DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND
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IN REPLY REFER TO
NAVSEAINST 9083.1
Ser 04L1/402
21 Jul 00

NAVSEA INSTRUCTION 9083.1

From: Commander, Naval Sea Systems Command

Subj: COMMERCIAL OFF THE SHELF (COTS) POLICY

Ref: (a) DODD 5000.1 Defense Acquisition
(b) DODINST 5000.2 Operation of the Defense Acquisition System
(c) DOD 5000.2-R Mandatory Procedures for Major Defense Acquisition Programs (MDAPS) and Major Automated Information Systems (MAIS) Acquisition Programs
(d) NAVSEA Memo Ser. No. 00B/157 of 17 Dec 1997, COTS Steering Board Charter

Encl: (1) COTS Management Strategies

1. Purpose. To establish policy for expanding the use and managing the risks of COTS products in accordance with references (a), (b) and (c).

2. Scope

a. This policy applies to ships and systems, sub-systems, components, and equipment procured by the Naval Sea Systems Command (NAVSEA) and affiliated Program Executive Officers (PEOs). COTS products include hardware, software and firmware.

b. The use of COTS does not modify or alleviate the responsibilities of the ship or equipment acquisition Program Managers from meeting other shipboard, environmental or survivability requirements as required by law, regulation or instruction.

c. This policy does not apply to nuclear programs under the cognizance of NAVSEA 08, including integration of nuclear plants into ships propulsion systems.

3. Background

a. References (a), (b) and (c) establish COTS products as the preferred alternative for the development of defense systems when existing military products cannot meet the operational requirement.

b. Commercial-military integration provides opportunities for faster and lower cost production of defense equipment and supplies through the use of commercial manufacturing technologies and economies of scale. COTS also provides access to a much larger industrial base, which may become crucial if the nation has to expand production to reconstitute forces to respond to new national threats.

c. The use of COTS products introduces complexities and new risks into our development, acquisition, budgeting, engineering and support processes including risks imposed by the rapid pace of technology change and the lack of complete design disclosure. Strategies, plans and budgets are needed to address additional risks.

d. Successful COTS integration requires extensive knowledge of "best practices" for the development, acquisition, modernization and maintenance of affordable ships and systems utilizing commercial items. As technology evolves, there is a need for NAVSEA and affiliated PEO Program Managers (PMs) to plan and budget for future replacement or update of COTS products throughout the life cycle of deployed equipment.

e. The COTS Steering Board (CSB) was established by reference (d) to bring together key decision-makers and experts to facilitate the exchange of information related to COTS implementation and to maximize opportunities for the expanded use of COTS in Navy ship systems.

4. Policy

a. Plans, strategies and budgets will be developed by NAVSEA PMs and affiliated PEO PMs to incorporate the use of COTS and manage the risks during acquisition, deployment (including combat and peacetime operations) and life cycle maintenance of ships' systems.

b. COTS plans and strategies will be prepared and updated by the PM in either separate program plans such as a COTS

Management Plan or addressed in the appropriate acquisition program document such as the Acquisition Plan, Acquisition Strategy, or Integrated Logistics Management Plan (ILSMP). The PM will determine the type of program plan to be used. Enclosure (1) contains a list of COTS management strategies that shall be included in the plan. Detailed guidance for COTS planning and implementation is provided in the NAVSEA COTS/NDI Handbook which will be available at http://COTS.NAVSEA.navy.mil.

c. Acquisition decisions will consider cost/benefit analysis of integrating COTS products, including product availability, reliability, maintainability, survivability, supportability and sustainability throughout the planned life cycle of the system.

d. NAVSEA-affiliated PEO PMs will provide new or updated COTS plans and strategies to a central site for information exchange.

e. The CSB will facilitate planning and implementation of COTS products.

5. Action

a. NAVSEA PMs and affiliated PEO PMs will:

(1) Develop either separate COTS Management Plans or integrate COTS planning information into appropriate acquisition program documents.

(2) Provide COTS planning information or separate COTS Plans to SEA 04L for information exchange.

(3) Affiliated PEOs will provide representation on the CSB.

b. NAVSEA Directorates will:

(1) Provide representation on the CSB.

c. NAVSEA 04 will:

(1) Provide executive leadership to the CSB, which includes representatives from across the NAVSEA claimancy and outside the claimancy as appropriate.

(2) Develop and maintain the web site, http://COTS.navsea.navy.mil, as a central site for exchange of information on COTS plans and strategies.

d. NAVSEA 05 will:

(1) Provide technical authority and support to the CSB and to PMs to ensure that commercial technology/COTS products fulfill military unique life cycle requirements.

e. The CSB will:

(1) Review COTS planning information to advise PMs on the use of "best practices", lessons learned and act as a forum to facilitate information exchange among various PEOs/PMs. CSB members may also provide recommendations to the PMs on the technical merits of the COTS strategies in accordance with applicable laws, regulations and instructions.

(2) Foster acquisition tool development for COTS products and promote their use throughout the NAVSEA acquisition community.

(3) Publicize information on COTS use to NAVSEA acquisition offices.

(4) Periodically review, update and promulgate NAVSEA COTS policy and guidance.

(5) Provide approaches and models to assist the PMs in monitoring and evaluating triggers or thresholds of fielded systems to insure the readiness, effectiveness, survivability and life cycle cost are not being adversely impacted by the use and management of commercial technology. Further, the CSB will serve in an advisory capacity to the PMs by making recommendations of corrective action for any system which is negatively impacting readiness, effectiveness, survivability or life cycle cost because of COTS product insertion/refreshment.

(6) Evaluate methodologies to provide integrated requirements, Program Objectives Memorandum (POM) and budgeting strategy to provide appropriate focus to resource sponsors.

G. P. NANOS, JR.

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COTS Managements Strategies

Below is a list of strategies that should be addressed in a COTS Management Plan. These are not all inclusive and are merely representative of the minimum issues that need to be addressed for COTS products.

1. Budgeting. COTS requires out-year funding to address the eventual turnover of technology. How will funding be supplied throughout the life cycle for this?

2. Technology Refresh. COTS products change at the whim of the commercial marketplace. How will you monitor and proactively deal with these changes? How will you address post-production support?

3. Market Analysis. Extensive efforts are required to understand where the commercial marketplace is today and its future direction. How will this be accomplished?

4. System Engineering. How will you address changes to COTS hardware and software throughout the life cycle and its impact to:

   a. System Baselines
   b. Certification and Qualification
   c. Test and Evaluation
   d. System Performance
   e. Intra and Interoperability
   f. Information Security
   g. Developing or Identifying Standards for Open Systems
   h. Fault Detection/Isolation
   i. Requirements
   j. System Safety
   k. Environmental Conditions (e.g. survivability, shock, noise, vibration, EMC/EMI, fire/smoke/toxicity, water spray, humidity, hazardous materials, pollution prevention, unplanned stimuli)

5. COTS Performance. COTS products may or may not be suitable for shipboard applications. How do you intend to evaluate this and if necessary modify COTS, or its installation, for shipboard combat and peacetime environments?

6. Rights in Technical Data. Technical data for COTS items is generally unavailable or very expensive to procure.

What workarounds have you put in place to address the limited technical data available for COTS items?

7. Configuration Management (CM). Traditional CM paradigms do not work for COTS products. How will you address the functional requirement to know what items are needed for production, support, Engineering Change (EC) planning, COTS Management Strategies etc.? How will you insure form, fit and function inter-changeability throughout the life cycle?

8. ILS. COTS products often have established commercial support philosophies. How will you leverage and integrate these into a total integrated support posture? How will existing technical and business processes be maximized for efficiencies and end user transparency? How will you provide the following for your COTS items?

   a. Supply Support
   b. Packaging, Handling, Storage & Transportation
   c. Maintenance Planning
   d. Manpower and Personnel
   e. Support Equipment
   f. Technical Data
   g. Training and Training Support
   h. Computer Resources Support
   i. Facilities
   j. Design Interface
   k. Reliability, Maintainability and Availability
   l. Software Licenses
   m. Warranty Management

9. Reliability, Maintainability and Quality Assurance. COTS products are designed and fabricated to varying standards of reliability, maintainability and quality. How will you evaluate current products and insure eventual replacements do not degrade in these and all other critical areas?

NAVAL SEA SYSTEMS COMMAND
COMMERCIAL OFF-THE-SHELF
AND
NON-DEVELOPMENTAL ITEMS
HANDBOOK

06/29/00

FORWARD FROM THE COMMANDER, NAVAL SEA SYSTEMS COMMAND

This document was created in response to the feedback from the NAVSEA Commercial-Off-the-Shelf (COTS) Workshop held in Norfolk, VA in August 1998, where the Fleet and the NAVSEA user community expressed the need for NAVSEA guidance in the utilization of COTS. The need for information concerning COTS strategies, solutions and success stories was also identified. In response, I tasked the NAVSEA COTS Steering Board to develop a COTS Policy Document and a COTS Guidance Document to help the NAVSEA community more effectively implement and manage COTS in Navy programs and share successful strategies as well as lessons learned based on user experience.

The COTS Policy document, NAVSEA Instruction XXXX.X titled "Commercial-Off-The-Shelf (COTS) Policy", was issued on ___tbd___, and provides the policy upon which this NAVSEA Commercial-Off-The-Shelf / Non-Developmental Item (COTS/NDI) Guidance Document is based. The Guidance Document was developed in the form of two complementary components, which together, form a powerful tool to aid NAVSEA and associated Program Executive Offices (PEOs) in the use of COTS/NDI. The two components are the NAVSEA COTS/NDI Guidance Document and the NAVSEA COTS/NDI Web Site at http://cots.navsea.navy.mil.

These components provide a high level framework for the implementation of COTS/NDI in individual programs. However, the most important benefit comes from the sharing of information that results from the aggregate of user community experience. All NAVSEA activities and affiliated PEOs should contribute to these resources so our successes can be duplicated and our processes optimized. The COTS/NDI website provides the vehicle for the sharing of such information. You are all encouraged to become an integral part of our strategy for success in the implementation of COTS/NDI in Navy systems.

/VADM Nanos/

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1. INTRODUCTION

In 1994 the Secretary of Defense challenged DoD to use more commercial products in its military systems. In compliance with this direction, Naval Sea Systems Command (NAVSEA) has significantly increased Commercial Off The Shelf/Non-Developmental Item (COTS/NDI) in system acquisitions. Given the fiscal constraints under which we operate, employing COTS/NDI is a prudent means of lowering the costs of acquiring equipment and systems that satisfy the Navy's needs. However, effective management of COTS hardware and software in Navy systems presents difficult and different challenges than traditional item acquisition and life cycle support—challenges arising from the exponential rate of change in technology and the impact these rapid changes have on COTS/NDI insertion, refreshment, and obsolescence over the life of a military system.

1.1 PURPOSE

This document provides overall guidance in the acquisition, integration, and maintenance support of COTS/NDI based hardware (including Hull Mechanical & Electrical (HM&E)) and software under the cognizance of the Naval Sea Systems Command. This handbook provides a framework to develop, manage and execute a comprehensive, cost effective, COTS/NDI program. These strategies are based on DoD policy; they leverage industry experience, lessons learned in other military applications, and current "best practices." It is not intended to detail *how* to accomplish these tasks, but rather to suggest guidelines that define *what* must be addressed and considered to ensure success in the application of COTS/NDI products to mission and program needs.

1.1.1 How to Use this Document

This **Guidance Document** provides overall guidance in the acquisition, integration, and maintenance support of COTS/NDI based equipment and systems under the cognizance of NAVSEA. This document is written from a global perspective and will help managers and implementers decide *what* factors to consider when employing and integrating COTS/NDI into systems, tailorable to their specific program.

NAVSEA's strategy for providing guidance on the use of COTS/NDI consists of two major components. This **Guidance Document** provides general concepts on "*what*" issues need to be considered for COTS/NDI systems, and the **NAVSEA COTS/NDI Web Site** which enables program personnel to obtain additional, detailed "*how to*" information, from a multitude of COTS/NDI sources from across DoD. This combination, together with each program's unique knowledge of their systems and programs, forms a powerful tool for the safe and cost-effective application of COTS/NDI. Figure 1-1 depicts how the Guidance Document and Web Site can be used for tailoring a NAVSEA COTS/NDI program.

This document, alone, will not provide the reader all the answers needed for acquiring, fielding, and supporting COTS/NDI systems. It is not a "cookbook" for the application of COTS/NDI in NAVSEA Systems, primarily because every acquisition is unique and every program must be tailored to meet specific program requirements and budget constraints. The considerations contained in this Guidance Document are intended to provoke questions that can then be answered by obtaining information from the complementary NAVSEA COTS/NDI Web Site and associated links.

The NAVSEA COTS/NDI Web Site at http://cots.navsea.navy.mil provides the following:

- The NAVSEA Commercial Off The Shelf Policy Instruction and COTS/NDI Guidance Document
- Links to DoD and Navy regulations, directives and other source documents relating to acquisition and support of COTS/NDI in military systems
- Format and repository for posting COTS/NDI lessons learned
- Repository for posting NAVSEA / PEO COTS/NDI Management Plans
- Repository for listing candidate COTS/NDI tools, such as Life Cycle Cost Models and COTS/NDI Technology Data Bases
- A posting of upcoming COTS/NDI Workshops, Conferences, Training Opportunities, and other COTS/NDI events.

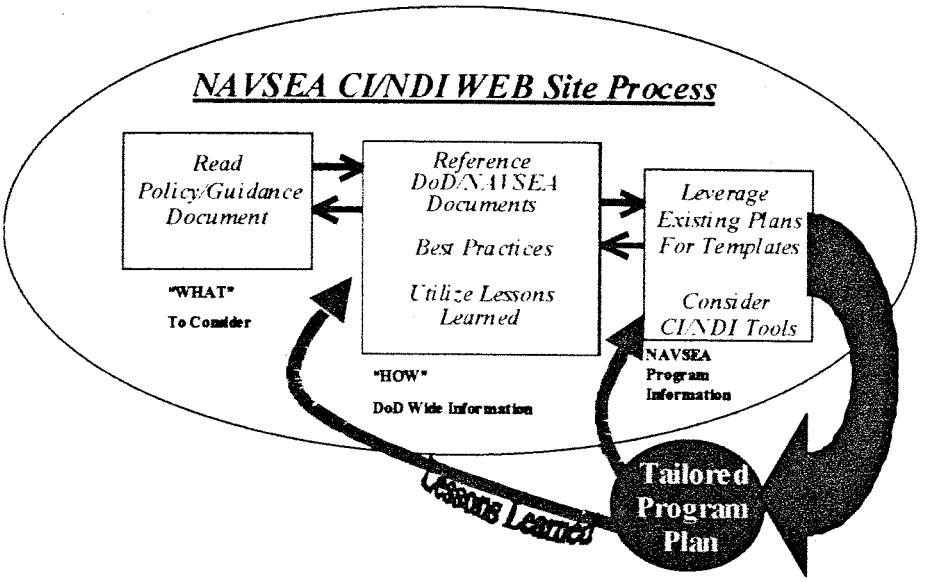

Figure 1-1. NAVSEA COTS/NDI Policy/Guidance Process

1.2 SCOPE

This document outlines approaches for developing successful acquisition and support strategies whenever commercial products are employed in military applications. It focuses on the acquisition and life cycle support of COTS/NDI for hardware (including HM&E) and software for all NAVSEA programs (excluding Nuclear Propulsion Programs under the cognizance of SEA 08). Its contents apply to NAVSEA Directorates, affiliated Program Executive Offices (PEO's) and Program Managers, and NAVSEA Field Activities. The document provides

guidance for those disciplines involved in all phases of the COTS/NDI acquisition and life cycle support process. While it is understood that acquisition projects vary greatly in complexity and requirements, the guiding tenets contained herein should be reviewed for applicability to the individual acquisition program, and tailored accordingly. Finally, the document attempts to consolidate salient points from previously prepared plans, reports and studies.

1.3 OBJECTIVE

This document will help managers and implementers decide "what" factors to consider when employing, integrating and supporting COTS/NDI. NAVSEA acquisition objectives are to obtain products which:

- Reduce system acquisition costs by reducing development costs and taking advantage of the large, cost competitive, commercial marketplace.
- Reduce the time required to field new military systems by reducing development time.
- Capitalize on commercial research and development to field state-of-the-art systems more quickly.
- Reduce Navy Total Ownership Cost (TOC).
- Achieve interoperability.
- Work as intended in their designated environment.
- Can be maintained without added risk to a ship's mission.
- Maximize use of commercial infrastructure.

1.4 RESPONSIBILITIES

NAVSEA Commercial Off The Shelf Policy Instruction XXXX.X specifies the roles and responsibilities for NAVSEA Directorates and Field Activities, affiliated Program Executive Offices, and Program Managers involved with COTS/NDI acquisitions.

NAVSEA 04 will maintain this document and central web site with input from cognizant NAVSEA organizations.

1.5 BACKGROUND

The use of COTS/NDI became acceptable for shipboard applications on 29 June 1994, when the Secretary of Defense formally initiated a new way of doing business. Secretary Perry challenged the Department of Defense to: "*...basically and fundamentally change the way it does procurement. We have to buy more commercial products, we have to make greater use of commercial buying practices, and we have to use industrial specifications in place of military specifications.*" Accompanying this action was the cancellation or conversion of many military specifications and standards and careful scrutiny of the "value added" by any government standards that were to be retained. It should be noted that use of COTS/NDI is not required if it jeopardizes mission performance or is more expensive than traditional Military Specification (MIL-SPEC) acquisitions from the perspective of total ownership cost.

1.6 DEFINITIONS

The following are key definitions to assist the reader in understanding the terminology used throughout this document. A complete list of definitions is found in section 10.

Commercial-Off-The-Shelf (COTS)/Commercial Item (CI). "A commercial item is defined as any item, other than real property, that is of a type customarily used for non-governmental purposes and that: (1) has been sold, leased licensed to the general public; or, (2) has been offered for sale, lease, or license to the general public; or any item that evolved through advances in technology or performance and that is not yet available in the commercial marketplace, but will be available in the commercial marketplace in time to satisfy the delivery requirements under a Government solicitation."

