

Three CMI Strategies | 2

The Office of Technology Assessment has grouped some of the policy options discussed in this assessment into three broad civil-military integration (CMI) strategies that Congress might consider. The three strategies are delineated according to the anticipated difficulty of implementation and their potential impact. They incorporate ongoing government and industry activities as well as possible future actions.

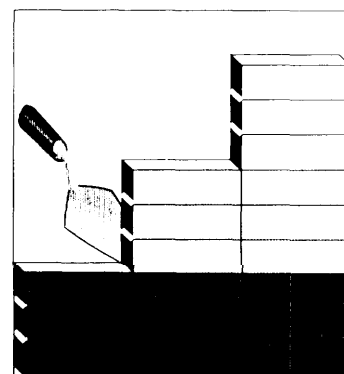
These strategies are not mutually exclusive alternatives: taken together, they might comprise a phased approach to implementing CMI. For this discussion we have named the strategies Readjustment, Reform, and Restructuring.

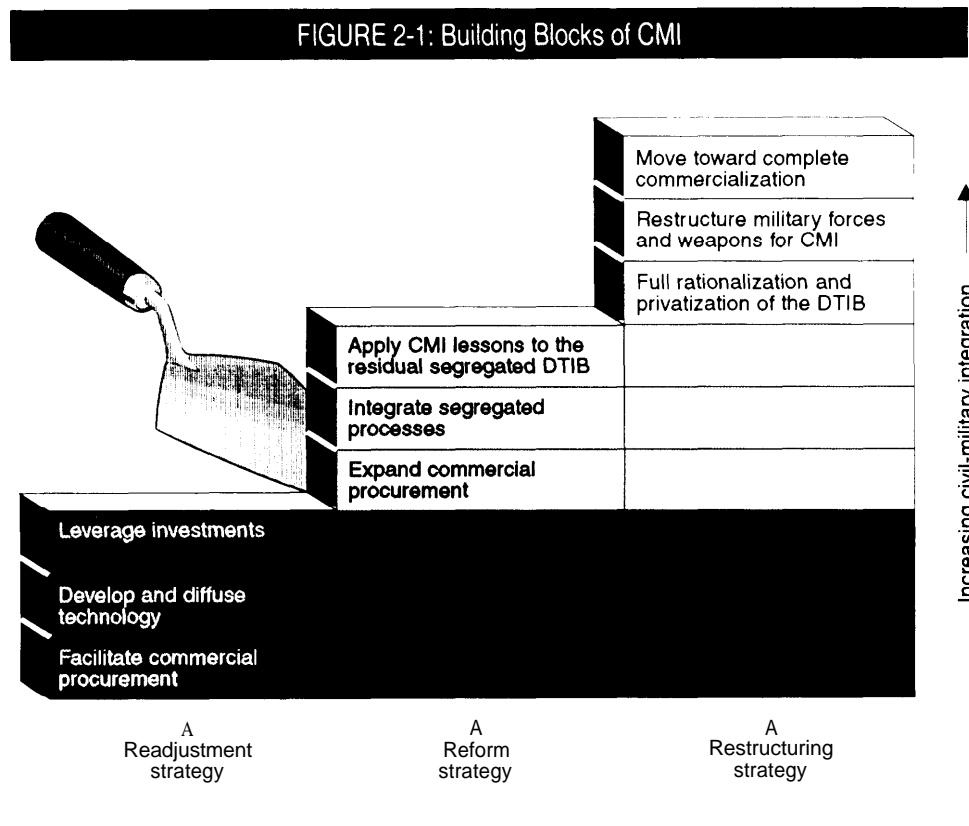
STRATEGY ONE: READJUSTMENT

A **Readjustment Strategy** makes incremental changes that enhance the use of commercial goods and services and promote process integration at the industrial sector level. It includes many of the current congressional, Department of Defense (DOD) and industry CMI initiatives (e.g., many of the provisions in the Federal Acquisition Streamlining Act of 1994 (FASA), and DOD initiatives on military specifications and standards). But the strategy may have only a limited effect on process integration at the firm or facility level, and so might be viewed as the first step of a more comprehensive approach to CMI that includes subsequent **Reform** and **Restructuring** (figure 2-1.)

A Readjustment Strategy aims at eliminating some of the barriers to CMI that stem from both the unintended consequences and misapplication of legislation and regulations and from inflation,

DOD can take many of the steps necessary to implement this strategy without additional legislative authority. Other steps,





SOURCE Office of Technology Assessment, 1994

such as raising the simplified acquisition threshold, do require congressional action. Even where DOD can act alone, congressional support may be essential to ensuring success. For example, although DOD has unilaterally begun to eliminate the use of many military specifications and standards, Congress will have to decide the level of support for these initiatives when groups opposing some changes raise their concerns. Further, Congress may need to provide funds to train the acquisition workforce to properly implement the DOD initiatives.

A Readjustment Strategy contains three main components: facilitating commercial procurement, developing and diffusing technology, and leveraging investments and sharing resources.

■ Facilitate Commercial Procurement

The principal focus of a Readjustment Strategy is increasing the levels of commercial purchases and

the use of commercial buying practices. Several ongoing initiatives are directed at this goal.

Adopt Commercial Specifications and Standards

Using commercial specifications and standards in place of military equivalents is one of the most important steps DOD can take unilaterally to increase commercial procurement. But this change will require time to implement fully, and its benefits may take years to be realized.

According to new DOD guidance, military specifications and standards will be used only where no adequate commercial specification or standard is available. Even when a military specification or standard is necessary, that specification will be written in terms of desired performance rather than the physical characteristics or method of production of an item. Performance-driven specifications encourage innovation. They re-

BOX 2-1: Commercial Items and Services in the Persian Gulf War

Commercial items were used extensively during the Persian Gulf War. For example, coalition forces used the Global Positioning System (GPS)—an array of geosynchronous satellites that broadcast positioning information—to navigate over largely unknown terrain and execute the massive military envelopment from the west that was key to the ground attack. GPS is a military system, but contains provisions for commercial use with somewhat degraded positioning information. Lacking sufficient military GPS receivers, DOD purchased and successfully used several thousand less accurate and supposedly less durable commercial receivers.

United States and allied forces used imagery provided by the commercial LANDSAT satellite system to plan operations, and leased commercial satellite communications channels to augment the Defense Satellite Communications System.

Other commercial items used included commercial vehicles to haul equipment in the rear areas, and commercial meal packs (called Meals Ordered Ready to Eat—Contingency Test) that substituted for military meals.¹ The United States also drew extensively on commercial shipping and aircraft to transport people and equipment to the theater of operations.

¹ Department of Defense, *Conduct of the Persian Gulf War Final Report to Congress*, April 1992.

SOURCE Office of Technology Assessment, 1994.

quire, however, knowledgeable government personnel to evaluate them.

Case studies have shown that adopting commercial specifications, standards, and business practices will often produce savings. In some cases, costs were estimated to have been reduced by 20 to 60 percent, or more.¹⁸ DOD has estimated that adopting performance specifications might save \$550 million over the initial two years of the program.¹⁹ That estimate appears overly optimistic, if for no other reason than implementation is likely to take longer than anticipated. Further, there are some in DOD who question moving “too rapidly” toward reliance on commercial specifications and standards. Their concerns are likely to slow the process.

