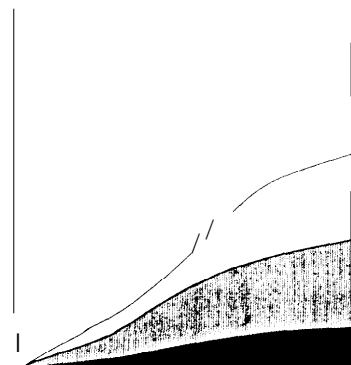


Summary and Findings 1

The end of the Cold War has not brought an end to the need to maintain a viable American defense force. Since 1990, the United States has fought a major conflict against a well-armed, if badly led, opponent, and deployed troops to several regional trouble spots. Although the emergence of a new global military threat on the order of that of the former Soviet Union is unlikely in the foreseeable future, demographic changes, border disputes, and the expansionist goals of some regional leaders have fostered the growth of a variety of lesser threats to peace and stability. In the longer term (15 to 20 years), however, the re-emergence of a major military threat cannot be discounted. The United States, in concert with its allies, will need to maintain adequate military forces to protect its vital interests against these various contingencies.

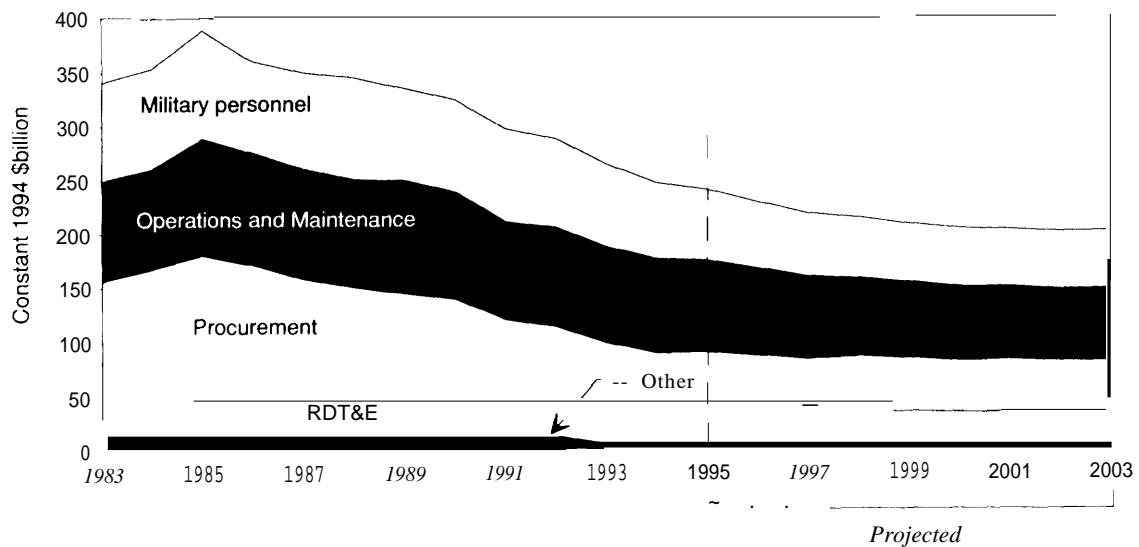
These forces must be reconciled with short-term budget constraints. The remarkable changes in the global security situation accompanying the end of the Cold War have resulted in significant and continuing reductions in the U.S. defense budget. Assuming no new global military threat, total U.S. defense budget authority is predicted to fall from a peak of almost \$390 billion (constant 1994 dollars) in 1985 to about \$200 billion (constant 1994 dollars) in the first decade of the next century. (See figure 1-1.) Confronted with continued fiscal constraints, the defense budget may decline even further.

Spending for research and development, procurement of goods and services, and depot-level maintenance activities necessary to arm and sustain American forces in the field could fall from about \$190 billion to between \$80 to \$100 billion in that same period, measured in constant 1994 dollars.



2 | Assessing the Potential for Civil- Military Integration

FIGURE 1-1: DOD Budget Forecast by Category



SOURCE Electronic Industries Association *Ten-Year forecast of Defense, NASA and Related Markets Electronic Opportunities*, October 1993

Confronted with declining budgets, many government officials and private-sector executives advocate the increased use of the commercial technology and industrial base (CTIB) as one strategy for preserving adequate technological and industrial capability to help meet future national security needs.¹ This increased use of the CTIB, dubbed civil-military integration (CMI), can take many forms, including purchasing commercially available goods and services, conducting both defense and commercial research and development in the same facility, manufacturing defense and commercial items on the same production line, and maintaining such items in shared facilities.

CONGRESSIONAL INTEREST

Congress has been very interested in the potential benefits of CMI. But Congress has also been concerned about the potential costs and risks associated with changing acquisition policy to promote such integration. Congressional interest is evident in earlier defense acquisition legislation. The Competition in Contracting Act (CICA) of 1984, for example, requires federal agencies to “promote the use of commercial products wherever practical.”² And the Defense Procurement Reform Act of 1984 mandated that DOD use “standard or commercial parts” when developing or acquiring militarily unique products “whenever

¹This report uses the modifiers “civil,” “civilian,” and “commercial” interchangeably when discussing the portion of the national technology and industrial base that sells on the open market on the basis of price. The modifier “private,” however, when referring to a business or sector, denotes nongovernment ownership.

² 10 U.S.C. § 2301 (b)(6).

er such use is technically acceptable and cost effective.”³

Despite several DOD initiatives to increase commercial purchases and use commercial business practices, many in Congress, industry, and the executive branch noted a slow acceptance of commercial goods and services for defense use and a reluctance to make changes in government practices that would promote CMI.

The 1990, 1991, and 1993 Defense Authorization Acts all contained language promoting CMI. The 1990 Defense Authorization Act directed DOD to streamline regulations governing commercial products and to design and implement a simplified uniform contract for commercial items. The 1991 Defense Authorization Act called on DOD to determine the availability and suitability of nondevelopmental items (including commercial items) prior to contracting for militarily unique products. The 1993 Defense Authorization Act directed DOD to modify its acquisition policy to encourage the integration of the defense technology and industrial base (DTIB) with the CTIB.

Although the Clinton Administration has embraced many of the proposed acquisition reforms designed to increase integration, actual change has been slow. However, DOD has launched a number of new initiatives aimed at increasing CMI, including eliminating the unnecessary use of military specifications and standards. The Department also proposed several pilot acquisition programs to test new ways of doing business. These initiatives hold the promise of producing important change.

As this report goes to press, Congress has passed the Federal Acquisition Streamlining Act (FASA) of 1994. FASA incorporates many of the proposals from the Acquisition Law Advisory Panel commissioned earlier by Congress to rec-

ommend changes to acquisition law, and includes a number of provisions that will enhance CMI. Specifically, FASA provides a new definition of commercial items, raises the dollar threshold for simplified acquisition contracts, makes it more difficult for the government to demand rights in technical data, removes some of the requirements for cost and pricing data in the case of commercial products and/or competitive contracting, and increases potential government purchases of commercial items.

FASA is an important step toward increasing CMI, but overall cost savings from its provisions may be limited. They will affect only a portion of DTIB spending (this is considered in more detail in the discussion of CMI strategies in chapter 2), and they may not have an effect on some of the activities where savings might be greatest (e.g., the integration of processes and also in the reduction of government infrastructure as a result of CM I). But even if savings are less than some anticipate, the effect on the long-term preservation of the DTIB could still be significant. The provisions for commercial purchases should increase the potential for gaining access to useful technology in rapidly developing commercial sectors. This access may be crucial in a fiscally constrained environment.

In their requests to OTA to undertake an examination of the potential for CMI, the Senate and House Armed Services Committees noted that despite the studies recommending increased use of commercial industry to support national security objectives, as well as broad verbal support from government and industry, “there have been few changes in the acquisition process to increase civil-military integration.” The Committees requested that OTA “focus on the technical potential for civil-military integration.”

³*Streamlining Defense Acquisition Laws: Report of the Acquisition Law Advisory Panel to the United States Congress*, January 1993, p. 8-3. The Defense Procurement Reform Act is Public Law No. 98-525, § 1202, 98 Stat. 2588 (1984).