Modified Commercial Item: "A modified commercial item is any item with modifications of a type customarily available in the commercial marketplace or minor modifications of a type not customarily available in the commercial marketplace made to meet Federal Government requirements. Such modifications are considered minor if the change does not significantly alter the non-government function or essential physical characteristics of an item or component, or change the purpose of the process."

Non Developmental Item (NDI): "A non-developmental item is: (1) any previously developed item of supply used exclusively for governmental purposes by a Federal agency, a State or local government, or a foreign government with which the United States has a mutual defense cooperation agreement; (2) any item described in (1) that requires only minor modification or modifications of the type customarily available in the commercial marketplace in order to meet the requirements of the procuring department or agency; or (3) any item described in (1) or (2) solely because the item is not yet in use (FAR 2.101)."

Technical Refresh. A programmatic, Diminishing Manufacturing Sources and cost-driven life cycle process that supports the replacement of COTS/NDI. This refreshment is predicated upon life cycle cost effectiveness and continued compliance with current system performance and interface requirements and is normally transparent to the end user.

Technology Insertion. Infusion of new technology into the current design that increases mission capability or that satisfies current mission requirements while minimizing life cycle cost and maximizing support capability.

1.7 FRAMING THE ISSUES

Many things must come together to make the application of COTS/NDI work; including implementation of significant changes in the way systems are acquired and supported. The following considerations must be addressed for systems using COTS/NDI:

- Requirements should be defined (both hardware and software) in performance/functional specifications that meet mission needs, and enable and encourage the use of COTS/NDI where feasible.

- To gain the advantages presented by the commercial marketplace, neither the integrator nor the government should impose restrictions or requirements outside the norm of the commercial marketplace, while still meeting mission requirements.
- The foundation of a successful COTS/NDI application is to design hardware and software architectures that will withstand insertion of new technology, for whatever reason, without impacting their use in the system. This requires the use of Open System Architecture, with strict adherence to commercial interface standards for hardware and software.
- Major emphasis in the systems engineering process should be on the selection of new technology through market research rather than from Navy sponsored product development.
- Testing should be focused on system performance requirements, operational effectiveness, operational suitability for the application, and integration of commercial and development items. Test conditions should be based on actual operating conditions. Leverage commercial testing to the greatest extent possible.
- There is increased risk to the deployed system whenever products are acquired and installed in a fielded system without thoroughly testing them in the planned system configuration. Provision should be made for adequate test facilities at an integrator or at a Navy facility, before a commercial item is deployed to the ship.
- Contractors supplying COTS/NDI products should be allowed to use their existing support structure and existing data without change whenever possible. The modifications of these support structures are costly.
- The innovative use of contractor incentives can affect TOC. The commercial supplier or integrator will seek ways to reduce costs when presented with the appropriate incentive.

The acquisition and life cycle support concept revolves around intelligent selection and procurement of COTS/NDI products to ensure the Fleet is adequately supported and that the system technology is up to date. This acquisition concept consists of a comprehensive implementation program including:

- Market research, including surveillance of leading edge technologies, investigation of promising commercial products, and the assessment of technology trends.
- Supportability assessment of the preferred COTS/NDI products.
- Procurement of the selected products.
- Integration and system testing of the COTS/NDI items.
- Planning for technology refresh and technology insertion.

This concept is used to ensure that the commercial products employed remain within the broadest market possible and thus possess the most efficient leveraging opportunities for procurement and support. Planned system upgrades provide a means to achieve this objective. Further amplification of these concepts is contained in the later sections of this document.

Figure 1-2 illustrates not only the iterative and integrated application of the systems engineering processes involved in COTS/NDI acquisition and insertion, but also the inherent interdependencies. An efficient Data Management System will help ensure that these processes are effectively linked and integrated.

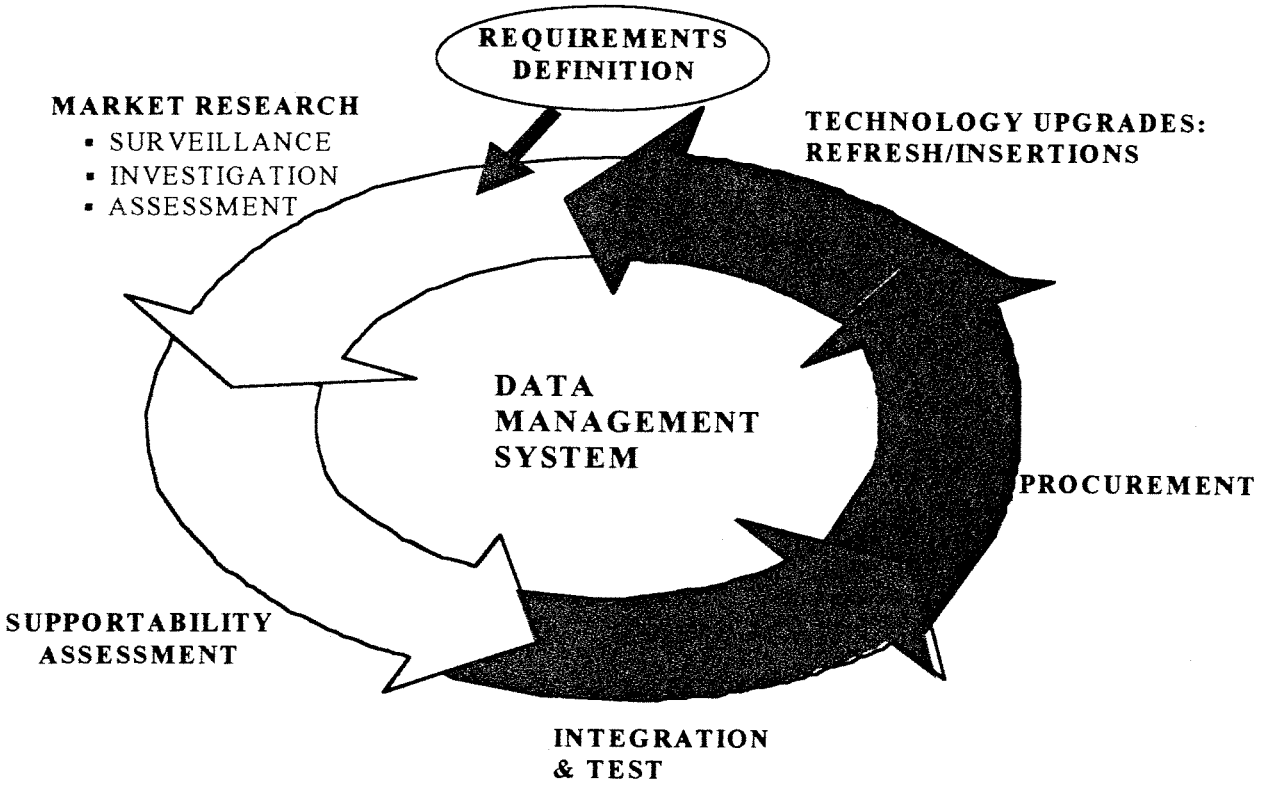

Figure 1-2. COTS/NDI Systems Engineering Process

1.7.1 Benefits of COTS/NDI:

Commercial Technology: Competition forces companies to bring the latest and most advanced technologies to the marketplace as quickly as possible. This allows Navy program managers to apply these technologies to meet their current requirements without most of the development risks and within a shorter timeframe. Because commercial products are competitively priced, cost risks are reduced.

Faster and More Cost Effective Acquisition: Using commercial items saves both development time and cost because the product is already designed and manufactured. The item can be acquired, tested, and integrated with other items to form a system faster than if the entire system was developed from scratch. Because a company developed the commercial item, the research

and development costs are built into the price, and amortized across all buyers of the product. On general use or commodity type items, the government is essentially paying only a small fraction of the R&D costs.

1.7.2 Challenges of COTS/NDI:

Quick Changeovers: The primary concern with using COTS/NDI is the quick changeover of the commercial market, resulting from the rapid pace of technology advancement, manufacturing processes, and other factors. This necessitates that Navy Program Managers constantly track the market and deal with fairly rapid product obsolescence. Formulating a support plan for a system impacted by the rapidly changing market requires substantial up front program planning. This requires continuous interdependent and complementary engineering and product support processes.

Integration and Interoperability: The integration and interoperability of commercial items at the equipment, system, platform, and battle group level are significant challenges. The ability of two or more systems to exchange information and utilize the information exchanged is a key issue with COTS/NDI products. Consequently, additional integration time and resources to resolve COTS/NDI interface and performance problems during system development and test must be anticipated.

POM/Budgeting: The Program Objective Memorandum (POM) and budgeting work well for military unique items, however it is not currently tailored to accommodate rapidly changing COTS/NDI applications. Because of the nature of the commercial market and rapid technology changes, the life span of both hardware and software is significantly shorter than the life span of Military Specifications (MIL-SPEC) items. Program Managers must develop timelines for COTS/NDI insertions and upgrades, and develop budget justifications in a timely manner to meet program requirements.

Configuration Management: With the adoption of rapidly evolving and vendor controlled COTS/NDI items, the early establishment of a strong CM process is vital. This discipline is applicable to hardware, software, processed materials, services, and related technical documentation, and is seen as a major challenge in supporting COTS/NDI programs. Programs must understand and rely more on functional configuration and less on physical configuration.

Logistics Support Planning: Although the COTS/NDI logistics support objective is unchanged, the short life of commercial hardware and software and the existence of commercial support for the products may require a different strategy for COTS/NDI support planning. The objective of logistics support planning for COTS/NDI is the same as the logistics objective for traditional military systems; to ensure the Navy can operate, maintain, and sustain the systems at the lowest life cycle cost without adversely impacting its mission.

Total Ownership Cost (TOC): With the introduction of COTS/NDI into military systems, budgets have been significantly reduced to reflect lower expected acquisition costs. These expectations arise in part from the belief that the acquisition cost of COTS/NDI is less than that of traditional military systems, and that most of the Research and Development (R&D) costs will be born by the commercial vendor. While the initial acquisition cost of COTS/NDI may indeed be less than the acquisition cost of militarized equipment, the TOC may in fact be higher when considering all acquisition, integration, testing and support costs over the total life cycle of the program. The impact of early design decisions on life cycle costs must be recognized and

analyzed. The Program must assume the responsibility for controlling life cycle costs. Life cycle costs must be considered in conjunction with technical performance.

Test and Evaluation (T&E): Standard commercial practices may not provide the test and evaluation needed to validate the performance characteristics required for a Navy application of COTS/NDI equipment. This may require additional test and evaluation, quality assurance testing, and/or engineering analysis for applications in a shipboard environment.

Mixed Support Strategy: Most large weapons systems will likely contain MIL-SPEC portions that have no corresponding commercial counterpart, but it is also likely that the system will make use of commercial products as suitable applications are identified. This mix of commercial products with MIL-SPEC designs presents a formidable challenge to a support strategy. The support plan must adjust to provide interfaces for non-traditional support concepts to work alongside traditional ones.

These COTS/NDI challenges require a shift in the way we acquire, modernize, and support our fleet, and require a thorough understanding of both the advantages and constraints in doing business within the COTS/NDI environment.

Survivability: The shipboard combat environment is a truly military unique environment. There is no commercial counterpart to this environment. The support plan must provide the vehicle to ensure that the survivability of the platform is not degraded due to the use of commercial products and technology.

2. PROGRAM MANAGEMENT

As the use of COTS/NDI products continues to proliferate, it becomes increasingly important that NAVSEA sponsored programs ensure the common development, implementation, and tracking of COTS/NDI within programs. Tasks such as the creation of COTS/NDI hardware and software databases, generation of obsolescence reports, vendor surveys, etc. should be considered as global assets within the NAVSEA community. This will allow each program to take advantage of the development and support efforts of other programs, resulting in leveraging of funds and focusing scarce technical resources. COTS/NDI can thus enhance supportability by introducing increased commonality between systems. It can also pose special problems due to rapid technology advancements.

The Program Manager should assess how well the system accommodates an open system architecture and can adapt to anticipate changes. Each system and subsystem has characteristics of its own. Many MIL-SPEC systems are mature, have been in production for many years, and are being supported in many ships in the Fleet. Insertion of COTS/NDI products is less likely to be of advantage in this case. Other systems are of more recent vintage that can more readily accommodate commercial products and associated technology upgrades. Assessments must be made of each system/subsystem to discern how to most cost effectively acquire and support it for the projected life of the equipment and system life. Similar systems/subsystems should be placed into like groupings leveraging on commonality for acquisition, training, and life cycle support considerations.

The challenges of COTS/NDI are not new. Program Managers have already successfully initiated innovative approaches to manage COTS/NDI in their particular program. Numerous documents are available within DoD that provide insights and lessons learned that are applicable to COTS/NDI insertion. Many of these can be found on the NAVSEA COTS web site referenced in Section 1 of this document. Program Managers should obtain, use and leverage the methodologies that have been successfully employed in the management of commercial items in military systems.

The remainder of this section outlines specific activities that fall under the purview of the Program Manager. While the activities may be performed by one or more of the technical disciplines (e.g., Systems Engineering, CM, ILS, etc.), responsibility for formation of the strategy and oversight of the results rests with the Program Manager.

2.1 ESTABLISHMENT OF A COTS/NDI INTEGRATED PRODUCT TEAM (IPT)

At program inception, a Program Manager should consider the formation of a multi-functional IPT which will remain active for the life of the program. Representatives of the system disciplines, as an adjunct to their normal responsibilities, shall be selected to address COTS/NDI research, procurement, test, fielding, and supportability issues. The membership, scope, and duration of the IPT should be tailored to the size and complexity of the program. The IPT may form working groups to conduct investigations and perform specific functions related to the IPT charter. Forming an IPT later in the program provides minimal benefit since the design approved at Critical Design Review (CDR) will drive most of a system's life cycle costs. Accordingly, the PM should lead the IPT to develop a methodical approach to the various acquisition phases. The use of an IPT ensures that all disciplines have the opportunity to provide inputs prior to finalization of performance specifications and selection of the commercial items. Figure 2-1 illustrates this process.

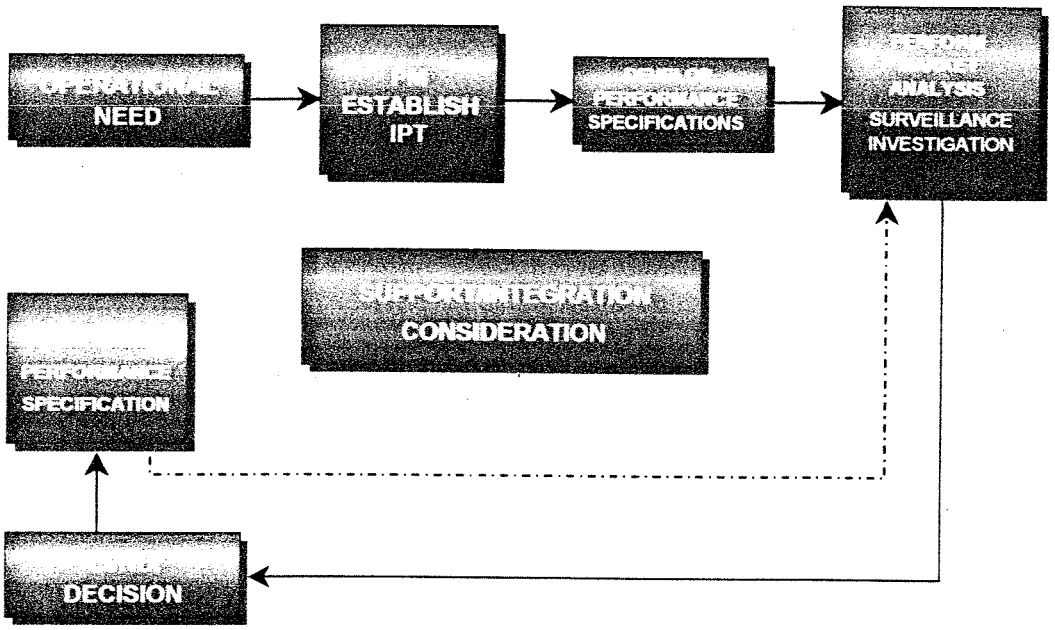

Figure 2-1. COTS/NDI Decision Process

2.1.1 COTS/NDI Planning

NAVSEA Instruction XXXX.X states that all ship's systems supported by NAVSEA and incorporating COTS/NDI shall have plans that address the risk incurred by the use of commercial products. These plans should identify program processes and risks unique to COTS/NDI applications and are to be tailored as applicable. There is no requirement for a specific format or content of these plans. However, many Program Offices have established COTS/NDI Management Plans and those plans are available for use by other programs. Many of these plans will be available at the NAVSEA COTS web site (http://cots.navsea.navy.mil).

2.1.2 Databases

The IPT should ensure that COTS/NDI components (Hardware/Firmware/Software) and their interdependencies are identified, managed, and tracked through a common database. Consideration should be given to providing a relational database management system (RDBMS) that allows several databases to inter-operate via the functionality of the RDBMS. If a particular COTS/NDI item is used in a number of places throughout the system, each instance should be recorded. Creation of these databases provides the Program Manager with impact assessments of item obsolescence issues. The database aids the PM in understanding the total number of items required, supported, needing upgrade etc. It also aids the testing organization in determining the total scope of interface testing required for the replacement item.

2.1.3 Vendor Surveys

While the selection of a particular product through requirements definition and market research

will determine initial procurements, the contact between the Program Manager and the vendors must continue through the system life cycle. Commercial vendors should be periodically queried as to the stability of the product (i.e., will it remain in production, how long, is it being upgraded, etc), and the supporting infrastructure, if applicable. The results of these surveys will occasionally lead to the generation of an obsolescence report. This report will contain all the pertinent information to assist the program office in making acquisition and support decisions.

2.1.4 Cost Modeling

Modeling plays a critical part in program budgeting, especially those containing COTS/NDI. Cost models are used to outline and apply costs to the various processes used during a program 's life cycle. Life Cycle Cost Models and techniques should be used and maintained in the initial selection and throughout the life of COTS/NDI. They aid in determining how often to conduct technology refreshes and in calculating when to make bridge buys to support an item until the next scheduled refresh occurs. In the absence of a proven COTS/NDI budget model, it will be necessary to project budgets for technology refresh and bridge buys based upon past program experience and any existing tools until a mature model emerges. As the program matures, such models will help Program Managers make informed tech refresh/insertion decisions and budget accordingly.

