

# SD-2

# DoD Acquisitions Buying Commercial Items and Nondevelopmental Items



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# Foreword

Since the MilSpec Reform efforts of the mid-1990s, DoD has increasingly relied upon the commercial marketplace to fulfill its needs for military products and services. Our ability to field affordable, state-of-the-art systems when they are needed, to buy the millions of items needed to support our troops and fielded systems, and to provide the necessary services to our military personnel depends on efficient use of available resources. We must continue our efforts to make effective use of commercial items—both products and services—and nondevelopmental items in DoD acquisitions.

This document offers guidance on acquisitions involving all types of commercial and nondevelopmental items: systems, subsystems, assemblies, parts, and items of supply. Commercial services are also addressed. This document does not present a “cookbook” approach to the acquisition of commercial and nondevelopmental items; such an approach could not accommodate the vast array of potential applications. It does offer lessons learned and things to consider when participating on an integrated product team.

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# Background

Part 12 of the Federal Acquisition Regulation (FAR), “Acquisition of Commercial Items,” requires that agencies use, to the maximum extent practicable, commercial items or nondevelopmental items (NDIs) to meet agency needs. Agencies must also require that prime contractors—and their subcontractors at all tiers—incorporate, to the maximum extent practicable, commercial items or NDIs as components of items supplied to the agency. This requirement is echoed in the Defense Acquisition Guidebook. The purpose of this document is to present best practices and lessons learned about including commercial items and NDIs in DoD acquisitions.

This document is intended to be used by both DoD and contractor personnel who must make decisions about the use of commercial and nondevelopmental items. Government users of this document may include program managers, contracting officers, customers/users, engineering and technical personnel, and other stakeholders with an interest in acquisition. Contractor personnel for whom this document may be useful are contractor program managers, engineers, subcontract administrators, quality assurance managers, subcontractors, and other personnel involved in the acquisition.

This document covers the entire spectrum of acquisitions. Because acquisitions vary tremendously in size, in scope, and in the product or service to be acquired, the concepts discussed may not be applicable in all circumstances. DoD and contractor personnel should tailor the concepts to the particulars of the acquisition.

Additional guidance on the procurement of commercial items is available in the Defense Procurement and Acquisition Policy's Department of Defense Guidebook for Acquiring Commercial Items. The handbook is more focused on processes such as pricing, contracting, and administration, while this document is focused more on in-depth treatment of earlier acquisition processes such as acquisition strategy, market research, quality assurance, test and evaluation, and life-cycle support planning. The two documents are complementary and valuable resources on commercial item procurement.

## WHAT ARE COMMERCIAL ITEMS AND NONDEVELOPMENTAL ITEMS?

According to Part 2 of the FAR, a commercial item is any product or service that is customarily used by the general public or nongovernmental entities for nongovernmental purposes. Commercial items may include the following:

- **Products, other than real property, that have been offered for sale, lease, or license to the general public.** Possible indications that an item is commercial are a commercial sales history, listing in catalogs or brochures, an established price, and distributors. Examples of commercial items bought by DoD are transport aircraft, computers, medicine,

and fuel. The commercial market is global; commercial items are not limited to the domestic commercial market.

- **Products that evolved through advances in technology or performance and will be available in the commercial market in time to meet the delivery requirements of the solicitation.** Examples of such items are product updates, model changes, and product improvements such as new versions of software.
- **Products that have received minor modifications to meet DoD requirements.** To be considered minor, a modification may not significantly alter the product's nongovernmental function or essential physical characteristics and may not change the purpose of a process. In determining whether a modification is minor, consider the value and size of the modification and the comparative value and size of the final product. Dollar values and percentages may be used as guideposts but are not conclusive evidence that a modification is minor.
- **Products that were created by integrating commercial subsystems and components into a unique system.** For example, a computer system composed of commercial subsystems would be considered a commercial item. Another example is industrial plant equipment that combines commercial components into a unique item based on customer needs.
- **Products developed at private expense and sold competitively in substantial quantities to state and local governments.** Examples are protective vests used by police departments and rescue equipment used by fire and rescue units.
- **Installation services, maintenance services, repair services, training services, and other services procured to support a commercial product.** The source of the services provides similar services to the general public under terms and conditions similar to those offered to the federal government. Help desks, call centers, warranty repair services, user training, equipment installation, and other services related to item support are examples.
- **Standalone services offered and sold competitively, in substantial quantities, in the commercial marketplace based on established catalog or market prices for specific tasks performed and under standard commercial terms and conditions.** Construction, research and development (R&D), warehousing, garbage collection, and transportation of household goods are examples. Additional guidance on the acquisition of commercial services can be found in DoDI 5000.74, "Acquisition of Commercial Services."

An NDI is a product that was developed exclusively for governmental purposes. According to Part 2 of the FAR, NDIs include the following:

- **Defense products previously developed by U.S. military services or defense agencies of U.S. allies and used exclusively for governmental purposes by Federal agencies, state or local governments, or a foreign government.** For example, the mechanical dereefer (a mechanism for releasing parachute reefing lines) used with the U.S. Army's cargo parachutes was developed for and first used by the Canadian Army. Another example is the use by the other U.S. military services of trucks developed by the Army.

- **Items that require only minor modifications to meet the requirements of the procuring agency.** For example, the Army's M-119 Howitzer was a modified version of the British Light Gun.
- **Products fully developed and in production, but not yet sold and in use.** Use of such items enables DoD to capture the latest product developments and new technology, but they also pose some risk because they do not have a performance history.

Another type of NDI, which is not explicitly addressed in the FAR, is a unique system created by integrating NDI subsystems and components. Some development, such as software necessary for subsystems and components to work together, may be involved to ensure that the unique system functions as required. Any development required for integration should be managed through a developmental acquisition strategy.

## WHY USE COMMERCIAL AND NONDEVELOPMENTAL ITEMS?

The potential benefits to DoD from the use of commercial products and NDIs to meet requirements have grown in number and significance as the defense environment has changed. Among the key benefits are the following:

- Access to the latest technology,
- Faster delivery,
- Lower prices,
- Integration of the defense and commercial industrial bases,
- Access to commercial support services, and
- Elimination of the need to fund the development and support of unique items.

Perhaps the most important benefit that DoD receives from the use of commercial products and NDIs is access to the latest technology. In many of the technological areas significant for defense items, DoD no longer leads private industry in R&D and application. For example, in the fields of communications, electronics, and computers, the pace of technological evolution resulting from high commercial demand outstrips the capabilities of any government R&D program.

The need to field a system as quickly as possible also is a major incentive for using commercial products or NDIs. The use of commercial products and NDIs reduces or eliminates the need for time-consuming and costly R&D and thus expedites the time to field systems. The use of commercial products and NDIs also can reduce a program's technical risks.

Another incentive for DoD to use commercial products is the potential savings in procurement costs. The economies of scale of the much larger commercial market allow items to be sold at lower prices. Lower costs for commercial products not only benefit the taxpayer, but may allow more development dollars to be spent in areas for which no commercial alternatives exist.

The integration of the defense and commercial industrial bases is another important benefit from the use of commercial products. DoD requirements that are integrated into commercial

production are far more likely to have a stable industrial base to draw from if a surge in requirements occurs due to an emergency. In addition, in times of reduced procurement, DoD business is not sufficient to keep many defense-unique suppliers in business. Integrated commercial and defense production is beneficial for the nation's security and economy in the long run.

Finally, when DoD uses commercial products, DoD gains access to the contractor's commercial support network. This may include installation, maintenance and repairs, training and technical support, and inventory and logistics support. DoD can take advantage of the commercial contractor's distribution and support network without having to maintain or establish its own network or to pay a contractor to establish one where none existed. The savings in dollars, as well as in improved customer satisfaction, can be substantial.

DoD also benefits from the use of standalone commercial services such as construction and R&D. The benefits, similar to those of commercial products and NDIs:

- Access to the service provider's commercial service network,
- Lower costs through economies of scale,
- Market acceptance of the service and provider, and
- Efficiency and expertise acquired through market-driven competition.

Another benefit of obtaining commercial services is that they can often be tailored to the needs of the customer. For example, a commercial service provider's equipment maintenance plan may offer a minimum level, typical level, or high level of maintenance, depending on the user's needs. This allows for greater flexibility when making tradeoff decisions.

## WHAT ARE THE CHALLENGES?

Although commercial items and NDIs bring significant benefits to DoD, they also can pose challenges. For example, one challenge with buying commercial products is that the numerous government-unique requirements—such as contractor adherence to socioeconomic requirements, cost accounting standards, and oversight processes—can discourage commercial firms from participating in the DoD market entirely, which may limit DoD's access to the latest technologies. This challenge can be mitigated by following the acquisition policies in FAR Part 12, which reduces the number of unique government contract terms and conditions. Even when FAR Part 12 is used, commercial firms may still be reluctant to sell directly to the government. They may perceive additional administrative burdens and contractual issues, their strategic objectives may not include the government as a potential customer, or DoD's requirement may not be significant enough to entice them to do business with DoD.

Several important and growing challenges apply to commercial items and NDIs, as well as to military-unique items. Among these are counterfeit parts, environmentally sensitive materials, such as lead or cadmium, and issues relating to product availability, such as obsolescence and diminishing manufacturing sources. There are additional hardware, software, system security,

and cybersecurity concerns when using commercial items. DoD has a requirement to ensure that its systems survive compromise from a cyber attack. The extent to which commercial items are integrated into the system, how much is used in critical applications, the security features built into each item, and the quality of security architecture engineering designed into the system all come into play when ensuring that our systems can withstand cyber attack. For example, implementing a "wrapper" around untrusted commercial software may mitigate the likelihood of associated malware impacting mission success. DoDI 500.02, "Operation of the Defense Acquisition System," Enclosure 14, provides extensive information on cybersecurity risks and mitigation. These issues, described in Appendix A, pose significant, costly, and growing challenges for product acquisition teams. Team members should be aware of these potential problems and take appropriate steps to help mitigate the related risks.

Successful programs recognize the challenges of using commercial products and NDIs and develop strategies to address the challenges and minimize their impact. Table 1 lists the major challenges along with approaches for reducing the risks associated with them.

**Table 1. Challenges and Mitigation Approaches: Commercial Products and NDIs**

Challenge	Mitigation approaches
Performance in military environment	<ul style="list-style-type: none"> <li>• Conduct product verification testing</li> <li>• Test product samples</li> <li>• Use test beds</li> </ul>
Costs for frequent upgrades	<ul style="list-style-type: none"> <li>• Budget up-front for expected upgrades</li> <li>• Determine acceptability of less frequent upgrades</li> </ul>
Risk that desired features or performance may be changed unilaterally by the commercial firm	<ul style="list-style-type: none"> <li>• Participate in supplier-customer forums to influence designs</li> <li>• Determine if other suppliers exist</li> <li>• Determine whether the government can maintain desired features</li> </ul>
Risk that supplier may go out of business or leave the industry	<ul style="list-style-type: none"> <li>• Determine if alternative vendors exist</li> <li>• Use open interface standards</li> <li>• Determine whether the government can support the product if necessary</li> </ul>
Integration of various commercial items/NDIs into system	<ul style="list-style-type: none"> <li>• Use independent consultants/advisors with expertise in integrating commercial items</li> <li>• Use open interface standards</li> <li>• Determine how integration of multiple items affects overall performance</li> </ul>
Costs of testing to ensure performance	<ul style="list-style-type: none"> <li>• Plan for less developmental testing but more operational and performance testing</li> </ul>
Configuration management	<ul style="list-style-type: none"> <li>• Adapt to industry cycles where possible</li> <li>• Determine if less frequent upgrades are possible without compromising supportability of older items</li> <li>• Budget and plan for licenses to obtain access to required technical data</li> </ul>
Cybersecurity and system security risks	<ul style="list-style-type: none"> <li>• Use appropriate cyber-threat protection measures to reduce the risk to program information and systems</li> <li>• Ensure that all cybersecurity standards related to the analysis of program risks are used</li> <li>• Ensure that all FAR and DFARS clauses related to information security are included in solicitations and contracts</li> </ul>



Successful programs also must recognize the challenges of using commercial services. For example, outsourcing DoD functions to commercial providers allows the military to concentrate its resources on core combat-related functions. However, once the transition to a commercial service provider has taken place, it may be difficult and expensive to reconstitute organic capability if that becomes necessary. Therefore, before deciding to outsource a DoD function, the risks and benefits should be carefully analyzed.

Cybersecurity risks and mitigation concerns are an important consideration when acquiring commercial IT services. Per DoDI 5000.74, "Acquisition of Commercial Services," DoD must ensure that all IT services that receive, process, store, display, or transmit DoD information will be acquired, configured, operated, maintained, and disposed of consistent with applicable DoD cybersecurity policies, standards, and architectures. The statement of work should include a requirement for how the contractor will satisfy security control issues.

Of lesser importance, but still a factor potentially limiting the use of commercial services, is the willingness and ability of a commercial service provider to obtain security clearances for personnel who may need access to secure facilities to perform services. The need for any security clearances should be addressed in the statement of work.

Deployment issues pose another challenge for DoD and commercial service providers. Costs for commercial services can increase dramatically if civilian contractor personnel must be deployed to a combat area. Civilian contractor personnel may demand high salaries to compensate for potential risks when performing work in a military theater of operations.

Another potential deployment issue concerns the overlap of contractual requirements with military command and control. Issues that need to be addressed include what duties the contractor is contractually required to perform, what organizations they report to, and who has authority to direct the actions of contractors in a military theater.

DoD, the State Department, and other government agencies may all be operating simultaneously in a military theater, each with their own contracts with commercial service providers. The coordination and interaction of different agencies, along with their subcontractors, are important planning and operational considerations. Agencies must work together to clearly define the operational parameters to which their commercial contractors are expected to adhere.

## **WHO SHOULD BE INVOLVED?**

As in any acquisition, when considering commercial items or NDIs, stakeholder involvement is crucial to a successful program. Key stakeholders include the customer or end user, program manager, contracting officer and other contract specialists, and acquisition personnel.

