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Acquisition and Technology, Committee
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March 1998

BEST PRACTICES

DOD Can Help Suppliers Contribute More to Weapon System Programs





**United States
General Accounting Office
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**National Security and
International Affairs Division**

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March 17, 1998

The Honorable Rick Santorum
Chairman
The Honorable Joseph I. Lieberman
Ranking Minority Member
Subcommittee on Acquisition and Technology
Committee on Armed Services
United States Senate

As you requested, this report assesses whether best commercial supplier practices offer ways to improve the process the Department of Defense (DOD) uses to manage suppliers engaged in developing and producing major weapon systems. It also determines how differences in commercial and DOD environments for managing suppliers affect the corresponding practices. We make recommendations to the Secretary of Defense that are intended to help DOD improve the way it manages suppliers.

We are sending copies of this report to other congressional committees; the Secretaries of Defense, the Army, the Navy, and the Air Force; and the Director, Office of Management and Budget. We will also make copies available to others on request.

If you or your staff have any questions, I can be reached at (202) 512-4841. The major contributors to this report are listed in appendix II.

A handwritten signature in black ink that reads 'Katherine V. Schinasi'. The signature is written in a cursive, flowing style.

Katherine V. Schinasi
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Defense Acquisitions Issues

Executive Summary

Purpose

Leading commercial companies have found that more cooperative business relationships with suppliers have improved their ability to respond to changing business conditions. Such relationships have led to lower costs and have translated into higher quality, greater productivity, and shorter product design and delivery times. The Department of Defense (DOD) also faces difficult business conditions in that it must find ways to modernize its weaponry more economically, for it continues to state a need to modernize weapons at a faster pace. DOD has an opportunity to incorporate best supplier practices into the process it uses to acquire weapon systems. In doing so, DOD may be able to respond more quickly to technological changes with shorter cycle times, reduced costs, and improved weapon system quality.

The Chairman and the Ranking Minority Member, Subcommittee on Acquisition and Technology, Committee on Armed Services, requested that GAO assess whether best supplier practices can benefit weapon system programs. Specifically, this report (1) identifies best commercial practices for establishing, managing, and sustaining excellent supplier relationships and (2) compares these practices with those of DOD, selected prime contractors, and the supplier teams on two weapon system programs.

Background

The term “supplier” refers to a firm that provides goods or services that comprise part of a final product being made by another firm. On a complex product such as an aircraft or a weapon system, suppliers can number in the thousands and are categorized into different levels or tiers. For example, on a military aircraft program, the firm responsible for putting the complete aircraft together and delivering it to DOD—the final customer—is referred to as the prime contractor. The firms that supply components or services to the prime contractor comprise the first tier of suppliers. Firms that supply products to the first tier constitute the second tier of suppliers. The tiers continue until the products being supplied reach an elemental level, such as raw materials, rivets, and bolts. Suppliers are typically responsible for the majority of a complex product’s content, whether the item is military or commercial. Generally speaking, suppliers account for 50 to 80 percent of a major item’s value. Perhaps more importantly, much of the technical innovation incorporated into a new weapon comes from the suppliers.

To gain insights into the dynamics of contracting teams in an actual program situation and to obtain the supplier’s perspective, GAO conducted case studies of two munitions programs. One program was the Brilliant

Anti-armor Submunition, referred to as BAT, which is the older and more traditionally managed of the two programs. It is a self-guided submunition that searches for moving tanks and other armored targets that it is intended to track and destroy. The other program was the Joint Direct Attack Munitions (JDAM), which is a strap-on guidance kit that converts free-fall bombs into guided munitions. JDAM is one of seven congressionally authorized Defense Acquisition Pilot Programs that were afforded early statutory and regulatory relief to test methods for streamlining the acquisition process. The program has employed several acquisition reforms and has applied innovative supplier management techniques.

Results in Brief

The best commercial practices, when analyzed in the aggregate, can be seen as four traits that operate in a system that is self-sustaining because it provides mutual benefits to both the firm responsible for the final product and its suppliers. First, the leading commercial firms embraced effective supplier relationships as a core business strategy and built organizational structures with skilled people to carry out the strategy. Second, leading companies used a rigorous supplier selection process to create a strong supplier base that they could more effectively manage. Specific practices included use of stringent supplier selection criteria, reliance on a manageable number of suppliers, maintaining some level of competition between suppliers, and periodic supplier base assessments against company goals. Third, they established effective communications and feedback systems with their suppliers to continually assess and improve both their own and supplier performance. These practices not only helped the firms' goals, priorities, and performance assessments to be well understood by all key suppliers but also helped the suppliers' ideas and concerns to be understood as well. Fourth, the firms fostered an environment in which suppliers realized that more significant contributions were matched with significant rewards, which made suppliers more likely to invest their intellectual capital—their ideas—into the venture.

DOD and prime contractors were aware of such benefits and were implementing some of these practices. However, experience on the Brilliant Anti-armor Submunition program showed that it could be difficult to translate the desire for better supplier relations into tangible differences in the actual relationships among suppliers, prime contractors, and DOD. In the Brilliant Anti-armor Submunition program, the four traits did not comprise as powerful a system as was formed by the best commercial practices. Although practices found in the second and third traits—such as

supplier certification, ratings, and a forum for meeting with suppliers—had been adopted, their impact on the Brilliant Anti-armor Submunition was blunted by weaknesses in central support and a rewarding environment. The prime contractor's commitment to improved supplier relationships was not perceived by some key suppliers as much more than procedural changes. Some key suppliers did not feel they were encouraged to contribute to the product's design or that their extra efforts to innovate were encouraged. Consequently, their performance was strictly limited to compliance with contract requirements. On Joint Direct Attack Munitions program, a more rewarding environment was created for suppliers even though improved supplier relations was not an explicit program objective. Nonetheless, the actions taken by DOD on the program bolstered the support for supplier relationships and encouraged the suppliers to play a much greater role. Ultimately, the relationships with suppliers became central to the success of the acquisition reform initiatives being piloted.

DOD shares responsibility with the prime contractors for shaping the suppliers' environment. Thus, the role it plays on individual programs has a direct bearing on the sophistication of supplier relationships and the success of best supplier practices. The supplier relationships on the Brilliant Anti-armor Submunition program reflect DOD's traditional role of distancing itself from suppliers. This role can be traced, in part, to the fact that DOD has not articulated a particular supplier policy to guide program managers. By default, DOD's concerns over interfering with the contractual relationship between the prime and a supplier have encouraged an arms-length approach to suppliers by managers. Also, the Brilliant Anti-armor Submunition prime contractor believed that the system's requirements were made so specific by DOD that there was little opportunity to allow suppliers much voice in the design. DOD disagreed that it had exerted such control. On the Joint Direct Attack Munitions program, DOD was much more proactive and involved with the suppliers. Its pilot program mandate supported the program office's involvement in seeing that best supplier practices were used. As a result, high-performing suppliers were selected, all tiers of suppliers participated in meeting the program's priorities, and long-term benefits were offered to the prime contractor and its suppliers for good performance. The ultimate success of this approach in producing a weapon that will perform as required remains to be seen. Nonetheless, suppliers praised the approach for the relationships it fostered.

Principal Findings

Supplier Relationships Must Have Central Support

The commercial firms embraced effective supplier relationships as a core business strategy and built organizational structures with skilled people to carry out the strategy. For example, Chrysler is organized into several product platform teams such as for large cars, small cars, and trucks. The platform teams developed strategies for each product, coupled with commodity strategies that defined which product components were to be purchased from which suppliers. These teams linked business objectives and performance factors with supplier relations. In so doing, they replaced supplier relationships previously forged by individual business units. The companies also created purchasing organizations to support their supplier management strategies. It is a major undertaking for a firm to commit the resources to implement an active supplier policy. Such a commitment is not based on altruism or a management theory; rather, the commitment comes from the desire to maintain a competitive edge.

While commercial firms can act unilaterally to garner better relationships with their suppliers in weapon programs, DOD shares the responsibility for directing the programs with the prime contractors. Thus, if DOD does not encourage improved supplier relationships, the prime contractors may not have as strong an incentive to adopt best practices. According to DOD officials, the traditional concern for violating privity of contract has distanced DOD and its program managers from supplier management concerns. Privity refers to the direct relationship between the parties to a contract. Thus, there is privity between DOD and the prime contractor but not between DOD and the prime contractor's suppliers. However, experience with JDAM shows that privity of contract concerns do not prevent a program manager from taking a more active role in prime and supplier selection. This more active approach during the competitive development phase set the expectation from the outset that supplier management would figure prominently into JDAM's success and DOD's selection of the prime contractor. For example, DOD program officials used the actual performance of the suppliers and the prime contractors during a competitive development phase as a key factor for choosing the prime contractor and supplier team that would complete development and enter production.

Rigorous Supplier Selection Creates Strong Supplier Base

By concentrating on proven suppliers meeting stringent selection criteria, the leading commercial companies limited the number of suppliers, thereby reducing internal resources needed for supplier management and oversight. Over a decade, Varian Oncology Systems reduced the number of its production suppliers from 1,100, which it considered unmanageable, to 345. The companies selected suppliers using specific assessment methods, such as certifications and quality audits that identified the total cost of doing business, not just the sales price of the supplied product. Total cost includes tangible factors, such as quality, and intangible ones, such as effective communications. For example, DuPont assessed a supplier's technology edge, as well as price and the cost to the company if the supplier failed. While building closer relationships with fewer suppliers, the companies included enough suppliers to ensure there was competition and a back-up source.

Several defense contractors had reduced the number of suppliers and established criteria for selecting the best suppliers. Since 1991, AlliedSignal Aerospace has reduced its supplier base from over 10,000 to less than 3,000. Also, DOD has placed new emphasis on using best value, which calls for using broader criteria than lowest price for selecting contractors. Best value can include criteria such as quality and a firm's performance on past contracts. Prime contractors had begun using best value in selecting suppliers, but some believed that price was still DOD's main concern. Officials from one firm said that there was resistance at the lower levels of the services to applying best value.

The BAT program experienced turnover in some key suppliers, suggesting difficulties in the selection process. One supplier we met with was the third source chosen for that component, after two lower priced suppliers had faltered. Another supplier was changed because program requirements had been revised. In contrast, the DOD program office's involvement helped guide the selection of JDAM suppliers. As a result of the DOD teams including key suppliers as part of their assessment of the prime contractors, one of the prime contractors later selected two new suppliers after asking the DOD teams to recommend better performers. DOD offered its advice, but did not mandate changes in the choice of suppliers.

An Effective Communication and Feedback System Must Exist

Leading commercial firms established a framework for communications with their suppliers that allowed for continuous feedback to improve the performance of both parties. Suppliers knew whom to discuss suggestions or problems with because they had a single, authoritative point of contact.

Key suppliers were often included as members of teams and shared in decision-making and design ideas. The companies' attention extended to performance of lower-tier suppliers primarily through communication with first-tier suppliers. The companies' own commitment to optimal supplier relationships helped them to look for and expect the same commitment from their own suppliers. In other cases, companies took a more "hands on" approach; Chrysler worked with first tier suppliers to jointly manage lower-tier suppliers, extending all the way to the raw material stage. The leading companies interacted with key suppliers in close teaming arrangements that facilitated sharing information. Commonly called integrated product teams, members worked together so that design, manufacturing, and cost issues were considered together. Instead of a hierarchy, team members were encouraged to participate as partners in meeting project goals and to interact frequently. Some companies colocated suppliers with their own people or set up central working facilities with suppliers.

The companies regularly provided suppliers with feedback on their performance. Performance was assessed formally through periodic reports and informally through team participation. For example, Plow and Hearth provided suppliers with a quarterly performance summary that supplemented weekly meetings on supplier issues raised by merchandising, product returns, and inventory control staff. When problems were identified, the company and the supplier worked together to develop corrective actions. The companies provided technical assistance to their suppliers to help improve performance. Companies also solicited feedback on their own performance as a customer, recognizing the importance of being a "preferred" customer of the top suppliers.

Most prime contractors said that they had processes for setting performance expectations, assessing performance, and providing feedback. All of the prime contractors were using integrated product teams. For some BAT suppliers, the presence of commercial-like mechanisms like these, by themselves, did not improve supplier relationships. Some suppliers believed that engineers made design decisions without considering cost and schedule considerations. One supplier said that its concerns over the cost and producibility of its own component were ignored in the program's production readiness assessment and cost estimate. It noted that technical assistance personnel was sent by an upper-tier firm, but did not have the expertise to offer in solving problems. JDAM suppliers were uniform in describing the program as structured in a way that encouraged communication. A key factor was

how integrated product teams were employed from the beginning—including the design phase—with DOD closely involved. DOD helped create this situation by requesting team plans as part of the original request for contract proposals.

A Rewarding Environment Is Key to Fostering the Best Supplier Relationships

The best practices were sustained when a commercial firm created an environment in which it became an attractive customer. Firms did this by not only rewarding superior suppliers with future business but by building partnerships, allowing top suppliers to participate in product planning and design, sharing business plans, and relaxing the procedures for doing business together. Not all suppliers enjoyed these sophisticated relationships—commercial companies made distinctions in how they worked with different suppliers. In turn, the key suppliers were willing to go the extra mile, commit their own resources to enhance prospects for future business, and comply with the rigor that the source selection and evaluation mechanisms demanded. The suppliers' responses improved product output and reinforced the initial commitment that the product developer made to strengthening supplier relationships.

Mutual trust—earned through action—was essential to creating this environment. For example, Chrysler's relationships with some suppliers had evolved to the point that it no longer needed to make large investments in some key technology areas because of the relationships it had developed with some suppliers. Instead, the suppliers made the technology investment themselves and had enough confidence in their relationship with Chrysler that they did not fear the long-term commitment that this entailed. For its part, Chrysler trusted the suppliers to make the investments that would keep their vehicles competitive. Both supplier and product developer saw their success as that of the final product and a continuing, mutually beneficial relationship.