2.2 BUDGETING

The POM and budget process for COTS/NDI is the same as for any other Navy material acquisition. However, the introduction of COTS/NDI into military environments presents many unique budgetary challenges. Some of these challenges include reduced budgets, and the costs associated with rapidly changing technology and technology refresh, life cycle support, and the increased manpower requirements necessary to manage COTS/NDI. To adequately manage COTS/NDI programs, each of these challenges must be properly considered, modeled, and planned for in the out year budget cycles.

Because of the nature of the commercial market and rapid technology changes, the life span of both hardware and software is significantly shorter than the life span of MIL-SPEC items. Therefore, COTS/NDI out year budgets should anticipate periodic re-procurements, support engineering, and logistic efforts to replace items that are no longer supportable with next generation technology. Program Managers will be challenged to develop sensible timelines for item upgrades and to justify requests to accomplish these upgrades. Market surveys must be conducted and relationships established with commercial item suppliers to ascertain their plans for future support.

In preparing program budget forecasts, the Program Manager should determine which equipment and systems are most susceptible to changes resulting from technology advancements or product obsolescence and define a strategy for life-of-type buys, bridge buys or succession of block upgrades to incorporate current technology. These forecasts should be based on industry growth trends considering both software and hardware. The information required for these forecasts is a direct output of the market surveillance process. The results should be grouped into projected change packages and analyzed for life cycle cost impacts. This process should result in a reasonably predictable budget projection for the life of the program. Modeling techniques are available to aid in this process.

Cost as An Independent Variable (CAIV) is a methodology used to acquire and operate affordable DoD systems by setting aggressive, achievable life cycle cost objectives, and managing achievement of these objectives by trading off performance and schedule, as necessary. Cost objectives balance mission needs with projected out-year resources, taking into account anticipated process and product improvements in both DoD and industry. CAIV has brought attention to the government's responsibilities for setting/adjusting life-cycle cost objectives and for evaluating requirements in terms of overall cost consequences of acquisition and technical refresh/insertion decisions.

As discussed above, the support budget for systems using commercial products can be difficult to project. Commercial product cycles are short in comparison to MIL-SPEC product cycles. Figure 2.2 illustrates a conceptual comparison between a typical military system (or build-to-print system) versus a system based on commercial items. The support expenditures for a military based system will have a limited number of major peaks resulting from large upgrades performed during the system life. The commercial based system will tend to have many smaller upgrades, reflecting the dynamic nature of commercial products.

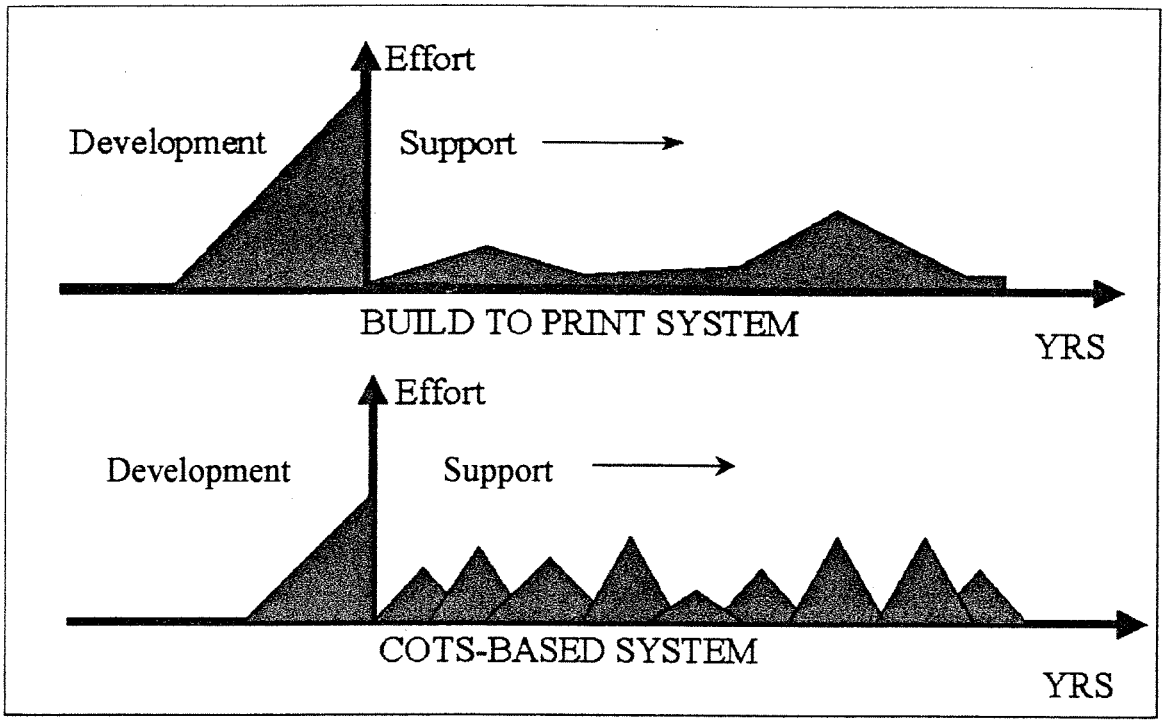

Figure 2-2. Conceptual Build-to-Print versus COTS/NDI based System

2.3 ACQUISITION AND CONTRACT MANAGEMENT

For acquisitions of COTS/NDI many of the traditional steps, procedures, requirements, and safeguards associated with the acquisition process may be unnecessary or even counterproductive. These standard process elements should be scrutinized to determine their applicability to the acquisition of COTS/NDI. DoD Regulation 5000.2-R presents a spectrum of processes, ranging from the minimum, appropriate for an unmodified commercial item relying on commercial support, to the maximum necessary for a high risk, full development program. The goal of the acquisition process is to ensure, through demonstration (testing) and documentation (historical or developed data), that the solution proposed will meet the operational requirement in the operational environment and will be supportable. The acquisition process must demonstrate to the decision authority that these concerns are satisfied. There is not only latitude in the contract process, but specific direction to tailor the acquisition process to fit the program requirements. Many standard process elements may have been accomplished already. For example, documented market investigation results or contractor test and performance data may be adequate to assess manpower and training requirements, supply support, reliability, and other support requirements.

2.3.1 Communicating the Requirement

Communications with potential contractors concerning program requirements must be clear and concise. Government intentions must be totally understood by potential offerors. The extent to which the government desires support for the item being procured must be delineated as clearly as the description of the item. This is not to say that the solicitation must include descriptions on how to build and support the item. However, all functional requirements, including supportability must be clearly spelled out. For commercial vendors it is imperative that the government understand the extent to which the vendor plans to support the item and how they manage change. A questionnaire should be included in the solicitation that asks the vendor to provide the information needed for the government to understand, plan and budget for the vendors planned life cycle and support processes.

2.3.2 The Statement of Work (SOW)

In COTS/NDI procurements, it may be necessary to require contractor services (e.g., contractor logistics support, technical data, extended warranties, etc.) in addition to the commercial item. It is important that the solicitation documents, including Requests for Proposals/Quotations and Invitations for Bid, are carefully prepared and tailored so the required services are also solicited and the proper information obtained to effectively evaluate the offer. For system level procurements, the solicitation documents should be structured to encourage COTS/NDI alternatives in full or partial fulfillment of the need.

2.3.2.1 Software SOW

For contracts utilizing COTS/NDI software as part of the system development, the Program Manager should:

- Obtain an understanding of the integrator's plans and processes to select, evaluate, and incorporate COTS/NDI products during software and system development.
- Understand the specific activities that the integrator plans to perform for COTS/NDI software during each phase of the system and software development, including requirements analysis, system design, and software test.

- Understand the integrator's plans to document COTS/NDI software products, including version information, customization details, and COTS/NDI vendor product information.
- Require the integrator to identify data rights and license information for all COTS/NDI software.

2.3.3 Solicitation and Source Selection

An effective solicitation and source selection process is critical to the success of a COTS/NDI acquisition. A comprehensive solicitation package will ensure that all system requirements are addressed. An effective source selection process will ensure that the best possible solution is chosen. Information needed to make an effective choice between COTS/NDI alternatives is very similar to the information needed during the market investigation to justify COTS/NDI as an alternative. Therefore, solicitation documents should be tailored to fit program requirements and cover the information obtained through the market investigation.

2.3.3.1 Evaluating the Proposals

The potential supplier(s) may offer a specification sheet or claim proprietary information. The IPT should determine if the item(s) meets system requirements. Analyses or tests may help do this. After determining which item(s) complies with the performance specification, the IPT faces the task of assuring that future deliveries by the same supplier(s) can still be relied upon to perform satisfactorily in the system. If a supplier maintains that such information is proprietary, examine alternative sources of supply before contracting with this supplier. Qualifying multiple suppliers will help to ensure competition.

When proposals/quotations are received, they must be evaluated based on technical and operational capability, Integrated Logistics Support (ILS), life cycle costs, as well as past contractor performance. A brief description of the areas to be evaluated for "best value" are provided below:

- Technical/Operational Capability - The potential supplier(s) must demonstrate the performance of their product after convincing the government that their proposed methods will meet the requirements of the solicitation.
- Integrated Logistics Support - Evaluation of the logistics capabilities to operate and support all COTS/NDI is critical. These capabilities include any resource that provides a product or service needed to sustain the operation of a system in its operating environment. Ultimately, the ability of a system to perform a mission depends on the integrity of the system's logistics support.
- Life Cycle Cost - Both initial purchase cost and the life cycle operation and support costs must be considered. Life cycle operation and support costs for COTS/NDI represent a significant portion of total cost of ownership, making it absolutely necessary to closely analyze these costs.
- Manufacturer specific information – These may include items such as the health of the

company, market share, experience with technology and similar products, experience with other military programs or customers, and product maturity.

2.3.3.2 Licenses

During the selection process, the IPT should consider the period for which any license remains valid, and what effect modifying a COTS/NDI has on the license. This is important, as license violations can affect the life cycle cost associated with a COTS/NDI . License restrictions can also impinge on the freedom to make future changes to interfacing systems that would necessitate modification to a COTS/NDI. It is preferable that licenses be: legally transferable from the original purchaser to another user (such as a ship or shore site); capable of being removed and installed by the user as opposed to the vendor; and reinstallable on new machines and platforms as older equipment is replaced. Finally, COTS/NDI licenses may expire while the item awaits installation or soon after deployment since the period for which they are valid normally begins with delivery from the vendor, not from the beginning of use.

2.3.3.3 Warranties

To preserve their reputations and stay competitive, contractors back their products with warranties, often at no additional cost. A warranty may provide the government some recourse when it receives a defective item. Also, the contractor can be required to warrant the performance of an item to specific requirements identified in the performance specification. The government should consider utilizing commercial warranties (e.g., maintenance, extended, etc.) if they can be justified as cost effective.

The most common problem experienced by the Navy is that the warranty period often starts upon delivery date to the Navy or to the integrator, and has already expired by the time the equipment is actually installed in the field. Also, it is important to ensure that the warranty transfers to the Government through a prime contractor. Since the prime, not the Government is often the original customer, such a transfer may not be automatic. Each situation is unique and the use and benefit of a warranty must be carefully evaluated for each acquisition. It may be beneficial to negotiate out a warranty if it reduces the overall cost of the contract.

It is key to the exercise of the contract to know what constitutes a violation of the warranty by the user and whether the vendor will actually repair the product with original parts or merely deliver an operational product out of their existing stock. If the latter occurs, the user may receive the same part number and revision but with minor changes in parts or programming that may cause operational problems in it's military application.

It is important that warranty provisions are tailored to the type of COTS/NDI and existing supply and maintenance methods. Commercial warranties often require unique procedures, forms, and notification processes which may not be compatible with normal government logistics support procedures. To the maximum extent possible, warranties are to be transparent to Organizational ("O Level") and Intermediate ("I Level") personnel.

2.3.4 Customer-Vendor Teaming

Industry input on product descriptions and statements of work helps clarify technical aspects and helps reveal alternative ways to meet requirements. Vendor teaming is an effective means of addressing joint issues. Examples include:

- Continued acceptance of orders for the item in question for a certain number of years.
- Providing spares, repairs, and support services for hardware and software for a certain number of years after the last order for the item.
- Informing customers of all drawing and process changes relating to the design and fabrication of the product and/or software changes.
- Providing quality assurance and test data on parameters that are particularly critical to the customer.
- Agreeing to prices for anticipated future procurements.
- Providing detailed configuration information for all delivered products.
- Agreement to be a test site for new vendor developed items.
- Providing the government with out-of-production drawings or source code when not competitively sensitive.

2.3.5 Other Procurement Considerations

Managing commercial procurements poses different challenges than those associated with traditional military sources. Makers of military unique items commit to work to certain standards, maintain and present manufacturing records (including defect history), use controlled processes, and submit to customer test and inspection oversight. Buying a commercial item based upon a supplier's part number provides no guarantee that internal parts, materials, finishes, manufacturing processes, and software have not changed from a previous procurement. Accordingly, while the supplier may certify that a follow-on item conforms to the original specifications, this does not guarantee that a parameter critical to the buyer remains unchanged. The critical parameters must be delineated in contract language to help ensure conformance to government requirements.

3. TECHNOLOGY MANAGEMENT

Technology management is a critical aspect of acquisitions in today's military market. Determining performance characteristics and supportability issues of COTS/NDI requires the use of market research for new or existing systems. This research should be leveraged in a proactive method for determining and planning for upgrades and replacements. These upgrades and replacements (referred to as technology insertion and refresh) are necessitated by the frequent obsolescence of commercial products and the extended life of military systems, which exceeds the life of the commercial product. The use of technology management concepts must be used for the life of a program(s).

3.1 MARKET RESEARCH

When building a new system or evaluating technology refresh or insertion in an existing system, market research must be performed. Market research is a process for gathering data on product characteristics, supplier capability, life cycle support processes, and the business practices that surround them. Market research should be initiated early, while the requirement is still flexible, and should be continued throughout the acquisition process. When performed early in the acquisition process, market research allows the Program Manager to utilize commercial practices to shape acquisition and support strategies and identify important performance parameters and characteristics. Flexibility in operational requirements is an important consideration in the effective use of COTS/NDI in system acquisitions.

Market research consists of two interrelated processes: market surveillance and market investigation. Market surveillance means staying abreast of general industry practices and trends. Market investigation focuses on a well-defined requirement and results in a recommendation on whether or not commercial items can fill that need.

3.1.1 Market Surveillance

Market surveillance is the continuing effort by acquisition and development activities (including laboratories) to become and remain technically current within their areas of technical expertise on products with potential for Navy use. Program Managers should use these sources to develop/modify operational requirements, develop acquisition strategies, and identify COTS/NDI alternatives. This should include investigation into the existence and availability of suitable items already in DoD or other government inventories. Sources for market surveillance data include industry publications, journals, catalogs, product data sheets, trade shows, industry representatives, other government activities, foreign military data exchange, and more. This data provides a broad knowledge of the potential for the use of commercial items to fill a DoD requirement. However, more specific, detailed information from the marketplace must generally be obtained before a final decision to use a COTS/NDI solution can be made. The decision making process (market investigation) must consider operational performance requirements, reliability, maintainability, supportability, cost effectiveness, safety, survivability as well as all the traditional logistics elements.

3.1.2 Market Investigation

Market investigation which is a follow-on activity to market surveillance is the process of evaluating the availability of commercial and non-developmental items before an initial milestone review decision, or before drafting a product description, such as a commercial item description. The operational requirement provides the basis for conducting market investigations. Market investigations are required to develop product descriptions, determine logistics support requirements, and determine what additional testing is required. They also facilitate effective technology refresh and insertion decisions.

After an operational requirement has been identified, the information from market surveillance is assessed against the operational requirement to determine the nature of available products and the number of potential vendors. Based on this preliminary determination, the Program Manager decides if there is sufficient information to make a COTS/NDI decision or what additional information is needed to support a sound COTS/NDI decision. Typically, more data will be needed since all system parameters must be considered.

Potential suppliers should be sent draft performance specifications, as detailed as is practical and stated in performance rather than "how to" terms. They should also be given detailed questionnaires specifically designed to determine their product's ability to meet the Navy's operational requirements. Information on item characteristics and product supportability should be evaluated to determine if requirements can be met, if requirements should be adjusted, or if tradeoffs should be considered.

3.2 TECHNOLOGY ASSESSMENT OF FIELDED SYSTEM

Once a COTS/NDI system is fielded, maintaining a tailored market research process will be required over product(s) life cycle(s). The individual program complexity, criticality to mission, and interoperability dependence will drive the market research process tailoring.

Technology assessments will help Program Managers:

- Integrate various program schedules with varying COTS/NDI product life cycles.
- Identify commercial software, firmware, and hardware products that can extend useful system operational life before the existing products become obsolete.
- Optimize Tech Refresh/Insertion periodicity.
- Monitor technology and standards trends.
- Assist in the preparation of POM submission.

The success of the technology assessment, planning and implementation process depends on the ability of Program Managers and their key IPT members to adhere to the open system principles and standards. Technology assessments should be conducted and results monitored and refined throughout the acquisition process for all equipment/systems that incorporate COTS/NDI products. The following subparagraphs provides consideration for tailoring a programs market research process.

Figure 3-1 illustrates technology assessment considerations and potential solutions.