SOME CRITICAL QUESTIONS

The glacial pace of change in the face of widespread support raises several questions about the potential for actually accomplishing integration. These questions are important in considering policy alternatives for Congress. They include:

- How much integration currently exists? Where is this integration occurring?
- Are some technologies, industrial sectors, industrial tiers, and activities (e.g., R&D, services) more amenable to CM I than others? Are there identifiable characteristics that enhance the potential for integration? If so, can these characteristics be developed in other technologies, industrial sectors, industrial tiers, and activities?
- What are the benefits of increased CMI? What are the costs and risks? Are the incentives for CMI sufficient to foster integration?
- What are the limitations to CMI in achieving national security objectives? What are the potential implications for weapons design and battlefield performance?

An estimate of the current level of integration and of how and where that integration occurs is absolutely essential in developing policy alternatives for future integration. In the past, there has been no systematic attempt to estimate either the level of integration or the means of that integration. DOD is beginning an estimating process.

OTA conducted a trial industry survey that provided insights on the current and potential levels of integration and suggested an approach to systematic gathering of integration data. A better understanding of what characteristics might make a technology, industry, or activity more amenable to integration could help direct CMI efforts toward areas that might have the greatest potential for change. Past case studies, and the analysis in this assessment, provide some insight into characteristics of amenability. Industry interviews and discussions suggest that amenability to integration might be promoted in various technologies and industrial sectors through conscious efforts to de-

sign for dual-use (commercial and defense) **rather** than for military use alone.

Cost savings and access to technology are frequently cited as reasons to integrate, but savings have been difficult to document or may not necessarily translate beyond a particular case study. Policy development demands a better understanding of the potential benefits and the associated costs. This assessment has attempted to provide more insight on benefits and costs by combining the findings of individual case studies with: data from a survey of selected industry sectors; macroeconomic data on defense spending patterns; and information on the industrial tier structure.

It is clear that the incentives to change the acquisition laws and regulations to enhance CMI have been insufficient in the past. While the falling defense budget appears to be a major new incentive for integration, it too may be insufficient to prompt total change necessary to gain the full benefits of CMI. But a better understanding of the potential benefits and costs of CMI may add sufficient stimulus to promote change.

Most previous studies have focused on the administrative and regulatory barriers to CMI and on the need to adjust these. But integration also confronts technical barriers. Some military specifications are absolutely essential. But determining what is and is not truly essential for military purposes can be difficult. It is clear, however, that greater reliance on commercial technology will have an impact on the nature of weapon systems and on future force operations. These effects will be evident not only in the systems available, but also in the ability of the technology and industrial base to respond to national security requirements.

DEFINING CMI

Definitions are essential—not only for the term “civil-military integration,” but also for the various related activities, such as “commercial goods” and “commercial services.” Policy formulation for CMI has been handicapped by the lack of a standard definition of CMI. OTA developed a

working definition of CMI (see chapter 3), and definitions of commercial goods and services (see chapter 4).⁴

In this study, Civil-Military Integration (CMI) is defined as the process of uniting the Defense Technology and Industrial Base (DTIB) and the larger Commercial Technology and Industrial Base (CTIB) into a unified National Technology and Industrial Base (NTIB).⁵ Under CMI, common technologies, processes, labor, equipment, material, and/or facilities would be used to meet both defense and commercial needs.

Although most of the analysis and discussion of CMI has been focused on activities at the facility level, in the course of this assessment it became clear that useful integration activities also occur at other levels. This assessment therefore examines integration activities that occur at the level of: 1) the industrial sector within which firms, government organizations, and academia can share product and process technologies, and 2) the firm, where certain corporate resources can be shared (e.g., research, finance) even if the actual defense and commercial work of the firm is segregated.

In estimating the degree of integration that currently exists, or could exist in the future, this assessment used a broader definition of what constitutes integration than has been used in many past studies. During interviews and analysis, R&D, manufacturing, maintenance, and administrative activities were each considered independently. Thus, a firm that integrates R&D and separates production is not considered segregated, but is considered to have one activity segregated and one integrated.

TABLE 1-1: Sources of Segregation

- Acquisition laws, regulations, and culture
- Military specifications and standards.
- Militarily unique technologies or products
- Commercially uneconomical orders
- Emphasis on performance over costs.
- Classified technologies.

SOURCE OTA based on analysis of previous CMI Studies 1994

SOURCES OF SEGREGATION

Previous studies identified a number of sources of segregation, as shown in table 1-1.

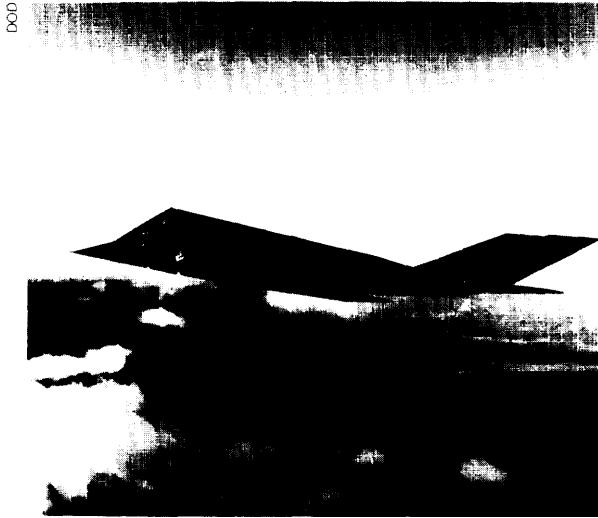
Defense cost accounting rules are the most often cited reason for segregating operations. In actual practice, however, the reasons for segregation appear to vary by technology and product. Still, the current structure of acquisition laws and regulations—and the culture they engender—provides few incentives to integrate. Furthermore, many of the regulations promote an adversarial relationship between government and private industry and raise product costs. Provisions of FASA address some of these issues.

Beyond the acquisition culture, segregation has also resulted from the use of military specifications and standards in situations where they were not necessary. Full implementation of the new DOD policy on the use of specifications and standards should solve some of these problems.

Segregation flows from the fact that some military products, services, and processes with specialized uses have no commercial market. And while some militarily unique items might benefit

⁴The definition of commercial goods and services used during the assessment is roughly equivalent to the definition contained in the Federal Acquisition Streamlining Act of 1994.

⁵This national base is understood to be embedded in the larger Global Technology and Industrial Base. Policy makers will have to develop DTIB policies in the context of this larger base.



from coproduction on a commercial production line, they are often ordered in volumes that are economically unattractive to commercial manufacturers.

The segregation of the DTIB also stems from the priority placed on developing and producing high-quality and high-performance equipment—a result of decisions to spend money rather than lives to achieve military objectives. This source of segregation was exacerbated by technological trends during much of the Cold War period, when military technology often led its commercial counterpart.

A final factor has been the need to keep some types of technology and information (e.g., design of nuclear weapons) out of the general public domain and away from potentially hostile countries. The desire to preserve superiority in sensitive conventional technologies, such as radar-absorbent materials, by limiting dissemination of information about them is another example.⁶

BENEFITS OF THE CURRENT SYSTEM

Although the policies that created the current acquisition system contributed to the segregation of the DTIB, these policies were implemented to achieve important goals, including: public accountability, mobilization readiness, development of high-quality equipment, and preservation of technology security.

One of the primary objectives of instituting the cost-based acquisition structure was to guard against waste, fraud, and abuse. In addition, the government used the defense budget to attain a number of socioeconomic goals, including support for small and minority-owned businesses.

While the classification of some development programs contributed to segregation, such segregation was also beneficial in limiting the flow of information to adversaries and providing a technological edge on the battlefield. The results were evident in the active combat of Korea, Vietnam, and Iraq, and during the Cold War confrontation with the Soviet Union.

Similarly, the standardization of equipment following World War II was both a benefit to logistical support (providing greater reliability and faster repair) and a factor in segregation. Despite the higher costs of equipment, it could be operated and maintained more efficiently than in the past.

The fact that past policies have had both beneficial and harmful effects makes change more difficult.

IMPETUS FOR CHANGE

The end of the Cold War has provided an impetus for changing the current structure of the DTIB. Yet even earlier, it was evident that the current level of segregation was unacceptable. The demise of the Soviet Union and the risks it posed to the security of the United States, however, have removed many of the constraints on modifying the defense

⁶ See U.S. Congress, Office of Technology Assessment, *Proliferation of Weapons of Mass Destruction: Assessing the Risks*, OTA-ISC-559 (Washington, DC: U.S. Government Printing Office, August 1993).

acquisition system. The current system appears to cost more than the Nation is willing to pay.