DOD has also moved to adopt commercial standards such as ISO 9000 in lieu of DOD standards.²⁰ Proponents argue that accepting ISO 9000 is critical for increasing the international competitiveness of U.S. firms. But use of ISO 9000 is not without controversy. Some government quality-control personnel oppose the change. So do some U.S. firms.

Indeed, there is concern about moving too hastily toward reliance on commercial specifications and standards. Some commercial items were used successfully during the Persian Gulf War. (See box 2-1.) But not every commercial item proved successful. Some chocolate candies melted in soldiers’ hands rather than their mouths. Some com-

¹⁸ In the case of the STU-III secure telephone, an estimated 10-fold reduction was achieved.

¹⁹ Estimate by the DOD Process Action Team for Specifications and Standards.

²⁰ ISO 9000 is shorthand for International Standards Organization 9000-9004, a series of documents on quality assurance published by the Geneva-based ISO. The five documents outline standards for developing Total Quality Management and a Quality Improvement Process. ISO 9000 consists of guidelines for the selection and use of quality systems contained in 9001-9003. ISO 9001 outlines a model for quality assurance in design, development, production, installation, and servicing. ISO 9002 outlines a model for quality assurance in production and installation. ISO 9003 outlines a model for quality assurance for final inspection and testing. ISO 9004 is not a standard, but contains guidelines for quality management and quality system elements.



This commercially available Rockwell "Pluggin'" GPS receiver is being purchased by the U S Army.

mercial laptop computers were fouled by the fine sand. None of the commercially available boots measured up to the Commander-in-Chief's requirements. Thus, commercial goods and services, while useful, are not a panacea.

In implementing change, DOD will need to overcome internal resistance, and work closely

with industry in determining which commercial specifications and standards to accept, and which military specifications and standards remain essential. DOD involvement in setting commercial specifications and standards will be essential to ensure that defense interests are advanced. Since DOD accounts for only a small part of the overall business in most industrial sectors, it may have to compromise some performance requirements (thus increasing concerns over possible future mission failures) or fund special technological developments when commercial items do not meet a need.

Eliminate Cost-Accounting and Pricing Requirements

Industry representatives have repeatedly identified cost-accounting and pricing requirements for commercial goods and services as one of the greatest deterrents to doing business with the government. Actions taken in a Readjustment Strategy conform with recommendations of the Acquisition Law Advisory Panel to eliminate cost and pricing data requirements for all contracts below \$500,000.²¹ The DOD requirement that firms certify that the government is getting the best price offered any customer—said to be derived from the Truth-In-Negotiations Act (TINA)—would be eliminated. Steps must also be taken to preclude cost or pricing data from being used in competitive, fixed-price contracts.²²

Adopt a New Definition of Commercial Items and Services

The lack of a good, common definition of a commercial item has contributed to the misap-

²¹ As this report goes to press, the Federal Acquisition streamlining Act of 1994 (FASA) has eliminated cost and pricing requirements not only for contracts below \$500,000 (included in the Readjustment Strategy), but also for all commercial purchases (an action included in the following Reform Strategy).

²² This raises the issue of how legislation is implemented. TINA is intended to ensure that the price of products sold to the government is fair and reasonable. While TINA provides exemptions for contracts with adequate price competition or catalog or market prices on commercial products, in practice "competition" and "commercial" have often been misapplied, requiring cost and pricing data in competitive markets and even for some commercial products. Further, TINA allows for price analysis as an alternative to cost analysis—but, reportedly, because DOD contracting officers are often not trained to perform such analysis, they instead opt to require certification by the contractor that the government has received the most favored customer price. A major problem thus arises less from legislation than from lack of training and experience.

plication of cost and pricing data. Acceptance of a definition such as that in the Federal Acquisition Streamlining Act of 1994 (FASA) will eliminate some cost and pricing problems and expand the use of commercial products. This definition, however, might still exclude items with little or no commercial market if those items have not evolved from a product that is on the market. The FASA definition might thus preclude DOD from rapidly acquiring some leading-edge technologies that have not yet established a commercial market.

Reduce Requests for Rights in Technical Data

DOD could promote the development of technology by limiting its requests for rights in technical data. This would encourage vendors to provide their best product technologies. DOD could, for example, expand on practices in the Technology Reinvestment Project (TRP) and the Department of Commerce Advanced Technology Program (ATP), allowing firms to retain rights to technology developed partly at government expense.²³ FASA provides for the presumption of commercial ownership of data on commercial products, thus placing the burden of proof of ownership on the government. But this change is insufficient to answer many industry concerns. Anticipated DOD changes, in response to recommendations from the government/industry technical data committee established under Section 807 of the 1992 Defense Authorization Act, may eliminate many of the disputes over rights in technical data between DOD and industry.

■ Develop and Diffuse Technology

A second major component of a Readjustment Strategy is the collective development of technologies by the defense and civilian sectors for defense and commercial use.

The source of new technology is unpredictable. It may emerge from defense or commercial re-

search, or result from the development of a particular weapon or commercial product. Therefore, ensuring effective technology transfer may depend on a variety of approaches. Further, an effective plan to promote development and diffusion of technology requires mechanisms to measure the returns on investment.

Rationalize Research Funding

With fewer available resources, DOD might choose to direct more of its funds into research that is not strictly defense-related, but holds promise of producing dual-use technology. Through the Advanced Research Projects Agency (ARPA), DOD already funds general research. Such research may become more important in the face of reduced defense budgets. Previous modifications to the law governing independent research and development (IR&D) should also promote the exploration of nondefense technologies.

But it is essential to identify technology areas in which DOD support of dual-use technology development in the private sector can make a difference. Resources for research in areas that are thought to be militarily unique may be scarce, so every effort will need to be made to avoid funding duplication.

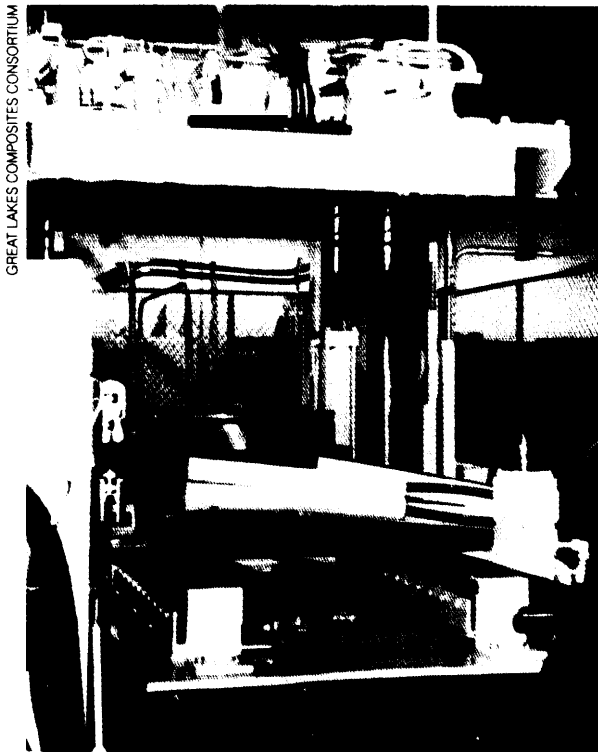
Exploit Individual Programs

DOD might make better use of efforts within specific programs to develop and diffuse technology. The Manufacturing Operations Development and Integration Laboratories (MODIL) developed by the Strategic Defense Initiative Office (SDIO) is an example. In this program, SDIO used small amounts of seed money to fund joint efforts among companies, universities, and laboratories directed at developing space optics.