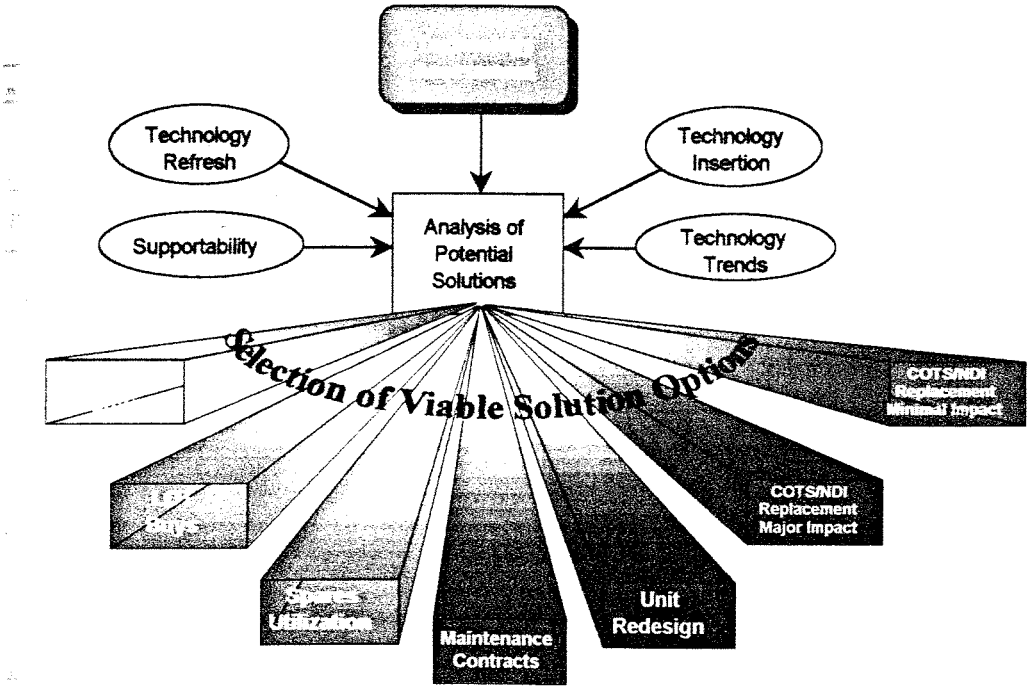

Figure3-1. Technology Assessment Solution Options

3.2.1 Technology Refresh

Technology Refresh is the systems engineering and logistics process for replacing obsolete system components with newer commercially equivalent technology into a military system to sustain a system's performance. Technology refreshes are generally predicated upon Diminishing Manufacturing Sources (DMS) (obsolescence) and life cycle cost effectiveness of the associated engineering change and continued compliance with the current system performance and interface requirements. Technology refresh strives for a seamless transition in functionality and associated support. Technology refresh, however, may inherently improve the performance of the equipment as a byproduct. Technology refresh may also inadvertently degrade the performance of the equipment due to unseen changes to internal parts, materials, finishes, manufacturing processes, and software from a previous procurement.

3.2.2 Technology Insertion

Technology Insertion involves improvements to the military system with the integration of newer or enhanced capabilities that increase functionality and/or to specifically reduce total ownership cost. Either solution can be planned to occur in conjunction with commercial sector announced or

anticipated obsolescence of a single product or group of commercial products. These processes allow the Program Manager the opportunity to systematically plan the removal of obsolete equipment and components, to maintain operational requirements, and/or meet new requirements. Technology insertions are mostly concerned with improving system performance in accordance with available commercial technology and/or revised mission requirements.

3.2.3 Product Surveys

Product surveys are accomplished as a method of tracking commercial market technology changes. Product surveys involve an assessment of commercial product life cycles through a continuous effort of communication with vendors. This communication is focused on obtaining dates associated with end of production, end of support, or next product introduction. Survey the technologies associated with the products in order to identify trends in life cycles and emerging supportable changes in response to commercial interest. An assessment of system life cycle impacts due to product obsolescence and change is used during technology assessment activities to develop strategies for new/substitute product implementation. System configurations, installations, production schedules, integrated logistic support products, and stock availability are all key areas of impact assessment.

To stay aware of these areas, a commitment to involvement in commercial standards organizations is necessary. An IPT focused on commercial products and their application to military systems will effectively provide the needed analysis for technology assessments. Every opportunity should be taken to use shared data for common integrated products and technologies across NAVSEA programs.

3.2.4 Technology Supportability Considerations

The technology assessments contribute to a proactive change plan for the system and/or subsystem under analysis. Assessments involve evaluating alternatives to obsolescence such as life-of-type buys, bridge buys, reutilization of assets, and, as a last resort, full redesign. If the change does not impact form, fit, or function at the system level, including computer programs and/or commercial software and firmware, retrofit by attrition may be considered. It is imperative that decisions made as a result of the technology assessment process be reflected in budgets submitted during the POM cycle.

Technology refresh/insertion planning also considers the use of small manageable changes resulting in progressive modernization, which reduces the need for major change activity (i.e., SHIPALT's, ORDALT's or Field Changes at regular overhauls.) Planning for these small changes considers the technology evolution, the impact to existing configuration management programs, and the changes in threat mitigation requirements and warfare objectives.

A properly planned Technology Refresh/Insertion process helps to mitigate system availability concerns due to obsolescence and budgeting issues while optimizing the acquisition and support of COTS/NDI based system. Extreme care must be exercised throughout the technology assessments to ensure that there is not degradation of the performance of the equipment due to unseen changes.

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4. SYSTEMS ENGINEERING

The application of commercial based products to Navy systems does not fundamentally alter the traditional system acquisition process. However, it does require tailoring the overall process to include integration of commercial hardware and software into Navy systems. The following issues should be given special consideration for applications with commercial based products:

- The Requirements Definition phase should incorporate formulation of computing requirements into performance specifications.
- The System Design phase should address open system engineering principles.
- System Integration solutions must factor in commercial technologies.
- The System Certification phase should be enhanced to account for potentially more frequent configuration changes and to address issues regarding the incorporation of proprietary components.
- The Production and Life Cycle Support phases should account for technical and funding issues associated with advanced operating environments, quick technology evolution, and technical support to the Fleet.

4.1 COTS/NDI OPEN SYSTEM DESIGN CONSIDERATIONS

The attributes most commonly associated with open systems are portability and interoperability. Other attributes commonly associated with open systems are scalable, extensible, and standards based. However, the term open should not be equated with COTS/NDI based or distributed since such systems are not necessarily open.

An open system engineering design strategy mitigates the uncertainties associated with developing and fielding applications on rapidly evolving commercial processing platforms. The development of open systems should focus on all aspects of system design, including software, hardware, electrical and mechanical. Expectations of achieving cost benefits through increased vendor competition and reduced migration effort are frequently cited reasons for adopting an open system approach. Perhaps more importantly however, open system design provides a means of achieving application code stability in a diverse and ever changing technology market. For software developers, a key goal is to achieve forward and backward compatibility–that is, to ensure that the software product operates as intended despite changes to the underlying commercial components. Such stability should be the primary motivation for pursuing an open system design.

Judicious selection of appropriate standards is of paramount importance in implementing an open system. Successful long term COTS/NDI management requires strict adherence to recognized open system standards. Just as technology and products change over time, the industry standards used in commercial and industrial computing systems evolve as well. Standards have a definite life cycle, emerging to support new capabilities enabled by new technological capabilities, and then being replaced as newer technologies and techniques emerge and take over. When developing COTS/NDI based systems, it is important to understand and plan for this dynamic characteristic of standards. For military systems which have already been developed, the re-architecture of system interfaces and protocols to insert COTS/NDI may not be viable or a cost effective option.

4.1.1 Hardware/Software System Architecture

The use of commercial products in Navy systems often influences the design considerations for the developmental portions of the system. To effectively utilize commercial information technologies, the Navy must pursue architecture independent designs. The qualities most associated with architecture independence are application portability, system interoperability, and ease of integration.

To establish architecture independence, systems engineers should consider insulating the application software from specific processing platform attributes and vendor unique features. This approach allows for a system design with sufficient flexibility to withstand technology obsolescence, market evolution, and other commercial factors the Navy cannot fully control. Furthermore, architecture independence provides the conditions necessary to achieve scalability. This lets the number of processors and/or the overall processing power vary without altering the computer program design or source code. Such an approach contrasts sharply with many of the legacy developments in which the tactical software is tuned to the low level features of the computing platform. Even in commercial based systems, it may occasionally be necessary to permit certain architectural dependencies in order to meet unique requirements. System engineers should document and then eliminate any such dependencies when equivalent standards based technologies become available. Considerations for Information Technology Standards, Commonality, and Open Systems appear below.

4.1.2 Software Special Considerations

Critical factors in software language selection are multi vendor support, performance, object oriented design support, access to reuse libraries, security, and robustness. Other factors include cost, availability of competent programmers and designers, and ease of use. Choose programming language support from the commercial mainstream to leverage the skills of the IT workforce and avoid unnecessary Non-Recurring Engineering (NRE) costs for language development. Base the selection of a specific compiler to support the language on evaluation of the associated tool suites, including the libraries, editors, browsers, and debuggers.

One of the most difficult tasks for a system integrator, is to insure that all the different COTS/NDI (Operating Systems, drivers, Single Board Computers (SBC), interface cards, networks, etc.) work together seamlessly. Software Engineers on new development projects should consider the following software specific considerations:

- Software architectures that include ease of changes as a primary consideration
- Automated tools for design and verification
- Tools to make it possible to recognize the dependencies among system components
- Consideration for incremental software design
- Generation of Simulation/Stimulation software
- Roles and responsibilities of Systems/Software Engineers.

4.1.2.1 Software Reuse

Reusable software generally applies to unique software that was prepared for, and is owned totally, by the government. An example of this is signal processing software which is common throughout the military. Some of the issues with software reuse are:

- Software was written in a language no longer used
- Operating system is no longer is supported or compatible with the current software architecture
- Most software code would require some modification. The original formatting of input/output code would require change to fit the specific application
- Code with which a vendor may still have some licensing provisions or data rights.

4.1.2.2 Firmware/Middleware

The term "software" can be interpreted as specific software applications developed under contract to the government, military or commercial software which is "burned" onto a circuit card - commonly called "firmware", and commercially developed software which is used as is, or modified for military use. Middleware represents software that controls the interfacing of the various system components. Included are interface protocols, timing, message reformatting, etc. Commercial vendors are making extensive use of firmware in their product design. This firmware can be revised or updated periodically by the vendor to address design/application issues. Users of these products need to make provisions for managing the updated firmware for their product application. The IPT should address changes to firmware, as with other products, through the vendor survey process.

4.1.3 Fault Detection/Fault Isolation (FD/FI)

Fault detection and isolation capabilities are often found in commercial items. The system integrator should take advantage of these capabilities to the maximum extent possible. However, determining the source of failures can be potentially much more difficult in COTS/NDI based systems if system level FD/FI capabilities are not available. The extent of FD/FI required at the component level to satisfy system fault tolerance requirements must be determined. Strategies vary, depending upon mission criticality and Lowest Replaceable Unit (LRU) definitions, but pursue a common, system wide approach if possible.

4.1.4 Information Technology (IT) Standards

The Department of Defense (DoD) has several efforts devoted to creating, adopting, and approving standards for use in all IT hardware and software as well as other standards for providing IT program development and support services. Since off-the-shelf components sometimes do not meet the needs of a mission critical combat system, several design issues as outlined below, must be considered when integrating commercial technology. Although it is DoD policy to maximize the use of commercial technologies, COTS/NDI solutions must not compromise operational requirements.

4.1.5 Information Security

Reliance on commercial hardware, software components, and the Internet exposes critical military systems to the same risks the commercial sector faces (i.e., denial of service attacks, unauthorized access, data protection, etc.). Fortunately, several commercial market areas have been forced to deal with security for these technologies—the two leaders being the banking industry and the Internet. Additionally, the National Security Agency is providing security tools certified to military standards which complement some widely used commercial technologies. The best

strategy for success in information security is to initiate close relationships with those using and certifying the systems to ensure that a secure, yet operable, capability is fielded.

4.1.6 Commonality

Since numerous program organizations may be responsible for producing the various combat system elements, the migration to COTS/NDI based systems could lead to an parochial condition in which each subsystem contains its own, independently engineered open system design. When brought together aboard ship, these subsystems could form a complex mix of technologies that leave the system fraught with logistics and interoperability problems. The acquisition, support, and maintenance of multiple computing infrastructures could also negatively impact platform Total Ownership Cost. To minimize such problems, aggressively promote technical interactions with other programs to increase the commonality of the system's technology base. The objectives of these interchanges should be to:

- Select system wide interface standards that support interoperability.
- Establish a common user interface environment to simplify Fleet training and system operation.
- Choose common components.
- Coordinate technical refresh plans.
- Identify potential opportunities for software reuse

4.2 COTS/NDI SHIPBOARD ENVIRONMENT

COTS/NDI typically require some measure of integration or modification to survive in a shipboard environment. The extent of modification required depends on the criticality of the item, its inherent environmental hardness, and specific shipboard conditions. Additionally, shipboard environment prohibits use of some materials that are acceptable in commercial applications.

Environmental conditions vary significantly throughout the ship. Consider the intended location of COTS/NDI onboard ship in determining the type and magnitude of environmental conditions to which the item will be exposed. Market survey data on environmental ruggedness helps determine suitable locations for commercial items onboard ship.

The criticality of COTS/NDI to the ship's mission or safety influences the degree of hardening required. Some items may not be critical enough to the ship's mission to warrant the cost of environmental hardening. In other cases, the commercial item may be so critical to the ship's mission, vulnerable or costly to replace that the extra cost of ruggedization is worth the cost to avoid the risk of system failure, or the cost of repeated repair and replacement.

If the market survey does not yield sufficient data to resolve shipboard environment issues, you may need to test the commercial candidate to ensure satisfactory performance and safety. When market surveys or testing demonstrates that available commercial candidates cannot meet shipboard requirements, consider:

- Reviewing mission profiles to determine if shipboard environmental requirements are valid for the specific application of the potential commercial item.
- Shielding, hardening or isolating the item.
- Modifying the item to meet shipboard requirements.

Some commercial items may have been qualified to commercial standards, but the commercial testing may have to be augmented by further testing to Navy requirements.

4.2.1 Power

Commercial items often rely upon the continuous availability of commercial grade AC power. Without conditioning and augmentation, shipboard power does not meet commercial grade specifications. Additionally, commercial equipment is intended to work on a grounded power system that may be incompatible with the shipboard power system. Shipboard power accommodation techniques include Automatic Bus Transfer (ABT) switches, Uninterruptable Power Supplies (UPS), and isolation transformers.

4.2.2 Survivability

Two factors of significant importance in a military environment which are not common in a commercial environment are survivability and combat system integration. The purpose of the ship platform is to carry out its mission in wartime conditions that may include exposure to such hazards as shock fire and heat. Survivability shall be a major design criteria for all mission critical equipment. Survivability features include the ability to withstand battle damage (graceful degradation), to be maintained at maximum readiness during an engagement (modularity), and to permit rapid repairs following any casualties (reconfiguration).

4.2.3 Shock/Vibration

Equipment used aboard ship is subjected to shock and vibration as a result of service conditions as well as from hostile engagements. In all cases mission critical equipment and systems must be designed to operate within the service environment to be encountered aboard ship. The design integrity must be verified through test or other acceptable evaluation methods. Since some shock mitigation methods exacerbate vibration transmission, these two environmental concerns must be addressed concurrently. Shipboard shock and vibration can be mitigated at the ship, cabinet, and/or unit levels. Possible modifications to the COTS/NDI include adding stiffeners and strap downs, and replacing weak parts with stronger ones (i.e., substituting metal for plastic). It is not uncommon for commercial equipment to specify that the equipment survives a certain shock (e.g., G) loading. This loading is often applicable to the equipment while it is configured for shipping or handling and is not applicable to the "as-installed" shipboard configuration. Also, it is not uncommon for a manufacturer to test the equipment to a "shock" load that is not representative of the shipboard underwater explosion shock environment. In order to minimize further environmental testing efforts, data from market surveys that indicate both the level of the testing that was conducted and the details of the testing environment to which the equipment was subjected must be obtained.

4.2.4 Temperature/Humidity

Most Navy ships cool electronic equipment via both air and water while commercial electronic

equipment is usually air cooled. Air cooling options are preferred whenever Heating, Ventilation and Air Conditioning (HVAC) system capacities will not be exceeded. Humidity tolerances of commercial items are typically well within the range maintained in manned spaces on Navy vessels. Modifications for humidity are usually not necessary unless condensation is anticipated. Condensation occurs most frequently when employing water cooled enclosures. Isolation techniques are largely limited to applying conformal coatings to internal components. Although inexpensive, the process may alter the performance and durability of the COTS/NDI.

4.2.5 Electromagnetic Interference (EMI)

EMI issues encompass both radiated and conducted electromagnetic energy. Requirements are commonly placed upon both the electromagnetic emissions from an item, and the susceptibility of an item to electromagnetic radiation and conduction. Additionally, strong DC magnetic fields at some shipboard locations may present an environmental hazard to commercial items. In order to minimize the environmental integration effort, data from market surveys indicating EMI emissions and susceptibility of commercial items should be considered in the placement and arrangement of those items on board ship.

4.2.6 Electromagnetic Pulse (EMP)

Radiation resistant system components may be needed to survive high power microwave effects or EMP, which may result from the high altitude detonation nuclear weapons. EMP susceptibility must be considered in the design or selection of components. For shipboard systems, the current practice with respect to EMP is to consider systems located within the ship to be sufficiently shielded by the ship's structure and the equipment enclosures. Components mounted externally or having external components (e.g., antennas) require filtering or shielding depending upon their EMP susceptibility.

4.2.7 Corrosion and Fungus Resistance

Commercial equipment is not always corrosion and fungus resistant; however, most shipboard commercial items are located in manned spaces, where conditions are not especially susceptible to corrosion and fungal growth. In addition, such concerns are mitigated by the relatively short life of COTS/NDI. Accommodation techniques typically involve non-selection of items containing certain materials or applying special coatings and finishes. The cost of invoking such requirements should be weighed against the likelihood of exposure of a particular item to unfavorable conditions, and the duration of that exposure.

4.2.8 Fire, Smoke and Toxicity

Commercial equipment to be used aboard naval ships must be constructed of materials that limit fire spread, smoke and toxic emissions. Fires are a constant threat, from both peacetime accidents and combat. Minimizing fire spread is critical in order to confine damage to the smallest area possible. Smoke, a byproduct of the combustibles, can seriously impair crew movement during firefighting, shipboard operations and emergency escape. Toxic emissions from the combustables can be harmful (and even lethal) to personnel, and can cause unnecessary additional damage to equipment. Material selection, shipboard location and additional protection schemes are some of the areas to consider in the COTS/NDI selection process.

