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Integrating Civilian and Military Industry

The segregation of the defense and commercial economies is hurting both, and only government can break down the barriers to cooperation.

The coming decade will present critical challenges to the military strength of the United States, and to its economy as well. In defense, we can anticipate a reversal of the Reagan-era defense budget buildup, and intense efforts to reduce the incredible costs of individual weapon systems. On the national economy side, there are a huge deficit, lopsided trade relations, a deteriorating infrastructure, and an urgent need to revitalize industry. One way to strengthen simultaneously the military and economic spheres is through greater integration of military and civilian technologies at the engineering and production levels. Historically, the nation's security and its economy have been treated as either conflicting issues ("money spent on defense hurts the economy") or as totally independent public policy issues. Neither of these perspectives is helpful today, and it is doubtful they ever made sense at all.

Resistance to change

The Defense Department influences the U.S. economy directly through the more than $ 170 billion it spends annually on military R&D and procurement, and indirectly in a variety of ways. For example, almost a third of U.S. scientists and engineers are employed in military-related activities, and more than 10 percent of factory workers are supported by defense. Defense not only pays for almost a third of the nation's research and development but has either created, or played a critical role in the growth of, new industries such as communication satellites, jet aircraft, and computers. Finally, defense pays for a disproportionately large share of the nation's manufacturing capital equipment and has often led the way in the development of advanced manufacturing technologies—from numerically controlled machine tools through computer-integrated manufacturing.

Such support, however, has had its dark side. The Defense Department's "unique way of doing busi-

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ness," which includes special requirements for everything from accounting standards through design and production-process specifications, has driven apart the commercial and defense economies. The result for the defense economy has been a great deal of waste and inefficiency,

Comically expensive toilet seats, hammers, and coffee pots have attracted widespread attention, but a much more serious concern is the dizzying rise in the cost of weapon systems. The cost of a single aircraft carrier is now about $3.4 billion, an F-15 fighter aircraft around $38 million, a B-1B bomber well over $200 million, and each new M-1 tank around $2.4 million. If costs continue to rise at the current rate of 7 percent a year in constant dollars, the next generation of systems could cost twice as much. By driving up costs with inefficient procurement practices, the Pentagon is finding itself unable to buy as many ships, planes, and tanks as it needs.

The escalating costs of military hardware spring directly from ingrained procurement practices:

- maximizing performance regardless of cost and ignoring questions about ease of manufacture
- using very small and labor-intensive production runs
- paying high overhead to contractors who must fulfill demanding paperwork and accounting requirements
- relying on sole-source contracting, which removes the incentive to cut costs
- distrusting the quality of commercial products
- depending on firms that produce only military goods
- maintaining reserve production capacity to meet emergency production surges.

These practices are not essential to producing useful defense hardware. Yet they persist largely because of bureaucratic inertia; there has been no strong pressure to apply the commercial sector's standards of efficiency and cost-effectiveness to defense engineering and production, much less to integrate the two domains. Pentagon buyers have worried that the commercial emphasis on cost would result in unacceptably low performance for their weapons. Similarly, they argued that the military has unique requirements, such as nuclear hardening, and that very specialized procurement and financial accounting requirements are dictated by the use of public funds.

From the industrial side, even firms working in both fields have felt it in their interest to specialize because of the differences between the two markets. A fundamental concern is that integration could have very negative effects; maximizing performance regardless of cost is a philosophical virus that could infect the commercial side of the business. In fact, one of the most frequently heard arguments against integration is the dismal record of defense firms that have tried to make the conversion. For example, Grumman lost $ 134 million in the 1970s and early 1980s by trying to diversify into bus manufacturing.

A growing urgency to act

The problems in the defense industrial base, which have been building up for many years, were largely masked during the big Reagan defense buildup in the early 1980s. With so many new programs and so much more money, inefficiency was less visible and idle capacity not a problem. In addition, the disappearance of many key suppliers in the aftermath of the Vietnam War (when defense procurement fell from $44 billion in 1969 to $17 billion in 1975 in constant dollars) permitted foreign parts suppliers to eagerly rush in to fill the vacuum when things rebounded during the Reagan years.

