

GAO

Report to the Chairman, Subcommittee  
on Oversight of Government  
Management, Committee on  
Governmental Affairs, U.S. Senate

July 1993

# ACQUISITION REFORM

## Contractors Can Use Technologies and Management Techniques to Reduce Costs



---

---

**National Security and  
International Affairs Division**

B-207974

July 15, 1993

The Honorable Carl M. Levin  
Chairman, Subcommittee on Oversight  
of Government Management  
Committee on Governmental Affairs  
United States Senate

Dear Mr. Chairman:

In the face of defense industry downsizing, the Department of Defense (DOD) is planning to expand the potential of the defense industrial base by encouraging contractors to use modern manufacturing technologies and innovative management techniques. As requested, we assessed the potential for defense companies to reduce their work-in-process costs through the use of these technologies and techniques. Such actions benefit the government because the government often pays for all or most of the work-in-process costs—the inventory, labor, and related overhead costs incurred during the manufacturing process.<sup>1</sup>

For a group of defense and commercial companies, we compared the cost reduction efforts of defense companies with those of selected commercial companies identified in the financial and technical literature as having used innovative technologies and techniques.<sup>2</sup> We identified those that had achieved cost reductions resulting in significant savings and their motivation for taking these actions. We also considered the role that government policies and programs can have in encouraging these efforts.

---

**Background**

To protect or increase market share and sustain profitability in the long term, companies may seek to reduce their overall costs. By using modern manufacturing technologies and innovative management techniques, companies can reduce costs by shortening the time to manufacture a product, decreasing defects, improving quality, reducing inventory, and so forth. (App. I describes some of these technologies and management techniques.)

---

<sup>1</sup>On cost-type contracts, DOD can reimburse contractors for all incurred allowable costs on a monthly basis. On qualifying fixed-price contracts, DOD can reimburse contractors through progress payments amounting to 85 to 100 percent of allowable incurred costs each month.

<sup>2</sup>In this report, we refer to both corporate and segment levels as companies. Also, a defense company sells large amounts of its products to DOD; a commercial company, on the other hand, sells most of its products to non-defense customers.

---

Because companies generally need to pay work-in-process costs before they receive cash for products sold, companies obtain financing for much of these costs. They can use debt and equity as sources of funds to finance these costs, or they can obtain financing from their customers, which may take the form of advance or milestone payments. For defense companies, DOD can finance all or most of the work-in-process costs. Generally, as work-in-process costs are lowered, financing requirements are reduced and overall costs can also be reduced on future contracts, resulting in savings to the government.

---

## Results in Brief

The potential exists for more defense companies to make significant work-in-process cost reductions by incorporating more efficient manufacturing technologies and innovative management techniques. Of the 24 defense companies surveyed, 3 had instituted these more efficient techniques and practices and had achieved reductions comparable to the 3 commercial companies we visited. The common motivator for these six companies was a competitive market. Savings to DOD from such cost reductions can be significant. One of the defense companies reported reducing work-in-process costs by \$80 million and passing the savings on to the government.

In general, competitive market forces may not be sufficient to motivate defense companies that produce nonstandard weapons and equipment to significantly reduce their work-in-process costs. In this environment, most defense companies have not significantly reduced their costs. One reason is that cost reductions can reduce reported profits. In addition, many defense companies receive government financing which may not encourage companies to reduce costs. Accordingly, to the extent that competitive market forces do not operate in the defense industry to compel cost reduction efforts, defense companies will be less likely to aggressively pursue such actions if doing so reduces profits in the near term.

DOD has established programs that have played a limited role in motivating companies to reduce costs. DOD officials stated that they were committed to acquisition reform which will reduce the differences between commercial and military business practices that may be counterproductive toward a company's efforts to reduce costs. Significant progress in this area will require DOD to stimulate contractors' cost reductions through several policies and programs, not merely those which focus on manufacturing technologies.

