Commercial Derivative Aircraft (CDA) Acquisition Guide

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS

PREFACE

The acquisition of commercial aircraft adapted to meet military needs (i.e., Commercial Derivative Aircraft (CDA)) is different from traditional DoD aircraft acquisitions.

In a traditional Department of Defense (DoD) development program, which normally begins with from-the-ground-up research and development, the acquisition process baseline is a common set of specifications and user performance requirements. More importantly, from a design and development point of view, the contractor starts with a clean sheet of paper. A CDA program begins, potentially, with different but fixed commercially developed products, which have their own and already set form, fit, function, and performance characteristics. These may or may not be compatible with the ultimately expected configuration and performance characteristics of the military end product.

The delta between the basic "green" aircraft and the final militarized product affects the complexity and scope of the effort necessary to achieve the final expected configuration and performance. The manufacturer of the "green" aircraft, the seller/broker of the "green" airframe, the airframe modifier, and the system integrator may or may not be the same entity. The source and/or type of certifications required of the "green" aircraft and the final product may be different. Decisions about the material content of the "green" aircraft, made in a commercial environment, may not comport with laws applicable to defense acquisitions. Additionally, the intellectual property rights in the baseline "green" airframe are probably fixed and may vary substantially among aircraft manufacturers, affecting technical interfaces, the range of available government acquisition choices, source of repair and core maintenance capability decisions, as well as life cycle cost associated with long term system operation and support.

This is the world of CDA acquisition. It is fraught with high expectations, often inadequate appreciation of risk and understanding of commercial practices, and lack of a support structure – policies, procedures, and training – within the DoD that specifically address the unique aspects of CDA programs in ways that materially assist program participants. This guide is a compilation of the current knowledge, experiences, and best practices from CDA programs across the DoD with significant emphasis on USAF programs. It addresses the entire spectrum of CDA programs from those with minimum modifications to the "green" aircraft to those with extensive modifications that may include, for instance, significant changes to mold lines, avionics and even adding weapons.

1.0   INTRODUCTION

1.1   Purpose

The military services have relied on Commercial Derivative Aircraft (CDA) and their hybrids (CDHA/CDTA) to satisfy national defense needs ever since the time of the Wright Brothers. Over 130 separate CDA fleets have been employed by the military in the last century. CDA programs have been thoroughly studied since the 1970s without substantive policy changes or noted improvements in management practices. Similar to traditional Department of Defense (DoD) aeronautical system development programs, CDA programs use the policies and procedures of current DoD acquisition statutes and regulations, which are primarily focused on new system development. Adapting these to the commercial environment and the world of commercial derivatives becomes the primary challenge for the program manager and the program team. Past CDA program successes can largely be attributed to the skills and experience of these individuals since there has been no specific training or guidance oriented to CDA program planning and execution.

This CDA Acquisition Guide is the result of research into recent CDA programs – successful and not-so-successful – across the DoD. It focuses on identifying specific practices that are within the influence of an individual program manager, program team, or service to either adopt (in the case of successful practices) or avoid. The premise behind selecting this course of action is simple. Knowledgeable sources determined that it would be much more useful to identify successful practices having a reasonable chance of being implemented, and unsuccessful practices having a reasonable chance of being avoided, especially if using (or deciding not to use) those practices did not depend upon high-level policy changes at the national level.

1.2   Methodology

The first step in formulating this guide was to review the existing knowledge and professional consensus on CDA programs. This involved a review of the literature documenting prior studies, analyses, papers, and program histories in this area, as well as reports and case decisions resulting from protests, litigation, audits and the like. The second step was to construct a model, based on the literature review, of the program areas most significant to CDA acquisition. This model was used to organize data from the literature review for preparation of the guide and to prepare an interview questionnaire. The third step involved the collection of data via interviews. These interviews included government program managers and program team members, in addition to Service and OSD staff, from different CDA acquisition programs past and present. The interviews were used to fill in the gaps in information found in the literature, as well as to calibrate successful practices identified in the literature with the experience of "real world" practitioners. The interviews were especially important for refining insights already gained into program-level management practices and relating them to CDA programs. At the completion of these steps, the guide was written.

1.3 Organization

The program areas most significant to CDA acquisition are depicted in Figure 1.3-1. This figure is not intended to be an all-inclusive picture of the elements of an acquisition program. Instead of recapitulating the formal DoD acquisition training offered to program managers and related acquisition functional specialists, this guide focuses on those elements which may be different for CDA programs. The chapters and sections of the guide are organized according to Figure 1.3-1.
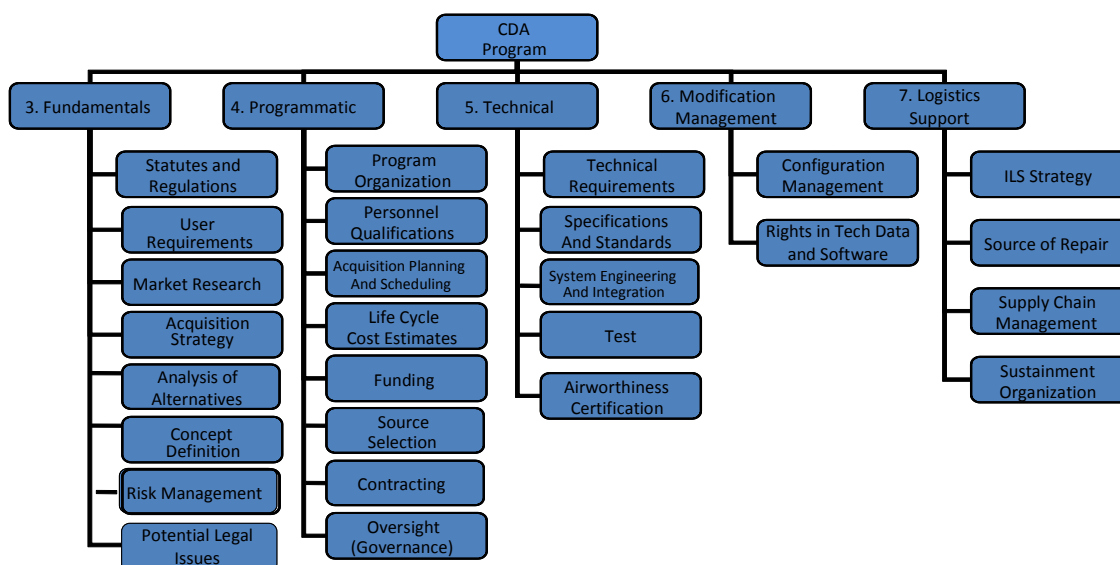
Figure 1.3-1 Unique Aspects of CDA Programs

1.4 Summary of Findings

Figure 1.4-1 depicts – at a summary level – the challenges and keys to CDA acquisition programs. It also portrays how the most significant program areas in CDA acquisition (the chapters and sections of this guide as depicted in Figure 1.3-1) fit in the Defense Acquisition Framework 2008 either as applicable to specific program phases or as cross-cutting activities that are applicable across the entire acquisition and sustainment life cycle. Figure 1.4-1 highlights the *key messages* to be considered when planning and executing CDA programs and the *keys to success* derived from research and interviews from past and present programs and practitioners.

CDA Acquisition in the Defense Acquisition Framework 2008 (CDA GUIDE REFERENCES)

KEY MESSAGES

- CDA programs require the same discipline as traditional DoD development programs
- The acquisition strategy is just as critical on CDA programs as it is on traditional DoD development programs
- Use commercial business practices as much as possible
- Determine if any pre-contract testing, try-out, inspection or other "hands on" activity will benefit the overall program
- There is extensive Source Selection Guidance – Use it
- The Request for Proposal (RFP) must establish requirements that are clear and measurable
- Understand and rationalize the constraints of the trade space between the "green" aircraft and the desired military product in the source selection evaluation and basis for award
- Be prepared to do cost and price analysis to ensure fair and reasonable pricing

KEY MESSAGES

- CDA programs are unique and different
- Requirements must be flexible in CDA programs
- Market Research is essential and should be continuous and diverse
- The closer the requirements are to the "green" aircraft the better
- Conduct AoAs that consider both developmental and non-developmental options and include requirements trade-offs.

KEY MESSAGES

- A robust risk management process is critical
- Use Integrated Master Planning/Scheduling (IMP/IMS)
- Make the test program compatible with and complementary to FAA's test approach
- Rely on the commercial infrastructure for logistics support as much as statutory mandates and service policies will allow.
- Manage relationships with the Original Equipment Manufacturer (OEM), modification contractor, and organic depot
- More, not less, guidance applies to CDA programs
- There are multiple statutes and regulations affecting the use of commercial items and practices in DoD – Pay attention to them
- There is a unique, additional set of guidance in the FAA Federal Acquisition Regulations (FARs)
- use the FAA Military Certification Office (MO) throughout the life cycle
- There are special procedures for foreign built CDA

User Needs (3.3)

Technology Opportunities & Resources MARKET RESEARCH (3.4)

A	B	C
MATERIAL SOLUTION ANALYSIS	**TECHNOLOGY DEVELOPMENT**	**ENGINEERING AND MANUFACTURING DEVELOPMENT**	**PRODUCTION AND DEPLOYMENT**	**OPERATIONS AND SUPPORT**

Material Development Decision — Commercial Buy Decision — PDR — PDR — CDR — FRP Decision Review

| AOA (3.6) | CONCEPT DEFINITION (3.7) | PROGRAMMATIC (4.1) TECHNICAL (5.1) | MODIFICATION MANAGEMENT (6.1) | LOGISTICS SUPPORT (7.1) |

| Pre-Systems Acquisition | | Systems Acquisition | | Sustainment |

| 3.5, 3.6, 4.2, 7.5 | 3.5, 3.7, 4.1, 4.2, 4.4, 4.7, 5.2, 7.5 | 4.1, 4.4, 5.1, 5.2, 5.3, 5.5 | 6.1 | 7.2, 7.3, 7.4 |

CROSS CUTTING (3.1, 3.2, 3.4, 3.8, 3.9, 4.3, 4.5, 4.6, 4.8, 4.9, 5.4. 5.6, 6.2, 6.3)

FREQUENTLY CITED CHALLENGES IN CDA PROGRAMS

- Budgeting
- Congressional Mandates
- Pricing
- Inflexible Requirements
- Unrealistic Cost Estimates/Schedules
- Funding Constraints ("Colors" of money)

- Testing
- Lack of Commercial Experience
- Airworthiness Certification
- Technical Authorities
- Requirements Creep
- Data Rights
- Source Selection Criteria and Basis for Award

KEYS TO SUCCESS

- Manage expectations
- Get buy-in from the chain of command
- Be sure there is a thorough, written definition of what is to be acquired
- Conduct continuous and exhaustive market research
- Reconcile user requirements with commercial system capabilities
- Finalize data/software rights, test and sustainment strategies *early*
- Validate Original Equipment Manufacturer (OEM) claims

- Foster and manage partnerships with and among users, contractors, the Federal Aviation Administration (FAA), the test and sustainment communities
- Ensure good communication
- Conduct product demonstrations/evaluations
- Embrace commercial standards and data systems
- Use FAA certification whenever possible

Figure 1.4-1 CDA Acquisition in the Defense Acquisition Framework

2.0   BACKGROUND

2.1   General

The use of clear and consistent terminology is one of the challenges facing defense planners and program managers in the world of commercial derivative aircraft programs. This terminology is dictated by the many Government departments and agencies that establish policy and procedures related to the acquisition, certification, and data rights protection of both civil and military aircraft and their underlying technologies. This guide does not try to reconcile terminology, but rather carefully limits and consistently applies the terminology herein to a few well defined terms. This section describes the terms and then establishes the scope and intended usage of the guide based on those terms.

2.2   Definitions

A *Non-Developmental Item (NDI)* is any previously developed item 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; and any item described here 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 (1). The statutory definition of non-developmental item included commercial items and still does. When they meet defense needs, however, the acquisition of commercial items provides benefits over and above the acquisition of other previously developed items. Commercial items and NDI are separate items by definition in the Federal Acquisition Regulation (FAR), and the preference for commercial items over all others in defining defense requirements is reiterated in FAR Part 11.

A *Commercial Item (CI)* is one customarily used for nongovernmental purposes that has been or will be sold, leased, or licensed (or offered for sale, lease, or license) to the general public. An item that includes modifications customarily available in the commercial marketplace or minor modifications made to meet federal government requirements is still a commercial item. In addition, services such as installation, maintenance, repair, and training that are procured for support of an item described above are considered commercial items if they are offered to the public under similar terms and conditions or sold competitively in substantial quantities based on established catalog or market prices (2). (FAR 2.101)

A *Commercial Off-The-Shelf* (*COTS*) item is one that is sold, leased, or licensed to the general public; offered by a vendor trying to profit from it; supported and evolved by the vendor who retains the intellectual property rights; available in multiple, identical copies; and used without modification of the internals (3). *COTS is frequently used as a synonym for commercial item; however, it is now defined in statute as "unmodified commercial items."*

For a more thorough discussion of the relationships between and among NDI, CI, and COTS, see Appendix A.

A ***Commercial Derivative Aircraft (CDA)*** is any fixed- or rotary-wing aircraft procured as a commercial Type Certificated off-the-shelf non-developmental item (4).

A ***Military Commercial Derivative Aircraft (MCDA)*** is a civil aircraft procured or acquired by the military (5).

A ***Commercial Derivative Hybrid Aircraft (CDHA)*** is any fixed- or rotary-wing aircraft procured as a commercial Type Certificated off-the-shelf developmental or non-developmental item and subsequently modified to meet military mission requirements. These aircraft shall not be used for passenger carrying missions unless the aircraft is in compliance or modified to comply with Federal Aviation Administration (FAA) airworthiness standards (4).

Commercial Derivative Transport Aircraft (CDTA) is any fixed- or rotary-wing aircraft procured as a commercial Type Certificated off-the-shelf non-developmental item. These aircraft are used primarily for the transport of passengers (6).

A ***Dual Use*** item is machinery, technology, etc., having both civilian and military applications.

A ***"Green" Aircraft*** refers to an aircraft, or that part of the aircraft, that is common with the commercial version (7).

2.3   Scope

Figure 2.3-1 depicts a context for CDA programs based on the definitions above.

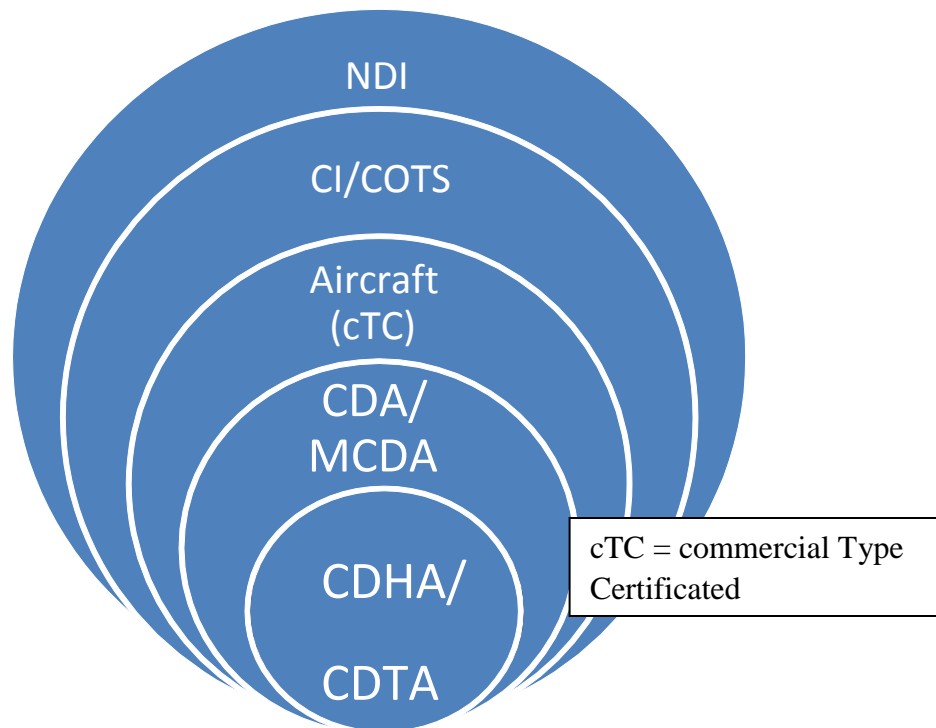
cTC = commercial Type Certificated

Figure 2.3-1 Genealogy of Commercial Derivative Aircraft (CDA)

The primary focus of this guide is on programs involving CDA (also referred to as MCDA) derived from non-developmental, unmodified (COTS) commercial aircraft (the "green" aircraft), with original Type Certificate, and encompassing minor and major modifications to these aircraft to meet military mission requirements (referred to as either commercial derivative hybrid aircraft (CDHA) or commercial derivative transport aircraft (CDTA)). This guide addresses both fixed- and rotary-wing aircraft programs. As appropriate, it also addresses CDA programs involving commercial development (dual use) and other unique derivations of commercial aircraft. Throughout the guide the general term CDA will be used to represent these unique derivations as well as the various types of CDA described above (MCDA, CDHA, and CDTA).

The application of the guidance provided herein to the integration of commercial items or commercial derivative items on military aircraft or to other commercial derivative vehicle programs may be considered but is not the primary objective of this guide.

2.4   Usage

This guide provides a comprehensive set of guidelines to assist defense planners and program implementers in the execution of CDA programs. The guide assumes users are Defense Acquisition Workforce Improvement Act (DAWIA) certified at level 1 or higher for program management or other related acquisition specialties. While it is written primarily for an Air Force audience, the guide should be useful for all military services involved in CDA programs.

The primary users of the guide should be program managers and program teams, but it is also to be used by those representing the user, test, and logistics communities and the Service and OSD staffs on the CDA program. In the end, the success or failure of a CDA program – as is the case in any DoD acquisition program – depends on teamwork and a common understanding and approach to program challenges.

The guide is designed to be used as both a *text book* for general guidance on the subject as a whole, as well as a *cook book* for reference to specific guidance in one or more individual sections. CDA program teams – and especially CDA program managers – should study the entire guide to fully appreciate the potential complexities and challenges of CDA programs. Program managers should use the guide as a checklist to ensure their acquisition strategies are thorough and executable and provide acceptable risk management. Program teams and participants should use the various sections for planning and execution of their respective responsibilities through all phases of the acquisition life cycle.

In addition to material collected during interviews, some of the material used in this guide is derived from the list of references in Appendix B. These references are cited in the guide as (#) with # being where the reference can be found in Appendix B.

3.0 FUNDAMENTALS

3.1 General

> **MAJOR THEMES:**
> - CDA programs are unique/different
> - CDA requirements can come from many sources
> - Requirements assessment is most critical to CDA program strategy
> - Managing expectations is essential to success
> - CDA programs require the same discipline as traditional DoD development programs
> - The closer the requirements are to the "green" aircraft the better
> - There is limited trade space in commercial designs

➢ *Why is this important?*

Remember: the acquisition of Commercial Derivative Aircraft (CDA) *is* different.

- It is a different marketplace.
- Familiarity with Federal Aviation Administration (FAA) regulations and processes is necessary.
- A different approach to requirements, data, and sustainment is required.

CDA programs span a wide range of complexity dictated largely – but not necessarily solely – by the extent of the modifications to the "green" aircraft. The Defense Science Board defined eight levels of CDA based on development maturity and levels of modification required to meet user requirements (3). The exact scale is not important – just consider that CDA range from the VIP/Special Airlift Mission (SAM) fleet to the Airborne Laser (ABL). Within that range is a wide variety of potential missions: transport; refueling; training; intelligence, surveillance, and reconnaissance; warning and control; search and rescue; even weapons delivery. No matter how one describes the range of CDA programs and the variations within that range, be sure of two things: First it will be non-linear, i.e., as one moves from passenger transport (maximum commonality with the "green" aircraft) to weaponized systems (minimum commonality with the "green" aircraft) the program complexity will increase dramatically; second, the probability of under-estimating the scope and risks of the CDA program will also increase.

➢ *What's different?*

CDA solutions have sometimes been "issued" by the headquarters, Congress, and other senior leaders—most of which were not based on traditional acquisition techniques. In these cases the solution may have driven the requirements and/or required compromises to the requirements.

COTS vendors are driven by today's fast-paced market (characterized by highly volatile business strategies and market positions), not by the government program team, which may have little, if any, impact on vendor behavior. This can result in inconsistent and short term product

availability, obsolescence of components, and unplanned integration and testing requirements (8).

The difference between integrating commercial items and developing a custom capability is fundamental**.** In traditional DoD development, the program directs the behavior of system components and the interfaces among components. Program teams using commercial items may have little insight into how the commercial items are put together, how they behave, and why. Identifying the assumptions of commercial items and developing a strategy for working with (and around) these assumptions makes integration challenging (2).

Finally, using commercial items means that many acquisition activities are repeated throughout the life of the program*.* In some sense, system development and sustainment activities merge. The opportunity to enhance system performance or capabilities through rapid technology insertion is one of the motivators for using commercial items. Some form of re-planning and re-engineering will be ongoing throughout the life of the system (2).

➢ *What to watch for.*

A CDA acquisition program may be quicker, but don't go into it thinking that it will be easier than a traditional mil-spec development. CDA programs require the same skills and discipline as traditional DoD development programs.

Beware of the possibility of a disparity between the technical description (requirements) and the public description. Leadership and advocates may get out ahead of the process and commit to a CDA approach before user requirements are fully understood and reconciled.

A study entitled "Commercial-off-the-Shelf (COTS): Doing it right" identified the following *cautions* when considering a commercial solution (8):

- As a weapon system may be in the inventory for up to 40 years or longer, there must be technology refresh and insertion points. Vendors may go out of business, merge with other companies, and drop products—sometimes without any warning. As a result, change is a constant. To cope, programs may require a separate funding line for technology updates so the program can insert newer, higher-performing, and often less-expensive components. The rate of change, coupled with many different configuration permutations, requires that programs pay increased attention to configuration management.

- COTS systems or components may not be designed to meet all military environmental requirements. Some parts may still have to be "militarized" to function properly in the required military environments or may react differently in a military environment. Additionally, after a component is qualified, vendors may substitute parts with little or no notice, thus requiring requalification.

- "Color of money" conflicts can create problems. For example, COTS modifications may be bought with procurement dollars but may need some developmental testing, and the developer is not able to use procurement dollars for Developmental Test and Evaluation.

- The use of COTS items can also affect other system aspects. Processes such as maintenance and training can be affected. If the decision is made to maintain FAA certification, the maintenance and training will have to be done in accordance with FAA, not DoD or individual service, procedures.

- Most of the personnel and organizations in the DoD acquisition community, both within the government and the private sector, have years of experience developing requirements-driven, specification-constrained, custom-designed and built components and systems. Now, with potential CDA acquisitions, they are asked to incorporate constantly evolving, market driven, commercial systems. In many cases, this fundamentally changes the work these personnel do and how they do it.

In addition, the Defense Science Board (DSB) noted several other areas where CDA programs can run into difficulties (3):

- Programs are driven by perceived urgency that leads to unrealistic timelines and underestimated costs. There is a lack of adequate personnel experience or expertise, on both the government and the prime contractor staffs. The lack of personnel, time, and funding to carry out adequate systems engineering and programmatic analysis of alternatives is especially noticeable. This lack of planning results in post-award changes that severely limit the potential benefit of using commercial-derivative systems.

- Many government requirements (i.e., the Berry Amendment, Naval Vessel Rules, and so on) directly contradict design and manufacturing trends today. All of these things must be considered and addressed when buying commercial- or government-derivative systems.

- An additional factor is poor contractor team communication. A lead system integrator (LSI) working with an original equipment manufacturer (OEM) must have excellent management personnel, with knowledge and experience of the systems to be constructed. In the same vein, the equipment manufacturer needs to have a solid understanding of the government's expectations and processes.

Table 3.1-1 summarizes the challenges identified by recent studies and current practitioners of commercial acquisitions in the DoD. These challenges will be discussed in more detail in the following chapters and sections of this guide.

Table 3.1-1 Frequently Cited Challenges in CDA Programs

Budgeting	Congressional Mandates
Pricing	Inflexible Requirements
Requirements Creep	Testing
Lack of Commercial Experience	Airworthiness Certification
Technical Authorities	Unrealistic Cost Estimates/Schedules
Data Rights	Funding Constraints ("Colors" of Money)
Source Selection Criteria and Basis for Award	

> ➤ *What to do.*

Use of commercial items offers significant opportunities for reduced development time, faster insertion of new technology, and lower life cycle cost, owing to a more robust industrial base. Maximum use of mature technology provides the greatest opportunity to hold fast to program cost, schedule, and performance requirements and is consistent with an evolutionary acquisition strategy. However, no matter how much of a system is provided by commercial items, you must still engineer, develop, integrate, test, evaluate, deliver, sustain, and manage the overall system. Particular attention should be paid to the intended usage environment and understanding the extent to which this differs from (or is similar to) the commercial usage environment; subtle differences in usage can have significant impact on system safety, reliability, and durability.

Work with the user to define and, if necessary, modify capability needs to facilitate the use of commercial items. This includes hardware, software, interoperability, data interchange, packaging, transport, delivery, and automatic test systems. Within the constraints of the described capability needs, require contractors and subcontractors to use commercial items to the maximum extent possible.

The OSD guide on commercial item acquisition offers the following lessons learned and considerations (2):

- There is no single set of rules that covers the broad range of possibilities. Deciding how commercial items affect a specific program depends on the degree to which the program intends to use commercial items, the extent to which introducing the commercial item alters the physical characteristics of the system, and the complexity of integrating commercial and custom DoD items. There may be several competing approaches, and the program team must determine which is most appropriate. Regardless of the approach selected, some common fundamentals have been observed in programs that have used commercial items.

- First, increased reliance on commercial items implies a different paradigm of system acquisition. The most fundamental change involves the dynamic interaction among the system context, the system architecture and design, and the commercial items available in the marketplace. Managing this interaction requires unprecedented cooperation among the program team, the stakeholders, the contractor, and in many cases the vendor, in order to affect the tradeoffs necessary to keep the program on track.

- All programs benefit from close working relationships among the various parties. Unfortunately, many programs (including those making use of commercial items) continue to follow a model akin to the traditional model where an attempt is made to fully specify requirements before design alternatives and marketplace exigencies are considered. If a program is to maximize its opportunities to benefit from the commercial market, then marketplace technologies, products and dynamics must influence many aspects of the system context (including requirements), the architecture and design, and the acquisition strategy. In short, the goal in design of a commercial-based system must be to adapt requirements to the capabilities available in the marketplace rather than adapting commercial capabilities to military requirements.