The combination of increasing dependence on foreign sources of weapon parts, substantial inefficiency, production bottlenecks, and lack of backup production capacity for emergencies made it impossible to ignore the looming crisis in the defense economy in the mid-1980s. In 1986, the President's Blue Ribbon Commission on Defense Management (the "Packard Commission") made a very strong case for military use of commercial components as well as commercial practices, pointing out the dramatic quality improvements and cost savings that could be realized through use of technology that is now prevalent throughout the commercial sector.

The commission emphasized that in the commercial world, advanced technology is used to simultaneously lower equipment costs and to improve the performance of new systems. Companies seek the best possible performance in a product that will sell at a price the market can bear—an approach known as design-to-cost. In the defense world, advanced technology is used almost exclusively to maximize performance. The effects of the two approaches are evident,

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for example, in electronics: Commercial systems have improved dramatically in performance while prices have plummeted; military systems have experienced equivalent performance improvements, but costs have risen as well.

The effects of the military's single-minded attention to performance are most evident at the margin. Achieving the last few percent of performance improvement in a weapon system tends to raise costs by 30 to 50 percent, thus reducing the number of weapons that can be acquired. If, instead, unit costs were made an important engineering design criterion—along with performance—defense contractors would have an incentive to use new technologies (from lower-cost materials to advanced manufacturing techniques) to improve the quality of equipment *and* to reduce cost. Essentially, the Pentagon would be trading a very small reduction in an individual system's performance for a large increase in the number of systems acquired.

The Air Force is experimenting with such a design-to-cost approach by setting a cost objective of $35 million per plane for its Advanced Tactical Fighter. Based on historical trends, individual aircraft would have cost more than $100 million each in the absence of such a constraint.

Another adaptable commercial practice is the use of continuous competition during production instead of the typical military reliance on a sole contractor. When the Pentagon experimented by authorizing two firms to produce an item—for example, the Hellfire missile, the Alternate Fighter jet engine, and the Side-winder missile guidance system—and to compete for an annual share of sales, quality improved and net cost dropped an average of 25 percent. Still greater production cost reductions are possible when two firms competitively develop weapon systems and the production contract is awarded to the one with the best combination of performance and proposed production and support costs. This approach resulted in savings of 50 to 70 percent for the Army's Multiple Launch Rocket System and the Air Force's Air Launched Cruise Missiles.

Congress has approved such practices through the Competition in Contracting Act of 1984, and the Pentagon has begun to implement them. The hope is that, over time, the Pentagon will be able to shift to greater use of market forces, instead of regulations, for control of quality and costs in defense procurements.

Turning to off-the-shelf components

Changes are also needed in encouraging the use of commercial components in military systems. In the past, defense technology was often far ahead of its commercial counterpart in both performance and reliability; thus, the Pentagon's rationale was that paying a higher price was worth it But in many areas this is no longer the case; better and cheaper equipment is available in the highly competitive and fast-growing commercial marketplace. Nonetheless, the defense establishment—on the industry as well as the government side—has clung to its traditions and has insisted upon extensive use of special-purpose equipment and parts, built to unique military specifications.

The result is that the Pentagon pays dearly—often five to ten times as much—for the specialized nature of its parts and equipment, and yet often gets inferior results. For example, in microelectronics, today's commercial equipment is built to withstand environments (such as being hard-mounted on automobile engines) that are as difficult as those stipulated by the Pentagon. This large-volume, field-tested commercial equipment is higher in quality, lower in cost, and embodies much more advanced technology than comparable military equipment. One recent Defense Science Board study of comparable electronic systems, such as computers, radios, sensors, and displays, found the commercial equivalents to be between two and ten times cheaper, up to five times faster to acquire, generally more reliable, one to three years more advanced in technology, and capable of withstanding equally harsh environments.