Use Current Diffusion Programs

Cooperative Research and Development Agreements (CRADAs), originally designed to transfer

²³The government does have the right to use the data and, in some cases, to promote its commercialization if the developing firm does not bring a product to market.



This hydraulic clamp is available for use by clients at the Great Lakes Composites Consortium for limited production runs or prototyping

technology out of the federal laboratory system, are now viewed as a means to facilitate two-way transfer, helping government laboratories gain access to commercial technologies.

The TRP program allows firms to keep data rights as an enticement in technology development. This approach may enhance technology development, but not diffusion. The TRP's Manufacturing Extension Partnership Program, on the other hand, might promote technology diffusion. So too might DOD participation in regional manufacturing centers and consortia that perform research of interest to both defense and commerce. The Great Lakes Composites Consortium and SEMATECH are examples.

Support for many of these activities is decentralized, with organizations vying for funding from the Office of the Secretary of Defense (OSD), the Services, and defense agencies. The Navy, for example, supports five Centers of Ex-

cellence in manufacturing in the private sector. The Army lists 12 university science and technology centers in 7 different research areas (including electronics, rotor craft, mathematics, high performance computing research, and others). DOD is attempting to bring order into its science and technology process. Readjustment would include stronger coordination of programs.

While efforts such as the TRP, CRADA, and consortia can positively affect development and diffusion of technology, in the aggregate they account for a small portion of defense technology and industrial base (DTIB) spending. In the longer term, development and diffusion of common technologies depend on acquisition reforms that allow businesses to integrate firms and facilities profitably.

■ Leverage Investments/Share Resources

A third component of a Readjustment Strategy is leveraging investments in technology and industry to derive the maximum benefit from public and private spending. Some of this sharing will come from selecting common technologies for defense and commercial exploitation. Some CRADA and TRP projects that include government laboratories, manufacturing centers, and other government facilities already do this.

Other high-cost resources, such as R&D and test facilities, could also be shared. Commercial use of the Navy's David Taylor Model Basin for design of ships is an oft-cited possibility. Unique government computer capabilities could be made available. Los Alamos National Laboratory and other DOE laboratories, for example, provide support to industry on a fee basis. The Army's National Automotive Center plans to draw industry and government researchers together to develop new dual-use product and process technologies.

While sharing resources makes great sense on paper, there can be problems in practice. Industry managers, for example, worry about timely availability of test facilities. More importantly, many in industry question whether the government has much to offer. The proof, however, is probably in

actions rather than words. Private-sector representatives are reportedly making more approaches to government facilities.

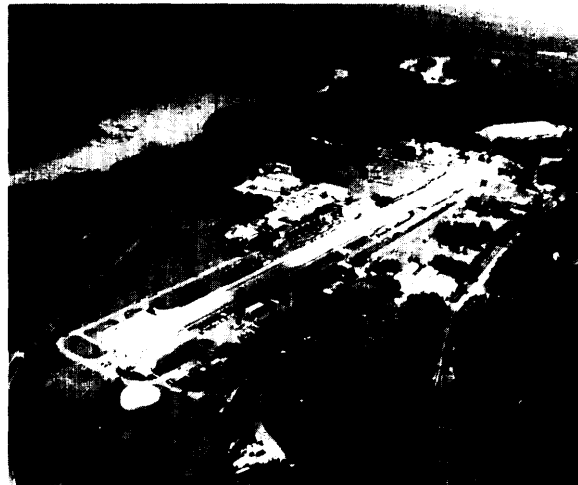
■ Benefits of Readjustment

Actions taken as part of a Readjustment Strategy should reduce some costs, provide better (and faster) access to essential goods and services, and increase the number of available vendors. For example, a relatively simple reform, the Defense Logistics Agency's use of commercial air-delivery of medicine to U.S. forces in Alaska, has lowered medicine costs, eliminated waste associated with excess inventory, and reduced transportation and handling expenses. But savings may be diminished by the limited nature of the changes a Readjustment Strategy makes in cost accounting and pricing requirements, rights to technical data, and the DTIB structure.

Actions taken in the Readjustment Strategy can affect a large percentage of the total contract actions (estimated over 98 percent), but not the majority of the DTIB budget. If commercialization were to reduce the number of government oversight and processing personnel handling these millions of actions, however, there might be significant savings. The 1993 Defense Science Board Task Force on Acquisition Reform estimated a \$4 billion annual savings from a reduction of about 45,000 government acquisition personnel alone. This savings estimate appears high, based on cost figures supplied to OTA by the DOD Comptroller, but \$1.5 to \$2 billion in annual savings may be possible. Greater government personnel reductions (and more savings) could occur under both the Reform and Restructuring Strategies.

Figure 2-2 illustrates how the potential savings from a Readjustment Strategy might phase in over time.

Exact savings are impossible to determine, but case studies and surveys provide the basis for estimates of how much and when savings might occur. Savings could result from changes in the specifications and standards themselves (e.g., certain required military quality tests might be eliminated) and from increased competition as



CARDEROCK DIVISION, NAVAL SURFACE WARFARE CENTER

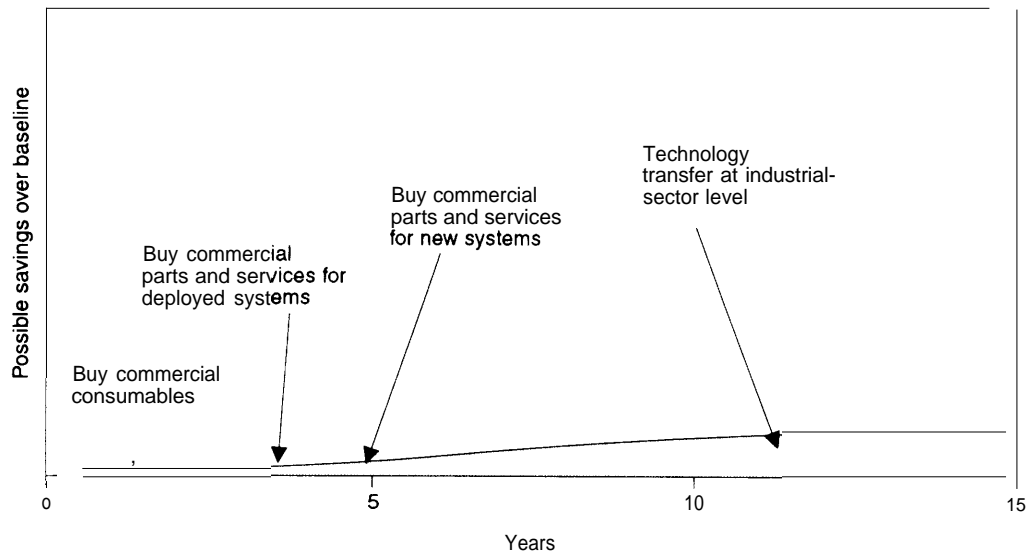
The David Taylor Model Basin, the long building in the center, is an example of a government facility that has excellent dual-use possibilities.

commercial firms bid for defense business. Other savings may result from changes in contracting. Further in the future, savings might be derived from manufacturing technology transfer, which could drive down production costs. Some of the case studies reviewed suggest relatively high savings for particular items. DOD's earlier commercial products program for purchasing, however, is estimated to have produced an approximate average cost saving of about 10 percent on commercial items.