For a large or complex acquisition, an integrated product team (IPT) should be established. An IPT is a multidisciplinary group of people who are collectively responsible for delivering a defined product or process. In addition to the key stakeholders, the IPT should include

members of the systems engineering, production, fielding/deployment, and operational support and logistics communities in order to optimize the design, manufacturing, business, and supportability processes.

Depending on the acquisition, the IPT may also include subject matter experts such as

- transportability experts to assess requirements for packaging, handling, storage, and transportation;
- system security engineers to provide expertise on security measures and requirements needed for the protection of computer systems, networks, and information;
- human factors engineers to deal with human-oriented acquisition issues or topics;
- representatives of the test and evaluation community to plan the test strategy for the program; and
- members of the training community to ensure that system users and organization/unit leaders are prepared to employ the system advantageously and that operators, maintainers, and support personnel are properly trained and can retain their operational effectiveness.

In addition, independent industry experts or consultants may be needed to assist the IPT with its evaluation of various aspects of the commercial and nondevelopmental items under consideration.

The IPT members must be continually engaged in the acquisition process and decisions. This requires that they understand the latest developments in the market and adapt program objectives and strategy accordingly. In other words, a program that seeks to maximize the use of commercial items or NDIs must adapt itself to the pace of the commercial market.

## **WHAT IS THE PROCESS FOR BUYING COMMERCIAL AND NONDEVELOPMENTAL ITEMS?**

In general, the process used to acquire commercial and nondevelopmental items is a streamlined version of the acquisition process described in DoD Directive 5000.01, "The Defense Acquisition System," which provides the policies and principles that govern the defense acquisition system (Appendix B summarizes the key policies). DoD Instruction 5000.02, "Operations of the Defense Acquisition System," in turn, establishes the management framework that implements these policies and principles.

Buying commercial or nondevelopmental items involves the following key activities:

- Define requirements both at a high level and at a detailed engineering level
- Identify a candidate commercial or nondevelopmental item that appears to best meet the requirements

- Develop a life-cycle support plan for the item
- Test and evaluate the item to determine its ability to satisfy the requirements
- Plan and implement the acquisition strategy.

The remainder of this document describes these activities. Recognize, however, that they are not necessarily discrete nor are they necessarily sequential. Furthermore, they may not all be necessary, depending on the item to be bought. For example, when acquiring a relatively simple item, such as a laptop computer, it may be possible to eliminate both testing and development of a support plan. In contrast, when acquiring a complex item, such as a financial management system or a weapon system, these activities may be somewhat iterative, requiring early and ongoing market research and tradeoff analyses to identify the item that best meets DoD's needs with the least performance, cost, and schedule risk. Moreover, DoD may plan the acquisition strategy first and then contract with a system integrator or other prime contractor to design and engineer the item; to select the systems, subsystems, and components to be incorporated into the end item; and to deliver the item that meets the performance requirements at the best value and in the needed time frame. Whether DoD or the contractor is responsible for delivering the item, the use of commercial systems, subsystems, and components to the extent practicable is preferred.

Regardless of the item to be acquired, the process requires continual interaction among IPT members to reach consensus on the preferred solution. To achieve consensus, the customer/user, the program manager, and other IPT members must remain flexible in their acquisition strategy and be willing to adapt to the commercial environment if they hope to realize the full benefits of commercial technology.

Adapting to commercial markets is both a necessity and a challenge for programs that seek to maximize the use of commercial items. A program that relies on commercial items may never be "finished" in the traditional sense, because commercial firms continually revise and update their products to compete in the commercial market. Moreover, commercial items can pose challenges to programs in areas such as integration, modification strategy, support of outdated items, and budgeting for upgrades. At the same time, a program can realize significant benefits from using commercial items, such as obtaining the latest technology without the need to unilaterally fund its development.

# Define Requirements

Initially, requirements are defined at a high level by the customer or end user. The focus at this point is on operational requirements, for example, the type of item needed and the environment in which the item must operate. In addition, the customer/user should distinguish between requirements that are mission critical and those that are mission enhancements. System security engineering should be part of the requirements determination. System security is a design consideration that should be on par with other aspects of commercial acquisition such as reliability, safety, performance, and quality concerns. The system security requirements need to be established early and include inputs from the user, software development, engineering, logistics, and other relevant stakeholders.

To maximize the potential for commercial and NDI solutions, operational requirements should be stated in terms of performance or functionality and should be flexible. The use of commercial technology in an item can best be maximized when the capabilities of commercial items form the basis of the requirements, rather than when the user establishes the requirements independent of any knowledge of commercial capabilities. Undertaking market research to gain a broad understanding of commercial markets, technologies, companies, and products (strategic market research) is a good way to learn about commercial capabilities. (For detailed information about market research techniques, see SD-5, *Market Research: Gathering Information about Commercial Products and Services*.)

Once an acquisition program, along with the IPT, is established, the requirements can be defined in more detail. As with any acquisition program, thresholds and objectives for total ownership (life-cycle) cost, schedule, and performance parameters must be determined. A threshold is the minimum acceptable value for a parameter that, in the user's judgment, is necessary to provide a capability that will satisfy the mission need. An objective is a value beyond the threshold that could potentially have a measurable beneficial impact on capability, operations, or support above that provided by the threshold value.

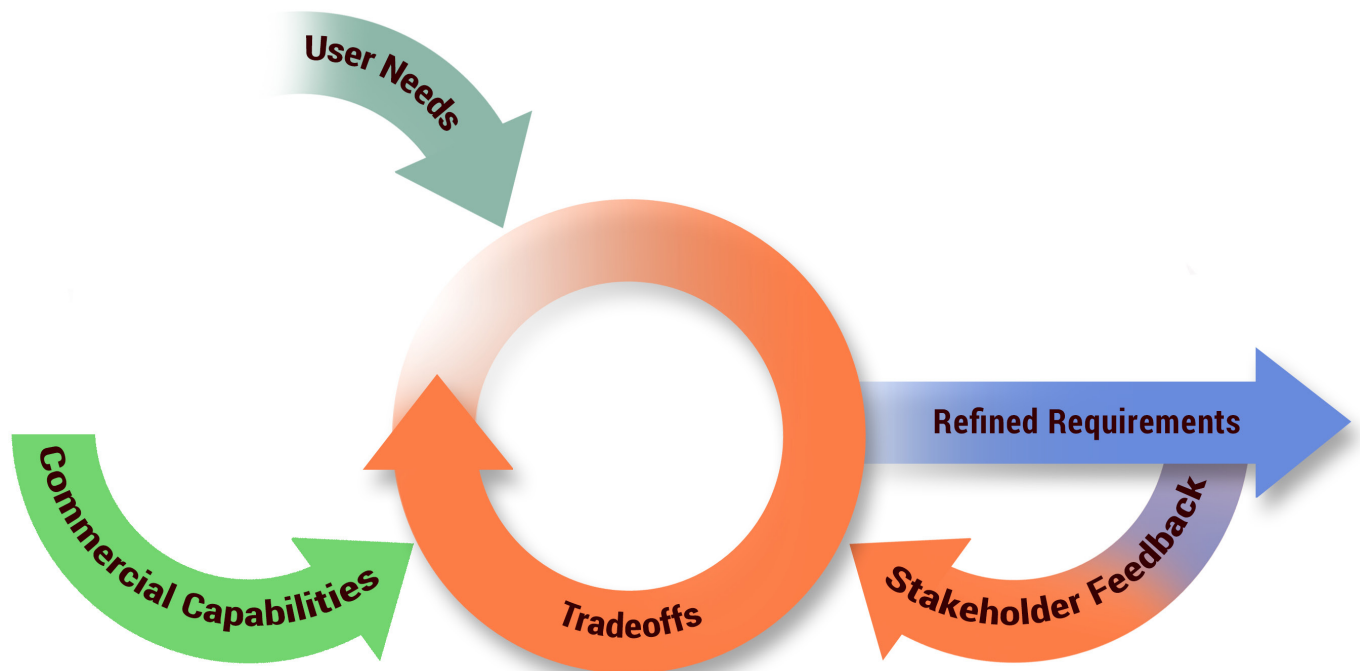
To establish realistic objectives, the IPT must balance mission needs with projected outyear resources. Balancing mission needs and life-cycle costs requires tradeoff analyses. Such analyses address unit costs, parametric estimates, mission effectiveness analyses, technology trends, and other relevant considerations such as commercial versus DoD specifications. As different trades are considered, the requirements become more refined.

Throughout the trades process, continual communication with the customer/user is crucial to clarify the amount of flexibility in requirements and to share knowledge of potential commercial items and NDIs that may be available to meet the requirement. A customer who is aware of the impact on the performance, cost, and schedule, as well as the risks, of various alternatives can make realistic tradeoff decisions and ensure that the requirements are satisfied.



Flexibility is key. Operational requirements should not be considered fixed and unalterable; rigidity does not work in today's defense environment. Requirements must be continuously refined as new information about market capabilities and products is received. (Figure 1 depicts the concept.) Flexibility is especially important during the early stages of an acquisition.

**Figure 1. Requirements Definition**



As requirements are refined, the number of threshold items should be limited, and the threshold values should represent true minimums. In addition, requirements should be stated in terms of capabilities, rather than technical solutions and specifications. This approach to defining requirements gives industry maximum flexibility to meet overall program objectives. The source selection criteria communicated to industry must reflect the importance of developing an item that can achieve stated production and life-cycle cost objectives.

Not only is strategic market research helpful when defining high-level operational requirements, but it is an important tool in trades analyses. A key step in conducting market research is communicating DoD requirements to industry. This information must reach industry early in the process for two reasons. First, it allows vendors to identify potential commercial items or NDIs that can meet the DoD requirement. Second, early communication of requirements ensures that industry representatives will be better prepared to answer questions asked during subsequent market research and analysis.

DoD requirements can be communicated to industry through sources-sought announcements; requests for information advertised in FedBizOpps, trade journals, and other mass media;

and presolicitation or bidders conferences. Whenever possible, requirements should be stated as performance specifications (in terms of outcomes or results) rather than as design specifications (in "how-to" terms).

As part of determining operational system requirements, the IPT should consider DoD's Trusted Systems and Networks Strategy, referenced in DoDI 5200.44, change 2, "Protection of Mission Critical Functions to Achieve Trusted Systems and Networks (TSN)." This strategy minimizes vulnerabilities in system design of mission-critical functions or components. It integrates robust systems engineering, supply chain risk management, security, counterintelligence, cybersecurity, hardware and software assurance, and information systems security engineering disciplines to manage risks to system integrity and trust. The Trusted Systems and Networks Strategy is a cradle-to-grave approach that supports design trades and considerations by continuously analyzing and evaluating vulnerabilities and risks for components. The operational requirements agreed to by the customer/end user, including any tradeoffs in light of commercial capabilities, will ultimately govern the degree to which commercial items/NDIs are incorporated into the end product.

## MARKET RESEARCH

Market research is the process of collecting and analyzing information about the capabilities within the market to satisfy requirements. For specific guidance about conducting market research, readers should review Standardization Document (SD) 5, *Market Research: Gathering Information about Commercial Products and Services*.

SD-5 contains detailed guidance for performing both strategic and tactical market research. The guiding principles for successful market research are as follows:

- Start early
- Define and document the requirements
- Refine as you proceed
- Tailor the investigation
- Repeat as necessary
- Communicate the results
- Involve users.

In a traditional DoD acquisition program, the emphasis is on defining the requirements and using market research to determine the extent to which the commercial market is able to meet those requirements. Based on the results, tradeoff decisions can be made or R&D can be initiated to develop unique capabilities.

When attempting to maximize the use of commercial items in an acquisition, the emphasis should be placed on market research to determine the capabilities of the commercial market. The user's requirements, ideally, are then oriented toward commercial capabilities. System security should also be included in market research to discover known item security vulnerabilities and countermeasures.

# Identify Candidate Commercial and Nondevelopmental Items

After operational requirements have been defined, a design engineer specifies the detailed requirements and turns them over to a parts/components engineer who identifies specific commercial items or NDIs that will satisfy the requirements. This activity requires tactical market research. Tactical market research is a focused effort designed to answer specific questions about the market, suppliers, products, services, and so on. The first step is to develop a list of potential suppliers. One source is the procurement activity, which may have lists of suppliers for the same or similar products. Another important source is the Internet, which can be searched for potential suppliers and industry associations that can provide information. (For detailed information about tactical market research techniques, see SD-5, *Market Research: Gathering Information about Commercial Products and Services*.)

Potential suppliers should be contacted to determine whether they produce commercial or nondevelopmental items that could satisfy the requirements and, if so, to gather detailed technical information about those items. Industry input on product descriptions and statements of work can help clarify technical aspects and reveal alternative ways to meet requirements. (Appendix C contains a discussion of product descriptions.) Avenues for obtaining industry input include the following:

- Draft solicitations issued before the formal solicitation
- Coordination with industry of draft product descriptions and statements of work.

Before soliciting information from suppliers, the IPT should seek input from the various DoD functional discipline proponents and independent testers, as well as from technical experts. These entities can provide the IPT with questions to be answered during the market investigation. Specific questions about performance, operation, and design features need to be asked because they must be addressed during test and evaluation of candidate items. For example, the design characteristics must be evaluated in terms of supportability and compatibility with support equipment. The following are some other questions concerning commercial availability:

- Can the market supply and support DoD's needs for the entire life of the end product?
- Are the commercial suppliers stable, or are changes in ownership or business arrangements likely to make an existing commercial product obsolete in the future?
- Is the item in a growth and development phase, or does the commercial producer plan to phase it out relatively soon?
- Is the commercial item tied to overseas companies, materials, or countries that might result in availability issues during international economic, political, or natural crises?

Answers to these questions rarely pose disruption to the commercial acquisition; rather, they indicate areas in which additional thinking and planning for contingencies must occur.