Studies show that segregation often increases initial acquisition and life-cycle costs; limits flows of information and technology; and reduces the numbers of firms willing to sell to the government. These studies further suggest that segregation contributes to decreased economic competitiveness due to the inefficient use of national resources.

Many of the studies have attempted to calculate the added costs and other negative effects of the government requirement for cost and pricing data; unique contract clauses; the use of inappropriate or unnecessary military specifications and standards; and disputes over technical data rights. Studies have estimated cost increases of 20 to 60 percent resulting from various government acquisition rules. Some estimates were even more dramatic. A Defense Science Board study on commercial products, for example, reported that the militarily specified version of the STU-III classified telephone cost 10 times more than a commercial version.⁷ Although it is difficult to generalize the finding of such case studies, it is clear that the current system has driven up costs and acquisition times.

Part of the added costs are alleged to result from the numbers of personnel in private firms needed to respond to DOD's reporting demands and to interface with the government's oversight personnel. Businesses must retain contract specialists and others to gather and report the information necessary to comply with current government accounting, auditing, and other requirements.

The government oversight complex is costly too. DOD employs more than 178,000 personnel as a part of the acquisition workforce. This runs in excess of \$7 billion per year in salaries alone. Added to the expense of these personnel are the expenses of redundancies between private- and



U.S. ARMY

The Anniston Army Depot Tank Rebuild Line is part of the public-sector DTIB.

public-sector capabilities in research, development, testing, and engineering (RDT&E), production, and maintenance—almost 370,000 people work in these functions in public sector facilities (e.g., Service and DOE laboratories and test facilities, DOD and DOE production facilities, and Service maintenance facilities). Allowing for double-counting of some personnel in both the acquisition workforce and the RDT&E effort, the total public sector workforce is estimated between 475,000 to 500,000, costing more than \$18 billion per year.

The segregated nature of the DTIB restricts the flow of product and process information and technology between the DTIB and the CTIB, discouraging innovation in both the manufacture of military systems and the substitution of more advanced components in those systems. In some cases, the DTIB does not have access to the full range of technology available in the CTIB.

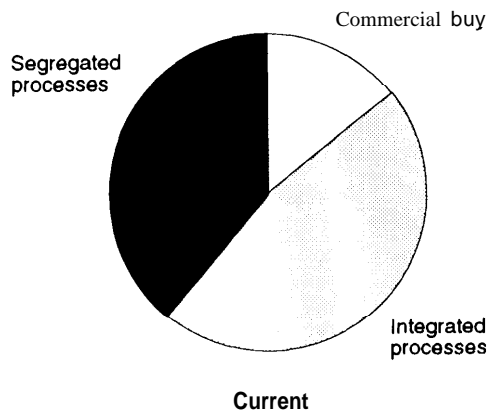
In sum, studies indicate that the current level of segregation has resulted in inefficiencies and redundancies that have restricted the exploitation of scarce national technology and industrial base resources. The decline in defense funding necessi-

⁷ Caution needs to be applied to all cost savings estimates. The commercial alternative STU-III was developed several months after the defense version and contained some less expensive, and better, technology not previously available.

8 | Assessing the Potential for Civil-Military Integration

tates greater efficiency in defense acquisition and makes reform of the current system a priority.

FIGURE 1-2: Current Facility-Level CMI Division of the Private DTIB at All Tiers



Key

Commercial buy Procured from private facilities on the basis of a commercial market price

Integrated Processes Procured from private facilities that predominantly use common processes for both defense and commercial goods or services. This sharing of processes might occur in R&D, production, maintenance, or administration. It might involve the use of common equipment, labor, management, or inventory.

Segregated processes Procured from private facilities that have largely or completely segregated their defense work from any commercial work.

SOURCE: Industrial survey conducted by the Office of Technology Assessment, 1994.

FINDINGS

The assessment resulted in a number of findings related to the questions stated earlier and other aspects of CMI.

■ Some Integration Currently Exists

The current DTIB appears to have a significant amount of integration already. OTA esti-

mates that many of the goods and services coming from the private-sector portion of the DTIB are already derived from either commercial purchases or firms using integrated processes. Much of the DTIB, nonetheless, appears mired in segregated processes. Figure 1-2 shows an estimate of the current degree of CMI based on the results of OTA's industry survey.⁸

The figure estimates the value added to national security goods and services through 1) commercial purchases, 2) integrated processes, and 3) segregated processes.

These estimates are based on a limited industrial sector survey. Thus, they should be considered suggestive rather than definitive. Nevertheless, they do provide valuable insights on the DTIB.

■ Increased Integration Appears Possible

The findings of this assessment confirm that it is possible to increase commercial purchases, make greater use of commercial practices, and promote the integration of processes—if changes are made in current government acquisition policy, efforts are made to adapt technologies, and steps are taken to restructure the DTIB. The level of growth of CMI will depend on the extent of policy change.

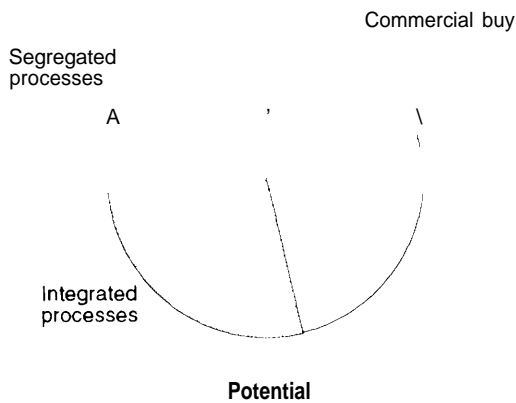
OTA's broad estimates of the potential for increased CMI, based on significant reform, are shown in figure 1-3.⁹

The estimate of potential increase of CMI shown in figure 1-3 does not indicate any particular amount of savings. Estimating cost savings requires considerations of the impact of these policy changes on the base over time. OTA has made some estimates of potential savings, discussed later in this chapter and more extensively in the examination of CMI strategies in chapter 2.

⁸ These estimates are based on a Macroeconomic examination of the DTIB and an industry survey. The survey is discussed in chapter 4, box 4-2.

⁹ In addition to the industry survey noted earlier, OTA used interviews, case studies, and analyses of selected industrial sectors to validate its estimates. Again, these estimates are based on a limited sample and should be considered suggestive rather than definitive.

FIGURE 1-3: Potential Facility-Level CMI Division of the Private DTIB at All Tiers



SOURCE Industrial survey conducted by the Office of Technology Assessment 1994

Case studies and surveys reviewed for this assessment support the industry survey conclusion that with appropriate policy initiatives, increased integration is possible. But because almost all of these studies considered only individual segments of the DTIB, the case studies provide very limited insight into the impact of a comprehensive CMI policy on the DTIB as a whole. The 1993 report of the Defense Science Board Task Force on Acquisition Reform is an exception. That report attempted to both identify possible increases in CMI within the entire base and quantify potential savings.

The potential for increased integration is enhanced by the fact that both Congress and DOD are actively pursuing CMI initiatives. As noted earlier, Congress has pushed for greater integration in recent legislation, including FASA. DOD has responded with several initiatives. Most recently, Secretary of Defense William Perry issued a directive eliminating the use of many military specifications and standards and placing

greater reliance on commercial specifications and standards. In addition, DOD has supported further efforts to simplify contract procedures, and has nominated seven pilot programs for testing alternative acquisition strategies.¹⁰

Developments in technology reinforce the trend toward integration of the DTIB and CTIB. More products and services can meet both defense and commercial needs. The same model personal computer, for example, can be used at the Pentagon or at General Motors Corp. The same ruggedized laptop computer might be used by military forces in the field or by petroleum exploration teams in remote areas. Components of these systems are even more interchangeable. The improved quality of commercial integrated circuits, for example, often make them interchangeable with devices produced according to military specifications and standards. Some even argue that commercial items are often superior.

Developments in process technology are increasingly applicable to defense and commerce. Commercial manufacturing is gaining the capacity to profitably produce small lots of an item. Some observers anticipate that with advances in



Commercial computers and electronic components can now meet many defense needs

¹⁰FASA supported the implementation of five DOD pilot programs: the Fire Support Combined Arms Tactical Trainer, Joint Direct Attack Munitions, Joint Primary Aircraft Training System, Commercial-Derivative Aircraft, and Commercial-Derivative Engine.

