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DEPARTMENT OF DEFENSE HANDBOOK

OPERATIONAL SAFETY, SUITABILITY, & EFFECTIVENESS FOR THE AERONAUTICAL ENTERPRISE

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FOREWORD

1. This handbook is approved for use by the Department of the Air Force and is available for use by all departments and agencies of the Department of Defense.

2. This document is applicable to all USAF systems and end-items, and designated system and end-items procured, operated, and/or maintained by the Air Force for other governments managed through the Aeronautical Enterprise. Although other methods can satisfy the requirements set forth in Air Force Policy Directive (AFPD) 63-12, Air Force instruction (AFI) 63-1201 and Air Force Materiel Command Instruction (AFMCI) 63-1201, Assurance of Operational Safety, Suitability & Effectiveness, this handbook provides a framework that satisfies those requirements. This military handbook provides guidance for implementing and preserving a solid operational safety, suitability, and effectiveness (OSS&E) program for the Aeronautical Enterprise.

3. Section 1.3 identifies applicability of OSS&E to the variety of Air Force owned and operated systems and end-items. Section 4.2 describes the implementation of OSS&E for legacy systems and end-items. Section 4.3 identifies the requirements for the internal management plan for OSS&E. Section 5 contains the OSS&E mandatory process elements that must be addressed in the internal management plan. The remaining sections expand and clarify activities associated with OSS&E assurance.

4. This document includes internal bookmarks and external hyperlinks. Clicking on these jumps you to the referenced location. To return to your jump point in this document from a bookmark or hyperlink, use the back arrow key on the menu bar. Note that some external locations (links) may require special access (e.g., .mil) or passwords. To gain access to those locations, you should contact the POC listed on that web page. Hyperlinks will be updated with major revisions; during the interim, periodic updates will be available via the ASC/EN website. If viewing in Microsoft Word®, to display the URLs, select Tools and then Options, select the View tab, and check the Field Codes block. If using Acrobat Reader®, two versions are available, with and without the URLs displayed. See ASC/EN website.

5. Beneficial comments (recommendations, additions, and deletions) and any pertinent data which may be of use in improving this document should be addressed to ASC/ENOI, 2530 Loop Road West, Wright-Patterson AFB OH 45433-7101 or via e-mail to Engineering.Standards@wpafb.af.mil.

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APPENDIX

1. SCOPE

1.1 Scope

Operational safety, suitability, & effectiveness (OSS&E) emphasizes those aspects of systems management and related disciplines necessary to ensure that USAF aircraft systems and end-items (including support equipment, weapons, training systems, simulators, ground-based systems, etc.) continue to provide safe, sustainable, and acceptable performance during operational use. Specific policy delineating the responsibilities for implementing OSS&E assurance elements is provided in AFPD 63-12, AFI 63-1201 and AFMCI 63-1201.

1.2 OSS&E overview

OSS&E can best be viewed as an umbrella that pulls together all other incumbent requirements and processes for sustainment of Air Force systems and end-items. The operational command, single manager (SM) and chief engineer/lead engineer (CE/LE) are responsible for the implementation and execution of OSS&E for their system and end-items. To ensure all external organizations are aware of their role in continued OSS&E assurance, a flow-down of requirements to suppliers and other organizations through contracts, memoranda of agreement (MOAs), service level agreements (SLAs), or other means should be employed where they add value. Regardless of the vehicle selected, the information that the SM and CE/LE require from each supporting organization to assure OSS&E for the system/end-item must be addressed. Any changes that impact the OSS&E baseline, or form, fit, function, and interface (F^3I) need to be coordinated with each customer. The goal is for the SM/CE to be kept informed of changes to equipment installed on the platform they manage. This is specifically critical for equipment used on multiple platforms. Each SM/CE is responsible for OSS&E assurance of the systems and/or end-items they manage regardless of whether or not they are tracked by HQ AFMC for OSS&E implementation. Likewise, the operational command, SM, and CE are ultimately responsible for sustaining assurance of OSS&E for their program regardless of to whom they have delegated authority. The PM/CE receiving equipment with OSS&E assurance managed elsewhere is still responsible for the integrated system OSS&E assurance. The MAJCOMs must ensure that all operating units understand their role in assuring OSS&E.

1.3 OSS&E applicability

1.3.1 Air Force, Air National Guard, and Air Force Reserve

OSS&E is applicable to all operational Air Force systems and end-items, including those operated by the Air National Guard and Air Force Reserve as well as designated systems and end-items procured, operated, or maintained by the Air Force for other Government agencies. A complete list of tracked products is available on the HQ AFMC OSS&E website and includes air systems, unmanned air vehicles, and ground-based systems such as training and mission planning, as well as support equipment. HQ AFMC established OSS&E implementation levels for the reportable systems and end-items as defined in table I. The SM is responsible for maintaining the accuracy of the reportable system/end-item list. However, OSS&E assurance applies to all systems and end-items defined above.