For this reason, the Department of Defense has begun trying to buy more commercial parts and is looking into changing its specification procedures so that specialized parts will be used only where they are absolutely necessary. By using commercial parts, the Pentagon will have the advantage of buying equipment that has already met the market test for quality and price. This approach also makes it more possible to rapidly increase production during an emergency by switching production lines from commercial to military. Thus, idle capacity would not have to be maintained. (The Soviets build railroad cars and tanks in the same plant—and train the workers on both—so they can rapidly shift over when required.)

Aiding the commercial sector

Meanwhile, government is under increasing pressure to help the private sector compete in the highly competitive global market. As an alternative to protectionist trade barriers, many policymakers see a need for the government to play a more stimulative role, particularly in sectors—such as the overlap between civilian and military technology—that will have a big payoff. The reason for the attractiveness here is that such industries—electronics, lightweight structural materials, advanced manufacturing equipment, and information systems, among others—will provide the foundation on which the overall economy will build in the future.

The government, with guidance from industry, has already taken some steps to craft programs that simultaneously address the needs of the commercial and military economies:

- The Pentagon's very-high-speed integrated circuits (VHSIC) program aims to develop product and manufacturing processes that have commercial as well as military uses.
- The Pentagon is increasing funding of computer integrated manufacturing—a vital commercial technology.
- The Pentagon is supporting Sematech, a consortium of semiconductor producers organized to improve manufacturing technology.
- In 1988 the Pentagon began a three-year, $250 million Microwave and Millimeter Wave Monolithic Integrated Circuits (MIMIC) program to stimulate progress in gallium arsenide semiconductors for commercial and military uses.

These steps indicate a growing willingness on the part of Congress to fund broad industrial development projects that have dual-use applicability. Significantly, they are all at or near the components, materials, and manufacturing technology level of the defense industry—the lower tiers at which there has historically been some overlap between the military and civilian economies. For example, the military provided the early market for semiconductors, structural composites, and lightweight metals—all now widely used commercially. Thus, there is an historical basis for the steps now being taken; the difference is that there is now an explicit recognition of the desirability of taking these steps for the civilian economy, rather than exclusively for defense. In the past, it was expected that there would eventually be some "trickledown" into the commercial economy.

This move toward simultaneous consideration of both military and civilian goals is starting to receive wider support within the U.S. government. For example, the Senate Armed Services Committee has established a new Subcommittee on Industrial Base and Technology to explore this issue; bills introduced by Senator John Glenn (D-OH) and Representative Mel Levine (D-CA) propose creating a civilian equivalent of the Defense Advanced Research Projects Agency; consideration is being given to using selected portions of the defense-oriented national laboratories such as Sandia for long-term, commercially oriented research and development; and broad "revitalization of the industrial base" is one of the major initiatives of Robert Costello, the new undersecretary of defense for acquisition.

The road to integration

While these initial steps are encouraging, rapid progress will not be made without a significantly greater effort. And, because so many of the barriers to integration have been created by the government, the principal agent for change must be the federal government—in the products it asks for, how it specifies them, how it buys them, and how it regulates (or doesn't regulate) the industrial suppliers.

An obvious early task for the Pentagon is to remove the barriers that discourage (or prevent) firms that are currently in both defense and commercial businesses from integrating their engineering and production operations. Now that the full complement of

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100 B-1B bombers has been built, the production facilities, which cost hundreds of millions of dollars, are likely to sit idle waiting for another project—the military fears that it will be difficult to reassert its priority claim to such facilities if they are used for commercial production. But the United States cannot afford such waste of capital equipment. The Pentagon should encourage its contractors to find uses for idle production capacity while making provisions to ensure that it will be available in a military emergency.

Although such a policy will help, the United States needs a more aggressive integration strategy, perhaps modeled on the policies of U.S. allies, The United Kingdom, for example, funds commercial research projects in defense laboratories and has established a private company to identify and transfer military technologies with commercial potential In 1984, Italy established an Interministerial Coordinating Body for Defense and Civil R&D. France has a similar body to oversee and integrate advanced civilian and military advanced research. Japan has an explicit defense-industrial strategy based on integrating its growing defense production capability into civilian industries.