Defense prime contractors believe there are legal, regulatory, and budgetary obstacles to fostering such long-term relationships. Similarly, some key BAT suppliers did not see their environment as conducive to such relationships. They viewed their role as only complying with the design requirements handed down to them by the upper-tier firms. They believed that attempts to do more—such as offer design suggestions or make long-term investments—would not reap benefits. Some suppliers believed no consideration was given to their years of working together when it came to the low-rate production contract proposal. One supplier said it was required to submit a four-volume proposal for the low-rate production

contract, detailing how its component would be designed, produced, and made to conform to quality standards, even though it had just spent the last 6 years designing, documenting, and producing the component for BAT. The president of one supplier firm said that while he invested the firm's own funds for commercial tooling because of its long-term potential, he would not invest the firm's funds in BAT tooling because the return was too uncertain.

In contrast, JDAM suppliers believed they were full participants in a long-term relationship with the upper-tier customers. Through the joint effort of the DOD program manager and the prime contractor, these relationships were cultivated in the JDAM program without being stymied by the obstacles perceived by some prime contractors. Second-tier suppliers cited the importance of developing a strong alliance between the parties. One supplier said the prime contractor held clear authority over the program, but the development of new solutions to win the contract was the result of great teamwork. For example, one supplier was able to substitute commercial materials that differed in configuration from military materials but not in function. The supplier worked with other first-tier suppliers, the prime, and DOD, and they agreed on an improved interface connection for the component.

Recommendations

GAO makes recommendations to the Secretary of Defense. These recommendations are intended to strengthen DOD's support for better supplier relationships and to create an environment that encourages such relationships. These recommendations appear on pages 63 and 64 of the report.

Agency Comments

DOD concurred with the views expressed in the report and all of the recommendations and also provided additional information on efforts to address the issues. A discussion of DOD's actions appears on pages 64 and 65. DOD's comments appear in appendix I.

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Abbreviations

BAT	Brilliant Anti-armor Submunition
DOD	Department of Defense
GAO	General Accounting Office
IPT	integrated product team
ISO	International Standards Organization
JDAM	Joint Direct Attack Munitions

Introduction

The Department of Defense (DOD) continues to state a need to more quickly modernize weapons for the armed forces. It has a budget of over \$40 billion for fiscal year 1998 to acquire and upgrade weapons and may not receive substantially more than that in future years unless savings materialize in other budget areas. Therefore, it must find new ways to modernize more economically. DOD has an opportunity to incorporate commercial supplier practices into the process it uses to acquire weapon systems. In doing so, DOD may be able to respond more quickly to technological changes with shorter cycle times, reduce costs, and improve weapon system quality.

Suppliers Play a Key Role in Developing and Producing End Items

The term “supplier” refers to a firm that provides goods or services that comprise part of a final product being made by another firm. For example, a tire manufacturer would be considered a supplier to an automobile manufacturer. In this case, the automobile manufacturer would be viewed as the “customer” by the tire supplier. On a complex product such as an aircraft or a weapon system, suppliers can number in the thousands and are categorized into different levels or tiers. The term “subcontractor” is also used to refer to a supplier.

In the case of a military aircraft, the firm responsible for putting the complete aircraft together and delivering it to DOD, the final customer, is referred to as the prime contractor. Although the prime contractor may make some of the aircraft itself, it may buy major subsystems, such as engines, landing gear, and navigation equipment, from other firms. The firms supplying these items and other products to the prime contractor comprise the first tier of suppliers. Each of these firms, in turn, makes significant products for which it depends on suppliers. For example, the engine manufacturer buys major engine components from its own suppliers; thus, it is a supplier to the aircraft manufacturer and a customer to the engine component suppliers. The major engine component suppliers would comprise the second tier. The firms that they buy parts from would comprise the third tier. These tiers continue down to basic piece parts, such as rivets, bolts, common computer chips, and raw materials.

Some firms are suppliers for one product and prime contractors for others. Although the smaller firms tend to be found among the lower tiers on complex products, in the upper tiers it is possible for a supplier on a given product to be a larger firm than the firm assembling the complete product. For example, it is possible for a large firm like Lockheed Martin,

a manufacturer of major military and commercial end items, to supply components for a smaller firm's product.

Suppliers are typically responsible for the majority of a complex product's content, whether the item is military or commercial. Generally speaking, suppliers account for 50 to 80 percent of a major item's value. For DOD, this means that a large part of the money spent on building a new weapon system may actually be paid to suppliers. Perhaps more importantly, much of the technical innovation that is incorporated into a new weapon comes from the suppliers. According to the Aerospace Industries Association,¹ much of the technical innovation comes from the suppliers at the lower tiers. Studies of agile manufacturing techniques reinforce that much of a company's competitive edge will depend on its supply chain.

Many leading companies recognize they must encourage the best suppliers to view them as valued, preferred customers. Being a good customer may be a necessity because the supplier can be less dependent on the customer company than vice versa. Suppliers are becoming increasingly powerful in dealing with customers because of their size or almost sole-source relationships. Some suppliers can choose their customers or be inflexible about the product they are willing to supply. Such is also the case for DOD, as evidenced by the recent withdrawal of many integrated circuit manufacturers from the military market.

Best Supplier Practices Produce Tangible Benefits

We have reported that companies have become increasingly aware that they cannot do everything on their own.² Therefore, companies are rethinking their business relationships, such as developing closer relationships with strategic suppliers. Companies have found that cooperative business relationships improve their abilities to respond to a changing economic environment by allowing them to focus on their core businesses and reduce costs in their business processes. For example, since 65 percent of its automobiles is made by suppliers, Ford Motor Company realized that to reduce costs and improve quality, it would have to improve its relationships with suppliers. In addition to lower product and administrative costs, exemplary supplier relationship practices can translate to significant company benefits such as higher supplier quality

¹The Association is a trade association that represents the leading manufacturers of commercial, military, and business aircraft, helicopters, aircraft engines, missiles, spacecraft, and related components and equipment.

²Partnerships: Customer-Supplier Relationships Can Be Improved Through Partnering (GAO/NSIAD-94-173, July 19, 1994).

levels, greater productivity, faster product design and delivery times, and better supplier engineering and technological contributions, as the following examples show.

- Texas Instruments Semiconductor Group reduced its cycle time in obtaining manufacturing supplies by 25 to 40 percent and the number of material inspectors from 14 to 1 at one site and 15 to 7 inspectors at another site.
- Honda claimed an 8 to 1 return on its supplier relationships investment with an average 48-percent increase in supplier productivity, a drop in the average parts per million defect rate from 900 to 200, and virtual elimination of cost overruns.
- Varian Oncology Systems saved about \$10 million and eliminated half of its inspection staff.

To the extent that opportunities to improve supplier relations on defense programs exist and are capitalized upon, the outcomes of weapon system programs could similarly improve. Suppliers can contribute to resolving long-standing cost and schedule problems in major weapon system programs. As the pace of technological improvement quickens, shorter product cycle times will improve DOD's ability to incorporate the latest innovations. Better supplier relationships may lower investment costs, enabling the services to modernize at a faster pace with existing funding. DOD believes that modernization should proceed more quickly and wants to increase the annual investment in procurement by \$20 billion, but the money has been slow to materialize. In addition, shorter weapon system development cycles could yield improved products and better capabilities to the military forces sooner.

Objectives, Scope, and Methodology

The Chairman and the Ranking Minority Member, Subcommittee on Acquisition and Technology, Senate Committee on Armed Services, asked us to assess whether best supplier practices can benefit weapon system programs. The objectives of this report are to (1) identify best commercial practices for establishing, managing, and sustaining excellent supplier relationships and (2) compare these practices with those of DOD, selected prime contractors, and the supplier teams on two weapon system programs.

To identify firms considered among the best in the commercial sector regarding supplier relationships, we conducted literature searches, consulted data from past winners of the Malcolm Baldrige Quality Award,

and met with experts in the area of supplier management to gather uniform information about supplier management practices and their effects. We gathered information from the following commercial firms, which our research showed to be among the best in the area of supplier relationships:

- Motorola, Inc. (wireless communication equipment manufacturer), Schaumburg, Illinois.
- Chrysler Corporation (automobile manufacturer), Auburn Hills, Michigan.
- Texas Instruments Semiconductor Group (semiconductor manufacturer), Dallas, Texas.
- Xerox, Inc. (document production equipment manufacturer), Webster, New York.
- Honda of America (automobile manufacturer), Marysville, Ohio.
- Corning, Inc. (glass product manufacturer), Corning, New York.
- Varian Oncology Systems, Inc. (oncology equipment manufacturer), Palo Alto, California.
- Baxter Healthcare Corporation (medical supplies manufacturer), Round Lake, Illinois.
- DuPont (petroleum and other products manufacturer), Wilmington, Delaware.
- Plow & Hearth (mail order catalog company), Madison, Virginia.
- Toyota Motor Sales, USA, Inc. (automobile manufacturer), Torrance, California.
- McKesson Corporation (wholesale distributor), San Francisco, California.

We selected 6 companies from the top 50 DOD prime contractors to assess the degree to which defense contracting companies were aware of and were implementing best supplier practices. These firms were

- McDonnell Douglas Military Transport Aircraft Division (acquired by the Boeing Corporation during the course of our review), Long Beach, California;
- Northrop Grumman Electronics and Systems Integration Division (acquisition by Lockheed Martin pending), Hawthorne, California;
- AlliedSignal Aerospace, Torrance, California;
- Honeywell Defense Avionics Systems Group, Albuquerque, New Mexico;
- Motorola Space and Systems Technology Group, Scottsdale, Arizona; and
- Boeing Space and Systems Group, Seattle, Washington.

Some of these firms also serve as suppliers to other defense prime contractors and perform a significant amount of work for commercial

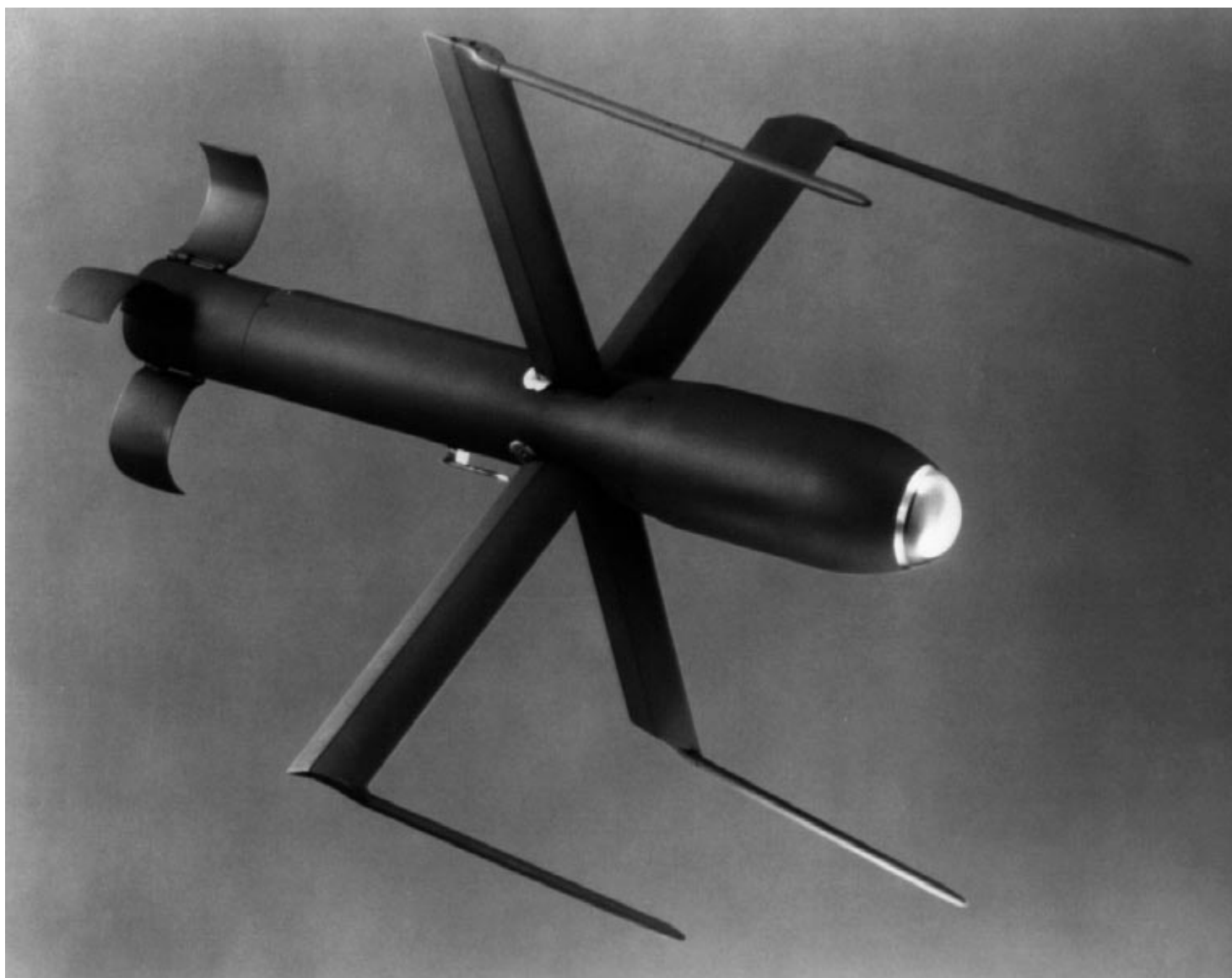
companies. Together, the companies receive billions of dollars in government contracts for goods and services each year. We met with each firm and reviewed literature on their supplier management practices. Interviews with knowledgeable officials at both the commercial and defense firms were a primary source of information.