4.2.9 Noise

Naval ships have maximum-allowable noise requirements that vary according to the type of ship. Airborne noise levels are specified for particular types of shipboard compartments, and mostly are directly related to the noise-producing systems and equipments contained within them. Structureborne noise levels are specified for specific equipments. COTS/NDI systems and equipments are subject to specified airborne and structureborne noise levels, and may require additional design treatments in order to achieve them.

4.2.10 Transient Radiation Effects on Electronics (TREE)

These effects are caused by initial gamma and neutron emissions from a nuclear burst (a remote, but possible combat-induced effect on a naval ship). The ship's hull is relatively transparent to the TREE conditions, and TREE emissions can result in the failure or degraded operation of sophisticated solid state circuits. Consideration should be given to TREE protection for COTS/NDI electronics used in vital systems.

4.2.11 Nuclear Air Blast

The shock (blast) wave and associated phenomena produced by an explosion in air, resulting in the propagation outward of a sharp pressure front accompanied by subsequent air motion, can cause severe loading on shipboard systems and equipment. Such a shock wave produced by a nuclear explosion can have significantly high loadings imposed on the ship (and its equipment) from relatively great distances. COTS/NDI used in vital naval shipboard systems should consider these potential effects, and may require additional protection/ mitigation schemes incorporated into their design.

4.2.12 Air Blast Induced Shock (ABIS)

ABIS is the shock wave from a detonation impact on the ship that causes dynamic deformations of the deck, and is transmitted through the foundations. Topside exposed equipment experience this shock loading as well as that resulting from the direct airblast pressure. Internal equipment, however, experience only the first effect of blast-induced shock. In contrast to the vertical shock motions from underwater explosions, those of airblast-induced shock are predominantly in the horizontal direction. COTS/NDI equipment that will be used aboard naval ships must demonstrate that they can withstand these horizontal shock loadings.

4.2.13 Salt, Fog, Spray

COTS/NDI equipment used aboard naval ships must be capable of operating in the nautical environment. Depending upon specific locations aboard ship, the equipment can be subjected to varying degrees of salt-water impingement, salt spray and humidity. It may be necessary to provide additional levels of protection in order to assure proper operation under these adverse conditions.

4.3 INTEGRATION AND INTEROPERABILITY

Integration and interoperability must be addressed at each stage of the systems engineering process. As such, integration does not refer to a distinct stage of the system engineering process; nevertheless, the subject deserves special consideration because the effectiveness of a system's functionality and interoperability relies upon the quality of the integration solution. The three major levels in system integration and interoperability are component, subsystem/system, and Platform/Navy/DoD levels.

4.3.1 Component Integration

Component integration involves assembly of hardware, support software, and application program components to produce a fully operational subsystem. Element integration must accomplish the proper hosting of the developmental applications on commercial platforms. Adhering to the architecture independence strategy discussed previously should facilitate integration. Unknown or undisclosed compatibility problems that arise when assembling various commercial hardware and software components may complicate integration.

When integrating commercial components be sure to address these special concerns:

- Configuration Tailoring Requirements – The integrator must properly manipulate any configurable parameters, switches, files, etc., as necessary to achieve proper installation and operation of the product.
- Platform Sensitivities – Many commercial products will operate on multiple vendor platforms; however, in some cases there may be noticeable performance differences. The integrator must determine if such sensitivities will impact component compatibility and/or system performance.
- Physical Characteristics – The integrator must ensure the form and fit of individual components are compatible with the system design.
- License Management – The integrator should be aware of a product's license management scheme, especially the ability to legally transfer licenses from the original purchaser to another user (such as a ship or shore site).

4.3.2 Subsystem/System Integration

Subsystem integration harnesses multiple elements to establish a high level system function. Similarly, system integration refers to the interweaving of the various subsystems to form a system (e.g., a combat system). These two levels of integration are often pursued in separate efforts that differ in scope; however, the engineering issues are similar. Some of the more notable subsystem/system integration concerns are addressed below:

- Messaging Approach – Software interactions between system applications must be

facilitated by some means of communication. Standards based commercial messaging implementations are preferred as they promote system commonality and architecture independence. In some instances, proprietary or developmental messaging implementations will be required to accommodate unique performance requirements. Nevertheless, commonality should remain a primary objective.

- System Coupling – The characteristics and data content of inter-subsystem communications are traditionally specified in Interface Design Specification (IDS) documents. In network based systems, Application Program Interface (API's) may be developed in lieu of IDS's. At the very least, legacy IDS's should be revisited when Navy proprietary communication facilities are replaced with commercial implementations (as when an Asynchronous Transfer Mode (ATM) network implementation supplants point-to-point Naval Tactical Data System (NTDS) communications). This is likely to happen more frequently in the future as new network systems are developed.
- Data Formats – The integrator should be aware that commercial processing systems are not always fully compatible with respect to lower level data manipulation. More technical considerations arise when two systems based on processors of different types exchange data. High level message formats should be specified in an API or IDS.
- Bandwidth Allocation – As multiple subsystems are hosted on a common shipboard network, communications resource allocations must be established and tracked to ensure that system capacities are not exceeded. The probability of encountering shipboard communication failures caused by poor bandwidth management is much higher for shared interconnect systems than for the point-to-point oriented legacy systems.

4.3.3 DoD Interoperability Considerations

Consider interoperability within a battle group, across the Services, and with our Allies when integrating COTS/NDI based systems. Other Services and Allies may employ systems based on different architectures. So, it is prudent to anticipate likely future partners and work with them toward architecture compatibility. In addition, various efforts have been initiated to promote Fleet and/or battle group interoperability. The Joint Technical Architecture (JTA), Information Technology for the 21st Century (IT-21), and Defense Information Infrastructure (DII) Common Operating Environment (COE) are examples.

5. TEST AND EVALUATION

Commercial Off The Shelf and Non-Developmental Item acquisitions need to be supported by a tailored test and evaluation program. The extent of the testing program for a COTS/NDI acquisition depends on the type of item, similarity of the item's commercial use to the intended military environment, performance history of the proposed system or item, and the amount and quality of test data available from the original system development or from the commercial producer. A COTS/NDI test and evaluation program has the following objectives:

- Ensure item meets operational and safety requirements.
- Satisfy legal requirements, such as mandatory testing and reporting requirements for milestone decisions.
- Maximize the inherent advantages of using a commercial or NDI approach, such as user experience and test and performance history.

The general guidance for COTS/NDI acquisitions is to conduct testing only when existing data (contractor or other) is insufficient. To avoid redundant testing, the IPT must understand to what standards commercial or other product developers tested their systems and be open to accepting their test results in lieu of conducting military testing. It is important to obtain assistance from developmental testing experts at an early point and to keep accurate testing records throughout the process. Early participation by Operational Test and Evaluation Force (OPTEVFOR) is equally important. Together these testing experts can verify existing test data and plan for additional tests if required.

COTS/NDI test and integration planning should consider both development and support phase testing requirements. For a COTS/NDI based system development, the developer's test plans should address requirements and facilities for COTS/NDI evaluation and conformance testing, as part of the system integration and test plans. During the support phase, the Program Manager should allocate resources for conformance and compatibility testing of fielded systems that will regularly undergo COTS/NDI product upgrades. The Program Manager should also plan and budget for spares to support testing.

5.1 INITIAL SYSTEM TESTING AND CERTIFICATION

System certification is contingent upon accomplishment of a complete Test & Evaluation (T&E) program to ensure the system meets specified mission, performance, functional, and safety requirements. Certification is granted based upon the results of numerous levels of testing and detailed analyses into documented system performance parameters to ensure the overall ship mission is accomplished. For legacy systems based on Navy-developed hardware and software, the certification approach took advantage of the detailed insight into the functionality and design of the military components. For COTS/NDI systems, certification strategies must be enhanced such that similar assurances can be achieved for commercial components for which this detailed insight is lacking. In addition, practical strategies are required to ensure that system certification is not compromised by rapid technology changes associated with commercial items.

Questions and issues related to test and evaluation should be thoroughly addressed during the commercial item market investigation process. The developers, users, and independent

operational test community should be involved early in the development process. If the market investigation supports a COTS/NDI solution, all remaining test and evaluation requirements should be determined and documented in the test and evaluation plan. The plan should also include a summary of previous testing and results. Developers, users, and independent operational testers should work together to tailor test requirements and execution strategy. Specific tests required will vary with each individual acquisition. Testing should vary with the type and application of the item. The IPT should determine which of the following four situations applies, and document test requirements accordingly:

- **COTS/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.
- **COTS/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. Pre-production qualification testing will be required if early qualification testing leads to modification of the original item. Production qualification testing as well as operational testing will be required.
- **COTS/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. Pre-production testing of the complete system is required. Hardware and software integration testing will be necessary.
- **COTS/NDI that has been modified.** Testing focuses on the modification to ensure it meets the operational requirement and does not negatively impact overall operation. Production qualification testing as well as operational testing will be required.
- **Unit Testing**

Unit (or component) testing is performed on the individual system components which include application modules, peripheral devices, processor boards, etc. Once all components have been individually verified, the assembled components are ready for integration testing.

Some strategies for certifying COTS/NDI components appear below. Sufficient resources and facilities need to be established to support COTS/NDI component testing activities.

- **Conduct compliance tests** – Many component performance specifications require adherence to various industry standards. Compliance tests can demonstrate how successfully the component design meets the standards.
- **Leverage market "burn-in"** – If the COTS/NDI component supports a non-mission critical function, the certification requirements may be less stringent. In such cases, it may be acceptable to forego unit testing if the component has accumulated a track record of reliable performance in widespread industry use. Even if unit testing is still required, the use of reputable commercial products increases the level of product assurance.
- **Conduct black box tests** – Functional testing of a component involves stimulating the component with all possible inputs and verifying that the outputs satisfy the performance requirements. These tests can provide the same degree of assurance

achieved for developmental items. However, this approach requires adequate specification of the component's performance requirements and thorough test procedures that anticipate all potential system inputs and outputs.

5.1.1 Integration Testing

Integration testing involves the examination of system performance at the element, subsystem, and system levels. This examination focuses on requirements contained in the performance specifications and the interface design specifications. COTS/NDI test procedures are usually "black box" oriented in that the system is stimulated with a specific set of inputs (which may consist of operator actions, sensor data, inputs from other systems or subsystems, etc.) and the output or results are observed and analyzed for correctness whether hardware or software. Limited analysis of the application software is often included in the integration test evolution by using embedded breakpoints or data recording features. Such tests may be conducted at land based test sites with a mix of live and simulated interfaces or aboard ship using live interfaces. Integration testing often requires extensive resources both in terms of manpower and facilities.

Early test and evaluation of COTS/NDI components is important during COTS/NDI system development. Quality vendor support of the commercial product is also important during system test and integration phases to provide commercial product troubleshooting assistance or other product information not readily available in standard commercial manuals and documentation.

COTS/NDI software products should meet known interface standards. Using controlled, standardized interfaces will facilitate future changes and upgrades without impacting the entire system (see Software Data Management 6.3.3). Interoperability, or the ability of two or more systems to exchange information and utilize the information exchanged, is a key issue with COTS/NDI products. Therefore, the Program Manager should plan for and allocate additional integrator time and resources to resolve COTS/NDI interface and performance problems during system development and test. As part of the COTS/NDI selection process, the integrator should communicate with the vendors to determine the COTS/NDI product's interoperability with other COTS/NDI products to be utilized in the system under development. For COTS/NDI products with no positive interoperability records, the integrator should either find another product with interoperability data or flag the product as a risk item. For those critical COTS/NDI products, the integrator should consider prototyping as a means to identify interoperability issues early in the development. The Program Manager should plan for possible cost and schedule impact during the integration and test phases resulting from integration and interoperability problems associated with COTS/NDI products.

The COTS/NDI products must also demonstrate compliance with the shipboard environmental requirements specified for the equipment. Compliance may be demonstrated through vendor conducted tests which fulfill the Navy's requirements for shipboard equipment or through testing specifically intended to meet the Navy requirements.

5.2 MAINTAINING SYSTEM CERTIFICATION

Testing and verification of a system's individual components and functions form the basis for unit level certification. The initial certification extends only to the specific configuration tested. As such, subsequent changes to the system configuration usually require a repeat of some level of

component or system certification. This may become very complex with COTS/NDI, because multiple system configurations may exist on similar Navy platforms. For commercial based systems which change frequently, give special consideration to ensure system certification can be maintained at a reasonable cost as each system's configuration evolves. The recommended approach is to establish a documented component certification process that is capable of determining potential system impacts.

6. CONFIGURATION MANAGEMENT

Configuration Management is applicable to hardware, software, firmware, middleware, and related technical documentation. CM is an integral part of life cycle management. CM helps ensure that all data relating to product characteristics (form, fit, and function - including interfaces) are accurately established, maintained and made readily available to support the engineering, logistic support, and acquisition aspects of a program. For CM to achieve this goal, it must integrate with the other program functions (budgeting, systems engineering, test and evaluation, ILS, etc.) throughout the life of the program. For effective management of all aspects of CM, four CM elements are commonly established:

- Configuration Identification
- Configuration Change Management
- Configuration Status Accounting
- Configuration Verification and Audit

These disciplines should be applied to all COTS/NDI items as well as any developmental items. However, as each of these disciplines is applied to a COTS/NDI, the range and depth of its application should be tailored. In the past, the types (range) and amount (depth) of information NAVSEA contracted for was substantial. In depth documentation was required to support our MIL-SPEC equipment at all prescribed levels of support. This support requirement remains even as the development of new equipment shifts to a heavy infusion of COTS/NDI. What is changing is the type and level of detail required in that documentation. Configuration Items may be replaced at a higher assembly level than before, requiring a lesser level of detailed life cycle documentation.

6.1 CONFIGURATION IDENTIFICATION

The Configuration Identification element forms the basis for all Configuration Management efforts. It determines which items to manage, the means of documenting the item's product characteristics, and a unique means of identification of that item. This discipline, as it applies to COTS/NDI, will influence the level of effort required for the Configuration Control, Configuration Audit, and Configuration Status Accounting disciplines. If not identified, the Commercial Item is invisible to the user and the support community. This could result in a serious impact to parts utilization, testing, and interchangeability. For this reason, it is imperative that a thorough process of identifying and tracking all Configuration Items be established and adequately managed throughout the life cycle of the system in which they are installed.

6.1.1 Selection of Configuration Items

Determining which COTS/NDI should be treated as Configuration Items follows the same process as for developmental items; that is, through consideration of factors such as: (1) the ability to procure an item as a unit; (2) the need to specify the performance and interface requirements of an item; (3) the need to track the physical and configuration characteristics of an item; and (4) the need to logistically support an item. All types of COTS/NDI, such as equipment, computer programs (tactical, operating systems, support environment), firmware, and middleware are eligible for Configuration Item consideration based on the above criteria.

6.1.2 Documentation

Document commercial Configuration Items in a manner that allows for repurchase and/or replacement of the item. Any critical performance and interface characteristics (form, fit, function) of a commercial item shall appear in a Status Accounting System. As part of the commercial item selection process, determine the proper documentation for the Configuration Items, assess the need to guarantee design integrity through the use of data escrows, ascertain the availability of after market vendors, and then establish whether or not there is a need for the collection of commercial item characteristics.

6.1.3 Item Identification

Using the traditional DoD methods of marking Configuration Items should no longer be contractually required. COTS/NDI vendors will each use their own method for identifying their Configuration Items. Thus, functionally equivalent COTS/NDI equipment may not be marked in a consistent manner among manufacturers. If re-marking of COTS/NDI equipment is deemed necessary, the cost associated with this must be weighed against any benefits during the selection process.

The challenge to the configuration manager will be to establish and maintain the identification of each COTS/NDI independent of how its manufacturer has marked it. To ensure tracking of interchangeable as opposed to unique parts, the Program Manager may choose to apply serial numbers and/or other auxiliary identifiers (e.g., Government part numbers, identification or modification plates) to Configuration Items. This can be also be accomplished by identifying the Configuration Item by its manufacturer, part number and serial number and using techniques such as bar coding to provide additional information where required. Except in rare circumstances, commercial items should not receive official Navy or DoD nomenclature. For configuration management purposes, commercial items may be named according to a scheme designating their functional characteristics (e.g., monitor, hard drive, etc.).

6.2 CONFIGURATION CHANGE MANAGEMENT

The Program Manager is responsible for establishing the necessary processes for managing the Configuration Item baseline throughout its life cycle. Because the government is a low volume buyer (in the overall commercial marketplace) baselines that include COTS/NDI must be managed rather than controlled. Baselines containing rapidly changing COTS/NDI equipment should be established at a lesser level of detail, therefore reducing the cost to maintain them. However, it is important that once established, a defined process be used to maintain the baseline's integrity. The baseline must ensure that the Configuration Item's identity is not lost. Any departures from an established baseline should require the submission, for Government approval, of an Engineering Change Proposal (ECP) or a request for a deviation/waiver.

6.2.1 Supplier Change Management

The major impact to the configuration change management program lies in the total control by the supplier over the timing and content of changes made to their products. To maintain its systems in an operational mode, the Government or its agent must stay abreast of changes in the commercial marketplace. This should be accomplished by conducting vendor surveys and/or establishing CM agreements with commercial market suppliers. These processes enable the Government to: (1) receive advance notification of supplier changes that affect product

performance or interfaces; (2) receive advance notice of intended product obsolescence; (3) receive advance notice of intent to cease support of a product; and (4) receive advance notice of intended changes to licensing agreements or warranty provisions. The costs and risks associated with relying on vendors to provide change notification shall be considered as a major factor in establishing the change management program.

6.3 CONFIGURATION STATUS ACCOUNTING

Configuration Status Accounting (CSA) is defined as the formal recording and reporting of the established configuration documents, the status of proposed changes, and the status of the implementation of approved changes. Key performance elements include proper data recording, assuring data accuracy, and providing data to the user in a timely manner. The volatility of a COTS/NDI requires that an adequate CSA program be established and managed.