The elimination of military specifications and standards will probably have their initial effect on the purchase of consumables—food, paper, motor oil, and services that are purchased regularly. Savings could appear within months of the implementation. But many consumables and services are already purchased commercially—so initial savings might be quite small.

Savings derived from the purchase of component parts may take more time—possibly beginning to be felt 12 to 18 months after the initiation of new procedures, when orders are made. Retrofitting parts specified to commercial standards in deployed systems is possible, but there may be constraints. It may take time to gain acceptance of such changes by system operators and producers. Firms may question whether the use of commer-

FIGURE 2-2: Phased Impact of a Readjustment Strategy



SOURCE Office of Technology Assessment, 1994

cial specifications and standards will increase their legal liability. And the nature of the limited modification of the laws governing technical data rights under a Readjustment Strategy may lead some firms to continue to refuse government business, particularly in the case of commercial items that are adopted for government use.

It may take 8 to 10 years after the implementation of a Readjustment Strategy until new systems incorporating commercial items and built to commercial standards are developed. Fiscal constraints are likely to limit new starts and associated savings.

Finally, technology investment programs, such as the TRP, manufacturing centers, and consortia, should promote acceptance of common technologies, affect new product and process technology, and even further reduce costs in the longer

term—10 to 15 years. If these savings amount to an additional one percent,²⁴ total annual cost savings over the projected baseline might fall between 3 to 5 percent of total DTIB spending.

There may be some additional savings related to any reduction in personnel processing contracts and engaged in oversight. These savings could begin in the first year, but the maximum effect is not likely to occur for 5 to 10 years after a Readjustment Strategy is implemented.

Of course, cost savings are not the only benefit of pursuing a Readjustment Strategy. Increased purchase of commercial items provides defense access to rapidly moving commercial technologies. And with the defense market open to more potential vendors, a more responsive DTIB might be available in times of crisis.

²⁴ Studies attempting to identify the returns on commercial R&D investments provide a wide range of potential effects. However, the totals spent in these activities are a relatively small proportion of the DOD budget—any future savings derived from these investments are likely to be correspondingly small.

■ Disadvantages of a Readjustment Strategy

There appear to be few disadvantages to a Readjustment Strategy. A major disadvantage is that the strategy leaves much of DTIB spending untouched and the current cost-based acquisition structure would remain in force for much of the base. This situation not only limits savings, but, more importantly, it may also leave some defense firms at a distinct disadvantage in competing for sales of commercial products, because they will be required to maintain government cost-accounting for their militarily unique products. Since these firms may contain the key design and engineering teams essential for developing new military systems (said to be the “core” of the DTIB), some provision must be made to ensure the survival of such teams.

Some socioeconomic goals may be undermined, although steps can be taken to avoid this. For example, FASA reserves contracts under the \$100,000 threshold for small business. Job losses are probably also inevitable, but they will be offset at least in part by new jobs in the commercial marketplace.

Training costs may rise as a result of the elimination of the established military specification and standards system. Further, the increased use of commercial goods and services might open the door to foreign competitors. But foreign sourcing need not be a vulnerability. Proper management should reduce any problems.

STRATEGY TWO: REFORM

The second major strategy—Reform—builds on the foundation of a Readjustment Strategy and takes a more aggressive and expansive approach to fostering CMI. But to achieve greater benefits, Reform presents more difficult choices.

A Reform Strategy rests on three pillars: further expansion of commercial purchases; integration of R&D, manufacturing, maintenance, and services; and application of CMI policies and prac-

tices to the segregated DTIB where possible. For this more comprehensive strategy to succeed, however, a concentrated effort to acquire better data is crucial.

Current CMI information relies heavily on anecdotal evidence and a limited number of case studies, and is difficult to apply to the DTIB as a whole. Future data collection for CMI needs to be more systematic. It requires interagency cooperation and needs to be collected in ways that allow the findings to be applied to the DTIB as a whole. OTA conducted a trial industrial survey (outlined in box 4-2 in chapter 4) that illustrates how such data might be collected. The Census Bureau might perform a more detailed industrial survey to obtain better data.²⁵

■ Expand Commercial Purchases

Commercial purchases in a Readjustment Strategy may be constrained by requirements for rights in technical data; by continued demand for cost and pricing information, requiring government cost accounting; by insufficient change in government buying practices; and by an acquisition workforce not used to buying commercial products. A Reform Strategy would seek to remove these hurdles.

Buy Commercially

FASA eliminates government cost and pricing requirements for all commercial purchases. This is essential to further increase commercial goods and services. There is, however, some skepticism about whether contracting officers will demand pricing information that might continue to make special accounting necessary.

Exempting all commercial purchases from socioeconomic-related contracting requirements is another alternative for increasing commercial procurements. The objectives of these unique contract requirements might be met in other ways. FASA makes a start, but implementation of FASA requires DOD to conduct a waiver process. The

²⁵Observations on selecting a representative industrial sample and gathering data are presented in appendices C and D.

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Acquisition Law Advisory Panel concluded that where DOD contract requirements duplicate existing federal, state, and local laws, these laws could be applied instead. Where special government efforts are considered essential to achieve a desirable socioeconomic objective, the actual requirement might be implemented differently—possibly as a part of a “best value” contract evaluation rather than within a contract clause. The idea is to establish the desired socioeconomic objective as an industry norm rather than an additional individual contract requirement.

DOD can further facilitate greater commercial purchasing by revamping its bid and proposal process to be more flexible and timely. The use of electronic transactions with commercial vendors is a useful start to the process. Giving procurement officials the same authority enjoyed by commercial buyers would speed acquisition.

Develop a Trained Workforce

The expansion of commercial purchases requires a highly trained, high-quality acquisition workforce. A new acquisition corps of “smart buyers” should have training in market research, the technical competence to evaluate purchases, and the authority to act on their findings. The current acquisition corps might be retrained or—if it proves to be too deeply entrenched in its old ways—DOD might gradually replace the corps through attrition or early outs.

A critical change in promoting commercial buying practices is to modify the current incentive structure. The new system must include the development of new measures for judging and rewarding the performance of procurement officials.

■ Integrate Processes

The second main element of a Reform Strategy involves policies designed to integrate R&D, manufacturing, maintenance, and service processes. Process integration eliminates redundancies within firms and facilities, generating economies of scale and allowing the government to piggyback on commercial operations. It would

yield direct, facility-level technology transfer between the commercial technology and industrial base (CTIB) and DTIB.

A Reform Strategy might reap these benefits through implementation of the following policy options:

Change Cost-Accounting Requirements

Perhaps the most important step to integrating processes at the facility level is finding alternative means to assure that the government is paying a fair price for militarily unique goods and services.