- Second, the marketplace, not the program, drives development of the commercial item. Development of commercial items is driven primarily by the vendors' perceptions of what will sell to the largest number of potential users. Strive to conform to the behavior of the other buyers in the marketplace, and then exert control by managing and verifying requirements in a manner that optimizes the use of commercial items—often by adopting the requirements of the other buyers as closely as is practical. Market research must be performed to evaluate the capabilities of available commercial items, the performance of vendors, and the relative size of the program to the vendor's business base. Business relationships should be established with contractors and vendors to ensure that program needs are communicated in a manner that maximizes the program's leverage. Finally, the system should be engineered to accommodate market-place-driven changes to commercial items throughout the system life cycle.

- Numerous acquisitions have stumbled for lack of careful consideration of the above fundamentals. However, there are logical remedies to the unique risks imposed by commercial items—and those risks, when addressed correctly, can be far outweighed by the benefits.

- As a first step in identifying and mitigating these risks, understand the lessons learned by similar programs and determine how these experiences can enhance program acquisition.

In addition, consider the following practices:

- Carefully manage expectations especially early in the program. There may be a gap between the senior leader "advocate" and the operational requirements. A lot of work may be needed to adjust or control expectations (requiring both time and budget).

- As an adjunct to the preceding practice, keep the chain of command engaged. Make sure the folks on the program team understand, meet and know the chain of command.

- Know the Original Equipment Manufacturers (OEMs), their capabilities and how to get them to respond to government needs.

- BE ADAPTABLE – There are no clear cut instructions for a CDA program. A lot depends on the OEM.

- Get the FAA involved sooner and have the program team understand certification processes and issues.

- Tailor current Acquisition regulations, when possible, or secure appropriate deviations. The regulatory structure is ill-suited to deal with a true CDA.

- Pay attention to your service's "technical authorities" (as defined in (3)). They are unusually important in CDA programs. Understanding data requirements and test (upfront) is necessary to properly scope the effort.

3.2   Statutes and Regulations

MAJOR THEMES:
- More, not less, guidance applies to CDA programs
- Policy on CDA acquisition continues to evolve
- There is a unique, additional set of guidance in the Federal Aviation Administration (FAA) Federal Aviation Regulations (FARs)
- There are multiple statutes on the use of Commercial Items and practices in DoD
- Specific Service regulations apply (e.g., AFI 63-101)
- ICAO and ITARS policies address foreign built products

➢ *Why is this important?*

On top of the normal guidance for a program manager, a CDA program has unique, additional guidance – both statutory and regulatory – which must be understood and addressed. The statutory guidance is summarized in Appendix C.

The acquisition of foreign built products offers another large area of policy and guidance to be considered: International Civil Aviation Organization (ICAO) regulations. The ICAO Council adopts standards and recommended practices concerning air navigation, its infrastructure, flight inspection, prevention of unlawful interference, and facilitation of border-crossing procedures for international civil aviation. In addition, the ICAO defines the protocols for air accident investigation followed by transport safety authorities in countries signatory to the Convention on International Civil Aviation, commonly known as the Chicago Convention. Also, the acquisition of foreign built products can invoke statutory and regulatory provisions dealing with source restrictions.

Additionally, in each agency there is a body of regulations and guidance which addresses CDAs. In the Air Force, for instance, AFPDs 62-4 (6), 62-5 (4) and 62-6 (9) along with AFI 21-107(10) provide specific guidance and requirements.

> ➢ *What's different?*

If the aircraft is to maintain its Type Certificate, the lengthy and very explicit Federal Aviation Regulations (FARs) govern the processes by which commercial aircraft are certified and maintained according to FAA governance procedures. Further, the FARs and FAA implementing offices also set the standards and requirements which govern long-term support activities for these commercial systems. See Appendices D and E and Section 5.6 for further discussion of FAA certification.

The FAA Military Certification Office (MCO), in Wichita, KS, interfaces with government CDA programs. The MCO, staffed by FAA experts, is charged with assisting CDA programs with certification, as well as advising on certification of modifications (Special Type Certificates) to CDAs. Additionally, the MCO provides support to CDA programs establishing maintenance and support requirements and procedures in terms of their safety of operation. The MCO CANNOT become involved in certification aspects of military mission operations of CDA systems since this exceeds their charter.

> ➢ *What to watch for.*

Existing law (the Federal Acquisition Reform Act (FARA) and the Federal Acquisition Streamlining Act (FASA)), the Federal Acquisition Regulation (the other FAR), and the Defense Federal Acquisition Regulation Supplement (DFARS) address a preference for acquiring commercial systems when such systems meet the needs of the military and other government agencies. However, recent trends show a migration away from commercial practices in favor of the more bureaucratic procedures associated with traditional DoD development programs. Indeed, the DFARS (revised in April 2008) at 234.7002(a), states that a DoD major weapon system (expected eventual RDT&E over $300M (FY 1990 constant dollars) or expected eventual procurement over $1.8B (FY 1990 constant dollars)) may be treated as a commercial item or acquired under procedures established for the acquisition of commercial items, *only if a SECDEF or DEPSECDEF determination is made, the offeror has submitted sufficient information to determine price reasonableness on the basis of price analysis, and the Congressional defense committees are notified. DFARS 234.7002(b) and (c) permit subsystems and components of major weapon systems (other than COTS) to be treated as commercial items only if the major system satisfies the above requirements or the contracting officer determines in writing that the item is a commercial item and the offeror has submitted sufficient information to evaluate price reasonableness through price analysis.* In terms of the Federal Acquisition Regulation this is a migration away from Part 12, Acquisition of Commercial Items, to Part 15, Contracting by Negotiation. The reason for this change is primarily to gain the additional cost and pricing support data provided along with contractor proposals so that negotiations will yield an expected lower price. Past use of commercial practices, in some cases, is suspected to have provided contractors with profits in excess of those the government normally expects to pay.

For over 60 years, the federal government has enforced laws restricting the export of certain goods, technologies and information. There are two main sets of laws: the Export Administration Regulations (EARs), administered by the U.S. Department of Commerce, and the International

Traffic in Arms Regulations (ITARs), administered by the U.S. Department of State. Restrictions on transactions with certain specific proscribed and embargoed countries under U.S. and United Nations embargoes are enforced by the U.S. Department of Treasury through its Office of Foreign Assets Control (OFAC) and by the Department of State through its Directorate of Defense Trade Controls (DTC). OFAC maintains the list of foreign countries against which the United States has issued economic or trade sanctions, as well as lists of suspected terrorists, drug traffickers or others engaged in illicit activities.

➢ *What to do.*

Being aware of, and conversant with, the myriad of guidance applicable to CDA programs is only the first step for the program team. The real job is one of understanding those regulations which must be precisely complied with; those regulations which permit tailoring, choice among options, or waivers; and those regulations which may not apply at all to the program being worked. For instance, higher headquarters may insist that FAR 15 rules must be utilized to obtain adequate cost and price support data for negotiations and price setting, even though the program is essentially a commercial product acquisition.

The CDA program team, including users and maintainers, should be thoroughly knowledgeable of the Federal Aviation Regulations (FARs) as well as the assistance to be obtained from the FAA in setting the technical and operating standards for the CDA program.

Be aware of ICAO, ITARS and OFAC restrictions. Also be aware of requirements emanating from Buy American Act, Berry Amendment, and other related source restrictions.

3.3   User Requirements

> **MAJOR THEMES:**
> - There are many different types of users
> - User Requirements *should* determine whether (and which) CDA solution is applicable
> - Sometimes a pre-determined CDA solution drives requirements
> - Requirements must be flexible in CDA programs
> - More requirements trade space is needed in CDA programs than in traditional DoD development programs

➢ *Why is this important?*

As in any DoD acquisition program, requirements definition and subsequent stability are key to program success. In programs considering a CDA approach, requirements definition and the ability to adjust requirements to match or closely match the capabilities of the "green" aircraft are absolutely critical to making the right decision on whether to pursue a CDA solution. The closer user requirements remain within the capabilities of the "green" aircraft, the lesser the program risk and the higher the probability of success. Also, locking user requirements early can save considerable cost and schedule by possibly allowing the modifications to be made on the Original Equipment Manufacturer (OEM) production line.

➢ *What's different?*

CDA solutions are sometimes "issued" by a higher authority and appear non-negotiable. In these cases, the solution may drive the requirements and/or require compromises to the fundamental requirements. Often in these cases, the exact aircraft is appropriated and requirements are "backed into."

Remember that commercial aircraft were built to meet a different set of requirements than military; this means thinner technical margins. The commercial approach is to design for a narrower operating environment. The smaller the operating band, the lower the cost will be for that item. In contrast, many military requirements cover a wider set of (and often more severe) operating environments. The lesson to be learned here is not to expect to get everything and still meet budget and schedule.

Requirements must be considered flexible, especially early in the acquisition of a COTS-based system. It is necessary to achieve trade-offs between system requirements and the marketplace. Requirements need to be sufficiently flexible to accommodate differences between government and commercial practices.

➢ *What to watch for.*

If using a CDA, make sure the baseline is close enough to the requirements so that a major redesign is not required. Even though it might be possible, the resulting modified aircraft and its lack of growth potential may be disappointing.

Talk with the real users to understand what triggers requirements. The Joint Requirements Oversight Council (JROC) process may provide an Operational Requirements Document (ORD) that specifies what is needed on the aircraft, but many times the end users' needs do not make it through the process. There are too many folks between the end users and the CDA program team. The Joint Capabilities Integration and Development System (JCIDS) process now in place is "cumbersome" for CDA. CDA programs are not usually staffed to work JCIDS.

Unique military requirements exist because a particular component may need to work under greater extremes of temperature or vibration than are necessary in the commercial environment. The more the requirements deviate from commercial versions, the more costly and less likely there will be a commercial solution. Commercial products are often too generic and frequently not suited for defense systems with high performance requirements and exposure to severe environments. This reality suggests that the establishment of military requirements needs to go hand-in-hand with a thorough understanding of the capabilities and limitations of commercial products and technologies. It is becoming increasingly impractical to design systems that operate at the most extreme environmental conditions (that is, temperature, humidity, shock and vibration). There needs to be a three-way tradeoff in the requirements generation process among performance, cost, and commercial availability.

➢ *What to do.*

Establish requirements very carefully. Keep it simple – have fewer requirements and Key Performance Parameters (KPPs). Scrub requirements before opting for CDA to determine if requirements are equivalent to – or within reasonable technical reach of – the commercial application or are flexible enough to accommodate the CDA solution.

Maintain a flexible view of requirements and business practices. Identify all of the stakeholders and involve them early. Pare down stated requirements to reflect only essential stakeholder needs (3).

Ensure that users of the items are involved early in the acquisition process and understand the nature, potential limitations, and advantages of modified commercial and non-developmental items. Only in that way can the user and acquisition community maintain the flexibility that is needed in establishing requirements to make effective use of the modified commercial or non-developmental item (11).

Lack of involvement of the real end users in requirements formulation, trade-offs, etc. can lead to significant problems. However, the use of outside experts to help shape the requirements may be beneficial. During requirements definition, consider employing external experts who understand the ramifications of adopting new processes. These experts are able to assist the program team by setting expectations as to what the philosophy and approach can and cannot do as well as providing information as to the products in the marketplace. Typically, users of legacy systems create requirements that ensure that a new system performs in the same way as the existing legacy system. External experts will, with credibility, question those legacy requirements.

3.4 Market Research

> **MAJOR THEMES:**
> - Market research is necessary and essential
> - Market research should be continuous and diverse
> - There are many resources for conducting market research
> - Use surveys and feedback from current commercial users
> - Validate Original Equipment Manufacturer (OEM) claims

➢ *Why is this important?*

Market research is the key to determining whether a need can be met by a commercial or non-developmental item. Market research identifies what products are available in the commercial marketplace, and under what terms and conditions they can be acquired.

Market research is a primary means of determining the suitability of commercial items and the extent to which the interfaces for these items have broad market acceptance, standards organization support, and stability. Market research supports the acquisition planning and

decision process, supplying technical and business information about commercial technology and industrial capabilities.

> ➢ *What's different?*

On commercial programs, the government has to do its own market research and commercial "pricing" since there is frequently limited or no cost and price support data or price history data provided by the contractor. There is, however, a wealth of commercial marketing literature available on most products covering technical and delivery practices and capabilities.

> ➢ *What to watch for.*

There may be difficulty in getting adequate data from which to negotiate a fair and reasonable price per Federal Acquisition Regulation (FAR) Part 12 rules.

Do not rely exclusively on contractor marketing claims as these are often exaggerated. Use surveys and feedback from current commercial users.

> ➢ *What to do.*

Conduct market research as follows:

- Identify key functional/performance and mission environment characteristics, and schedule and quantity requirements from user need statements.

- Identify product attributes, industry production and delivery capabilities, and commercial business practices from market research activities (literature, product symposiums/conventions/trade shows, market rep. visits).

- Compare the market research and needs information to make a commerciality determination.

- Recommend an acquisition strategy using commercial business practices information if warranted.

Continue market research, tailored to program needs, throughout the acquisition process and during post-production support. FAR Part 10 requires the acquisition strategy include the results of completed market research and plans for future market research (12).

In addition, the DSB Task Force on Integrating Commercial Systems into the DoD recommends the following (3):

- Conduct market research independent of the contractor.

- Identify all significant commercial players in the relevant application area.

- Participate in the relevant conferences, trade shows, and user, professional, and standards groups.

- Search worldwide, across all foreign and commercial products for related processes and products to find timely solutions and minimize development time and cost. The use of competitive evaluations, including testing and modeling, is a key step in this process.

3.5 Acquisition Strategy

MAJOR THEMES:
- Acquisition strategy is just as critical on CDA programs as it is on traditional DoD development programs
- Consider military service life, Diminishing Manufacturing Sources (DMS), obsolescence, commercially driven changes and eventual loss of the commercial customer base
- Be sure there is a thorough, written definition of what is to be acquired
- Establish and maintain performance, cost and schedule baselines
- Consider state-of-the-art vs. state-of-the-practice differences
- Consider total system operation and support, including predicted costs and delivered value to the user
- Determine if any pre-contract testing, try-out, inspection or other "hands on" activity will benefit the overall program
- Get buy-in from the chain of command

➤ *Why is this important?*

To consider, and then employ, a commercial product to fill a needed military requirement is, in itself, a major part of an acquisition strategy. CDA are widely thought to lead to faster deployment, reduced costs and reduced risks compared with traditional DoD development programs, which is why CDA are often acquired. The elements of cost, schedule, risk and performance are the building blocks of an acquisition strategy, and CDA bring their own unique considerations and opportunities to acquisition strategy development.

➤ *What's different?*

Support of a CDA which "outlives" its commercial counterparts in terms of continued, long-term use (and thus "outlives" the commercial marketplace for the underlying "green" aircraft) can run a higher risk of parts obsolescence and/or diminishing manufacturing sources. This area of risk must be planned for in the acquisition strategy. If contractor support (Original Equipment Manufacturer (OEM) or a principal subcontractor) is expected to vanish prior to the expected life of a CDA system, then the acquisition strategy must consider acquiring delivery of and rights in any technical data or software necessary to enable extension of support as long as required.

There are known drawbacks to selecting commercial systems to fulfill government needs. Obsolescence can become a problem if the basic commercial system continues to be upgraded by the OEM over the years of its use but the government foregoes these updates or upgrades. Similarly, constant changes to commercial software baselines may drive out-of-date, and potentially unsupportable, software in a government system which has not incorporated the updates as they are developed. The acquisition strategy for an evolving commercial product may need to include negotiating licenses, subscribing to product updates and technical documentation, and taking a very long view of the system support relationship with the OEM(s).

> ➤ *What to watch for.*

The Defense Science Board Task Force on Integrating Commercial Systems into the DoD (3) defines eight "levels" of commercial systems. These levels extend from the foundation of buying a commercial product and using it "as is" to specifying and purchasing a product that does not yet exist, but requires commercial development and utilizes commercial plants and processes. An accurate and complete understanding – along with a thorough, written definition – of what is to be acquired is truly essential for creating a viable and success-oriented acquisition strategy. It starts with requirements definition, and nothing is more important to program planning than agreeing on not only a performance baseline, but also on estimated cost and schedule baselines, which are deemed to be achievable and based on high confidence, independent estimates.

Even in the commercial world there are both state-of-the-art and state-of-the-practice type products. Developing a strategy that relies on the latter is much more likely to reduce program risks and ease the integration of military-unique features. Past CDA program failures have demonstrated the difficulties created by requiring multiple state-of-the-art capabilities to be integrated on existing commercial platforms. "Gold-plated" or technology-reach requirements often lead to program problems and even failures, while sticking to state-of-the-practice type requirements enhances potential program success.

Be aware that in the commercial world, products are designed with marketability as the primary concern. Some government "requirements" that give little or no consideration to cost (e.g., source restrictions on materials and components) are not considered in the commercial design and development process but must, as a mandatory legal matter, be considered, reconciled, and complied with in the acquisition strategy development for a CDA.

Acquisition strategy development must always consider total system operation and support, including predicted costs and delivered value to the user. Cost of operations and support (O&S) is critical to user satisfaction, and an independent assessment of the O&S costs should be part of any program planning and budgeting process. Failure to recognize the costs of O&S early in a program can lead to funds reallocation resulting in smaller fleets or the inability to modernize an existing fleet.

Upper-level management needs to understand the advantages and disadvantages of a CDA approach, and they have to support the effort with resources. They have to understand that they are buying into a different process.

> ➤ *What to do.*

Remember, the commercial business model works well because market pressures compel economically rational decisions leading to continuing innovation, minimal waste and increased technical sophistication. Commercial products are adaptable out of necessity, are designed to be competitive, and usually decrease in cost as they are produced in rising quantities. Therefore, acquisition strategies which seek to take advantage of commercial systems may do so if the true

and total basic program requirements which the government poses are met in a commercial system or systems.

The Army Aviation and Missile Life Cycle Management Command (AMCOM) Competition Management Office (CMO) (13) suggests using a decision tree to assist the strategy analysis. Always start with the need and market research information. Compare it to the key definitions and make a determination if a CDA approach should be considered in the strategy. Always be sure to document the contract file with the determination and rationale.

The Defense Science Board Task Force on Integrating Commercial Systems into the DoD (3) recommends that the following elements be considered in the strategy:

- Require early Systems Engineering and Programmatic Analysis of Alternatives (SEAPA). An effective SEAPA process will ensure that the properly evaluated cost and schedule (including sustainment and life cycle costs) are firm requirements, along with performance, before Milestone B.
    - Effective implementation of SEAPA would incorporate routine planning for "blocks" to implement incremental development. This allows the injection of new technologies with low risk and matures system performance. Establishing a timeline for insertion as part of the acquisition strategy allows feedback from users, maintainers, and technologists, and can keep the program on track.
- Recognize that some flexibility of technical and performance requirements – including certification – is needed to effectively and affordably balance schedule, cost, and performance. Strategies include the use of Other Transaction Authority (OTA), innovative ownership and licensing of intellectual property, incremental "block" development, and the application of a modular open systems approach (MOSA). Strategies also include extended opportunities for competition (for example, by eliciting "bid samples" for commercial items), updating import regulations, and including test and evaluation methods with initial procurement planning.
- Plan for life cycle sustainment up front. This includes doctrine, training, and testing. Sustainment over the life cycle of the system (and beyond) should be considered in selecting commercial systems. Toward this goal, commercial manufacturers may provide warranties and offer performance-based logistics plans. Acquisition officials should state in the request for proposals that the system will receive scheduled technology refreshment rather than assume a system is frozen in the original configuration.
- Involve the test, evaluation, and qualification community early in the process.

Acquisition strategy planning should determine if any pre-contract testing, try-out, inspection or other "hands-on" activity will benefit the overall program. Generally, existing commercial products can be made available by the OEMs to assist the procuring activity in their market research or product familiarity activities. These assessments can either verify or debunk contractor marketing claims and can provide part of the basis for source selection decisions.

Always consider whether and to what degree there is a developmental or test component to the CDA program which may require different fund types or different contract types (or perhaps different type line items within a contract). Consider, as well, potential legal issues that may present themselves in a CDA program (see section 3.9), and make every effort to anticipate, plan for, reconcile, resolve, and/or avoid, these matters in the development of the acquisition strategy.

Competition, or the lack thereof, is a central feature of CDA acquisition strategy development. When adequate competition for a given military capability exists, the ease of obtaining contractor cooperation is greatly magnified. For instance, needed technical data on commercial systems can usually be obtained inexpensively by the government under competitive conditions but is very difficult and highly expensive to obtain under sole source conditions. Therefore, acquisition strategies, even in the CDA world, should incorporate competition, even going so far as challenging requirements which lead to sole source dilemmas. Early user involvement can greatly aid in this activity.

At times, more than one government agency may be in discussions with an OEM to procure the same commercial aircraft (e.g., Boeing 737). If this situation is encountered, attempt to consolidate requirements with others and create a way to make the buy for the consolidated requirements rather than using a piecemeal approach.

Significant changes in requirements should include revisiting the CDA marketplace, the CDA business case, and the current acquisition strategy.

3.6   Analysis of Alternatives (AoAs)

> **MAJOR THEMES:**
> - Follow current AoA guidance; do the AoA early
> - Conduct AoAs that consider both developmental and non-developmental options
> - Develop a life cycle cost estimate for each alternative
> - Evaluate requirements trade-offs

➢ *Why is this important?*

Analysis of Alternatives (AoA) is often overlooked in some CDA programs because the CDA platform might be dictated in legislation or in a set of requirements fitting only one platform, or in the circumstance where there is only a single product from a sole source supplier. However, when the statement of needed capabilities is sufficiently broad to permit multiple solutions to be considered, the AoA process is extremely valuable to formulating the acquisition strategy.

➢ *What's different?*

The DSB Task Force on Integrating Commercial Systems into the DoD (3) points out that AoA or Systems Engineering and Programmatic Analysis of Alternatives (SEAPA) should consider COTS/GOTS commercial- or foreign-derivative components or systems well prior to Milestone A decisions.

➢ *What to watch for.*

The need for fundamental systems engineering in large defense systems is well documented. An important aspect of systems engineering occurs pre-Milestone A, where an analysis of alternatives considers programmatic needs and available technologies, and trades off performance, schedule, and cost. The degree to which this step is carried out is a reliable indicator of program success (3).

➢ *What to do.*

Consideration of COTS/GOTS commercial- or foreign-derivative components or systems should be a logical part of the analysis of alternatives and pre-Milestone A generation of requirements. This includes a comparison of tradeoffs among existing, modified existing, and new designs, and among available DoD, commercial, and foreign components and systems. Tradeoffs may arise from cost, schedule, certification regimes, risk, and estimates of "operational usefulness" and "supportable" mission performance in various concepts of operation (3).

3.7   Concept Definition

MAJOR THEMES:
- Reconcile user requirements with commercial system capabilities
- Conduct product demonstrations/evaluations
- Assess existing support infrastructure
- Finalize data, test, and sustainment strategies

➢ *Why is this important?*

Once a CDA solution has been determined to be viable through Market Research (3.4) and Analysis of Alternatives (3.6), it is important to define a system concept, a technical approach (required modifications to the "green" aircraft) to establish technical and test requirements, and a strategy for life cycle management. Concept definition provides the basis for risk management (3.8) and – along with the Acquisition Strategy (3.5) – for program planning and execution (Chapter 4).

➢ *What's different?*

Unlike traditional DoD development programs where a solution is derived to meet the validated user requirements, if a CDA approach is considered viable there must be a concerted effort to match user requirements to the COTS/NDI product. In an ideal world – and in the preferred (lowest risk, lowest cost) CDA approach – the user requirements would fall within the capabilities of the COTS product. Unfortunately, this is rarely the case for DoD CDA programs; hence the term Commercial Derivative Aircraft. Concept Definition then is the phase when the user requirements or the COTS product or both are modified to satisfy basic user needs. The rigor and buy-in to this process determines the feasibility and probability of success of the CDA solution and CDA acquisition program.

> ➤ *What to watch for.*

Look for aircraft that closely match the mission of the military requirement. Many times COTS platforms are selected with a hope to make major modifications to meet the ultimate requirements. The closer you can keep requirements to the "green" aircraft the better.

It is important to determine how significant the program is to a specific vendor as part of the market research. This knowledge can be used to establish an appropriate relationship with the vendor. In some cases, the vendor can be influenced to be responsive to unique program needs (e.g., by incorporating new features into the commercial item). At the same time, DoD's unique requirements and expectations will not always sway the vendor. In this case, revisit requirements and expectations to make sure they are absolutely necessary and, where appropriate, work to adjust them to allow the use of commercial items.

> ➤ *What to do.*

The DSB Task Force on Integrating Commercial Systems into the DoD discusses the following steps when conducting concept definition (3):

- Determine the gap between the capabilities and services provided in the marketplace and those required by the system.
- Include the vendor in tradeoff discussions when possible.
- Provide incentives to encourage the contractor to investigate all solutions that lead to the appropriate outcome.
- Resist modifying the commercial item.
- Plan for a life cycle support system for any modified commercial item.
- Plan to make repeated tradeoffs among the system context, the architecture and design, and the capabilities in the marketplace.
- Document all tradeoffs made.
- Provide early functional demonstrations to get stakeholder buy-in.

3.8   Risk Management

> **MAJOR THEMES:**
> - A robust risk management process is critical
> - Follow current guidance
> - Risks must be shared by all stakeholders
> - Risks may be different for CDA programs

> ➤ *Why is this important?*

Commercial derivative aircraft programs, just as traditional DoD development programs, have programmatic risks that can impact the cost, schedule and technical performance of the system being acquired. These risks must be actively managed to ensure successful program execution.

In regards to DoD acquisition, risk is defined as "a measure of future uncertainties in achieving program performance goals and objectives within defined cost, schedule, and performance constraints" (14). There are risks in every phase of a program, which must be actively managed throughout the acquisition life cycle to ensure acceptable system performance and program execution. These risks tend to increase significantly as the scope of the military modification increases and the mission diverges from the mission of the "green" aircraft.

➤ *What's different?*

From a risk management perspective, there are a number of differences in executing a CDA program. Specifically, there are more primary stakeholders in a CDA program than a traditional DoD development program. In addition to the sponsoring Major Command, government acquisition team and prime contractor; the modification contractor (often different from the prime) and the certification authority (typically the Federal Aviation Administration (FAA)) must be considered primary stakeholders. As such, their requirements, positions, and opinions must be an integral part of the program's risk management strategy.