## Modern Technologies and Innovative Management Practices Can Significantly Reduce Costs

Of the 24 selected defense companies, 3 had reduced work-in-process costs and obtained other benefits comparable to those achieved by 3 commercial companies. The defense companies that had significantly reduced work-in-process costs included one whose sales were entirely to DOD and two whose sales shifted recently from largely DOD to largely commercial customers. The cost reductions achieved by the six companies ranged from \$21 million to \$427 million. The companies accomplished the work-in-process cost reductions by employing various modern manufacturing technologies and innovative management techniques that shortened cycle time and by making efficient use of inventories, as indicated by their inventory turnover ratio.<sup>3</sup> Increases in inventory turnover ranged from 35 to 119 percent. The companies adopted new manufacturing technologies and management techniques to protect or increase their market share and improve their long-term financial health. The following sections provide details on the results and benefits achieved.

### Companies With Sales to DOD

All 24 defense companies we visited employed modern manufacturing technologies and management techniques to some degree. Several defense companies reported notable improvements in two or more of the following: improvements to work-in-process levels, increased inventory turnover, and shortened cycle times. However, only one of the defense companies with sales primarily to DOD could demonstrate significant savings to the government at this time.

The one defense company that had significantly reduced its work-in-process costs, comparable to the best commercial companies, did so when faced with loss of business to a competing firm. We were told that this defense company, with annual sales of \$300 million from DOD, lowered work-in-process costs by \$80 million over 2 years. Through the use of such methods as cellular manufacturing,<sup>4</sup> this company reported reducing cycle time for four of its major defense programs by over 30 percent and doubling inventory turnover in about 2 years. Actual labor hours were reduced, resulting in direct savings to the government on future contracts. Other benefits included improved quality and decreased defects.

<sup>3</sup>Inventory turnover can be calculated by dividing cost of sales by average inventory. A consistently high inventory turnover over a period of years may indicate an efficient use of inventories.

<sup>4</sup>Cellular manufacturing is a process whereby similar parts are produced within a single line or cell of machines operated by machinists designated to work only within the line or cell.

---

However, according to company officials, the work-in-process cost reductions lowered the company's reported profits by \$15 million. The profits declined because the contractor had not reduced overhead<sup>5</sup> commensurate with the reductions in direct labor costs. Overhead had been allocated to government contracts based on direct labor hours. When direct labor hours were reduced, less overhead was reimbursed by DOD. The portion of overhead not charged to DOD contracts reduced the company's reported profits in the near term. However, the company believes that reducing work-in-process costs will ultimately increase future profits and sales by making the company more competitive.

If employing modern manufacturing technologies reduces a company's near-term profits and requires companies to reduce their overhead billings, this may explain why other companies, even in an era of declining defense budgets, may not be motivated to achieve maximum reductions in work-in-process costs.

---

### Companies With Sales to Commercial Customers and DOD

Two aerospace manufacturing companies, whose business mix shifted from mostly defense to mostly commercial, significantly reduced their work-in-process costs. One company reduced work-in-process costs by \$158 million in about 3 years on sales of \$7.5 billion, according to company officials. Because of increasing competition and financial concerns, this company reduced work-in-process costs by such methods as establishing process improvement teams and reorganizing the factory floor. Officials said that by grouping similar parts for production along a "flow line" concept, the company reduced the movement of parts across the factory from 6 to .25 miles. The company also achieved results by shortening total cycle time from about 60 weeks to 40 weeks through such initiatives as statistical process control, synchronous manufacturing, and lot size reductions. Additional benefits included increasing inventory turnover by over 50 percent and reducing total inventory, saving over \$500 million in a few years. Company officials believe that these actions will increase future profits and sales by making the company more competitive.

Faced with competition, the other aerospace manufacturing company reported reducing its inventory levels at its production operation by \$427 million over 4 years. Inventory levels were lowered through the use of "process mapping," or flowcharts, that identify all steps in the

---

<sup>5</sup>A substantial portion of the allowable costs in DOD contracts consists of overhead and general and administrative expenses. These costs are not directly assigned to particular contracts. They are costs associated with supporting the production activities, performing the general day-to-day management of the business, and supporting those activities necessary to obtain new business.

---

manufacturing process. Specially organized teams used this technique to rearrange equipment to achieve a more continuous flow of parts through the factory. These changes resulted in shortening cycle time by over 60 percent for one process and increasing inventory turnover for the production operation by 35 percent. Company officials said they believe reduced inventory costs will offset increased debt and financing costs associated with its commercial work.