6.3.1 Status Accounting Systems

Sufficient configuration data should be gathered (or created, if necessary) on any COTS/NDI introduced into a system to ensure that the engineering, logistics, and acquisition functions can do their jobs. If possible, avoid creating new databases, as many commercial and Navy databases exist to perform this function.

6.3.2 Data Integrity

It is necessary to establish a set of business rules governing data format, its entry into databases, verification, and reporting within a status accounting system. Program Managers may modify these business rules to take into account the requirements for proper identification of the functional and physical characteristics of COTS/NDI used in a system. Establish a relationship between the business rules and the engineering, logistics, and acquisition process to ensure that the data necessary to these processes is maintained and is readily accessible. Consider other provisions to ensure that data remains current as a COTS/NDI goes through systems integration or item modification. Finally, automate data collection and entry to the maximum extent practicable.

6.3.3 Software Data Management

In the program management section, it was suggested that the system IPT consider the generation of a software database, which would document the types of interfaces, which CI/NDI components have with each other or Mil Spec. items, ie; a description of the unit, where it's located, who it talks to, the communication method, vehicle (SME, LAN/WAN, etc), what the message content is, protocols, etc.. This type of information becomes invaluable to a test organization when items are replaced through obsolescence, technology upgrades or technology insertion. It provides the basis for the testing that must be done to assure product quality. Through the database, the test organization knows the full spectrum of characteristics the replacement item must satisfy and be tested for.

6.4 CONFIGURATION VERIFICATION AND AUDIT

The Configuration Audit will authenticate that the product's required attributes have been achieved by the product and the product's design has been accurately documented. The Configuration Audit may be comprised of a Functional Configuration Audit (FCA) and a Physical Configuration Audit (PCA). The FCA validates that the item functionally meets all performance

specifications. The PCA validates that the item is accurately represented by all documentation that is procured to support it throughout its life cycle.

A verification audit for a commercial item may or may not be required depending on its complexity and its criticality to the mission. A major difference between an audit of COTS/NDI and that of a developmental item will be the range and depth of information reviewed during the audit. Many COTS/NDI vendors will retain the data rights to their detailed design and will not release them to the Government or the prime integrator without additional cost. For the vendors, releasing this data could adversely impact their business. The item's life cycle support needs are met, however, with the validation of the item's conformance to its baseline documentation and all form, fit, and function requirements.

7. INTEGRATED LOGISTICS SUPPORT

Selecting a commercial or non-developmental item does not imply that any of the elements of logistics support can be ignored. The support elements of COTS/NDI candidates must be thoroughly assessed during the market investigation because logistics support remains a critical factor in the decision as to whether a COTS/NDI selection is even feasible. In arriving at a decision regarding support, remember that departure from traditional methods of getting logistics support may be required or even desired. Consider the complete range of possible support methods available, from full reliance on contractor logistics support, to full use of traditional organic support.

One of the primary goals of the logistics support program for a COTS/NDI product is to influence the selection of the item based on logistics considerations and best value to the Navy. The decision to use COTS/NDI based systems requires the early and concurrent involvement of the ILS community. It is vital that logistics considerations become a part of the commercial item selection process. Operating and support costs for COTS/NDI systems can and will escalate if not effectively managed in the early stages of the program. Programs using COTS/NDI systems or equipment should maximize the use of the existing (commercial) logistics support capabilities and data. Development of new (organic) logistics products for COTS/NDI should be limited to meeting a critical mission need or achieving cost savings.

The unique support considerations of COTS/NDI must be evaluated within the context of traditional logistics support elements by conducting a supportability assessment. Opportunities, challenges, and special considerations for each logistics support element are described in this section.

7.1 MAINTENANCE PLANNING

The maintenance concept for traditional military developmental systems has consisted of three levels of organic maintenance: Organizational (O-Level), Intermediate (I-Level), and Depot (D-Level). The maintenance philosophy for COTS/NDI may be significantly different, because a commercial maintenance support infrastructure may already exist for the commercial item. Reliance on the existing commercial maintenance infrastructure has the potential to reduce or eliminate the cost for establishing and manning traditional organic maintenance facilities and processes. A maintenance concept for COTS/NDI should be developed which will best utilize the existing commercial maintenance and support systems. Therefore, the challenge is to capture expert knowledge in commercial product support and integrate into a system support infrastructure "that meets the threshold values of all support performance requirements and sustainment of them in the most life-cycle cost-effective manner". (DoD 5000.2-R, paragraph 1.4.5.1)

A maintenance planning assessment should be conducted as part of the supportability assessment early in the Program Definition and Risk Reduction Phase of the program. Follow-on assessments should be conducted in subsequent phases as the system design matures and the system is produced and ultimately fielded. The goal of the maintenance planning assessment and follow-on maintenance support effort is to establish the most cost effective maintenance approach while minimizing risk to system maintainability and supportability. Personnel performing the

maintenance planning assessment should make a thorough review of the market investigation data and consider all available support options.

Factors for consideration when establishing the maintenance concept include:

- The degree to which manufacturers, other military services, or other sources already provide maintenance support to existing customers.
- The responsiveness of any such support activity to meet military requirements in peacetime and wartime.
- The degree to which the military service will be able to provide organic maintenance support, and the need for support facilities or a training and sea-shore rotational base for service technical personnel.
- The affect of COTS/NDI on system availability as specified in the Operational Requirements Document (ORD).
- The Level of Built-In Test (BIT) and FD/FI capability of the COTS/NDI.

7.2 SUPPLY SUPPORT

An effective supply support strategy ensures the availability of spare parts, repair parts, and support and test equipment to support the maintenance concept. In traditional development efforts, much of the supply support planning occurs during the Engineering and Manufacturing Development Phase with concurrent, integrated engineering techniques being emphasized to ensure the design meets supportability needs. This is not possible with COTS/NDI because the development is already complete and the item is likely to be in full scale production. The manufacturer has a commercial support plan and infrastructure in place to serve its customers. As is the case with maintenance planning, the challenge in developing a supply support strategy for COTS/NDI is how to best leverage the existing commercial support system. The Program Manager must ensure requirements for supply support are addressed in program planning documents and contracts with COTS/NDI manufacturers and/or integrators.

The supply support assessment for commercial items will establish the best value approach for supply support. It is important when conducting the assessment to consider all the alternatives available, from traditional organic support methods to full reliance on the commercial market. The supply support assessment should consider item history and previous user experience in the commercial market. Parts lists and repair kits, as well as parts usage and failure data may be available from the manufacturer. Usage factors to consider include service life, environment, and other factors that may differ between the intended military application and the original design application. The market investigation process should take into consideration the possible obsolescence or discontinuation of production of parts or components needed to sustain or repair fielded hardware.

Historical usage data will significantly aid in the accurate prediction of initial provisioning requirements for repair parts and related support equipment, and help estimate follow-on provisioning needs. A thorough provisioning process provides the means to achieve operational readiness and meet affordable materiel and replenishment requirements. To provide effective provisioning support for COTS/NDI, the market investigation data should be thoroughly reviewed to ensure there is sufficient technical data to develop Provisioning Technical

Documentation (PTD) in support of the maintenance concept.

The effect of commercial items on the military supply system must be considered. It is important to remember that the Navy supply system is the primary vehicle for O-Level maintenance activities to submit requisitions for spare or replacement components. If the commercial market is going to be utilized to provide supply support, the interfaces between the Navy supply system (requisition process) and the commercial supplier must be identified and documented. Alternative supply methods should be investigated and employed where cost effective. Some possible alternatives are:

- Traditional Naval supply system support.
- Direct Vendor Delivery (DVD) - manufacturers or vendors store and distribute spares and repair parts as needed (also referred to as "Just-in-Time" support).
- Organic Direct Vendor Delivery (ODVD) - same as DVD but an organic activity stores and distributes the parts.
- Prime system contractors or integrators provide supply support.
- Replacement end items are purchased as needed (discard upon failure).

7.3 SUPPORT AND TEST EQUIPMENT (S&TE)

S&TE is used to verify operational status and/or restore the systems/equipment to operational status during planned and corrective maintenance. S&TE requirements will depend upon the adequacy of BIT capability and FD/FI capability of the COTS/NDI in the system and COTS/NDI interface requirements.

Requirements for support and test equipment must be identified as early as possible and included in contracts and specification documents. 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 need for new calibration standards and procedures to support the required test equipment must also be determined. These requirements should be an integral part of the COTS/NDI selection criteria.

To provide effective support for S&TE, make a thorough review of the market investigation data. Factors for consideration when establishing the S&TE concept include:

- Determine if there is a requirement for any S&TE capability (e.g., General Purpose Electronic Test Equipment (GPETE), Special Purpose Electronic Test Equipment (SPETE), special tools, adapters, etc.).
- Determine if existing or modified S&TE provides the required support.
- Conduct an analysis to minimize/prevent the introduction of new test equipment.
- The level of BIT and FD/FI capability of the COTS/NDI.

7.4 TECHNICAL DATA

Technical data includes specifications, drawings, technical manuals, calibration procedures, software documentation, and other data required to install, test and inspect, perform preventive and corrective maintenance, operate, and repair the item or its parts. The technical data required

must complement the maintenance and supply support strategies. Where suppliers claim proprietary rights to data, as is normally the case for commercial items, the technical, engineering, and logistics disciplines should validate the supplier's claim and carefully review the data requirements to avoid buying unnecessary and expensive data rights.

In traditional procurements, the procuring activity bought not only hardware and software but also technical data rights for the end items as they were developed solely for the procuring activity's use. Under those contracts the Navy is procuring sufficient data to re-procure the system. However, the Navy does not own rights to design or manufacturing data for COTS/NDI products used in the system. The government should seek to negate the need for excessive COTS/NDI product data by avoiding the use of single source products or product features that are unique to a single manufacturer. If deemed appropriate, Government negotiated rights to vendor data (hardware and software) prior to the vendor going out of production may need to be considered as part of the acquisition strategy/analysis up front, and included in the cost analysis used in COTS/NDI selection. This analysis includes software rights and operating systems.

For COTS/NDI software, it is just as important as for newly developed software to determine and document how the system specification requirements are satisfied by the COTS/NDI software product and to ensure requirements traceability is established, maintained, and documented. COTS/NDI software products are usually described and documented in user's manuals. COTS/NDI product design information will in most cases be unavailable or proprietary. However, considering life cycle support of the system, the developer should document any COTS/NDI customization information and corresponding rationale in software support documentation. In some cases, it may be necessary to negotiate with vendors for some degree of data rights for critical commercial software products.

In most cases there is no longer a requirement to develop Navy unique technical manuals for commercial equipment. The manufacturer of the equipment may supply the commercial technical manuals along with the equipment. However, the commercially supplied technical manuals may not meet all of the Navy's requirements. Commercial technical manuals may need to be supplemented with government unique requirements such as safety issues and interface requirements. The government should avoid modifying or duplicating information in commercially supplied technical manuals.

The supportability analysis should include a detailed review of technical data requirements and options for long term support of Navy requirements. Data rights information should be a key consideration during product selection. Data rights policies of COTS/NDI product manufacturers regarding product data disclosure vary among manufacturers from complete prohibition of disclosure to full disclosure. If it is impossible to avoid the use of a product for which data rights may become an issue, the cost and availability of the data should be considered during the supportability analysis, and compared with other options in the event the need for the data arises. Identify whether there are provisions for the vendor to notify the government of COTS/NDI documentation changes. Contracts should mandate notification when organic support, part numbers, or designs change.

Technical data considerations during the supportability analysis include:

- Availability of commercial technical manuals.

- Adaptability of commercial technical manuals to Navy end user requirements. Consider whether requirements such as safety, installation, operation, and maintenance of the COTS/NDI in its operational environment are available in sufficient detail to support the system maintenance concept.
- Identification of hazardous material and disposal methodology.
- Technical Data reproducibility rights.

7.5 TRAINING AND TRAINING SUPPORT

In developing the training requirements, consideration should be given to the impact of COTS/NDI on traditional training concepts. The possible short life cycle of COTS/NDI may preclude use of extensive shore based training. Training based on functional principles vice specific hardware attributes can take advantage of open systems modularity by reducing data requirements and shortening the training pipeline. The government should consider developing training materials for use in electronic classrooms or on board trainers that are integrated with the COTS/NDI system.

Training experts should be involved in the supportability analysis to consider training program support options for systems employing COTS/NDI. Significant interface with Fleet Training Commands is necessary to ensure the Navy training infrastructure is part of the decision making process for establishing training concepts. The following issues should be considered when reviewing options for training plans:

- The need for a new or revised Navy Training Plan (NTP) or MAPP if applicable.
- Changes to the training requirements contained in Crew Scheduling and Phasing Plans (CSPP's) for new construction ships.
- Impact of COTS/NDI training concept to Navy Enlisted Classifications (NEC's).
- Availability and cost of vendor provided Computer Based Training (CBT), factory training, or on-the-job training for the COTS/NDI products.
- Availability and cost of vendor furnished training and technical documentation to support the maintenance concept.

7.6 MANPOWER AND PERSONNEL (M&P)

Manpower and personnel issues should be considered during formulation of the operational requirement. The requirement should be structured so commercial items can be used without negatively impacting manpower and personnel criteria. In some programs, application of commercial items has made it possible to reduce shipboard manpower requirements by reducing time required to conduct preventive and corrective maintenance. If this is not feasible, reevaluation of the basic acquisition decision or modification of the initial support concept may be necessary.

The supportability analysis should include a consideration of the potential impact of use of COTS/NDI to Manpower and Personnel. COTS/NDI that results in an increase in either

shipboard or shore based M&P requirements should be avoided. The training supportability assessment should address the proper support requirement in accordance with the COTS/NDI concept. To provide effective manpower and personnel requirements for the COTS/NDI, review the market investigation data for support options. The following issues should be considered during the supportability analysis:

- Minimum manning requirements imposed by higher authority may override COTS/NDI induced crew reductions.
- Effect of insertion of COTS/NDI on reliability, maintainability, and supportability and associated maintenance requirements.
- Impact of COTS/NDI on the number and type of personnel required for systems maintenance.
- Effect of COTS/NDI on Human-Machine Interface (HMI) including display management features and operator requirements.
- Use of embedded training or CD-ROM based training may reduce the number of shore based instructors and support personnel.

7.7 PACKAGING, HANDLING, STORAGE, AND TRANSPORTATION (PHS&T)

Before completing the solicitation package, determine requirements for packaging, handling, storage, and transportation consistent with commercial practices. Commercial packaging standards may be used to the extent they meet or exceed military requirements; however, any required modifications should be included in the solicitation package.

The potential exists that the COTS/NDI hardware will be subjected to temporary storage in adverse climatic conditions during delivery to Navy platforms, or long term storage in less than optimal environments. Commercial methods of packaging may not provide adequate protection under these adverse conditions. In extreme cases, packaging configurations may undergo environmental, accelerated life, or shock testing to prove the adequacy of the packaging to protect the COTS/NDI hardware item while in the "as-stowed" configuration. For continental U.S. point-to-point shipping, best commercial practice packaging should be adequate.

For storage on board Navy platforms, specific requirements must be tailored to the particular COTS/NDI hardware. Commercial item fragility and environmental susceptibility data should be analyzed to identify requirements for special handling and storage on board ships. COTS/NDI hardware that is determined to be too fragile for standard shipboard handling or storage procedures must be packaged in accordance with appropriate military standards.

The supportability assessment should include a complete review of PHS&T requirements for commercial equipment. Decisions for PHS&T requirements must account for the issues discussed in the preceding paragraph. The supportability analysis should include a comprehensive review of market investigation data to determine if existing commercial packaging and shipping methods will be adequate to protect the end item in the various environments it will see between manufacture and installation aboard ship.

7.8 FACILITIES

The use of COTS/NDI has the potential to significantly alter the requirements for specialized facilities to support the equipment or system. In traditional Navy developmental programs, the Navy often established and maintained specialized integration, test, support, and training facilities. Use of commercial equipment may negate the need for some or all of these specialized facilities.

Life Cycle Cost analysis and tradeoff studies help determine the most cost effective approach to satisfying facility requirements. The process for determining facility requirements for test and integration, training, software maintenance, compliance testing, etc. will be unique for each program based on funding, end item quantities, installation and support schedules. Three approaches are commonly used:

- Using existing or modified government owned facilities
- Relying on existing commercial facility infrastructure
- Sub-contracting for use of contractor owned facilities

The supportability analysis must include a complete review of facility requirements. This is especially important for systems utilizing COTS/NDI, since the government may be able to rely partially or fully on the commercial facility infrastructure to meet its requirements. Determining the adequacy of contractor owned facilities for COTS/NDI systems requires a thorough review of the market investigation data. The following facility issues should be considered during the supportability analysis:

- The need for a system test bed capable of testing repaired and/or replacement parts prior to designating them as "Ready For Issue."
- The need for a system test bed to test computer program modifications and upgrades before Fleet introduction.
- Requirements for a system test bed to test technology/product refresh and next generation technology systems prior to Fleet introduction.
- Utilization of government or contractor facilities to conduct operator and maintenance training.
- Rapid technology change can result in multiple system configurations installed on similar platforms. Any integration/test facility will need to be able to maintain some capability for backward compatibility.

7.9 DEMILITARIZATION AND DISPOSAL

COTS/NDI equipment owned by the Navy is subject to the same disposal requirements as MIL-SPEC equipment. In general, unmodified COTS/NDI equipment may be disposed of in a manner similar to the commercial industry disposal process. The presence of hazardous material contained in the COTS/NDI equipment (e.g., lithium and lead acid batteries, components containing mercury, etc.) must be identified and a review of Navy hazardous material procedures conducted prior to disposal. Particular attention may be required for modified COTS/NDI

equipment where the modifications add hazardous material (e.g., specific paints applied for service durability) which requires removal prior to disposal.

For those COTS/NDI programs which are electronic in nature and include software programs, potentially the most important aspect of the disposal process would include removal of any classified or sensitive information from hard drives, removable drives, and other storage media. These actions should be included as part of the demilitarization process/requirements. Consideration should also be given to making the prime contractor or Original Equipment Manufacturer (OEM) responsible for asset disposal.