In addition to the availability of suitable commercial or nondevelopmental items to meet operational requirements, the system architecture can affect the degree to which commercial and nondevelopmental items can be used. Maximum use of commercial items and NDIs in a system requires an architecture based on open standards, specifically, the standards found in the DoD Information Technology Standards Registry. Those standards are to be used by DoD for all new systems because they facilitate interoperability and integration of systems within the Global Information Grid. An open system may be characterized by the following:

- Well-defined, widely used, nonproprietary interfaces or protocols
- Standards that are developed and adopted by recognized standards bodies
- Explicit provision for expansion or upgrades through the incorporation of additional or higher performance elements with minimal impact on the system
- Definition of all aspects of system interfaces to facilitate new or additional system capabilities for a wide range of applications.

In other words, an open system implements sufficient open specifications for interfaces, services, and supporting formats to enable properly engineered components to be used across a wide range of systems with minimal changes; to operate with other components on local and remote systems; and to interact with users in a system that facilitates the transfer of a system, a component, data, or a user from one hardware or software environment to another.

Balancing the various factors affecting the use of commercial items or NDIs will likely require additional tradeoff analyses. All potential alternatives and solutions should be considered. Acquisitions frequently require tradeoffs between performance and cost and between one performance parameter and another. Tradeoffs are appropriate when they optimize satisfaction of user requirements such as performance, affordability, and availability. In short, tradeoff analysis is an important tool in acquiring an item that presents the overall best value. In some cases, immediate or accelerated availability, coupled with reduced risk and avoidance of development costs, may be much more important to the user than a marginal change in performance.

After considering the results of tactical market research and tradeoff analysis, the IPT should be able to determine if the needed commercial or nondevelopmental item can be used as is. If it cannot, then the IPT needs to determine whether the requirement can be modified, or whether the item can be modified.

In some cases, a commercial item must be used as is, even if it does not meet all requirements. A good example is a microcircuit. Commercial entities are reluctant to design microcircuits to military specifications because DoD generally buys very few of a particular design, making the cost high. In those cases, the engineer must design the end product to accommodate the shortcomings of the circuits.



In other cases, the requirement can be modified or met in some other way. For example, a commercial alternative may not satisfy a particular reliability requirement such as a 300-hour mean time between failures. One option is to accept the lesser reliability level. Another is to compensate for the reliability shortfall by using other equipment or, if cost savings per unit will be sufficient, by implementing redundancy or a dispose-and-replace policy.

If performance tradeoffs are not possible, modifying the item to meet the user requirement more completely may be a viable approach. However, careful management is required to handle the ramifications of the modifications. For instance, many of the item's cost, risk, schedule, and supportability benefits may be jeopardized as a result of a modification. Therefore, before going forward with a modification, the IPT should evaluate the total effect of any modifications, particularly in the area of logistics support. For example, a vendor may not recognize or support the resulting redesigned item, and DoD may have little or no organic support capability for it.

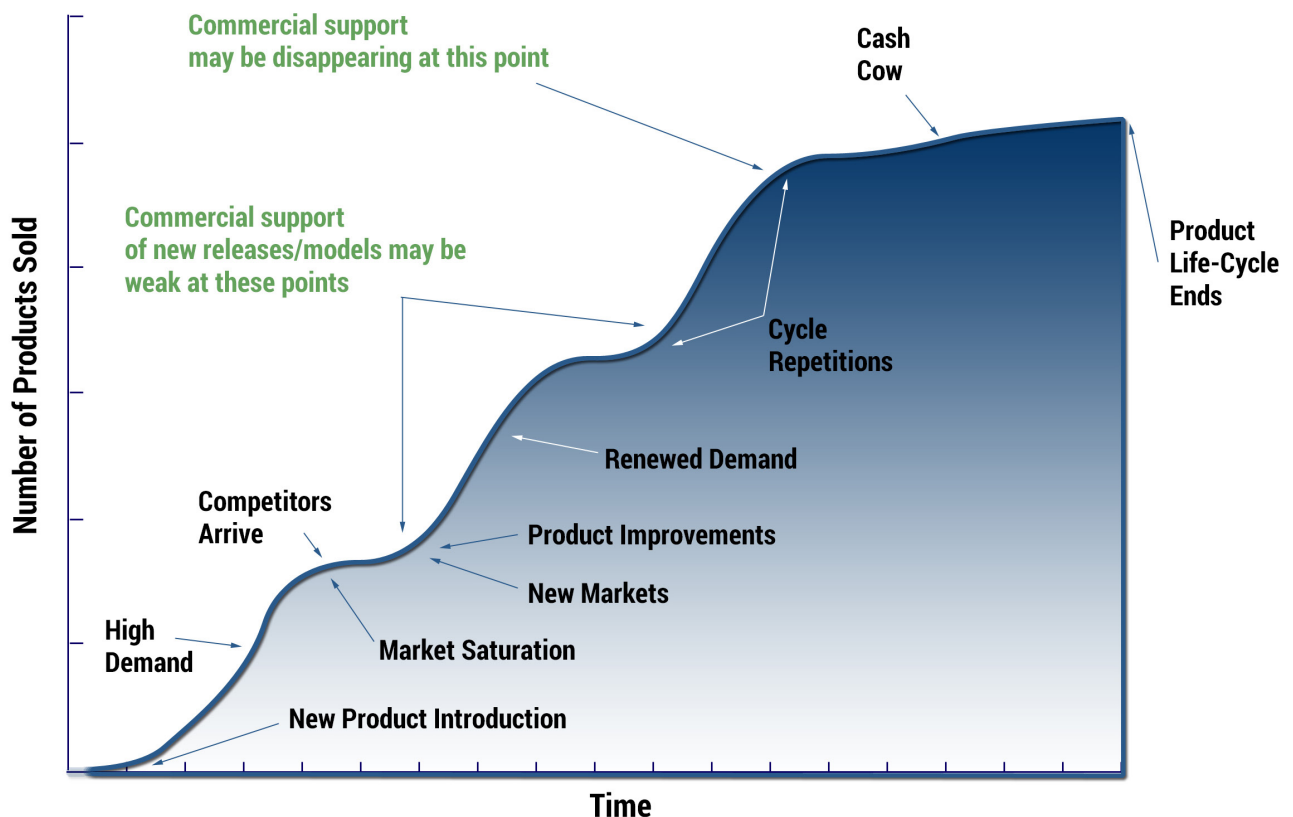
Modification or customization of a commercial product or NDI may jeopardize its characteristics and lead to expensive development efforts, supportability issues, cybersecurity risks, and configuration management issues. Commercial services, however, are often relatively easy to adapt to meet customer needs. In fact, commercial services are often intended to be tailored to the needs of the customer. For example, a vendors' equipment maintenance plan may offer three maintenance levels: minimum, typical, or high. This allows for greater flexibility when making tradeoff decisions.

# Plan for Life-Cycle Supportability

In addition to considering the performance of a commercial item or NDI, along with the cost of and schedule for acquiring the item, the IPT also must consider the item's supportability. In short, supportability is a critical factor in the decision as to whether a commercial or nondevelopmental item is practicable.

When a candidate item meets performance, cost, and schedule requirements, it is tempting to assume that it will not have an adverse impact on the supportability and life-cycle cost of a program, even if the seller has a support system for the item. However, due to the rapid pace of changes in the commercial market, and depending on where a product is in its life cycle (Figure 2), DoD may find that an item is unlikely to be available or no longer supported by the commercial market. Thus, in the long run, supportability of a commercial or nondevelopmental item may not be cost-effective.

**Figure 2. Life Cycle of a Product**



The following are examples of questions that the IPT should address when considering the life-cycle support of a commercial or nondevelopmental item:

- Can the market supply and support DoD's needs?
- Is the market capable of identifying and addressing system security engineering issues?
- Is the item likely to be updated or revised frequently, requiring DoD to replace the item with the newer version?
- Will the new version of the item be compatible with the operations and support infrastructure?

Given the many issues related to supportability and life-cycle cost, an acquisition decision should not be made until life-cycle support tradeoffs for a candidate item are identified, analyzed, and compared with those of alternative candidates. The specific goal when planning life-cycle support for a commercial item or NDI is threefold:

- Determine the appropriate logistics support method
- Analyze key logistics support elements that influence the selection of the item and can affect the item's life-cycle cost
- Consider the likely extent and frequency of product enhancements and upgrades and their implications for logistics support.

## LOGISTICS SUPPORT METHODS

Logistics support methods range from no support, which implies disposal of the item when it fails; to no organic support, which means that the contractor is responsible for supporting the item throughout its life cycle; to combined contractor and organic support; to all organic support, which means that DoD is responsible for supporting the item throughout its life cycle.

When deciding on the most appropriate method for supporting a commercial or nondevelopmental item, consider the following questions:

- **Has the item been modified?** If the item has been modified to the extent that the existing support process would also require significant modification, then total contractor support may not be feasible. Remember, too, that an item requiring significant modification is not considered commercial or nondevelopmental. Any modification must be minor; it may not significantly alter the product's function or essential physical characteristics.
- **Where will the item be used?** Will it be used in a fixed, industrial, or benign environment, or will it be used in a mobile, austere, hostile environment? Will the military environment change the item's reliability characteristics, leading to more frequent maintenance? Will the environment significantly change the manner in which the item must be repaired? If so, contractor support might not be the best approach.

- **How long will the system be used?** If the system's projected service life is only a few years, then contractor support might be preferable to establishing an in-house logistics support structure.
- **How much of the software is mature? How much is customer unique?** Software, never delivered 100 percent "bug" free, may take several years to mature. The logistics support structure should address software maintenance of potential user requirement upgrades.
- **What is the need for system replacement or upgrade due to changing technology? Can the in-house support structure keep up with changes in the system and modify the support strategy accordingly?** If not, then contractor logistics support is preferred.
- **Why is a commercial item or NDI being selected?** If the reason is to take advantage of an advancing technology (with changing configurations), then contractor support is preferred. If the reason is to take advantage of the availability of a proven, stable design, then in-house support may be the best approach because the configuration of the item will not change. On the other hand, a proven, stable design that has been around a long time may have fostered a worldwide, inexpensive support structure readily available to military users.

In general, one of the advantages of buying commercial items and NDIs is that they usually have an existing support system. Programs using commercial items or NDIs should maximize the use of existing logistics support capabilities and data. Development of new organic logistics elements for commercial and nondevelopmental items should be limited to meeting a critical mission need or achieving substantial cost savings.

## IPS ELEMENTS

The supportability of commercial items and NDIs must be evaluated within the context of the key Integrated Product Support (IPS) elements. Not only do the support elements affect life-cycle costs, but they potentially play a significant role in tradeoffs between supportability, performance, cost, and schedule. Figure 3 depicts the IPS elements.

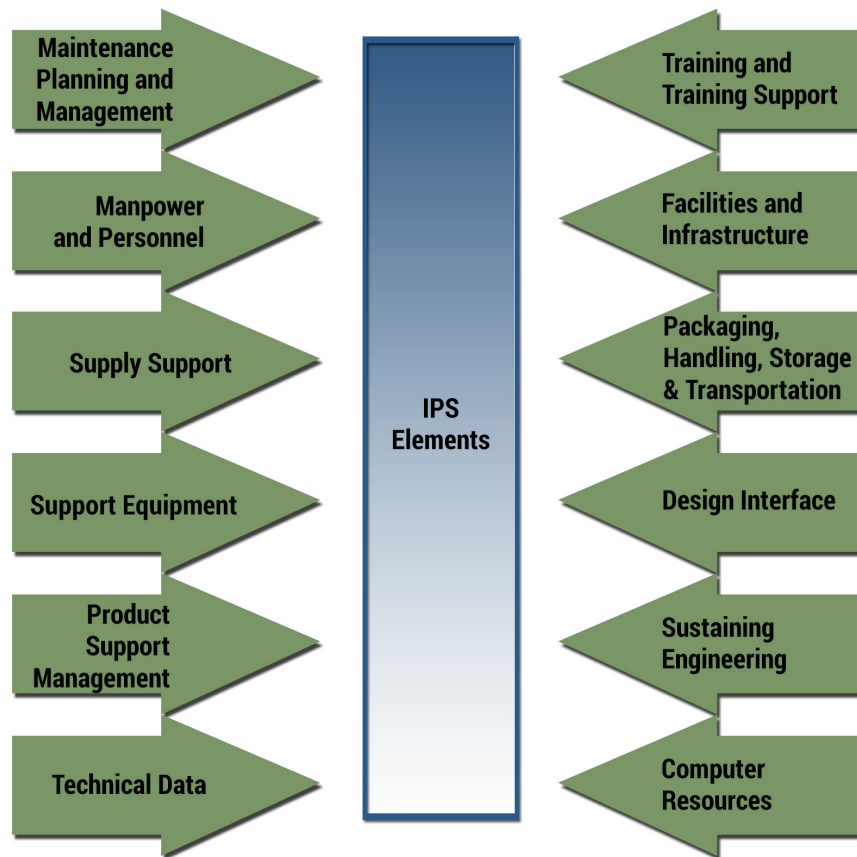
## Maintenance Planning and Management

Except for items that will be discarded when they fail or reach the end of their useful life, all commercial and nondevelopmental items require maintenance. Manufacturers of commercial items may be able to support their products with preventive maintenance, repair parts, and technical personnel through the item's expected service life. Possible maintenance strategies might include one or more of the following:

- Return to factory for repairs, possibly with a pool of replacement items to minimize turnaround time
- On-site repair by contractor personnel
- Provision of test equipment, procedures, and parts for intermediate- or depot-level repair.



**Figure 3. IPS Elements**



Commercial or other military maintenance facilities may be able to replace or supplement in-house maintenance facilities, reducing life-cycle costs and personnel, training, and documentation requirements. The challenge will be how to best use existing commercial or other maintenance and support systems. The following factors should be considered:

- Degree to which manufacturers, other military services, or other sources already provide maintenance support to their customers
- Responsiveness of such support activity to meet military requirements in peacetime and wartime (mean logistic downtime, need for priority service, wartime surge, and so on)
- Degree to which the military service will be able to provide in-house maintenance support, and the need for support facilities or a training and rotational base for service technical personnel
- Need to minimize downtime.