---

### Companies With Sales to Commercial Customers

Three commercial companies, faced with increasing competition, significantly reduced their work-in-process costs. One of these commercial companies reduced inventory levels from \$1.9 billion in 1984 to \$1.6 billion in 1991 while more than doubling its revenue, according to company officials. The inventory management improvements were accomplished through a sequential application of (1) inventory control systems, such as manufacturing resource planning and (2) manufacturing techniques and concepts, including just-in-time and total quality control. In addition, in a 7-year period ending in 1991, inventory turnover increased by 119 percent, which an official said contributed to freeing up at least \$500 million in cash for the company. These actions will allow the company to protect or enhance market share and increase profitability.

Another commercial company reported reducing its work-in-process costs by \$30 million over 2 years. The company lowered work-in-process costs primarily by instituting a just-in-time technique called "direct line flow," whereby similar tasks and products are grouped together in a logical progression across the factory floor. This approach required the company to rearrange the factory floor, which decreased movement of parts and subassemblies. Also, by moving from mass to low unit production, the company reduced the number of units in final assembly from five to two. Officials said that by incorporating these changes, the company decreased labor hours from 175,000 to 35,000 and shortened total cycle time required to build each unit from 18 to 10 months. The company also increased inventory turnover by 40 percent.

The third commercial company, with annual sales of \$4.8 billion, implemented such actions as just-in-time management. Company officials said that these changes reduced inventory levels by \$21 million and increased inventory turnover by 50 percent at its largest operation and shortened production cycle times by one-half at another unit. Reductions in total inventory have largely contributed to the company saving \$140 million. A company official said that these actions not only reduced

---

debt and production costs but also improved quality and increased market share.

---

## Market Forces May Be Insufficient to Motivate Defense Companies

Competitive market forces may not be sufficient to motivate defense companies to reduce their costs. DOD buys a number of goods and services that are not available in the competitive marketplace. The defense companies in our survey produce nonstandard items for military and space exploration that do not lend themselves to competitive market prices and, therefore, are purchased without the benefit of the competitive marketplace as the ultimate determinant of price. In this environment, DOD may not be able to rely on competitive market forces to motivate defense companies to significantly reduce their costs.

Competitive market pricing means that producers are able, over the long run, to deliver items to the customer at prices below the competitors' prices while remaining economically viable. In this environment, there is a very strong motivation for companies to reduce costs. However, as previously discussed, only 3 of the 24 defense companies significantly reduced their costs as a result of competition. Furthermore, two of these defense companies' sales shifted recently from largely DOD to largely commercial customers.

Defense companies operate in a different environment than commercial companies, especially in the area of financing. DOD can finance all or most of the work-in-process costs for large defense companies. According to DOD officials, commercial companies do not receive the same amount of financing from their customers. As a result, DOD officials stated that defense companies maintain a relatively smaller financial investment in a federal project than would companies having to obtain their own financing, which may be counterproductive toward motivating companies to reduce their work-in-process costs. For example, one of the defense companies that we visited, an aerospace manufacturing company whose business mix shifted from mostly defense to mostly commercial, was motivated to reduce its work-in-process costs when it was required to obtain more private financing. DOD officials stated that other government policies may also be driving counterproductive behavior by defense companies.



---

## DOD's Policies and Programs Not Adequate Motivators

DOD, in recognizing that competitive market forces may not be sufficient to serve as a motivator, established certain policies and incentive programs to further motivate defense companies to achieve cost reductions. DOD officials stated that the programs that they have tried in the past to motivate companies to achieve cost reduction have not always been successful. DOD is reexamining the way it conducts its business with defense companies to encourage lower manufacturing costs. As part of its acquisition reform efforts, DOD is looking at alternative means to motivate defense companies to achieve significant cost reductions, which will include a review of procurement regulations that relate to financial matters. The following describes some of the policies and programs that DOD has tried in the past to motivate defense companies to reduce acquisition costs.