Another key difference is the acquisition environment. In addition to the strategy considerations for traditional DoD development programs, the following must also be considered:

- Federal Acquisition Regulation (FAR) Part 12-Acquisition of Commercial Items or Part 15—Contracting by Negotiation
- DFARS Subpart 234.70 – Acquisition of Major Weapon Systems as Commercial Items,
- Single prime/integrating contractor or Original Equipment Manufacturer (OEM) and modification contractor
- Organic or CLS sustainment or some combination
- Military or FAA certification

All of these strategic decisions will influence/constrain the overall program risk management strategy.

➤ *What to watch for?*

Program timelines tend to be shorter for CDA programs than for traditional DoD aircraft development timelines. While it is normal for a large fighter/bomber/cargo aircraft development program to take many years to develop and test prior to fielding, CDA program development/modification timelines are generally much shorter. This leaves the acquisition team with less schedule trade space to recover from technical or programmatic risks that come to fruition.

The near-total dependence on commercial technology warrants careful consideration. Particularly in the avionics and mission systems areas, commercial aircraft rely exclusively on market-driven, commercial communications, computing and display devices. The rapid rate of change of digital electronic devices drives significant concern with obsolescence, long term sustainment of subsystems and diminishing manufacturing sources. Unlike traditional DoD

development programs with large development budgets, CDA programs are generally ill-equipped to develop application specific electronics unique to their needs or buy lifetime supplies of electronic subsystems/devices.

Upper-level management may not understand the risks in moving to COTS solutions. The perception is that upper-management views COTS as low risk. In fact, COTS-based solutions do entail risk simply because so much is out of the control of the system integrator (15).

For CDA programs the top risk areas tend to be:

User Requirements

One of the risk areas most often cited by CDA program managers is a set of stable, well-defined user requirements that closely match the capabilities of the commercial aircraft under consideration. The risks in this area are many. Unstable requirements can drive significant changes into the aircraft production and modification lines, cause additional test and evaluation activities, increase program cost, and stretch program schedules. Ill-defined requirements do not properly inform the Analysis of Alternatives and can lead to a non-optimum commercial aircraft selection. Similarly, requirements that diverge from the "green" aircraft mission set significantly decrease the likelihood of successful program execution.

Another requirements area of risk is inadequate or incomplete market research early in the acquisition planning phase of the program. Thorough market research allows the program team to properly scope the solicitation and target potential solutions. It also informs the verification and test planning activities.

A third area of requirements risk is tradeoffs in threshold and objective performance requirements that fail to meet the user's stated need, improperly defining the proposed system's prospective sources (commercial, modified commercial, or non-developmental) and required future design modifications (16).

Airworthiness Certification

Airworthiness certification is required for all military CDA aircraft and represents another area of significant risk – whether conducted by the military certification authority or the FAA. Specifically, FAA certification can impact program schedule as the program office has less influence on FAA manpower allocation and approval timelines. Also, the FAA's primary focus is safety, which drives conservative behavior.

Modification Management

The modification of commercial aircraft is perhaps the primary challenge for CDA program teams. This risk area increases non-linearly as the aircraft mission diverges from the "green" commercial aircraft mission.

Workforce Staffing and Training

Commercial development programs generally have smaller staffs than traditional DoD development programs. They tend not to attract the acquisition personnel primarily interested in cutting edge military technology. Also, the training for commercial acquisition is lacking across the DoD.

Acquisition Management (16)

Despite streamlining, paperwork requirements, pricing data, accounting requirements, and continuous audits of CDA programs stifle the cost and schedule objectives laid out in the acquisition strategy.

Traditional DoD developmental program paradigms and developmental program mindsets continue to reflect a cultural resistance toward implementing timely and cost-effective CDA acquisition strategies.

Lack of program manager (PM)-contractor and PM-user teaming on risk responsibility and risk sharing hampers flexibility in risk management efforts.

Programmatic micro-management by stakeholders defeats the benefits of a CDA acquisition strategy.

Technical Requirements (16)

Technical performance in commercial applications as specified in commercial item descriptions (CIDs) may not equate to or explicitly meet technical performance in military applications as stated in MIL-SPECS and MIL-STDS after a CDA acquisition strategy is already approved.

Performance specifications and standards based on form, fit, and function (that allow contractors to design solutions) instead of the "how-to" MIL-SPECS and MIL-STDS used in design and manufacturing may encounter workforce resistance or complacency.

Inadequate market research leads to acceptance of products having insufficient or undocumented technical data or CIDs with which to re-complete the procurement for future buys.

Test and Evaluation (16)

Requirements are not stable, realistic, or well-understood by designers, developers, testers, or managers.

Over-testing is conducted despite the presence of a satisfactory contractor test and evaluation data package.

Developmental and technical testing costs are saved but operational testing for operational effectiveness and suitability may involve conditions not grasped by the contractor testing program. These incomplete tests and data may be overlooked or

unquestioned in the accelerated CDA acquisition cycle and corresponding accelerated CDA testing program.

Integrated Logistics Support (ILS)

Technical data packages may be unavailable or incomplete, which creates instability of spares and parts access (16).

Competitive re-procurements of parts may not contain proper incentives to attract spares and parts vendors (16).

ILS and a system life cycle focus may be overlooked during the requirements development stage (16).

Use of military standard and nonstandard parts may create multiple parts and spares lines (16).

Depot and repair levels may not be defined in terms of operational environments (16).

There are several other challenges that may drive ILS risk:

- Depot activation
- Managing public-private partnerships
- Data rights (drawings, re-procurement packages)
- Supply chain management (often outside traditional DoD systems)
- Commercially formatted technical data
- Commercial maintenance strategies

➢ ***What to do.***

The program's risk management efforts should emphasize teaming and risk-sharing to properly allocate risk to the stakeholder(s) most capable of mitigating the risk. The risk management processes and reports should be in a consistent format across the entire team. This common format allows uniform quantification and facilitates a common understanding of specific risk areas. The integrated product teams should jointly execute the risk management strategy.

Measures of performance for risk handling should be included in the Government's Risk Management Plan (RMP). Trade-offs should be considered primarily when current systems exist to sustain the force until the CDA system is fielded. Contractor RMPs should be specified in solicitations as a deliverable. These should be consistent with the Government RMPs. Risk sharing should be emphasized in contracts and monitored by the DoD/contractor team through integrated product teams (IPTs) (16).

While the risks of acquiring commercial systems differ somewhat from the risks of a traditional DoD development program, a disciplined, robust, risk management process can work well in either acquisition environment. Also, since there are risks throughout a program, all members of

the program team should understand the organization's risk management process and participate in their areas of responsibility.

Effective risk management results from having a disciplined, repeatable process that the acquisition workforce understands and incorporates into the daily execution of the program. The process should provide a framework for balancing cost, schedule, and performance requirements within a program's trade space. Since there are risks in every phase of acquisition, risk management should begin at the very inception of an acquisition program. In fact, teams should include risk management in the pre-Milestone A phase during the Analysis of Alternatives and market research activities. A robust risk management program should continue throughout the program's life cycle as programs continue to face risk through the Operations and Support phase and even into the Disposal phase. A risk management process is most effective when it has recurring senior leadership attention and is fully integrated into the program review, oversight and systems engineering processes.

While there are numerous examples of specific risk management processes in use by government and industry teams, they generally share a common set of sub-processes. These common sub-processes include a risk identification phase, followed by an analysis and planning phase, a mitigation implementation phase, and finally a tracking and reporting phase. Figure 3.8-1 (14) provides a pictorial representation of the process and further stresses the iterative nature of the process.
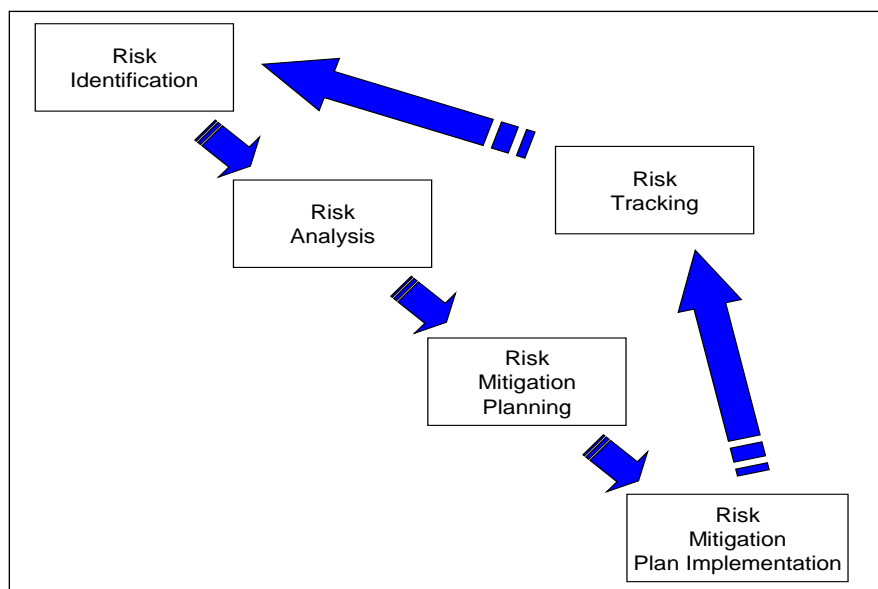

Figure 3.8-1 Risk Management Process

The identified programmatic risks must be assessed as to both the likelihood and consequence of occurrence. A standard format for depicting the likelihood and consequence of occurrence facilitates common understanding of program risks at all levels of management – particularly for portfolio managers and senior leaders who make risk acceptance decisions for multiple programs. Figure 3.8-2 is typically used to determine the level of risks identified within a

program. The level of risk for each root cause is reported as low (green), moderate (yellow), or high (red) (14).
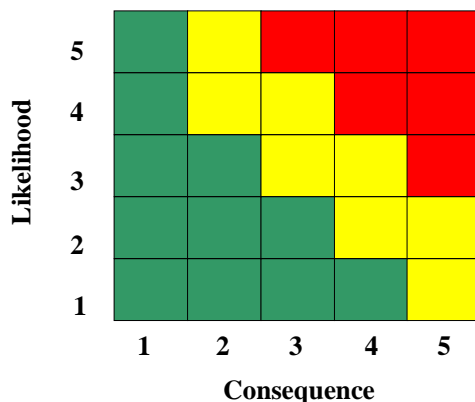

Figure 3.8-2 Risk Reporting Matrix

Consider the following risk mitigation strategies when developing your RMP (16):

User Requirements

Insert CDA market research into the acquisition cycle as part of the Materiel Solution Analysis, prior to Milestone A.

Use the IPT structure to better screen and develop requirements.

Specify in solicitations that CIDs for meeting user requirements are a deliverable.

Acquisition Management

Require RMPs as a contractor deliverable.

Require workforce training and education in CDA and commercial practices.

Technical Requirements

Evaluate the CIDs against military requirements which may apply to verify their adequacy for design and development.

Train and educate the acquisition workforce in CIDs and commercial specifications.

Test and Evaluation (T&E)

Conduct test and evaluation data reviews of the contractor's commercial testing program and results.

Participate in demonstrations of the contractor's testing process.

Use modeling and simulation anchored in realistic, integrated T&E with combined Development and Operational Testing (DT/OT), and Live Fire T&E.

Integrated Logistics Support (ILS)

Define ILS requirements when deciding what category of CDA the acquisition strategy involves.

Conduct market research of contractor ILS capabilities, do ILS testing, and support demonstrations in the intended operational environment and conditions. Options the program team can consider include:

- Buy commercial upgrades as they evolve and become available.

- Make a one-time mass spares purchase to sustain the duration of the system's life cycle.

- Buy the technical data package to solicit sources of supply that coincide with the end of production and support by the original contractor.

Specify training packages and publications as a contractor deliverable.

3.9   Potential Legal Issues

MAJOR THEMES:
- Relationship of "green" aircraft specifications and performance characteristics to derivative aircraft performance requirements
- Nature of the "green" aircraft as commercial and responsibility for its acquisition certification
- Type and scope of effort to derive militarized final product from "green" aircraft
- Clear contract requirements, adequate data rights, and compliance with statutory and regulatory requirements
- Clear source selection criteria and basis for award, well understood evaluation procedures, fair discussions with offerors, and well reasoned and documented selection decision

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➢ *Why is this important?*

Protests delay the execution of programs. Litigation disrupts programs, increases costs, and causes animosity between the program office and its suppliers. GAO audits and IG investigations can adversely affect program funding and authorization. Nothing will result in protests, litigation, or GAO and IG examinations faster, or more surely, than legal issues related to ambiguous specifications, disagreement over contract performance responsibility, unclear delivery requirements, statutory and regulatory compliance issues, and questions about the integrity of the source selection and procurement process. Avoiding these occurrences by addressing such matters in a disciplined way at the beginning of a program will vastly improve the chances for program success.

➤ *What's different?*

In the traditional DoD development program, which normally begins with from-the-ground-up research and development, all competitors begin the process with a common set of specifications and user performance requirements and, more importantly, from a design and development point of view, a clean sheet of paper. In a CDA program, all competitors are starting, potentially, with a different but fixed commercially developed product, which has its own and already set form, fit, function, and performance characteristics. These may or may not, and/or to a greater or lesser degree, be compatible with the ultimately expected configuration and performance characteristics of the militarized end product. The delta between the characteristics of the "green" aircraft and the desired modified final product may vary widely from one "green" platform to another. This changes the trade space, and thus alters the interaction between and among requirement thresholds, performance goals, source selection evaluation criteria, and basis for award.

This also affects the complexity and scope of the effort necessary to achieve the final expected performance and can give rise to questions about which contracting party is responsible for the outcome. The manufacturer of the "green" aircraft, the seller/broker of the "green" airframe, the airframe modifier, and the system integrator may or may not be the same entity. The source and/or type of certifications required of the "green" aircraft and the final product may be different. Decisions about the material content of the "green" aircraft will have been made in a commercial environment and may not comport with laws applicable to defense acquisitions. Additionally, the intellectual property rights in the baseline "green" airframe are probably fixed and may vary substantially among aircraft manufacturers, affecting technical interfaces, the range of available government acquisition choices, source of repair and core maintenance capability decisions, as well as life cycle cost associated with long term system operation and support. One need only examine GAO protest decisions, ASBCA case decisions, and GAO and other reports of relatively recent vintage to understand how failing to recognize, fully appreciate and proactively address these differences can delay and disrupt a program and even drive it to cancellation or unsuccessful results.

➤ *What to watch for.*

Be aware of the performance characteristics of the "green" aircraft and the compatibility (or incompatibility) of these characteristics with the expected physical and functional configuration of the end product, and (as a follow-on from that) who, under the selected acquisition strategy, will be responsible for both compliance of the "green" aircraft with its own specifications and the delta between it and the militarized final product. For example, will inherent operational attributes such as vibration in the "green" platform affect the capability of the installed systems in the militarized aircraft; will such problems be corrected by modifying the "green" platform, the installed systems, the method of integrating the installed systems into the militarized aircraft or a combination of these; and who will have contractual responsibility (engineering, modification, cost, and schedule) to make these corrections? Have the right type and right amount of funds been programmed for these activities?

Are the form, fit, function, and performance specifications of the "green" aircraft stable? If not, whose contractual responsibility will it be if configuration or performance changes occur in the commercial product (e.g. new model dash numbers, or in the case of used airframes, latent differences in configuration, or condition discrepancies) between source selection and contract performance such that the performance of the derivative aircraft or the scope of effort required to achieve it are affected?

Does the baseline "green" aircraft have to be commercial or commercial-off-the-shelf (COTS) or could/should offerors have the flexibility to propose a developmental platform or an already developed military platform (government-off-the-shelf (GOTS))? Is the direction/selection of a single baseline platform an appropriate and defensible limitation on competition?

Is the selected/directed "green" platform really a commercial or COTS product as defined in law and regulation, and how does this affect the contracting officer's ability to get cost or pricing data or utilize other tools needed to ensure fair and reasonable pricing? Does the CDA system being acquired meet the definition of Major Weapon System, and, if so, does the use of commercial acquisition procedures under FAR Part 12, if selected, comply with the determination, price analysis, and reporting requirements of DFARS Subpart 234.70?

Who is going to be the contractually designated integrator (government, prime, third party subcontractor), who will actually purchase the "green" aircraft (government – provide as GFP or integrator), and from whom will it be purchased (OEM, broker, third party source)? Will the "green" aircraft be new or used? Who will be contractually responsible for the "green" aircraft meeting its baseline form, fit, function, and performance specifications and for the condition of the "green" aircraft (both in terms of configuration and maintenance condition) at the point of integration?

What type and scope of modification does the program expect? Have the requirements for software been appropriately estimated? Is there significant potential for the amount and complexity of software needed to grow unexpectedly? Will this turn what was originally expected to be a simple modification and production effort into a complex, expensive, and drawn out development effort for which the risk to the contractor should have been more appropriately recognized with a different type of contract or which should have been funded with R&D funds vice production or modification funds?

Is airworthiness certification required and from what source? Who is responsible for the certification? Will modifications to the "green" airframe (e.g. intrusions into the structure such as cutting doors, etc.) negate the Federal Aviation Administration (FAA) certification?

Who will be responsible for maintenance of the system over its life? Does the contract clearly and specifically delineate these responsibilities? Is this responsibility included in the contract and, if so, as a requirements item, task order item, or option?

Will the contract call for the delivery of adequate technical data, computer software, and software documentation and will the government acquire sufficient rights in data and software to satisfy its legal requirements for source of repair and core maintenance capability decisions?

Does the material content of the "green" aircraft create Buy American Act, Berry Amendment, or other source restriction issues?

Are the government's requirements clearly understood and clearly related in the instructions to offerors, the source selection evaluation criteria and the basis for award? Has the source selection plan carefully considered, and the solicitation adequately addressed, the potential conflicts and the proper balance associated with the choice between unlimited proposal flexibility for offerors, on the one hand, and limitations on what an offeror can be given "credit" for in the evaluation of its proposal? Have all government participants in the source selection been trained so that the evaluation of proposals will be consistent with the source selection criteria and the discussions with offerors will avoid misleading competitors as to the status of their proposal evaluations and potential for award?

There are myriad of additional questions that might be asked, but the foregoing questions are some of the most critically important.

> ➢ *What to do.*

First, strive to ensure that there are no inherent characteristics of the form, fit, function, or performance of the "green" aircraft that will be incompatible with the intended modification, system integration, or militarization of the derivative aircraft. Ensure that the configuration of the selected/directed "green" aircraft is stable, and if not, clearly understand the potential effects of any resulting configuration changes on the CDA program. If there are any potential incompatibilities, configuration changes, or condition discrepancies, clearly define whose responsibility it will be to rectify them and who bears the cost and schedule risk. Ensure the source selection and contract provisions clearly spell this out.

Determine early whether the "green" aircraft must be a particular commercial product or whether adaptation of more than one commercial platform, a GOTS platform, or a current developmental product will meet the user's needs without unacceptably increasing program risk. Do not unnecessarily restrict competition and potentially create a protest based on an allegation of overly restrictive specifications leading to an unjustified sole source situation for the "green" airframe or any portion of the modification effort.

Be certain that the specified or selected "green" aircraft indeed meets the statutory and regulatory criteria for a commercial or COTS product before designating it as such. Due to resulting restrictions on the contracting officer requiring cost or pricing information, improper designation, or classification of an acquisition as commercial inhibits the determination of a fair and reasonable price, and thus leaves the military department vulnerable to over pricing. If the CDA meets the definition of a "major weapon system" (see DFARS 234.7001), ensure that the requirements of DFARS 234.7002 are met before using commercial item procedures.

Ensure the selected contractor's proposal and the contract clearly (and consistently) state who will be the purchaser and provider of the "green" aircraft (if the contract is not with the "green" aircraft's OEM), who will have total integrator responsibility (government or contactor), and

who will be responsible for both the "green" aircraft meeting is own baseline specifications and the final militarized product meeting the performance requirements of the CDA program.

Carefully estimate and clearly understand what type and scope of modification effort is expected to derive the militarized final product from the baseline "green" aircraft. Failing to understand this and/or badly underestimating the amount of effort needed to adapt the commercial product to the specified military use (especially in the area of software development – e.g. complexity and number of lines of code required) may turn what was expected to be a simple modification into an extensive research and development effort. A resulting claim may allege that the government mislead the contractor into understanding the program to be a low risk commercial product adaptation, whereas the effort was, in fact, a substantial research and development effort with significantly greater magnitude of risk, longer performance schedule, and higher cost that should have been procured using contract terms more risk appropriate to R&D efforts.

Make a definite decision and clearly specify what type of airworthiness certification is required, from what source, and who is responsible for securing it. If FAA certification is going to be required, examine what effect any required or expected modifications to the airframe or flight control systems will have on the FAA airworthiness certification. Determine whether the place of manufacture, or expected airspace in which the aircraft will be used, is determinative of the type and source of certification and clearly specify, contractually, the responsibility for securing the certification.

Determine, and clearly specify, who is to be responsible for maintenance of the system. If this decision has not been made, construct appropriate contract provisions that leave open to the government the full range of options for future changes in the source of repair and core maintenance decisions without subjecting the government to breach-of-contract claims for failing to abide by ill-conceived contract terms that may be interpreted as giving rise to a requirements contract.

Ensure that the contract calls for delivery of, and that the government acquires, sufficient rights in technical data, computer software and software documentation to meet its legal requirements for source of repair decision making and development of statutorily required core maintenance capabilities. Further, ensure that delivery and acquisition of appropriate rights in data and software needed to support the system sustainment strategy are solicited, negotiated and acquired while the program is in a competitive environment. See Section 6.3 for a more detailed discussion of Rights in Technical Data and Computer Software.

Clearly understand what materials are incorporated into the COTS "green" aircraft that may cause compliance issues with Buy American Act and Berry Amendment requirements and plan for waivers, if available, or for contract requirements that obligate the contractor to ensure the "green" aircraft complies with these statutory restrictions.

Understand the user's requirements and translate them into clear, understandable, source selection evaluation criteria and basis for award. Provide a clear statement of what offerors will get "credit" for and what they will not get credit for. Strictly abide by the evaluation criteria and

basis for award disclosed in the solicitation. Ensure that discussions with offerors clearly and fairly disclose weaknesses, deficiencies, discriminators, and risks. Make sure all source selection personnel have been properly trained.

Work closely within the acquisition/source selection team to ensure that program management, technical, contracting, comptroller, sustainment, and legal personnel are working in close cooperation with each other and are pro-actively communicating in real time to bring attention to potential issues at the earliest possible stage and resolve them in a collaborative manner so that they do not become program disrupting events.

Review or, at a minimum, ensure program counsel reviews the following:

- Report of the Defense Science Board Task Force on Integrating Commercial System into the DoD Effectively and Efficiently, February 2009, DSB_2009-02-ICS (3)
- Protest of AT&T Paradigm Corp., 90-3 BCA 23062
- Raytech Engineering v. Dept of the Navy, 93-3 BCA 25928
- DoD Contracting: Efforts Needed to Address Air Force Commercial Acquisition Risk, GAO-06-995, September 2006 (17)
- Appeal of the Boeing Company, 92-1 BCA 24414
- Appeal of Reflectone, Inc., 98-2 BCA 29869
- Appeal of Slingsby, 03-1 BCA 32252
- Appeal of Lockheed Martin Aircraft Center, 08-1 BCA 33832
- Weapons Acquisition: DoD Should Strengthen Policies for Assessing Technical Data Needs to Support Weapon Systems, GAO-06-839, July 14, 2006
- Defense Depot Maintenance: Weaknesses in the T406 Engine Logistics Port Decision Methodology, GAO/NSAID 98-211
- Defense Depot Maintenance: DoD Shifting More Workload for New Weapon Systems to the Private Sector, GAO/NSAID 98-8
- Defense Procurement: Air Force did not Fully Evaluate Options in Waiving Berry Amendment for Selected Aircraft, GAO-05-957, September 23, 2005
- The Buy American Act, 41 USC 10a-10d; The Berry Amendment, 10 USC 2533b; National Defense Authorization Act for Fiscal Year 2008, sections 804, 815, and 884
- Matter of the Boeing Company, B-311344; B-311344.3, .4, .6, .7, .8, .10, .11, June 18, 2008
- Defense Acquisitions: Assessments of Selected Weapon Programs, GAO-08-467SP, March 2008, in particular those sections dealing with the following commercial derivative programs: Airborne Laser (ABL); C-130J Hercules; Joint Cargo Aircraft; KC-X Aerial Refueler; P-8A Multi-mission Maritime Aircraft; VH-71 Presidential Helicopter Replacement

4.0 PROGRAMMATIC

4.1 General

> **MAJOR THEMES:**
> - Start with clear, measurable requirements
> - Conduct robust program planning
> - Rely on experienced people
> - Establish partnerships with and among users, Original Equipment Manufacturer (OEM)/Program Integrator/Modification contractors and subs, Federal Aviation Administration (FAA), and the test and sustainment communities
> - Organize Contractor/Government teams synergistically
> - Ensure good communication
> - Use commercial practices as much as possible

> ➢ *Why is this important?*

Decisions to buy COTS/GOTS and commercial- or foreign-derivative products are increasingly complex. As an example, a program may purchase a "commercial system" with the plan to make minor changes and incorporate the system directly into service. The minor changes (i.e., "painting it green") may include such straightforward steps as pasting on safety labels or adding DoD virus protection to software. However, if the system is subjected to rigid levels of military design requirements, so many changes, both minor and major, may be required as to make the original system unrecognizable – in cost as well as configuration (3).

A program manager may intend to purchase a commercial system with the understanding – at a high level – that the unmodified commercial system is "good enough" to be militarily useful. Commercial systems can provide tremendous and immediate military value, especially when the advantages of lower cost, reduced delivery time, and lack of development risk are considered. However, the DoD acquisition system and procurement processes today are not structured to explore if minor changes, or even a smaller number of major changes, to a commercial product would provide military value. The traditional procurement process often leaves program managers with insufficient flexibility to trade off production schedules with desired performance and life cycle costs (3).

> ➢ *What's different?*

There are major translation and communication differences between commercial and traditional DoD development/production programs…different definitions, language, and processes. The expectations for CDA programs are different. There is a tendency to underestimate CDA program scope and risk, required personnel skills and experience, and schedule and budget. There is also a tendency – or in some cases there is pressure – to ignore or pay lip service to the fundamental attributes of sound program management: program planning, risk assessment, and performance measurement.