1.3.2 Joint service programs

Any acquisition system, subsystem, component, or technology program involving a strategy which includes funding by more than one DoD component, during any phase of the system's life cycle, is considered a joint program. The OSS&E documents do not differentiate OSS&E assurance based on the acquisition strategy. Nor does the shared acquisition strategy of a joint service program relieve the Air Force SM of the responsibility to assure and preserve OSS&E for the life of the Air Force system/end-item. The AF CE should review the processes and technical data to determine acceptability to assure OSS&E and provide a recommendation to the SM. The AF SM should determine if the other service's technical processes and airworthiness certification process are adequate for AF OSS&E compliance and continued assurance.

1.3.3 Support and ground-based systems

Support systems (i.e., support equipment and ground-based systems) need to be kept up-to-date with the system/end-item. Changes to systems or end-items must be analyzed for impacts on the support equipment, ground-based system, corresponding technical orders, manpower, and personnel training requirements. Changes to the support system must be assessed to ensure they do not degrade overall system or end-item capability. Effectively trained operators and maintainers also play an important role in support of the overall mission in assuring OSS&E. Maintainers must understand that they control the quality of information entered into the maintenance tracking system (e.g., CAMS, G081) and have overall control of daily system/end-item activities that impact OSS&E assurance. Without the maintainer's support and dedication, OSS&E assurance is not possible. Operators also play a key role in ensuring OSS&E by properly documenting ASIP and other performance parameters specific to the weapon system.

Support equipment is becoming more computer based and versatile. This complicates maintaining the OSS&E baseline. Just as the manager of systems and end-items must deal with obsolescence issues, upgrades, and diminishing resources, equipment specialists must also address these concerns for support equipment. Regardless of who or how a change is identified for support equipment, the single manager is responsible to verify that use of the support equipment results in safe, suitable, and effective operation of the system or end-item.

Ground-based systems (including ground control systems and mission planning systems) play a critical role in the OSS&E of systems/end-items. Just as our warfighters depend on our weapon systems to conduct the missions, they depend on these systems to provide the necessary operational information and maintenance data to keep their systems flying. Strong linkages must exist between the system/end-item, ground control system and/or mission planning system's respective management organizations. This is particularly true when a ground-based system is employed by multiple weapon systems. Therefore, changes in the weapon system must flow down to the support or ground training system single manager, where applicable, to ensure compatibility and commonality are maintained. Conversely, improvements and upgrades to support or ground training systems must be passed up to the system or end-item manager to maintain compatibility and commonality.

The training system (both aircrew and maintenance) must be verified to ensure it meets the intended function. The Air Force training system and device simulator certification program (SimCert) aids in making this determination. However, SimCert is not a continuous process and cannot be used to ensure concurrency with the system or end-item. Therefore, a recertification process must be in place to ensure concurrence with the overall system or end-item. This includes not only the hardware configuration, but also the software configuration.

OSS&E is assured at the integrated system level by the system SM, including all support systems and ground-based systems. Individual systems/end-items that form part of the entire system may have their own (separate) OSS&E assurance processes. The system SM is encouraged to make use of these separate OSS&E assurance processes. However, OSS&E assurance is the SM's responsibility for the entire system. This increases the need for succinct SLAs, MOAs, or other agreements, procedures, and processes with external organizations such as program managers, supply chain managers, and equipment specialists. This is imperative when their component is installed/used on many systems and changes to accommodate one system may impact another system.

1.3.4 Unmanned air vehicle (UAV)

The UAV conducts missions from ordinary airfields as part of an integrated force package complementary to manned tactical and support assets. UAV controllers observe rules of engagement and make the critical decisions to use or refrain from using force. The unique aspects of this type of system, such as minimal maintenance, extended periods of storage, dynamic mission control (with minimal human supervision) and ability to return home autonomously, make OSS&E assurance a vital part of maintaining UAV warfighting capability. Since UAVs are systems and may be composed of several end-items, OSS&E is applicable.

1.3.5 Non-Air Force-managed systems and end-items

AFPD 63-12 states that OSS&E principles apply to all systems and end-items managed by the Air Force. However, the SM should control certain aspects of OSS&E for components, items, and systems/end-items that are not managed by the Air Force. The SM should tailor the application of the OSS&E requirements to meet unique program needs and constraints. Contracts for a guaranteed pilot or maintainer, leased aircraft, and contractor logistics support (CLS) complicate the application of OSS&E. OSS&E still has some applicability; however, it may be limited. For example, consider the guaranteed student type contract. In this example, the Air Force does not own or maintain the simulator system, so effectiveness may be the only applicable portion of OSS&E. However, ineffective training resulting from poor configuration control could cause unsafe actions in the aircraft and lead to suitability issues.