If in-house support is unavoidable, a preferred strategy is to select commercial items or NDIs that have built-in or automated features to assist users or maintenance personnel with quickly and accurately identifying faulty items. These items can then be removed and replaced with high confidence that the units are in fact faulty. This capability may be provided by built-in

test equipment or the use of test measurement and diagnostic equipment test procedures. The maintenance technician in the user organization removes the lowest line-replaceable unit and replaces it with a working element, sending faulty units to the intermediate maintenance activity or depot. Intermediate facilities stock units for direct exchange. Items not replaced at the intermediate level are shipped to a depot. Depots usually repair to the piece-part level. The program office must identify criteria and subsequent maintenance concepts and formulate transition plans when required.

If the item must be supported and maintained by the user, the maintenance plan for the item and supporting data must be purchased. Maintenance plans must meet all program requirements (economic, readiness, performance, operational, and safety).

## Manpower and Personnel

Decisions about manpower, as well as about the knowledge and skills required of the people who must operate and maintain an item, typically are made as the operational requirements and initial support concepts are formulated. The following specific areas influence acquisition decisions:

- Number and type of people required for operation
- Number and type of people required for maintenance (all levels)
- Skills, knowledge, or grade levels required.

If a commercial item or NDI does not meet the manpower and personnel criteria, the basic acquisition decision will have to be reevaluated, or the initial support concept will need to be modified.

## Supply Support

Supplies needed to support a commercial item or NDI include parts and repair kits. When planning and costing life-cycle support, the IPT must estimate the initial provisioning requirements as well as follow-on provisioning needs. To predict those needs as accurately as possible, the IPT should obtain lists of parts and repair kits from the manufacturer. The team also should try to obtain item history—service life and environment in which the item has been used, for example—and parts usage data from the manufacturer and other entities that have acquired the item. Another concern is the possible obsolescence or discontinuation of production of the replacement parts needed to sustain or repair fielded hardware.

The IPT also needs to decide on the best approach for maintaining an adequate inventory of supplies. The following are examples of possible alternative supply methods:

- Component manufacturers or vendors store and distribute spares and repair parts as needed (just-in-time support).
- Prime system contractors provide supply support.
- Replacement end items are purchased as needed (discard upon failure).

## Support Equipment

Requirements for support and test equipment must be identified when planning life-cycle support. Use of DoD standard test equipment (which may be commercial) instead of unique test equipment recommended by the manufacturer is preferred, but may not be feasible for a commercial item. The IPT also must address the need for new calibration standards and procedures to support the required test equipment.

## Product Support Management

Product support management is based on integrating all activities across the IPS elements. Acquisition requirements are key to determining which approach the product support manager will use to develop the product support concept and plan designed to optimize commercial item availability, reliability, and cost reduction. The IPT should be ready to assist the product support manager in determining the type, quantity, and cost-effectiveness of product required to meet DoD needs.

## Technical Data

The majority of DoD's processes and products contain some type of technical data. Acquiring and managing technical data is extraordinarily important in the acquisition of commercial items. Technical data includes engineering data, product data, contract data, and logistics data. The IPT should be aware of the importance of technical data and attuned to the appropriate and correct methodologies for acquiring, using, distributing, controlling, and disposing of this data. The IPT should be very attentive to security and access concerns associated with using and distributing technical data.

## Training and Training Support

The life-cycle support plan should maximize the use of in-house training and training support. However, contractor assistance usually is required for providing initial training on new equipment and for establishing the institutional training base.

If training aids or devices are required, contractor-owned or contractor-provided equipment should be used where possible. Another approach is to use a contractor for all training and training support.

## Facilities and Infrastructure

The IPT must decide on the facilities that will be necessary to support the item throughout its life cycle. The decision may be affected by factors such as the amount of space, type of environment, types of facilities, the location of the facilities, and improvements needed to existing facilities.

## Packaging, Handling, Storage, and Transportation

Another key element of support planning is determining the requirements for packaging, handling, storage, and transportation consistent with commercial practices. When necessary, transportability experts should participate on the IPT as subject matter experts. The IPT may not want to acquire an item that is difficult to transport.

## Design Interface

Open system and modular design approaches ease design interface problems, allowing for cost-effective innovation, upgrades, and flexibility. These approaches enable DoD to capitalize on rapidly evolving technologies, rather than being constrained to using specific products.

## Sustaining Engineering

Sustaining engineering ensures the continued operation and maintenance of a system. The focus of sustaining engineering is minimizing the downtime of a system and lowering the risk of future downtime. The IPT should be aware of any system design changes and modifications that would enhance continued system operation.

## Computer Resources

The breadth of computer resources is rapidly changing on a daily basis. Integrated and stand-alone computer technology can perform a myriad of vital activities within both DoD and the commercial arena. Deciding which commercial computer technologies are appropriate for DoD purposes is a huge challenge. The IPT should include a subject matter expert well versed in current and future technologies, have insights as to realistic applications, and be knowledgeable about costs and trade-offs.

## PRODUCT ENHANCEMENTS AND UPGRADES

To maintain their competitive advantage, commercial firms may frequently enhance or upgrade their products using new technology. For a simple item that requires no support, enhancements and upgrades do not pose a support problem; when the item fails, it is simply replaced with the enhanced or upgraded version. Support can become a costly problem, however, for a complex system comprising multiple commercial products, each with its own enhancement/upgrade cycle. In that case, technology enhancements and upgrades may occur nearly continuously, which has several implications for logistics support:

- The supplier may reduce or eliminate support of older products.
- The user's ability to support the item may be affected.
- Configuration management and control can be difficult.
- Security can be a concern when upgrading information technology products.



When deciding on the long-term supportability of a commercial item or NDI, the IPT should determine where the product is in its life cycle and why a commercial item is being considered, as well as how complex the item is. If, for example, one of the goals of using a commercial item is to take advantage of state-of-the-art technology, the IPT's support plan should allow for frequent product changes. To the extent possible, the team should take advantage of commercial service, repair, and spare parts distribution systems and practices for supporting items and for incorporating item upgrades. Another approach is to establish a flexible support system—one that can readily accommodate enhancements and upgrades.

On the other hand, if the number of modifications to the item can be minimized, it may be possible to preserve the existing support system—which may be contractor support, in-house support, or commercial support. In general, the IPT should avoid modifying the existing support system (and the accompanying documentation).

One of the most important considerations concerning configuration management and control is the ability of the user to adjust to possible configuration changes beyond his control, or even visibility. Relying on the contractor's configuration management system or obtaining contractor logistic support may be the best solution. When the contractor is responsible for configuration control, the data requirements for engineering change proposals can be eliminated, reducing the amount of data the contractor must provide the government. Data requirements should be kept to the minimum.

When upgrades to information technology products are required, there is an increased security risk. The introduction of malware, such as viruses, worms, and Trojan horses, into the product can be significantly increased when upgrading the system. The IPT should develop risk assessment plans and courses of action to identify and address vulnerabilities.

The *IPS Elements Guidebook* contains further information on IPS elements and product support management. The *Defense Acquisition Guidebook*, Chapter 4, provides in-depth coverage of life-cycle sustainment.

# Test and Evaluate Candidate Items

The need to field a system as quickly as possible is a major incentive for using commercial items and NDIs, because use of such items will save DoD many hours of unique design, engineering, and development time. The amount of time required for testing and evaluation also will be reduced. However, the use of commercial items or NDIs does not eliminate the need to ensure that the items meet the performance requirements. Therefore, commercial item and NDI acquisitions need to be supported by a tailored test and evaluation program.

The extent of the test and evaluation program for a commercial item or NDI acquisition depends on the type of item (modified, unmodified) and the similarity of the item's current or planned use to its intended use in the DoD environment. The IPT needs to determine which of the following four situations applies:

- **Commercial item or NDI intended to be used in the same environment and under the same conditions for which it was designed.** Development testing is normally not required before production qualification testing. Operational testing is required when organic maintenance is a necessity.
- **Commercial item or NDI intended to be used in an environment different from that for which it was designed.** Early qualification testing will probably be required in the operational and maintenance environment. Preproduction qualification testing will be required if early qualification testing leads to modification of the original item. Production qualification and operational testing also will be required.
- **Commercial item or NDI intended for integration into a larger system.** Feasibility testing to qualify a test sample should be conducted before the item is integrated into the system. Preproduction testing of the complete system is required. Hardware and software integration testing also will be necessary.
- **Commercial item or NDI that has been modified.** Testing should focus on the modification to ensure that it meets the operational requirement and does not have a negative effect on overall operations.

A test and evaluation program for commercial items and NDIs relies largely on data from external sources, rather than on actual testing. Examples of these data are the performance history of the proposed item, test data from the original system development or from the commercial producer, and user experience. (Much of the needed information can be gathered as part of the tactical market research.) The rationale for a reduced test and evaluation program for commercial and nondevelopmental items is that these items have already undergone previous testing and are generally accepted in the commercial marketplace or in another military application.

As a general rule, testing is needed only when existing data are insufficient. For example, development testing is conducted only to obtain specific information that cannot be satisfied by existing data. The IPT should obtain assistance from the developmental testing experts at an early point. Early participation by the military service's independent operational test agency is equally important. Together, these testers can verify existing test data and plan for additional tests if required.

Most testing of commercial items is operational testing—testing to ensure that the system will operate as intended in the military environment. A comprehensive assessment of the total operation and support effectiveness is particularly significant when considering commercial products not designed for the defense environment. However, the IPT should not assume that the defense environment is more demanding than the commercial environment without investigating the commercial uses of an item. Commercial products developed for an industrial or other harsh environment requiring high reliability may meet defense needs even though the general consumer products do not.

Operational testing also is important when the end item comprises multiple commercial items; the interaction of multiple commercial items can have unintended and unexpected operational effects on overall performance. In addition, commercial product upgrades may revise or eliminate certain product features and may negatively affect system performance. To satisfy end users, additional operational testing may be required. This process may have to be repeated throughout the system life cycle as commercial items are upgraded and replaced.

Once the existing data on the performance and other aspects of the commercial or nondevelopmental items have been assessed, the remaining test and evaluation requirements need to be documented in the test and evaluation plan. The plan should also summarize the testing, including results, done by the supplier or other parties. Developers, users, and independent operational testers should work together to tailor the test requirements and execution strategy. Specific tests required will vary with each individual acquisition.

To ensure that the planned testing is appropriate, it is essential that requirements documents clearly and unambiguously state required capabilities, operating environments, and interfaces. To this end, the test and evaluation team should review draft requirements documents; this review should result in a significant reduction in the amount of unnecessary or redundant testing. In addition, redundant testing can be avoided, and the acquisition expedited, if the military test and evaluation community understands the test practices and standards used by industry and is open to accepting the results in lieu of DoD testing.

In general, the test and evaluation program should be designed to

- verify commercial claims related to the item itself, including its reliability, maintainability, and electromagnetic compatibility;
- verify the supplier's quality assurance; and
- verify the item's supportability.

In addition, some NDIs may be candidates for the Foreign Comparative Testing program, which is discussed in Appendix D.

## VERIFICATION OF COMMERCIAL CLAIMS

One definite advantage to buying commercial items and NDIs is that they are existing products that can be seen, operated, and tested. The use of a product sample is one way to screen candidate items. Samples can be used to do the following:

- Verify manufacturer's claims regarding performance and quality
- Test for operational effectiveness in a military environment
- Determine the acceptability of intangible item characteristics like ease of use and ergonomics
- Evaluate against source selection criteria.

The following are factors to consider when including a sample requirement in a solicitation:

- Identify the number and size of samples required and where they should be delivered
- Articulate the item characteristics to be evaluated in the product description
- Describe how installation and operation of the sample will be handled
- Address responsibility for the transport, delivery, and disposition of samples after evaluation is complete
- Address waivers for previously tested or approved items.

The discussion below is oriented toward acquisitions of large systems and complex equipment. Much of the test and evaluation process discussed is not appropriate for items of supply, consumable items, or commodities that are typically prequalified or tested at the time of procurement.

## Reliability

Reliability, with its impact on operation and support costs, must receive critical attention in the acquisition process. For commercial items and NDIs, the reliability assessment should be an operational assessment of the military application in the expected military environments.

Because the basic design of a commercial item or NDI cannot be controlled by the buyer, the objective of the test and evaluation program is to determine whether the item meets the reliability requirements identified by the customer. The following are examples of the types of data needed by the IPT to assess an item's reliability:

- Supplier's overall reliability design program
- Mean time between failures
- Built-in test capabilities

- Current and planned mission environment
- Extent to which the supplier's reliability design program includes
  - thermal analysis;
  - failure modes, effects, and criticality analysis;
  - environmental stress screening;
  - reliability allocations and predictions;
  - shock and vibration analysis;
  - parts selection and qualification program, including incoming inspection of critical parts; and
  - system and subsystem reliability testing.

Not all commercial products will have accumulated the required reliability data or the extensive testing required for military qualification. However, some items will have substantial market-generated performance data that may be more extensive than the data generated through military testing programs or experimental use.

If reliability cannot be adequately assessed with the existing data, the IPT should consider obtaining some typical products from the market for hands-on evaluation. Reliability can also be made a factor in source selection, which is consistent with commercial practices.

The amount of testing required to verify that a commercial item or NDI meets the operational requirement for reliability is governed by whether the item will be used in the environment for which it was designed and by operators with skills equal to the operators for which it was designed. If the operational environment and operators are equivalent to the design environment and operators, it may be possible to eliminate qualification testing based on the history of the item.

## Maintainability

Maintainability is another area requiring attention in the acquisition of a commercial or non-developmental item. The maintenance system for commercial items may differ from the DoD system. Therefore, the test and evaluation program must evaluate the maintainability features of the commercial items—accessibility, interchangeability of parts and components, use of standard parts, built-in testing and maintenance equipment, and ease of handling—to determine if they are suitable for DoD use. The criteria for evaluating maintainability for a commercial item or NDI are the same as for a development program.

To determine a commercial or nondevelopmental item's maintainability, the test and evaluation program should begin with a review of maintainability data based on the item's operational history. When such quantitative maintainability data are not available, it may be possible to review certain analyses performed by the manufacturer when developing the item—predictions;



failure mode, effects, and criticality analyses; thermal and stress analyses; and even service and warranty records—or to assess relative maintainability values. The focus should be on determining how the item can be maintained in the DoD environment.