➢ *What to watch for.*

Current acquisition regulations and processes are ill-structured to deal with CDA programs especially the less complex CDA (CDA > 90% common with green aircraft). There are few real exceptions for CDA programs; they have to deal with the Federal Acquisition Regulation (FAR) and DoD acquisition system, as well as a myriad of statutes and regulations dealing with "colors" of money, contract type, source restrictions, socio-economic goals, cost accounting, and more.

Many CDA programs begin with Contractor Logistics Support (CLS) as the sustainment strategy. Initial cost estimates are therefore CLS-centric and don't necessarily consider the potential need for tech data, parts buyout, or Government support as the commercial market dwindles.

CDA programs have limited programmatic trade space. Expectations that CDA programs are faster and cheaper often equate to the imposition of tighter schedules and constrained budgets, including limited development dollars. For these same reasons, CDA programs tend to be at the end of the personnel staffing food chain. They are usually understaffed and/or staffed with junior, inexperienced people especially when it comes to experience with commercial practices. This situation is compounded by the fact that the DoD acquisition workforce, in general, is understaffed and under-experienced.

Many CDA programs do not adequately integrate systems engineering analysis and programmatic analysis *early* enough to influence decisions and tradeoffs. Traditional DoD costing models do not work well for commercial or commercially derived systems, especially in the cost of "minor" changes to established systems. Without adequate systems engineering and programmatic analyses of alternatives, it is usually impossible to predict the cost of modifications to commercial systems (3).

➢ *What to do.*

As in any DoD acquisition program (or for that matter any program or project), "pay me now or pay me (more) later" is the rule when it comes to planning. A DoD best practice for program planning is the Integrated Master Plan/Integrated Master Schedule (IMP/IMS) (18). Coupled with Earned Value Management (EVM) (19) and Risk Management (section 3.8), these are the fundamental tools of quality program management. These tools have significant value for CDA programs, no matter what the level or complexity, especially when applied to the modification activities.

Focus on getting a few good experienced people on the Government program team. Experience should include DoD acquisition, commercial business practices, and as appropriate, FAA certification procedures. This may require the use of (and budget for) contractor subject matter experts (SMEs). Take advantage of all the resources available to the program – OEM, integrator/modification contractors, FAA, users, testers, logisticians, contractor SMEs – using an integrated product/process team (IPT) approach, and engage them all early. Work hard to have good rapport and communications with the contractor team at all levels.

Pay close attention to statutory and regulatory requirements that are inconsistent with or impose restrictions that diminish the advantages of a CDA acquisition. Work closely with legal and other subject matter experts, and address these matters early in the program planning and execution process to avoid surprises and to find solutions.

4.2   Program Organization

> **MAJOR THEMES:**
> - Integrated Product Team (IPT) based
> - Supportive, experienced, upper-level management
> - Maintain personnel stability
> - Include technical and airworthiness certification talent
> - Organize Contractor/Government teams synergistically
> - Ensure and encourage good communication
> - Use commercial business practices and processes

➢ *Why is this important?*

It is the team that wins the game…not individuals, not money, not policies or processes…the team; the whole team. Given that CDA programs can take on so many different aspects, it is very important that the team: (a) be shaped to match the dimensions and demands of the program; (b) not only encourage but facilitate horizontal and vertical communication; and (c) use common practices and processes as much as possible.

➢ *What's different?*

When basing a DoD program on a COTS product, two very different business cultures are being brought together. On the one hand, there are the COTS Original Equipment Manufacturer (OEM) and family of vendors who operate and interact according to commercial business practices. These generally entail fixed price commercial contracts and payment procedures, little technical oversight or data, no pricing data, and OEM management of the supply chain. On the other hand, there is the Department of Defense with the Federal Acquisition Regulation (FAR) and multiple acquisition policies and procedures; strict rules for budgeting, source selection, pricing and contracting; and substantial organic supply and repair capabilities that must be considered if not utilized. In addition, the Government has multiple, independent communities representing the interests of the military users, systems engineering, test, and sustainment – and in some CDA programs, the White House, and Congress. To bring these cultures and interests together into a coherent, effective team is perhaps the greatest challenge of CDA program management.

➢ *What to watch for.*

CDA programs tend to be understaffed and/or staffed with junior, inexperienced people especially when it comes to experience with commercial practices. Engineering resources are especially problematic for several reasons: (a) it is "only" a mod program; (b) there is limited

development, and (c) there is little attention given to post-delivery needs such as the inevitable requirements creep and sustainment issues.

COTS OEMs and their vendors generally do not have the experience, resources, or systems to comply with many DoD acquisition requirements. Even large firms, many of which do business with the DoD, frequently separate their defense and commercial sectors. Do not assume that the OEM even in these cases can adapt to DoD acquisition requirements. Program teams are most effective in working with OEMs/vendors when the program adopts practices and expectations that are familiar to them. Further, not only should the program team act like a commercial organization, it should also expect to be treated like a commercial organization by the OEM/vendor. In the past, some program managers have expressed frustration that OEMs/vendors do not react to program needs and direction.

Free and open horizontal and vertical communication is essential. The entire community should be engaged early during requirements definition, development of the acquisition strategy, and concept definition. That dialogue needs to continue throughout the life of the program. No government or contractor participant should be inhibited from communicating up, down, or across the chain of command.

Upper-level management needs to understand the advantages and disadvantages of a CDA approach, and they have to support the effort with resources. They have to understand that they are buying into a different process. Ensuring adequate numbers of experienced people is critical. This expertise may be fulfilled via use of contractors without conflicts of interest *(i.e.,* scientific, engineering, technical, and administrative (SETA) support contractors that do not participate on contractor teams) for some non-inherently governmental functions. Greater use of government hiring authority for "specially qualified scientists and engineers" should also be considered.

The organization needs the ability to surge as required, using borrowed personnel or contracted services. All stakeholders must be involved: government, the services, combatant commands, original equipment manufacturers (OEMs), and system integrators.

➢ *What to do.*

In managing COTS-intensive systems, strive to bring together many disciplines. This can best be achieved through the practice of Integrated Product and Process Development (IPPD) and the formation of Integrated Product Teams (IPTs). Adopt IPTs as a way of improving the working relationship between the government program team and the contractor. This demonstrates that the program team is going to be an active partner in facing some of the risks inherent in the chosen approach. This development and management approach also suggests opportunities for reducing technical risks inherent in the use of fast-changing commercial technologies.

Good vertical communication is essential between the government program team and the prime and subcontractors, especially in cases where subcontractors have not had significant military experience. Equally important is horizontal communication between the acquisition community and the users of the procured equipment, i.e., the warfighter community. This is best accomplished with a recognized integration program built into the RFP and the contract. An

example of this type of communication is exemplified by the use of earned value management (EVM) accounting (19). EVM implementation prescribes a valuation of planned work and pre-defined metrics to quantify the accomplishment of work, called the "earned value." Full communication and shared understanding is needed among the government, prime contractors, and key subcontractors working as a team throughout the acquisition process and continuing through sustainment (3).

When picking a team, invest up front in training and selection of key personnel. Look for specific commercial acquisition experience. Make better use of reservists (FAA Designated Engineering Representatives (DERs), commercial pilots, Individual Mobilization Augmentees (IMAs), etc). Ensure the team (contractor, suppliers, and government) has sufficient technical talent to work inevitable development and post-delivery issues.

Encourage a cultural change that focuses on risk management rather than on risk aversion. This will require management support at all levels and better training of the acquisition work force in market research, pricing, and other commercial procurement practices (20).

4.3   Personnel Qualifications

> **MAJOR THEMES:**
> - CDA specific training is lacking
> - CDA experience is critical
> - Commercial business practices are different
> - Federal Aviation Administration (FAA) processes differ

> ➢ *Why is this important?*

A properly staffed and trained team of acquisition professionals is fundamental to the success of any weapon system procurement – commercial acquisition or traditional DoD development program. The DoD has invested significant resources to ensure that acquisition professionals have access to a wide range of acquisition training covering the entire spectrum of acquisition career fields. Further, the DoD has a rigorous professional certification program that requires acquisition personnel to complete specific training, education, and experience requirements to receive certification. These certification requirements increase commensurate with the responsibility level of the position.

Inadequate acquisition training is probably the single biggest inhibitor to government adoption of a commercial approach. Acquisition personnel are not usually trained in how to conduct market research, surveys, and analyses; nor are they trained to execute a CDA program in a commercial marketplace.

> ➢ *What's different?*

While the DoD has a robust acquisition training and certification program, it is focused on the procurement of traditional military unique weapons systems, services, and business information

technology systems. There is no formal training specifically for the procurement of commercial derivative aircraft/weapon systems. This lack of training is unfortunate as commercial acquisition differs significantly from traditional DoD development programs. Unique aspects of commercial acquisition include:

- Business systems and processes
- Program timelines
- Service governing regulations and Federal Acquisition Regulation (FAR) (e.g., FAR Part 12 -Acquisition of Commercial Items vs. FAR Part 15—Contracting by Negotiation
- Federal Aviation Regulations (FARs) Part 21 environment
- Skill sets
- Contractors and vendor base
- Product support

➢ *What to watch for.*

The services do not track acquisition personnel with commercial experience. There is no central data repository or special experience identifier; and therefore, no easy way to find these well trained and experienced personnel.

The FAA Military Certification Office (MCO) has developed training modules for DoD CDA program personnel (21). There are also excellent courses in FAA certification in the private sector (e.g., University of Kansas at Wichita).

➢ *What to do.*

Ensure your program team is staffed with personnel who are, as a minimum, Defense Acquisition Workforce Improvement Act (DAWIA) certified at level 1, preferably higher, in their respective functional domains.

Ensure there is relevant competence and experience, across both the technical domain and project management, in the key government personnel. Demand it in the primes and subcontractors. Specialized education and training in acquiring COTS/GOTS and commercial- or foreign-derivative items (including use of Other Transaction Authority, OTA)) may be needed across the team: program managers, financial managers, technical personnel, contracting personnel, and systems engineers. Personnel should also have knowledge on specific systems, including hardware and software, as well as an understanding of management and operations issues (3).

Train the program team and stakeholders (including operators and maintainers). The training should cover all the unique aspects of commercial acquisition – from the initial evaluation of user needs through sustainment and disposal. The training should include specific guidance on:

- How to evaluate commercial items
- Commercial specifications and standards
- Commercial business practices and financial management
- FAA certification processes
- Industry maintenance strategies and techniques
- Intellectual property issues

Use the following strategies to enhance the qualifications of the program team:

- Supplement government acquisition personnel with outside experts to support commercial derivative acquisition activities. Consider Reservists with commercial or FAA experience.
- Acquire or develop tailored, just-in-time training to support the specific program needs (based on the acquisition phase).
- Search out and track personnel with CDA experience.
- Pick contractors with past experience in CDA acquisition and modification.

4.4   Acquisition Planning and Scheduling

MAJOR THEMES:
- Use stakeholders strengths
- Use Integrated Master Planning/Scheduling (IMP/IMS)
- Do regular risk assessments
- Consider Earned Value Management (EVM) for complex CDA programs

➢ *Why is this important?*

"He who fails to plan, plans to fail."

A robust acquisition plan is a fundamental part of any successful procurement – traditional DoD development programs or commercial derivative acquisitions. The acquisition planning process results in a documented plan that describes, coordinates, and integrates the efforts of all the stakeholders responsible for program execution. It explains how the operational needs will be met within the cost, schedule, and technical requirements constraints placed on the program.

A comprehensive acquisition plan will contain:

- The overall procurement strategy (competitive/sole source and traditional development/commercial item procurement)

- Contract type and post-award contract administration strategy

- Key business considerations (competition plans, cost control, contractor surveillance, etc.)

- Budgeting and funding data

- Alternative acquisition approaches (as applicable)

- Major milestones

- Risk mitigation strategy

- Sustainment approach (if known)

- Signatures/approvals of the acquisition leadership

The written acquisition plan should communicate the program team's approach for executing the program; balancing cost, schedule, and performance; and obtaining approvals for entry into subsequent phases of the procurement.

➤ *What's different?*

COTS product volatility, ownership changes, and unpredictable technological directions impact CDA programs. The loss of COTS/NDI product support can result in the inability to continue development of systems, to deploy systems in a timely manner, to provide technology upgrades to systems, or to maintain systems. Previous planning becomes void. Up-front contingency planning is important. The use of open systems concepts and interface standards may help.

➤ *What to watch for?*

Program timelines are assumed to be shorter for CDA programs than for traditional military aircraft development timelines. While it is normal for a large fighter/bomber/cargo aircraft development program to take many years to develop and test prior to fielding, CDA program development/modification timelines are generally expected to be much shorter. Depending upon the extent of the delta between the configuration and performance characteristics of the "green" aircraft and the intended militarized final product, this may not be true and could lead to a high risk schedule.

Failure to plan for changes in commercial items and the marketplace will potentially result in a system that cannot be maintained as vendors drop support for obsolete commercial items.

➤ *What to do?*

When purchasing a commercial derivative aircraft, assess the strengths and weaknesses of the primary stakeholders and allocate efforts accordingly. Also consider the size and functional makeup of both the government and contractor teams and assign responsibility based on risk and expertise. Pay close attention to the complexity of the effort needed to produce the militarized final CDA from the "green" aircraft.

Develop an Integrated Master Plan (IMP) and Integrated Master Schedules (IMS) to facilitate program execution. Many consider the IMP and IMS as fundamental management tools for

effective planning, scheduling, executing, and tracking of the myriad of complex program activities. The IMP is a top-level plan consisting of a hierarchy of important program events, with each event being supported by specific accomplishments and criteria to be satisfied for its completion. The IMS flows directly from the IMP and supplements it with additional levels of detail to produce a detailed schedule showing all the tasks required to accomplish the IMP events (18). Disciplined adherence to the IMP/IMS complements and supports the systems engineering process.

The periodic assessment of program risks is another important tool to assist the planning and scheduling processes (see section 3.8). Program risks are inherently non-static in nature and the realization of the individual risk items can significantly impact program schedule. The recurring assessment of the program risk areas and their mitigation plans should be a fundamental part of program reviews, acquisition governance, and the systems engineering process. Technology evolution, funding, service priorities, and even world events can all impact program execution and should be regularly considered in the program's risk management philosophy.

For programs with complex modifications or significant development/non-recurring engineering efforts, consider the implementation of an earned value management system (EVMS). (Note that under Defense Federal Acquisition Regulation Supplement (DFARS) Subpart 234.2, application of EVMS is mandatory for cost or incentive contracts in the case of major systems that meet specified dollar thresholds, and is discouraged and requires a waiver for firm-fixed-price contracts.) A high-quality EVMS helps a program team integrate and balance the technical, cost, and schedule aspects of a program. Earned value management coupled with a time-phased, resource-loaded integrated baseline allows program managers to quantify variances to the program schedule and associated budget. Using the variances, program teams can identify significant causes and forecast future cost and schedule impacts. This can facilitate the development of corrective action or recovery plans. EVM facilitates both performance measurement (i.e., where are we with respect to the program baseline) and performance management (i.e., what we can do about it). A suitable EVMS provides the program team data that:

- Relates time-phased budgets to specific contract tasks and/or statements of work (SOW)
- Measures work progress objectively
- Relates cost, schedule, and technical accomplishment
- Allows for informed decision making and corrective action
- Is valid, timely, and able to be audited
- Allows for statistical estimation of future costs
- Supplies managers at all levels with status information at the appropriate level
- Is derived from the same EVM system used by the contractor to manage the contract (19)

4.5   Life Cycle Cost Estimates

> **MAJOR THEMES:**
> * Cost estimates are normally commercial and Contractor Logistics Support (CLS) centric, which lowers the Life Cycle Cost Estimate (LCCE)
> * Deviations from commercial standards and CLS are likely to occur and need to be considered in the LCCE

> ➢ *Why is this important?*

One of the major drivers for doing CDA programs is the promise of cost savings. The life cycle cost estimate (LCCE) by definition will include all aspects of commercial savings. To the degree that the program team fails to execute the program, or if the market changes drastically as defined in the acquisition strategy, the costs will deviate in a higher direction.

> ➢ *What's different?*

Commercial derivative programs tend to be based on multiple customers sharing the non-recurring costs and driving production costs down a decreasing price curve. Long term O&S costs assume CLS, which means the aircraft will participate in large parts and Line Replaceable Unit (LRU) pools along with access to low cost inspection and major repair facilities. The commercial program basically offers DoD a large customer base to spread out overhead costs, production aircraft that benefit from price curve reductions, and a large maintenance organization that spreads its cost over multiple customers. This is quite different than most traditional DoD programs where the government bears the full costs of the system. Any deviations from this minimum cost scenario may drastically increase costs to the DoD.

> ➢ *What to watch for.*

Cost estimation is different in a COTS-based development setting. For a traditional DoD development program, models exist that help program teams estimate the current state and expected completion of a program. Given that similar models for COTS-based systems are still emerging, it is harder for program managers and developers to know how well system development/modification is progressing.

The deviations that raise costs are:

* Long schedules at reduced quantities
* Federal Acquisition Regulation (FAR) Part 15 contracts that deviate from commercial standards
* Major changes to the commercial "green" aircraft that prevent leveraging the commercial manufacturing or sustainment resources
* Changes that force DoD to invest in non-recurring assets, facilities or personnel

➤ *What to do.*

Acquisition of COTS/GOTS and commercial- or foreign-derived systems allows a lower risk than developing a new system, and therefore allows a different approach to life-cycle costing. Costs, especially unit production cost in the quantities anticipated, should be a requirement in the acquisition process. By virtue of inserting cost into the requirements process, changes to the cost would incur analysis and trades against other performance and schedule requirements (3).

Be fully aware of commercial practices in this industry and attempt to use FAR Part 12 commercial acquisition approaches whenever possible. Basic approaches would include:

- Verify FAR Part 12 contracts (and their inherent savings) are part of the acquisition strategy if feasible.
- Verify that commercial payments are allowed under the acquisition strategy or else include the higher cost of contractor financing.
- Determine whether the program can accept minimal data for both cost and technical concerns or else include cost of same.
- Make sure that the LCCE focuses on all deviations from the commercial aircraft or processes.
- Utilize commercial logistics support opportunities to leverage off commercial customers. The assumption of CLS in the LCCE is the assumption most likely to change during program execution for both practical and political reasons. Consider creating a LCCE which includes a blend of contractor and organic support.
- Minimize non-recurring investments to optimize leveraging of the commercial investments.

4.6 Funding

> **MAJOR THEMES:**
> - Commercial business practices often limit budget flexibility
> - Commercial markets change rapidly – faster than budget modifications
> - Commercial vendors often mix multiple "colors" of money in their prices

➤ *Why is this important?*

DoD traditional acquisition is bounded by extensive rules that often limit a program's ability to use commercial practices in a flexible manner. The government rules for traditional acquisition programs are in place to create an environment of strict accountability. CDA program managers and financial staff must consider budget availability when developing contract strategies since most commercial aircraft providers offer significant discounts for accelerated programs, but also significant penalties for contract changes (due to budget modifications). Restrictive rules under Federal Acquisition Regulation (FAR) Part 31 – Contract Cost Principles and Procedures, the

Truth in Negotiations Act (TINA), Cost Accounting Standards (CAS), a variety of socio-economic provisions, statutory and regulatory source restrictions, and a host of other rules uniquely applicable to government contracts, but not applicable to commercial programs, can significantly affect the cost of "green" aircraft and subsystems compared to normal commercial prices.

➢ *What's different?*

Commercial manufacturers size their production schedules to minimize cost and to serve multiple customers. This provides the best price to all but also fixes the price to all. In traditional DoD acquisition, the manufacturer has one customer – DoD – so they willingly adjust their manufacturing to match DoD budgets – albeit for a major price change.

To meet commercial terms normally requires consistent annual funding – something that is not always possible with yearly budget fluctuations. The DoD budget process divides funding in four basic "colors" of money: research and development, production, operations and maintenance, and military construction. Commercial vendors do not operate in this world and often include elements of each area in a typical system's price or contract. These potential disconnects between the content of a commercial program and the strictly segregated types of DoD funding and the statutorily imposed restrictions on their use is significant, as failure to abide by the rules associated with proper use of funds can result in violations of the Anti-Deficiency Act. This forces DoD program managers to re-plan their programs so that all key elements are completed using the proper, legally available funding sources.

In the commercial realm, the customers buy fixed numbers of aircraft with significant deposits and tend to not make major changes (22). The government tends to request a set lot size and provide an estimated budget profile which the contractor has to try to live within. Any differences between the normal commercial production run and the DoD always increases the cost to DoD.

Cost estimation is different in a COTS-based development setting. For a traditional DoD development program, models exist that help program managers estimate the current state and expected completion of a program. Given that similar models for COTS-based systems are still emerging, it is harder for program managers and developers to know how well system development/modification is progressing. Budgeting should be conservative in order to factor in contingencies.

➢ *What to watch for.*

Commercial vendors normally employ business practices where they assume full execution and thus will make significant long lead purchases to gain quantity discounts and the lowest prices for materials. Most will desire commercial payments which require the majority of the funding much earlier than traditional DoD acquisition programs that utilize milestone payments. The current emphasis on Federal Acquisition Regulation (FAR) Part 15 is quite restrictive compared to FAR Part 12 commercial contracts. Typical FAR Part 15 payment practices require the contractor to wholly fund the program or accept standard progress payments with full Cost

Accounting Standards (CAS) compliance. Commercial standards are much less restrictive with little, if any, CAS-like requirements. This can raise the cost of the program with no benefits for the additional budget requirement.

While no different than traditional DoD development programs, budget changes will have significant impacts on a CDA program, especially on the commercial parts ("green" aircraft) phases of the program.   As the budget is cut or stretched out, this likely raises the unit cost of the "green" aircraft since any previous quantity discount effects are lessened.

FAA Military Certification Office (MCO) funding is difficult – services' money is not always available until late in the fiscal year, which means the FAA must cover in the interim. The MCO is supposed to be fully funded by customers.

Funding disconnects may occur when appropriations are defined prior to final requirements or Congressional wish lists.

> ➤ *What to do.*

CDA programs, especially the acquisition of the "green" aircraft or subsystems, need a firm policy with their customers on funding (23). A major challenge is to get funding on a schedule consistent with the desired acquisition schedule. Many modifications, especially for VIP/SAM CDA, are funded with fall-out money, not programmed and budgeted via normal means.

Carefully plan out the budget to make sure the type of budgeted funds match their intended use in the development, acquisition, and sustainment of the CDA aircraft. A typical VIP aircraft has long service and major O&S requirements. A demonstrator or Special Operations Forces (SOF) aircraft with limited numbers may always remain in an R&D mode and have little need or requirement for O&S funding. Since a major benefit of CDA should be lower cost, ensure that the DoD budget matches the commercial requirements and that changes are minimized. Deviations from commercial practices can easily be measured in additional budget requirements. A carefully planned acquisition profile along with other commercial buyers can significantly reduce cost (24).

When planning a CDA program, the request for budget authority/funding must be properly drawn and consistent with the type of work to be conducted. This requires a clear understanding of the complexity of the effort needed to transform the "green" aircraft into the militarized CDA product and whether the effort is development, production, and/or test. Attention to this area will significantly reduce program risk due to exhaustion of the right type of funds, program disruption due to investigations of funds misuse, and the possibility of program cost growth and schedule slippage.

4.7   Source Selection

> **MAJOR THEMES:**
> * The Request for Proposal (RFP) must establish requirements that are clear and measurable
> * Careful market research must precede the RFP
> * Be prepared to do cost and price analysis to ensure fair and reasonable pricing
> * Consider flying or otherwise assessing commercial platforms as part of the source selection process
> * Consider requiring the program 'integrator" to conduct source selection procedures for the modification systems
> * Past performance analysis is often the key discriminator among offerors
> * There is extensive Source Selection Guidance – Use it

> ➢ *Why is this important?*

Many CDA programs have been launched as sole source efforts for acquisition of the "green" aircraft based on legislative direction or on requirements statements that limit choices to a single product. Even in these cases, though, it is often possible to compete for the modification work on the "green" aircraft among offerors specializing in post-production modifications. There are also cases where the basic airframe can be competed, such as the Air Force's C-32 and KC-10A. Therefore, completing a successful source selection in the CDA world is often a necessary program step requiring careful planning and precise execution.

> ➢ *What's different?*

There is very little difference in the process of conducting a source selection for a CDA product than in conducting a source selection for a traditional, developmental, unique military product. Each branch of service publishes their own source selection procedures and these are applied to CDA and unique military programs alike. For instance, the estimated dollar value and acquisition category (ACAT) of a given program govern the level of source selection authority regardless of the program being for acquisition of a CDA or not. The difference lies in the details of the source selection criteria and their relationship to the delta between the "green" aircraft and the expected militarized final CDA product, what parts of that delta are mandatory or threshold requirements and what parts are objectives, the effect that has on the "trade space" available to offerors to trade off performance, cost and schedule, and the manner in which that is communicated to offerors in the solicitation and is translated into understandable and executable evaluation standards and basis for award.

> ➢ *What to watch for.*

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Requirements, Requirements, Requirements

There are numerous offices and requirements inputs between the user and the CDA program office. Finding agreement on requirements among all stakeholders is necessary and difficult to the point of being elusive. This area must be worked very hard.

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It seems simple to write down and specify the users' needs in terms of system performance capabilities, but painful experience has shown that this is a very difficult process. Careful market research should precisely document the proven capabilities of commercial systems which fulfill or exceed the program's needs. Do not rely exclusively on contractor marketing claims as these are often exaggerated. CDA requirements must be based on clearly understood user's mission needs and must be scrubbed to ensure that they do not "favor" one commercial platform over another. Rather, tying absolutely necessary and minimal mission performance needs to requirements statements is the safest and surest method to specify program requirements. Finally, tracking requirements in a formal, documented manner is recommended.

Past performance is an important part of any procurement but especially so in CDA programs. Comparison of future service requirements to contractors' past performance is required (Federal Acquisition Regulation (FAR) 12.206). More importantly, past performance analysis is often the key discriminator among offerors when they manufacture similar products with nearly the same characteristics and prices.

> ➢ *What to do.*

As part of a competitive procurement, Systems Engineering and Programmatic Analysis of Alternatives (SEAPA) can be part of a Request for Information (RFI) or a broad agency announcement (BAA), with subsequent negotiations between the government and two or three finalists as part of the source selection process. This should include required testing of available and existing systems.