10 | Assessing the Potential for Civil-Military Integration

TABLE 1-2: Characteristics That Make a Defense Good or Service (G/S) More or Less Amenable To Integration

More amenable	Less amenable
Fills a similar defense and commercial need.	Has no related commercial variant (esp. weapons).
Readily customizable from commercial G/S.	—
Processes similar to commercial processes.	Process is specialized for performance or security reasons.
A service.	—
Sourced from lower tier (subcomponent, commodity).	Sourced from a higher tier, especially at the prime integration level.
Economically viable volume/predictable rates.	Noncommercial volume/uneven rates.
Commercial technology leads defense technology.	Defense technology leads commercial technology.

SOURCE Off Ice of Technology Assessment, 1994

manufacturing technology, it will even be possible to produce a single item profitably. Except in time of crisis or war, the defense base has always had to deal with small orders and uneven production runs, making such flexibility particularly attractive.

Improvements in commercial product quality also favor the use of commercial products. Commercial developments in design and development processes using simulations for virtual prototyping, and concurrent engineering to reduce future production risks, are applicable to defense as well.¹¹

Integration occurs not only at the facility level, but also at the levels of the industrial sector and the firm. Integration should be promoted at all three. Integration at the **industrial sector level** involves drawing from the same pool of technologies, specialized assets, and processes to meet both defense and commercial needs. Integration at the **firm level** is characterized by the sharing of corporate resources to meet both defense and commercial needs. **Facility level** integration is marked by the sharing of personnel, equipment, and material.

But not all technologies, industrial sectors, or industrial tiers are equally amenable to integration. Complex defense systems requiring

high levels of systems integration may not lend themselves to CMI. Tier 1 prime contractors performing such work may therefore be less able to integrate commercial and military practices (although common administrative and management control activities may be possible). Lower tier activities, such as production of components and subcomponents for those systems, appear far more amenable to integration. Surveys indicate that firms at these lower tiers, small or large, may be more likely to be integrated, and the products and processes involved may be more amenable to integration than are those at the prime contractor level. Indeed, many firms at the lowest tiers may not even know they are serving defense needs.

Table 1-2 lists some of the factors that may make a good or service more or less amenable to some form of integration.

Goods and services that have equivalent defense and commercial uses, and that may be sourced from a lower tier, appear to be more amenable to integration—either commercial purchase or integrated processes. Many electronic and aviation components fall into the more amenable categories. The potential for integration is further affected by manufacturing processes. Defense and commercial goods sharing similar production

¹¹OTA is currently conducting an assessment of defense modeling and simulation that addresses some of these issues as well as examining the use of modeling and simulation for military operations.

processes (e.g., integrated circuits) have a better chance of integration than those relying on dissimilar production techniques (e.g., fabrication of stealthy composite aircraft structures). Security considerations can limit the suitability of certain defense manufacturing processes for integration with commercial production.

Services, which involve the most flexible processes of all, appear particularly amenable to commercial purchases. But there are currently government constraints against exploiting some commercial services.

Identifying those technologies, industries, and tiers that maybe more amenable to integration can aid policy development and help focus efforts on areas with higher potential for success. Figure 1-4 shows an estimate of the amenability of the major procurement categories (e.g., R&D, manufacturing, maintenance and services), and tiers to alternative CM I policies.¹²

■ Increased CMI Provides Benefits

The findings of this assessment confirm that benefits can be derived from increased CMI. The assessment points to areas of potential cost savings and possibilities for increased technology transfer that might aid both the defense and commercial sectors. More importantly, the assessment indicates that increased CMI may be essential for preservation of a viable future capability to meet U.S. national security needs.

Potential Savings

The implied estimated savings of 20 to **60** percent for some individual case studies and savings of factors of 10 in a few selected cases, do not translate into proportional savings across the entire DTIB. **Potential savings are difficult to quanti-**

fy. OTA's analysis indicates that savings may be lower than some advocates have claimed, and be more difficult and take longer to achieve than many anticipate. Still, even if the percentage increase of total potential savings from greater CMI is relatively small (2 to 3 percent of the baseline DTIB spending), overall savings would amount to several billion dollars per year.

Insight into where and how savings might occur can be gained by considering national defense spending patterns. For example, the potential for CMI appears greatest in the lower tiers among activities that are more amenable to integration. Yet savings from these tiers are likely to be limited because many of the products, processes, and services procured at these tiers are already integrated or purchased commercially. Further, the total value added at the lowest tiers accounts for comparatively little defense spending. (See figure 1 -5.)

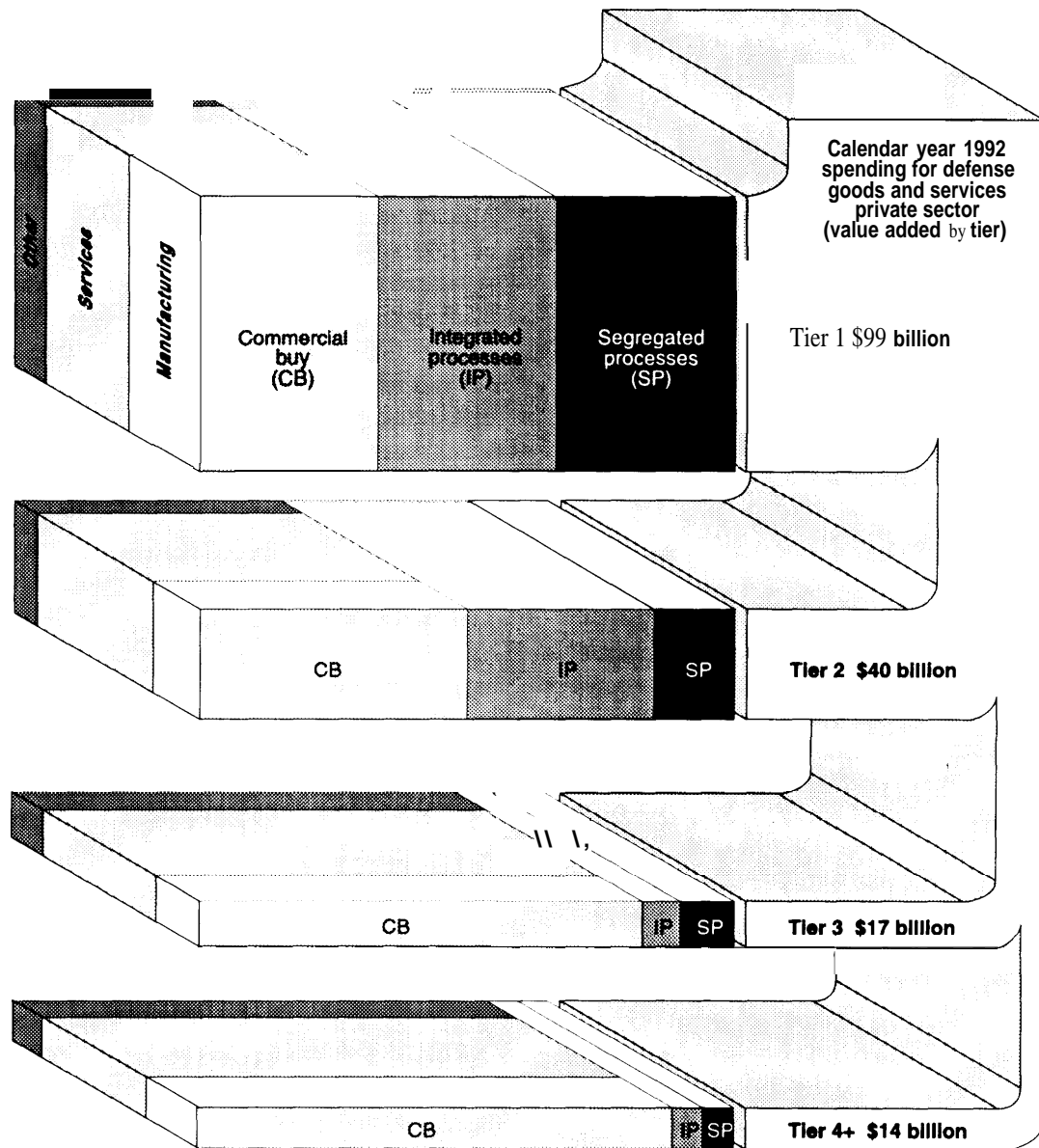
In calendar year 1992, an estimated \$180 billion flowed to the U.S. private sector for national security goods and services.¹³ OTA estimates that another \$18 billion was spent for personnel working in the public sector DTIB.