If the available data are insufficient to determine maintainability, testing may be needed. Program office, functional area activity, and test activity personnel should coordinate planning and execution of testing programs and provide test alternatives to the decision maker.

If the data or tests demonstrate that the item cannot meet maintainability requirements, the IPT should consider the following alternatives:

- Require total contractor logistics support, including a requirement to meet a specified operational availability
- Scrutinize mission profiles or the basis of issue to determine if the demonstrated maintainability values of the potential commercial items or NDIs are acceptable under different circumstances
- Purchase sufficient replacements to meet the specified operational availability
- Modify the commercial item or NDI to meet maintainability requirements.

Follow-on evaluations may be needed for items that have demonstrated marginal maintainability characteristics during qualification tests.

## Electromagnetic Compatibility

Electromagnetic compatibility problems can present a potentially hazardous situation, resulting in loss of life, damage to hardware, or degradation of mission performance. Therefore, the test and evaluation program must address the electromagnetic compatibility of a commercial item or NDI when compatibility is a requirement of the DoD mission or environment. The criteria for evaluating electromagnetic compatibility are the same as for a development program.

Many approaches can be taken to gather valid data for assessing an item's electromagnetic compatibility. For example, the IPT can ask the manufacturer to provide any electromagnetic compatibility analyses performed during design and development of the item. When quantitative data are not available, the IPT could try assessing relative electromagnetic compatibility values. These approaches and others should be used to obtain enough electromagnetic compatibility data upon which to support a decision to use a commercial item or NDI.

If the data available are insufficient to resolve electromagnetic compatibility issues, the item should be tested to ensure satisfactory performance when high electromagnetic levels exist and to ensure safety when safety factors differ from the design environment.

When data or tests demonstrate that candidate commercial items or NDIs cannot meet electromagnetic compatibility requirements, the IPT should consider the following actions:

- Review mission profiles to determine if the demonstrated electromagnetic compatibility values of a candidate commercial item or NDI are acceptable
- Shield or isolate the item
- Modify the item to correct electromagnetic compatibility problems (such modifications can be time consuming and costly)
- Tailor the electromagnetic compatibility program for acquisition of commercial items based on the information gathered during market and life-cycle analysis.

## VERIFICATION OF QUALITY ASSURANCE

The quality of commercial and nondevelopmental items is a central issue throughout the acquisition life cycle. Quality assurance improves the likelihood that high-quality items will be produced and that they will systematically and reliably satisfy customer requirements.

Quality assurance encompasses quality of design, prevention of defects, and quality of conformance, or the extent to which the item conforms to the design criteria or requirements. To put it another way, quality assurance refers to planned and systematic production processes that provide confidence in a product's suitability for its intended purpose. Quality assurance includes regulation of the quality of raw materials, assemblies, products, and components; services related to production; and management, production, and inspection processes.

Again, like other aspects of the test and evaluation program for commercial and nondevelopmental items, the starting point when assessing a supplier's quality assurance is to review available data:

- Objectives established and processes developed to deliver the desired results
- Implementation of the developed process
- Approach used to monitor and evaluate the implemented process
- Actions taken to improve if the results of testing against the established objectives demonstrate the need for changes.

If a commercial item or NDI is already accepted in the marketplace, a quality program and history probably exist for the item. To be meaningful, the quality history should show product quality over time and the satisfaction of previous users. In-process quality data, such as process and test yields, can also be reviewed to assess product assurance.

In general, quality assurance for items of supply and consumable items is largely a function of the product description and some level of verification, usually in the form of a visual inspection. Quality assurance is more involved for systems, complex equipment, items with significant support requirements, and items for which conformance to specification requirements is important. For example, quality assurance for certain items might be addressed through qualification.

Qualification is the process by which products, processes, or materials of manufacturers and distributors are examined and tested to determine conformance to specification requirements in advance of, and independent of, an acquisition. Products and manufacturers that successfully pass the qualification process are then identified on a list of qualified products or qualified manufacturers:

- A qualified products list (QPL) focuses on qualifying products or families of products. A QPL is usually appropriate for items of supply that have a stable design or composition and will be available for an extended period of time, making it practicable to qualify individual products without incurring prohibitive testing costs. A product that meets the established qualification requirements will be included on a QPL.
- A qualified manufacturers list (QML) focuses on qualifying a manufacturer's materials and processes rather than its products. A QML is usually appropriate for items of supply that are experiencing very rapid technological advances or have numerous variations or custom designs that make individual product qualification impractical or excessively expensive. A QML applies to processes or materials that generally meet the following criteria:
  - They do not have recognized industry part numbers.
  - They are procured to a specification that covers a wide range of technologies—like hybrid microcircuits.
  - They are a family of products with similar characteristics—like printed wiring boards.

A searchable Qualified Products Database (QPD) contains QPL and QML information. The QPD can be accessed through ASSIST.

Hardware, software, and firmware quality assurance is mandatory to ensure the lowest possible vulnerabilities in fielded DoD systems. Analysis and assessment of vulnerabilities combined with innovative methodologies to test and develop protection tools is key to successful hardware and software assurance. The Joint Federated Assurance Center is a federation of DoD organizations that promotes software and hardware assurance by providing expertise and support to defense acquisition programs and activities. It is the DoD Center of Excellence for all things security assurance related.

## VERIFICATION OF SUPPORTABILITY

If commercial testing does not address operability in the intended military environment and relevant information is not available from existing sources, test and evaluation may be required. This testing should be designed to determine or verify the suitability and supportability of the item. Independent evaluation results provided to the developer and the user may affect tradeoff analyses, source selection, and the support strategy.

# Plan and Implement the Acquisition Strategy

DoD Directive 5000.01 states “the primary objective of Defense acquisition is to acquire quality products that satisfy user needs with measurable improvements to mission capability and operational support, in a timely manner, and at a fair and reasonable price.” Thus, the acquisition process must ensure, through documentation (historical or developed data) and demonstration (testing), that the solution proposed will satisfy the operational requirement in the operational environment and will be supportable.

The directive indicates that there is no one best way to structure an acquisition program to accomplish the primary objective of the Defense Acquisition System; however, the DoD acquisition process, as defined in DoD Instruction 5000.02, provides the flexibility needed to execute a wide variety of acquisition strategies. The instruction establishes a simplified and flexible management framework for translating mission needs and technology opportunities, based on approved mission needs and requirements, into stable, affordable, and well-managed acquisition programs.

For acquisitions of commercial items and NDIs, many of the steps, procedures, requirements, and safeguards associated with the DoD acquisition process may be unnecessary or even counterproductive. The IPT should scrutinize the standard process elements to determine their applicability to the acquisition of a commercial item or NDI. Many standard process elements may have been accomplished already. For example, documented market research results or contractor test and performance data may be adequate to assess manpower and training requirements, supply support, reliability, transportability, and other support requirements.

## Key Guidance

**Defense Acquisition Guidebook**

**DoD Directive 5000.01, “The Defense Acquisition System”**

**DoD Instruction 5000.02, “Operation of the Defense Acquisition System”**

**FAR Part 12, “Acquisition of Commercial Items”**

FAR Part 12 indicates that because of the broad range of commercial items acquired by the government, variations in commercial practices, and the relative volume of the government's acquisitions in a specific market, tailoring the acquisition process for commercial items may be considered. Of course, this tailoring should only be undertaken after conducting market research to ascertain exactly what is available to meet DoD requirements.

When planning the acquisition strategy, the IPT must not only identify the item to be acquired, but it also must address the acquisition method, budgets, and business considerations such as the contract type, pricing, best-value source selection, technical data and intellectual property, and warranties. A Defense Procurement and Acquisition Policy memo dated September 2, 2016, "Guidance on Commercial Item Determination and the Determination of Price Reasonableness for Commercial Items," may provide the IPT with additional pricing information. The Defense Contract Management Agency's Centers of Expertise is staffed to provide the IPT with insights on market analysis, commerciality review, and commercial pricing.

The following sections summarize several key considerations pertinent to the acquisition of commercial items and NDIs.

## ACQUISITION METHOD

DoD has several methods for obtaining commercial products. If the acquisition is for a standalone commercial system, subsystem, or component, the IPT should use the procedures in FAR Part 12. A similar approach is used for commercial services. Standalone contracts for commercial products or services are typically used for lower-dollar value or less complex acquisitions.

When acquiring major systems, DoD typically does not use a commercial contract because major systems usually require some type of R&D. The traditional contracting approach is a prime contractor-subcontractor arrangement. Under this arrangement, the prime contractor is responsible for the overall system and awards subcontracts for subsystems, components, and services. The prime contractor would not typically follow FAR Part 12 procedures, but DoD would encourage the prime to incorporate commercial items and NDIs in the system. The prime could then issue subcontracts for commercial products or services using special subcontracting rules (see FAR Subpart 44.4 and Subpart 244.4 of the Defense Federal Acquisition Regulation Supplement) that allow the use of FAR Part 12 procedures. The prime contractor is responsible for determining whether the subcontracted product or service is considered commercial in accordance with the FAR.

Another method used by DoD to acquire a major system is to contract directly with the suppliers of the various subsystems and components, making commercial item determinations in each case and writing individual contracts accordingly. In addition, DoD typically awards a separate contract for a system integrator to build the system from all of the subsystems and



components. The administrative costs for this acquisition method are higher than for other methods, but awarding and administering multiple contracts affords maximum flexibility to DoD when negotiating terms with the individual contractors. This method also may allow DoD to acquire commercial subsystems and components that may not otherwise have been available through a prime contractor-subcontractor team.

## BUDGETS

The Program Objective Memorandum and budget process for acquiring commercial and nondevelopmental items is the same as for any other DoD acquisition. However, the acquisition of commercial items and NDIs may require more cautious management of the process. For example, because an NDI acquisition is faster than development of an equivalent materiel item, there is less time to program funds.

The problem of less time to program funds is addressed through reprogramming actions or out-of-cycle new start program justifications. The question of the amount and type of funds needed is more problematic. Research, development, test, and evaluation funds are normally used for market research and purchase of items needed for test and evaluation. They are also used for modification of existing items. Procurement, operations, and maintenance funds are normally used for production and deployment. However, procurement funds can be used for nonrecurring engineering, like that involved in the integration of commercial items or NDIs into a system.

The following questions must be answered when budgeting for a program:

- Is a commercial item solution feasible?
- If not, is an NDI solution feasible?
- What testing is necessary to determine if a commercial or NDI solution is feasible?
- If a commercial or NDI solution is feasible, what testing is necessary to determine which of the potential items meet the operational requirement?
- Will the government have to buy items to test?
- What are the unit costs of the potential NDI solutions?
- Is any parallel development required, such as software development or product improvements?
- What is the program schedule? When will testing be done? When is contract award expected?
- Will one or more contracts be used for testing and for procuring production quantities?

## CONTRACT TYPES

Firm-fixed-price or fixed-price contracts with economic price adjustments usually are used for acquiring commercial items—both products and services. These types of contracts may be used in conjunction with award-fee incentives or with delivery or performance incentives when the award fee or incentive is based on factors other than cost. Indefinite-delivery contracts are also permitted as long as prices are based on firm-fixed prices or fixed prices with economic price adjustments.

When it is not possible at the time of award to accurately estimate the extent or duration of the work, or to anticipate costs with a reasonable degree of certainty, a time-and-materials contract or labor-hour contract may be used, under certain limited circumstances, to obtain commercial services. FAR Subpart 12.207 describes the conditions under which these contracts can be used. Additional limits and requirements are also imposed for DoD awards; the DoD guidance is in Subpart 212.2 of the Defense Federal Acquisition Regulation Supplement.

Another important aspect of FAR Part 12 contracts is that contracting officers can tailor the contract terms and conditions, within certain limits, to reflect usual and customary commercial practices.

## PRICING

Purchasing a commercial item or NDI does not eliminate the need for the contracting officer to determine that the price is “fair and reasonable.” The contracting officer should establish price reasonableness in accordance with FAR Parts 13.106-3, 14.408-2, or subpart 15.4 and should be aware of customary commercial terms and conditions when pricing commercial items. Commercial items prices are affected by factors that include such issues as speed of delivery, length and extent of warranty, limitations of seller's liability, quantities ordered, length of the performance period, and specific performance requirements.

Price analysis, as opposed to cost analysis, is the preferred approach for determining price reasonableness. The information needed to make this determination can be collected through market research. The following are examples of the types of information that are useful:

- Prices of commercial items sold, or offered for sale, to the public
- Potential value of any modifications to commercial items
- Purchase histories, including prices paid for similar items
- Prices for similar items on Federal schedules
- Prices based on catalogs or price lists.

The IPT also can use market research to determine whether the published prices were actually paid by other commercial customers, or whether the usual commercial practice in the market is to discount published prices.

Pricing in the commercial marketplace is often determined by market leverage. Depending on market conditions, buyers or sellers may exert greater leverage over pricing. Large commercial customers can exert significant price leverage on their suppliers. DoD may not be a significant customer to some commercial suppliers. DoD should try to become an attractive customer to its commercial suppliers by purchasing economic quantities where possible and being flexible with respect to terms and conditions.

If it cannot determine the price reasonableness of a commercial item, the IPT may ask the commercial supplier for supporting cost information. However, for commercial item acquisitions under FAR Part 12, the cost accounting standards are not applicable to contractors. Contracting officers may request only the minimum amount of cost data to determine price reasonableness, and the contractor does not have to certify the data.

## **BEST-VALUE SOURCE SELECTION**

Best-value source selection involves evaluating and comparing factors in addition to price when making the contract award decision. This approach is similar to that used by individual consumers when making a purchase. A consumer is willing to pay more for a product with features offering more value for the money.

The best-value approach is an especially powerful tool in commercial item acquisitions. Commercial vendors develop products that include many different features intended to differentiate their products from their competitors' products. Thus, the IPT can select the product that optimizes performance and life-cycle cost factors. Moreover, the item usually has a quality history, and the supplier has a support record associated with that item.