1.3.5.1 Foreign military sales and other non-USAF aircraft

OSS&E applies to operational Air Force systems, end-items, and designated foreign assets managed by the Air Force. USAF assisted and/or commercially procured Air Force systems or end-items for foreign militaries are excluded from the OSS&E assurance policies, with the exception of designated systems. The exclusion also applies to non-Air Force-owned, foreign systems or end-items operated in the United States. When the USAF operates foreign owned systems/end-items, the using command operating such aircraft determines the daily operational airworthiness. Additional guidance is found in AFI 11-401.

1.3.6 Carry-on equipment

Carry-on equipment can be used to improve operational capability. This equipment may interface with the aircraft or operate as a stand-alone unit. An interface can be as simple as a mounting/tie-down or as complex as tying into on-board systems and sharing resources. Carry-on equipment should be assessed for impacts to the system or end-item OSS&E assurance and preservation. Likewise, all certifications should be accomplished with and without the carry-on equipment installed and operating. When carry-on equipment is managed via an external organization, an SLA/MOA should be developed to ensure changes do not impact OSS&E or required certifications. AFI 11-202V3 addresses carry-on electronic devices' operational limitations and use in flight. AFI 11-202V3 identifies ASC/ENAE as the technical guidance and data evaluation organization for carry-on electronics not listed within the AFI (or aircraft –21). That AFI also refers to AFRL/HEPR as the technical guidance organization for carry-on medical equipment operated in flight. Additional information on the contents of the aircraft –21 is found in AFI 21-103.

1.3.7 Commercial off-the-shelf (COTS)/nondevelopmental items (NDI)

There are two elements key to OSS&E assurance of COTS/NDI. The first element is an understanding of the inherent capability of the COTS/NDI to form an initial OSS&E baseline. The second is a thorough understanding of the operational requirements associated with its intended use as a system/end-item, including the environment in which it will be used and if it will be used as an integrated part of a larger system. A deficiency in knowledge of the inherent capability of the COTS/NDI does not exempt the SM from OSS&E responsibility. It is the responsibility of the SM, as part of the overall acquisition strategy, to acquire or develop the key product characteristics necessary to form the basis for an initial system or end-item OSS&E baseline. It is also the SM's responsibility to assure this baseline for the life of the system including functionality provided by COTS and NDI components. Recall that OSS&E is preserved at the system or end-item level.

1.3.8 User procured equipment

User responsibilities for SM managed systems and end-items are defined in AFI 63-1201. Essentially, the user must coordinate any configuration changes with the SM. For systems and end-items procured or managed by the user, the user assumes all responsibility for the preservation of the OSS&E baseline and consistent application of the mandatory OSS&E process elements. See AFI 63-1201 for specific user responsibilities for systems and end-items they manage.

1.3.9 System of systems

Defining an OSS&E baseline for a system or end-item that is part of a system of systems may prove to be the most difficult. Many stand-alone systems (e.g., F-16, B-2, etc.) operate as a system within a system (i.e., provide information to other platforms). In this case, the interactions of one system/end-item may have a profound impact on the operation of the system of systems. The OSS&E baseline should address the critical aspects of the system/end-item required by other platforms.

1.4 OSS&E implementation

OSS&E, in its simplest terms, consists of two parts: 1) establishing the OSS&E baseline and 2) preserving the OSS&E baseline throughout the life of a system or end-item. To establish the OSS&E baseline, the SM and the user first reach a documented agreement stating key/critical characteristics for a given system or end-item. After these are identified, the system or end-item is assessed against those characteristics to validate compliance with the OSS&E baseline. The steps for achieving full OSS&E compliance on a legacy aircraft program are described in table I below.

TABLE I. OSS&E six levels of implementation.

Level	Activity	Entry Criteria	Exit Criteria
1	Chief engineer assigned		System/end-item (S&EI) on OSS&E S&EI list Chief engineer identified on OSS&E S&EI list Process is in place to update S&EI list
2	Configuration control process established	Level 1 completed	Configuration control processes identified and documented at the program level Configuration control process training requirements identified Configuration control processes in-place and operating Delegated authority identified and documented