To obtain insights into the dynamics of contracting teams in an actual program situation and to obtain the supplier's perspective, we conducted case studies of two weapon systems currently in development. Our case studies were performed on two munitions programs: the Brilliant Anti-armor Submunition, referred to as BAT, which is the older and more traditional of the two programs; and the Joint Direct Attack Munitions (JDAM) program, which is piloting several acquisition reforms and has applied innovative supplier management techniques. For each program, we discussed practices with the military service program office and the prime contractor and selected suppliers at the first and second tiers. We concentrated on suppliers who were designing custom components for the end product. In the report, we kept suppliers anonymous—designating them with a letter—to guard against harming the contracting team.

BAT Program

The BAT is a 3-foot long, 44-pound self-guided, submunition that, once dispensed, glides as it searches for moving tanks and other armored targets that it is intended to track and destroy. The submunition began in 1984 as a classified program and progressed into the engineering and manufacturing development phase in May 1991. It is an Army program and Northrop Grumman is the prime contractor. The Army has funded efforts to develop a new version of the BAT, which is to improve performance against stationary targets. It is expected to be fielded about 5 years after the basic BAT. Figure 1.1 shows the BAT.

Figure 1.1: The BAT Submunition



The BAT program used more traditional acquisition practices.

Source: DOD.

The BAT program has had some turbulence. We recently reported that the submunition's test schedule appeared to be extremely ambitious and that testing uncovered several problems that required design changes, additional testing, and schedule delays.³ Subsequently, the low-rate initial production was rescheduled from December 1997 until December 1998. An earlier delay (2 years) resulted from the Army's switch of BAT carriers, from the Tri-Service Standoff Attack Missile to the Army Tactical Missile System, according to the program manager. Further, the number of BATs to be purchased was cut from 35,000 to 19,500. Most recently, the Congress deleted all \$85.2 million in fiscal year 1998 procurement funds and added \$35 million in research and development funds in response to the program delay. Including the improved seeker, these changes have increased development costs from \$700 million to \$1.2 billion and production costs by almost \$7,000 per unit (all figures in constant 1991 dollars).

BAT was conceived and designed before major acquisition reform initiatives, such as the replacement of traditional military specifications with performance specifications, were implemented in 1994. Nonetheless, the Army believes BAT is ahead of other programs in applying acquisition reforms. Northrop Grumman has nine first-tier suppliers for the major BAT components. We interviewed five of the nine first-tier suppliers, five second-tier suppliers and the two additional first-tier suppliers competing for the seeker on the improved BAT.

JDAM Program

JDAM is a strap-on guidance kit that converts free-fall bombs into guided munitions. The program is jointly funded by the Air Force and the Navy. The prime contractor is McDonnell Douglas, recently purchased by Boeing. The program is in the last year of engineering and manufacturing development, with production planned for mid-fiscal year 1998. DOD plans to buy about 87,500 JDAM kits at about \$3.39 billion, amounting to a program unit cost of about \$38,700. Figure 1.2 shows the JDAM.

³Brilliant Antiarmor Submunition: Opportunity Exists to Conduct Critical Test Prior to Production Decision (GAO/NSIAD-98-16, Oct. 30, 1997).

Figure 1.2: The JDAM System



The JDAM program used commercial-like practices with its suppliers.

Source: DOD.

DOD views JDAM as a successful program that benefited from the application of commercial practices. In this sense, it represents a departure from the traditional DOD approach to acquisition management. JDAM is one of seven Defense Acquisition Pilot Programs that were afforded early statutory and regulatory relief under the provisions of the Federal Acquisition Streamlining Act of 1994 to test methods for

streamlining the acquisition process. This designation gave DOD the authority to manage these programs more like commercial programs. According to DOD, the successful application of commercial practices enabled these programs to demonstrate significant improvements; it believes that these programs could reduce cycle time by 25 percent. In addition to applying DOD's formal acquisition reform initiatives, JDAM has been cited as a program that placed an unusually strong emphasis on suppliers from the beginning. We interviewed four of the first and five of the second-tier suppliers.

In this report, we highlight best commercial practices in supplier relationships. As such, they are not intended to describe all of commercial industry, all commercial practices, or to suggest that commercial firms are without flaw.

We conducted our review between October 1996 and January 1998 in accordance with generally accepted government auditing standards.

Commercial and DOD Supplier Practices Have Similarities and Key Differences

The best practices of commercial firms recognized as industry leaders in the area of supplier relationships maximized the participation and contribution of key suppliers in developing, producing, and planning products. We found that supplier relationship practices could be aggregated into four traits:

Central support: The leading firms made a strong commitment to optimizing supplier relations as essential to maximizing product success. This was manifested by making sure that supplier relationships received central direction and support, including the services of an effective purchasing organization staffed by experienced and skilled people.

Rigorous supplier selection: A rigorous supplier selection process was implemented, which created a manageable pool or base of strong suppliers.

Communications and feedback: The firms created channels for open communication and continuous assessment of performance for both customer and supplier.

Mutually rewarding environment: The firms created an environment whereby the suppliers also benefited from superior performance.

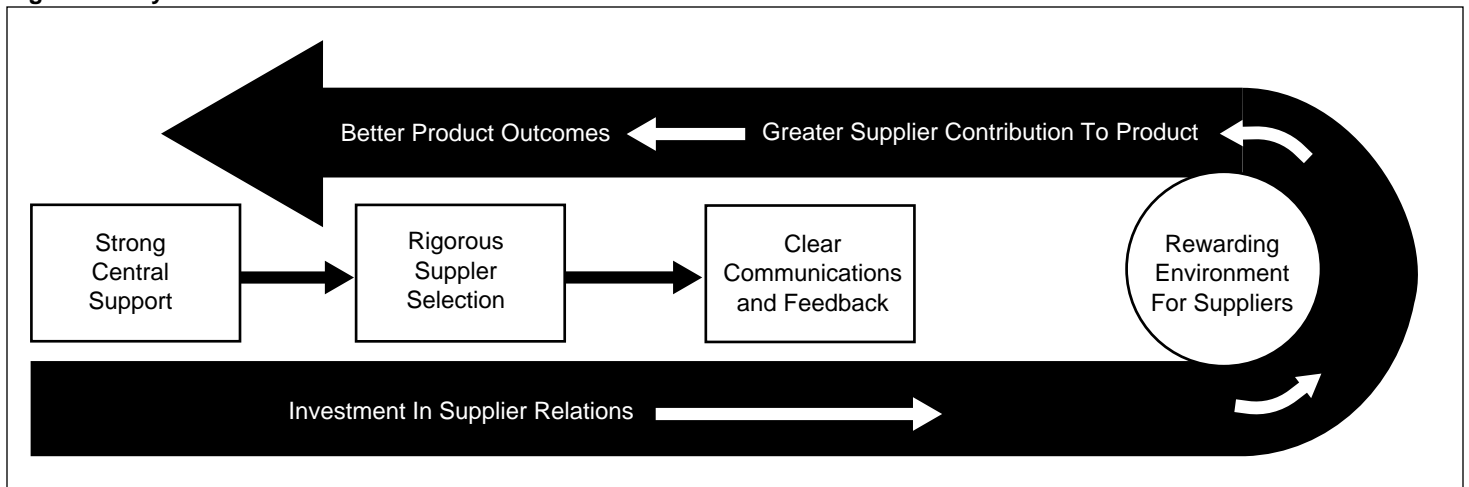
All of the commercial companies we contacted had all four traits, but individual practices differed.

DOD and its prime contractors are aware of these practices and their benefits and are attempting to implement the practices in varying degrees. However, on the basis of our meetings with prime contractors, we found that it can be difficult to translate the desire for better supplier relations into tangible differences in the actual relationships among suppliers, prime contractors, and DOD. It is particularly difficult to create an environment in which suppliers for DOD programs believe there are true incentives for doing more than complying with the terms of the contract. DOD's experience with JDAM so far indicates that it is possible to create a better environment for fostering mutual benefits between defense prime contractors and their suppliers.

Best Practices Are Fueled by Mutual Benefits Between Customer and Supplier

The leading commercial firms went beyond simple supplier relationships that were limited to the purchase of goods and services in return for payment. Their relationships evolved to the sharing of information and interaction on a variety of business functions in a joint effort to make a better quality product more quickly and less expensively. Both the firm responsible for the complete product—the product developer—and its suppliers benefited from the process. The four traits we used to describe these relationships can thus be seen as the components of a self-sustaining system as shown in figure 2.1.

Figure 2.1: System of Four Traits Seen in Commercial Best Practices



The first three traits put the mechanisms in place to develop the desired relationships between the product developer and the suppliers of product components. In essence, this is how the product developer created the system and communicated it to the different tiers of suppliers. Together, the individual practices within these traits shaped and guided the relationships and developed a clear understanding of the product goals and business terms as well as effective conduits for assessing performance and communicating. These conduits were primarily face-to-face contacts with people who used agreed-on measures of performance. They extended through all tiers of suppliers and were built upon stable, cooperative relationships. The product developers saw to it that the system and the product's needs were communicated to all tiers of suppliers.

It is the fourth trait that generates the energy in the system. The practices within this trait created the “quid pro quo,” that is, the realization by the key team members that they were all benefiting from the relationship and that more significant contributions were matched with significant rewards. Essentially, the best practices emerged and were sustained when the product developer created an environment in which it became an attractive customer. It did this by not only rewarding superior suppliers with future business but by building partnerships, allowing top suppliers to participate in product planning and design, sharing business plans, and relaxing the procedures for doing business together. In turn, the suppliers were willing to go the extra mile, commit their own resources to enhance prospects for future business, and comply with the demands of the source selection and evaluation mechanisms. They were also willing to invest their ideas and intellectual capital back through the system. The suppliers’ responses improved product output and reinforced the initial commitment that the product developer made to strengthening supplier relationships. Mutual trust—earned through action—was essential to creating this environment.

Incentives for Improved Supplier Relationships May Not Be as Strong for DOD Programs

Supplier relationships on defense acquisition programs differ from the commercial sector. In the commercial sector, the product developer decides how best to meet customer needs; in the defense sector, this responsibility is shared between DOD and the prime contractor, with DOD having the ultimate responsibility. While DOD is implementing a number of reforms to make its acquisition process more commercial-like, its supplier relationships can be hampered by traditional acquisition practices.

In a more traditional program, like BAT, the four traits do not comprise as powerful a system as is formed by the best commercial practices. While a number of the practices that make up the middle two traits—such as supplier certification, ratings, and a forum for meeting with suppliers—have been adopted, their impact on the BAT program was blunted by weaknesses in central support and the quid pro quo environment. The commitment of the prime contractor to improve supplier relationships was not perceived by some key suppliers as having been much more than procedural changes. Part of the reason is that although DOD shares responsibility for determining what is important in managing an individual program, its traditional approach has been to maintain an “arm’s length” relationship with prime contractors and have little involvement with suppliers.

Regarding the fourth trait, some key BAT lower-tier suppliers did not believe they were encouraged to contribute to the design of the product or that their extra efforts to innovate were encouraged, or that business relationships were simplified. Instead, they believed there was no basis for expecting the business relationship to extend beyond the contract in hand. Consequently, their performance was limited to compliance with contract requirements, impairing the program's ability to take full advantage of the suppliers' intellectual capital, such as design or product ideas.

The JDAM program office took a much more active role in ensuring that high-performing suppliers were selected, ensuring that all tiers of suppliers understood and participated in meeting the program's priorities, and offering long-term benefits to the prime contractor and its suppliers for good performance. In short, it had bolstered the practices in the first and fourth traits. At the time of our review, the program appeared to have fostered a system of supplier relationships that emulated best commercial practices.

Commercial-Like Mechanisms Adopted by Defense Firms Can Be Muted in Implementation

The defense prime contractors we met with recognized the need to adopt commercial-like practices to maximize the contributions of their suppliers. To varying degrees, these firms had put in place the mechanisms or infrastructure to select the best suppliers and to establish the means for communicating and improving performance. Thus, the prime contractors were attempting to establish better supplier relationships in the areas we described as the first three traits of commercial best practices. However, differences in whether suppliers actually perceived an improvement in the relationships on the individual BAT and JDAM programs suggest that how these mechanisms were implemented was as important as their establishment. Specifically, the mechanisms applied on the BAT program did not effectively reach or have the same impact on several second-tier suppliers as they did on JDAM. To some extent, these differences could be attributed to the newness and increased latitude of JDAM as a pilot program and to its prime contractor being further along in adopting commercial practices. Another key factor was the more traditional “arms length” role DOD played on the BAT program, as contrasted with the proactive role it played on JDAM.

Supplier Relationships Must Have Central Support

Best Commercial Practices

The leading commercial firms embraced effective supplier relationships as a core business strategy and built organizational structures with skilled people to carry out the strategy. These firms provided central, consistent supplier policy direction and enforced specific practices across business units.¹ By so doing, the firms not only informed the different business units but also helped the units agree on implementing factors, such as supplier costs, selection, development, and long-term alignment of key suppliers with business goals. The firms implemented their supplier strategies primarily by creating supplier management teams (often called commodity teams or internal councils). These teams or councils linked business objectives and performance factors—such as quality, cycle time, and total cost initiatives—with supplier relationship activities. In so doing, they replaced independent supplier relationships previously forged by individual business units.

¹For purposes of this report, a “business unit” is an organized unit within a corporate firm. Most major firms have divided their businesses into some type of strategic business units.

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For example, Chrysler is organized around several product platform teams such as for large cars, small cars, and trucks. The platform teams developed strategies for each product, coupled with commodity strategies that defined which product components were to be purchased from which suppliers. Motorola has had a commodity team structure since 1982. Motorola said they also established a central Supplier Management Council and three regional councils for the Americas, Europe, and Asia. The councils followed the same mission and vision statements and shared decisions with each other to ensure consistency across the company. The use of councils encourages people in all areas of the company to approach supplier relationships from a common understanding. Collectively, the council and commodity structure forged unity and a willingness to share supplier information between business units and regions and a willingness to work together. Some of Motorola's products are shown in figure 3.1.

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Figure 3.1: Examples of Motorola Commercial Products



Motorola's council and commodity structure helps share information among different products.