Because the best-value approach can be complicated when numerous variations of a product exist in the commercial market, the IPT needs a complete understanding of the requirement and the relative importance of its discriminating characteristics. The team should then translate the requirement into evaluation criteria. The criteria should be qualitative discriminators that will reveal substantive differences among competing products. In addition, the IPT should establish evaluation criteria addressing the government's objectives, the marketplace, and the risks; again, these criteria should enable the IPT to discriminate among items. Together, the evaluation criteria must provide the basis for justifying the item's selection.

In the solicitation, the IPT must clearly communicate the requirement and the general method, including criteria, that DoD will use to evaluate candidate products or services. Once vendors understand what is needed and how the products or services offered will be evaluated, they can better determine what to offer.

To support the source selection decision, the evaluation team should document strengths, weaknesses, risks, and the associated value of the offered items.

## TECHNICAL DATA AND INTELLECTUAL PROPERTY

Obtaining technical data—specifications, drawings, technical manuals, calibration procedures, and other data required to test and inspect, perform preventive and corrective maintenance, operate, and repair the item or its parts—often poses challenges in commercial item acquisitions. One of the key challenges is that suppliers usually claim proprietary rights to the technical data on commercial items. Even when suppliers are willing to provide technical data, the costs can be prohibitive. The IPT should validate the supplier's claim and carefully review the data requirements to avoid buying unnecessary and expensive data rights.

Once the IPT has identified the technical data required to complement the maintenance and supply support strategies, it has several options for acquiring rights to the data:

- Include contract provisions allowing government use of data as necessary but not for procurement.
- Include contract provisions providing for the transfer of the data package and rights to the government if the original manufacturer goes out of business or drops the particular item from production.
- Establish a technical data escrow account. With this option—particularly useful when technical data are critical for protecting DoD from potential product obsolescence or the potential inability of the supplier to support the product in the future—the government, rather than purchasing the data outright, negotiates with the supplier to establish a technical data escrow account. The supplier then populates the escrow account with technical data, which can be accessed by the government at a later date if necessary.

Another challenge is that commercial suppliers often do not have technical data in formats that DoD typically expects.

Rights related to commercial software are different. The government does not take ownership of the software itself. Rather, the government obtains the same rights to use the software that a commercial customer would. If the government requires rights beyond the commercial rights, the government must negotiate and pay for the desired licensing of the software.

## WARRANTIES

Warranties are available for commercial equipment. The IPT must determine whether an available warranty is translatable to the intended use and whether its use would be cost-effective. When making these determinations, the IPT should consider the need to establish logistic channels for returning items for repair and the cost of reimbursing maintenance facilities for their repair efforts or for scrapping items. Any decisions to modify existing or standard warranty provisions should be based on a cost/benefit analysis. The availability of a suitable warranty may be a critical attribute in the decision to use a commercial item or NDI.

# Appendix A.

## Issues Requiring Special Attention

When buying commercial items and NDIs, acquisition teams must be aware of and take steps to mitigate the risks associated with three potential problems: Diminishing Manufacturing Sources and Material Shortages (DMSMS), counterfeit parts and components, and components without leaded solder and finishes. These problems can have large regulatory compliance and life-cycle cost implications, as well as issues with performance.

### DIMINISHING MANUFACTURING SOURCES AND MATERIAL SHORTAGES

#### The Problem

DMSMS situations arise when a source for an item stops producing the product, when the manufacturer changes the product enough that it cannot directly replace the original product, or when procurements fail because of product unavailability. Commercial items and NDIs are particularly prone to DMSMS situations. Many of these items, especially those containing electronics, have short life cycles. Such products are continuously being improved or replaced by next-generation products. A typical commercial electronic product may be available for only 2 or 3 years before a new generation of products emerges or before the item is replaced by newer technology. This trend conflicts with DoD's efforts to significantly prolong the life of weapon systems that contain such products. As a result, repair parts disappear long before the end of the weapon system's life cycle.

Obsolescence of nonelectronic and commercial off-the-shelf items also poses a significant problem to weapon systems sustainability. When a commercial item or NDI has been incorporated into a defense system designed to be in service for 30 to 40 years, most of those items will eventually become obsolete and potentially become a DMSMS problem.

#### Risk Factors

The risk of DMSMS is due to several factors:

- **Rapid change.** Commercial markets are driven by competition, profits, and market share. In the electronics technology sector, rapid technological advances drive rapid introduction of newer, more capable products. In this rapidly evolving environment, new product versions may not be interchangeable with earlier versions.
- **Limited product data.** Commercial item data are generally limited to specifications, operating instructions, and maintenance documentation. Buyers of commercial items may obtain interface and performance characteristics but have little or no insight into the



internal composition of a product. This lack of insight may greatly complicate the process of identifying suitable replacement items when a DMSMS situation arises.

- **Configuration and content variation.** While developing and producing commercial items, manufacturers face constantly changing prices and availability of components such as microchips, diodes, resistors, capacitors, disk drives, memory devices, and displays. As a result, different production lots can be functionally equivalent but contain different components and subassemblies. The product manufacturer may or may not identify these configuration changes.
- **Inventory costs.** It is not in a manufacturer's best interests to warehouse quantities of an existing product (or repair parts) when the product will soon be replaced by a next-generation product. To avoid both costly warehousing expenses and unmarketable excess inventory, a manufacturer will minimize its aging stock, thereby limiting product availability.
- **End of production.** When a commercial item will soon go out of production, the effects of the end of production must be examined and understood at both the product and system levels to determine what actions if any are needed.
- **End of support.** As new commercial items are introduced into the market, manufacturers must determine when to stop supporting the older products. To avoid alienating the customer base using the older product, a manufacturer may support the product even if doing so is not profitable. However, at some point, support by the original equipment manufacturer (OEM) will end. (Third-party sources may be available to provide support services.)

## Risk Mitigation Strategies

Solving DMSMS problems is complex, data intensive, and expensive. The best way to mitigate the risks of DMSMS is to design systems that enable frequent technology upgrades or refreshments through the insertion of newer items as they become available. For example, systems should be designed with standard interfaces and plug-and-play modules.

Risk mitigation does not stop when the design phase is completed. Rather, it must continue throughout the system's life cycle. The following are among the risk mitigation strategies often used by IPTs:

- Involve individuals who understand the interrelationships among commercial market forces, market research, technology trends, commercial standards, commercial product risks, and risk mitigation strategies.
- Involve users early and throughout the program life cycle to identify and resolve constraints related to commercial items. Early end-user involvement helps to ensure that requirements accurately reflect user needs. Users also can help prioritize requirements and identify and resolve potential suitability issues.

- Perform continuous commercial item market research and vendor surveys. These activities attempt to determine vendor plans for changes to, discontinuation of, and support for the items in the future. To the extent possible, obtain, as early as possible, any product discontinuation notices and information on opportunities for life of needs buys.
- Project the manufacturer's product support period and inventories.
- Integrate market research results with field data, including information technology, obsolescence projections, system supportability, performance requirements, reliability, maintainability, availability, and logistics.
- Ensure that product obsolescence information is part of the overall system life-cycle planning.
- Plan and provide for testing. Commercial products change rapidly and may have undisclosed design changes. In addition, products being considered for system technology refreshment need to be tested within a system context to verify functionality. Testing is necessary to ensure that engineering changes do not have a negative effect on system performance.
- Use product selection factors that include product maturity; manufacturer production and support history, stability, and flexibility; market share; and upward/downward compatibility. These need to be weighted as to their relative importance and influence on DMSMS risks.
- Continually analyze the product to project and prioritize product obsolescence issues to identify emergent or unplanned commercial item support issues due to changing business or market conditions such as bankruptcies, mergers, and product line changes; and to determine alternatives to avoid obsolescence situations.
- Perform and budget for resolutions to DMSMS issues.
- Tailor risk analyses to take into account such factors as market conditions, technology longevity and supportability, optimum technology refresh cycles, numbers of system configurations, and risk mitigation strategies.

The risk mitigation strategies should be identified in the integrated program plan, a "living" document that is continuously updated to address overall strategic planning, including program decisions and changes, and to project the system's evolution. The plan also should address commercial item support options such as end-of-life buys, extended warranties, license extensions, technology refreshment, third-party maintenance, and data rights.

For more information, see SD-22, *Diminishing Manufacturing Sources and Material Shortages: A Guidebook of Best Practices for Implementing a Robust DMSMS Management Program*.

## COUNTERFEIT PARTS AND COMPONENTS

### The Problem

Counterfeiting of parts and components occurs in nearly every type of commodity, whether electronic or mechanical. A counterfeit part is a part that is a copy or substitute offered without legal right or authority to do so or a part whose material, performance, or characteristics are knowingly, or unknowingly, misrepresented by a supplier in the supply chain. Thus, a counterfeit part could be, for example, a used product sold as new, a commercial product sold as military grade, a product stolen from the manufacturer's production line, a product built without authorization from the intellectual property rights holder, or a product containing pure tin, but sold as containing lead.

The counterfeiting problem is huge. In 2016, the Organization of Economic Cooperation and Development and the European Union Intellectual Property Office estimated the value of international trade in counterfeit and pirated products at \$416 billion, or as much as 2.5 percent of all international trade. The negative aspects of counterfeiting and piracy are projected to drain \$4.2 trillion from the global economy and put 5.4 million legitimate workers out of a job by 2022.

A 2009 Department of Commerce survey, focused on discrete electronic components, microcircuits, and circuit board products, found that 45 percent of participating organizations had encountered counterfeit parts. The participating organizations represented the entire supply chain from manufacturer to end user. The high percentage of organizations with counterfeit incidents indicates the pervasiveness of the counterfeit threat, which is of particular concern to DoD and the aerospace industry because of the potential threat to safety and security.

That same survey also found that incidents of suspected or confirmed counterfeit parts rose by more than 240 percent from 2005 to 2008. The survey showed that item resale value is not a major factor in determining what products are counterfeited; of the reported counterfeit incidents, most parts had a selling price between \$10 and \$100. Parts need not be expensive to be lucrative in the counterfeit marketplace. The counterfeiters do not have the costly research, development costs, or marketing expenses. In addition, counterfeit goods are typically manufactured with deficient raw materials and substandard manufacturing processes.

### Risk Factors

The risk of counterfeit parts and components entering the supply chain is due, in large part, to DMSMS and electronic waste (e-waste) recycling. The link between DMSMS and counterfeit parts is strong. Counterfeiters find markets with serious shortages and seize the opportunity to fill the shortages with counterfeit parts. At the same time, the counterfeit market is lucrative, because customers that need to fill a critical need will often buy from risky sources, either in spite of the danger or because they are unaware of the danger. To put it another way, DMSMS creates a demand for hard-to-find components. In many instances, these components are essential to keep older weapon systems or equipment operating. Parts obsolescence often forces buyers to seek out unfamiliar sources when known and trusted sources can no longer

supply the needed items. The vast majority of counterfeit parts enter the supply chain through unauthorized distributors, or those most removed from the original component manufacturer (OCM). Although unauthorized distributors make up the largest part of this problem, sometimes counterfeits are passed along, unknowingly, from trusted sources. Industry has even seen instances of counterfeits contaminating trusted supply sources through returned merchandise.

The link between e-waste and counterfeit products also is strong. Many electronic components contain hazardous materials such as lead, barium, beryllium, mercury, cadmium, or arsenic. The danger associated with environmental contamination from equipment containing those substances has led to legislation or directives in Europe and other places governing and restricting the disposal of e-waste. Two of the most important of these directives—Reduction of Hazardous Substances (RoHS) and Waste Electrical and Electronic Equipment (WEEE)—were issued by the European Union and apply to such electronic items as computers, cell phones, televisions, appliances, tools, toys, and sports equipment. RoHS regulates the hazardous substances used in electrical and electronic equipment, while WEEE regulates the disposal of this same equipment.

Compliance with the legal requirements greatly increases the cost of recycling e-waste. Consequently, tons of scrapped electronic products are shipped from around the world to nations where these requirements do not exist or are not enforced. (The National Safety Council estimates that 75 percent of all personal computers ever sold are now part of the e-waste stream.) The majority of this e-waste is shipped to China and a handful of other Asian nations. Those nations, in turn, strip components from the e-waste; re-mark them with new part numbers and recent date codes, update the packaging, and so on; and return the items—now counterfeits—to the global supply chain. Counterfeit parts and components originate in many different countries, but according to some estimates, approximately 80 percent of all counterfeit items come from China. The top 10 countries are China, Taiwan, India, Malaysia, Philippines, Indonesia, Singapore, Thailand, Russia, and South Korea. Eastern Europe, South America, and the Middle East are also known sources of counterfeit parts.