Level	Activity	Entry Criteria	Exit Criteria
3	Plan to assure and preserve OSS&E documented	Level 2 completed	Plan should include strategies/approach for: ▪ Identifying, reconciling, and preserving OSS&E baseline characteristics ▪ Achieving and/or maintaining required certifications ▪ Establishing OSS&E program level and product line metrics ▪ Identifying data system feedback mechanisms OSS&E Execution Plan coordinated with appropriate product, logistics, test, and specialty centers
4	OSS&E baseline developed and coordinated with user	Level 3 completed	OSS&E baseline characteristics identified Critical characteristics for measuring safety, suitability, and effectiveness selected Users coordinated
5	OSS&E assessment of fielded systems/ end-items	Level 4 completed	Fielded system/end-item data gathered OSS&E baseline characteristics assessment completed OSS&E baseline disconnects identified Recommended corrective actions to users
6	Full OSS&E policy compliance	Level 5 completed	Level 5 corrective actions completed All required certifications in place and maintained Metrics and feedback systems monitoring OSS&E health Processes established and in place to maintain OSS&E baseline characteristics

The basis for establishing OSS&E assurance lies in documented evidence of compliance with safety, suitability, and effectiveness requirements. New development/update/modification programs are to be structured to produce such documentation, but legacy systems should rely primarily on existing documentation and be supplemented with surveys as necessary. Both can vary widely depending on the maturity and age of the system. The scope of validating program compliance with OSS&E requirements includes the following:

a. Validating the functional baseline (i.e., performance is satisfactory with respect to operational safety, suitability, and effectiveness).

b. Validating the product baseline (i.e., the system/end-item is configured as intended).

c. Ensuring that qualified manufacturers/suppliers are supplying quality parts, equipment, subassemblies, and subsystems for the system/end-item.

d. Ensuring that maintenance and repair sources are delivering quality products for the system/end-item.

e. Verifying that maintenance data is correct and adequate to sustain the system/end-item in the intended configuration for its intended use.

f. Ensuring that necessary processes are in place for preserving OSS&E assurance.

g. Ensuring that quality and qualified maintenance equipment (tools, support equipment, etc.) are provided with up-to-date maintenance instructions and procedures.

These are detailed in section 4 through section 7. As an aid, the C-5 OSS&E Pilot Program Chief Engineer Team Report can provide insight and format to assist in documenting OSS&E compliance.

1.5 OSS&E training

OSS&E training is currently available through various means. ASC conducts stand-up instruction for system program offices upon request, and provides web-based training currently available to organizations with ".mil" access at https://ossande.wpafb.af.mil. The web-based training contains three tiers of training. Tier I is an overview of the OSS&E process and applies to all personnel. Tier II is directed at single managers, item managers, chief engineers and equipment specialists, users, and supply-chain managers. Tier III is intended for the Aeronautical Enterprise and includes training on airworthiness certification. Additional training information is available at HQ AFMC/ENPD.

2. APPLICABLE DOCUMENTS

See Appendix A.2.

3. DEFINITION OF TERMS AND ACRONYMS

See Appendix A.3.

4. OSS&E ASSURANCE

OSS&E assurance is only possible if the SM/CE, interfacing organizations, and using command understand their roles and responsibilities. The SM's actions to establish and enable continued assurance of OSS&E do not involve a formal OSS&E certification. The SM should, however, ensure the organization maintains adequate documentation that provides a history of the events and supporting evidence that all OSS&E implementation criteria were fulfilled. The data repository is necessary to support program office sustainment activities and ensure future changes continue compliance with the OSS&E baseline. The SM can then assert that the required OSS&E baseline has been established and that the processes necessary to maintain the baseline are documented and in place. Similarly, as the system changes due to modifications, the CE should add any new technical documentation that supports OSS&E assurance to the data repository. The chief engineer is responsible to the SM for ensuring that the technical processes are documented, complete, and being followed. External organizations that can impact other systems/end-items need to understand and support continuous OSS&E assurance by coordinating upgrades, modifications, or changes with the SM. The user must identify any changes to the aircraft configuration, designated operational capability (DOC), usage environment, or other changes that could impact the OSS&E baseline. In addition, the user is responsible for the assurance of OSS&E for systems and end-items procured directly.

4.1 OSS&E execution

An OSS&E execution plan is required per HQ AFMC/DR/EN memorandum, 22 Feb 02. The plan must address the strategy for developing, coordinating and validating baselines, internal monitoring, and reporting. In response to this memorandum, for Aeronautical Systems Center (ASC) systems and end-items, a two-part OSS&E plan is prescribed per ASC/EN memorandum, 22 Dec 2000. The ASC memo also provides guidance to the other organizations within the Aeronautical Enterprise as required by the HQ AFMC memorandum. Part I is the OSS&E Implementation Plan that addresses the six levels leading to full compliance with OSS&E (identified in section 1) for systems/end-items currently in sustainment and fulfills the requirements of the HQ AFMC memorandum. Programs not currently in sustainment are required to comply with the OSS&E policy and instructions by first unit delivery for operational use; thus, no implementation plan is necessary. OSS&E implementation level 6 (full OSS&E policy compliance) requires processes be established and in place and that the processes be followed. Part II is the OSS&E Internal Management Plan that documents these processes and is applicable to all systems/end-items during sustainment. There is a significant advantage to the two-part approach regarding levels of approval. The OSS&E implementation plan (Part I) is approved by the Center commander as required by the HQ AFMC memorandum. However, the OSS&E Internal Management Plan (Part II) is approved by the SM and is therefore easier to update.