The least intrusive but possibly most risky option is for DOD to rely solely on internal DOD price and cost analyses. This option places DOD in the same position as commercial buyers seeking to purchase unique items. Some goods and services lend themselves to this form of cost estimation, notably those involving tasks and products that are well understood and have known material costs.

DOD might also accept the data generated by the contracting firm’s own cost accounting system. Some firms are moving toward an activity based cost-accounting system that might provide much of the data requested by DOD without adding unnecessary overhead to the firm’s commercial activities.

Change Contracting Approach

Unique contract requirements or unnecessary demands for rights in data stifle process integration in much the same way they stifle commercial procurements. Focusing DOD contracts solely on the products and not the process would help foster process integration.

“Form, fit, and function” specifications detail the general type of product, how it should interact with neighboring components, and how it should perform. Their use in place of detailed “how to” standards may open numerous opportunities for using commercial goods and services. They would also facilitate quick incorporation of new commercial technologies into defense goods. The

new DOD directive on military specifications and standards appears to address these issues.

While FASA makes some changes on rights in technical data, these changes do not appear to address concerns firms have over the possible loss of privately developed manufacturing technology in integrated facilities. Government's demand for rights in technical data might be further restricted in a Reform Strategy. Where obtaining rights is critical, the technical data might be protected in escrow or compensated through licensing arrangements. As noted in the Readjustment Strategy, new DOD data rights procedures are expected as a result of recommendations by the Section 807 committee.

Change Acquisition Philosophy

CMI studies on process integration have argued for a concerted effort to change DOD design philosophy to use more dual- or multi-use technologies. DOD military specifications and standards initiative addresses this issue. The design of equipment upgrades should include more commercial components and subcomponents.

New systems specifications should emphasize designs that accommodate commercial components and processes. This could be achieved by making the cost of a system a more important design criterion than in the past. Designing for commercial processes might allow a militarily unique item to be manufactured or maintained in a commercial facility rather than at a segregated site.

Streamlining Oversight

DOD can use alternatives to current visual inspections by residential government personnel to ensure quality. Such changes are implicit in the changes in military specifications and standards—if fully implemented.

The commercial market provides quality information as well as pricing data. Buyers research and track the quality of products. Firms inspect suppliers' quality and sometimes have a representative at a supplier facility. Firms also rely on statistical process controls and other means of quality monitoring. The government could apply



Terry Manufacturing produces uniforms for both the U S Army and McDonald's in the same facility with the same workforce

all of these approaches. If still unsatisfied, DOD could do inhouse testing of a statistically significant sample of the product. FASA directs DOD to rely on standard commercial product warranties.

Preserve the Base

DOD will need to foster development of product and process technologies to help preserve the base. Participation in industrial-sector organizations and consortia, as discussed in the Readjustment Strategy, can help coordinate DOD and commercial efforts. In some cases, it might be in DOD's interest to promote particular technologies of clear benefit to the military.

Similarly, DOD has a role in fostering process technologies. Trends towards increased flexibility in manufacturing could permit commercial plants to accommodate defense needs even with historically uneconomical production volumes.

Finally, the government may need to make a special effort to help defense firms be competitive despite the shift toward commercial procurement. Absent substantial reorganization, many of these firms are unlikely to be able to compete. Moreover, defense firms may now find themselves in the position of producing recently redefined commercial items and militarily unique items in the same facility and facing cost accounting and oversight rules not applicable to commercial firms. Since these are the firms that maintain the design and engineering teams essential to future weapons

development, the government may wish to help them by treating their products preferentially for a limited time. They might also be exempted from certain requirements (e.g., defense cost accounting) so that their commercial ventures are not unduly burdened by continuing defense work.

■ Apply CMI Lessons to the Segregated DTIB

Policies directed at the segregated segment of the DTIB are a final aspect of a Reform Strategy. These private and public entities develop, produce, and maintain goods and services that are highly unique, complex, and/or classified.

Use CMI as a Criterion for the Elimination of Redundancies

The segregated DTIB, like the rest of the DTIB, is currently undergoing significant downsizing and restructuring. DOD might leverage limited funds by eliminating redundancies within the segregated DTIB as well as by shifting work to the integrated base.

If policy makers decide to emphasize private over public organizations, they may also want to strengthen these segregated industries to ensure their survival during downsizing. Ensuring that antitrust barriers to business mergers in critical industrial sectors do not preclude rational downsizing might help protect core competencies that would otherwise be lost, and could help achieve more economical production volumes as well.

Apply Commercial Buying Practices

Under a Reform Strategy, the segregated portions of the DTIB will continue to operate according to different rules than much of the rest of the DTIB. But it should be encouraged to procure goods and services from commercial firms and companies with integrated processes to the maximum possible extent. DOD can promote such procurement by shifting the incentive structure toward the use of the commercial and integrated markets.

Encourage Technology Transfer

Technology transfer with the segregated DTIB must be encouraged. Intra-firm technology transfer in companies that conduct both commercial and defense operations can be promoted by facilitating sharing of labor, management, research centers, and other resources.

Firms and public sector organizations that do only defense work, are probably limited to industrial sector-level technology transfer, via consortia, standards bodies, shared test facilities, etc.

■ Benefits of a Reform Strategy

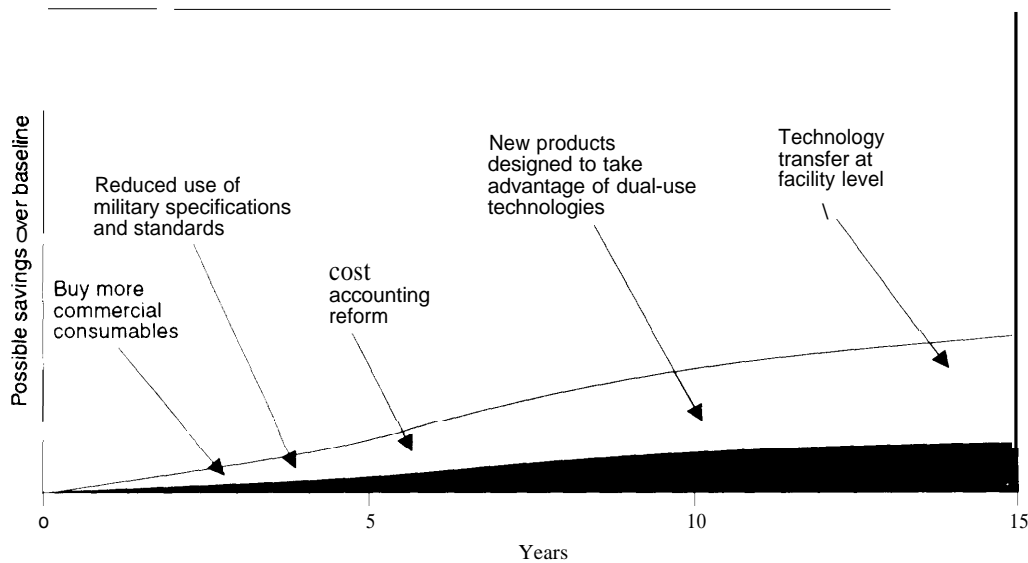
The policies outlined above have a number of potential benefits, including cost savings, technology transfer, and crisis responsiveness.