DOD permits profit incentives to be negotiated and included in certain contracts when the required supplies and services can be acquired at lower costs and, in certain instances, with improved delivery or technical performance.<sup>6</sup> Incentive contracts provide contractors higher profits for better performance in prescribed areas, such as in motivating contractors to effectively manage costs. However, incentive contracts only represent about 20 percent of the negotiated procurement dollars. We were told that incentive contracts have typically not been used to motivate defense companies to use innovative technologies and techniques.

In addition, DOD's profit policy, which has evolved over the past 25 years, has been designed to motivate efficient and effective contract performance. DOD's current profit policy attempts to provide a preference for investments in equipment with cost-reducing potential. However, DOD has reported that investments in equipment usually are not recovered for a number of years and incurring such costs that will be recovered over a long term increases risks to future profitability, especially in the defense environment where programs can be reduced or eliminated from one fiscal year to the next. The application of the profit policy is intended to provide increased incentives for long-term productivity gains. However, we were told that the focus for most companies remains on maximizing profits in the near term.

---

<sup>6</sup>The two basic categories of incentive contracts are fixed-price incentive contracts and cost-reimbursement incentive contracts. Fixed-price incentive contracts are preferred when contract cost and performance requirements are reasonably certain. Cost-reimbursement incentive contracts are suitable for use only when uncertainties involved in contract performance do not permit costs to be estimated with sufficient accuracy.

Both the incentives in the profit policy and contractual incentives are applied on a contract-by-contract basis. However, our work showed that the companies that have achieved significant cost reductions typically achieved these reductions by making improvements on a factory-wide basis. To be effective, incentives on specific contracts would have to be sufficient to motivate defense companies to make improvements on a factory-wide basis.

DOD also has established certain incentive programs to achieve greater productivity and cost reductions. Two such programs, the Manufacturing Technology Program and the Industrial Modernization Incentives Program (IMIP), were designed to provide seed funds to elicit private sector investment in defense-related manufacturing when private industry has not committed funds for manufacturing technology on a timely basis in support of DOD requirements.

Recently, DOD has recognized that the management of the Manufacturing Technology Program needed to be strengthened and has attempted to improve the program. For example, to obtain funding in the future, Manufacturing Technology projects will require a clear statement of project goals, as well as the effectiveness measures by which those goals will be evaluated. The Manufacturing Technology programs in the military services are being consolidated within the Office of the Secretary of Defense.

IMIP was created to make improvements on a factory-wide basis, which include both well established and state-of-the-art technology. Under IMIP, incentives were provided to motivate a defense company to invest corporate funds which were intended to reduce acquisition costs. The concept was to negotiate a business arrangement benefiting both the company and the government, an arrangement that may not have been possible otherwise. The IMIP program has been criticized, in part, because the savings attributed to the program were not always validated. DOD officials stated that problems involved in validating the savings attributed to IMIP could not be resolved, that IMIP "wastes money on meaningless studies" to validate savings, and that IMIP could not ensure that the government pays only for modernization efforts that the contractor would not have done anyway. DOD canceled the program in fiscal year 1993.

Two large industrial associations have called for DOD to continue providing incentives for companies to improve their manufacturing processes. For example, the National Security Industrial Association has stated that the

---

Congress and DOD must sustain their support for the manufacturing programs in the services and IMIP . . . the Association has stated that the critical importance of manufacturing processes and techniques to ultimate defense force superiority and our overall economic vitality requires a strong emphasis upon this area of technology.

As part of the new administration's challenge in formulating its defense policies and programs, the Deputy Secretary of Defense has recently stated that the

defense industrial base has been decreasing at a faster rate than the defense budget, because budget cuts have been proportionately deeper in the procurement account than in the rest of the budget . . . The DOD has a cardinal interest in maintaining the health of the industry as it goes down in size . . . DOD can manifest this interest in two ways. First, it can encourage and facilitate the conversion process underway at some companies.<sup>7</sup> Second, it can shape its development and procurement programs to ensure that the residual defense industry maintains a minimal essential production capability.

The Deputy Secretary of Defense has stated that it will be necessary to make a major reform of the defense acquisition system. As part of these efforts to reform the acquisition system, DOD programs could be structured to play an increasing role in motivating defense companies to make cost reductions.