4.2 Part I: OSS&E Implementation Plan

This section of the OSS&E assurance plan pertains to legacy systems and end-items and fulfills the requirement of the HQ AFMC Memorandum concerning continued OSS&E assurance. However, if the system/end-item entered into sustainment 1 March 2000 and is not yet fully OSS&E compliant, then the Part I plan is required. Legacy, in the case of OSS&E, applies to those systems transitioned to the user and in sustainment on or before the date OSS&E policy went into effect, 1 March 2000. A listing of these systems and end-items is available on the HQ AFMC website. Each SM must ensure accuracy of the information on this site and provide corrections via HQ AFMC/DR. Full OSS&E compliance (level 6) is required by the end of FY 05 (HQ AFMC goal); however, HQ AFMC/CC has directed that efforts be made to achieve level 6 prior to this date. The ASC plan contains one additional requirement above the HQ AFMC execution plan: a brief system/end-item description. This description is necessary in order to lay the groundwork for identifying management responsibility, metric development, flight safety/mission critical components and other activities necessary to assure OSS&E throughout the life of the system/end-item.

As with new systems, the basis for establishing OSS&E assurance on legacy systems lies in documented evidence of compliance with safety, suitability, and effectiveness requirements. For new developments, updates, or modifications, a program can be structured to produce such documentation (section 9). For legacy systems, OSS&E implementation should rely to a large degree on existing documentation. The available documentation can vary widely depending on the maturity and age of the system and may be supplemented with surveys and audits as necessary to fulfill OSS&E requirements.

The six levels in table I reflect the update to the OSS&E execution plan per HQ AFMC memo 22 Feb 2002. Part I of the OSS&E plan, as defined in the ASC/EN letter, contains the details for establishing OSS&E assurance for legacy systems/end-items. It is organized into seven areas:

a. Single Manager's Assessment. The single manager's assessment is based on table I. The assessment should also identify implementation challenges in meeting the OSS&E full compliance target date.

b. System/End-Item Description. Before OSS&E assurance can start, the system/end-item is defined. The system/end-item description may be derived from the configuration management system (CMS). The level of detail captured in the OSS&E Implementation Plan must be sufficient to identify responsible management organizations and to provide positive control for flight-safety-critical items, mission-critical/support-critical items, and those impacting effectiveness. This description serves as the basis for establishing the SLAs, MOUs, MOAs, or other agreements, etc., that aid in identifying the necessary certifications for the system or end-item; it also identifies the party responsible for obtaining the certification. See section 7 for additional information on developing the agreements.

c. OSS&E Baseline Establishment and Management. The OSS&E baseline consists of those features and aspects that describe the system/end-item capabilities most important to the user and single manager. The baseline may be associated with a particular block, model, or mission design series (MDS). Establishment of the OSS&E baseline is described in section 6. The actual baseline should be included in Part II.

d. Organizational Management Relationships. Part I establishes the strategy and planning activity required for achieving full OSS&E compliance. Organizational agreements with other Government agencies are established to provide the program support necessary to maintain OSS&E assurance (see System/End-Item Description above). The agreements should include external organizations supporting propulsion, software, and weapons, as well as the supply chain managers, equipment specialists, depots, training locations, and Defense Contract Management Agencies (DCMAs). Since program needs vary, the list of organizations requiring agreements (formal or informal) depends on the program's support structure.

e. Training. Training is required to understand the nuances of OSS&E. The development of the OSS&E training curriculum is an enterprise responsibility. Training is applicable to all managed programs. Developing program-specific processes and procedures is the responsibility of the SM/CE. The implementation plan should identify the requirements and schedule for personnel (including the SM) to receive the appropriate training (HQ AFMC, Aeronautical Enterprise, center- and program-unique).

f. Funding. Funding issues for OSS&E implementation/assurance should be identified; the specifics are detailed in the HQ AFMC/DR/EN memo.

g. Schedule. The center OSS&E focal point tracks full OSS&E compliance (level 6). Therefore, the SM needs to establish a schedule for achieving level 6. Completion of the six levels of implementation provides the foundation for the continuing assessment and preservation of OSS&E.