Reform Strategy savings will come from increased use of commercial products, lower overhead costs in integrated and segregated facilities, higher production volumes in integrated firms, expanded adoption of commercial buying practices, and a further reduction in numbers of government DTIB personnel.

Savings from increased commercial purchases, just as in the Readjustment Strategy, will not be immediately evident. (See figure 2-3.) Commercial purchases may increase gradually over the first several years after implementation, although because of the increased volume, savings should be more immediate than under a Readjustment Strategy. Development of dual-use technology and systems may begin to influence savings in the mid-term (3-5 years). Integration of processes and redesigning with cost and manufacturability as key criteria are likely to further reduce costs in the medium term. But any savings related to new programs are likely to begin only in the longer term (8-10 years) and can be affected by the expected reduction in new starts.

OTA developed a table of possible savings in the private sector DTIB based on assumptions about the potential savings related to CMI policies discussed in chapters 4, 5, and 6 and the estimated change in total CMJ derived from OTA's industry

FIGURE 2-3: Phased Impact of a Reform Strategy



SOURCE Office of Technology Assessment, 1994

survey. The proposed policies used for the survey correspond to those in a Reform Strategy. While the table does not provide a definite estimate of savings, it does bound the range of potential savings. Combined with other information, it can be used to better define likely savings. The data from the table are shown graphically in figure 2-4.

Overall, savings from a Reform Strategy (including those private sector savings derived from the Readjustment Strategy) might yield private DTIB savings ranging from 0 to about 17 percent, a range we believe shows the limits of the potential returns from the policies discussed. While it is possible that savings in the segregated portion of the base might exceed 10 percent, average savings from past commercial purchases are estimated by some in DOD to be closer to 10 than 30 percent. Thus, even with far greater expected savings from the segregated base, total estimated savings from the private sector DTIB are likely to stay well within the boundaries described in figure 2-4.

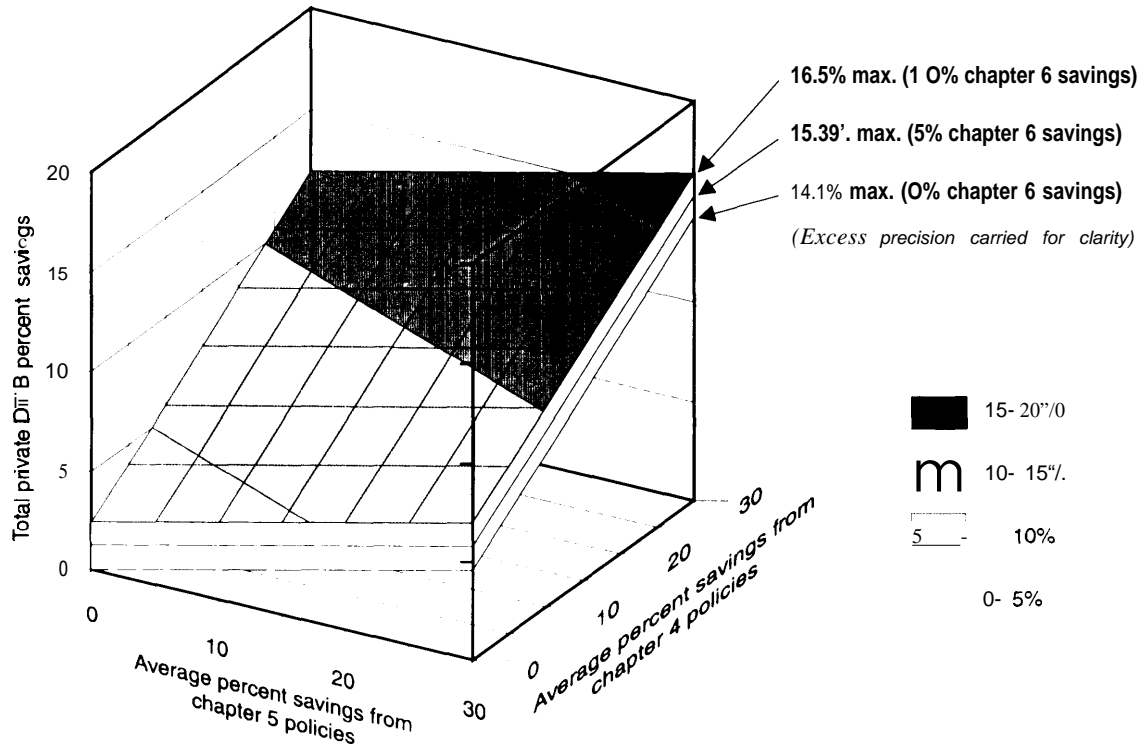
Applying DOD estimates of a possible 10-percent average savings on commercial purchases, a 15- to 20-percent average savings from integrated

processes (a figure that many observers believe is too high), and a 10-percent savings in the segregated portion of the base might provide overall savings of 5 to 10 percent of private sector DTIB spending. In the future base such estimates might produce savings of \$5 to \$10 billion per year. Less optimistic estimates would, of course, result in lower estimates.

Additional savings not included in figure 2-4 might come from reductions in personnel, resulting from reduced oversight requirements. Another \$1.5 to \$2 billion in savings might be possible over the long term.

Further personnel savings might be achieved by eliminating redundancies between the private and public sectors of the DTIB, e.g., closing government research, development, testing, and engineering, and maintenance facilities. These reductions might begin 2 to 3 years after implementation, but could take 8 to 12 years or longer to complete. Congress has been reluctant in the past to close public facilities.

FIGURE 2-4: Potential Total Private DTIB Savings at the Facility Level



SOURCE Office of Technology Assessment, 1994

Other Benefits

A Reform Strategy should expand direct technology transfer at the firm and facility levels between the DTIB and the CTIB. At a minimum, opportunities will grow for spin-on from the CTIB to the DTIB and spin-off from the DTIB to the CTIB. Broadening the use of business-like approaches and technology transfer as part of a Reform Strategy could also strengthen producers of militarily unique goods and services.

A Reform Strategy is likely to result in a larger—perhaps global—mobilization base, given the increased number of firms that engage in defense-related production. Promotion of flexible and agile manufacturing would further expand the number of potential defense suppliers.

Finally, a Reform Strategy could enhance U.S. global economy competitiveness. Integrating the

entire NTIB means that the benefits of research and development in manufacturing, information management, and specific product technologies are widely shared across U.S. industry. Elimination or reduction of the redundancies between the DTIB and the CTIB will leverage funds, resources, facilities, and highly trained personnel.

Disadvantages of a Reform Strategy

Together with significant benefits, a Reform Strategy has some drawbacks. These include the cost of training and/or recruiting new acquisition personnel; increased costs for some products or services; greater risk of fraud and abuse of public funds; potentially lower quality for some military items; the possibility of job loss; and risks of proliferation of defense technologies to other countries.

OTA did not attempt to quantify the costs and risks. While they are real, they appear to be far lower than are the potential benefits of pursuing a Reform Strategy.

The possibility of lower quality items and a resulting combat failure is the most worrisome, but those advocating change argue that commercial specifications and standards should only be used in cases where they meet performance requirements. Adherence to this standard should avoid this problem.