## Risk Mitigation Strategies

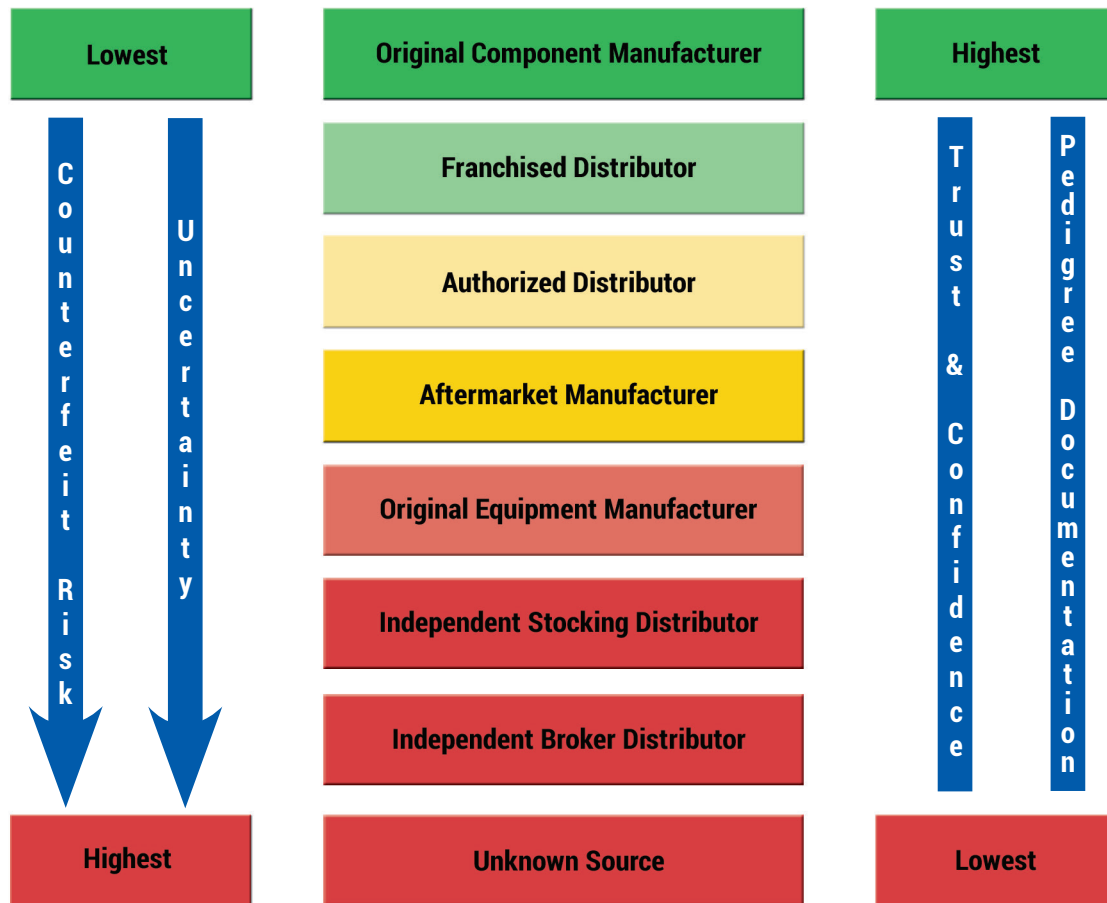
The risk of counterfeits can be mitigated in one of two ways:

- Avoid buying parts and components from unknown sources; instead, purchase such products only from trusted suppliers
- If no known, trusted supplier is available, subject the purchased products to rigorous inspection and testing.

The degree of trust, and the risk of counterfeits, varies with the type of supplier, as shown in Figure A-1.

- The OCM designs and engineers the part, owns the intellectual property rights, and can easily provide a pedigree or proof of a part's authenticity.
- A franchised distributor has a contractual agreement with the OCM to buy, stock, repackage, sell, and distribute its parts.

**Figure A-1. Relationship between Type of Supplier and Level of Risk and Trust**



- An authorized distributor is officially authorized by the OCM to sell its parts.
- An aftermarket manufacturer has permission from the OCM to manufacture and sell the OCM's intellectual property as replacement parts.
- An OEM produces or builds equipment or systems containing OCM parts.
- An independent distributor purchases parts with the intention to sell and redistribute them, generally with no contract, authorization, or direct relationship with the OCM.
  - A stocking distributor stocks large inventories of parts, which may be purchased from any number of sources.
  - A broker distributor searches the market and locates parts that meet the customer's requirements and target price. Brokers locate parts but do not necessarily stock parts. A broker distributor may, in some instances, be a single individual operating out of a private home, warehouse, or storefront.



## CHECKLIST OF KEY BEST PRACTICES FOR MITIGATING THE RISK OF COUNTERFEITS

- Provide institutionalized policies and procedures on how to avoid and handle counterfeit components.
- Provide clear written guidance on how to test, handle, and track incoming and outgoing parts and how to manage and dispose of suspected counterfeits.
- Maintain a register of approved suppliers.
- Purchase electronic components through reputable distributors with stringent quality-control procedures.
- Determine if a distributor is certified by ISO (ISO 9002:2015), SAE International (AS9120A, AS6081, and AS6496), and Electrostatic Discharge Association (ANSI/ESD S 20.20-2014).
- Determine if a distributor follows IDEA-STD-1010B inspection techniques for counterfeit detection.
- Determine if a distributor has CTI CCAP-101 certification for counterfeit avoidance and detection.
- Determine if a distributor has memberships in leading trade organizations such as IDEA and ERAI.
- Determine if a distributor uses escrow accounts and offers product warranties.
- Review the distributor's past business practices, request letters of recommendation, and schedule on-site visits.
- Determine if a distributor offers potential buyers enough time to carefully inspect or test component lots prior to final payment.
- Check with the Better Business Bureau or similar organizations to assess whether a distributor uses ethical business practices.
- Before trading with an unknown supplier, check trade references.
- Build strong relationships with suppliers you trust.
- Specify a preference to procure directly from OCMs or authorized distributors.
- When possible, buy parts directly from OCMs and their authorized distributors.
- Require supply chain traceability to the OCM or after-market manufacturer.
- Require suppliers to trace parts back to OCMs in order to prove part authenticity.
- Require suppliers to provide proof of a valid OCM warranty.
- Specify quality requirements in contracts and purchase orders intended to minimize the risk of being provided counterfeit parts.
- Visit or audit potential suppliers to verify their quality practices, including their ability to perform authenticity testing, ensure compliant parts, and identify and block counterfeit parts.
- Periodically test components to confirm that they meet or exceed OEM specifications.
- Verify how the components were handled, stored, and shipped.
- Confirm that suppliers use effective counterfeit avoidance policies and practices.
- Ensure that suppliers maintain effective processes for mitigating the risks of buying and selling counterfeit parts.
- Assess potential sources to determine the risk of receiving counterfeit parts.
- Communicate with suppliers, monitor supplier performance, and provide feedback to suppliers.
- Require independent third-party inspection and testing and comply with AS6171.
- Avoid buying batches of components with different colors, dates, or batch codes.
- Use contractual clauses that help protect the buyer from counterfeit parts.
- Train all employees who handle electronic parts (including purchasing, quality assurance, and receiving personnel) on how to inspect parts and identify possible counterfeits.
- Conduct training and increase awareness about counterfeit risks and risk mitigation.

Note: CCAP = Counterfeit Components Avoidance Program, CTI = Components Technology Institute, ERAI = Electronic Resellers Association, Inc., and IDEA = Independent Distributors of Electronics Association.

According to organizations that have investigated the counterfeiting problem, the best mitigation strategy is to procure items only from OCMs and their franchised or authorized distributors. When the original manufacturer no longer makes the required item, or the item is in short supply, users must obtain these products on the open market, which increases the risk of purchasing counterfeits. Therefore, purchasing on the open market warrants special precautions.

The most effective precaution is to purchase from suppliers that maintain full traceability. The most important document for traceability is the certificate of conformance, a formal declaration by the supplier that all requirements have been met. Responsible suppliers must provide traceability certificates that trace parts back to the OCM. Lacking a certificate, the next best trail is an unbroken chain of documentation (certifications, packaging slips, etc.) tracing the movement of the parts back to the OCM. Although traceability provides some level of insurance, be aware that, just as parts can be counterfeited, certificates can be faked as well.

Products backed by the original manufacturer's warranty offer the greatest assurance of integrity and traceability. Each step further away from the OCM adds a new layer of uncertainty about the pedigree, decreasing buyer confidence in the product's authenticity and increasing the risk that the part may be a counterfeit. Another precaution is to know what the item should cost. If a supplier's prices are significantly lower than expected, or significantly lower than the competition's prices, the supplier may be offering counterfeits.

If it is impossible to avoid buying products from an unknown or less-trusted source, the purchased products should be subjected to rigorous inspection and testing to determine their authenticity. The inspectors should look for signs of counterfeiting in two places: the products themselves, and the documentation and packaging accompanying the products. Table A-1 identifies some visual cues or indications of possible counterfeit parts.

**Table A-1. Indications of Possible Counterfeiting**

Component	Documentation and packaging
Blacktopping	Misspellings
Indents	Poor use of English
Body molds	Missing manufacturer's logo or label
Part markings	Mismatch between the logo or label on the product and that on the manufacturer's website or on previous shipments
Locations where the parts were made	
Part texture	Impossible date codes (e.g., in the future)
Leads	Mismatch between date codes or lot codes on the certificate of conformance and the codes on the parts
Evidence of prior use	
Variations in size or shape	
Improper fit	
Packaging variations	
Variations in graphics and colors	

Products that pass the initial inspection should then be subjected to various types of testing:

- Thermal-cycle testing
- Electrical testing (continuity, functional, parametric, and radio-/high-frequency testing for parasitics)
- Burn-in
- Curve-tracer testing
- RoHS compliance testing
- Microscopic inspection using advanced microscopes and cameras with charge-coupled devices
- X-ray and x-ray fluorescence
- Destructive physical analysis
- Internal visual verification using decapsulation.

Some counterfeit-detection approaches may not be cost-effective for all parts and components. The best application is on larger units such as avionics, computers, instruments, and actuators or on anything that is deemed a safety or mission-critical component.

In sum, the procurement process is the main entry point for counterfeits due to the use of unapproved suppliers, lack of part-authentication procedures, lack of communication and cooperation between suppliers and customers, insufficient inventory control procedures, and limited counterfeit-avoidance procurement policies and practices.

The strategies for mitigating the risk of counterfeiting should be documented in a counterfeit parts control plan. The plan should, among other things, address the detection, verification, and control of in-process and in-service suspect counterfeit parts; detection of counterfeit parts before formal product acceptance; supply chain traceability to the OCM or aftermarket manufacturer; procedures for assessing potential sources of supply and maintaining a register of approved suppliers; flow down of applicable requirements; and methods for physical identification, segregation, quarantine, and control of suspect or confirmed counterfeit parts to preclude their use or installation. The plan also should require reporting of all occurrences of counterfeit parts to internal organizations, customers, Government-Industry Data Exchange Program, industry-supported reporting programs (e.g., the Electronic Resellers Association, Inc.), and criminal investigative authorities (Federal Bureau of Investigation or Department of Commerce). Finally, it should discuss requirements for certificates of conformance and testing certifications.

The following are two key standards related to counterfeits:

- SAE Aerospace Standard AS5553B, "Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition"
- IDEA-STD-1010-B, "Acceptability of Electronic Components Distributed in the Open Market."

## COMPONENTS WITHOUT LEADED SOLDER AND FINISHES

### The Problem

DoD and the U.S. aerospace industry want electronic components, particularly those used in applications requiring high-reliability performance, that are made with leaded solder and finishes. However, finding such components is difficult because of various bans on the use of lead. Without lead, solder is more brittle and, therefore, may not be able to handle mechanical stresses such as the g-force created when spacecraft lift off.

Lead-free finishes can be problematic because of the risk of tin whiskers. Tin whiskers are elongated, electrically conductive crystalline structures that grow spontaneously from pure-tin surfaces. Tin whiskers have caused failures in electronics by short-circuiting to adjacent conductors. Aircraft, satellites, and missiles also have failed due to tin-whisker short circuits. Most tin whisker-related failures occur after 1 to 3 years of service, early in the life cycle of defense weapon systems.

### Risk Factors

The risks related to leaded versus lead-free components are twofold: the difficulty of finding manufacturers that will produce electronic components using lead solder and finishes, and the difficulty of distinguishing between parts that appear to be identical but are, in fact, different in terms of their lead content—some are lead free while others are not.

Lead has long been known as hazardous to humans and the environment, and its use has, for many years, been banned in plumbing, coatings, gasoline, paint, and other products. In an effort to further reduce the risks, the European Union nations sought to reduce the amount of lead in the manufacturing process by issuing the RoHS and WEEE directives, which became European law in 2003. Beginning on July 1, 2006, the European Union began banning the import of electronic components that include lead and other heavy metals. The United States, Japan, China, South Korea, Argentina, Australia, and Turkey have taken similar measures.

To be able to sell parts to countries in Europe and beyond, and to remain competitive, manufacturers must comply with the RoHS and WEEE directives. The RoHS and WEEE directives do not apply to defense and aerospace products. However, the defense and aerospace industries depend on commercial manufacturers as their sources for electronic components. Manufacturers design and produce electronic components primarily for the commercial market, and those products are lead free. Producing the same product, but using lead, for the defense and aerospace industries would not be economical, because the defense and aerospace requirement for electronic components accounts for less than 1 percent of the electronic components market. Few, if any, can afford to operate two independent manufacturing lines for the same product, one without lead and one containing lead. The end result is that many key components and assemblies used in aerospace systems are now available only in their lead-free forms.

Even when the defense and aerospace industries can obtain electronic components with lead solder and finishes, they risk mistakenly using lead-free parts in applications requiring high-reliability performance unless they implement practices that will mitigate the risk.



## Risk Mitigation Strategies

It is essential to understand from the outset whether an application needs RoHS-compliant (lead-free) components or whether it needs components containing lead. RoHS-compliant components should be used in all applications except those requiring high reliability; this practice will preclude penalties associated with noncompliance. On the other hand, if a military or aerospace application requires high reliability, then only components with traditional tin-lead solder (63 percent tin and 37 percent lead) and lead finishes should be used. Below are a few best practices that may help to avoid potential issues related to leaded versus lead-free components:

- Ensure that suppliers fully understand the issues of using leaded versus lead-free components.
- Verify that suppliers use different part numbers for leaded and lead-free components that are otherwise identical. If different part numbers are not issued, it is difficult to distinguish lead-free parts from leaded parts. This is also an issue when components are returned or when they are recycled.
- Whenever possible, buy from trusted sources. Avoid unknown sources offering questionable products at a low price.
- Seek components that have a clear pedigree to verify whether components are lead free or not.
- Upon receipt of the components, verify that they are truly RoHS compliant or contain lead, whichever is needed to meet the requirements. Sample and test parts whenever a pedigree for the part is not available. An x-ray process can tell if there is lead in the part, without destroying the part, but it cannot detect all of the hazardous materials listed in the RoHS directive. The most certain way of testing a part involves destroying it to get a complete chemical breakdown.
- Never commingle leaded and lead-free components in inventory or applications. Although maintaining dual inventories and manufacturing lines can be costly, the costs of failures can be far greater.
- Stay informed about research on solder alloys being tested to replace tin-lead. Although none yet is a proven replacement for tin-lead, research may soon yield an acceptable substitute that will meet high-reliability requirements.

## REGULATION AFFECTING THE SUPPLY CHAIN

The manufacturing industry is continually grappling with new legislations and regulations. One of the most complex but most important pieces of legislation in the European Union's history is the REACH regulation. The REACH regulation states that it is the responsibility of manufacturers or importers to know the chemical composition of each of their products and to prove the safety of all substances used.