Prime contractors at tier 1 accounted for the largest single segment of private DTIB value added. Of the estimated \$180 billion they received in calendar year 1992, prime contractors are estimated to have contributed some \$99 billion in value added to defense goods and services, and transferred some \$81 billion to lower tiers through the purchases of goods and services (figure 3-1, chapter 3, illustrates this flow). **Spending at the prime contractor tier in this model includes** not only money going to large defense contractors, such as McDonnell Douglas and General Dynamics, but **all direct government contracts, includ-**

¹²This estimate is based on responses from the OTA industry survey and the full implementation of the integration policies associated with a Reform Strategy outlined later in this chapter.

¹³This estimate is derived from Bureau of the Census economic data, and is estimated by tier from the Bureau of Economic Analysis input output model. Estimates include not only funds for the Department of Defense, but also for intelligence functions, the Department of Energy national security programs, and all other national security spending.

FIGURE 1-4: Amenability to CMI



SOURCE Office of Technology Assessment, 1994 Based on data from industrial survey conducted by the Office of Technology Assessment 1994, Bureau of Economic Analysis Data and Bureau of the Census, CY 1992 spending by federal government for national defense (excludes noncomparable Imports and spending for government salaries in the public sector of the DTIB); and Department of Defense, Figure 1 Composition of Defense and Non-Defense Purchases, ' *Projected Defense Purchases Detail by Industry and State Calendar Years 1991 Through 1997*, November 1991, p 4 Assumes full Implementation of policies associated with a Reform Strategy discussed in chapter 2

ing those for less exotic activities, such as laundry services and auto leasing.¹⁴ The bulk of the *money going to* the private sector, however, goes to a relatively small number of large contracts. Of the more than 12 million contract actions in 1992, less than 3 percent accounted for more than 90 percent of the money spent. Whether large or small, however, the firms and funds at tier 1 are the most directly affected by the government acquisition process.

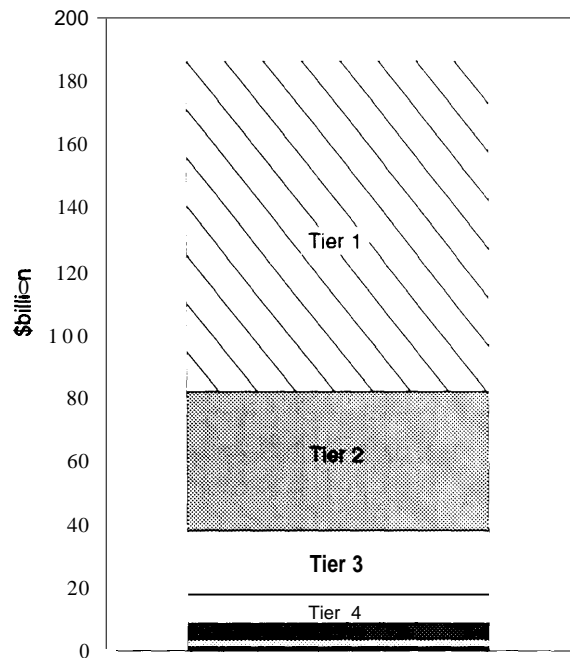
OTA developed estimates of potential savings resulting from alternative policies, based on findings from case studies, interviews, and surveys. OTA also conducted some parametric assessments of potential private DTIB savings. Although it is difficult to accurately gauge potential savings—particularly in the out-years—it does appear possible to bound the potential savings and to gain insight into when such savings might accrue.

A curve illustrating the possible time phasing of savings from increased CMI associated with the strategies discussed later in this assessment is shown in figure 1-6.

Savings, from increased commercial purchases and buying practices and the elimination of many military specifications and standards, might begin to appear relatively soon after implementation of new policies, but the amount of early savings will be constrained by the fact that many of the items that are initially affected (e.g., clothing, subsistence, and fuel) already are purchased commercially.

Savings from the purchase of commercial components and subcomponents require government and industry to change complex military specifications and standards and retrofit commercially specified parts into existing systems. These savings are, therefore, unlikely to have much of an impact for at least a year or two after program implementation. Savings from new items will take even longer. Given the probable slowdown in new

FIGURE 1-5: Estimated Valued Added to Goods and Services by Tier



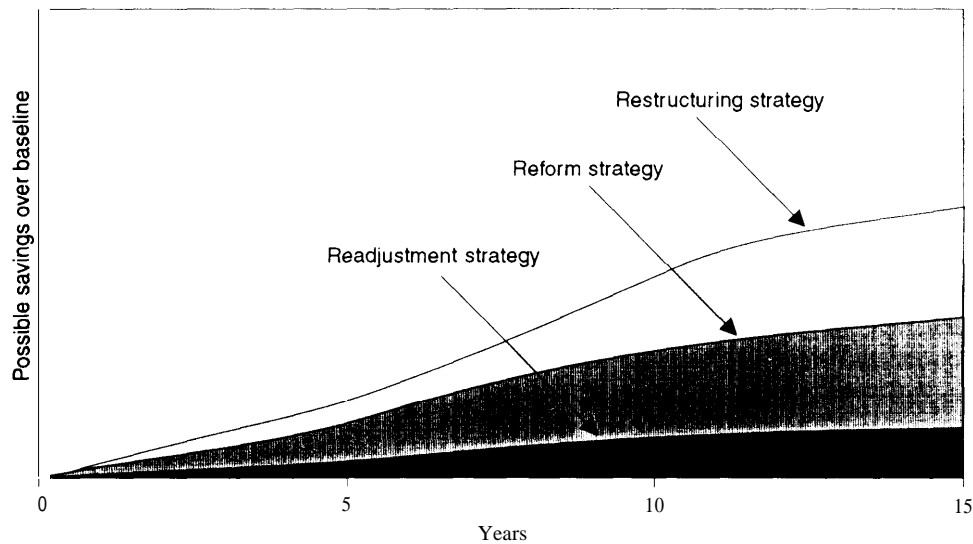
SOURCE Office of Technology Assessment, 1994 Based on data from Bureau of Economic Analysis Data and Bureau of the Census, CY 1992 spending by federal government for national defense (excludes non-comparable Imports and spending for government salaries in the public sector of the DTIB)

programs, any real savings from new system development will be unlikely to appear sooner than seven to 10 years after implementation.

Savings from increased process integration are derived from more efficient use of available resources. The reduced use of military specifications and standards promises increased process integration—if changes are also made in cost accounting requirements and the rules governing technical data rights. Some process integration savings might begin soon after implementation of changes in the use of military specifications and

¹⁴Data used for developing the numbers for these tiers was collected and assembled by commodity rather than by firm, so that the value added by a particular contractor may appear at both the prime contractor level and at lower tiers, depending on the product.

FIGURE 1-6: Phased Impact of CMI Strategies



SOURCE Office of Technology Assessment, 1994

standards-as special testing requirements are eliminated, facilities are consolidated, and the necessary industry workforce reduced. But significant savings here will also depend on changing acquisition rules, eliminating government acquisition oversight personnel, planning products for dual- or multi-use, and designing for manufacturing with commercial processes. These steps will all take time to implement.

OTA's examination of possible savings from increased CMI revealed that gaining significant savings may require major restructuring in the DTIB—for example, eliminating government inventory of commercially purchased parts, adopting long-term (three to five years) service contracts for supply of goods and services, and closing government facilities (e.g., depots and Service R&D facilities) made redundant by such approaches. Savings from such restructuring could be significant, but they are unlikely to begin

to appear for five to 10 years after the implementation of change. Even greater CMI benefits might be derived from redesigning forces, as well as weapon systems, to take maximum benefit of CMI.

OTA made its own estimates of savings, as well as considering estimates from other studies. Based on the available data, it appears that total potential cost savings from increasing CMI might range from a few percentage points to as high as 15 to 20 percent of baseline DTIB spending depending on the set of policies implemented. But given the complex range of policies being considered and the time frames within which savings might occur, narrowing the range of possible savings is difficult. Applying the estimates of savings resulting from annual efficiency improvements made by the Defense Science Board Task Force on Acquisition Reform¹⁵ to OTA's estimates of the po-

¹⁵ See U.S. Department of Defense, Office of the Under Secretary of Defense for Acquisition, *Report Of the Defense Science Board Task Force on Defense Acquisition Reform*, July 1993, Table 1. Estimated Potential Annual Efficiency Improvements (After a 5-year Period), p. C-8.

tential for integration derived from OTA's industry survey, gives an overall estimated cost savings in the range of 5 to 10 percent of estimated baseline spending.