Source: Motorola.

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Leading commercial companies generally created purchasing organizations to support their supplier management strategies. Often a blend of centralized and decentralized operations, the purchasing organizations assisted line management on both a company-wide and business unit level. These purchasing organizations were staffed by experienced and well-trained people who helped line managers consider multiple factors, such as product quality, total life-cycle costs, and technological capabilities, in deciding on which suppliers to use. Commercial firms also supported their supplier management strategies by streamlining the supply ordering and distribution process and building a technological infrastructure to facilitate company and supplier business contacts and supplier base management. Internet sites, electronic commerce, electronic data interchange, bar coding and scanning, and advance shipping notices were some of the information technology applications companies used to make it easier for suppliers to conduct business with them.

It is a major undertaking for a firm to embrace an active supplier management policy and to commit the resources necessary to implement the policy. A firm's commitment to such an undertaking is not based on altruism or a particular management theory. Rather, the commitment is based on the desire to maintain a competitive edge. In our recent report on applying best practices to preparing weapons for production, leading commercial firms took a similar position: best practices were adopted because they helped a firm succeed.²

Defense Prime Contractor
Practices

The defense companies we visited had corporate policies regarding suppliers, but some firms were further along in establishing corresponding organizational practices than others. McDonnell Douglas, the JDAM prime contractor, had a well-established supplier program. Supplier importance was recognized in the firm's corporate philosophy and was designated as a core company competency. Well-documented problems with the C-17 aircraft encouraged McDonnell Douglas' Military Transport Aircraft division to revamp its quality and supplier selection program using best commercial practices. The division also created nine commodity teams and sponsored a supplier management council. Figure 3.2 shows the C-17 aircraft.

²Best Practices: Successful Application to Weapon Acquisitions Requires Changes in DOD's Environment (GAO/NSIAD-98-56, Feb. 24, 1998).

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Figure 3.2: C-17 Cargo Aircraft



Problems on the C-17 program led to major changes to improve supplier relationships.

Source: DOD.

Boeing Space and Systems Group's supplier base management program has as one of its goals, a common and consistent approach to manage its supplier base. AlliedSignal Aerospace had Sector Commodity Teams managing specific commodities. The teams were responsible for selecting partners and developing long-term agreements to be used by all purchasing organizations throughout AlliedSignal Aerospace. The Northrop Grumman division responsible for BAT initiated procedures in September 1996 to formalize communication with suppliers and provide

performance feedback. The procedures reflected their corporate value statement, which states:

We regard our SUPPLIERS as essential team members. . . . We owe our suppliers the same type of respect that we show our customers. Our suppliers deserve fair and equitable treatment, clear agreements and honest feedback on performance. We consider our suppliers' needs in conducting all aspects of our business.

DOD Policies Silent on Supplier Issues

Although DOD has devoted significant effort to reducing the cost of doing business with the government, it has not directed its policies at the types of relationships that exist between prime contractors and their suppliers. Some DOD efforts may facilitate better supplier relationships, such as the use of teams. While JDAM made use of these tools to help build good supplier relationships, focusing on suppliers as a means to make reforms work was an innovation of the JDAM program and not an explicit objective of the pilot program.

According to an Aerospace Industries Association official, the significance of suppliers has tended to be overlooked. He noted that until recently, the Association had not adequately considered supplier firms in its dealings, citing an example of how an acquisition reform that prime contractors support can have unanticipated consequences on suppliers. Specifically, the Single Process Initiative gave prime contractors the opportunity to simplify quality assurance and other procedures in their own facilities. However, suppliers that worked for more than one prime contractor suffered as each contractor established its own processes. In 1997, the Association expanded its membership to supplier firms and created a council to represent the suppliers' views.

Similarly, while DOD is interested in whether its prime contractors choose capable suppliers, it has traditionally taken a hands-off approach to how prime contractors deal with suppliers. DOD officials attributed this approach to a concern that direct dealings between the government and subcontractors would be contrary to the legal doctrine of privity of contract.

Privity refers to the direct relationship that arises between the parties to a contract as a result of their mutual obligations. Thus, there is privity between DOD and the prime contractor on a contract but not between DOD and the suppliers because there is no contract between them. According to DOD officials, the traditional concern about privity of contract has

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distanced DOD and its program managers from supplier management concerns. Although privity concerns might preclude communications that could imply a contractual relationship between DOD and a subcontractor or that would be inconsistent with the existing contracts, they need not be a barrier to other forms of communication with suppliers or to efforts to improve relationships between and among the government, a prime contractor, and suppliers. Moreover, privity concerns may be reduced by the parties agreeing that the government may have direct communications with suppliers. We believe such communication appears to have facilitated innovation and teamwork on the JDAM program.

While the role played by DOD through the Army program office on the BAT program was traditional regarding supplier relationships, a very different role was played by the JDAM program office. Officials were significantly involved in the JDAM effort from the beginning of the program, taking a much more open, hands-on role in dealing with potential prime contractors and their suppliers. This approach set the expectation that supplier selection and management would figure prominently into program success and DOD's selection of the prime contractor. According to DOD officials, the more active approach was taken because affordability was the top program objective. DOD program officials visited and evaluated the performance of the individual suppliers to the two competing prime contractors. They used the actual performance of the suppliers and the prime contractors during an early development phase as a key factor for choosing the prime contractor and supplier team that would win the competition to complete development and enter production.

DOD's traditional reticence in guiding supplier relationships represents a significant difference in the environment defense prime contractors operate in compared with commercial firms. Commercial firms are driven toward optimizing supplier relationships to gain a competitive edge in winning the customer's business and they can act unilaterally in garnering those relationships. In the acquisition of weapon systems, DOD is the customer on the one hand and on the other it shares responsibility for managing and directing the program with the prime contractor. Thus, if DOD does not encourage implementing best practices in order to get the best out of suppliers, the prime contractors may not have as strong an incentive as commercial firms to adopt such practices.

Rigorous Supplier Selection Creates Strong Supplier Base

Best Commercial Practices

Leading companies used a rigorous supplier selection process to create a strong supplier base. Specific practices included using stringent supplier selection criteria, relying on a manageable number of suppliers, maintaining or developing some level of competition between suppliers, and periodically assessing the supplier base against company goals. A desired result of such a process was a strong supplier base that companies can effectively manage. For example, Texas Instruments Semiconductor Group said their selection process meant there was a reliance on a few, very capable suppliers, a stronger relationship between the company and suppliers, and stronger business processes for both companies when they interacted.

Knowing the importance of suppliers to their business success, the leading commercial companies used specific criteria to select suppliers and the supply chains they represented. Companies selected suppliers based on needs for supplier backup, capacity requirements, competition needs, suppliers' product range, and the complexity of the product. In their selection procedures, the companies weighed the total cost of doing business with each supplier, not just the sales price of the item. The total cost of doing business included tangible factors, such as quality, and intangible factors, such as effective communications. If the companies only considered lowest price suppliers, then their total costs might be higher because of quality, delivery, and service problems. Using the total cost approach in conjunction with selecting a limited number of suppliers was seen as important to building more sophisticated supplier relationships.

Another key selection criterion best practice companies stressed was comprehensive quality. They expected their suppliers to have a comprehensive quality system, generally based on ISO-9000, the Malcolm Baldrige National Quality Award, or other quality standard systems.³ For example, Motorola required all of its suppliers to show intent to apply for

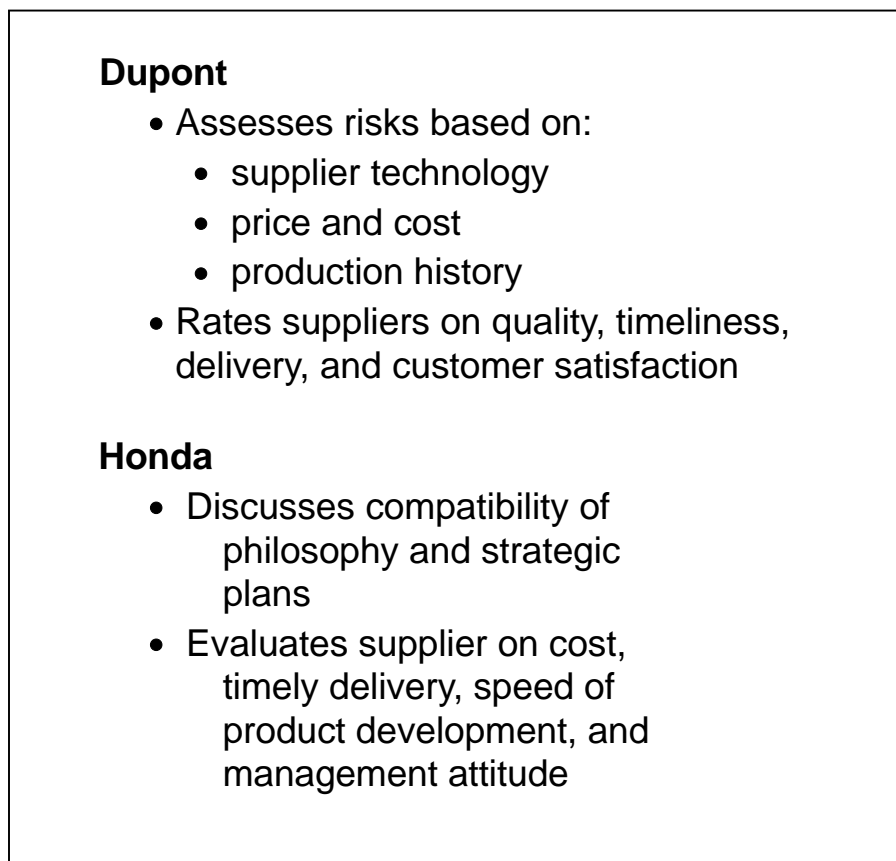
³ISO-9000 is the commercial standard for quality assurance. Independent, certified quality consultants conduct on-site audits of applicants and give approval. The Malcolm Baldrige National Quality Award promotes awareness of quality excellence, recognizes quality achievements of U.S. companies, and publicizes successful quality strategies. Industry specific quality standards also are used, such as the QS-9000 for the automotive industry.

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the Baldrige competition. Xerox used a multinational supplier quality survey and an on-site assessment as part of its supplier selection. As a result, many companies often replaced expensive incoming part or item inspection of selected supplies with supplier certification programs or the assurance of high performance capabilities through the supplier selection process. Baxter Healthcare Corporation, for example, developed a quality history for supplier certification. By certifying the supplier's test methods, Baxter minimized its own product testing and eliminated some receiving and inspection functions. Its plants did not have to wait for supplier shipments to be inspected or hold inventories anticipating poor quality materials or delayed shipments.

The companies evaluated suppliers using assessment methods such as certifications, surveys, inspections, statistical process control, and quality audits. The method varied by the importance of the product and how much performance assurance was desired. Companies started by thoroughly analyzing their supplier base needs, drawing on information about business requirements, industry performance trends, supplier base performance and supply chain management, and potential suppliers. Supplier evaluation techniques used by Dupont and Honda are described in figure 3.3.

Figure 3.3: Evaluation Techniques for
Selecting Suppliers



Almost all the leading companies we contacted either had limited or planned to limit the number of suppliers that they relied on by concentrating on proven suppliers that met the selection requirements. By relying on a limited supplier base targeted to companies' purchasing needs, companies could make better use of their internal purchasing resources, such as people. At the time of our review, Toyota Motor Sales officials said they planned to reduce the number of suppliers providing goods and services, such as advertising, from 1,500 to about 1,000. Of these, only 100 suppliers accounted for 80 percent of the company's indirect purchasing expenditures. In 1986, Motorola began implementing its supplier reduction strategy, which relied on creating a base group of suppliers that stayed the same unless performance fell or new suppliers offered technological innovations. Over a decade, Varian Oncology

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Systems reduced the number of its production suppliers from 1,100, which it considered unmanageable, to 345.

In reducing the size of the supplier base, commercial companies were careful to include enough suppliers for an item to ensure there would be competition and a back-up source. These were not necessarily head-to-head competitions. For example, Honda said they selected two suppliers that made the same product but targeted the product for different automobile models, such as one steering wheel supplier for the Honda Accord and another for the Honda Civic. Several of the commercial firms also attempted to limit the business they did with an individual supplier to keep the supplier from becoming too dependent on any one customer.

Defense Prime Contractor
Practices

Several of the defense prime contractors we contacted had developed or were developing supplier selection practices similar to best commercial practices. They had reduced the number of their suppliers and established selection criteria and categories to differentiate between types of suppliers. For example, AlliedSignal Aerospace reduced its supplier base from over 10,000 in 1991 to less than 3,000, increasing the volume of business with the remaining suppliers. By reducing suppliers, Honeywell's Defense Avionics Systems Group reported reducing costs by reducing the number of buyers and quality managers required.

DOD has placed new emphasis on the use of "best value" to justify selection of a contractor or supplier on a basis of more than lowest price. This initiative is similar to the total cost approach to supplier selection used by commercial firms. Some defense contractors recognized and were moving toward the use of best value in selecting suppliers. Boeing's Space and Systems Group said they used historical performance data to determine overall best value by recognizing the penalties associated with late delivery and poor supplier quality. Honeywell Defense Avionics Systems officials said they get best value in some commodities by reducing the supplier base to only preferred suppliers, then competing them on price.

Some prime contractors were skeptical of whether DOD was really supporting the best value approach. According to one firm, the government hurts itself by basing awards on the lowest bid. It noted that the government does not necessarily get the best value product if the supplier is late or has low quality. Another firm noted the incentive for a prime contractor to use best value in selecting its suppliers reflects the

emphasis DOD places on best value in selecting the prime contractor. Officials from this firm stated that although DOD may support a best value policy, resistance to that approach was still apparent at the lower levels in the services, particularly auditing agencies, which still focus on price differences in evaluating subcontracting practices.