8. PRODUCT ASSURANCE

Product assurance considerations for COTS/NDI acquisitions include quality assurance, reliability, and maintainability. While these considerations are also applicable to MIL-SPEC acquisitions, the extent to which they can be invoked for COTS/NDI acquisitions and follow-on support will vary depending on the scope and complexity of the item or system. The concepts discussed below should be considered when utilizing COTS/NDI in military applications.

8.1 QUALITY ASSURANCE

Product quality is a central issue throughout the acquisition life cycle and includes quality of design, prevention of defects, and quality of conformance; or the extent to which the item conforms to the design criteria or requirements. If a COTS/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. In-process quality data, such as process and test yields, can also be assessed to determine product quality.

It is advisable to develop a supplier rating system to evaluate how well COTS/NDI suppliers meet contract requirements, including specific quality assurance requirements. The best rating system includes compliance with technical requirements, delivery requirements and after delivery support for hardware and software products. Commercial suppliers and their products change faster than the suppliers of MIL-SPEC products. Consequently, contracts will be of a shorter duration for most items. Detection of problems associated with a particular supplier's products requires real time feedback to implement corrective action and halt further acquisition of the product.

8.2 RELIABILITY & MAINTAINABILITY

As with developmental items, it is necessary to perform system level reliability and maintainability assessment efforts for COTS/NDI based systems to ensure effective logistics support can be established. The essential reliability analysis/tasks that must be performed are reliability predictions, system level Failure Mode Analysis, Failure Reporting and Tracking Analysis, and reliability verification. Consider the following when evaluating and fielding COTS/NDI:

- Reliability predictions may be difficult to obtain from the vendor.
- Lack of data may limit the depth of failure mode analysis that can be done on COTS/NDI.
- Vendor's definition of reliability data may be different than Navy standards (e.g., Ao, MTBF, MTTR, MLDT).
- Failure reporting to measure item reliability and to detect and correct trend failures and latent defects is still required.

8.2.1 Reliability

Evaluating commercial product reliability is somewhat different than evaluating the reliability of new development products. First, detailed engineering and manufacturing data for commercial products is frequently not available. Second, the Government is not involved in the design process and production testing for a commercial product. So the Government cannot continuously evaluate reliability during design reviews, through analysis, or based on production

test results. Table 8-1 compares reliability activities for new development and commercial products.

Table 8-1. Comparison of Reliability Activities for New Development and Commercial Products

AREA OF ACTIVITY	DESCRIPTION OF ACTIVITY	
	NEW DEVELOPMENT	COMMERCIAL PRODUCTS
Determine Feasibility	Develop requirements based on user needs and technology being used. Estimate achievable level of reliability.	Limited to verifying manufacturer claims and determining effect of military environment on reliability.
Understand the Design	Perform FMEA and other analyses for entire design. Conduct design reviews. Develop de-rating criteria. Conduct development testing.	Limited to integration and design of any external items needed to allow the commercial product to function.
Parts Selection	Analyze design to determine correct parts application for robust design. Identify needed screening.	At the discretion of the commercial manufacturer.
Validate the Design	Conduct extensive development testing addressing all aspects of the design. Identify deficiencies and take corrective action. Establish achieved reliability levels.	Limited to what is needed to verify manufacturer claims and to validate integration or external item design.
Manufacturing	Design manufacturing processes to retain inherent R&M. Implement statistical process control and develop good supplier relationships.	Limited to determining types of process and process control and developing good supplier relationships.

8.2.2 Maintainability

The maintainability features of the commercial item should be evaluated to understand the impacts on accessibility, interchangeability of parts, power down conditions, built-in testing and diagnostics run-time, and the use of dip switches, jumpers and other commercially prevalent configuration altering items. These could affect documentation and training as well as overall system availability. Similarly, the location of external cable runs and cooling air intakes and exhausts must be compared to the installed COTS/NDI location aboard ship to ensure access to the unit as a whole.

In the situation where several COTS/NDI items are being integrated for a military application, diagnostic software and built-in-tests are less likely to be standard and a diagnostic shell is needed to provide a single status indication and fault isolation capability to the operator. While

considerably less costly to code than for a development system, the diagnostic shell is critical to meeting Mean Time To Repair (MTTR) requirements.

As great progress has been made to provide a paperless maintenance environment through the use of embedded training, on-line help and interactive electronic technical manuals, consideration must be given to the availability of the on-line help during a failure of the tactical element. Separation of tactical and support application hardware and software is a sound maintainability attribute.

Maintainability Demonstrations have been common place in traditional development programs. There is still value in conducting these demonstrations to ensure that all mechanical accesses and maintenance spaces are adequate. However, the natural design of commercial parts may often conflict directly with long established maintainability practices. One example that is often observed is the use of front connecting cables that cover the accessibility of other components. The goal of the maintainability demonstration should be to assess the reasonable access and maintenance of the system within the specified repair time rather than a firm, checklist approach, commonplace for newly developed hardware. The Maintainability Demonstration should also be used to validate fault isolation procedures in the Technical Manual as well as Built-in Test, special tool requirements, remove/replace procedures, and Preventative Maintenance System (PMS) procedures.

9. ACRONYMS

Acronym	Definition
ABT	Automatic Bus Transfer
API	Application Program Interface
ATM	Asynchronous Transfer Mode
CBT	Computer Based Training
CDR	Critical Design Review
COTS/NDI	Commercial Off The Shelf / Non-Developmental Item
CM	Configuration Management
COE	Common Operating Environment
CSA	Configuration Status Accounting
CSPP	Crew Scheduling and Phasing Plans
DII	Defense Information Initiative
D-Level	Depot level
DoD	Department of Defense
DVD	Direct Vendor Delivery
ECP	Engineering Change Proposal
EMI	Electromagnetic Interference
EMP	Electromagnetic Pulse
FCA	Functional Configuration Audit
FD/FI	Fault Diagnosis / Fault Isolation
FMEA	Failure Mode & Effect Analysis
GPETE	General Purpose Electronic Test Equipment
HMI	Human-Machine Interface
HVAC	Heating, Ventilating and Air Condition
IDS	Interface Design Specification
I-Level	Intermediate level
ILS	Integrated Logistics Support
IPT	Integrated Product Team
IT	Information Technology
IT-21	Information Technology 21st Century
JTA	Joint Technical Architecture
LRU	Lowest Replaceable Unit
M&P	Manpower and Personnel
MIL-SPEC	Military Specification
MTTR	Mean Time To Repair
NAVSEA	Naval Sea Systems Command
NEC	Navy Enlisted Classification
NRE	Non-Recurring Engineering
NTDS	Naval Tactical Data System
NTP	Navy Training Plan
ODVD	Organic Direct Vendor Delivery

OEM	Original Equipment Manufacturer
O-Level	Organizational level
OPTEVFOR	Operation Test and Evaluation Force
ORD	Operational Requirements Document
PCA	Physical Configuration Audit
PEO	Program Executive Office
PHS&T	Packaging, Handling, Storage and Transportation
POM	Program Objective Memorandum
PTD	Provisioning Technical Documentation
R&D	Research and Development
R&M	Reliability & Maintainability
S&TE	Support and Test Equipment
SPETE	Special Purpose Electronic Test Equipment
T&E	Test and Evaluation
TOC	Total Ownership Cost
UPS	Uninterruptable Power Supplies

10. DEFINITIONS

Acquisition. The acquiring by contract with appropriated funds of supplies or services (including construction) by and for the use of the Federal Government through purchase or lease, whether the supplies or services are already in existence or must be created, developed, demonstrated, and evaluated. Acquisition begins at the point when agency needs are established and includes the description of requirements to satisfy agency needs, solicitation and selection of sources, award of contracts, contract financing, contract performance, contract administration, and those technical and management functions directly related to the process of fulfilling agency needs by contract.

Acquisition Phase. All the tasks and activities needed to bring the program to the next major milestone occur during an acquisition phase. Phases provide a logical means of progressively translating broadly stated mission needs into well-defined system-specific requirements and ultimately into operationally effective, suitable, and survivable systems. An example of an acquisition phase is Program Definition and Risk Reduction.

Application Program Interface. A language and message format used by an application program to communicate with the operating system or other system program such as a database management system (DBMS). APIs are implemented by writing function calls in the program, which provide the linkage to a specific subroutine for execution. Thus, an API implies that some program module or routine is either already in place or that must be linked in to perform the tasks requested by the function call.

Asynchronous Transfer Mode. Asynchronous Transfer Mode (ATM) is a form of fast packet switching that allows for data transmission via broadband ISDN. Broadband ISDN is a much faster form of digital communication than standard ISDN. It uses fibre optic cabling to deliver services with transmission rates of more than 150 Mbps. It will eventually replace the ISDN service delivered via copper wiring. ATM carries information in fixed length packets called cells, each containing 48 bytes of user information and 5 bytes of header. The total cell is therefore 53 bytes. A virtual circuit is set up between two or more stations, which agree to communicate. ATM cells are then transferred through the ATM network from source to destination. ATM can transport all communications applications including data, voice, imaging, and video. In using small fixed length cells, ATM provides a fast- packet switching alternative to asynchronous transmission and synchronous transmission.

Architecture. The organizational structure of a system or component, their relationships, and the principles and guidelines governing their design and evolution over time. (IEEE 610.12)

Black box. Describes a component whose behavior can only be determined by studying its inputs and related outputs. The internal design characteristics are unknown to the user or analyst.

Bridge buy. A limited quantity of components purchased to satisfy near-term requirements until detailed analysis and a longer-term solution can be achieved.

Certification for Initial Operational Test and Evaluation (IOT&E). A service process undertaken in the engineering and management development (EMD) resulting in the announcement of a system's readiness to undergo IOT&E. The process varies with each Service.

Commercial Item A commercial item is any item, other than real property, that is of a type customarily used for non-governmental purposes and that has been sold, leased, or licensed to the general public; or has been offered for sale, lease, or license to the general public; or any item evolved through advances in technology or performance and that is not yet available in the commercial marketplace, but will be available in the commercial marketplace in time to satisfy the delivery requirements under a government solicitation. Also included in this definition are services in support of a commercial item, of a type offered and sold competitively in substantial quantities in the commercial marketplace based on established catalog or market prices for specific tasks performed under standard commercial terms and conditions; this does not include services that are sold based on hourly rates without an established catalog or market price for a specified service performed.

Commercial Off-The-Shelf. Commercial items that require no unique government modifications or maintenance over the life cycle of the product to meet the needs of the procuring agency.

Commercial Off-The-Shelf (COTS) Item. A commercial item produced and placed in stock by a contractor, or stocked by a distributor, before receiving orders or contracts for its sale. The item may be commercial or produced to military or Federal specifications or description.

Common Operating Environment (COE) "Mission application independent" architecture, reusable software and a set of guidelines and standards in three "layers":
1) a kernel (operating system/software tools/print services)
2) infrastructure services (data exchange/network management) and
3) common support applications (e.g. office automation).
Current major systems that are COE compliant are the Global Command and Control System (GCCS) and the Global Combat Support System (GCSS). The COE is also called the Defense Information Infrastructure Common Operating Environment or DIICOE.

Computer Software (or Software) A combination of associated computer instructions and computer data definitions required to enable the computer hardware to perform computational or control functions.

Computer Software Configuration Item (CSCI) Analogous to a hardware configuration item, that is, a CSCI is software program (typically) which performs a common end-use function, follows its own development cycle, and is individually managed. It is also called a Software Item (SI).

Computer Software Documentation Technical data information, including computer listings and printouts, which documents the requirements, design, or details of computer software, explains the capabilities and limitations of the software, or provides operation instructions for using or supporting computer software during the software's operational life.

Concept Exploration (CE) Beginning after Milestone 0 approval, the initial phase of the system acquisition process. During this phase, the acquisition strategy is developed, system alternatives are proposed and examined, and the systems program requirements document is expanded to support subsequent phases.

Contractor. An entity in private industry which enters into contracts with the government to provide goods or services.

Contractor Furnished Equipment (CFE) Standard items of hardware, electrical equipment, and other standard production or commercial items furnished by a prime contractor as part of a larger assembly.

Cost as An Independent Variable (CAIV) Methodologies used to acquire and operate affordable DoD systems by setting aggressive, achievable life cycle cost objectives, and managing achievement of these objectives by trading off performance and schedule, as necessary. Cost objectives balance mission needs with projected out-year resources, taking into account anticipated process improvements in both DoD and industry. CAIV has brought attention to the government's responsibilities for setting/adjusting life-cycle cost objectives and for evaluating requirements in terms of overall cost consequences.

Critical Design Review (CDR) A review that may be conducted to determine that the detailed design satisfies the performance and engineering requirements of the development specification; to establish the detailed design compatibility among the item and other items of equipment, facilities, computer programs, and personnel; to assess producibility and risk areas; and to review the preliminary product baseline specifications. Normally conducted during Phase II, Engineering and Manufacturing Development (EMD).

Defense Acquisition Deskbook An automated reference tool sponsored by the Office of the Under Secretary of Defense (Acquisition and Technology) (OUSD(A&T)) to assist program offices in implementing DoDD 5000.1 and DoD 5000.2-R. It consists of a World Wide Web (WWW) home page with a bulletin board, an information structure of discretionary information, and a reference library of statutory and regulatory guidance. The information structure and reference library may be accessed through commercially available web browsers, and are available by CD subscription from the home page location.

Defense Information Infrastructure (DII) Encompasses the assets and elements (communications networks, computers, software, databases and people) available to meet DoD's information needs.

Defense Information Infrastructure Common Operating Environment (DIICOE) See Common Operating Environment.

Design Interface One of the traditional elements of logistics support and one of the functions of logistics. Involves the relationship of logistics-related design parameters, such as reliability and maintainability, to readiness and support resource requirements. These logistics-related design parameters are expressed in operational terms rather than inherent values and specifically related to system readiness objectives and support costs of the materiel system.

Development. The systematic use of scientific and technical knowledge in the design, development, testing, or evaluation of a potential new product or service (or of an improvement in an existing product or service) to meet specific performance requirements or objectives. It includes the functions of design engineering, prototyping, and engineering testing; it excludes subcontracted technical effort that is for the sole purpose of developing an additional source for an existing product.

Developmental Test and Evaluation (DT&E) Any engineering-type test used to verify status of technical progress, verify that design risks are minimized, substantiate achievement of contract technical performance, and certify readiness for initial operational testing. Development tests generally require instrumentation and measurements and are accomplished by engineers, technicians, or soldier operator-maintainer test personnel in a controlled environment to facilitate failure analysis.

Electromagnetic Interference (EMI). EMI is an impairment of a wanted electromagnetic signal by an electromagnetic disturbance.

Electromagnetic Pulse (EMP). EMP is a very short burst of highly intense electromagnetic energy typically produced by nuclear detonations. It is characterized by a very short (10 nsec) risetime, high peak field intensity (50 kV/m), and a short duration (250nsec). Most of the energy is concentrated at frequencies below 10 MHz, where magnetic field effects predominate.

Engineering and manufacturing development. Those projects in engineering and manufacturing development for Service use but that have not received approval for full-rate production. This area is characterized by major line item projects, and program control will be exercised by review of individual projects. Engineering development includes engineering and manufacturing development projects consistent with the definitions within DoDD 5000.1.

Engineering Change Proposal (ECP) A proposal to the responsible authority recommending that a change to an original item of equipment be considered, and the design or engineering change be incorporated into the article to modify, add to, delete, or supersede original parts.

Engineering Development Model (EDM) A production representative system that may be used during the Engineering and Manufacturing Development (EMD) phase to resolve design deficiencies, demonstrate maturing performance, and develop proposed production specifications and drawings. May also be used for initial operational test and evaluation (IOT&E).

Environmental Hardness. The measure of environmental stress that a product can function under based on it's packaging and/or inherent characteristics or packaging when in a stowed configuration.

Federal Acquisition Regulation (FAR) The regulation for use by federal executive agencies for acquisition of supplies and services with appropriated funds. The FAR is supplemented by the Military Departments and by DoD. The DoD supplement is called the DFARS (Defense FAR Supplement).

Firmware The combination of a hardware device and computer instructions or computer data that reside as read-only software on the hardware device. The software cannot be readily modified under program control.

Follow-On Operational Test and Evaluation (FOT&E) The test and evaluation (T&E) that may be necessary after Milestone III to refine the estimates made during operational test and evaluation (OT&E), to evaluate changes, and to reevaluate the system to ensure that it continues to meet operational needs and retains its effectiveness in a new environment or against a new threat.

Functional Configuration Audit (FCA). The formal examination of the functional characteristics of a configuration item (CI) as demonstrated by test data to verify that the item has achieved the performance specified in its functional or allocated configuration prior to acceptance.

Government Furnished Material (GFM) Material is government property which may be incorporated into or attached to an end item to be delivered under a contract or which may be consumed in the performance of a contract. It includes, but is not limited to, raw and processed material, parts, components, assemblies, and small tools and supplies.

Government-Furnished Property. Property in the possession of, or directly acquired by, the Government and subsequently made available to the contractor.

Information Assurance Information operations that protect and defend information and information systems by ensuring their availability, integrity, authentication, confidentiality, and non-repudiation. This includes providing for the restoration of information systems by incorporating protection, detection, and reaction capabilities.

Information Technology (IT). Any equipment or interconnected system or subsystem of equipment that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information by an executive agency. IT includes computers, ancillary equipment, software, firmware and similar procedures, services and related resources.

Integrated Product and Process Development (IPPD). A management technique that simultaneously integrates all essential acquisition activities through the use of multidisciplinary teams to optimize the design, manufacturing and supportability processes. IPPD facilitates meeting cost and performance objectives from product concept through production, including field support. One of the key IPPD tenets is multidisciplinary teamwork through Integrated Product Teams (IPTs).

Integrator. The integrator as mentioned within this document refers to the party responsible for integrating commercial products into a functional military unit. This unit may be a complete system or a subset of a system (subsystem).