What does the acronym REACH stand for?



**Registration:** chemical producers are required to register safety data for all chemicals produced.

**Evaluation:** experts from the European Union evaluate safety data for higher volume chemicals and other chemicals of concern.

**Authorizations:** chemicals that are of a very high concern are subject to phasing out and replacement with safer alternative chemicals.

**Restriction of Chemicals:** chemicals may be banned or restricted.

The sole purpose of the REACH regulation is to address the production and use of chemical substances and their potential impacts on both human health and the environment. REACH requires all companies manufacturing or importing chemical substances into the European Union in quantities of one ton or more per year to register these substances with the European Chemical Agency. Manufacturers, importers, and their customers are required to communicate information on chemicals throughout the supply chain to be aware of information relating to health and safety of the products supplied. The main difference between RoHS and REACH is that while RoHS bans substances that are present in electrical equipment such as lead, mercury, cadmium, hexavalent chromium, and polybrominated biphenyls, REACH pertains to all chemicals including those used to make a product. These chemicals can include those found in materials, solvents, and paints.

The main concern for defense and aerospace industries with obtaining REACH-regulated products is whether they will meet requirements. A follow-on issue is, if the REACH products are deemed to not meet requirements, then extensive market research will have to be undertaken to locate suitable replacements or requirements will need to be reviewed and adjusted.

Below are some relevant standards:

- SAE-GEIA-STD-0005-1, "Performance Standard for Aerospace and High Performance Electronic Systems Containing Lead-Free Solder"
- SAE-GEIA-STD-0005-2, "Standard for Mitigating the Effects of Tin Whiskers in Aerospace in High Performance Electronic Systems"
- SAE-GEIA-STD-0005-3, "Performance Testing for Aerospace and High Performance Electronic Interconnects Containing PB-Free Solder and Finishes"
- SAE-GEIA-HB-0005-1, "Program Management/Systems Engineering Guidelines for Managing the Transition to Lead-Free Electronics"
- SAE-GEIA-HB-0005-2, "Technical Guidelines for Aerospace and High Performance Electronic Systems Containing Lead-Free Solder and Finishes"
- SAE-GEIA-HB-0005-3, "Rework/Repair Handbook to Address the Implications of Lead-Free Electronics and Mixed Assemblies in Aerospace and High Performance Electronic Systems" (formerly TechAmerica GEIA-HB-0005-3)
- ASTM F2725-11, "Standard Guide for European Union's Registration, Evaluation, and Authorization of Chemicals (REACH) Supply Chain Information Exchange."

# Appendix B. Key Policies Governing the Defense Acquisition System

**Flexibility.** There is no one best way to structure an acquisition program to accomplish the objectives of the Defense Acquisition System. Milestone Decision Authorities (MDAs) and program managers must tailor program strategies and oversight—including documentation of program information, acquisition phases, the timing and scope of decision reviews, and decision levels—to fit the particular conditions of that program, consistent with the applicable laws and regulations and the time-sensitivity of the capability need.

**Responsiveness.** Advanced technology must be integrated into producible systems and deployed in the shortest time practicable.

**Innovation.** Throughout DoD, acquisition professionals must develop and implement initiatives to streamline and improve the Defense Acquisition System. MDAs and program managers must examine and, as appropriate, adopt innovative practices (including best commercial practices and electronic business solutions) that reduce cycle time and cost, and encourage teamwork.

**Discipline.** Program managers must manage programs consistent with statute and regulatory requirements. Every program manager must establish program goals for the minimum number of cost, schedule, and performance parameters that describe the program over its life cycle.

**Streamlined and effective management.** Responsibility for the acquisition of systems must be decentralized to the maximum extent practicable. The MDA must provide a single individual with sufficient authority to accomplish MDA-approved program objectives for development, production, and sustainment. The MDA must ensure accountability and maximize credibility in cost, schedule, and performance reporting.

**Performance-based acquisition.** To maximize competition, innovation, and interoperability, and to enable greater flexibility in capitalizing on commercial technologies to reduce costs, acquisition managers must consider and use performance-based strategies for acquiring and sustaining products and services whenever feasible. For products, this includes all new procurements and major modifications and upgrades, as well as reprocurements of systems, subsystems, and spares that are procured beyond the initial production contract award. When using performance-based strategies, contract requirements must be stated in performance terms, limiting the use of military specifications and standards to government-unique requirements only. Acquisition managers must base configuration management decisions on factors that best support implementing performance-based strategies throughout the product life cycle.

**Products, services, and technologies.** The acquiring component must consider multiple concepts and analyze possible alternative ways to satisfy the user need. The acquiring component must seek the most cost-effective solution over the system's life cycle and must conduct market research and analysis to determine the availability, suitability, operational supportability, interoperability, safety, and ease of integration of the considered and selected procurement solution. The acquiring component must work with users to define capability needs that facilitate the following, listed in descending order of preference:

- The procurement or modification of commercially available products, services, and technologies, from domestic or international sources, or the development of dual-use technologies
- The additional production or modification of military systems or equipment previously developed by the United States or by U.S. allies
- A cooperative development program with one or more U.S. allies
- A new, joint, DoD component or government agency development program
- A new DoD component-unique development program.

# Appendix C. Product Descriptions

A product description provides the essential technical characteristics about the item to be acquired; it also defines the methods or procedures used to verify the technical characteristics. Product descriptions for commercial items and NDIs should evolve from the user's requirement and from information on item and industry capabilities identified during market research.

The following are the key types of product descriptions:

- **Non-government standards.** Non-government standards are developed by private-sector organizations, which plan, develop, establish, or coordinate standards, product descriptions, handbooks, or related documents. They may describe items or processes (such as test methods). Non-government standards may have been adopted by DoD and listed in DoD's ASSIST, which is the online repository of DoD specifications and standards. However, any suitable non-government standard, whether or not it has been adopted, may be used. Because non-government standards are developed by consensus involving all interested parties, they normally document commercial practices or standards for an item or process and are valuable tools in developing product descriptions for commercial items.
- **Commercial item descriptions (CIDs).** CIDs are simplified product descriptions that describe the available, acceptable commercial items that meet DoD needs. CIDs are normally used to buy commercial items when development of a standardization document is justified. The user's requirement, market research, and coordination with industry form the basis for the development of a CID. Requirements for samples and market acceptance criteria (for example, annual sales data, expected orders, and warranty provisions) are both useful tools in simplifying the CID. Market acceptance criteria can be used in other types of product descriptions as well.
- **Defense performance specifications and defense detail specifications.** Defense specifications are reserved for military-unique items when development of a standardization document is justified. These types of product descriptions may be used in an NDI acquisition, for example, when one military service uses an item previously developed for another service.
- **Program-peculiar documents.** These documents describe items developed and produced for use under a specific program, or as part of a single system, that have no application outside that program or system. They are frequently used to buy systems. They are not standardization documents. Even when they are used for development programs, program-peculiar documents should encourage the use of commercial items and NDIs as subsystems, components, and support equipment. This process can be facilitated by

asking the developer to conduct market research to identify opportunities for maximizing the use of commercial items and NDIs. In addition, to facilitate commercial item and NDI use, design-type requirements should be avoided as much as possible.

- **Purchase descriptions.** Purchase descriptions are used to competitively solicit and contract for an item when development of a standardization document is not justified, such as for infrequent or one-time buys. A "brand name or equal" description is an example of a purchase description. As with other product descriptions, when writing purchase descriptions, performance terms should be used whenever possible.

The following tips are useful to remember when selecting or developing product descriptions:

- **Communicate with the user.** Continuous two-way communication between the user and the person preparing the product description is essential to ensure that the description accurately reflects the user's requirement and to communicate information gained during market research.
- **Maintain consistency between the product description and the evaluation criteria.** To attain the overall best value for DoD, the product description must be consistent with the evaluation process and vice versa.
- **Consider the intended environment.** If the intended environment is similar to that for which the item was designed, existing commercial standards should be acceptable. If a commercial item will be used in a more severe environment, those special characteristics will need to be included in the requirements.
- **Evaluate market standards and practices.** For existing items, the market will have established standards for quality, production, and materials, as well as for item support, technical data, and warranties. Deviating from prevailing market standards and practices can erode the benefits of using commercial items.
- **Establish flexibility in the operational requirement to allow consideration of a broader range of alternatives.** The product description should reflect the user's flexibility by stating requirements in terms of acceptable ranges, targets, or desired and required values rather than exact values.
- **Document result of market research.** Market research information should indicate the potential for using commercial items or NDIs and serve as the basis for many of the characteristics contained in the product description.

To the extent practical, product descriptions should be written in terms of function or performance. Functional characteristics address what is to be accomplished, for example, "provide transportation." Performance characteristics address the level at which the function is carried out, for example, "provide transportation for up to four adults at speeds up to 60 miles per hour." A design characteristic, on the other hand, tells how the functional requirement will be met, for example, "provide a four-wheel gasoline-powered vehicle." Describing the requirements



in terms of function or performance allows maximum flexibility for suppliers to use established products and practices to meet the requirements and thus increases the likelihood that commercial or nondevelopmental items will be used. Compare the following two approaches to a product description for a fire extinguisher:

"Each fire extinguisher shall be equipped with a metal clip or bracket to hold the discharge nozzle when not in use."

"Each fire extinguisher shall be capable of being stored in an unobtrusive manner while being equally capable of effective and efficient use."

Unless there is an operational requirement that the nozzle bracket be made of metal, the second statement is preferable. It allows manufacturers to offer best-commercial-practice equipment without focusing on nozzle-bracket specifications. The latter statement is more likely to result in a commercial extinguisher being offered.

# Appendix D.

## Foreign Comparative Testing Program

The Foreign Comparative Testing (FCT) program is a congressionally mandated effort that supports U.S. policy encouraging international armaments cooperation and helps reduce overall DoD acquisition costs by facilitating the procurement of foreign NDIs.

The FCT program's objectives are to improve the U.S. warfighter's capabilities and reduce expenditures through the following:

- Rapidly fielding quality military equipment
- Eliminating unnecessary duplication of research, development, test, and evaluation
- Reducing life-cycle or procurement costs
- Enhancing standardization and interoperability
- Promoting competition by qualifying alternative sources
- Improving the U.S. military industrial base.

FCT involves the test and evaluation of items of defense equipment developed by U.S. allies and other friendly nations to determine whether such equipment can satisfy requirements identified by the military services and the commanders in chief to correct mission area shortcomings. Candidate projects are nominated annually by the military services to the Office of the Secretary of Defense. Projects that survive the screening process are prioritized by order of merit, and a summary of the recommended projects is provided to Congress for use in its authorization and appropriation actions for the upcoming year.

FCT funding supports lease and procurement of foreign test articles and subsequent test and evaluation by the sponsoring service. Priority for FCT funding is given to test and evaluation of NDI equipment that demonstrates good potential to satisfy U.S. requirements with little or no modification. As a low priority, technical aspects of foreign equipment or systems may be assessed. Testing of U.S. items in side-by-side comparisons with foreign items is not funded by the FCT program. Costs associated with the testing of U.S. items are borne by the appropriate service or U.S. Special Operations Command.

Generally, projects approved for test and evaluation through the FCT program are funded for no more than 2 years, although test and evaluation of complex systems may be funded for a longer period. Candidates for FCT funding must meet certain criteria:

- Demonstrate that the system meets a requirement for which no U.S. system exists or provides significant cost, schedule, or performance advantages over an existing U.S. system

- Support the above conclusion with thorough market research (for guidance in conducting market research, see SD-5, *Market Research: Gathering Information about Commercial Products and Services*)
- Establish that no offshore procurement restrictions exist
- Identify funds available to procure equipment that will meet the requirement against which the foreign item is being evaluated
- Identify any potential for establishing a U.S. source to produce the item
- Show the willingness of the DoD component to share costs and address the willingness of the foreign government or industry to do the same
- Address allied interoperability and support considerations, other DoD components' interests in the item, security concerns, and end-use certification requirements.

The FCT program is administered within the Office of the Secretary of Defense.

# Appendix E. References

Comparative Technology Office

<https://www.acq.osd.mil/ecp/programs/CTO.html>

Defense Acquisition Guidebook

<https://www.dau.mil/tools/dag>

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<http://www.acq.osd.mil/dpap/dars/dfarspgi/current/index.html>

Defense Standardization Program, Case Studies

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<http://acqnotes.com/acqnote/acquisitions/dodd-5000>

DoD Instruction 5000.02, "Operation of the Defense Acquisition System"

<http://acqnotes.com/acqnote/acquisitions/dodi-5000>

DoD Information Technology Standards Registry

[http://acqnotes.com/acqnote/careerfields/  
dod-information-technology-standards-and-profile-registry](http://acqnotes.com/acqnote/careerfields/dod-information-technology-standards-and-profile-registry)

DoD Specifications and Standards (ASSIST)

<https://assist.dla.mil/online/start/>

Federal Acquisition Regulation

<https://www.gsa.gov/policy-regulations/regulations/federal-acquisition-regulation-far>

Federal Acquisition Regulation Part 12, "Acquisition of Commercial Items"

<https://www.acquisition.gov/far/html/FARTOCP12.html>

GSA Federal Standardization Manual

[https://www.gsa.gov/cdnstatic/Federal\\_Standardization\\_Manual.pdf](https://www.gsa.gov/cdnstatic/Federal_Standardization_Manual.pdf)

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"Operation of the Defense Acquisition System," Enclosure 14, Cybersecurity in the Defense Acquisition System (2013)

[https://www.acq.osd.mil/fo/docs/DSD%205000.02\\_Memo+Doc.pdf](https://www.acq.osd.mil/fo/docs/DSD%205000.02_Memo+Doc.pdf)

Performance-Based Acquisition

<https://pba.app.cloud.gov/app/#/pba>

"Protection of Mission Critical Functions to Achieve Tested Systems and Networks (TSN)" (2017)

[https://fas.org/irp/doddir/dod/i5200\\_44.pdf](https://fas.org/irp/doddir/dod/i5200_44.pdf)





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