p. V.
performance metrics for past unmanned systems are less strongly entrenched. Secondly, the UAV sector includes a wealth of small start-up firms that are already pursuing new mission capabilities not yet considered by the U.S. military customer. Those start-up firms provide a wide array of joint venture partners and acquisition targets for established members of the defense industrial base—menu options that are not available in the shipbuilding sector.

For the IT sector, even if DoD and the services adopt transformation wholesale, systems integrators will be asked to work within familiar parameters. The most revolutionary technology sectors of the information-age economy will not be the most revolutionary defense industrial sectors. Well-established, long-trusted vendors with core competencies in dealing with the needs of the military will remain in the forefront of this sector, while potential new competitors from the IT world will generally remain subcontractors. That said, industry will respond only to clear incentives for transformation. DoD and the services must coordinate and organize appropriate transformation strategies if they want to fulfill the promise of Joint Vision 2020 or NCW. DoD and the services must get their own houses in order before they can expect industry to provide the technological innovation necessary for military transformation.

Transformation will require careful management of the services’ political relationships with Congress and industry. Congress may well be reluctant to commit to new, expensive programs in view of the apparently pressing needs of the war on terrorism and the plethora of existing programs that come complete with vocal service, industry, and public constituencies.

One way that DoD and service transformation advocates have sought political support is by linking the new investment with a “Revolution in Business Affairs” and supposedly cost-saving acquisition reform initiatives. Presenting NCW or other visionary technology developments in tandem with procurement reforms and manufacturing process improvements may provide political protection for key NCW-friendly programs. But DoD and the Services should be wary of over-promising savings. Loss of credibility now will increase the probability that transformation programs will be canceled before they reach the operational stage.

Emphasis on linking transformation to operational requirements—from changes in the strategic environment to changes in potential adversaries’ technological sophistication and/or military preparations—will also help maintain momentum toward transformation.¹⁵ Neither Congress nor the public will be keen to face charges that it did not provide the resources necessary to win the war on terrorism.

The good news is that the services are not obliged to fight the pork barrel proclivities of the American political system in order to achieve the

military after next. If military transformation figured to drive the existing defense industrial base into bankruptcy, then a powerful lobbying group with strong congressional allies would oppose—and probably overwhelm—plans for transformation. Instead, the equipment for NCW and other transformation visions is likely to derive from the established defense information technology and systems integration houses, and acquisition plans can tap existing platform suppliers.

To the extent that transformation promises the defense industry a substantial, stable resource commitment for many years to come—frankly, a bigger commitment than “business as usual” evolution of the force structure would entail—it will gain a powerful political ally. Indeed, several major firms appear to be positioning themselves as allies of transformation. Northrop Grumman explicitly identifies itself with the Revolution in Military Affairs and has put its money where its mouth is by acquiring firms involved with transformation-friendly programs, including Ryan Aeronautical to produce UAVs and Logicon to write advanced software. Forward thinking divisions within Boeing are also trying to position the firm as a full-service systems integrator rather than simply a producer of platforms, at least in part because they see NCW or NCW-like visions of transformation as the future of warfare. Transformation visionaries simply need to understand this dynamic and to tone down rhetoric that threatens industrial groups that could help them advocate transformation planning.

Appropriate incentives to the defense industry to gain support for transformation include:

- Clear, consistent guidance from the DoD and the Services (technological and programmatic priorities, coherent doctrinal and operational requirements).
- Analytic support from systems integration/technical advisory organizations (including, perhaps, the creation of a dedicated systems of systems FFRDC tailored to NCW requirements).
- Contractual and financial incentives for undertaking investments in innovative programs and closing redundant production capabilities.

When and where transformation might be viewed as a threat to the business base of defense industrial firms, those firms can and will exert powerful lobbying pressure to delay or divert transformation. If the defense industry generally and individual firms specifically can be persuaded to favor transformation because it benefits their shareholders, they will be a powerful ally in building political and budgetary support. Innovators inside the military thus must join forces with innovators in Congress and industry.
The defense industry of Russia is a strategically important sector and a large employer in Russia. It is also a significant player in the global arms market, with Russian Federation being the second largest military products exported after the USA. Russia is the second largest conventional arms exporter after the United States, with $13.5 billion worth of exports in 2012. Combined, the US and Russia account for 57% of all major weapons exports.

streamlining the numerous Defence industry and innovation programs under two broad initiatives funded at around $1.6 billion over the decade to FY 2025:

- establishing a new Centre for Defence Industry Capability, led by an advisory board comprised of private sector and Defence representatives to drive the strategic partnership with Defence, involve industry in governance of the industry programs and provide a range of business and skilling services.

The One Defence transformation is a clear path for Defence to operate with maximum efficiency and effectiveness. It will also allow Defence to establish better and transparent relationships with Government, Ministers, external stakeholders, central agencies, its own leadership and workforce.