Sharp Contrasts in Supplier Selection on BAT and JDAM Programs

The different experiences with the selection of suppliers on BAT and JDAM pointed out the key role both the prime contractor and DOD played in establishing a strong, dependable team at the outset of a program. The BAT prime contractor described the selection of its major suppliers as a targeted process, not part of an overall supply base strategy. The JDAM program had a much greater emphasis on a commercial-like, long-term supplier strategy at the outset of the program.

Of the 10 BAT suppliers we met with, 5 were original suppliers and 4 were replacements for original suppliers that had trouble with their components. Northrop Grumman reported one new supplier was added when the Army decided to use a different—and faster—missile to carry the BAT submunition, which required a different technology. Second-tier supplier F, the third BAT supplier for a particular component, stated that the two previous suppliers had good track records and lower bids, but after 2 years of development neither could produce the part within specifications. A company official said it took the firm's experience and special processes to make the part within specifications. On another component, second-tier supplier D was the back-up source until the first supplier "bowed out." If supplier D had been selected earlier, company officials said they could have used their knowledge in establishing the requirements. Two other firms informed us that they became BAT suppliers after the original suppliers had failed. One supplier official believed that a focus on procurement unit cost was the primary concern of the BAT program, rather than life-cycle cost. He believed this became an impairment, particularly when decisionmakers make poor assumptions about costs that affect the rest of the program, such as how much a part will cost.

Program priorities could influence the extent to which more supplier changes are made in the future. For example, one of the first-tier suppliers competing for the new seeker in the improved BAT informed us that because of a very tight schedule set by the Army, the firm selected a second-tier supplier based on its ability to build a test article quickly—not on its ability to meet the long-term criteria of production capacity,

delivery, and quality. The first-tier firm said that they might consider using other suppliers in the next program phase.

Program office involvement helped shape the selection of JDAM suppliers, emphasizing their potential for long-term success. The DOD teams that evaluated potential prime contractors included key suppliers as part of their assessment and reviewed manufacturing capabilities and prime contractor business practices. After the prime contract competition was reduced to two firms, DOD officials said that they met with officials from the firms and discussed what the teams had found at their suppliers. As a result, one prime contractor selected two new suppliers after asking DOD program officials to recommend better performers. DOD offered its advice but did not mandate changes in the choice of suppliers. Nonetheless, DOD's demonstrated interest in supplier capabilities, particularly in terms of price, quality, and production capabilities influenced McDonnell Douglas' selection of suppliers.

McDonnell Douglas officials described their selection of JDAM suppliers as an exhaustive, iterative, affordability-driven screening process. The company used its Preferred Supplier Certification process, which emphasized supplier performance and key process controls at the factory and the business level. Some suppliers were picked by the contractor to meet unique JDAM requirements, such as the high-volume requirements. Others were used because of their performance and preferred supplier status. Some dual sources were used to address component criticality and risk issues. JDAM suppliers confirmed the rigor of the process. Supplier M said that the process was much more involved than that of other weapon systems, typified by an intensive site survey process of first-tier suppliers. The review emphasized manufacturing, the supplier said, and forced the prime contractor and suppliers to think through JDAM from a design and production efficiency perspective.

An Effective Communication and Feedback System Must Exist

Best Commercial Practices

Leading commercial companies established effective communications and feedback systems with their suppliers to continually assess and improve both their own and supplier performance. These practices helped the product developer's goals, priorities, and performance assessments to reach all key suppliers and for suppliers' ideas and concerns to be expressed to the product developer.

Some leading companies designated an authoritative contact person as a single interface with suppliers so that suppliers trying to resolve day-to-day questions or problems were not passed from one company official to another. For example, each Chrysler supplier had a Chrysler person knowledgeable about the supplier's business to contact for all supplier dealings for that commodity. Typically, the leading companies also interacted with key suppliers in close teaming arrangements that facilitated sharing information. Commonly called integrated product teams (IPT), members worked together so that design, manufacturing, and cost issues were considered together. Team members were encouraged to participate as partners in meeting project goals and to interact frequently. In addition, some companies collocated suppliers with their own people or set up central working facilities with suppliers for working out issues such as how a product might be improved or be made less expensive. Motorola and Xerox saw such teams as a key vehicle for facilitating early supplier involvement in their products—one of their primary strategies. Motorola said key suppliers had building access and came in many times during a week to work with Motorola engineers.

To establish an objective basis for communicating about performance, the leading commercial companies set performance measures and expectations for each supplied product and service, using key elements such as quality, responsiveness, timeliness, and cost. These factors were consistent with the firms' selection criteria, and the product developer made clear to suppliers what these elements meant and how they would be used in business decisions. Most leading companies also provided periodic "report cards" and met formally with their key suppliers to

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discuss issues such as performance evaluation results, comparison of the suppliers with their competitors on key quality measures, customer and supplier improvement strategies, and future business opportunities. For example, Plow and Hearth reported sending suppliers a quarterly performance summary that supplemented continuous supplier feedback. Also, once a week, Plow and Hearth officials representing merchandising, product returns, quality assurance, and inventory control discussed specific supplier issues.

The customer and the supplier generally worked together to develop milestones, commitments, and deliverables for corrective action. Suppliers needing improvement met with Plow and Hearth for a “customer-supplier alignment,” which clarified each other’s services and problems and developed corrective action plans. Commercial firms typically provided their suppliers technical assistance to help improve performance that was supported by sophisticated company, supplier, and industry information systems and reports. Examples of such assistance included quality audits, benchmarking, training, newsletters, and direct help on production techniques. Specific assistance provided by individual firms is shown in figure 3.4.

Figure 3.4: Examples of Assistance Commercial Firms Provided Their Suppliers

Motorola

- Developed a training guide book
- Trained suppliers on specific quality goals at its Supplier Institute
- Provided technical assistance to suppliers on performance problems

Varian Oncology Systems

- Provided an engineer-staffed hot line and other technical assistance

Texas Instruments

- Participated in a consortium for supplier training

Honda

- Used teams to examine the operations and technology of a supplier to improve product and meet target cost

Commercial companies also extended their attention to lower-tier suppliers. Opened up internal training courses to lower-tier products accounted for a significant portion of product costs and significantly affected the final product's performance. Few companies reported direct involvement with lower-tier suppliers if they were satisfied with the first-tier supplier's supplier management processes and performance. While not directly managing lower-tier suppliers, the companies had ongoing knowledge of these suppliers' efforts through communication and monitoring of first-tier activities. More importantly, their own commitment to optimal supplier relationships helped them to look for and expect the same commitment from their own suppliers. For example, Honda reported working with first-tier suppliers to develop self-reliance or the capability to effectively manage their own supply chains. In other cases, companies took a more hands-on approach; Chrysler said they worked with first-tier suppliers to jointly manage lower-tier suppliers, extending all the way to the raw material stage.

**Defense Prime Contractor
Practices**

Most of the prime contractors informed us that they had processes for setting supplier performance expectations, assessing supplier performance, and providing feedback. McDonnell Douglas continuously measures supplier performance and reports to suppliers quarterly. To remain a McDonnell Douglas preferred supplier, specific criteria for quality and delivery must be met. For example, to remain a bronze supplier, the lowest level of preferred supplier, quality must be at 98 percent or better, and delivery must be within the 15 days prior to delivery date at least 95 percent of the time. AlliedSignal incorporates performance criteria in its agreements measuring cost, quality, delivery, and service. It also publishes and shares monthly measures with supplier partners, along with how their performance compared to other commodity sector partners. Boeing's Space and Systems Group had established a process for evaluating selected suppliers semiannually on performance factors that included cost, delivery, quality, and technical contribution.

Similarly, Honeywell Defense Avionics Systems suppliers received monthly reports detailing their performance and were rated on quality, delivery, and any shortfall. Honeywell also met quarterly with the executives of their top suppliers to discuss short- and long-term strategies and improvement plans. Northrop Grumman formally discussed performance results biannually with suppliers, supplementing other sources of performance feedback. The company recently began a supplier management program as a result of its Baldrige self-assessment that identified supplier management as an area for improvement. In 1997, the firm initiated a Subcontractor Performance Assessment procedure and planned to give suppliers a color-coded score based on performance in 16 areas, such as submitting data on time, and performance of a supplier's subtiers. A supplier performance assessment was to be used monthly to evaluate and document supplier performance on a variety of elements. A BAT supplier was the first to be assessed under the new procedures.

In 1995, the Secretary of Defense directed the services to apply the integrated product and process development and team concepts to the acquisition process. The initiative established teams as the preferred method for DOD to perform acquisition functions. This direction is consistent with the teaming that the leading commercial companies are doing. All of the defense prime contractors we met with stated that they were using IPTs. For example, Motorola said the Land Warrior program had many major development subcontracts, with a significant amount of new design, that were set up as teaming agreements. Boeing described a long history using teams for both military and commercial programs. Top

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suppliers are team participants and involved early on in the programs. While BAT was initiated before the DOD directive on teaming, the program manager for Northrop Grumman said that the program has operated under a team concept since its beginning.

**BAT Suppliers Cited
Problems With
Communications, Teaming,
and Feedback**

The BAT program's incorporation of commercial-like practices such as the use of teams and supplier rating systems received a mixed reception by BAT suppliers. The experience of at least some second-tier suppliers on the BAT program suggested that the presence of commercial-like mechanisms alone did not improve supplier relationships.

BAT has 10 IPTS, 1 for each major subsystem. Program officials described membership as generally consisting of a team leader, engineer, subcontract administrator, business management representative, scheduler, quality person, manufacturing representative, and a government focal point. Suppliers below the first tier were generally not involved. Two suppliers believed that the team approach was working well. First-tier supplier G said that there was a work process team in place at the beginning of its contract and the firm held weekly teleconferences with the prime contractor. While engineers might call each other directly, most communication with the prime contractor was through the supplier's contract manager. Similarly, supplier E stated that the IPT was central to the BAT program and had facilitated communication and problem solving.

Other BAT suppliers found problems with how the teams operated, as depicted in figure 3.5.

Figure 3.5: Problems in How Teams Operated

Comments From Some Suppliers on Teams

- It was hard to construe that a real team existed
- Engineers made design decisions without consulting other team members
- Technical requirements dominated over cost and schedule considerations
- Some BAT problems were due to trade-offs not being made

Other suppliers suggested that improved communications between suppliers would have benefited the BAT program. Supplier D said that design problems could have been avoided if it could have met with higher level assemblers. It stated that instead of working together to solve problems, the firms resorted to defending their own actions. Supplier A noted that there was no forum for the suppliers to collaborate with other firms that were supplying components for the same section of the submunition. The supplier believed that a few thousand dollars per unit could have been saved by exchanging physical space within the submunition to enable simpler packaging. Another second-tier supplier said that its first-tier customer sent technical assistance personnel, but they were not at all helpful. They noted that the technical people sent did not have the expertise to help and that their problem was much more sophisticated.

Supplier I cited some key communication voids with the upper-tier firms. This firm, which was responsible for a sophisticated and mission critical electronic component, believed that the design it has been given is not producible because of the limited opportunities to make design trade-offs as previously discussed. Nonetheless, the firm was not a part of the Army production readiness review to assess the risks the BAT program faced in preparing for production. Moreover, the firm believed the cost of its component to be three times the cost the prime contractor included in the overall cost estimate, but it was not consulted about costs either. Had

communications been better, these problems could have been addressed already; instead, they may show up as surprises later in the program.

Perhaps reflecting the newness of the Northrop Grumman rating system, several suppliers were not familiar with the new procedures or satisfied with the system's criteria and feedback. Some of the suppliers believed that their ratings were lowered for decisions DOD or the prime contractor had made, which resulted in skepticism about the usefulness of the ratings. Several examples follow.

- Supplier G said it received an overall poor rating from the prime contractor because BAT was behind schedule, caused by a stretch in the program—something the supplier had nothing to do with.
- Officials from supplier B believed the company's rating was low because of waivers that were necessary until the prime contractor decided on certain requirements.
- Supplier C said it received a low rating for waivers that were necessitated by the Army's change in the missile carrier for BAT. The supplier said that the changes were not reflected in the rating criteria or the delivery schedule. It was devastating to the firm, the supplier said, partly because personal bonuses were affected by customer ratings.

JDAM Suppliers Impressed With the Effectiveness of Communications and Feedback

JDAM participants uniformly described the program as structured in a way that encouraged communication. A key factor was how IPTs were employed from the beginning—including the design phase—with the government customer (represented by the DOD program office) closely involved. JDAM was one of the first programs to use these teams in all aspects of business. DOD helped create this situation by requesting that IPT program management structures detail the plans for teams and subcontractor as part of the request for contract proposals. The teaming approach was consistent with McDonnell Douglas' corporate view that it was a critical tool for developing products and working with suppliers.

An executive-level team set the core strategy for the JDAM project, and other teams were organized around issues such as affordability and component design. The executive team included vice presidents from McDonnell Douglas and the first-tier suppliers and focused on high-level programmatic approaches and pricing strategies. The executives were not allowed to delegate their responsibilities to lower-level managers, according to two suppliers. The executive team promoted affordability for the whole system rather than costs for individual suppliers. According to

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Defense Firms Can Be Muted in
Implementation

supplier O, the team was instrumental in the decision to use a Lockheed Martin connector that was more reliable and cost-effective than a McDonnell Douglas product.

JDAM suppliers we met with spoke highly regarding communications on the program. This communication started with a clear understanding at all supplier levels of what the program's priorities were and the institution of open channels (primarily through the teams) for exchanging information and making trade-offs to protect these priorities. Suppliers were considered integral members of the IPTs and fully participated in program decisions. For example, supplier engineering, purchasing, and manufacturing people were involved in the design process, which a supplier described as an interactive process in which the product specifications were defined by DOD, the prime contractor, and suppliers. One supplier observed that a key factor in the teams' success was McDonnell Douglas had put someone in charge at every level of the project who could make decisions and established a disciplined configuration control process.