The RFP is the foundation for the initiation of a CDA program and also for the program's source selection. Following the RFP in importance is the Source Selection Plan (SSP), a document which governs the conduct of the source selection, assigns responsibilities to specific individuals, sets schedules for source selection task completions, and replicates much of the critical information in the RFP. For instance, both the Instructions to Offerors (RFP Section L) and the Award Criteria (RFP Section M) are also normally presented in the SSP. Award criteria for CDA systems may be somewhat different than for traditional military systems, so ensure that they are tailored to completely capture the user's needs, are as objective and measurable as possible, and that they do not exceed the capabilities of the commercial systems expected to be offered (possibly resulting in further development on a commercial platform which is something that was supposed to be avoided by electing a CDA to begin with).

Understand the user's requirements and translate them into clearly understandable source selection evaluation criteria and basis for award. Avoid conflicts among what is absolutely needed (minimum essential requirements stated as KPPs or thresholds), what is wanted or desired (goals or objectives), and the trade space within which the offerors are permitted to make trades of cost, schedule and performance. Provide a clear statement of what offerors will get "credit" for and what they will not get credit for, keeping in mind the balance between unlimited proposal flexibility which complicates the source selection and the desire to achieve, through trade-offs, the best possible value for the user. Don't require offerors to provide volumes of extraneous information in the instructions to offerors – if it is not going to be evaluated and

doesn't affect the selection decision, don't ask for it. Strictly abide by the evaluation criteria and basis for award disclosed in the solicitation. Eliminate any disconnects between the evaluation process and what is stated in the solicitation, and ensure that discussions with offerors clearly and fairly disclose weaknesses, deficiencies, discriminators, and risks. Ensure that credit is given for, and only for, proposed trade space trade-offs for which the solicitation states that credit will be given. Make sure all source selection personnel have been properly trained.

Each of the services maintains extensive guidance on the conduct of source selections. As an example HQ Air Force Materiel Command guidance is extensive and very recently updated. This CDA Acquisition Guide does not duplicate that guidance but offers this advice as supplement to formal guidance.

- Competition among widely sold commercial platforms or other products may not guarantee the lowest possible prices to the government since manufacturers may choose to offer their products at prices which other valued customers (like major airlines) have previously paid (so that those previous customers feel justified in their business deals). Therefore, even in a competitive source selection, be prepared to do cost and price analysis to ensure fair and reasonable pricing.

- Use the source selection process and the attendant competitive forces to obtain the best deal possible regarding rights and access to contractor proprietary technical data and computer software.

- Consider flying or otherwise assessing commercial platforms as part of the source selection process to verify contractor claims and to establish conformance with government requirements. This technique has been employed with great success on other CDA programs.

- Consider requiring the program "integrator" to conduct source selection procedures for the modification systems (parts and services). If the government is the integrator, consider relying on the assistance of the platform Original Equipment Manufacturer (OEM) in creating the CDA modification equipment RFP and selecting the best source for the modification(s).

- Past performance analysis is often a major discriminator in the source selection process. Plan on assessing past performance of the CDA offerors by consulting not only other government offices which have experience with the CDA offerors, but also with commercial customers of the CDA offerors. These commercial customers usually have a wealth of information accumulated through long association with the CDA offerors.

4.8   Contracting

> **MAJOR THEMES:**
> - Each CDA contract must be tailored to operate with efficiency and to focus on user needs
> - When to use Federal Acquisition Regulation (FAR) Part 12 or FAR Part 15 procedures
> - Pricing Commercial Products
> - Warranties have calculable value and should be taken into consideration
> - Ensure Original Equipment Manufacturers (OEMs) are required to update and provide their technical documentation

➢ *Why is this important?*

The contracting process is an essential element of any larger acquisition process including acquisition programs for commercial derivative aircraft. Getting the contract right is the culmination of numerous, effective and encompassing predecessor events, and it is the genesis of multiple, well conceived, and executable future events. It is also a primary source of the program's history as the contract grows and evolves over the course of the program's life. Done well, contracting eases and accelerates the acquisition process. Done poorly, contracting paralyzes and complicates the acquisition process. Just as each CDA program must be tailored to fit the needs of each individual user community, each CDA contract must be similarly tailored to operate with efficiency and to focus on user needs.

Over the course of numerous CDA programs certain contracting wisdom has been accumulated that should be carefully considered as the contracting team undertakes any new CDA program assignment. Much of this wisdom may also pertain to non-CDA programs but it has been critically relevant to the success of CDA programs over the past 50 years.

➢ *What's different?*

One of the major decisions facing the contracting team on a CDA program is the matter of using, or not using, FAR Part 12 procedures for the acquisition of commercial items. *The <u>automatic</u> use of FAR Part 12 procedures is never recommended nor assumed*. Indeed, the DFARS (revised in April 2008) at 234.7002(a), states that a DoD major weapon system (expected eventual RDT&E over $300M (FY 1990 constant dollars) or expected eventual procurement ($1.8B (FY 1990 constant dollars)) may be treated as a commercial item or acquired under procedures established for the acquisition of commercial items, *only if a SECDEF or DEPSECDEF determination is made, the offeror has submitted sufficient information for price analysis to determine price reasonableness, and the Congressional defense committees are notified. DFARS 234.7002(b) and (c) permit subsystems and components of major weapon systems (other than COTS) to be treated as commercial items **only if** the major system satisfies the above requirements or the contracting officer determines in writing that the item is a commercial item and the offeror has submitted sufficient information to evaluate price reasonableness through price analysis.* In some cases Part 12 procedures can provide more than

adequate protection to the parties of a CDA program, but in others they may be insufficient to the needs of one or more of the parties. The development of an acquisition strategy should address this very significant question and carefully consider the pros and cons of using the FAR's commercial acquisition procedures. For instance, answer the question: Is the commercial aircraft to be acquired a truly "green" aircraft coming off the production line in the same configuration as others of its type being manufactured for commercial customers and, perhaps more importantly in today's environment, can it be priced fairly and accurately using commercial pricing means? Or, is it being modified in any way on the commercial production line to meet end-user needs? Or, is it being built on a commercial production line but, in fact, is a purely military prototype?

➢ *What to watch for.*

Unfortunately, the current government procurement system frequently forces contracting personnel to know more about the regulations that they operate under, than about the actual products that they buy. In the commercial sector the opposite is true. Consequently, few DoD contracting personnel currently have the price analysis and market research skills necessary to procure military items from commercial firms. The private sector uses price analysis almost exclusively. This is true for mundane items, state-of-the-art items, and tailor-made unique items (25).

The point to be made is that there are sufficient pricing tools available for the government to conduct the necessary price analysis for military requirements. A mastery of such tools would allow DoD contracting officers to procure from commercial firms without having to fall back on the Truth In Negotiation Act (TINA) requirement for cost or pricing data. The inability to do this can be traced directly to insufficient training in the use of price analysis and market research techniques. The majority of existing government cost and pricing courses focus almost exclusively on cost analysis (25).

In many respects the government has a more difficult pricing task than their commercial counterparts. While there are many pricing tools available, most are based on some type of comparison (such as with similar items in catalogs or with a standard market price). These comparison pricing techniques are not readily adaptable to military-unique items made in small quantities by commercial firms. While originally designed to protect the Government's interests, TINA and Cost Accounting Standards (CAS) regulations now serve to impede access to the advanced technologies and capabilities of the commercial sector (25).

Simply calling an item "commercial" does not absolve responsibility for determining that the price is fair and reasonable. It is incumbent upon the contracting officer to verify that the price is, in fact, fair and reasonable. There is no turning back to the days when suppliers provided reams of cost and pricing data to support their offers. Unlike the defense industry, commercial firms are usually unwilling to comply with DoD cost or pricing disclosure requirements. They view such information as proprietary and key to their competitive advantage. They do not want to provide this kind of data to accommodate what may well be a *small*, one-time customer like the DoD (23).

The Federal Acquisition Regulation (FAR, and not to be confused with the Federal Aviation Regulations (FARs)) provides numerous guides to contracting officers engaged in acquiring commercial products when commercial contracting practices are to be used (FAR Part 12). However, recent trends have moved DoD acquisition preferences away from FAR Part 12 methods in favor of FAR Part 15 methods even when the products being acquired are truly commercial in nature. This trend seems to respond to OSD and Service Secretary level concerns that commercial contracting methods have permitted some contractors to realize excess profits and receive unreasonable cash-flow opportunities. Therefore, the decision concerning what type of contract to pursue is perhaps one of the very first decisions to be made when a new CDA program is contemplated. This decision has significant influence on the nature and composition of the Request for Proposal (RFP) as well as the following contract(s).

> ➢ *What to do.*

Contracting Officers Take Note: *In many CDA programs the "green" aircraft type and manufacturer may be dictated along with the funding legislation or may be dictated based on the requirements statement (i.e., only one aircraft type meets the capability factors). In these circumstances, it will be necessary to negotiate with the sole source aircraft provider and will usually entail the difficult task of demanding and receiving cost and price support data with the offeror's proposal. Commercial aircraft manufacturers are loathe to supply this information since it is counter to commercial practices and can be expected to potentially harm the offeror's competitive position (if competitors gain access to the data and prices). Therefore, contracting officers should take every precaution to protect this data and to guarantee the same to the offeror. Current practice in DoD programs is to require this data, so the major manufacturers (Boeing, Gulfstream, Hawker Beechcraft, and numerous others) are adapting to this practice, albeit with some reluctance and lack of enthusiasm.*

Product warranties are offered on many commercial products and should be considered as an important part of any CDA program if offered by the OEM. Warranties have calculable value and should be taken into consideration when initially pricing the procurement. Methods to track and administer the warranties must be made part of the contract, and side agreements with the users to obtain their assistance should also be created so that warranty value (repairs, replacements, etc.) is not wasted.

Usually, Commercial OEMs update their technical documentation to reflect configuration changes, operational changes, and other information updates the purchasers of the products should know. Contracting officers should ensure that their contracts require this type of information be provided in the military and governmental documents (manuals, technical orders, etc.) associated with the CDA when such information is provided as a standard commercial practice.

If there isn't very strong assurance that the CDA buy can be priced accurately and fairly with FAR Part 12 procedures (e.g., under conditions of intense competition), or if regulatory guidance precludes the use of FAR Part 12 procedures, then the best guidance is to plan for a negotiated procurement IAW FAR Part 15 requiring full cost and price support data with the proposal. That

said, a number of Part 12 procedures and clauses not associated with pricing may be considered for a resulting contract which procures commercial items. The government contracting officer should carefully choose among contract terms, conditions and clauses which best suit the acquisition situation. Be certain, however, to comply with DFARS Subpart 234.70, as well as FAR Parts 12 and 15 where applicable.

4.9   Oversight/Governance

> **MAJOR THEMES:**
> - Use standard OSD and service oversight processes for applicable program Acquisition Category (ACAT)
> - Shape governance structure around Integrated Product Teams (IPTs)
> - Establish program office/user/vendor/Federal Aviation Administration (FAA) cross-cutting working groups
> - Expect different (non-DoD) surveillance for the Original Equipment Manufacturer (OEM)
> - The FAA can provide governance for certification, operational standards, and sustainment

> ➢ *Why is this important?*

The oversight of CDA programs and the governance structure used to manage the program should enhance communication, ensure quality and discipline, and facilitate execution. This is especially important given the wide range of uses and users, the potential for extensive involvement of non-DoD Federal Agencies, and the significant political interest in these systems and programs

> ➢ *What's different?*

Oversight of commercial aircraft development and production is the responsibility of the FAA. There is no Defense Contract Management Agency (DCMA) or Defense Contract Audit Agency (DCAA) surveillance of OEM production. Depending on whether the modifications are being done in-line or post-production, each CDA program must determine how it will interact with the OEM, FAA, and other contractors to monitor contract performance and quality.

CDA solutions are frequently mandated by Congress. Also, many CDA provide services that are essential to the missions of all military services and the combatant commands. Therefore, most CDA programs are designated or at least considered OSD special interest programs.

> ➢ *What to watch for.*

DoD cannot be looked upon like another airline since they don't fall under normal FAA oversight. Since DoD self-certifies it can do or not do anything it wants for oversight.

Quality surveillance of commercial aircraft production is not provided by a DoD agency such as DCAA. It is incumbent on the program team to assure the quality of the commercial item. The FAA can help.

➢ *What to do.*

Adhere to DoD 5000 oversight requirements for the Acquisition Category (ACAT) of the program.

Follow Service policy directives and instructions (e.g., AFPDs 62-4 (6) and 62-5 (4), NAVAIR INSTRUCTION 13100.15 (26), AFI 21-107 (10)) for roles and responsibilities within the Services.

Consider deploying government program personnel to the plants for oversight of OEM production especially if the program involves in-line modifications.

Structure the program governance around the IPT structure. Establish cross-cutting working groups for certification, sustainment, and other key program elements. Include Program Executive Officer (PEO) and Service staff; the user, test, and logistics communities; FAA; contractors; and the program team. Conduct regular program reviews of risks, IMP/IMS, and earned value.

5.0   TECHNICAL

5.1   General

> **MAJOR THEMES:**
> - Modification of a commercial aircraft to perform a military mission is not a trivial activity
> - Commercial marketplaces, not DoD, drive the development of commercial aircraft
> - The government may not get the same level of data and insight
> - Think commercial

> ➢ *Why is this important?*

Once the decision is made to procure a commercial aircraft, it is important to quickly assess and determine the best approach for managing the myriad of technical activities associated with any major system procurement. These activities include:

- Technical requirements definition
- Baseline development
- Engineering design
- Aircraft modification
- Airworthiness certification
- System architecture
- Interoperability
- Configuration management
- Verification and test
- Training

The procurement and modification of a commercial aircraft to perform a military mission is a non-trivial activity, and the challenges it presents should not be underestimated.

> ➢ *What's different?*

Unlike traditional DoD development programs, the commercial marketplace drives development of the commercial aircraft, not the military service or program team. The aircraft designs are in response to a real or perceived commercial demand to be fulfilled. The secondary market military usage is not generally considered a significant design driver. This allows the military end users to avoid lengthy, expensive development programs and instead take advantage of existing commercial technologies including planned and market driven modernization activities.

> ➢ *What to watch for.*

The reliance on commercially developed technologies has an inherently negative aspect. The military customers will have much less design influence and therefore, should largely be willing

to accept the original system design performance. An inherent risk in CDA programs is the danger of diverging too far from the commercial aircraft design mission. This will generally require more extensive modifications, significantly reducing the program's probability of successful execution.

When executing a CDA program, the government engineers may not get the same level of data and insight as with a traditional DoD development program. Further, the program team must learn to deal with FAA personnel and communication interfaces. Finally, additional technical requirements (policies, MIL SPECs, etc) may be piled on after contract award.

> ➤ *What to do.*

Conduct extensive market research to ensure that there are in fact commercial systems that have a high probability of achieving the military performance requirements within program cost and schedule constraints.

Adopt commercial practices where appropriate. A commercial aircraft includes design influences that reflect the manufacturer's expectation of how it will be used. This includes its concept of operation, internal and external interfaces and data standards, system architecture and design, supply chain management, and sustainment strategy. Where acceptable, DoD expectations should be adjusted to accommodate both the aircraft's intended commercial use and the underlying technical and business practices supporting the product design (2). Further, commercial companies operate, modify, train, and sustain these systems routinely. Understanding these techniques can aid in choosing the best value approach for life cycle management (unless constrained by other factors).

5.2 Technical Requirements

> **MAJOR THEMES:**
> - Retain sufficient trade space
> - Use performance-based requirements
> - Minimize modifications
> - Pay attention to Technical Authorities

> ➤ *Why is this important?*

The defense acquisition process normally starts with an identified military operational need, translated into a set of technical requirements that inform and guide the entire acquisition activity.

> ➤ *What's different?*

In CDA acquisitions, the trade space available to program managers is quite different from the trade space available for traditional aircraft development programs. Traditional DoD development programs generally have large development budgets and years of technology development and engineering and manufacturing development. So, traditional aircraft

development programs have some cost and schedule trade space, in addition to their technical performance trade space. Conversely, CDA programs have little to no development budgets, no technology development and a short engineering and manufacturing development phase. Further, commercial acquisitions are more subject to marketplace conditions with little real ability to drive or even affect market behavior. CDA programs typically consist of commercial aircraft modification and integration of non-developmental subsystems (either military specific or commercial). Consequently, CDA programs, with little development budget and compressed timelines, have virtually no trade space save technical performance requirements.

➤ *What to watch for.*

One of the risk areas most often cited by CDA program managers is a set of stable, well-defined technical requirements that closely match the capabilities of the commercial aircraft under consideration. The risks in this area are many. Unstable requirements can drive significant changes into the aircraft production and modification lines, cause additional test and evaluation activities, increase program cost, and stretch program schedules. Ill-defined requirements do not properly inform the Analysis of Alternatives and can lead to a non-optimum commercial aircraft selection. Similarly, technical requirements that diverge from the "green" aircraft mission set significantly decrease the likelihood of successful program execution.

Another requirements area of risk is inadequate or incomplete market research early in the acquisition planning phase of the program. Thorough market research allows the acquisition team to properly scope the solicitation and target potential solutions that closely match the technical requirements. It also informs the verification and test planning activities.

Technical authorities are a significant element and influence in the DoD acquisition process (3). Technical authorities are responsible for the Operational Safety, Suitability, and Effectiveness (OSS&E) of DoD systems. Technical authorities may impose technical requirements on CDA programs over and above the operational needs.

➤ *What to do.*

There are a number of actions available to mitigate the risk of unstable or ill-defined technical requirements. First, ensure robust participation by the acquisition community – specifically including the appropriate technical authorities – in the requirements formulation process. This generally means participation and leadership in requirements development team activities.

Use performance-based methods for acquiring CDA systems and insist on a set of requirements that are:

- Performance based (specify product functions and level of performance)
- Stated in clear, concise language
- Well defined and stable
- Quantitative
- Verifiable (with means for verifying performance)

- Material and process independent (allow flexibility in means to achieve results), and that allow interchangeability with parts of a different design

Be prepared to conform to the behavior of the other buyers in the marketplace even adopting the requirements of other commercial operators as closely as practical. Ensure that the requirements are feasible.

Conduct thorough market research early – preferably during the Materiel Solution Analysis Phase. Include the end user and as many relevant acquisition team members as practical. The market research should assess the capabilities of available commercial items; the performance of Original Equipment Manufacturers (OEMs), vendors, and modification contractors; and the relative size of the program to the commercial business base. Market research should determine the suitability of the commercial marketplace for satisfying a military need or requirement. This process will help the program team to become informed customers.

Finally, strive to select a commercial aircraft that will minimize the number and scope of modifications required to fulfill the military missions. Historically, the probability of program success drops dramatically as the commercial aircraft are subjected to extensive modifications or the mission diverges from the original intended mission of the commercial aircraft.

5.3   Specifications and Standards

> **MAJOR THEMES:**
> - Embrace commercial standards and data systems
> - Guard against the imposition of specialized standards
> - Manage user expectations

➢ *Why is this important?*

Adherence to a set of published specifications and standards, whether commercial or military, is critical to the development, production, modification, operation, and sustainment of any complex weapon system. CDA programs are no exception. A disciplined design/manufacturing process underpinned by appropriate technical specifications and standards can ensure product performance, reliability, maintainability, and safety; allow interoperability with other designated systems; and facilitate test, certification, and qualification. Specifications and standards are a must – the issue most often encountered is which type to choose: traditional military specifications and standards or commercially developed and maintained specifications and standards.

A major cost advantage in the use of many commercial-derivative systems is their adherence to published industry standards. While the government's technical authority may use such standards, certification is based on test and evaluation, rather than only meeting these industry standards. The use of global standards, however, can ease the requirements process significantly and can enable cost-effective sustainment models. Use of published industry standards can also

speed test, certification, and qualification steps because industry no longer needs to learn, follow, and maintain two or more sets of processes or systems (3).

> ➢ *What's different?*

The primary difference between a CDA program and a traditional DoD development program in this area is the readily available library of commercial specifications and standards for a commercial aircraft. These standards are generally developed and maintained by the aircraft Original Equipment Manufacturer (OEM) and major suppliers consistent with guidance provided by standards oversight bodies (including the Federal Aviation Administration (FAA) and other national, international, and industry organizations). These specifications and standards guide many of the design, development, and manufacturing activities of the product producers.

> ➢ *What to watch for.*

In current acquisition practice, the government can mandate specialized standards that conflict with common industry practices. The use of these government-only standards can impose many derived requirements. In some cases, a change in operational practice can avoid the costs associated with these specialized standards and/or derived requirements. In past programs, there has been no opportunity – no process – to evaluate these trades (3).

Current acquisition practices do not provide incentives to DoD prime contractors for use of commercial (non-government) standards. For example, some system integrators use their own proprietary standards rather than commercial interface/middleware standards (3).

If the choice is to use commercial specifications and standards, guard against the imposition of additional specialized standards that conflict with the commercial specifications and standards. These imposed standards can create added derived requirements; require extra testing, qualifications, and certifications; delay program schedules; and increase program costs. There are many sources of these imposed standards – interoperability requirements; communication protocols; specified architecture and operating environments; joint, international and coalition participation and service/DoD acquisition, test, and technical authorities.

> ➢ *What to do.*

The current DoD acquisition policy is to work within the commercial specifications and standards (3) – and that should be the default position of the CDA program team. However, strive to make the most informed decision practicable and understand the cost and risks of using commercial specifications and standards. Broadly socialize this approach throughout the stakeholder community – particularly those organizations that might impose additional specifications and standards.

5.4   Systems Engineering and Integration

> **MAJOR THEMES:**
> - Understand the marketplace
> - Stress open architecture
> - Plan for obsolescence and upgrades
> - Ensure interoperability

> ➢ *Why is this important?*

Rigorous systems engineering discipline is necessary to ensure that the DoD meets the challenge of developing and maintaining needed warfighting capability. Systems engineering provides the integrating technical processes to define and balance system performance, cost, schedule, and risk within a family-of-systems and systems-of-systems context. Systems engineering should be embedded in program planning and be designed to support the entire acquisition life cycle (27).

In addition to the DoD guidance, it is generally accepted in the aerospace community that any aircraft production or modification activity requires a disciplined systems engineering process. The systems engineering process includes requirements analysis, functional analysis and allocation, design synthesis, and verification.

Systems engineering can be considered as consisting of two significant disciplines:

- The specific technical domain in which the systems engineer operates
- Systems engineering management

Most government aircraft program management activities focus on the systems engineering management discipline and work to integrate the following major activities:

- Development phasing, design process coordination, and baseline generation
- A disciplined systems engineering process that facilitates solving design problems and tracking requirements through the development phase
- Life cycle integration involving customer inputs in the design process and ensuring the system viability throughout its life cycle (28)

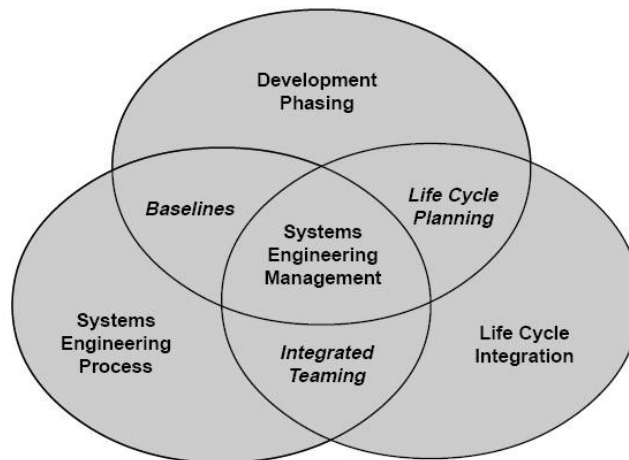Figure 5.4-1 illustrates the relationship in Venn diagram form.

Figure 5.4-1 Systems Engineering Management

> ➤ *What's different?*

The primary difference for CDA programs is the government's inability to affect the design of the commercial aircraft being procured. This is exacerbated by the limited insight into the production activities, planned product upgrades, test, qualification, and vendor choice. This drives reliance on commercially certified design and manufacturing practices, negotiated delivery schedules, and any planned surveillance of the modification activities.

> ➤ *What to watch for.*

Do not underestimate the difficulty of modifying a commercial aircraft for military missions. Similarly, do not underestimate the complexity of integrating a number of commercial items. Successful integration of multiple commercial items requires extensive engineering efforts, particularly when the system architecture is already defined. Understand the commercial marketplace including planned commercial modernization roadmaps, supplier release dates, evolving commercial aviation requirements, parts obsolescence, and vanishing vendor issues (2).

> ➤ *What to do.*

Conduct comprehensive market research to ensure the commercial aircraft modifications required to perform the military mission can be accomplished within acceptable levels of risk. The risk is highly non-linear as the modification scope grows and the military mission diverges from the commercial aircraft mission.

Stress an open, modular design that will facilitate the insertion of new commercial technology, as frequent changes to commercial items may drive repeated system re-integration activities throughout the life of the program. Seek multiple sources for critical items/subsystems to mitigate the risk of vendors dropping support for obsolete commercial items. Develop a plan for participating with the commercial modernization efforts – inclusive of both hardware and

software. Finally, create a plan to support new interfaces and protocols required to maintain interoperability with other required systems.

5.5   Test and Evaluation

> **MAJOR THEMES:**
> - Rely on the Original Equipment Manufacturer (OEM) for most of Developmental Test and Evaluation (DT&E)
> - Focus on DT&E of Military-Unique Modifications, Operational T&E (OT&E), and Live Fire T&E (LFT&E)
> - Make the test program compatible with and complementary to FAA's test approach
> - Involve the test, evaluation and qualification community – including the Federal Aviation Administration (FAA) – early in the process

> ➤ *Why is this important?*

DoD Instruction (DoDI) 5000.02 states that "test planning for commercial and non-developmental items shall recognize commercial testing and experience, but nonetheless determine the appropriate DT&E, OT&E, and LFT&E needed to ensure effective performance in the intended operational environment" (27).

> ➤ *What's different?*

While the service's Responsible Test Organization (RTO) is charged with ensuring the requisite testing is accomplished to the program manager's satisfaction, effective CDA test planning accepts commercial testing and experience and the FAA's involvement in the testing of each candidate CDA. Using existing test data to the maximum extent possible will go a long way to more complete, effective, and efficient testing.

Working closely with the program team, the RTO can best manage programmatic risk by structuring the Test and Evaluation Master Plan (TEMP) to account for the testing baseline established by the OEM and the FAA. There is no need to test everything; only test what must be tested to ensure the user and the service are getting what the warfighter needs and the taxpayers can afford. However, modifications of CDA may require significant regression testing to minimize the risk associated with the integration of technologies and missions.