A number of people have proposed that nondefense agencies are the logical home for a coordinating effort. They have argued for either the Department of Commerce or a totally new entity that would be pieced together from elements of several government Organizations. But either of these options faces formidable short-term stumbling blocks; Creating a new locus of bureaucratic power would not be easy, and a new type of federal interference in the free market may be unacceptable to many Americans, Thus, if action is to be taken soon, it appears to be up to the Department of Defense; it has the need, the resources, the defense-industry responsibility, and, most important, the political support to take the leadership role.

However, in order to take advantage of expertise in other areas and to gain broad-based support, the Pentagon would need to work closely with other agencies such as Commerce, Labor, and Treasury. Additionally, all players—industry and government alike—must recognize that it will require years for any significant integration to take place. Yet, given that a typical defense weapon system program now takes approximately eight years for development alone, such a schedule is not at all unusual for defense planning. Thus, even if it were to be done solely for the benefit of national security, steps should be taken now in order to ensure that when new weapon systems come along their costs will be significantly lower and their quality significantly higher.

To initiate such integration the Pentagon should take the following five steps:

Issue a specific policy statement. While there are indications that this is the direction in which some in the Pentagon currently want to move, an explicit statement would be helpful in drawing in others,

Assign specific organizational responsibilities. At the top level, the primary responsibility would be within the Office of the Secretary of Defense (specifically, the Under Secretary for Acquisition, complemented by a small staff capable of providing adequate data and analyses to substantiate the recommended actions). Additionally, it would be necessary to build an organizational and procedural infrastructure that would involve the military services as well as other government agencies in this activity.

Identify and reduce existing barriers to integration. In some cases, these will simply be ingrained government practices, such as the current assumption of unique military specifications as the norm rather than as the exception. In other cases there may be actual requirements—for everything from drawing and soldering standards to procurement practices—that have, over time, been codified in defense regulations, directives, and specifications, but not required by law. Finally, in a few cases, there is legislation,

including special accounting requirements, proprietary data restrictions, and other laws that restrict the government from buying commercial products or even using commercially oriented facilities. Indeed, the Pentagon system has grown so Byzantine that significant research will be necessary simply to identify all the barriers imbedded in the system as a prerequisite for reducing them.

Develop a long-range strategy. Begin by identifying priority industries, such as machine tools, software, electronics, and new materials, for which strong linkages are possible between the military and civilian economies. Then, based on an evaluation of the technical and economic strength of these industries, select specific subsectors that can contribute to the military as well as benefit from increased defense business. Finally, Pentagon officials would identify the specific weapon system programs best matched with commercial capabilities, and direct program managers to integrate commercial firms into the development and production process.

Initiate a series of demonstration programs in order to work out many of the obstacles that are likely to be encountered. It is particularly important that these not be done on an "ad hoc" basis—as was the case with the VHSIC, Sematech, and superconductivity, but that they be well integrated into the overall organisation, procedures, and strategy.

The results of these policy changes will be to make the defense economy more like the commercial sector in terms of design approaches, procurement practices, cost sensitivity, and use of commercial components. The bottom line will be a more efficient defense economy and lower costs for military hardware.

An even greater payoff will come when the commercial sector recognizes that the military market is no longer out of reach. This side of integration will take time, however, because U.S. commercial industry will not be pushed into producing military hardware; it makes little sense to employ heavy-handed government pressure to influence private-sector behavior. Government policy, therefore, should focus on changing what *government* does—that is, on reforming the defense economy. When the Department of Defense starts buying more commercial components and makes cost a critical criterion for selection of weapon systems, the commercial sector will become interested. And when companies begin pursuing defense business as part of their overall strategy, integration will begin in earnest. The United States will be making progress against two of its most formidable problems.

Recommended reading

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