JDAM suppliers agreed to a rigorous assessment. The foremost performance criterion was the achievement and continued maintenance of the average unit production price, quality, and schedule goals. McDonnell Douglas tailored corporate performance measures to JDAM and used a variety of methods to collect performance data. Suppliers generally received monthly reports or program reviews for JDAM. Informally, the IPTs allowed for ongoing assessments and responses to problems. Second-tier suppliers believed that the technical assistance provided by McDonnell Douglas and upper-tier firms was extensive and was facilitated by the IPTs. According to one supplier, problems were not seen as weaknesses of its customer or of itself but as issues that should be worked on jointly. Another supplier noted problems are cooperatively resolved, and that expertise was shared on both sides, consistent with the teaming philosophy.

A Rewarding Environment Is Key to Fostering the Best Supplier Relationships

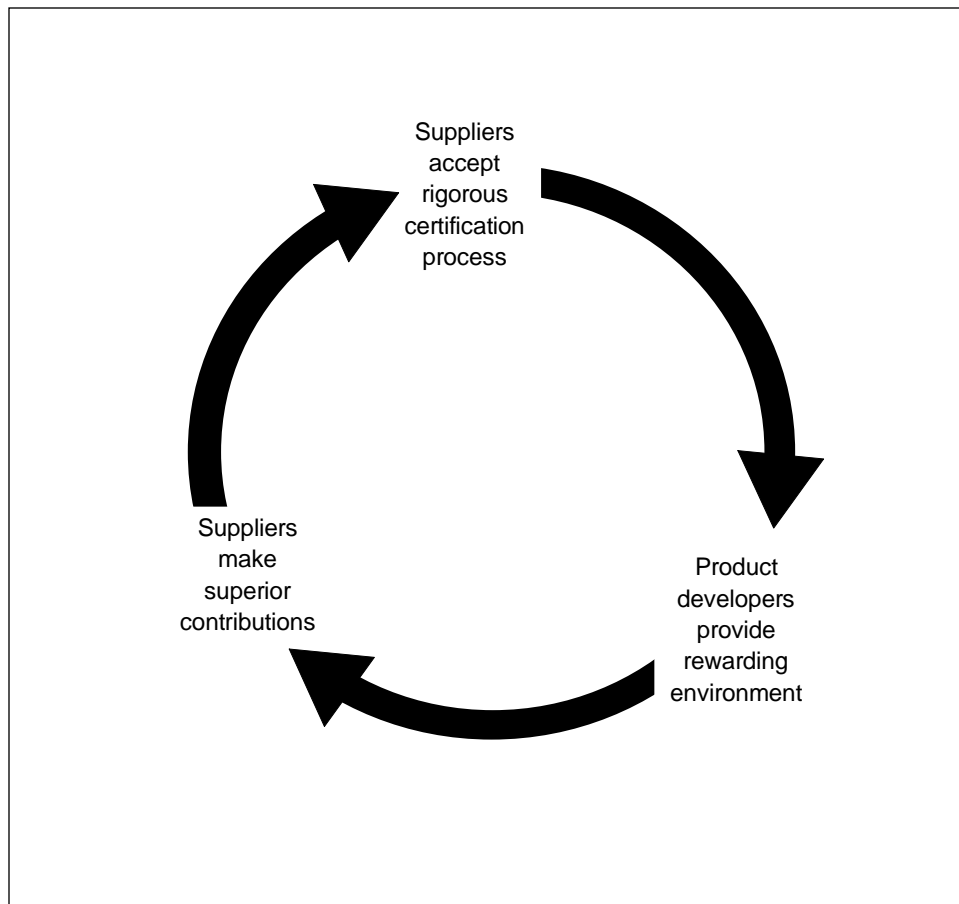
In our analysis, it was the fourth trait—providing a rewarding environment for sophisticated supplier relationships—that provided the energy for the other practices to work. This last trait constituted the quid pro quo or the realization by both the suppliers and the product developer that they were all benefiting from the relationship in ways other than near-term monetary compensation. Through tangible action on the part of both the product developers and the suppliers, each learned that more significant contributions were matched with longer-term rewards. The result was trust and commitment.

The participants in weapon system programs may face difficulties in creating an environment that fully leverages the other practices to get the most out of supplier relationships. As with the other traits, both DOD and the prime contractors play a significant role in fostering the right environment. Defense prime contractors believe there are obstacles to fostering such long-term relationships. As discussed in chapter 3, experience on the BAT program shows that despite the relaxation of some DOD requirements and the institution of individual best practices, such as IPTs, and supplier assessments, several key suppliers believed that their environment was unchanged. JDAM's more rewarding, commercial-like environment was created through an atypical, proactive approach by DOD and the prime contractor that cultivated supplier involvement.

Best Commercial Practices

The leading commercial firms we met with had created an environment in which both they and their suppliers were getting more from their business relationships than a good product for a fair price. Suppliers had become important to the conception and design of new products and the products benefited from their contributions. The mutually rewarding nature of this environment are depicted in figure 4.1.

Figure 4.1: Mutually Beneficial Aspects of a Rewarding Supplier Environment



As indicated in the figure, the interaction of the product developer and the suppliers in fostering a rewarding environment can be seen as a loop or cycle. As discussed earlier, leading firms establish rigorous systems for selecting, rating, and communicating with suppliers. Suppliers first had to see enough potential benefit to be willing to put themselves through this process. In return for suppliers meeting these demands, product developers provided more sophisticated, long-term relationships that included more involvement with product design, business plans, and streamlined business procedures. The suppliers responded by committing some of their own resources, including intellectual capital, to the longer-term business opportunities. This response made for a better long-term product and reinforced the product developers' commitment to better supplier relationships.

Suppliers Accept the Rigor of the Product Developer's System

The first steps in establishing the right environment for optimizing supplier relationships are taken by the product developer when it commits to fostering more rewarding relationships and puts the mechanisms in place to develop these relationships. We described these as the first three traits earlier in this report. Leading commercial companies are asking a lot from suppliers when they submit them to rigorous selection criteria, performance standards, and continuous assessments. A potential supplier faces the potential denial of business if it fails to meet the selection criteria. Moreover, suppliers in undergoing the process are agreeing to be judged under criteria determined by product developers and that they may not be rated in the top category.

Most commercial companies made some distinction among suppliers' performance. For example, Baxter Healthcare Corporation said they designate some suppliers as preferred. Supplier were designated preferred based on factors such as quality, delivery, service, and cost. These were suppliers who also had exemplary continuous improvement practices and would work on a continuous basis to reduce both theirs and Baxter's costs. A supplier's willingness to submit to such a system, therefore, is a significant step that is taken with the expectation that the customer's business offering is worth the effort.

Companies Offer Key Suppliers More Rewarding Business Relationships

Leading commercial companies ask suppliers to meet high standards, then differentiate the types of relationships within their pool of suppliers. Many treat key suppliers—those contributing the most to their product, such as critical parts or unique processes—differently than suppliers for noncritical or standard parts. For example, one Corning division categorized suppliers and developed relationships with them based on the extent of their impact on the customer and performance. Level 1 suppliers have a direct impact on customer satisfaction, level 2 suppliers are important to day-to-day operations but not directly linked to customer satisfaction, and level 3 suppliers provided commonly available products. DuPont differentiated between alliance partners—suppliers with similar goals and objectives that wish to work with DuPont for mutual benefit—and all other suppliers.

The more sophisticated relationships that commercial firms cultivated with their key suppliers included features such as participation in business planning, product design, and long-term agreements that operated with reduced procedures. Relationships were also strengthened by an openness to suggestions and criticisms from suppliers as a way to improve the

customers' performance. For example, Texas Instruments formed alliances with some suppliers and involved them in planning long-term strategies and risk assessments. Company executives meet biannually to discuss their joint progress and emerging problems.

Some leading companies recognize that key suppliers need accurate and timely sales forecasting and other business information to manage their own supply chains. The companies develop processes to provide short- and long-term sales forecasts, helping suppliers anticipate the amount and timing of orders. Motorola said a large number of suppliers participate in schedule sharing. Under this program, Motorola electronically posts a 26-week schedule depicting forecasted usage of supplied components. Varian Oncology Systems allows suppliers to dial into its manufacturing forecast for the next 12 months, officials said. They also share more detailed and sensitive information with suppliers who have closer relationships with the Varian. Honda meets with many of its key suppliers in a top management business meeting to discuss performance, the supplier's financial situation, the definition of a fair profit, and the potential for expansion of Honda's business.

Key suppliers were directly and actively involved in significant product decisions, including design. Most often through the use of teaming arrangements, the companies encouraged the key suppliers to participate and provide input during the entire product life cycle. Some companies collocated suppliers with their own people or set up central working facilities with suppliers to share information and coordinate design and production activities. For example, Chrysler reported that they select key suppliers early in a product's concept stage. These suppliers joined a design team for a specific platform and made presentations to Chrysler management on product design, target cost, and the design and delivery schedule. Officials from Varian Oncology Systems informed us that they had involved suppliers in design for the last 4 or 5 years.

In some cases, contractual arrangements reflected the different relationships. Contracts and agreements that guided strategic alliance or partnering relationships were less structured and generally lasted for several years. For example, Corning contracted with its best suppliers for a 3- to 5-year period. Also, once Corning determined a supplier to merit a "certified" or "preferred" rating, then its materials were no longer subject to incoming inspection. Honda considered some key suppliers as suppliers "for life" and used only a purchase and sales agreement to conduct business with those firms, officials said. These agreements did not include

details on quantity, price, or the length of the agreement. At Texas Instruments, the commodity teams made some strategic supplier contracts virtually open-ended.

Some leading companies' commitment to mutually rewarding relationships with suppliers was also demonstrated by their willingness to identify and take action on supplier issues and problems. The companies used methods such as surveys, supplier meetings, and formal customer-supplier councils or supplier advisory councils to assess existing customer-supplier working arrangements, identify problem areas, and report back to suppliers. Figure 4.2 gives examples of how some of the companies we visited identify and take action on supplier issues.

Figure 4.2: Company Actions Taken to Solicit Supplier Concerns

Chrysler Surveys Suppliers on:

- Performance of Chrysler purchasing agents
- Trust in Chrysler
- Willingness to invest in future business

Honda

- Surveys suppliers about how good a customer Honda is
- Responds in writing on how it will address concerns

Motorola

- Holds business reviews with each supplier
- Uses supplier advisory council for feedback

Suppliers Respond by Offering More Than a Good Product and Price

Key suppliers responded to these more sophisticated relationships by investing their skills and expertise in making the end product better. Their contributions were not limited to providing a quality component at a good

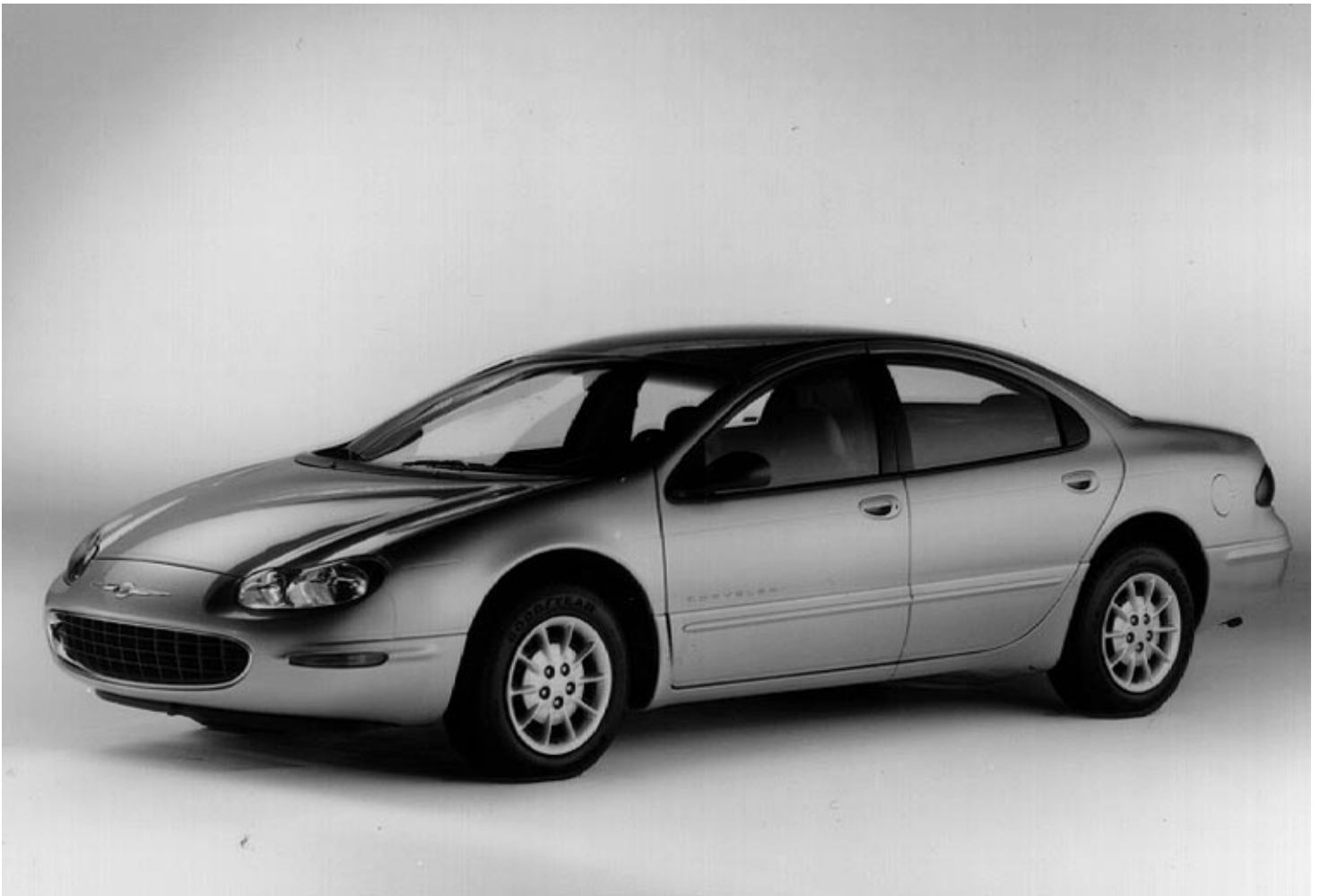
price or to the contract's terms. Often, the product developers and suppliers jointly identified cost drivers and used this information as a basis for target costing and cost reduction on specific products.¹ Honda said they involve key suppliers in target costing for its new car model designs and found that the suppliers could help Honda (1) evaluate Honda's component cost estimates and (2) pinpoint component cost differences, including those based on poor Honda design or use of obsolete technology.