The potential for greater fraud and abuse of DOD funds, for example, is difficult to estimate. Many observers argue that the current system is not particularly protective of government funds. Since it was imposed, in part, in reaction to egregious cases of fraud and abuse, however, removal of such controls may lead to more such cases.

Reform policies will likely result in a shift in employment away from traditional defense companies and public facilities and toward commercial firms. Some defense firms will not be able to make the transition. The ongoing consolidation within the defense industry would suggest that the private sector is already taking actions to cope with the changing environment.

Socioeconomic programs may be negatively affected if efforts are not made to find less intrusive ways to promote these goals.

Finally, new policies might increase proliferation of advanced technologies to third parties. If weapon technology is merged with commercial technologies, then exports of advanced commercial technologies could offer other states access to U.S. weapon technology.

STRATEGY THREE: RESTRUCTURING

The third CMI strategy, **Restructuring**, might achieve an even higher level of CMI. This strategy would not only restructure the DTIB, but would also change military force structure and weapon systems to take advantage of developments in the DTIB. Due to its encompassing nature, a Restructuring Strategy carries a greater degree of risk.

A Restructuring Strategy assumes that the policies associated with Readjustment and Reform

have been implemented. A Restructuring Strategy involves extensive rationalization and privatization of the public and private sector DTIB, changing requirements for military systems forces, and progress toward what might be termed complete commercialization of the base.

■ Which Future?

The changing nature of warfare will influence the use of the DTIB to support military requirements, and the nature of any Restructuring Strategy. If future security threats are similar to those of the past (e.g., direct military threats from nation states), then there may be fewer opportunities to radically alter either the shape of the DTIB or military requirements. DOD might, however, still benefit from further CM I as a means of extending scarce dollars.

Alternatively, a decline in major military threats to U.S. interests could promote a fundamental reorientation of military forces away from traditional war-fighting and toward different missions, including peacekeeping and humanitarian assistance. Under such a reorientation, the armed forces might need to be differently equipped, organized, and trained. Light, versatile capabilities might take precedence over heavy, durable, sustainable ones. The requisite DTIB might then be materially different and, possibly, more similar to its commercial counterpart.

Between these two extremes lies a variety of potential futures, requiring a DTIB with varying amenability to CMI.

Tighter restrictions on conventional arms exports could have a significant impact on an industrial base that now depends on overseas sales to sustain important capabilities. The denial of such markets might even precipitate changes in requirements and increase CMI.

Concepts of future military operations also have implications for our industrial posture. Reducing human presence on the battlefield, for example, suggests a concentrated pursuit of such technologies as autonomous vehicles, robotics, and extended-range smart munitions.



Future military operations, such as those depicted here, will probably mix new and old military equipment. A strong CMI strategy might have a significant effect on the nature of that equipment

Technology trends and choices will also have a significant effect on the nature of future conflict and the DTIB. Technological advances and diffusion are likely to accelerate in the future, with potentially profound effects on the technology life cycle—from concept origination to product obsolescence. Process technologies, for example, will increasingly accommodate integrated processes.

■ Rationalize and Privatize the DTIB

Some rationalization of public and private R&D, production, and maintenance activities occurs un-

der both the Readjustment and Reform Strategies. A Restructuring Strategy would pursue rationalization to the maximum extent possible, with the goal of relying on private-sector capabilities.

Some countries, Japan and Germany for example, depend almost entirely on the private sector for maintenance and support. Japan turns to the private sector for R&D. The United States might adopt this position.

DOD could promote the consolidation of the defense support infrastructure around private, rather than public, entities. Less controversial within the military, but perhaps more so in Congress, would be the elimination of most of the public sector military support infrastructure and its replacement by private contractors. The most obvious savings might come from privately run maintenance depots and air logistics centers, but there are numerous other services that might be spun off from DOD, including transportation and inventory control.

At the extreme, DOD could contract with a private company to handle defense procurement. While on its face this seems a questionable approach, the Nation has done precisely this with much of the U.S. nuclear arsenal. The Department of Energy has provided overall funding and general guidance for the national laboratories, and relied on the laboratories to design, develop, and produce the Nation's nuclear weapons. Indeed, it is the laboratory director, and not a government official, who certifies the reliability of nuclear weapons and the nuclear stockpile.²⁶

One advantage of having a private contractor fulfill this role is the private sector's ability to attract the best and the brightest of America's talent through its flexibility in management, personnel practices and pay. A private contractor is better positioned than a government agency to size itself efficiently according to the workload.

²⁶ It should be noted that this approach appears to have worked well with regard to the development of the nuclear stockpile, but possibly less well with regard to the overall running of the laboratories and their full range of missions.



Rocket artillery is widely used by the United States and other nations

■ Restructure the Military Forces and Weapons

Restructuring portions of the military itself would provide opportunities to increase CMI dramatically. Some of these changes would be relatively minor and easily acceptable. Others would be far-reaching and extremely controversial.

Just as individual weapon systems can be designed to take advantage of commercial or integrated components, parts, hardware, or services, the armed forces themselves could be configured to take maximum advantage of commercial goods and services. During the 1970s, the Army's 9th Infantry Division experimented with many commercial products (e.g., dune buggies with mounted anti-tank weapons) and examined alternative ways to employ off-the-shelf equipment. New weapons that are more amenable to integration (e.g., rocket artillery launched from tubes commonly available in industry, or standoff bombers built around commercial airlines airframes) might replace more militarily unique

hardware (e.g., tube artillery or penetration bombers).

The opportunities for such shifts in force structure will increase in coming years as older weapon systems and equipment become obsolete and need to be replaced. Replacement decisions could be heavily influenced by an understanding of the commercial market. DOD already requires procurement officers to examine alternative tactics and nondevelopmental items (including commercial items) before initiating a new militarily unique development project. Similarly, DOD planners might use CMI as one factor when reallocating roles and missions among the Services.

■ Move Toward Complete Commercialization

Finally, the acquisition process might be completely redirected by abandoning efforts to apply special rules to defense contracts. (See box 2-2.) Instead, DOD's procurement agency (whatever form it might take) would buy its goods and ser-

BOX 2-2: Alternative Acquisition Approaches: the French and Japanese

The French and Japanese defense acquisition systems differ significantly from that of the United States. France possesses one of the five largest defense industries in the world. It is the only European power currently producing the full range of advanced military weapon systems from fighter aircraft to nuclear-armed and -powered submarines. Japan, too, has a substantial arms industry that produces advanced weapon systems. The Japanese effort is supported by the world's second largest economy and a technologically sophisticated, consumer-oriented industrial base.

The French Ministry of Defense obtains its defense goods and services via a centralized procurement agency, the General Delegation for Armaments (DGA). The French government owns directly or indirectly nearly four-fifths of its defense industry. The French DTIB is consolidated: the manufacture of fighter aircraft, armored fighting vehicles, and aircraft engines are each the responsibility of a single company, Dassault Aviation, GIAT Industries, and SNECMA, respectively. Government ownership provides these industries with a degree of multiyear funding stability not found in the commercial market or in the U.S. defense market. In fact, the Ministry of Defense has virtually *carte blanche* in the allocation of resources, as the French Parliament has no line-item authority over the defense budget.