---

## Recommendation

The potential exists for defense companies to make significant cost reductions by incorporating modern technologies and innovative management techniques. However, competitive market forces may be insufficient to motivate defense companies to significantly lower costs, which can reduce reported profits in the near term. Further, defense companies operate in a different environment than commercial companies. We recognize that there are numerous factors that influence defense companies' behavior, and some of these are discussed in this report. For example, contract financing can be a key factor that influences defense companies' behavior. Significant progress in this area of acquisition reform will depend on DOD efforts to stimulate further contractor costs reductions through a reexamination of its various policies and programs. Accordingly, we recommend that the Secretary of Defense, as part of DOD efforts to reform the defense acquisition system, identify and eliminate to the extent possible the factors that result in defense contractors not incorporating appropriate technologies and management techniques to reduce costs.

---

<sup>7</sup>Offsetting the decreases in defense orders by developing and producing commercial products is sometimes called defense conversion.

---

## Agency Comments and Our Evaluation

In commenting on a draft of this report, DOD concurred with the recommendation. As part of its commitment to reducing acquisition costs, DOD stated that

- a reform effort will be undertaken to eliminate counter productive differences between commercial and military business practices;
- the effort will encompass the entirety of the business process, including accounting, finance, contracting, legal, marketing, and production considerations; and
- a Deputy Under Secretary of Defense (Acquisition Reform) has been established to identify and implement ways to improve the acquisition process.

DOD stated that the focus of our report is now an integral component of its reform effort. The comments are presented in their entirety in appendix II.

DOD's comments are responsive to our recommendation. We agree with the concept of a comprehensive acquisition reform effort that would eliminate counterproductive differences between commercial and military business practices and lead to reduced acquisition costs. We will review and monitor various aspects of this reform effort as a part of our continuing focus on defense acquisition issues.

---

## Scope and Methodology

To assess work-in-process management practices, we visited 27 companies—3 commercial companies, 2 companies' segments whose business mix shifted from mostly defense to mostly commercial, and 22 defense company segments. We focused on work-in-process and inventory management because the government finances most of the work-in-process costs and can benefit from the efficient management of these costs.

We selected commercial companies that had been identified in the financial and technical literature as having innovative technologies and techniques. We selected defense companies that had a large dollar volume of prime contracts with DOD and represented diverse industries, such as aerospace, electronics, ammunition, and so forth. The defense companies selected were among the top 50 prime contractors for 1990.

We obtained information from companies on specific actions taken to reduce work-in-process costs and the effect those actions had on reducing work-in-process costs and inventory levels and achieving savings.

---

Specifically, we asked the companies to provide information on work-in-process reductions and other benefits that resulted from their inventory management practices. We obtained company financial data, including inventory turnover ratios and other performance measures over a 5-year period. We analyzed the data for trends in overall company performance by assessing the improvements that companies made over time.

We also obtained and analyzed DOD data on the number and dollar amount of incentive contracts for 1985 through 1991.

We conducted our work between February 1992 and February 1993 in accordance with generally accepted government auditing standards.

---

We are sending copies of this report to the Secretary of Defense; other interested congressional committees; and the Director, Office of Management and Budget. We will make copies available to others upon request.

Please contact me at (202) 512-4587 if you or your staff have any questions concerning this report. Other major contributors to this report are listed in appendix III.

Sincerely yours,



Paul F. Math  
Director, Acquisition Policy,  
Technology, and Competitiveness Issues

---

# Key Manufacturing Technologies and Management Techniques Used at Selected Companies

---

**Cellular Manufacturing:** A manufacturing process that produces similar parts within a single line or cell of machines operated by machinists designated to work only within the line or cell.

**Computer-aided Design:** The use of computers in interactive engineering drawing and storage of designs.

**Computer-aided Manufacturing:** Use of computers to program, direct, and control production equipment in the fabrication of manufactured items.

**Just-in-Time:** A manufacturing concept based on planned elimination of all waste and continuous improvement of productivity. It requires successful execution of all activities from design engineering to delivery of the final product. Key components include having only the required inventory when needed; improving quality to zero defects; reducing cycle time by reducing lot sizes; and reducing costs.

**Manufacturing Resource Planning:** A method for effective planning of all resources of a manufacturing company.

**Material Requirements Planning:** A set of techniques that uses bill of material, inventory data, and a master production schedule to calculate material requirements.