Perhaps more significantly, Chrysler's relationships with its suppliers had evolved to the point that it no longer needed to make large investments in some key technology areas. Instead, the suppliers made the technology investment themselves and had enough confidence in their relationship with Chrysler that they did not fear the long-term commitment that this entailed. For its part, Chrysler trusted the suppliers to make the investments that would help keep their vehicles competitive. In this case, both supplier and product developer saw their success as that of the final product and a continuing mutually beneficial relationship. Figure 4.3 shows a Chrysler product.

¹Target costing involves determining the final price the customer will pay for the product, and then working backward to set fair prices for products, subsystems, and component parts.

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A Rewarding Environment Is Key to
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Figure 4.3: Chrysler Concorde LXI



Chrysler products depend on suppliers' research and development efforts.

Source: Chrysler.

DOD Practices

The environment for defense programs is complicated by having more players than commercial products with the addition of DOD as a participant. The environment for a given weapon system involves the interaction of DOD, the prime, and the suppliers. Experiences with the BAT and JDAM programs illustrate some of the problems DOD and the prime

contractors face in creating a rewarding supplier environment that encourages contributions, as well as potential solutions. Some BAT suppliers viewed their role as only complying with the design requirements passed down by the upper-tier customers and limited their efforts to the existing contract. They believed that to do more—such as offer design suggestions or make long-term investments—would not yield benefits. In contrast, JDAM suppliers believed they were full participants in a long-term relationship with their customers. Through the joint effort of the DOD program office and prime contractor, supplier relationships were cultivated without being stymied by the obstacles perceived by some prime contractors.

**Prime Contractors Support
Offering Suppliers
Rewarding Relationships
but See Obstacles**

Like leading commercial companies, most of the defense companies we contacted categorized their suppliers in various ways. Some used the terms such as preferred, acceptable, restricted and/or other designations to denote different levels of supplier performance. In general, the highest rankings were reserved for suppliers who consistently met quality, timeliness, and cost goals. The defense prime contractors also attempted to tailor different relationships to different suppliers.

Motorola officials informed us that their management of suppliers varied by categories. Fewer than 10 percent of their overall supplier base fell into their “approved” category. This category was significant because most of the products shipped from the approved suppliers were not subject to receiving inspection. Similarly, the preferred supplier certification process at McDonnell Douglas was used to rate suppliers into three categories: bronze, silver, and gold. Supplier performance was measured in key areas, such as acceptance rate and on-time delivery rate. Performance ratings ranged from “1” (process output does not meet customer expectations) to “5” (process output consistently exceeds customer expectations and positive trends have been documented for greater than 36 months). Preferred suppliers had to receive a 2.5 rating to merit the bronze category and a 4.5 rating to merit the gold category. Only 9 of 20,000 McDonnell Douglas suppliers had earned the gold rating at the time of our review, officials said.

To better leverage the capabilities of suppliers, AlliedSignal Aerospace develops Sector Long-Term Agreements between AlliedSignal Aerospace and suppliers chosen as partners for up to a 5-year period. They document the pricing, terms, and conditions for selected products and require yearly performance improvements. In return, the suppliers are guaranteed a

stable business base with AlliedSignal. Honeywell Defense Avionics Systems consolidated requirements and forecast future needs for selected goods across its commercial, space, and military groups. The company believed these actions would allow it to get better prices for these goods because of higher and more steady volume demands.

The prime contractors cited some difficulties in developing more rewarding relationships with their key suppliers. The process for AlliedSignal to set up its long-term agreements was lengthy and involved over 50 people to ensure compliance with government rules and regulations, such as the Federal Acquisition Regulations, before approval was granted, according to a government official. Boeing's Space and Systems Group officials believed that because of the nature of government contracting and method of funding, they could not forge long-term agreements or partnerships with their suppliers or provide their suppliers with reasonable forecasts of future demand. In contrast with their commercial business, the officials described the government contracting environment as low volume with unstable funding. They cited as an example an order to deliver 11 F-22 aircraft over a long period of time with no guarantee that the program would go forward.

Motorola officials stated that while their commercial divisions have moved to beneficial relations with their suppliers, starting with early teaming in design, the way government does business would impede a movement to this type of relationship on defense programs. They believed that requirements regarding competition in contracting made it difficult for a defense contractor to make an initial commitment to a supplier. Motorola stated that government pressure to continually compete suppliers worked counter to long-term relationships. Honeywell officials stated that government requirements, though reduced under the Federal Acquisition Streamlining Act, were still complicated and confusing, for many commercial-type suppliers. They noted that in their role as supplier on some programs, the prime contractor added as many or more requirements than DOD.

Several BAT Suppliers Did Not Believe the Program Fostered Rewarding Relationships

Relationships on the BAT program were described by several suppliers as bureaucratic, without distinguishing between established, proven suppliers and new suppliers. Some first-tier suppliers we contacted believed no consideration was given to their years of working together when it came to the low-rate production contract proposal. Supplier A said it was required to submit a four-volume basic proposal for the upcoming

low-rate production contract, detailing how their component would be designed, produced, and made to conform to quality standards even though it spent the last 6 years doing those very tasks for the BAT component. They said that although the low-rate production contract was essentially a re-buy of units already produced for testing, the prime contractor approached the next phase as if the program was back at the drawing board. Supplier C said that the prime asked for information it already knew from years of working with the supplier. Officials believed their company's high standards were unrecognized and wished their team could be allowed "to just do its job."

A number of first- and second-tier suppliers were frustrated with their inability to participate more fully in the BAT program. A key concern for several suppliers was nonresponsiveness to their cost-saving suggestions that involved design changes. A supplier A official said that the prime contractor's stated desire for using commercial items was not backed up by action. Although the company estimated cost savings of three or four to one using an industrial grade commercial part and was willing to guarantee the part for 20 years, it was told there was not enough data to make the change. Supplier D officials stated the original design for its component had a costly scrap rate and was not likely to be producible at high rates. The company invested its own funds to design an alternate part that met government specifications and could cut costs in half. However, the alternate part was not used because it challenged certain requirements.

Some suppliers thought that the prime contractor was not serious about adopting acquisition reforms and other changes in the upcoming low-rate production phase. Supplier B noted that although the prime contractor would say it removed some of the detailed military specifications from the program, the prime contractor had retained its own tight requirements anyway. The supplier also stated that the low-rate production proposal contained requirements that had been waived during development. Supplier A noted that the low-rate production contract referred to documents to be used as "guidelines," which were military specifications. Another supplier questioned why its component still needed government source inspection after passing its own ISO-certified quality manufacturing inspection and prime contractor inspection, considering that none of its products had failed the government inspection. The supplier shared concerns with the prime contractor and the Army regarding the added cost and effort for retesting thousands of production components, but the prime contractor included it in its contract proposal. Other suppliers

believed that the continued use of military specifications limited their ability to contribute to the product and reflected the customer's lack of trust.

The president of one second-tier company said that commercial firms kept suppliers more abreast of business plans and that he was confident that his commercial investments would pay off. Because of the uncertain nature of defense contracting, the president explained that he had to look at each defense order as a stand-alone order, which was an expensive way to do business. For example, he stated that while he invested the firm's own funds for commercial tooling because of its long-term potential, he would not invest the firm's funds in BAT tooling because the return was too uncertain. He said that although the 19,000 BAT units planned for production were held out as a carrot, the probability of the company working through the entire production was low because the program could be downsized, canceled, or the prime contractor might award later production to another supplier.

One second-tier supplier did have a long-term agreement with a first-tier customer that had not worked out well. According to one supplier official, the firm established a fixed-unit price for its component based on the volume forecast. They noted that while the supplier made good on its prices, the customer had only met 30 percent of the forecast volume, and had been inaccurate from the start. One supplier manager said that they typically invested their own funds in engineering efforts because with most customers, the return from large volume production covered the investment. On BAT, they lost money with this approach. The official said that they will not renew their long-term agreement with the first-tier customer and that any new agreements for research and development will be on a customer-funded basis.

Some suppliers had more positive experiences on the program. Supplier E officials said that they helped formulate the requirements in the development contract and that they had worked with another supplier to compromise on space utilization. Supplier F also believed the prime contractor was open to suggestions. Supplier C believed that many of the suppliers' recommendations to use commercial rather than military standards would be incorporated, although the supplier thought some changes would be too costly at this phase of the program.

**BAT Prime Contractor
Believed DOD
Requirements Provided
Little Flexibility**

BAT prime contractor officials said their ability to treat established suppliers differently from new suppliers, such as with streamlined inspections and paperwork, was constrained by program requirements. The officials stated that the development contract with DOD was very clearly defined and they were compelled to pass explicit requirements down to their suppliers, regardless of prior dealings with those suppliers. The officials said one difficulty in obtaining supplier input was that the program started with a “build-to-print” development package based on specifications. Every drawing referred to military specifications we were told. As a result, the prime contractor prepared and sent technical documents to potential suppliers requesting that they bid on the component as designed. They said they did not solicit input from suppliers even in low-rate initial production because the design was set and it would be too expensive to make substantial design changes. DOD disagreed that it has exerted such control over the BAT design. According to DOD, the Army did not have control of design when the Engineering and Manufacturing Development phase started, but only established a functional baseline. DOD stated that the contractor was responsible for developing the specifications and passing on requirements to subcontractors.

Prime contractor officials believed the low-rate production phase of the program would have more latitude in the requirements passed down to suppliers, but that many customer-imposed requirements would persist. They stated they have tried to use the military specifications only as guidelines wherever possible, but the customer still wanted the same product. Consequently, many of their direct suppliers incorporated the original military specifications in their low-rate production contract proposals.

Prime contractor officials stated that they have forwarded any business forecast information they received from their customer to the suppliers. They noted that one of the reasons the firm invited the DOD customer to a supplier conference was so that suppliers could get the information directly. They said they wanted their suppliers to stay interested in the product because they wanted their suppliers to invest in equipment and tooling for BAT. However, the officials said that for some suppliers, the BAT contract amount was a “drop in the bucket,” and thus not a great spur for investment.

**JDAM Provided a
Commercial-Like
Environment in a Defense
Setting**

On JDAM, the prime contractor said they formed alliances—sophisticated relationships—with key suppliers. The DOD program manager played an active role in creating the conditions conducive to such relationships, according to prime contractor officials. The ultimate success of this approach in producing a weapon that will perform as required remains to be seen. However, the approach did receive praise from key suppliers for the types of relationships it fostered.

The prime contractor and all four key first-tier suppliers informed us that the strong alliance between participants was based on trust and mutually shared goals. The parties agreed to long-term relationships that, according to the prime contractor, was the optimal way to achieve program target costs, high quality, and schedule performance. This approach was strongly supported by the Army customer. Vice presidents from the key first-tier suppliers were members of an executive IPT, which made them strategic partners in the program’s development and design process. Participants had to focus on how to make the best product as a whole because of the top priority DOD placed on decreasing the cost. To achieve cost reductions, the program manager at the time said the prime contractor had to turn to their suppliers. These characteristics encouraged suppliers at different tiers to invest more of their own resources in design and performance improvements.

Suppliers echoed the importance of developing a strong alliance between the parties. In highlighting differences between JDAM and other projects, supplier M said the “seamless” teams on JDAM stood out. The supplier said the prime contractor did not take a strong-armed role but asked its subcontractors to participate as partners. Supplier N said the prime contractor held clear authority over the program, but the development of new solutions to win the contract was the result of great teamwork. A second-tier supplier said the teaming arrangement was a lot closer than with other weapon systems. These arrangements also offered the second-tier suppliers the opportunity to add value because they were involved early in the design phase.

The JDAM environment was the byproduct of actions taken by DOD, the prime contractor, and the suppliers. Suppliers participated in the weapon’s design and had open communications with the prime contractor. Unlike the detailed specifications for BAT, DOD had stated the JDAM requirements in terms of key performance parameters, which allowed the contractor teams room to make design trade-offs. Instead of passing down specific design requirements to the suppliers, the prime contractor delegated design

authority and configuration control where possible, according to DOD program officials. This added responsibility gave the suppliers a stake in the product design and ultimate success. The suppliers retained ownership of their design responsibilities as long as they met the cost and performance specifications. According to the DOD program manager at the time, the lifetime warranty DOD demanded of JDAM also had the consequence of increasing supplier involvement. He said the suppliers were willing to accept the liability as long as they had a voice in the design.

Second-tier suppliers reported similar team participation experiences. For example:

- Supplier U said they were attracted to the program because their early involvement allowed them the opportunity to be innovative and make suggestions rather than work from a blueprint.
- Supplier S said they worked extensively with its first-tier customer to reduce the cost of its part.
- Supplier Q characterized its role in JDAM decision-making as a dynamic exchange of information. The supplier was asked how it would meet requirements and also to pose alternatives. At no time was the first-tier contractor dictatorial. The supplier was treated as an expert and its opinions were respected.

The planned stability and high procurement volume of the program facilitated the building of long-term relationships on the JDAM program by allowing the prime contractor to guarantee suppliers a certain amount of work and obtain their commitment, according to DOD program officials. One of the major steps that DOD took to facilitate this was to state in the contract that the government would neither compete the production nor ask the prime contractor to compete the suppliers for the duration of the commitment, as long as the program's performance specifications and cost goals were met. Prime contractor officials agreed that the long-term aspect of the program was very important and believed that suppliers were attracted to the high volume and long-term mutually beneficial relationships that resulted.