4.3 Part II: OSS&E Internal Management Plan

Part II complements Part I and addresses the documentation and continuous preservation of the OSS&E baseline. The Internal Management Plan needs to address four areas:

1) The OSS&E baseline, including references defining each characteristic (together with associated parameters and metrics). As the system matures, any updates to the baseline are captured in this section. Developing the OSS&E baseline is detailed in section 6. The OSS&E baseline should be associated with each of three groups: safety, suitability, or effectiveness. Since characteristics may or may not be directly measurable, metrics should provide a means to quantify each baseline characteristic.

2) Organizational management relationships necessary to maintain OSS&E are made with external organizations that interface or provide sustainment support, including propulsion management, software development, weapon integration, mission planning system, depots, training organizations, and DCMAs. Configuration changes may require updating these organizational management relationships to ensure that the new expected capabilities are maintained. Additional guidance is provided in section 7.

3) OSS&E process elements as identified in Chapter 1 of AFI 63-1201. Each of the elements in section 5 below should be described in sufficient detail to explain how the process supports/impacts sustainment of the OSS&E baseline. It should be evident that if certain key aspects of a mandatory process were not accomplished, there would be an impact to the way OSS&E is preserved. The SLAs and MOAs must be structured to assure seamless and consistent implementation of the mandatory process elements across all organizations supporting sustainment of the system/end-item OSS&E baseline. Clear lines of authority and control for these process elements must be established.

4) Per AFI 63-1201, the user and SM are required to continuously evaluate system and end-item OSS&E baseline performance. The goal is to identify potential degradations of operational safety, suitability, or effectiveness prior to impacting the warfighters' capability. To ensure consistency, this section should identify the data collection and reporting systems and other sources of data required in assessing the OSS&E baseline. It is likely that multiple metrics may be required to allow a single characteristic to be evaluated. OSS&E metrics are more fully discussed in section 6.2.

5. OSS&E MANDATORY PROCESS ELEMENTS

The purpose of OSS&E is to preserve the critical characteristics established during system/end-item acquisition. The preservation process begins when the system/end-item is turned over to the operational user. Hence, OSS&E is substantially a sustainment function, with its roots established during acquisition. Proper program execution through sound technical and managerial processes should fulfill the mandatory process elements required by AFI 63-1201. Therefore, OSS&E implementation should not impose new program requirements or result in contract modifications for sustainment. This section expands on the mandatory process elements and provides insight on methods for demonstrating compliance with AFI 63-1201. The necessary level of insight and application for each mandatory process listed below depends on the type of equipment and uniqueness of the program. The SM should tailor each of these processes, as necessary, to assure OSS&E of their program. Total system performance responsibility (TSPR) or contractor logistics support (CLS) type contracts do not eliminate the need for the SM to assure OSS&E. For these, the contractor is a major participant. There should be appropriate wording in the contract for the contractor to provide sufficient data such that the SM can assure OSS&E.

5.1 Disciplined engineering process

The cornerstone of OSS&E assurance is a management system that is based on a disciplined engineering process. The disciplined engineering process should incorporate the following philosophies: design for affordable change, evolutionary acquisition, and integrated change roadmaps. AFI 63-1201 introduces the requirements of a disciplined engineering process by describing six functions to ensure a robust process. The disciplined engineering process that has been used and proven in the Department of Defense (DoD) is the systems engineering process. This is a comprehensive, iterative, problem-solving process that transforms validated customer needs and requirements into a description of a life-cycle-balanced solution set that includes people, products, and processes. The disciplined engineering process applies to new system product and process developments, upgrades, modifications, and other engineering efforts conducted to resolve problems in fielded systems. The process should be executed by an experienced staff familiar with the complexities and tradeoffs of implementing this systematic and structured methodology. The following subsections address parts of the mandatory, disciplined engineering process and some of the tools used within that process. The process and tools are described at a top level and are not meant to be comprehensive. More information on the systems engineering process may be found in the *ASC/EN – SMC/SD Systems Engineering Guide*. **MIL-HDBK-500** is another resource on a disciplined engineering process: key supplier processes. This handbook provides guidance to aeronautical business sector suppliers to support defense systems acquisitions and is particularly useful to the SM/CE in evaluating contractors' engineering processes within the air system product line.

The mandatory elements of the engineering process, described below, are applicable to new development/upgrade/modification and sustainment of systems and end-items. However, even for existing or limited developmental items, such as commercial derivative aircraft, each of the elements needs to be consciously considered and a determination made as to how the objectives of the element can be fulfilled. The non-mandatory elements are included in section 8.