**Statistical Process Control:** Monitoring a process by analyzing outputs using statistical techniques that provide feedback to be used in maintaining and improving process capability.

**Synchronous Manufacturing:** A manufacturing management philosophy that includes a consistent set of principles, procedures, and techniques where every action is evaluated in terms of the overall goal of the system.

**Total Quality Control:** The process of creating and producing the total composite product and services so that customer expectations will be met.

**Total Quality Management:** Interfunctional approach to quality management involving marketing, engineering, manufacturing, and so forth. The focus is on meeting customer expectations by preventing, detecting, and eliminating sources of defects. Quality control, quality planning, and quality projects are all part of total quality management.

# Comments From the Department of Defense



PRODUCTION AND  
LOGISTICS

ASSISTANT SECRETARY OF DEFENSE  
WASHINGTON, D.C. 20301-6000

JUN 09 1993

Mr. Frank C. Conahan  
Assistant Comptroller General  
National Security and International  
Affairs Division  
U.S. General Accounting Office  
Washington, DC 20548

Dear Mr. Conahan:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report "ACQUISITION REFORM: Contractors Can Use Technologies and Management Techniques to Reduce Costs" (GAO 396157/OSD Case 9318). The Department concurs with the recommendation made in this report.

Firms doing business with the Department of Defense tend to focus on being technologically competitive in terms of product, rather than process, because selections are made primarily on the basis of the superiority of the weapon. Firms doing business with the Government behave differently than those doing business solely in the private sector, in part because of factors like budget uncertainty, the form and substance of the contractual instruments, intense Government oversight, and the Federal Acquisition Regulations prohibition of reimbursement of interest expense on Government contracts.

The Department is committed to reducing acquisition costs. Toward that end, efforts will be undertaken to eliminate the counterproductive differences between commercial and military business practices and create an environment that is more similar to the commercial environment. The scope of that effort will encompass the entirety of the business process, including accounting, finance, contracting, legal, marketing, and production considerations. In addition to creating an environment where common business practices are the rule rather than the exception, the Department will make changes to keep up with common commercial engineering and manufacturing practices made possible through technology breakthroughs or demanded by environmental constraints.

---

**Appendix II**  
**Comments From the Department of Defense**

---

The enormous and comprehensive nature of this reform makes it impossible for the DoD to identify at this time the precise actions that will be taken. The first step, however, has already been taken. The Under Secretary of Defense (Acquisition) recently established the Deputy Under Secretary of Defense (Acquisition Reform) (DUSD(AR)) to identify and implement ways to improve the Acquisition process. The focus of the modified GAO draft report is now an integral component of the DUSD(AR)'s mandate.

Sincerely,



David J. Berteau  
Principal Deputy Assistant Secretary  
of Defense (Production and Logistics)



---

# Major Contributors to This Report

---

**National Security and  
International Affairs  
Division, Washington,  
D.C.**

**David Childress, Assistant Director  
Ralph C. Dawn, Assignment Manager  
David B. Best, Evaluator**

---

**Philadelphia Regional  
Office**

**James Przedzial, Evaluator-in-Charge  
Anne-Marie Lasowski, Evaluator  
H. Cheryl Rusten, Evaluator**

---

**Dallas Regional Office**

**Ronald Salo, Senior Evaluator  
John Clary, Evaluator**



---

### Ordering Information

The first copy of each GAO report and testimony is free. Additional copies are \$2 each. Orders should be sent to the following address, accompanied by a check or money order made out to the Superintendent of Documents, when necessary. Orders for 100 or more copies to be mailed to a single address are discounted 25 percent.

Orders by mail:

U.S. General Accounting Office  
P.O. Box 6015  
Gaithersburg, MD 20884-6015

or visit:

Room 1000  
700 4th St. NW (corner of 4th and G Sts. NW)  
U.S. General Accounting Office  
Washington, DC

Orders may also be placed by calling (202) 512-6000  
or by using fax number (301) 258-4066.

---

United States  
General Accounting Office  
Washington, D.C. 20548

Official Business  
Penalty for Private Use \$300

First-Class Mail  
Postage & Fees Paid  
GAO  
Permit No. G100

---