The Japan Defense Agency (JDA) procures its weapons entirely from Japanese private corporations, whose main focus is commercial. Unlike the French, or even the United States, there are few government-owned or operated facilities, and no government-owned weapon manufacturers. There is, however, considerable concentration within the DTIB. Defense production is almost entirely in the hands of the largest Japanese *keiretsu* (conglomerates), including Mitsubishi Heavy Industries and Mitsubishi Electric Corp. Firms specialize, and often expect to be awarded certain contracts.

Procurements are managed by a central procurement authority. Procurement requests for equipment come from the JDA, with the blessings of both the Ministries of Finance and of International Trade and Industry. Priorities in Japanese defense production are determined and influenced at least as much by the agendas of the Ministry of International Trade and Industry (MITI), individual corporations, and the powerful Japanese Federation of Economic Organizations (Keidanren), as by the JDA. These organizations are gen-

vices like any other large commercial customer. Many large commercial customers manage to operate effectively, despite having little direct insight into the cost accounting of their vendors. DOD could observe these businesses, see how they determine the relative value of specialized items with little or no available market price information, and apply these lessons to its own procurement activities.

■ Benefits of a Restructuring Strategy

A Restructuring Strategy represents a significant departure from DOD's acquisition approach since the end of the Second World War. The more radical elements in this strategy hold the promise of major savings and benefits. In particular, it may be possible to derive savings from heightened effi-

ciencies within the newly privatized portions of the DTIB, from increased use of commercial goods and services within DOD itself, and from use of CMI as a factor in the requirements process.

Cost savings derived from the Restructuring policy options depend on the mix applied. A 60-percent reduction in the public sector R&D, production, and maintenance workforce might result in an estimated \$9 billion in yearly savings—some significant portion of which might be due to CMI. Savings over time are illustrated in figure 2-5.

■ Disadvantages of a Restructuring Strategy

Restructuring the DTIB would be costly and entail risks of failure in implementing these radical al-

BOX 2-2 continued: Alternative Acquisition Approaches: the French and Japanese

erally more interested in the development and commercial exploitation of new technologies than in developing advanced weapons. A major focus of Japanese defense procurement is thought to be the utilization of defense contracts as a means of facilitating the development of advanced technologies, particularly those with commercial or dual uses.

Both France and Japan accord other priorities to their arms industries beyond the production of the most advanced weapons possible. For the French, ensuring that the French arms industry remains viable, primarily through the development of weapons that are affordable for both the French military and the international arms market, is a high priority. In the Japanese case, the interest is in the development of high technology. The attendant manufacturing processes appear to have as much importance as the creation of advanced military capabilities.

In general, neither the French nor the Japanese DTIB possess the array of regulatory and legislative barriers that compel the segregation of the U.S. DTIB from the CTIB. Commercial processes, technologies, components, and practices are applied to defense goods, and commercial and defense goods are often developed and, where possible, produced side-by-side. But the DGA and the JDA often rely on administrative means rather than competition, to control cost and quality. These measures include fixed price and cost-plus contracts for militarily unique systems. In contrast with the United States, both the French and Japanese armaments industries enjoy close relations with their governmental customers. Indeed, in neither France nor Japan do government and industry engage in the same degree of adversarial relations that have marked the United States' government-industry relationship.

SOURCES: George K. Krikorian, American Defense Preparedness Association, *Analysis of the Weapons Acquisition Process of Selected Foreign Governments (France, United Kingdom, Germany, Israel)* for the Acquisition Law Advisory Panel (Washington, DC: Department of Defense Systems Management College, 1992); U.S. Congress, Office of Technology Assessment, *Lessons in Restructuring Defense Industry: The French Experience*, OTA-BP-ISC-96 (Washington, DC: U.S. Government Printing Office, June 1992); U.S. Congress Office of Technology Assessment, *Integrating Defense and Commercial Industry: The Chinese and Japanese Experience* (Washington, DC: U.S. Government Printing Office), forthcoming.

alternatives. There are threats to the effectiveness of U.S. forces in the field, the viability of the mobilization base, potentially greater vulnerability to foreign embargoes, and the possibility of proliferation of sensitive technologies.

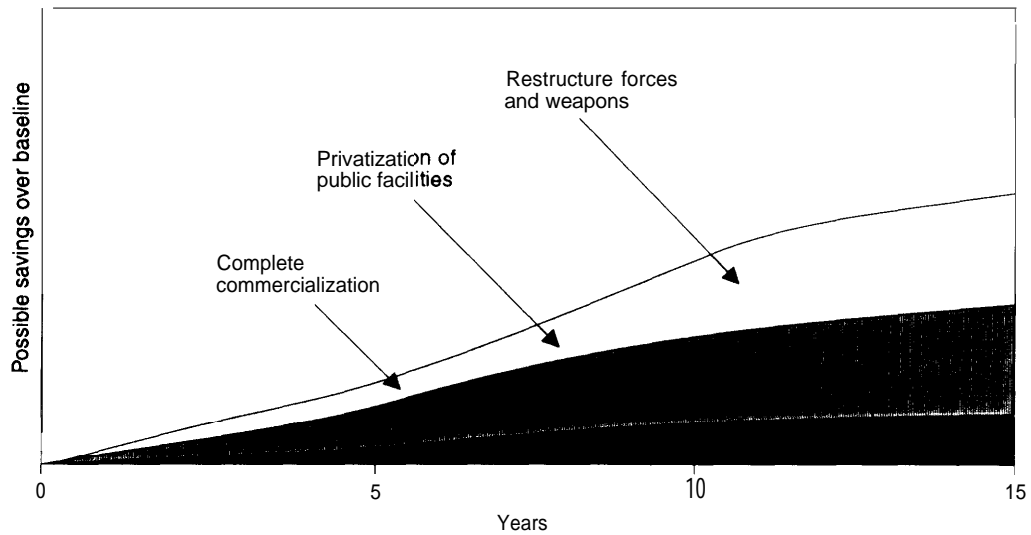
The most serious risk is that commercially available weapons and restructured forces may not meet the challenge of future conflicts. A restructured DTIB may no longer give forces the same qualitative edge they now enjoy. The current acquisition process pushes the edge of the technological envelope, although at significant cost. Restructuring the armed services to take maximum advantage of CMI may well gain economic efficiency at the price of technological superiority.

Second, privatization of purchasing may eliminate controls needed to avert waste, fraud, and

abuse of public funds. Third, eliminating all redundancies between the private and public sectors may leave DOD with insufficient expertise to be a smart buyer. Fourth, closing bases and terminating personnel will not be cost-free. Further, while the size of the mobilization base may expand with commercialization, the mobilization base may become more fragile. If key components, products, or processes must be sourced abroad, they may be inaccessible to the United States in a crisis.

Finally, even more than in the Reform Strategy, the Restructuring Strategy holds the possibility of increased proliferation of advanced technologies to potentially hostile countries and organizations. While this may not be a problem with regard to controlled technologies (e.g., nuclear weapons

FIGURE 2-5: Phased Impact of a Restructuring Strategy



SOURCE Off Ice of Technology Assessment, 1994.

design), it may become a real threat in the case of dual-use items. Relatively advanced--and previously limited--technologies, such as miniaturized electronics and hardened guidance systems,

might become available to pariah or unstable states. U.S. forces could find themselves opposed by forces equipped at an equivalent technological level.