Some observers are more skeptical of possible savings than was the DSB Task Force. These observers estimates would be lower. There are sound reasons for caution in estimating high rates of savings. As noted above, additional savings at the lower tiers will be constrained by the amount of ongoing integration and the more limited funds going to those tiers. Savings at the top tier will be constrained by the unique aspect of much of the defense systems integration activity that occurs there. This is likely to remain true even with significant CMI policy changes.

A few observers are even more optimistic than was the Defense Science Board report. Their estimates might approach the upper limit of the range cited above. But regardless of the ultimate size of the savings, any significant savings will take several years to appear. Achieving savings on the high end of the estimated range will demand major restructuring of the DTIB and the likely elimination of much of the government DTIB.

Other Potential Benefits

If CMI is successfully implemented, its most important contribution may not be savings, but instead the preservation of a capability to support future national security objectives, i.e., ensuring the existence of a viable DTIB in the face of significant defense spending reductions. Increases in commercial purchases, for example, might provide the defense community access to important technology in some fast-moving commercial sectors—particularly in electronics, software, and some manufacturing processes—otherwise not available to defense. A properly designed integration strategy may also enhance the commercial viability of a number of industries.

Technology transfer between the defense and commercial bases should also increase as a result of integration, but such increases are even more difficult to quantify than are cost savings. Some

studies, however, indicate that significant intra-firm movement of scientific, technical, and engineering personnel occurs in firms doing both commercial and defense work. Integrated facilities should enhance such transfer. Firms should be able to better leverage their investments.

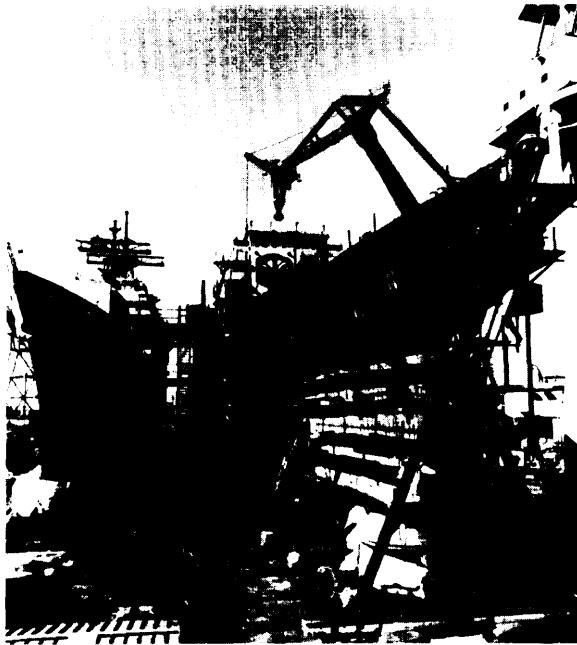
Activities such as the Technology Reinvestment Project (TRP), Cooperative Research and Development Agreements (CRADA), and DOD-funded consortia appear to contribute to technology transfer, but they are unlikely to have much immediate effect on facility-level CMI unless acquisition barriers such as special cost-accounting and rights in technical data are addressed. A number of metrics have been suggested to help evaluate the initiatives aimed at increasing technology transfer. Some of these are discussed in chapter 5.

■ Implementing Change Will Not Be Easy

The DTIB necessary to provide goods and services for national security is very complex. The base contains a wide range of technologies and industrial sectors, and is composed of large and small prime contractors, with thousands of subtier suppliers of components, manufacturers, research and development organizations, maintenance providers, and service industries.

The complexity of the DTIB and of DOD expenditures demands adoption of a diverse set of policies to increase integration. Some acquisition reforms, such as adopting commercial or performance specifications and standards, affect all levels (industry sector, firm, and facility) and activities. Others are more limited. Operations and Maintenance, for example, may be influenced by policies directed at increased purchases of off-the-shelf commercial items and making greater use of commercial buying practices. R&D, on the other hand, may be far less susceptible to influence by such policies. It may respond to adopting research goals that encompass both civilian and defense uses (dual-use technologies), eliminating or changing military specifications and standards, and modifying government requirements for rights in technical data.

INGALLS SHIPBUILDING



Tier 1 systems integrators such as shipyards, aircraft manufacturers, and armored vehicle producers will be difficult to integrate

But, as previously noted, the data essential for shaping policy are sparse. Despite recent DOD efforts, available data on the current use of commercial items by DOD remain insufficient to allow any firm estimates of potential savings from their increased use (thus, OTA's use of an industry survey to gain insights). DOD recently estimated that approximately 6.9 percent of the goods and services are purchased commercially. This estimate, however, comes only from the first and second tiers. DOD is attempting to refine these data.

The lack of data is due, in part, to the absence of any concerted effort by the federal government to track CMI. DOD has not previously gathered such information, partly because of definitional problems (e.g., lack of agreement on what constitutes CMI and what is a commercial item), but also because of a lack of interest. While the Census Bu-

reau gathers information on both the CTIB and DTIB, these data are not collected with CMI in mind, and are highly aggregated. Thus, census data provide general information on industrial sectors, but give little insight into developments at individual plants and enterprises.

DOD has established working groups to gather information in support of acquisition reform policy. Unfortunately, decisions are still too often based on data from studies that concentrated on only a few sectors and the higher tiers, although the 1993 Defense Science Board Task Force Report on Acquisition Reform did consider the entire DTIB. Absent an understanding of overall DTIB operation, the available knowledge remains insufficient to set a comprehensive CMI policy.

While case studies provide useful insights, their findings cannot easily be generalized across the entire DTIB. Indeed, one obvious problem of past studies has been a tendency by some to generalize potential savings for the entire budget based on findings of a particular case study or group of studies. An industry survey conducted by the Center for Strategic and International Studies is currently among the best sources of available data.¹⁶

OTA's own industry survey estimates are general indicators and not absolute estimates of current integration or firm forecasts of the potential for change. OTA estimates were supported by information derived from more than 100 interviews, site visits, workshops, a random sample of industrial sectors, an examination of 11 other industries, and discussions with industry executives and government personnel responsible for research, development, manufacturing, and maintenance.¹⁷

The public portion of the DTIB, by definition segregated, is relatively large, costly, and difficult to change. Public sector activities en-

¹⁶ Debra van Opstal, *Integrating Civilian and Military Technologies: An Industrial Survey* (Washington, DC: Center for Strategic and International Studies, April 1993).

¹⁷ These sectors included: shipbuilding, aircraft, communications equipment, portable laptop computers, flat-panel display technology, apparel, munitions, circuit breakers, fluid power products, gear manufacturing, and composite materials.

compass the full panoply of defense-related processes, including research, development, engineering and testing, manufacturing, maintenance, and other services. The total number of government employees estimated to be involved in these activities is about 370,000. These laboratories, test centers, arsenals, and maintenance facilities are spread around the country. Any change, with its potential for personnel cuts, therefore, becomes both a local as well as a national issue. Yet the rationalization of the public and private sectors of the DTIB and the elimination of unnecessary redundancies between the two sectors hold promise for cost savings.

■ There are Potential Costs and Risks

Policies designed to promote integration are neither cost nor risk free. The drawbacks will affect how change is implemented.

One of the most discussed risks, and potentially the most important, is that the goods and services purchased directly from the commercial sector, or conforming to commercial rather than military specifications and standards, will fail in military operations. While this is possible, there is no inherent reason why it must occur. Current proposals for change include provisions for using special specifications and standards where they are necessary to ensure performance.

A second risk is that by relying more on the commercial sector, DOD will become more dependent for off-shore goods and services. While this too is possible, there is no reason to believe that increased foreign sourcing necessarily leads to military vulnerabilities. Further, potential vulnerabilities can be identified and managed.

A third risk involves the potential increase in fraud and abuse that might result from a reduction in oversight, such as elimination of the requirement for cost and pricing data, elimination of the use of special government accounting practice, and the elimination of in-house quality inspectors. While there may be some increased risks, most of the alternatives proposed (e.g., increasing commercial purchases, using commercial quality standards, accepting commercial accounting systems)

provide for continued (but different) oversight of government spending.