Interface Standard. A standard that specifies the physical or functional interface characteristics

of systems, subsystems, equipment, assemblies, components, items or parts to permit interchangeability, interconnection, interoperability, compatibility, or communications. (MIL-STD-962C draft dated 14 June 1995)

Major system. That combination of elements that will function together to produce the capabilities required to fulfill a mission need. The elements may include hardware, equipment, software, or any combination thereof, but exclude construction or other improvements to real property. A system shall be considered a major system if --
(a) The Department of Defense is responsible for the system and the total expenditures for research, development, test, and evaluation for the system are estimated to be more than $115,000,000 (based on fiscal year 1990 constant dollars) or the eventual total expenditure for the acquisition exceeds $540,000,000 (based on fiscal year 1990 constant dollars);
(b) A civilian agency is responsible for the system and total expenditures for the system are estimated to exceed $750,000 (based on fiscal year 1980 constant dollars) or the dollar threshold for a "major system" established by the agency pursuant to Office of Management and Budget Circular A-109, entitled "Major System Acquisitions," whichever is greater; or
(c) The system is designated a "major system" by the head of the agency responsible for the system. (10 U.S.C. 2302 and 41 U.S.C. 403).

Information Technology. Any equipment, or interconnected system(s) or subsystem(s) of equipment, that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information by the agency. The term information technology includes computers, ancillary equipment, software, firmware and similar procedures, services (including support services), and related resources.

Integrated Product Team (IPT) Team composed of representatives from appropriate functional disciplines working together to build successful programs, identify and resolve issues, and make sound and timely recommendations to facilitate decision making. There are three types of IPTs: overarching IPTs (OIPTs) focus on strategic guidance, program assessment, and issue resolution; working level IPTs (WIPTs) identify and resolve program issues, determine program status, and seek opportunities for acquisition reform; and program level IPTs focus on program execution and may include representatives from both government and after contract award industry.

Interoperability The ability of systems, units, or forces to provide services to or accept services from other systems, units, or forces and to use the services so exchanged to operate effectively together. The conditions achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users.

Joint Technical Architecture (JTA) A common set of mandatory information technology standards and guidelines to be used by all emerging systems and systems upgrades including Advanced Concept Technology Demonstrations. The JTA is applicable to C4I and automated

information systems and the interfaces of other key assets with C4I systems (e.g., weapons systems, sensors) with C4I systems.

Lessons Learned Capitalizing on past errors in judgment, material failures, wrong timing, or other mistakes ultimately to improve a situation or system.

Life-cycle cost. The total cost to the Government of acquiring, operating, supporting, and (if applicable) disposing of the items being acquired.

Life of Type. The OEM, its distributors, or after-market suppliers may have enough inventory to meet the projected demands of the supported equipment for the rest of its operational lifetime or may continue to produce the component for a specified amount of time.

Line Replaceable Unit (LRU). An essential support item removed and replaced at field level to restore an end item to an operationally ready condition. (Also called Weapon Replacement Assembly and Module Replaceable Unit.)

Maintainability The ability of an item to be retained in, or restored to, a specified condition when maintenance is performed by personnel having specified skill levels, using prescribed procedures and resources, at each prescribed level of maintenance and repair. (See Mean Time To Repair (MTTR).)

Maintenance Planning The process conducted to evolve and establish maintenance/support concepts and requirements for the life cycle of a materiel system. One of the traditional elements of logistic support (LS).

Manpower and Personnel. The process of identifying and acquiring military and civilian personnel with the skills and grades required to operate and support a materiel system over its lifetime at peacetime and wartime rates. One of the traditional elements of logistic support (LS).

Market Investigation A phase of market research conducted in response to a specific materiel need or need for services.

Market Research A process for gathering data on product characteristics, suppliers capabilities and the business practices that surround them, plus the analysis of that data to make acquisition decisions. Market research has two phases: market surveillance and market investigation.

Market Research. Market research is a continuous process for gathering data on product characteristics, suppliers' capabilities and the business practices that surround them -- plus the analysis of that data to make acquisition decisions. This requires one to collect and analyze information about the market that subsequently can be used to determine whether the need can be met by products or services available in the commercial market; whether commercial practices regarding customizing, modifying products or tailoring services are available to meet customer needs; what are the customary terms and conditions, including warranty, buyer financing, and discounts under which commercial sales are made; and whether the distribution and logistics support capabilities of potential suppliers are sufficient to meet the needs of the government.

Market Surveillance Includes all the activities that acquisition personnel perform continuously to keep themselves abreast of technology and product developments in their areas of expertise.

Mission Critical System A system whose operational effectiveness and operational suitability are essential to successful completion or to aggregate residual combat capability. If this system fails, the mission likely will not be completed. Such a system can be an auxiliary or supporting system, as well as a primary mission system.

Model. A model is a representation of an actual or conceptual system that involves mathematics, logical expressions, or computer simulations that can be used to predict how the system might perform or survive under various conditions or in a range of hostile environments.

Modified Commercial Item: "A modified commercial item is any item with modifications of a type customarily available in the commercial marketplace or minor modifications of a type not customarily available in the commercial marketplace made to meet Federal Government requirements. Such modifications are considered minor if the change does not significantly alter the non-government function or essential physical characteristics of an item or component, or change the purpose of the process."

Nondevelopmental Item (NDI) A nondevelopmental item is any previously developed item of supply used exclusively for government purposes by a Federal Agency, a State or local government, or a foreign government with which the United States has a mutual defense cooperation agreement; any item described above that requires only minor modifications or modifications of the type customarily available in the commercial marketplace in order to meet the requirements of the processing department or agency.

Nondevelopmental Item. A Nondevelopmental item is:
(a) Any previously developed item of supply used exclusively for governmental purposes by a Federal agency, a State or local government, or a foreign government with which the United States has a mutual defense cooperation agreement;
(b) Any item described in paragraph (a) of this definition that requires only minor modification or modifications of a type customarily available in the commercial marketplace in order to meet the requirements of the procuring department or agency; or
(c) Any item of supply being produced that does not meet the requirements of paragraph (a) or (b) solely because the item is not yet in use.

Object Oriented Design. Object-oriented design is the method that leads to software architectures based on the objects every system or subsystem manipulates (rather than the function it is meant to ensure).

A general guideline for object-oriented design includes the following issues:

- How to find the objects
- How to describe the objects

- How to describe the relations and commonality between objects
- How to use objects to structure programs

Obsolescence. Commercial items no longer available for purchase or has been discontinued from production.

Off-the-Shelf Procurement of existing systems or equipment without a research, development, test, and evaluation (RDT&E) program or with minor development to make system suitable for DoD needs. May be commercial system/equipment or one already in DoD inventory. (See Commercial Item and Nondevelopmental Item.)

Open Standards Widely accepted and supported standards set by recognized standards organizations or the market place. These standards support interoperability, portability, and scalability and are equally available to the general public at no cost or with a moderate license fee.

Open System A system that implements specifications maintained by an open, public consensus process for interfaces, services, and support formats, to enable properly engineered components to be utilized across a wide range of systems with minimal change, to interoperate with other components on local and remote systems, and to interact with users in a manner that facilitates portability.

Open Systems Environment (OSE) A comprehensive set of interfaces, services and supporting formats, plus aspects of interoperability of application, as specified by information technology standards and profiles. An OSE enables information systems to be developed, operated and maintained independent of application specific technical solutions or vendor products.

Packaging. The process and procedures used to protect material. It includes cleaning, drying, preserving, packaging, marking, and utilization.

Packing, Handling, Storage, and Transportation. The resources, processes, procedures, design considerations, and methods to ensure all system, equipment, and support items are preserved, packaged, handled, and transported properly. This includes environmental considerations, equipment preservation requirements for short-and long-term storage, and transportability. One of the traditional logistic support (LS) elements.

Physical Configuration Audit (PCA) Physical examination to verify that the configuration item(s) (CIs) "as built" conform to the technical documentation which defines the item. Approval by the government program office of the CI product specification and satisfactory completion of this audit establishes the product baseline. May be conducted on first full production or first low rate initial production (LRIP) item.

Preliminary Design Review (PDR) A review conducted on each configuration item to evaluate the progress, technical adequacy, and risk resolution of the selected design approach; to determine its compatibility with performance and engineering requirements of the development specification; and to establish the existence and compatibility of the physical and functional interfaces among the

item and other items of equipment, facilities, computer programs, and personnel. Normally conducted during the early part of Engineering and Manufacturing Development (EMD) Phase II.

Prime Contractor. A contractor having responsibility for design control and/or delivery of a system/equipment such as aircraft, engines, ships, tanks, vehicles, guns and missiles, ground communications and electronics systems, and test equipment.

Product Survey. A product survey is one that obtains information about the vendor's product including start of product, end of production, end of support, pricing, product warranty, and company profile information necessary for determining life cycle support data on various products

Program Executive Officer (PEO) A senior military or civilian official who has responsibility for assigned ACAT I, ACAT IA, sensitive classified programs or other programs determined by the CAE. PEOs normally report directly to the CAE/CIO for assigned programs.

Program Objectives Memorandum (POM) An annual memorandum in prescribed format submitted to the Secretary of Defense (SECDEF) by the DoD component heads which recommends the total resource requirements and programs within the parameters of SECDEF's fiscal guidance. A major document in the planning, programming, and budgeting system (PPBS); is POM is the basis for the component budget estimates. The POM is the principal programming document which details how a component proposes to respond to assignments in the defense planning guidance (DPG) and satisfy its assigned functions of the future years defense program (FYDP). The POM shows programmed needs for 5 or 6 years hence (i.e., in fiscal year (FY) 94, POM 1996-2001 was submitted; in FY 95, POM 1997-2001 was submitted), and includes manpower, force levels, procurement, facilities, and research and development (R&D).

Provisioning. The process of determining and acquiring the range and quantity (depth) of spare and repair parts, and support and test equipment required to operate and maintain an end item of materiel for an initial period of service.

Quality Assurance. A planned and systematic pattern of all actions necessary to provide adequate confidence that adequate technical requirements are established; products and services conform to established technical requirements; and satisfactory performance is achieved.

Quality Program. A program which is developed, planned, and managed to carry out cost-effectively all efforts to effect the quality of materials and services from concept exploration and definition through demonstration and validation, engineering and manufacturing development, production and deployment, and operations and support.

Reliability The ability of a system and its parts to perform its mission without failure, degradation, or demand on the support system. (See Mean Time Between Failures (MTBF).)

Request for Proposal (RFP) A solicitation used in negotiated acquisition to communicate government requirements to prospective contractor and to solicit proposals.

Software Reuse The process of implementing or updating software systems using existing software assets.

Software Support The sum of all activities that take place to ensure that implemented and fielded software continues to fully support the operational mission of the system. Software support includes predeployment software support and postdeployment software support (PDSS).

Solicitation In contracting, the term means to go out to prospective bidders and request their response to a proposal.

Source Selection The process wherein the requirements, facts, recommendations, and government policy relevant to an award decision in a competitive procurement of a system/project are examined and the decision made.

Specification A document used in development and procurement which describes the technical requirements for items, materials, and services including the procedures by which it will be determined that the requirements have been met. Specifications may be unique to a specific program (program-peculiar) or they may be common to several applications (general in nature).

Standardization The process by which DoD achieves the closest practicable cooperation among forces; the most efficient use of research, development, and production resources; and agreement to adopt on the broadest possible basis the use of common or compatible operational, administrative, and logistics procedures and criteria; common or compatible technical procedures and criteria; common or compatible, or interchangeable supplies, components, weapons, or equipment; and common or compatible tactical doctrine with corresponding organizational compatibility.

Statement of Work (SOW) That portion of a contract which establishes and defines all nonspecification requirements for contractors efforts either directly or with the use of specific cited documents.

Subassembly Two or more parts joined together to form a unit, capable of disassembly, which is only a part of a complete machine, structure, or other article.

Supportability The degree of ease to which system design characteristics and planned logistics resources, including the logistic support (LS) elements, allows for the meeting of system availability and wartime utilization requirements.

Survivability The ability of a system and its crew to retain its mission keeping capability in a hostile environment, whether combat or peacetime, without suffering an abortive impairment of its ability to accomplish its designated mission. Survivability is composed of three aspects: Susceptibility reduction (which includes signature reduction, defensive weapons capability, and countermeasures), Vulnerability reduction (which includes minimization of the effects of underwater delivered or air delivered conventional, nuclear or other weapons), and Recoverability enhancement (including damage control, fire fighting, CBR defense, and systems reconfigurability).

Susceptibility. The degree to which a device, equipment, or weapon system is open to effective attack due to one or more inherent weaknesses. Susceptibility is a function of operational tactics, countermeasures, probability of enemy fielding a threat, etc. Susceptibility is considered a subset of survivability.

System

1. The organization of hardware, software, material, facilities, personnel, data, and services needed to perform a designated function with specified results, such as the gathering of specified data, its processing, and delivery to users.
2. A combination of two or more interrelated equipment's (sets) arranged in a functional package to perform an operational function or to satisfy a requirement.

Systems. A combination of elements that will function together to produce the capabilities required to fulfill a mission need.

Systems acquisition. The design, development, and production of new systems. It also includes modifications to existing systems that involve redesign of the system or subsystems.

Systems Engineering. A comprehensive, iterative technical management process that includes translating operational requirements into configured systems, integrating the technical inputs of the entire design team, managing interfaces, characterizing and managing technical risk, transitioning technology from the technology base into program specific efforts, and verifying that designs meet operational needs. It is a life cycle activity that demands a concurrent approach to both product and process development.

Technical Data. Specifications, plans, drawings, standards, purchase descriptions, and such other data to describe the Government's requirements for acquisition.

Technical Refresh. A programmatic, Diminishing Manufacturing Sources and cost-driven life cycle process that supports the form, fit, and function replacement of COTS/NDI. This refreshment is predicated upon life cycle cost effectiveness and continued compliance with current system performance and interface requirements and is normally transparent to the end user.

Technology Assessment. The process of pro-actively finding and solving availability problems in a system in order to keep the system operational over the mission-life of that system.

Technology Insertion. Infusion of new technology into the current design that increases mission capability or that satisfies current mission requirements while minimizing life cycle cost and maximizing support capability.

NEC DECISION PAPER

NEC Meeting Date:	22 May 2000
Decision Requested by:	Change Committee
Process Owner:	Change Committee Chair
Decision Title:	NAVSEA COTS Policy Instruction, Guidance Document and COTS Steering Board Charter

Decision Sought: Approval of the draft NAVSEA Commercial Off The Shelf (COTS) Policy Instruction, Guidance Document and revised COTS Steering Board (CSB) Charter.

BACKGROUND: The CSB was chartered by VADM Sterner in December of 1997 to aid the Command in the effective use of COTS. At a meeting in January of 1999, VADM Nanos re-affirmed the charter and requested the CSB prepare a policy for the Command on the effective use of COTS technology in NAVSEA systems.

In August 1999, the CSB brought a draft Policy to the Board of Deputies for concurrence. The Board required that the CSB eliminate a provision within the draft Policy requiring approved COTS Plans before Business Clearances would be issued by SEA 02. Also, the Board required the draft Policy be revised to allow for the incorporation of COTS planning information into existing program documents at the discretion of the PM/PEO. These have both been accomplished.

At that same Board of Deputies meeting, the CSB requested resources to develop a comprehensive COTS Guidance document. The Board was unable to provide the requested resources and instructed the CSB to develop a much abbreviated version of the COTS Guidance Document; a "What to Do" vice a "How to Do It" approach.

Since the Board of Deputies meeting in August of 1999, the draft Policy has been revised. The direction from the Board was maintained. The significant change since then has been the need for a cross-functional Integrated Product Team (IPT) to continually look for best practices, lessons learned and evaluate the effectiveness of the Policy and Guidance Documents. SEA 04, designated as the Command Process owner for COTS issues by VADM Nanos in January 1999, needs to keep the COTS Steering Board intact to perform the recurring tasks of best practice identification and Policy/Guidance evaluation. This is the reason for the revision to the CSB charter.

In anticipation of the NAVSEA COTS Policy and Guidance Documents being approved, the CSB has undertaken advanced planning to co-sponsor a workshop to roll out both documents. The first workshop was originally planned for late February 2000. Based on unforeseen delays, the February workshop was canceled. It has been rescheduled for 25-26 July 2000 at the Applied Physics Laboratory in Laurel, Maryland. VADM Nanos has agreed to be the keynote speaker. The CSB has tasked a sub-group to arrange the workshop and attend to the necessary details.

DISCUSSION: This Policy has been routed for comments to NAVSEA and all affiliated PEOs. To date, 37 pages of comments have been adjudicated. The second briefing of the Policy to Senior NAVSEA Management was held at the 11 May 2000 Business Transformation Executive Team (BTET) meeting. There were no unresolved issues.

PEO-TSC has currently established their own internal Policy and Guidelines regarding the use of COTS. The NAVSEA Policy mirrors the PEO-TSC Policy. The NAVSEA COTS Guidance Document mirrors the PEO-TSC COTS Guidelines. NAVSEA has an opportunity by approving the Policy and Guidance documents to establish some commonality across the Claimancy in implementing and managing COTS. This will enable the sharing of ideas, experiences and potentially resources.

OPTIONS:

1. Approve the documents requested.
2. Do not approve. Failure to approve may result in a lack of coherent plans and strategies as NAVSEA continues to introduce Commercial Technology to the Warfighter.

REQUIRED RESOURCES: SEA 04 will need to budget for approximately three (3) man-years of effort to staff the recurring activities of the CSB. Also, PEOs will need to provide a knowledgeable person to attend meetings and aid in the review of COTS Plans and Strategies to identify best practices, lessons learned, etc.

POA&M/METRICS: The Workshop to roll out the Policy and Guidance document is scheduled for 25-26 July 2000.

NON-CONCURRENCE/UNRESOLVED ISSUES: None

RECOMMENDATIONS:

1. Approve decision paper and upon approval, the COTS Policy and Guidance Documents will be routed through the normal "chop chain" for SEA 00 signature.

2. Approve the Revised COTS Steering Board Charter

Final Decision:

X **APPROVED BY EXECUTIVE DIRECTOR**

PETER F. BROWN

X APPROVED

G. P. NANOS, VADM, USN

23 May 00
DATE

☐ DISAPPROVED
☐ FURTHER ACTION REQUIRED PRIOR TO APPROVAL (see minutes).