> ➤ *What to watch for.*

Complete commercial testing may not have debugged everything (may not work as advertised and may require further testing). An item may have too many functional capabilities and can interfere with system performance once integrated. Reliability tests may not have been enough for the military application and may require further testing. Evolutionary development means the item may not be static, and tests conducted may not have been conducted on the exact equipment or fielded systems. Environmental testing may not meet all military specifications, and safety testing may be inadequate for the military application. The commercial market may

be unwilling to provide descriptions of performed testing or may not release specific data. Lack of Government control over the schedule of upgrades for commercial items may mean mandatory re-testing of interfaces to ensure they haven't changed.

> ➢ *What to do.*

The level of Government testing *should* be reduced since the commercial market has already accomplished functional testing. Access commercial market testing results to expedite integration and interoperability testing. Additionally, obtain the usage and failure data of products already in use (defects should have already been detected and eliminated). Finally, observe contractor testing instead of conducting new tests.

Make the test program compatible with and complementary to FAA's test approach. Embrace FAA involvement in the test program.

Market research of proposed designs, test and evaluation programs, and performance specifications should carefully consider trade-offs in test and evaluation for the sake of short-term cost and schedule objectives. Such trade-offs introduce risks to life cycle costs and support. OEM's test and evaluation data should be screened and validated independently by the operational test and evaluation community (16).

Include sufficient testing, consistent with commercial practices, before and after contract award, to ensure that the modified commercial and non-developmental items will work in the intended military environment (11).

Focus on DT&E of Military-Unique Modifications, OT&E, & LFT&E. The T&E community should prepare an analysis of the benefits and risks associated with the acquisition. They should compare the risks for T&E of the CDA and consider the need to thoroughly test the item(s) to performance specifications as part of the integrated system. The T&E community can use this analysis to propose test implications for cost, schedule, and performance risk to the program. The program team can then use the T&E risks, along with other program risks, to make an informed decision on whether to use CDA, and if so, which ones to use.

Involve the test, evaluation, and qualification community early in the process. Carefully consider who should be the Responsible Test Organization (RTO). Begin the TEMP early to positively affect the RFP and the program manager's Test and Evaluation Strategy (TES). The program manager should prepare a TES that describes the overall test approach for integrating developmental, operational, and live-fire test and evaluation, and that addresses test resource planning.

Consider the following additional test and evaluation recommendations as expressed by a DoD program manager (1):

- Thoroughly analyze known deficiencies of commercial equipment, NDI, and COTS before purchasing the items.

- Plan the conduct of operational testing as early as possible. This will identify problems early and allow resolution as soon as possible.

- Recognize that test and evaluation of commercial components is important when commercial suppliers are modifying a commercial system. Vendors do not test their items in military environments.

- Develop a sensible test program using previous manufacturing and government test results.

- Tailor testing to address program risk areas.

- Maintain on-site test organization representation during test execution to ensure test requirements are met and the test results are understood. Program managers cannot totally avoid testing just because they have purchased a commercial item for military use.

- Use common sense about testing to realize the cost savings from using commercial items.

5.6   Airworthiness Certification

> **MAJOR THEMES:**
> - Use Federal Aviation Administration (FAA) certification whenever possible
> - FAA certifications are different than military certifications
> - Pay attention to software certification
> - Develop and implement an airworthiness strategy
> - Develop an Airworthiness Certification Plan before the Request for Proposal (RFP)
> - Consider the FAA as partner, stakeholder and approval authority
> - Use the FAA Military Certification Office (MCO) throughout the life cycle
> - Data rights are extremely important to certification
> - There are special procedures for CDA manufactured in other countries

➢ *Why is this Important?*

USAF policy requires all CDA to meet civil certification airworthiness criteria for mission-oriented modifications to the maximum extent possible. USAF policy requires full civil certification for those military aircraft operated the same way as the baseline CDA counterpart. Other CDA may have mission requirements that are not equivalent to civil operations. They may have equipment installed that doesn't comply with applicable civil certification regulations or lacks applicable civil certification standards. In these cases, establishing airworthiness requirements may require using civil certification standards where practical and establishing military airworthiness requirements for other modifications. The military services may approve the airworthiness for these aircraft by accepting civil criteria and FAA approval for some modifications. They must perform subsequent military airworthiness qualification for those items that can't be shown to meet civil airworthiness standards (5).

Maintenance of the FAA type design (retention of Type Certificate):

- Allows continued use of commercial practices and procedures while still maintaining a configuration baseline

- Takes advantage of FAA approved Service Bulletin (SB) and Airworthiness Directive (AD) processes, which include engineering and spares acquisition processes

- Ensures quality control during production, which also applies to commercial vendors responsible for depot level maintenance

- Allows maximum commonality with commercial users (thus avoiding unnecessary spares and support equipment expense)

- Allows participation in spares pooling (thus decreasing inventory costs and aircraft downtime)

- Provides a firm foundation for re-competition of logistics support and/or aircraft re-sale (29)

FAA authority is limited by the responsibilities outlined in their Congressional charter and the regulatory requirements established in 14 CFR (Code of Federal Regulations) particularly with respect to the certification and operation of military aircraft. Civil regulations do establish requirements that civil type certificate holders must meet, regardless of whether the civil type certificate is used for civil or military purposes. On CDA, FAA authority is limited to certification, management, and administration of the applicable civil type and production approvals. Once these tasks are complete, and the aircraft is delivered to the DoD, authority for oversight of further modifications and airworthiness responsibility is assumed by the military (5).

Airworthiness certification is a repeatable process that results in a documented decision by the Program Manager (PM) that an aircraft system has been judged to be airworthy; i.e., it meets MIL-HDBK-516B (30) or the aircraft system carries the appropriate FAA type and airworthiness certificates (see Appendix D) or a combination of FAA and military certifications. Airworthiness certification verifies that the aircraft can be safely maintained and operated within its described operational envelope by fleet pilots and maintainers. Failure to follow this process could result in design features that have not been adequately evaluated for safety-of-flight impacts, with a corresponding increased risk of Class A mishaps.

➢ *What's different?*

Mission accomplishment is paramount to both the FAA and the military; they just go about it differently. The primary FAA focus is safety; the primary military focus is operational effectiveness. The FAA understands that the commercial operator of an aircraft can't make a profit if they can't get their payload from point A to point B. The FAA emphasizes that the design, manufacturing, and operation of aircraft must meet or exceed acceptable levels of risk. 14 Code of Federal Regulations (FARs) Part 25 airworthiness standards are based on, and incorporate, the objectives and principles or techniques of the fail-safe design concept, which considers the effects of failures and combinations of failures in defining a safe design. Catastrophic failure conditions must be shown to be extremely improbable. Extremely

improbable failure conditions are those having a probability on the order of 1×10^{-9} or less. The intent is to eliminate hazards from the design at the very beginning.

There are two different classifications of FAA airworthiness certificates: Standard Airworthiness Certificate and Special Airworthiness Certificate. A Standard Airworthiness Certificate (FAA Form 8100-2 displayed in the aircraft) is the FAA's official authorization allowing for the operation of type certificated aircraft in the categories listed in Chapter 2, Section 2, of FAA Order 8130.2F (31). The FAA Special Airworthiness Certificate (FAA Form 8130-7) is an FAA authorization to operate an aircraft in the US airspace in one or more of the categories listed in Chapter 2, Section 2, of FAA Order 8130.2F (31). The FAA will not issue an airworthiness certificate for a military CDA unless the configuration completely conforms with the FAA approved design. A Type Certificate (TC) is a design approval issued by the Civil Aviation Authority (CAA) of a given country (such as the US FAA and EU European Aviation Safety Agency (EASA)) when the applicant demonstrates that a product complies with the applicable regulations (see Appendix D). The TC normally includes the type design, the operating limitations, the Type Certificate Data Sheet (TCDS), the applicable regulations, instructions for continued airworthiness, and other conditions or limitations prescribed by the CAA. The TC is the foundation for other approvals, including production and airworthiness approvals. TC's are issued for airframes, engines and propellers.

A Supplemental Type Certificate (STC) is issued by the CAA approving a product (aircraft, engine, or propeller) modification (see Appendix D). The STC defines the product design change, states how the modification affects the existing type design, and lists serial number effectivity. It also identifies the certification basis, listing specific regulatory compliance for the design change. Information contained in the certification basis is helpful for those applicants proposing subsequent product modifications and evaluating certification basis compatibility with other STC modifications. The FAA can revoke an existing airworthiness certificate in any category (14 CFR Section 21.181), if the aircraft no longer meets its approved design or is not in an airworthy condition.

The CDA would normally enter the process of becoming a derivative aircraft (CDHA/CDTA) with its TC; at the end of the derivative modification, the FAA would certify the CDA design by issuing an amended TC and/or STC(s) if the military intended to maintain the type design. Classic examples of each within the Air Force include the C-32A (Boeing 737-200) aircraft, which maintain their type design, and the Airborne Laser (Boeing 747-400) which could not attain a STC due to the extensive and complex nature of the modifications which led to the TC being suspended by the FAA.

The military exercises similar practices, integrating safety into the design and manufacturing of military aircraft. However, the military's mission effectiveness is different than the civil mission; hence, MIL-STD-882 governs the level of acceptable risk as being a probability of one in a million, or 1×10^{-6} probability of a hazard causing a catastrophic event. It is the acceptance of this level of risk which is one of the fundamental differences between civilian and military airworthiness certifications.

Each CDA program generates its own Tailored Airworthiness Certification Criteria (TACC) for the modified commercial aircraft and Modified Airworthiness Certification Criteria (MACC) for follow-on, post-delivery modifications (see Appendix E). The key to success for TACC Airworthiness Integration is understanding the similarities and differences between MIL-HDBK-516B (30) and Civil Certitude. The military airworthiness process can be summarized in three steps:

1. The first step requires the development and approval of a TACC document for use as the basis for certification.
2. Second, the system design is evaluated for compliance with the TACC.
3. Third, any non-compliance must be assessed for operational safety risks and all identified risks accepted by the appropriate authority.

In the Air Force this process is controlled by the Aeronautical Systems Center (ASC) Airworthines Board and requires close coordination with functional experts within the Aeronautical Systems Center Engineering Directorate. ASC will verify that the design criteria, including requirements and rules, adequately address safety for mission usage, full permissible flight envelope, duty cycle, interfaces, induced and natural environment, inspection capability, and maintenance philosophy.

> ➢ *What to watch for.*

The PM is currently the "airworthiness authority" for USAF system. This means that the PM:

- Approves modifications, temporary and permanent, to the system's configuration
- Approves technical data used to operate and maintain the aircraft, including changes to maintenance procedures and repairs beyond the scope of the maintenance manuals
- Certifies airworthiness of the aircraft (i.e., the design is airworthy, the functional baseline is approved and under configuration management (CM), the physical configuration is approved and under CM and fielded aircraft conform to the design, and maintenance/repair/overhaul instructions are approved and under CM)
- Issues interim safety or operational supplements or immediate or urgent action Time Compliance Technical Orders (TCTOs) when necessary to limit operational risk prior to resolution of safety issues (this is done in conjunction with the lead Major Command (MAJCOM))
- Approves all TCTOs (after MAJCOM coordination on routine action and interim TCTOs, as a minimum)

The FAA is a partner, stakeholder, and approval authority. The FAA also provides governance. The FAA Military Certification Office (MCO) was created as part of the 10 September 2004 Memorandum of Agreement (MOA) between DoD and FAA (see Appendix D). The MCO: (a) performs FAA program management and integration functions for complex projects and those crossing regional boundaries; (b) works on policy, processes, and procedures to address unique challenges; and (c) improves certification support for military application work with DoD and

applicants to identify appropriate airworthiness solutions and maximize certification benefit on MCDA. The FAA is reimbursed for MCO activity per the MOA. The MCO should be notified initially by the military service of a new project. An MCO project must have a DoD military sponsor in order to proceed. The contractor/applicant must be on contract with a military service or the military sponsor needs to authorize the MCO in writing.

Certification support will fall into one of two categories per the DoD/FAA MOA, Baseline Support Services and Program Specific Services:

a) Baseline Support Services are provided for modifications to commercial aircraft that meet the following: the aircraft's primary mission (for example, carriage of passengers or cargo) is not altered; the flight usage spectrum is within the FAA certified flight usage (or can be accommodated by maintenance concepts); FAA expertise or civil standards exist; the aircraft are operated and maintained in a manner consistent with the way the aircraft was certified for civil use; and the modification is of a type that a civil applicant would typically request.

b) Program Specific Services are FAA support for certification, continued airworthiness, and technical assistance to the services where the modifications to a CDA do not meet the criteria for Baseline Support Services. The Procuring Service and FAA HQ will negotiate Program Specific Service Agreements (PSSAs) to support a particular program. The FAA will provide a cost estimate in response to the military service's requirements. Each PSSA must set: delivery schedule, period of performance, funding, and description of services to be tendered. The military service may request other services that are within the scope of the MOA, but are not specifically referenced. The MCO will provide those services as a part of Baseline Support Services, unless the FAA and military service agree a PSSA would be required.

Data rights can be tricky when dealing with CDA. It is critical to the success of the certification strategy and the certification plan to establish data rights with the OEM. Certification will require various data to validate the baseline/threshold from which military certification differentiates from the OEM established FAA type certification. This topic is discussed in detail in section 6.3, Rights to Technical Data and Computer Software.

The FAA focus is safety, not schedule. The MCO lacks the resources necessary to meet short term surges. The FAA MCO encourages applicants (military customers and OEMs) to hire Designated Engineering Representatives (DERs) as early as possible to help ensure meeting needed schedules.

There is no contractual relationship between the FAA and the OEM, so the PM is dependent upon their working relationship. The single most challenging issue for the FAA is to get the applicant to follow the FAA process and invest in the necessary resources.

Military unique modifications or equipment packages sometime end up with no FAA or military qualification. MCDA are modified with FAA issued design approvals, but items waived from

FAA certification are often incorporated without military technical oversight (21). Make sure everything is certificated.

As MCDA are often procured with the intent that FAA certification will satisfy airworthiness approval criteria, there is often no plan presented for military qualification/approval of waived items. The program team may or may not have the cognizance or technical resources to review or conduct the airworthiness approval; hence, allowances should be considered in the Systems Engineering Plan (SEP) and the Airworthiness Plan (AP).

The two regulatory bodies that primarily administer safety-critical issues – the FAA in the United States and JAA (Joint Aviation Authority) in Europe – recognize DO-178B (32) as an acceptable means of compliance for the approval of software in airborne systems. Certification of avionics equipment is typically achieved through FAA authorization of a TC or STC, Parts Manufacturer Approval (PMA), or a Technical Standard Order (TSO).

> ➢ *What to do.*

Determine whether it is best to go the FAA type certification or military type certification route. Normally, go with the FAA STC process, unless planning significant modifications. Modifications to add armament should be done as a military type certification.

- Consider certifying the modifications to the aircraft using civil airworthiness standards to the maximum extent practical.

- FAA MCO guidance in FAA Order 8110-101 (5) allows various levels of certitude to maximize use of civil standards.

- These levels of certitude are designed to ensure that modifications follow a closed loop process, type designs presented for certification comply with all applicable FAA airworthiness standards, and there is clear definition of the civil and military airworthiness seam (21).

In the case of the Air Force, the preferred solution is to obtain and maintain complete FAA Type Certification on Commercial Derivative Aircraft (4). While procuring and sustaining commercial derivative aircraft as closely as possible to their commercial counterparts is preferred, often times it is impractical. Mission requirements can run contrary to Federal Aviation Regulations making FAA certification extremely costly and nearly impossible. To remedy this, the aircraft may be partitioned (Engines, Avionics, Fuselage) into FAA Type Certified (TC) and "government approved" portions. Unique mission equipment and modifications that do not affect airworthiness are appropriate examples for government approval procedures versus FAA certification. The potential cost benefit from obtaining and maintaining a TC or STC aircraft or portions of aircraft is the use of the FAA certified parts pool and the FAA sustainment/maintenance baseline for contractor logistic support of the MCDA. This ensures a minimum level of safety and airworthiness equivalent to the aircraft's commercial counterpart.

Develop an airworthiness strategy as part of concept definition (Section 3.7). Careful integration of FAA and military certification requirements can appreciably expedite the overall certification process. However, evaluating the modifications may require a portion of previously accomplished tasks for the FAA certification to be re-accomplished. Specifically, if the modification is such that it affects OEM testing baselines, it may be necessary to re-accomplish portions of those test points in order to validate or establish specific baselines.

Develop a comprehensive Airworthiness Plan (AP) before the Request for Proposal (RFP). The FAA requires an Airworthiness Plan be developed prior to commencing production. The PM should produce a comprehensive certification plan, identifying certification requirements and who will satisfy these requirements. Additionally, certification requirements may exist at different phases of the program and different stages of product completion. Those responsible for certification accomplishment, and thus satisfying certification requirements, must be clearly identified as early as possible. This enables the PM to ensure the RFP and the eventual contract both contain the appropriate taskings for the involved parties. Having a successful certification strategy depends on having a realistic and comprehensive plan for completing the tasks and documentation required for certification. FAA Order 8900.1, Volume 10, Chapter 6, Section 2 (33) can help in preparing a workable plan.

Use the MCO throughout the life cycle. Each military service should notify the FAA MCO when the need for certification support is required. The MCO can assist in early discussions to define the scope of the program, early definition of RFP requirements; evaluation of proposals for source selection, and timely development of the Program Specific Service Agreement (PSSA) and FAA Statement of Work (SOW). This coordination will also assist contractors/applicants if DOD and FAA are on the same page. The FAA MCO can assist with developing new policies and procedures to support certification of commercial derivative aircraft and improve standardization. The DOD, FAA, and Industry must work together to use the most appropriate and efficient airworthiness criteria for CDA aircraft. The FAA role and relationship with the applicant is different than the DOD role with the contractor. FAA type certification is a disciplined process for verifying compliance of the design with FAA airworthiness requirements; it is not just a box to be checked. The FAA MCO can provide assistance to other FAA offices, the DOD, and Industry to accomplish this task.

For a program with a non-U.S. applicant, the FAA can issue a Type Certificate (TC), including an amended TC, or one or more Supplemental Type Certificates (STCs), for a product that is manufactured in another country with which the United States has an agreement for the acceptance of the product type (14 CFR §21.29). Examples of these agreements are a Bilateral Airworthiness Agreement (BAA) or a Bilateral Aviation Safety Agreement (BASA) with Implementation Procedures for Airworthiness (IPA). Prior to purchase of an aircraft of non-U.S. origin, the PM should contact the FAA MCO to verify that a bilateral agreement of proper scope exists with that government. The FAA will work with the Bilateral Partner Civil Aviation Authority (CAA) of the State of Design, under the procedures of the agreement, to provide the requested services; however, the CAA is not party to any PSSAs. The CAA should have the lead responsibilities in certification, continued airworthiness, Airworthiness Directives, support of

accident investigations, and so on. If a PSSA is issued, it should identify pertinent details of this relationship, and should address any limitations that could arise.

Validation is FAA certification based on the exporting CAA's certification. When validating the exporting CAA's certification of their aircraft, the FAA routinely exercises its right to examine any data at any time to satisfy itself that the product complies with U.S. requirements. The FAA generally focuses on areas that are controversial, covered by new regulations, or that have been shown to raise certification or service issues on other programs. By following a validation process, the FAA retains control over the certification program and stays involved in the significant issues, while relying on the exporting CAA to make compliance determinations on basic, low risk certification items. Ultimately, the FAA issues its own Type Certificate, which allows acceptance of these products in the U.S. system.

6.0   MODIFICATION MANAGEMENT

6.1   General

> **MAJOR THEMES:**
> - Select a qualified modification contractor
> - Manage relationships with the Original Equipment Manufacturer (OEM), modification contractor, and organic depot
> - Consider commercial Configuration Management (CM)
> - Make data rights decisions early

> ➢ *Why is this important?*

Managing the modification of a commercial aircraft to perform a military mission is the most critical aspect of a CDA program. Depending on the complexity of the conversion, the modification manager may be independent of the OEM. Additionally, the program office will be dependent not only on the experience of the modification manager, but the relationships within industry the modification manager has developed. Ensuring that the modification proceeds within scope should ensure airworthiness, both Federal Aviation Administration (FAA) and military, is achieved coincident with delivering a mission capable product.

> ➢ *What's different?*

Depending on the modification strategy, there is generally a larger group of primary stakeholders to satisfy including:

- Acquisition community
- Major Command (MAJCOM) resource sponsor
- OEM
- Modification contractor(s)
- Organic depot(s)
- Airworthiness certification authority (FAA, Military Department, Foreign Government)

To maintain FAA airworthiness certification, compliance with FAA directives is required to keep the aircraft within FAA standards.

> ➢ *What to watch for.*

Wherever possible the modifications should not cause the aircraft to lose its type certification and must comply with FAA guidance and procedures (6). There should be a strategy for compliance with OEM-issued Service Bulletins and FAA issued Airworthiness Directives including plans to correct FAA identified deficiencies. Compliance with FAA directives is required to keep the aircraft within FAA standards and to maintain FAA type design.

> ➢ *What to do.*

In concert with the aircraft manufacturer and modification contractor (if separate), carefully plan the production and modification activities to ensure program cost, schedule and technical performance requirements are satisfied. In many cases there are numerous modifications required to the commercial aircraft. Determine:

- Who will perform the modifications – OEM, organic depot or modification vendor(s)

- The location of various modifications (in-line, post production, combination of both)

- How to transport the aircraft (if required)

- The most effective and efficient scheduling of modifications

- How to minimize the impact to other production operations or maintenance, repair, and overhaul (MRO) activities

- Cost and risk

- Scope and contract type

- Modification type (temporary or permanent)

- Who will maintain configuration control

- Data rights required

- What kind of type certification to maintain (FAA or military)

One of the fundamental choices is who will perform the various modifications. A knowledgeable modification contractor/depot team with recent experience with the specific aircraft to be modified can greatly facilitate the success of any CDA program.

Also, the skillful management of the relationships among the OEM, modification contractor(s), and organic depot is very important. Written agreements on roles, responsibilities, schedules, and technical interfaces should be considered mandatory.

Decisions regarding configuration management, supply chain management, and other logistics support elements should be made based on the competencies of the organizations competing for these responsibilities. Carefully consider commercial practices used by other operators of these aircraft. As always, compliance with service regulations and statutory constraints in this area is critical.

Finally, plan the long term sustainment strategy for the maintenance of the aircraft including modifications and negotiate the rights to technical data and computer software required to support the chosen sustainment strategy.

6.2   Configuration Management

> **MAJOR THEMES:**
> - Configuration Management (CM) of military systems is uniquely challenging
> - Selection of CM provider(s) should be competency based
> - Consider commercial systems and techniques

> ➢ *Why is this important?*

Modern commercial and military aircraft are extremely complicated systems consisting of thousands of subsystems, structural assemblies, fasteners, and individual parts. Many of these subsystems are complex, software intensive electronics. A significant number of the avionics systems and structural components are safety-critical parts, crucial to the safe operation of the aircraft. Managing and maintaining the proper configuration of these systems is exceptionally challenging and is required for compliance with safety and regulatory mandates. The aircraft configuration must be constantly managed and updated throughout the entire life cycle of the system. Further, it should be done so in the most cost effective manner (34).

Configuration management provides a comprehensive view of an aircraft's history, including its original manufactured configuration and any changes made during maintenance or repair actions. Configuration management should document compliance with Service Bulletins, Airworthiness Directives and Time Compliance Technical Orders. It is a very important component of the aircraft life cycle management system, facilitating optimization of maintenance planning, component life tracking, aircraft availability, and operating costs.

> ➢ *What's different?*

CDA programs often have a choice of configuration management systems and providers to support their fleet. Use expertise from airframe and engine manufacturers, airline and freight operators, and other organizations that maintain aircraft. If the military services allow, the configuration management could be contracted to a commercial provider, often leveraging modern inventory management and data systems.

Operating an aircraft in a military environment presents a number of unique challenges. Military aircraft fleets routinely contain several configuration baselines and may have multiple missions to accomplish. They are often based in widely varying locations and climates, with infrastructure ranging from austere airfields to modern maintenance facilities and back shops. The military tends to retain airframes for very long time spans compared to most commercial applications. For example, the average life of Air Force aircraft is 24 years (35). Military services have significant, organic maintenance, repair, and overhaul (MRO) capability, including dedicated systems for supply chain and configuration management – often directly competing with commercial entities for fleet sustainment responsibilities. All these factors complicate the configuration management decisions and subsequent execution.

> ➢ *What to watch for.*

When a MCDA leaves FAA oversight, configuration control becomes the responsibility of the military airworthiness authority and military operator. The separate military services use different processes to maintain configuration control of MCDA, but all require documenting configuration changes in the maintenance records. These MCDA aircraft are often returned to FAA repair stations or other civil facilities for contract maintenance. The military services must ensure that processes are established and maintained for maintenance records and configuration control, and that maintenance personnel know to use these processes. In addition to being

critical for safety while it's in military service, maintenance records are critical in establishing civil airworthiness if the aircraft is sold and returned to civil operation. Some commercial aircraft are leased by the military services, which make every attempt to keep the leased aircraft configurations as close as possible to certified type design. The military services may also require that all records kept and maintenance performed on their aircraft be accomplished in accordance with commercial practices (36).

➢ *What to do.*

Make configuration management assignments based on the competency of the organizations competing for this responsibility. Consider recent, relevant expertise in the configuration management of fleets with similar complexity. The chosen configuration management system should make maximum use of data automation and inventory management techniques avoiding error-prone manual processes. The system should include provisions for multiple configuration baselines and a widely distributed fleet. It should be able to accommodate planned vendor release dates, diminishing manufacturing sources, technology refresh requirements, and parts obsolescence. Finally, the configuration management system should provide accurate, real-time configuration data on demand for current and any prior configuration or point in time.

6.3   Rights in Technical Data and Computer Software

> **MAJOR THEMES:**
> * Establish technical data and software needs *early*
> * Use of commercial technical data and software has been successful in a variety of CDA systems
> * Technical data rights and commercial warranties are companion issues of concern
> * Rights to technical data and software necessary to fully support the system should be addressed during competitive source selection if possible (consistent with the sustainment strategy)
> * Foreign built systems may pose data and software rights challenges

➢ *Why is this important?*

Knowing your program's technical data and software needs is key to structuring adequate data and software delivery and rights provisions in solicitations and contracts. Failure to obtain needed technical data and software and the appropriate level of rights therein can force procuring organizations into unwanted system support alternatives, higher than anticipated support costs (sole source dilemmas), misunderstood configuration alternatives/decisions, and obsolescence issues.

Two factors that are increasingly driving attention to rights in technical data and computer software, upfront, are the growth in the amount and importance of software and the growing military service life, with corresponding awareness that the commercial market may not be there for support throughout the system's operational life.