5.1.1 Operational risk management (ORM)

ORM is focused on operational assessments; in contrast, integrated risk management (IRM) is focused on cost, schedule, and technical performance risks. ORM is a process to evaluate risks not managed by another process (e.g., system safety, IRM, etc.) for improving individual and organizational performance in all functional areas and operations. ORM provides the process and tools to develop and enhance awareness and understanding of at-risk activities. Application of ORM may identify areas where regulatory guidance is overly restrictive or otherwise not consistent with mission requirements. In such cases, the risk assessment may be used to justify solicitation of an appropriate level waiver, variance, or change but will not in itself constitute authority to violate any directive, policy, standard, or other regulatory guidance. ORM should be tailored to meet the unique mission needs and operational requirements of each organization and should be documented in a plan. An ORM Checklist is provided at appendix A to aid in assessing the effectiveness of the ORM program. Operational risk management is required by Air Force Instruction 90-901.

Operational risk management is a key element in the disciplined engineering process required to assure OSS&E, and it is an essential component in the DoD’s strategy for acquiring and sustaining systems in an environment of diminishing resources. The principles of ORM are 1) accept no unnecessary risk, 2) make decisions at the appropriate level, 3) accept risk when the benefits outweigh the risk mitigation costs, and 4) integrate ORM into operations and planning at all levels. A disciplined, comprehensive risk management structure involves the early and continuous identification of critical program risks, and the establishment and monitoring of risk handling plans. When properly implemented, an effective risk management program helps to identify areas that require special attention and supports setting achievable technical, schedule, and cost objectives.

Early planning and aggressive application are critical to a successful ORM program. A comprehensive operational risk management process identifies and quantifies risk, provides potential solutions, tracks risk reduction activities, provides metrics to assess residual risk, and quantifies program impacts to the SM. When the system/end-item is in sustainment, the risks previously identified have been resolved with an acceptable residual risk. During sustainment, the ORM focus is on changes in the environment or application, aging, and wear-out of the system/end-item. There are many ways to fulfill the ORM mandatory requirements; however, the attributes of a good ORM program remain constant. ORM is a continuous, systematic decision-making tool consisting of the following six steps that define the process:

a. Identify the Hazard: A hazard is a real or potential condition that could result in injury, illness, or death to personnel, or damage to/loss of equipment or property. The program risk identification process should be capable of flagging changes to the system hazards as threats evolve, as additional capabilities are required, and as actual versus planned usage varies. Consider the five M's: man, machine, media, management, and mission. Sources of information are inputs from the using command, National Air Intelligence Center, modeling and simulation, and internal program metrics. The ORM plan should identify all customers, stakeholders, and external sources that could identify new hazards.

b. Assess the Risk: The chart below is similar to the chart used in assessing system safety. Safety has derived numeric values for hazard probability and definitions for severity. However, the numeric values for safety may not apply for ORM. In general terms, catastrophic is mission impossible, critical is mission impaired, moderate is mission possible with work-arounds, and negligible is minor disruption to the mission. For an aircraft system, the catastrophic value may be in millions of dollars, while for an end-item, the value may only be in thousands of dollars. Thus, the numeric values for probability and severity are unique to each product. However, the process for determining numeric values must be consistently applied during the assessment to provide a relative ranking of risk within an operation. The goal is to highlight areas of risk within a product.

c. Analyze Risk Control Measures: Risk can be handled through assumption, control, avoidance, or transfer. Regardless of the control measure selected, the residual risks have to be quantified. The cost of mitigating or handling the risk should also be known. If the selected approach is to transfer risk, the receiving system should perform a risk assessment to ensure the total risk to the receiving system remains acceptable.

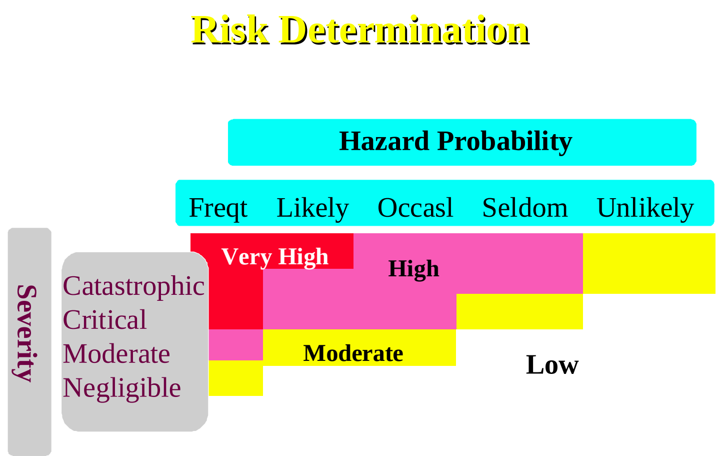


FIGURE 1. Risk determination.