In addition to these risks, CMI is likely to incur certain costs, at least in the short-term. There are two broad categories of identified costs. The first category is **personnel costs**. This includes both the jobs lost as a result of eliminating redundancies in the private and public sectors of the DTIB, and those likely to be eliminated within the acquisition workforce because of changes in oversight requirements (both public and private sector). Personnel retraining costs are inherent in providing the acquisition workforce with the skills necessary to operate in an integrated environment.

The second category is **activity costs**. This includes activities such as reviewing and eliminating inappropriate military specifications and standards and the expense of participation in standards setting bodies.

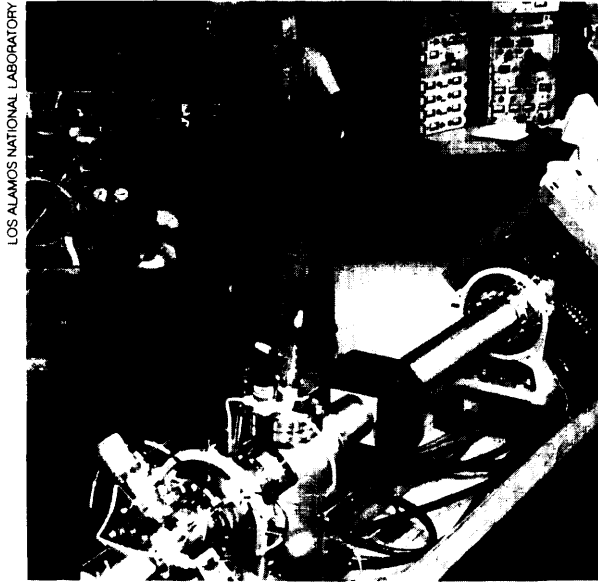
■ Strategies to Implement CMI

OTA grouped the policies examined in this assessment into three strategies designed to promote CMI. The strategies, termed Readjustment, Reform, and Restructuring, were divided according to the potential difficulty of implementation. The strategies can be viewed as additive. If taken together, they provide a phased approach to comprehensive CMI.

Strategy 1: Readjustment

A Readjustment Strategy contains three main elements: 1) facilitating commercial procurement, 2) promoting development and diffusion of technology, and 3) leveraging resources and investments. It takes advantage of ongoing, often unrelated activities to promote CMI—including several steps proposed by the Acquisition Law Advisory Panel and adopted in FASA.

Some of the steps necessary to implement this strategy (e.g., eliminating unnecessary military specifications and standards) can be taken by DOD without additional legislative authority. Others require congressional action (e.g., eliminating cost and pricing requirements on commer-



LOS ALAMOS NATIONAL LABORATORY

Government facilities often have extensive, specialized facilities that industry can exploit, such as the Ion Beam Material Laboratory at Los Alamos National Laboratory

cial purchases—including in FASA). However, even those steps that can be undertaken by DOD alone cannot succeed without congressional support.

Commercial purchases are facilitated by the elimination of cost and pricing requirements on such purchases, cessation of unique contract clauses, and changes in government requirements on rights in technical data. FASA addresses these issues.

Development and diffusion of technology require a continuing commitment to R&D, including programs to diffuse defense technologies and DOD efforts to access technology developed commercially.

Leveraging investments and sharing resources can occur through the adoption of dual-use technologies to meet defense objectives. DOD participation in TRP, CRADA, and consortia provide mechanisms for technology development and diffusion, as well as leveraging of investments.

The benefits of a Readjustment Strategy include cost reduction, better (and faster) access to essential goods and services, and an increase in the number of available vendors.

The strategy does have some disadvantages. One of its greatest shortcomings is that it leaves the overwhelming amount of DTIB spending under the cost-based acquisition structure, which industry observers argue is one of the most powerful factors in segregation. This situation not only limits potential savings but, more importantly, may leave firms making defense-unique items or performing defense-unique services at a competitive disadvantage in selling commercial products to DOD—including newly declared commercial products that these firms previously made to military specifications and standards.

Some socioeconomic programs may also be negatively affected, although actions mitigating the negative impact of any change can be taken. For example, FASA reduces the use of unique contract clauses in contracts under the \$100,000 Simplified Acquisition Threshold, while reserving these contracts for small business. Of course, actions to protect affected programs can have a negative impact on CMI. A further concern is that the increased use of commercial goods and services could open the door to more foreign sourced goods and services. Whether such an increase presents a real military risk depends on how it is managed.

Strategy 2: Reform

A Reform Strategy builds on the foundation of a Readjustment Strategy (i.e., assumes that Readjustment policies are implemented as a part of a Reform Strategy), and takes a more expansive approach to fostering CMI. The strategy rests on three pillars: further expansion of commercial purchases, integration of processes, and applying CMI lessons to the segregated portion of the DTIB.

Commercial purchases are expanded by: broadening the definition of commercial items; eliminating government cost accounting requirements for all commercial purchases; exempting all commercial purchases from unique contract requirements; limiting government rights in technical data related to these items; and, adopting

commercial buying practices. FASA includes some of these steps.

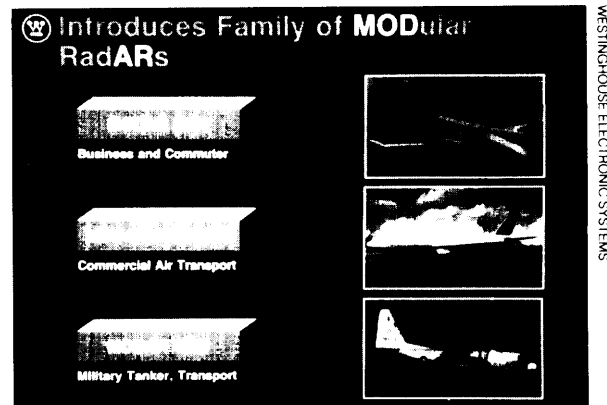
The second pillar of a Reform Strategy is integrating processes. A key step in process integration is to find alternatives to government cost accounting to ensure the government pays a fair price for goods and services that do not have commercial counterparts. Activity-based cost-accounting is one avenue being pursued; facility exemptions is another; government price analysis is a third.

Programs that stress dual-use design for products and manufacturing processes are essential. Increased emphasis can be placed on designs that accommodate commercial components and processes. DOD can foster developments in product and process technologies and help coordinate DOD and commercial acceptance of common technologies through participation in industrial sector organizations and consortia.

A final element of a Reform Strategy directs CMI policies toward that portion of the DTIB that remains segregated. CMI might be a major factor in reducing DTIB redundancies. A Reform Strategy would favor the retention of private firms and contractor-operated facilities (e.g., GOCOs) over government-owned and operated ones (e.g., GO-GOs). The elimination, or reduction, of the redundancies between the DTIB and the CTIB would help leverage funds, personnel and facilities. A second objective would be to use commercial products and processes where possible.

A Reform Strategy would produce additional cost savings over a Readjustment Strategy through increased commercial purchases—including large components or systems (e.g., aircraft engines, certain aircraft, and computer networks). The strategy would enhance technology transfer between the DTIB and the CTIB and a larger base would be available to meet defense needs.

A Reform Strategy has some drawbacks. The lessening of oversight might increase the potential for fraud and abuse. Greater use of commercial products might affect the quality of military items. Rationalization of the base would lead to job dis-



The Westinghouse MODAR wind-shear radar is an example of successful dual-use design

placement. There may also be increased prospects for proliferation of militarily relevant technologies to other countries.

Strategy 3: Restructuring

After successfully implementing the Readjustment and Reform strategies, a Restructuring Strategy might be considered. The strategy would not only restructure the DTIB, but would also change military force structure, as well as specific weapon systems, to take advantage of commercial items and services.

The nature of future conflict and technology trends will have a profound impact on future DTIB needs and consequently on this longer term strategy. A Restructuring Strategy will be designed to exploit changes in technology and to accommodate changes in conflict.

A Restructuring Strategy involves three principal elements: restructuring the DTIB aimed at elimination of all redundancies between the public and private sector DTIB, restructuring military forces and weapon systems to take full advantage of CMI benefits and, finally, movement toward complete commercialization.