➢ *What's different?*

Baseline system development and design data and operating software always start out as the property of the designer/developer or Original Equipment Manufacturer (OEM). Commercial firms do not go into a product development program with the idea of sharing that data. Transfer of rights in such data and software to the customer (even special purpose rights) is not the norm in the commercial sector.

Commercial formats and styles for technical data may be somewhat different from the same data presented in military formats (technical orders for instance). However, use of commercial technical data for routine maintenance and operational activities has been successful in a variety of CDA systems. Normally, CDA programs do not acquire unlimited or unrestricted rights to the full range of design data supporting a commercial system due to both cost and operational reasons.

➢ *What to watch for.*

Commercial software data (code and architecture documents) must be obtained if the procuring activity intends to maintain or modify the system software. This can be a source of major disagreement with software OEMs since, in the commercial world, they rarely provide software data to buyers of their hardware. Rather, the CDA user is usually forced to rely on OEM software management and must accept changes to the software as they occur throughout the life of the system.

Related to the software data concerns is the challenge of integrating mission component software with existing CDA software. For instance, installing complex sensors on a CDA platform could require integration of the sensor software with aircraft system software. This can be very risky as documented in a FAA Software Engineering Resource Center study in 2000: "The Achilles heel of all COTS projects is the interface to legacy systems. They fail here over and over again." (15) Moreover, even when accomplished successfully, if commercial changes in the software are made and forced on the customer by the OEM over the life of the system, without the concurrence of the CDA user, such changes can negatively impact the integration of the mission component software.

Small fleets usually rely on Contractor Logistics Support (CLS) for the life of the program, and technical data and software rights are usually neither required nor affordable. Normal commercial data provided to all customers (e.g., operations and flight-line maintenance manuals and similar type data) is usually provided with the product at no additional cost and is often sufficient for user's needs. However, in the case of a large fleet of CDAs and the desire to support the fleet organically in a service depot environment, rights to technical data and computer software necessary to fully support the system must be purchased or otherwise received. Appropriate compliance with certain statutory and regulatory requirements related to source of repair decision making and establishment of core maintenance capabilities may also be dependent on the availability of rights in technical data and computer software and software documentation.

In the case of technical data and software rights for subsystems, the commercial world rarely allows the buyer to obtain subsystem data since suppliers at this level, as a matter of practice, do not generate or offer such data. This situation can compel extraordinary efforts in the data and software rights arena with the prime contractor to create special business agreements with subsystem contractors so that needed data and /or software documentation can be obtained. In many cases this task may prove to be more difficult and more expensive than the value of the data or software warrants. Therefore, staking out and negotiating the needed data rights provisions are absolutely essential to the smooth execution of the program.

➢ *What to do.*

Rights in technical data and computer software and commercial warranties are companion issues of concern. In cases where commercial warranties meet users' needs in terms of repair or replacement of parts and maintenance of software, then access to technical data, software, and software documentation may not be necessary or affordable. These choices, however, must be fully understood and the terms of the warranties clearly specified and implemented contractually. Warranty administration and tracking is burdensome and must be carefully planned. Usually when a commercial source offers a warranty with its product, it also declines to provide technical documentation. Sole sources for products are similarly reluctant to provide technical data due to their business motivation to retain support responsibility for their products. Consider establishing contract option provisions to enable parts and/or technical data buyouts if necessary to provide long-term support. These areas of concern lead to the obvious need to establish the CDA program's integrated logistics support strategy, and associated data and software rights needs, as early as possible.

Electrical interfaces and software products are among the most perplexing areas of system integration challenges. To ensure an efficient systems integration effort, ensure that the integrator has adequate technical data and software documentation with which to complete the integration design and execution. Deficiencies in this area have led to major CDA program delays and cost overruns.

Involve maintainers and operators in the decisions on technical data and software very early in the process. This goes a long way towards determining the proper level of data rights needed, as well as obtaining buy-in from the groups who eventually will employ the products.

When competition among sources is present in an acquisition, the acquisition/delivery of needed technical data and computer software documentation and appropriate level of rights under Defense Federal Acquisition Regulation Supplement (DFARS) Part 227 is greatly facilitated due to the government's competition leverage. Carefully examine DFARS Part 227 and ensure that the appropriate level of access to and rights in technical data, computer software, and software documentation to support the user's and sustainer's needs are being solicited, negotiated, and acquired at a stage of the program when as much competitive leverage as possible exists.

In addition, consider:

- taking advantage of the OEM publication systems,

- ensuring that there will be access to the publications regardless of operational environment, to include all contingencies dealing with accessibility, Internet availability, and password management, and

- purchasing access to the master publication database. Contractually, the OEM retains oversight and management, and provides all updates, printing, and distribution. The affected operational units and other authorized personnel have access to the publications via a secured Web portal (20).

Last, be aware that the acquisition of foreign products can create data rights and data sufficiency problems. Many foreign sources are not accustomed to providing to buyers of their products data rights akin to U.S. practices. Added to this is the need to translate technical data verbiage into English, an area where difficulties with supporting foreign products have been experienced by many.

7.0 LOGISTICS SUPPORT

7.1 General

> **MAJOR THEMES:**
> - Develop and codify the Integrated Logistics Support (ILS) strategy early
> - Include all stakeholders
> - Think commercial

➢ *Why is this important?*

The sustainment of a fielded weapon system is one of the most important responsibilities of the services' materiel and supply commands, the subordinate acquisition and logistics centers, and the individual system program offices. It is an arduous task requiring significant planning, investment, and coordination among diverse stakeholders. Early initiation of the logistics planning and budgeting activities is crucial to the execution of a successful sustainment strategy, especially since approximately 60% of an aircraft's life cycle cost is in operations and support (37). Logistics support is an extensive set of activities, developed in a collaborative environment, that establish and maintain the system's operational capability and readiness. It is an overarching activity, executed throughout the entire life cycle, that bridges all phases of a program from development to disposal.

➢ *What's different?*

The logistics strategies for CDA programs can differ significantly from their traditional DoD development counterparts. Many CDA fleets continue to use commercial airline maintenance strategies, such as the Air Transport Association's Maintenance Steering Group-3 (MSG-3) recommendations to sustain their militarized CDA fleets (38). These commercial maintenance strategies move away from the military's conventional scheduled Programmed Depot Maintenance (PDM) overhaul intervals to an engineering analysis based logic that determines the optimal scheduled maintenance tasks and intervals for an aircraft's major subsystems and structure.

Another difference is the existing commercial infrastructure (sometimes very extensive) already in place to maintain commercial aircraft fleets. In addition to maintenance facilities, many operators have sophisticated inventory and supply chain management systems. Commercial parts pool sharing is another technique commercial operators use to reduce maintenance costs. Many Original Equipment Manufacturers (OEMs) and vendors also offer commercial warranties. Finally, the technical authority for most commercial fleets remains at the OEM and the vendors of the individual subsystems.

➢ *What to watch for.*

The supportability of commercial products in defense systems has become a serious concern. Commercial firms must deal with the obsolescence issue as well. This situation becomes a

problem (for both the commercial and military sectors) when the subsystems evolve at a faster pace than the platforms. There may be a time lag of three to five years. In contrast, it typically takes DoD ten or more years to develop or upgrade systems. In addition, military hardware could be around for possibly 40 years or longer (23).

Most CDA fleets choose to retain the Federal Aviation Administration (FAA) as the type certification authority. A consequence of this choice is that maintenance actions and modifications must comply with FAA guidance and procedures – deviations could cause loss of aircraft certification (4) (6). The use of FAA approved procedures and certified mechanics should be carefully considered if organic maintenance is planned. Commercial maintenance manuals are normally quite different in both content and format from military technical orders used to maintain aircraft.

> *What to do.*

Always consider life cycle sustainment in selecting commercial systems. For example, commercial providers may include warranties and contractor performance-based logistics (PBL) that affect life cycle cost. The use of commercial components also means that planning for change is critical (3).

One of the most effective strategies to ensure CDA fleets have robust logistics support is early and thorough planning with the involvement of all stakeholders. The logistics plan should cover the entire spectrum of logistics elements – maintenance, supply chain management, test and support equipment, technical authority, manpower and personnel, training, technical data, facilities, and employment concepts. The overall logistics strategy should be codified in a Life Cycle Management Plan or equivalent document with the concurrence of the acquisition community, the operational customer, the sustainment organization(s), the OEM, and the modification contractor(s). It should address how modified commercial and non-developmental items will be maintained and supported when fielded because Government access to technical data may be limited, and availability of parts supplied may cease before the intended military life cycles of the items expire (11). The plan should be updated as required to consider mission/operational changes, organic workload requirements, policy/regulation/statutory revisions, and other influential factors. Roles, missions, and responsibilities of all major players in the operations and support of the fleet should be clearly articulated and approved at the highest possible level. The Logistics Life Cycle Management Plan should consider:

- Using the OEM developed and defended aircraft maintenance plan proposed to the FAA oversight group to the maximum extent possible

- Capitalizing on the use of military service maintenance personnel with their associated qualification levels

- Enabling the use of any commercial equivalent depot worldwide as a possible candidate for aircraft depot requirements

- using a maintenance approach based on maintenance at the time of need and mirroring the approach used by commercial airlines to reduce aircraft maintenance requirements for depot and organizational maintenance (20).

Address all stakeholders in the development of a logistics support strategy as there is typically competition (both public and private) for maintenance and support activities. Of special interest is the operational customer(s). The effective execution of a logistics support strategy requires substantial end-user support to facilitate system implementation and compatibility with operational concepts. The operational user(s) should have access to customer support that provides the level of operational readiness and fleet availability the missions dictate (2). Also, consider tailoring some aspects of the logistics support strategy to the unique and differing tactics, techniques and procedures employed by differing users (i.e. differences between Active, Guard and Reserve or geographically dispersed units).

Finally, seriously consider commercial alternatives when devising logistics strategies. One of the primary advantages of selecting a commercial aircraft over a traditionally developed military aircraft is access to a commercially driven sustainment infrastructure. Delegating responsibility for sustainment to the contractor should be considered, via warranties or specified performance-based logistics (3). Commercial maintenance, supply chain management, data, training and facilities often offer cost effective alternatives to organic support and should be considered by the program team within the constraints imposed by service organic workload requirements.

7.2 Integrated Logistics Support Strategy (ILS)

> **MAJOR THEMES:**
> - Use commercial infrastructure
> - Ensure alignment between sustainment organizations
> - Balance flexibility and Performance Based Logistics (PBL)

> ➢ *Why is this important?*

The effort required to provide logistics support for a commercial or military aircraft system is monumental. It involves thousands of personnel, scores of vendors, numerous technical repair centers, a global supply chain, reams of technical data, training centers, and facilities. For Air Force systems, the operations and support phase of an aircraft program averages 24+ years and consumes 60% of the aircraft's life cycle costs. Synchronizing this activity is the responsibility of the program team. Early and comprehensive planning of an integrated logistics support strategy is absolutely crucial.

> ➢ *What's different?*

The integrated logistics support strategy should always be considered when selecting commercial aircraft as it varies significantly from traditional DoD development programs. The extensive use of commercial components means that planning for change, obsolescence, diminishing manufacturing sources and technology refresh is critical. This is especially true for CDA

programs since they generally contain little development budget for non-recurring design or development efforts. Further, the replacement components must maintain interoperability with other military systems and avoid interference with other systems (3). Finally, the use of commercial warranties is commonplace in commercial aviation and should be considered in the ILS planning.

> ➢ *What to watch for.*

The development of an ILS strategy for a CDA program does present some unique challenges. The procurement of technical data packages required for sustainment is almost always a contentious issue. The various stakeholders tend to have widely varying opinions of what and how much data is required. The commercial data is often not readily available and is often prohibitively expensive. Further, the subsystem data may not be available to the Original Equipment Manufacturer (OEM) and frequently must be negotiated separately with a vendor or supplier. (See Section 6.3 for a more complete discussion of Rights in Technical Data and Computer Software.) Commercial inventory and supply systems and parts numbering conventions can present significant challenges if required to be incorporated into organic data systems and processes.

Another complication is the often competitive relationship between the OEM/commercial vendors and the organic depots/technical repair centers regarding the performance of various logistics support tasks. A major issue here is, on a continuum of CDA, how can Contractor Logistics Support (CLS) or commercial facilities be used? Maintenance workloads, source of repair assignments, supply chain, and inventory management can all be areas of competition among the public and private entities vying for the workload.

Finally, the extensive use of performance based logistics (PBL) contracts for commercial providers has become an issue as the services move to more centralized control of operations and maintenance budgets. The large PBL contracts tend to inhibit the services' desire for the flexibility to move maintenance dollars between individual weapons systems as mission needs dictate.

> ➢ *What to do.*

Foster a collaborative environment and include all primary stakeholders in the ILS strategy development. When possible (considering statutory and regulatory constraints), pursue best value options for selection of sustainment organizations. Mission assignments (depot maintenance, supply chain responsibility, technical authority, training, etc) should be merit-based when possible and aligned with the aircraft mission. The use of existing commercial infrastructure should be seriously considered. Also, align and synchronize the various sustainment teams participating in the logistics support efforts.

Consider the use of a PBL strategy, as it is currently the DoD preferred approach for implementing product support. Operational requirements should guide the development of the PBL performance parameters. The PBL implementation approach should optimize total system

availability while minimizing cost and the logistics footprint. Include options for differing performance levels to ensure budget flexibility is preserved.

Finally, market research for system and product support capabilities (public and private) can help to define the extent and scope of opportunities for achieving support objectives with design and viable product support strategies. Research should include:

- Support elements currently provided (for a legacy system to be replaced)
- Current measures used to evaluate support effectiveness
- Current efficacy of required support
- All existing support data across the logistics support elements
- Assessment of existing technologies and associated support (12)

7.3   Source of Repair

> **MAJOR THEMES:**
> - Understand the process
> - Stress public-private partnering
> - Consider commercial strategies and infrastructure
> - Adhere to the services' policies and procedures

> ➢ *Why is this important?*

Selecting the source of repair for an aircraft and its many subsystems is an important decision, with long term ramifications and significant governing legislation and regulations. For Air Force aircraft, HQ Air Force Materiel Command (AFMC) establishes policy and administers the Source of Repair Assignment Process (SORAP). The Air Force uses the SORAP process to allocate its depot-level maintenance workloads. The SORAP process is applied to workloads for hardware, software, new acquisitions, major modifications, and major changes to fielded systems (i.e. life extensions, additional quantities, or significant increases in cost). The SORAP must be a collaborative process that includes all stakeholders' participation in determining the most beneficial source of repair.

> ➢ *What's different?*

CDA programs present unique challenges, especially when they choose to maintain Federal Aviation Administration (FAA) type design. The commercial derivative aircraft must be maintained as close as possible to airworthiness certificate requirements and use only FAA-certified maintenance supervision for maintenance (10). Since service maintenance technicians and activities do not require FAA certification, this presents a challenge and should be addressed if organic maintenance is contemplated.

> ➢ *What to watch for.*

Understand that the SORAP considers a broad range of factors when determining the source of repair. In particular, public laws concerning core logistics capabilities and funding limitations on depot maintenance significantly influence source of repair decisions. Specifically, Title 10 United States Code, Section 2464, *Core Logistics Capabilities* requires the services to establish and maintain organic capabilities to provide a ready and controlled source of technical competence and resources necessary to ensure effective and timely response to mobilization, national defense contingencies, or emergencies. This core workload must be accomplished in government-owned/operated facilities with government-owned/operated equipment by government personnel (39). Similarly, Section 2466, *Limitations on the Performance of Depot-level Maintenance of Materiel* (commonly referred to as the 50/50 law) requires that no more than 50 percent of the funds made available in any fiscal year to a military department or defense agency for depot-level maintenance and repair may be used to contract for the performance by non-federal government personnel (39). Other SORAP considerations are the service's long-term depot strategy and overall cost to the DoD. While the individual program requirements and costs are considered, they are not paramount. Recognize these constraints and work within them to ensure the sources of repair meet program needs. Be aware that compliance with the above requirements can necessitate access to and, in many cases, rights in a certain level of technical data or computer software to enable the decision making process and/or to establish the organic capability necessary to satisfy 50/50 and Core Logistics mandates.

> ➤ *What to do.*

Foster an atmosphere of collaboration among the diverse stakeholders throughout the SORAP. The SORAP should not be viewed as a direct competition between the organic depots and the OEM/modification contractor(s). Both DoD and the services encourage programs to pursue partnerships between the organic depots and contractors early in the acquisition life cycle. Specifically, Title 10 United States Code, Section 2474, *Centers of Industrial and Technical Excellence: Designation; Public-private Partnerships* allows organic depots to enter into public-private cooperative arrangements to perform work related to their core competencies. These partnerships are designed to ensure private industry and public depots establish and sustain core logistics capabilities, to assign non-core sustainment elements based on best value, and to promote technology infusion. The judicious use of partnerships can minimize data rights issues, utilize technical expertise across both the public and private domain, support both core and 50/50 goals, and promote a shared sustainment responsibility between the organic and contractor depot teams.

Ensure that the contract calls for delivery of, and that the government acquires, sufficient rights in technical data, computer software and software documentation to meet its legal requirements for source of repair decision making and development of statutorily required core maintenance capabilities. Further, ensure that delivery and acquisition of appropriate rights in data and software needed to support the system sustainment strategy are solicited, negotiated and acquired while the program is in a competitive environment. (See Section 6.3 for a more detailed discussion of Rights in Technical Data and Computer Software.)

For CDA programs that choose to maintain FAA type design, follow specific military service guidance for maintenance, repair, overhaul, inspection, and implementation of Airworthiness Directives and Service Bulletins for the commercial derivative aircraft. In the case of the Air Force, this is Air Force Instruction 21-107, Maintaining Commercial Derivative Aircraft (10).

7.4 Supply Chain Management

> **MAJOR THEMES:**
> - Using the supply chain already in place for the commercial system or platform makes great sense
> - Parts sharing with other Operators can cut costs
> - Reliance on Defense Logistics Agency (DLA) support may be advisable in some situations
> - Buying from foreign sources brings additional supply chain challenges

> ➢ *Why is this important?*

Modifications to CDAs may be minor or extensive and may include few or multiple components. The suppliers of these installed components form the supply chain for the CDA mission equipment, and they must be carefully managed to ensure that the necessary supply support follows for the life of the system. Usually the integrator of the CDA's mission equipment performs this function.

> ➢ *What's different?*

The CDA Original Equipment Manufacturer's (OEM) supply chain usually exists and is in a healthy state when a commercial aircraft is selected for a CDA application (e.g., Boeing 737). Using the supply chain already in place for the commercial aircraft or platform makes great sense. For instance, on the Navy's C-40A program the Navy contracted for supply support with Boeing, the 737 manufacturer, which includes a commercial parts sharing pool. This strategy permitted the Navy to forego investment in a complete 737 spare parts pool for common spare parts, a savings of $80M (20). Any existing user of the aircraft selected as a CDA platform will likely have an existing supply system, which may be a candidate for parts sharing (commercial airlines do this frequently with each other and with government users of the same platforms). Usually, by incorporating all applicable Federal Aviation Administration (FAA) Airworthiness Directives in their fleet of CDAs, the government can qualify to participate in a shared parts pool with other commercial users of the same equipment.

> ➢ *What to watch for.*

In most cases the OEM for the chosen commercial platform can be relied upon to manage its own supply chain as long as the commercial platform remains in wide use. But if the unfortunate situation occurs wherein the government becomes the only operator of the commercial platform, then the government may also become the de facto manager of that platform's supply chain. Similarly, if the modification equipment installed on the CDA is unique to government needs,

then management of the supply chain for that equipment becomes a government challenge as well.

The Defense Logistics Agency (DLA) manages a very great number of items, some of which might be utilized in the CDA's airframe, engines, or mission equipment. Reliance on DLA support may be advisable for part of the CDA's support planning with DLA then functioning as part the supply chain management team.

Contractors/Logistics Suppliers may be providing parts to military CDA, which are not FAA approved parts.

- Once FAA certifies type design, replacement parts sold for a type certificated product require manufacture under some kind of FAA Production Approval. All FAA approved parts are manufactured under some kind of FAA approved quality system or direct inspection.

- Processes, identification, and marking of approved parts are controlled in the civil airworthiness system, and for international export.

- Military airworthiness concerns for unapproved parts on CDA include:
    - parts that may or may not conform to type design and have no FAA inspection
    - the military may be relying totally on the contractor system, with no government oversight of manufacturing or inspection procedures
    - discovery of unapproved parts on military CDA could exclude eligibility for parts pooling with the civil fleet
    - if discovered, flight critical or safety related impacts are often difficult to determine

- Although civil regulations require compliance for parts on type certificated products under civil, foreign, or military registration, the FAA's Military Certification Office (MCO) recommends these requirements be clearly incorporated into military procurement/logistics support contracts (21).

In the case of foreign sources for parts and supplies the challenges can be even greater. Buying from foreign sources involves communication obstacles, monetary exchange rate issues, and sometimes cultural differences, which can contribute to increased need for supply chain management skills. Knowing the sources of supply and having experience with them is essential to gauge the degree of management effort necessary to ensure success.

> ➢ *What to do.*

As part of overall logistics planning, choose the best methods for supply chain management by first, identifying all key suppliers, and second, determining whether OEMs can be relied upon for supply chain management or whether it is less risky and/or costly to take on this responsibility within the government. Most CDA programs rely heavily on the OEMs who usually have robust supply chain management capabilities in place and serve multiple customers.

If possible, contract for supply support to provide an onsite representative, 24-hour delivery of parts for the continental United States and 72-hours worldwide, as well as commercial parts pool sharing. Ensure all applicable FAA Airworthiness Directives and are incorporated in order to meet obligations necessary to participate in parts pool sharing. Establish a funding line so money will be available to incorporate the Safety and Airworthiness Directives (20).

7.5   Sustainment Organization

> **MAJOR THEMES:**
> - The sustainment organization will have to deal with many competing entities
> - Involve the sustainment team early in the program
> - Staff the sustainment organization consistent with the fleet's Integrated Logistics Support (ILS) strategy

> ➢ *Why is this important?*

The military services tend to keep aircraft in their inventories for decades and the bulk of fleet life cycle costs are in operations and support. It is essential that the government organization directing this effort be properly trained and staffed.

> ➢ *What's different?*

For CDA programs, the initial logistics support is almost always performed by a contractor – many times the aircraft Original Equipment Manufacturer (OEM). Further, there is often long term support provided by the contractors, even including full maintenance and supply chain management. At some point, however, the military service may employ the CDA longer than there is a sustainable commercial market for its commercial counterparts. At this juncture, the military service will potentially need to be organized to manage, or at least monitor and oversee, logistics support of the CDA.

> ➢ *What to watch for.*

It is highly likely that there will be issues providing the technical data and/or computer software documentation required for organic support. Most programs also have insufficient budget for spares provisioning and, therefore, rely heavily on OEM production activities or vendor supply chains. The sustainment organization will have to deal with many entities, both government and commercial, all competing for elements of the logistics support activities.

> ➢ *What to do.*

Include the initial cadre of the sustainment team as part of the program organization (section 4.2) when the program organization is first established. The sustainment team should be involved early in the program and staffed consistent with the fleet's long-term support strategy (section 7.2). If the strategy is full organic support, the sustainment team should resemble a traditional system support management team. It should be fully staffed with all the engineering, logistics, supply chain management, finance, contracting, and program management personnel required to

support the fleet. Further, if the aircraft is to maintain FAA type design, the team will have to give special consideration to the qualifications of the maintainers and adherence to approved maintenance/modification procedures.

Conversely, if the strategy is contractor logistics support or a combination of organic/contractor support, the team makeup should be tailored as appropriate. For programs with Contractor Logistics Support (CLS), there is usually more reliance on contractor technical personnel and, consequently, a smaller government engineering staff. Also, if the contractor is managing the aircraft's supply chain, there will be a smaller government team of item managers, equipment specialists, etc.

If the CDA is expected to transition from CLS to organic support at some future point, ensure that contract provisions are put in place to provide a government option to acquire access to, or delivery of, the necessary level of, and appropriate rights in, technical data and computer software to meet this requirement. Ensure the sustainment team is knowledgeable of the data and software requirements.

Finally, the sustainment team should be capable of managing the complex and sometimes contentious relationships among the organic and contractor technical repair centers, operational customer(s), service acquisition and sustainment governance offices, and all other stakeholders.

APPENDIX A: COMMERCIAL AND NON-DEVELOPMENTAL ITEMS

Q. What is a commercial item, and what is a non-developmental item?

A. Commercial item and non-developmental item are defined in Part 2 of the Federal Acquisition Regulation (FAR), and that definition applies to all related sections of the FAR. The following paraphrases – and provides examples of – the FAR definitions. Notice that commercial items are no longer a subset of non-developmental items in the FAR definition. This differs from the previous definition of NDI used by DoD as illustrated in the figure below.
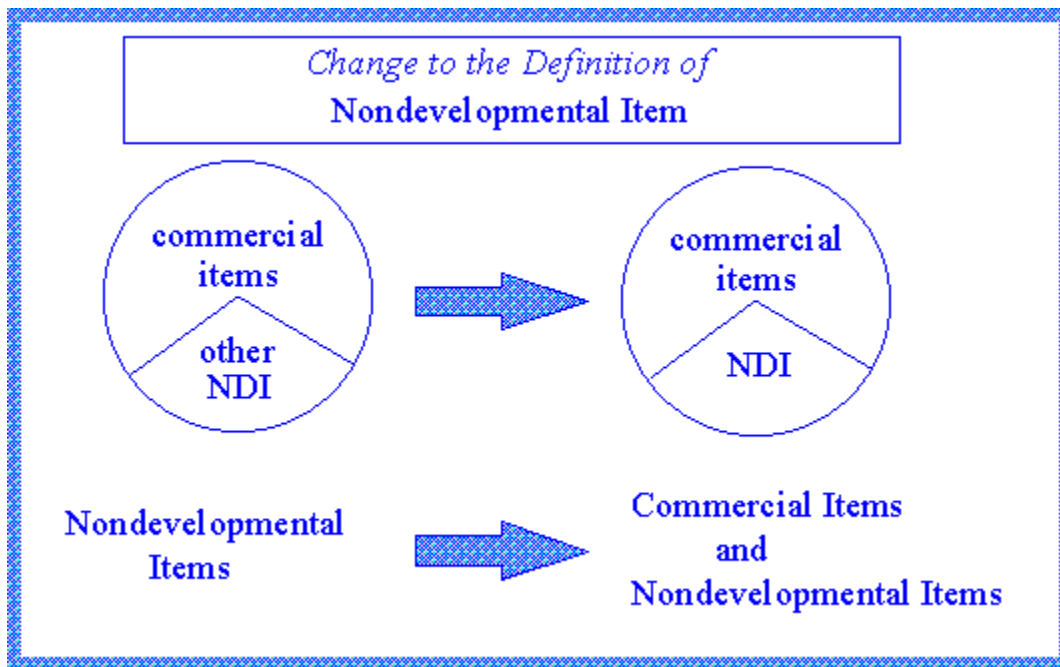
The definition of commercial item has eight subsets and some of them may seem a little out of place to you. You need to understand that the primary reason for the FAR definition is to identify items that can be purchased using the simplified procedures for commercial items in Part 12 of the FAR. In using the FAR definition, you need to consider why you are using the definition to determine if all of the subsets of the following definition are appropriate. For example, services are included in the FAR definition. If you are using the FAR definition to determine whether a commercial item description is the appropriate product description, you should exclude the subsets that include services. CIDs aren't used to describe services.