The suppliers agreed that the JDAM program was attractive from a business standpoint and they did not believe they were contending with a low volume, annually funded program. It represented a long-term commitment and a high volume of parts and millions of dollars in business potential on the domestic market, plus the potential for foreign sales. Suppliers could

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fit JDAM into their own strategic plans because the program offered long-term stability—they would be together for 5 or 6 years if they won the contract. Supplier U said they signed a general memorandum of understanding for 5 years with its first-tier customer. Most suppliers also reported that there was extensive sharing of business information. According to supplier A, the prime contractor shared project information, scope, scale, and business forecasts with them, which they shared with their second-tier suppliers. Lower-tier suppliers found the information important in planning and in staying fully informed on the program's status. Equally as important, the suppliers found the information to be valid and accurate.

Conclusions and Recommendations

Conclusions

In both the commercial and defense sectors, suppliers play a key role in the development and manufacture of major products. Suppliers are critical in terms of both the amount of the finished product they make, as well as the technological innovation included in the final product. The leading commercial firms have found that developing sophisticated relationships with key suppliers gives them a competitive edge in the cost, features, quality, and development time of their products. If such relationships were not beneficial from a business standpoint, they would not be cultivated because they take commitment, effort, and resources. DOD and its prime contractors realize the criticality of suppliers to the success of weapon system programs and DOD has emphasized the selection of capable suppliers. Nonetheless, a gap can be seen between how supplier relationships have traditionally operated on weapon system programs and how they operate in the leading commercial firms. DOD's experience with JDAM may show how to narrow that gap. Clearly, the need exists. The persistence of problems on weapon system programs, coupled with DOD's desire to modernize more quickly, spotlight the need to get better outcomes from new weapon programs, particularly in terms of development cycle time and cost.

Best commercial supplier practices, when analyzed in the aggregate, can be seen as four traits that operate in a system that is self-sustaining because it provides mutual benefits to both suppliers and the product developer. When this construct is applied to a traditional DOD program, gaps can be seen in two traits: (1) providing central support for optimum supplier relationships and (2) creating an environment whereby key suppliers see their extra commitment and effort as worthwhile. Experience on the BAT program shows that weaknesses in these two areas can diminish the effect of other best practices, such as the use of a rigorous supplier selection process, teams, and rating procedures.

Central Support

In the commercial sector, the product developer can unilaterally commit to centrally supporting better supplier relationships and can institute the requisite organizational changes that make a company a preferred customer. In the defense sector, DOD and prime contractors share this responsibility. It is difficult for the prime contractors to translate the desire for better supplier relations into tangible differences in the actual relationships without the active support of DOD. To some extent, the prime contractors have their own history to overcome; the Aerospace Industries Association, for example, noted that until recently, the Association itself had not adequately considered supplier firms. Similarly, DOD has

traditionally focused its attention on the prime contractors; it has encouraged the selection of capable suppliers but adopted a hands-off approach regarding supplier relationships.

DOD's involvement is important in influencing the prime contractors' commitment to better supplier relations and the extent to which such commitment permeates the different tiers of suppliers. DOD shares this responsibility because on any given weapon systems program, it is the customer, financier, requirements setter, and co-manager. One reason for the distance DOD has kept between itself and suppliers is the concern over violating the privity of contract that exists between the prime and its suppliers. However, the role played by the program office on JDAM shows how critical DOD's support can be to the value placed on supplier relationships at the outset of a program, without crossing the line on privity. Essential to DOD's influence on that program was the program office's weighing the choice of suppliers heavily in selecting a prime, supported by clear action—such as substantive visits to the suppliers during the competition.

A Rewarding Environment

DOD and the prime contractors share in fostering an environment in which suppliers believe that there are true incentives for doing more than complying with the contract's terms. It is true that the BAT program did not enjoy all of the advantages of the JDAM program for improving supplier relations. Nonetheless, the best practices that were attempted on BAT were not perceived by some key suppliers as much more than procedural changes. Several suppliers believed their design and other ideas were not welcomed or acted upon. In their view, despite their years of experience, they were treated like newcomers when they bid on subsequent BAT contracts. They also expressed reservations regarding the business projections that upper-tier customers shared with them. In short, they believe little trust or mutual benefit existed. They viewed their role as restricted to delivering a product that complied with the design requirements given them—they saw no value in doing more.

Several defense prime contractors stated that they were attempting to build long-term, more rewarding relationships with their suppliers, but believed that aspects of government business inhibited such relationships. They noted that government requirements, though reduced, were still complicated and that competition for lowest price was still emphasized by DOD contract officials. Another noted that instability of DOD programs, such as from funding uncertainty, weakened business projections. We do not

disagree that these may inhibit developing long-term relationships. Nonetheless, ways were found on the JDAM program to overcome these obstacles and create a commercial-like environment for suppliers.

While it remains to be seen if JDAM can deliver as promised, the lessons learned may help other programs to fully realize the potential of involving lower-tier suppliers to get better outcomes. Acquisition reform initiatives may provide vehicles for facilitating supplier relationships. On the other hand, the suppliers' full participation may be essential to the effectiveness of such reforms.

In establishing good supplier relationships, commercial firms have had to become better customers. By implementing the lessons learned from those firms—creating a system of incentives that rewards productive supplier relations—DOD can become a better customer for weapon systems. In so doing, DOD can also help its prime contractors forge better relationships with their suppliers.

Recommendations

We believe that actions to improve supplier relations are needed at both the Department level and the individual program level in DOD. Accordingly, we recommend that the Secretary of Defense:

- Develop a policy that promotes productive supplier relationships and emphasizes the importance of suppliers in improving program outcomes. In its absence, concerns about privity may dominate and minimize the contribution of suppliers.
- Communicate this policy throughout the acquisition workforce and the defense industry through training and other means. Training could include tools that effectively promote best supplier practices for both new and ongoing programs. Practices used in the JDAM program would be one good source of identifying such tools.

We also recommend that the Secretary of Defense ensure that weapon system program managers provide leadership and incentives for optimizing supplier relations on their programs by taking the following actions:

- Establishing acquisition strategies that support good supplier relationships. The conduciveness to supplier relations may be affected by (1) how program priorities, such as performance requirements, are set; (2) how enabling practices, such as design flexibility, cost-performance

tradeoffs, and teaming responsibilities will be used; and (3) what tools for recognizing and incentivizing prime contractor performance, such as source selection factors and contracting arrangements, are made available.

- Supporting the strategies with action. This can involve active interfaces with suppliers, through teaming or other vehicles, providing technical assistance, evaluating the prime contractors' success in fostering best supplier practices, and following through on promised rewards and corrective measures.

Agency Comments and Our Evaluation

DOD concurred with a draft of this report and all of its recommendations (see app. I). In agreeing that a policy, which emphasizes consideration of the prime subcontractor relationship and its outcome on programs is needed, DOD noted that this policy must also reflect consideration of privity concerns. DOD envisioned that this policy would also include the actions called for by our recommendation to ensure that leadership and incentives be provided by program managers in their acquisition strategies. DOD believes that current policies and efforts address some of the concerns raised in the report. These initiatives include (1) reducing the use of detailed specifications; (2) placing decision-making authority with the prime contractor; and (3) using IPTs, cost as an independent variable, past performance information, and integrated program team contractor reviews. DOD stated that, in addition to the extensive acquisition reform training currently offered, a JDAM case study was being prepared for release this year. Finally, DOD noted that (1) the biggest impediment to acquisition strategies that support good supplier relationships is the financial stability of the program and (2) stability is considerably beyond the control of any program manager or service. Nonetheless, DOD stated that long-term relationships can be established that are contingent upon the program's continuation under commercially acceptable terms and conditions.

We believe that some of DOD's current policies—such as less detailed specifications and cost as an independent variable—can give a program manager the latitude needed to create an environment that fosters greater supplier involvement. Others, such as IPTs, represent tools program managers can use to build and maintain relationships. Although these policies and tools are not directed at supplier relationships, they can facilitate stronger relationships and are at the same time dependent on the relationships. A supplier policy could thus clarify the role expected of program managers in cultivating supplier relationships to increase the chances for program success. We believe that the JDAM case study DOD

plans to incorporate into its training curriculum could help communicate a supplier policy by sharing not only the specific experiences of the JDAM program, but also by making the broader points that program managers (1) recognize their responsibility to be fully aware of the activities and progress being made by key suppliers, regardless of tier; (2) be made aware that, with appropriate regard for privity concerns, they may be more directly involved with suppliers; and (3) be encouraged to do so for the benefit of the program.

As DOD points out, there are factors that create instability beyond the control of a program manager or service. These could include reductions necessitated by an unexpected military operation or congressional direction. On the other hand, other factors are controllable by the services, such as decisions to reduce the funding of some programs to accommodate changes in other programs or to start new programs. Nonetheless, stability is but one of several factors that can affect a program manager's ability to build trust and commitment among suppliers.¹ Other factors, which are more controllable, include setting reasonable expectations about production quantities and schedules; setting a cost, schedule, and performance baseline that has a practical probability of being executed within available funding; and taking steps to ensure that prime contractors reward high-performing suppliers, such as with simplified business arrangements and increased business.

¹For more information on these issues see Weapons Acquisition: Better Use of Limited DOD Acquisition Funding Would Reduce Costs (GAO/NSIAD-97-23, Feb. 13, 1997) and Weapons Acquisition: A Rare Opportunity for Lasting Change (GAO/NSIAD-93-15, Dec. 31, 1992).

Comments From the Department of Defense



ACQUISITION AND
TECHNOLOGY

OFFICE OF THE UNDER SECRETARY OF DEFENSE

3000 DEFENSE PENTAGON
WASHINGTON DC 20301-3000

2 MAR 1998

Mr. Louis J. Rodrigues
Director, Defense Acquisition Issues
National Security and International
Affairs Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Rodrigues:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "Best Practices: DoD Can Help Suppliers Contribute More to Weapon System Programs," dated February 6, 1998 (GAO Code 707190/OSD Case 1537). The Department concurs in the views expressed in the GAO draft report; however, specific comments concerning your recommendations are enclosed. Technical comments to the report were separately provided. Thank you for the opportunity to review and comment on the draft report.

Sincerely,

Donna S. Richbourg
Acting Deputy Under Secretary of Defense
(Acquisition Reform)

Enclosure:
As Stated



Appendix I
Comments From the Department of Defense

GENERAL ACCOUNTING OFFICE DRAFT REPORT - DATED FEBRUARY 6, 1998

(GAO CODE 707190) OSD CASE 1537

"BEST PRACTICES: DOD CAN HELP SUPPLIERS CONTRIBUTE
MORE TO WEAPON SYSTEM PROGRAMS"

* * * * *

DOD COMMENTS IN RESPONSE TO THE GAO RECOMMENDATIONS

RECOMMENDATION: That the Secretary of Defense:

-- Develop a policy that promotes productive supplier relationships and emphasizes the importance of suppliers in improving program outcomes. In its absence concerns about privity may dominate and minimize the contribution of suppliers.

***DOD RESPONSE:** Concur. However, It is important that concerns about privity of contract be considered in this policy in order to avoid the ramifications of a possible "directed subcontractor" or "government direction" determination. Nevertheless, we agree that within such confines it is possible to develop a policy that requires consideration of the prime-subcontractor relationship and its outcome on the program. More can clearly be done to enhance this factor's importance both during the source selection process and beyond. Some efforts have already been taken in this regard, the most significant of which were the reduction in the use of detailed specifications and the implementation of Integrated Product Teams. Additionally, more and more programs are placing the decision making authority with the prime contractor through the use of Total System Performance Responsibility clauses. The combination of these efforts, the Department believes, has already helped to eliminate some of the difficulties referenced in the report.*

-- Communicate this policy throughout the acquisition workforce through training and other means. Training could include tools that effectively promote best supplier practices for both new and ongoing programs. Practices used in the JDAM program would be one good source of identifying such tools.

***DOD RESPONSE:** Concur. In addition to the extensive acquisition reform training programs currently offered, both in-house and through various electronic and satellite broadcast media, a JDAM case study, under the joint auspices of*

Appendix I
Comments From the Department of Defense

the Boeing Company and the Defense Systems Management College, is in production for release this year.

RECOMMENDATION: That the Secretary of Defense ensure that weapon system program managers provide leadership and incentives for optimizing supplier relations on their programs by taking the following actions:

-- Establishing an acquisition strategy that supports good supplier relationships. The conduciveness to supplier relations may be affected by: (1) how program priorities, such as performance requirements, are set; (2) how enabling practices, such as design flexibility, cost-performance tradeoffs, and teaming responsibilities will be used; and (3) what tools for recognizing and incentivizing prime contractor performance, such as source selection factors and contracting arrangements, are made available.

***DOD RESPONSE:** Concur. Acquisition strategies are established for individual programs not generically for all programs, and it is envisioned that all of the foregoing recommendations would be considered for inclusion in the "policy" that the first recommendation suggests should be developed. The Department believes that there are current policies that address some portion of the concerns that have been raised. These include the use of: (1) cost as an independent variable; (2) past performance information; and (3) integrated program team contractor reviews.*

-- Supporting the strategy with action. This can involve active interfaces with suppliers, through teaming or other vehicles, providing technical assistance, evaluating the prime contractors' success in fostering best supplier practices, and following through on promised rewards and corrective measures.

***DOD RESPONSE:** Concur. It must be recognized, however, that the biggest impediment to this recommendation is one considerably beyond the control of any program manager or service, i.e., the financial stability of the program. Without an ability to guarantee long term relationship, much of this can be mere conjecture. In recognizing this inevitability in government contracts, absent multi-year procurement authority, long term relationships can be established that are contingent upon the program's continuation under commercially acceptable terms and conditions.*

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