While some rationalization of public and private R&D, production, and maintenance activities occur under both the Readjustment and Reform strategies, Restructuring pursues rationalization to the maximum degree possible. Some countries—Japan and Germany—rely almost entirely



Tanker aircraft, built around passenger jet airframes, are examples of major dual-use products already in service.

on the private sector to provide for maintenance and support, as well as manufacturing.

Restructuring military forces to fully exploit CMI would be even more controversial than restructuring the DTIB. But there is some precedence for such policies. During the 1970s, for example, the 9th Infantry Division experimented with many commercial pieces of hardware, different ways to employ off-the-shelf equipment, and alternative force structures for employing that equipment. Weapons more amenable to integration—such as rocket artillery launched from tubes commonly available in industry, and standoff-bombers built around commercial airliner airframes—might replace more militarily unique hardware—such as tube artillery or penetration bombers.

Complete commercialization in acquisition would mean that DOD would purchase goods and services like other commercial customers but with one significant advantage: in some areas its purchasing power might give it considerable clout. Such clout might not exist, however, in important areas such as electronics.

A Restructuring Strategy represents a radical departure from DOD's post- World War II acquisition approach. The more radical reforms outlined in this strategy promise major benefits from significant rationalization of the private and public sector bases, better use of the Nation's technology

and industrial bases, rapid incorporation of new technologies, and a larger mobilization base.

But restructuring would be costly and involve significant risks, including uncertainties in the ability of weapon systems and forces to meet future performance requirements and the responsiveness of commercial firms to national emergencies.

OPTIONS FOR CONGRESS

This assessment confirms that greater CMI is possible. Benefits include cost-savings, increased technology transfer, and expansion of potential defense suppliers. But the assessment also indicates that cost savings are likely to be lower than some previous studies have suggested. Further, it will take several years after the implementation of CMI policies for major savings to occur. Even so, cost savings of even a few percent of total DTIB spending could produce billions of dollars in savings.

The assessment suggests that the most important benefit of increased CMI might be the preservation of a viable defense technology and industrial capability in a fiscally constrained period. Without increased CMI, the Defense Department may lack adequate access to rapidly developing commercial technologies and pay a premium for commonly available goods and services. Therefore, regardless of the size of the potential savings, some increased CMI appears to be a necessity.

The assessment uncovered no "silver bullets" that might easily achieve CMI goals. However, some policies can have broad effects. The elimination of military specifications and standards is such a policy; relief from supplying cost and pricing data is another. But in most instances the barriers to increased CMI are sufficiently intertwined to demand a comprehensive (and complex) approach if the projected benefits are to be achieved.

DOD can take some actions to facilitate CMI without any new legislation. In addition to the actions recently taken, the Department can also change the incentives for the acquisition workforce. It can move to ensure that cost and ease of

production are major factors in program development, and that acquisition personnel have the necessary skills to make sound technical judgments about commercial products and processes and have the necessary training to conduct a market analysis. DOD might also prohibit the use of certification of cost and pricing data absent clear evidence that a market analysis was attempted first and failed to provide the necessary information.

Congress has an important role to play if the full benefits of CMI are to be achieved. To date, congressional initiatives have been central to developing and pursuing CMI. The three alternative strategies (Readjustment, Reform, and Restructuring) provide a phased approach for considering implementing CMI.

Should Congress wish to promote CMI, while retaining strong oversight over defense expenditures, then it may wish to implement some of the Readjustment policies and stop at that point. A Readjustment Strategy, directed principally at increasing commercial purchases, provides high levels of direct oversight while opening the base to some new vendors and products. Changes in military specifications and standards open the base to additional firms and provide for the introduction into the DTIB of a modest amount of commercial innovation. Since much of the DTIB will be unaffected by these changes, however, benefits (including savings) are likely to be relatively small.

Implementing the DOD policy eliminating many military specifications and standards will require the support of Congress. Implementation will result in the decentralization of many more acquisition decisions. This will pose problems as well as provide benefits. In a system that operates with fewer rules, the price of greater overall efficiency might include some acquisition failures.

While greater benefits (in terms of savings and technology transfer) could follow from a Reform Strategy, it also involves increased risks such as reduced oversight and the potential for weapons performance shortfalls. A successful Reform Strategy involves a close interlinking of policies that must be implemented in concert. Expanding

commercial purchases into rapidly developing technologies may require a broader definition--or at least a broader interpretation--of commercial products and services than exists in the Readjustment Strategy (or FASA). Increasing process integration will necessitate further reduction in the demand for cost and pricing data, and fewer government demands for rights in technical data. Congress has important interests in each of these issues.

Increasing process integration also involves changes in system design philosophy that may have an effect on operational performance. Congress may wish to examine the implications of such changes in detail.

Should the Nation wish to make even greater use of the civilian base after implementing a Reform Strategy, a Restructuring Strategy could be pursued. While some actions of such a strategy (e.g., rationalizing the public and private sectors of the DTIB) will have begun as part of a Reform Strategy, they would be pursued to their limits in a Restructuring Strategy. Other actions, such as restructuring forces, commence under this strategy. These actions pose significant questions that demand more study. Congress may wish to examine possible force restructuring now, in anticipation of changes in the decades ahead.

■ Immediate Considerations

Congress has the option of going no further with the CMI than it has in its current acquisition streamlining legislation. Combined with DOD's CMI initiatives, FASA provides many of the benefits discussed in a Readjustment Strategy. Even if Congress wishes to pause, however, it may wish to consider steps to assess the effects of current initiatives.

Congress may want to ensure the increases in commercial purchases are monitored and that any savings are properly attributed. Although increased commercial purchases should begin to appear within 12 months, significant savings probably cannot be identified and reported for at least 3 to 5 years. Evaluation of the technology de-

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velopment and diffusion results of the TRP, DOD supported consortia, and similar initiatives is also important.

Finally, increased commercial purchases and the use of commercial vendors, if not properly managed, could threaten the long-term viability of the DTIB's design and engineering base. Congress may wish to monitor trends in DOD management and funding of this vital capability. The defense technology and industrial base reports previously requested by Congress will be even more important in this fiscally constrained environment.

The recent congressional and DOD initiatives also provide a solid foundation for a continued expansion of CMI. Should Congress wish to immediately continue to pursue CMI, the alternatives discussed under a Reform Strategy provide options for consideration. With significant legislative action already taken supporting the expansion of commercial goods and services, the initial focus of new efforts might be on the integration of processes. Process integration appears important not only for potential cost savings and increased technology transfer, but also because such integration appears important to retention of the critical defense system design and engineering capabilities. Integrated firms might combine an understanding of militarily unique technologies and operational needs with knowledge of developments in commercial technologies in ways that commercial firms are either unable, or unwilling to match.

For integration to succeed at the facility level, additional effort must be made to deal with the difficult issue of how to allow both commercial and defense activities in facilities while protecting public funds. These objectives are difficult to reconcile. Some firms are experimenting with activity-based cost accounting. Other observers argue that accepting data gathered with current commercial accounting systems should be sufficient to guard against fraud and abuse.

Designing items for dual-use, appears critical to the ultimate ability to integrate processes.

DOD's initiative on military specifications and standards can have a positive effect on dual-use design, but ultimately such an approach must confront the way in which military requirements are developed. Congress may wish to consider how requirements are developed and validated.

Because the defense base is so diverse, efforts to integrate processes might initially focus on areas that appear most amenable to integration (e.g., lower tiers, having commonality with commercial requirements, and services). Figure 1-4 shows one estimate of the amenability of tiers and activities (R&D, manufacturing, services, construction) to commercial purchases and process integration.

At the prime level, technologies with many common commercial and defense requirements such as transport aircraft, or aircraft engines might be considered excellent prospects for integration. Technologies with few commercial requirements such as tank guns, might be largely excluded from initial efforts.

A comprehensive CMI strategy must include provisions for preserving those militarily unique capabilities that remain largely segregated. A Reform Strategy includes efforts to incorporate commercial products and processes into the segregated portion of the base. But while this portion of the base can benefit from CMI changes such as purchase of commercial components, special efforts will still need to be made to ensure that these capabilities are preserved. DOD and Congress will need to ensure that these critical activities remain funded at a sufficient level to ensure their viability.

Finally, although there are immediate actions to be taken, successful implementation of CMI will require a long-term commitment. CMJ can provide benefits-but most of these benefits will take years to appear. Patience and a steady effort will need to be maintained. Congress will want to evaluate results over time, and make necessary course corrections to achieve the full range of projected benefits of CMI.