The following paraphrases the definition in FAR Part 2 and provides examples.

A commercial item is

- any item, customarily used for nongovernmental purposes, that has been sold, leased, or licensed to the general public or that has been offered for sale, lease, or license to the general public. For example, items sold in the commercial market, which includes wholesale and retail distribution centers, catalogs, personal sales – items offered for sale

commercially, but not yet sold, are also included. General examples of commercial items that the DoD buys range from food, clothing, and computers to trucks and airplanes. The availability of commercial items to meet a specific defense requirement is determined by market research.

- an item that evolved from a commercial item described in paragraph 1 above. A new model of an existing commercial product, product upgrades, or a new version of a commercial software package are examples.

- an item that meets the description in paragraph 1 above, but with minor modifications to meet DoD needs or modifications of type normally done for commercial customers. Examples include products that are customized commercially, such as automobiles, computer systems, and products with DoD unique modifications that do not change the basic properties or function of the item. Minor is a technical judgment call.

- any combination of items meeting this definition of commercial item, if it is normally combined and sold commercially. Examples include a computer or video system that is a combination of commercial items, even though the system itself may be a unique configuration.

- a service bought to support commercial items. For example, training, maintenance, and service contracts purchased to support items meeting the definition of commercial item are included.

- a service of a type offered and sold competitively in the commercial market at catalog or market prices. Construction, storage and distribution services, aircraft maintenance, and janitorial services are examples.

- any item or service described in 1 through 6 above, even though it is transferred between separate divisions of a contractor. For example, a commercial item transferred from a commercial division to a defense division of a company is still a commercial item.

- an item developed at private expense and sold in substantial quantities, on a competitive basis, to state and local governments. For example, products sold to state and local governments, not sold commercially, could be bullet proof vests and fire and rescue equipment. Remember this definition was created primarily to trigger the use of FAR Part 12 in solicitations and contracts. In that context, including this subset as a commercial item makes more sense.

What about COTS?
'COTS' is an acronym for 'commercial-off-the-shelf. It is frequently used as a synonym for a commercial item; however, it is now defined in statute as "unmodified commercial items".

Q. Why the change in the definition of commercial and non-developmental item?

A. The definition of commercial item and non-developmental item were separated to make clear the preference for commercial items over non-developmental items in defining defense requirements. This preference is mandated by statute.

The term non-developmental was coined by Congress in 1986 to describe items that were previously developed. Buying items already developed allows DoD to avoid paying for the development of new systems, components, and items. In this respect all non-developmental items, whether developed for the commercial or the military market, provide this benefit. As a result, the statutory definition of non-developmental item included commercial items and still does. When they meet defense needs, however, the acquisition of commercial items provides benefits over and above the acquisition of other previously developed items. Because of the size of the commercial market, commercial items offer price advantages resulting from economies of scale and price competition. Additionally, the commercial industrial base is an important resource, both for greater product availability and for access to state-of-the-art technology. Only through increasing our use of commercial products and practices can we take full advantage of our commercial industrial base. These benefits are especially important in the current environment of reduced defense spending.

Recognizing the importance of using commercial items, when they meet our needs, commercial items and NDI are separate by definition in the FAR, and the preference for commercial items over all others in defining defense requirements is reiterated in FAR Part 11.

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APPENDIX C: OVERVIEW OF COMMERCIAL ACQUISITION LEGISLATIVE HISTORY

(GAO Report 06-995) (17)

1972	Commission on Government Procurement: **Commission's recommendation**: Government should take greater advantage of the efficiencies of commercial marketplace.
1984	Competition in Contracting Act of 1984: **1984 act**: Required promotion of the use of commercial products whenever practicable.

1986	National Defense Authorization Act for Fiscal Year 1987:
	        1986 act: Required DoD to acquire non-developmental items (commercial items) to the maximum extent practicable.
	
	President's Blue Ribbon Commission on Defense Management (Packard Commission):
	        Commission's recommendation: DoD should expand the use of commercial products and commercial-style competition.

1993	Advisory Panel on Streamlining and Codifying Acquisition Laws (Sec. 800 Panel) **Panel's recommendation**: Called for the facilitation of government access to commercial technologies.
1994	Federal Acquisition Streamlining Act: **1994 act**: Expanded the commercial item definition to include non developmental items, those not yet on the market, and "of-a-type" items and stand-alone services. Exempted commercial item procurements from requirement to submit certified cost or pricing data to the government under certain conditions.• Provided preference for acquisition of commercial items and streamlined mechanisms for their procurement.
1996	Clinger-Cohen Act of 1996: **1996 act**: Exempts commercial item acquisitions from requirement to submit certified cost or pricing data and comply with cost accounting standards.
2003	Services Acquisition Reform Act of 2003: **2003 act**: Allowed different types of contracts to be treated as commercial acquisition under certain circumstances.
2006	DoD Authorization Act: **2006 act:** Requires that to use commercial acquisition procedures for major weapon systems, the Secretary of Defense must now (1) determine that procurement meets the definition of "commercial item," (2) determine that national security objectives necessitate the purchase of the system as a commercial item, and (3) give Congress at least 30 days notice before purchasing a major acquisition program using commercial acquisition.

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1994 – Federal Acquisition Streamlining Act – Pub. L. No. 103-355, Section 1202 and Title VIII (1994).

1996 – Clinger-Cohen Act of 1996 – Pub. L. No. 104-106, Div. D (1996), formerly the Federal Acquisition Reform Act of 1996 and renamed in Treasury, Postal Service and General Government Appropriations Act, 1997, contained in Omnibus Consolidated Appropriations Act, 1997, Pub. L. No. 104-208, Section 808 (1996).

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APPENDIX D: MILITARY TYPE CERTIFICATION

(FAA Order 8110.101, 09/07/2007, Chap 3)(5)

Basis of the Military Certification Program. In 2004, the FAA and representatives of the U.S. Armed Services created an interagency Memorandum of Agreement (MoA). In it, the FAA agreed to provide technical support, certification services, and continued airworthiness services for MCDA through our dedicated Military Certification Office (MCO). The DoD agreed to reimburse us for our services. Contact the MCO for the latest revision and copy of the MoA.

    a.   The Armed Services' objective is to assure military modifications to MCDA comply with the civil airworthiness requirements and do not compromise the safety level of the baseline aircraft as approved by the FAA.

    b.   FAA services in support of MCDA include:

        (1) Type certification, including amended type certification and supplemental type certification

        (2) Production certification and approval

        (3) Airworthiness certification

        (4) Military statement of conformity

        (5) Continued airworthiness, including instructions for airworthiness (ICA)

        (6) Technical assistance

    c.   Certification projects must have a U.S. Armed Services sponsor. This could include aircraft for other U.S. government agencies and foreign governments (such as foreign military sales or security assistance programs).

a. Type Certificates.

    (1) Generally, MCDA projects don't involve issuing a new TC. Most MCDA projects are major changes to existing FAA approved commercial aircraft designs because the military wants to use, or modify, an aircraft to meet their needs. The MoA allows for issue of new TCs only for 14 CFR(Code of Federal Regulations) parts 23 and 27 primary trainer aircraft. This includes issuing a TC under both14 CFR §§ 21.21 and 21.29. Applications for new type certificates under parts other than part 23 or part 27 must be coordinated with the MCDA PM and approved by AIR-100.

    (2) For non-U.S. aircraft projects, a branch of the armed services may contract for a foreign type certificated aircraft. These aircraft may be eligible for a TC under 14 CFR § 21.29. The application for a 14 CFR § 21.29 TC will only be accepted by the FAA if the aircraft has received a type certificate or equivalent from the civil aviation authority (CAA) prior to the issuance date of the armed services request for proposal. For the purposes of the MoA, this

would not be considered a new TC. Since international projects may involve a foreign aviation authority, licensing agreement, and partial manufacture in the U.S., the MCO coordinates with AIR-40 for guidance and project specific policy. The FAA conducts such projects under bilateral agreements using FAA Order 8110.52, *Type Validation Procedures*.

b. Amended Type Certificates. A FAA type certificate holder may apply to amend their TC to incorporate type design changes unique to military applications.

c. Supplemental Type Certificates. Under 14 CFR § 21.113, any person seeking to alter a product by incorporating major changes to type design, not great enough to require a new type certificate, can apply for a STC.

      (1) Most MCDA projects are accomplished through the STC process. To obtain FAA approval for their modifications, a contractor must apply for an STC.

      (2) ATC holder may certify a MCDA solely by STCs or in combination with an ATC. The applicant may make use of previously approved STCs if they are compatible with other proposed military modifications. See AC 21-40, *Application Guide for Obtaining a Supplemental Type Certificate,* and Order 8110.4 for conducting STC projects.

      (3) In complex modifications there could be several interdependent STC approvals. It is necessary that modifications are accomplished and approved so the end product stays in compliance with regulations. With an STC the installer must state that the modification is compatible with previously approved modifications. If an STC is installed and dependent upon the installation of other STC(s), then these should be noted in the Limitations and Conditions section of the STC. This scenario could also be accomplished using an umbrella STC, which lists the included STCs and the order of their accomplishment. See Order 8110.4 for further guidance.

Note: Post TC original equipment manufacturer (OEM) design changes and STC changes can be reviewed on MCDA. FAA Form 337, *Field Approvals*, changes cannot be issued for MCDA under military registration and therefore may not be applicable.

d. Amended Supplemental Type Certificates. The holder of an existing STC can apply to amend the STC to incorporate design changes. These amendments can establish an STC configuration unique to military applications, or incorporate revisions or upgrades to the original STC. Any unique military changes are noted on the supplemental data sheet or noted on amended STC.

e. Type Design Changes. The holder of a TC or STC may incorporate design changes to the approved design following 14 CFR part 21, Sub part D.

Military Airworthiness Authority Roles and Responsibilities.

      (1) Understand the rules and policy governing the relationship between the applicant and the FAA.

(2) Understand the applicant's rights and responsibilities when pursuing FAA approval under civil regulations.

(3) Work together with the MCO to define airworthiness requirements for MCDA.

(4) Invite the FAA to participate as a consultant on FAA regulations and procedures in official military program meetings with the contractor/applicant as an airworthiness partner.

(5) Ask the FAA to present their views on specific issues, or to provide general project status from their perspective.

Contractor/Applicant Roles and Responsibilities:

(1) Demonstrate the product meets minimum safety standards by showing compliance to the applicable regulatory requirements.

(2) Comply with requirements in 14 CFR part 21.

(3) Unless otherwise addressed in this order, conduct all type certification projects according to Order 8110.4.

(4) Submit a project specific certification plan (PSCP) providing an approach for showing compliance.

(5) Include proposed use of an authorized FAA delegated organization, company designees, and/or qualified outside designees in the project certification plan.

(6) Cover unique aspects to the MCDA modifications in the project certification plan. Unique aspects may include interdependent STC approvals, modifications to be made by other contractor/applicants. Describe interface requirements for other STCs, or "Provisions Only" approvals.

(7) Inform the MCO and military program office of modifications that are not part of the proposed type design (not FAA approved).

(8) Identify any known or potential certification/qualification problems early in the process so there is time to resolve them.

(9) Clearly identify the content and intent of the proposed STC approval in relationship to other modifications that may be made to the aircraft.

(10) Indicate if military participation in FAA technical coordination or official board meetings is permissible. The applicant has the right to conduct business and discussions with the FAA in private.

(11) Upon issuance of the certificate of approval, comply with the requirements for continued airworthiness for the type certificate. These requirements apply to all TC holders whether the certificate applies to civil, military, or both types of aircraft.

Note: The relationship between the armed service and the applicant is governed by the procurement contract. The FAA is not a party to this contract and not bound by any of its provisions.

Special Conditions, Exemptions, and Rulemaking. The DoD instructs the military to find commercial-off-the-shelf (COTS) solutions for mission fulfillment. For MCDA the DoD are required to obtain FAA approval to the maximum extent possible. The fundamental objective of the MOA is that the FAA will issue approvals that assure that MCDA meet civil airworthiness standards. However, if military modifications are not consistent with civil use or the regulations, FAA approval may not be possible. Rulemaking activities such as special conditions, exemptions and new airworthiness standards will not be considered except for the following circumstances:

    a. If the proposed type design change:

        (1) Has potential for civil applications,

        (2) Is proposed for implementation on five or more aircraft, and it is likely that the aircraft may return to civil operation, or,

        (3) Will be operated by the military under civil registry with a standard airworthiness certificate.

    b. The MCO-PM coordinates any request for special conditions or exemptions on a military project with the MCDA-PM.

    c. If there are design features or equipment that are not certifiable under existing regulations, we notify the applicant and the military airworthiness authority that the military is responsible for establishing airworthiness and certification criteria for these features and equipment.

Registration and Airworthiness Certification Requirements for R&D flight testing:

(1) When the applicant doesn't deliver the MCDA to the military and the aircraft is the asset and property of a civil entity, we consider it a civil aircraft and under temporary civil registration.

(2) When the MCDA incorporates modifications that are not FAA approved (but are undergoing modifications subject to FAA or military approval), we instruct the applicant to get a special airworthiness certificate in the experimental category for the intended purpose of operation (see Appendix B, in this order for the Table of Scenarios for Temporary Civil Certification of Military Aircraft for further information).

(3) While an aircraft is operating in experimental category:

    (a) For any research and development purposes, we do not approve or oversee the aircraft configuration.

(b) The holder of the experimental airworthiness certificate for research and development is responsible for configuration control, airworthiness, and risk mitigation of the development aircraft.

Certification Issues. The challenges we face in type certification of MCDA involve the integration and installation of military mission systems and equipment. These problems become more complex when it is necessary to interface the mission equipment with aircraft systems. The accepted methods for compliance to civil airworthiness regulations may not have been used when the equipment was designed, for example, software requirements in accordance with RTCA Inc. document, RTCA/DO-178B, *Software Considerations in Airborne Systems and Equipment Certification*, dated December 1, 1992, or most current revision. This does not mean the equipment cannot comply with civil regulations, but we must examine each piece of equipment to determine if an acceptable means of compliance can be determined.

Note: 14 CFR part 25, Transport Category Airplane, regulatory requirements are provided here as a basic reference. Similar or parallel requirements exist for other parts such as 14 CFR parts 23, 27, 29, 33, and 36.

Determining Feasibility. FAA requirements and standards are for civil operations, not for military or special mission operations. Therefore, we have to evaluate each proposed modification involving the installation of GFE/SME to determine the feasibility of FAA civil certification. The DoD doesn't necessarily need nor should have an FAA approval for all equipment. When determining the feasibility of certification, we consider these factors:

> **a.** Proposed operation
>
> **b.** Applicability of specific regulations
>
> **c.** Acceptability of any proposed qualification
>
> **d.** Conformity data

The FAA is responsible for certifying the aircraft as defined in the type design. All other modifications/equipment on the aircraft is the responsibility of the military airworthiness authority. The modifier and the receiving military airworthiness authority are responsible for evaluating and certifying that the GFE/SME is not included in the type design. The military airworthiness authority will ensure that the integrity of the original FAA approval is not compromised by non-approved GFE/SME and any subsequent military approved modifications.

Methods of Approving Military Equipment

1. Alternate Levels of FAA Approval for Military Projects. A complete civil type certification approval is required under civil registration so individual aircraft are eligible for a standard airworthiness certificate. The objective is to ensure the final aircraft configuration is in full compliance with all applicable airworthiness requirements. MCDA projects, however, do not require a standard airworthiness certificate. Furthermore, some military mission equipment may not be fully certifiable, or data may be unavailable to substantiate compliance. In other cases, the

equipment may be certifiable, but has no civil application, or operating it in the civil environment may be prohibited. However, safety aspects of integrating and installing the equipment with the baseline commercial aircraft must still be defined and evaluated by the military airworthiness authority and the FAA. Here, we may consider issuing different levels or partial approvals for modifications to MCDA. FAA certification personnel are instructed to contact the MCO before issuing any partial approval for MCDA. See Appendix A in this order for the Levels of Approval Table

2. Full Approval (Equipment, Installation, and Operation). Full FAA approval of associated systems and equipment must meet the following requirements:

a. The same requirements for a commercial modification to a civil aircraft. Include type design data, compliance substantiation, aircraft flight manuals, aircraft flight manual supplements, maintenance, and continued airworthiness documentation,

b. All applicable airworthiness regulations. Assure the operation is compatible and eligible for use on a civil aircraft of same type without special restrictions or limitations.

3. Limited FAA Approval (Equipment and Installation). Some military equipment may have no civil application or may only be authorized for public use for military operations.

a. Limited FAA approval of associated systems and equipment must meet the following requirements:

(1) The same requirements as for a commercial modification to a civil aircraft. Include type design data, compliance substantiation, airplane flight manual supplements, maintenance, and continued airworthiness documentation.

(2) All applicable airworthiness regulations.

(3) Special operational limitations and restrictions are required.

b. FAA may need help from the military to evaluate and determine compliance with this type of equipment because of the restriction on civil operation.

c. Installation approvals must have limitations and restrictions defined on the type design change, such as the STC description.

d. If operating the equipment during maintenance, it must be authorized by the military, and any limitations and restrictions must be included in both the airplane flight manual supplement and ICA.

e. If the limitations and restrictions can be followed, these installations may be legally permissible to install on an aircraft of civil registry.

f. The aircraft is a public use aircraft that needs to carry and operate the equipment for which operational limitations are imposed.

4. Safe Carriage (Equipment Approval). Installing military systems and/or equipment for "safe carriage" is a partial approval, signifying that the military hardware and equipment comply with applicable regulations in a non-functional state. The requirements are:

a. The FAA examines the physical aspects of the installation including aerodynamic effects, structural provisions, cabin safety, weight and balance, and noise requirements.

b. The installation, as defined on the type design, complies with regulations and poses no hazard to the aircraft.

c. Type design data must include physical and dimensional definition of the installed hardware.

d. Other data necessary to establish compliance with this equipment as installed in the aircraft.

e. Approval includes any modifications made to aircraft structure or systems to accommodate installation of the equipment. Approval does not authorize or allow the installed equipment to operate.

f. Equipment must be disconnected from power sources, antenna couplers, and other interfaces with the aircraft and these interfaces on aircraft type design are safely capped and stowed.

g. Cockpit controls are not included as part of the type design, if the equipment is controlled or will interface with the cockpit. The type design may incorporate blanking plates or other means to show that the equipment is not approved for function, and cannot be enabled or operated from the cockpit.

h. The equipment is not covered in the airplane flight manual supplement and instructions for continued airworthiness.

i. Maintenance covers only that required for aircraft provisions (structure, mounts, wiring, etc.) removal, and physical attachment for securing equipment to the aircraft.

j. "Safe Carriage" approvals cannot be extended to weapons, pyrotechnics, or any other hazardous materials that would otherwise be prohibited from carriage on a commercial aircraft.

k. The receiving military airworthiness authority is responsible for design approval, equipment qualification, system integration, compatibility, system architecture, functionality, and interface with aircraft systems, operation, and airworthiness approval for the installed equipment.

5. Provisions-Only. The equipment is not included as part of type design. The FAA may work with the applicant and the military to define "Provisions Only" approvals to support subsequent installation of military equipment. Provisions-Only approvals are not on-board installation approvals for the military equipment. They allow modifications or define limits for future military installations. Provisions-Only approvals assess and approve aircraft structure, design

characteristics, or system capabilities to handle defined and predetermined structural loads, interface or attachment provisions, and electrical power requirements. The requirements for Provision-Only approvals, to the extent defined in type design, are:

a. Accurately define the criteria for which the provisions are designed.

b. Meet applicable airworthiness requirements.

c. Address approvals in the airplane flight manual and instructions for continued airworthiness.

d. Include the specific criteria for which the provisions are approved on the description of the type design change, or reference a document that establishes all interface points and design limits.

FAA and Military Combined Approvals. The complete approval/certification of a

MCDA can be considered as a "hybrid" of FAA certification and military approvals since we approve some type design changes and the military approves some modifications. These "junctions" or "seams" between FAA and military approvals are evaluated and integrated by the military airworthiness authority into the aircraft certification as a whole. The military's management and integration of the civil and military processes for safety and airworthiness of the aircraft is crucial in determining the airworthiness of the MCDA. The military coordinates with the armed service and the type certification applicant to ensure that all aspects of the airworthiness of the MCDA platform flow between civil and military processes. Those aspects of the modification that do not meet civil certification requirements must have criteria defined under the guidelines of MIL-HDBK-516, *Airworthiness Certification Criteria*, dated September 26, 2005, or most current revision (Appendix E). The contractor is responsible to qualify, or demonstrate compliance to the military airworthiness authority.

Managing Civil/Military Airworthiness Seams. Both military and civil airworthiness processes depend on evaluating the airworthiness integrity of the aircraft as a whole. The FAA's type certification process requires the applicant to prepare associated hazard assessments and safety analyses at aircraft level. They're to use defined processes to ensure the integrity of the type certificated configuration. Military modifications to the aircraft may not use the same processes, and the differing processes may not be compatible. The hybrid tailored airworthiness certification criteria (TACC) and modification airworthiness certification criteria (MACC) includes the management of the "seams" between FAA certificated baseline aircraft and modifications installed to meet military mission needs. The farther the hybrid aircraft varies from the FAA certified baseline, the more its airworthiness depends on military qualification processes. Aircraft level functional hazard assessments and system safety assessments may need to be re-developed by the contractor/applicant to encompass the military approved modifications. Since this falls outside our type certificated configuration, we can't require the contractor/applicant to submit these documents to us as compliance substantiation. The responsibility for integration and oversight of the configuration falls on the military airworthiness authority and their contractor. The military may need technical assistance from us

or our designees (as advisors) to evaluate military approved modifications and to develop integrated aircraft level assessments for hybrid aircraft.

APPENDIX E: MILITARY HANDBOOK 516 BACKGROUND

(FAA Order 8110.101, Type Certification Procedures for Military Commercial Derivative Aircraft, 09/07/2007, Appendix F) (5)

1. **Purpose of MIL-HDBK-516.** MIL-HDBK-516, *Airworthiness Certification Criteria* (30), can be used in determining airworthiness for all military manned and unmanned, fixed- and rotary-wing air vehicle systems. The military uses the MIL-HDBK-516 as a guide to ensure all aspects of airworthiness for the aircraft and installed systems have suitable criteria established for evaluation. It is a tool used to outline general airworthiness evaluation criteria for principal and system level aircraft components from a military perspective.

2. **Who Uses the MIL-HDBK-516.** The military airworthiness handbook is approved for use by all departments and agencies of the Department of Defense. MIL-HBK-516 is the fundamental document used by the military system program manager, chief engineer, and contractors to define their military aircraft airworthiness certification basis.

3. **Military Certification Basis.** MIL-HDBK-516 criteria are tailored and applied to establish the airworthiness criteria and a military certification basis for a new military platform. The defined military certification basis is used and tailored as required at any point throughout the life of an aircraft when an airworthiness determination is necessary, especially when there is a change to the baseline.

4. **Using Civil Standards in the Military Certification Basis.** The contractor can use the referenced technical guidance documents in MIL-HDBK-516 to establish military specifications for a new military organic aircraft (aircraft developed specifically for military use with no civil counterpart). For existing commercial aircraft procured by the military, FAA civil airworthiness standards apply to a type certificated MCDA unless military modifications make compliance with the civil requirement impractical. If that's the case, then the contractor can use existing military criteria for the modifications, or establish new criteria by writing specific requirements applicable to the individual aircraft type. The contractor follows this process to establish the military certification basis for the new aircraft. The resulting airworthiness requirements may then be established as contractual specifications. For MCDA with missions comparable to the similar civil aircraft, FAA certification requirements may satisfy most, if not all, of the MIL-HDBK-516 airworthiness criteria. The certification basis for the MCDA may use the baseline civil certification basis to a large extent.

5. **Tailored Airworthiness Certification Criteria (TACC).** When a new aircraft platform is procured by the military, MIL-HDBK-516 can be used as a starting point for airworthiness requirements. Not all of the airworthiness criteria in MIL-HDBK-516 apply to every type of military aircraft or subsequent modification. Platform-unique, previously undefined criteria may need to be added to fully address safety aspects of unique configurations. Therefore, the total set of MIL-HDBK-516 criteria is tailored to identify a complete subset

of applicable airworthiness criteria, creating the system's certification basis. This military certification basis is then fully documented and maintained under strict configuration control. This military certification basis is known as the tailored airworthiness certification criteria (TACC). The TACC of a MCDA is often the closest thing to a detail specification that is available for a civil/military hybrid. The rules the military uses developing a TACC are as follows:

    a.   Identify each criterion as either applicable or non-applicable, considering system or product complexity, type, data, and intended use. Document the rationale for identifying any criteria as non-applicable.

    b.   Do not delete or modify applicable criteria in any manner. However, if a portion of otherwise applicable criteria does not apply, identify the applicable and non-applicable portions, and document the rationale.

    c.   Add more applicable criteria with specific measurable parameters, where appropriate (they add value to the definition of airworthiness requirements).

6.   Modification Airworthiness Certification Criteria (MACC). The military can require modification airworthiness certification criteria (MACC) for all modifications to in-service aircraft that affect the airworthiness of the aircraft. The military program office will develop additional criteria, as appropriate, for any capabilities or systems not fully addressed or contained in the MIL-HDBK-516 TACC. The criteria may be reduced in scope to only those criteria for which the modification needs to be evaluated. Guidance for preparation and final acceptance of the TACC or MACC is coordinated between the contractor/applicant/modifier and the responsible military PM organization.