Strive to eliminate the hazard first. If unable to "design out" the hazard, incorporate safety devices. If safety devices prove impractical, provide warning devices. Training and procedures are also practical control measures. The least preferred control measure is transferring the risk to an external entity. The receiving entity must accept the risk and the resulting risk must be less than keeping the risk associated with the original entity. If this is not analyzed and understood, transference only targets accountability and not risk reduction.

d. Make Control Decisions: These decisions are based on many factors, including available resources, funding, schedule, and user expectations. Balancing the cost of the control measure and effective risk reduction is a good place to start. There are several potential pitfalls when the “best value” is selected over the optimum. These include inappropriate control for the problem, refusal by users/leaders to use the measure, or impedance of the mission.

e. Implement Risk Control Measures: The control decision should be clearly understood by all stakeholders including the user, using command, support center, and contractor. The user must perceive the using command’s commitment to support the control decision. User coordination is critical, since users are the recipients of the risk control measures and implement those control measures not reduced via design.

f. Supervise and Review: Evaluate the control measures to ensure they produce the desired effect. Confirm that cost savings and/or implementation costs are within expected values. Obtain feedback from the user regarding the impact on performance.

To be effective, risk management should be a continuous, daily activity employed from cradle to grave. More information on the risk management processes may be found in the following:

Operational Risk Management Program may be found in AFI 90-901, AF PAM 90-902 and AFPD 90-9 available at https://rmis.saia.af.mil/guidance.asp.

AFMCPAM 63-101, *Acquisition Risk Management,* which is available at https://www.afmc-mil.wpafb.af.mil/pdl/afmc/63afmc.htm.

Additional guidance on risk management and associated key activities can be found at: https://www.en.wpafb.af.mil/risk/risk.asp.

5.1.2 System safety

System safety is the application of engineering and management principles, criteria, and techniques to achieve acceptable mishap risk within the constraints of operational effectiveness, suitability, time, and cost, throughout all phases of the system life cycle. In fact, AFI 63-1201 requires that SM continuously evaluate mishap field data for the systems/end-items they manage. This objective is achieved through timely actions on systematic assessments of the system in its concept, development, delivery, use, and maintenance environments/phases by way of hazard analyses and risk management assessments. The degree of safety in a system is directly dependent on the adequate technical and risk assessment under the limitations of funding, schedule, and technical capability or technology available.

Chapter 9 of AFI 91-202, the *Air Force Mishap Prevention Program*, outlines system safety program requirements and responsibilities for single managers (SMs) and using commands. Additionally, safety criteria such as FAR 25.1309 and SAE ARP 4761 (commercially available) can provide insight into FAA and commercial practices.

The SM is to establish and maintain a tailored system safety program using MIL-STD-882 as a guide. Where variation or innovation in tasking or methodology is allowed, proof is required to demonstrate that the approach accomplishes the required objectives and tasking contained in the Air Force policies. Some basic tenets of a system safety program include the establishment of hazard risk-resolution criteria, properly scoped hazard analyses, hazard tracking, resolution, documentation, and forums for hazard deliberations and resolution.

AFI 91-202 requires that system safety groups (SSGs) be established for all Acquisition category I (ACAT I) programs and for all aircraft programs unless waived by the major command (MAJCOM). The purpose of the SSG is to oversee the system safety program throughout the life cycle of the system and to document the mishap risk review process with the specifics identified in the SSG charter. The SM or deputy chairs the SSG, and membership includes user command maintenance and operations representatives. If residual risk remains after being addressed by the SSG, AFI 91-202 and MIL-STD-882 define the appropriate levels of authority (SM, PEO, or AFAE) for acceptance of residual mishap risk. In the sustainment phase, SSGs are primarily concerned with engineering change proposals, mishap trends and recommendations, and deficiency report (DR) tracking.

5.1.2.1 Materiel safety program

Chapter 16 of AFMC Sup 1 to AFI 91-204 requires the materiel safety program. The materiel safety program manager (MSPM) at each center is responsible for tracking mishap recommendations to closure. A responsibility of the MSPM is ensuring that SMs are cognizant of what is occurring with systems in their program. This is accomplished by providing system safety managers (SSMs) with the message traffic for their systems and similar systems. The MSPM also tracks airworthiness directives for each commercial derivative system and provides a copy to each affected program office. Additional guidance is found in AFI 92-204.

5.1.3 Configuration management

To ensure OSS&E of a system/end-item, it is essential to know the configuration(s), both functional and physical. While this may be a challenge after the system/end-item has been fielded for some time, various methods contribute to knowing the configuration. The configuration should be controlled at the appropriate level, and that is determined by how the system or end-item is procured and managed. While little may be known about the configuration of legacy systems/end-items or COTS equipment, the form, fit, function, and interface requirements must be known and managed. The internal management plan should address how the configuration, as applicable to OSS&E, is preserved. Appropriate configuration control must be maintained for all equipment interfacing or supporting the system/end-item, including ground control stations, mission planning systems, training systems, and support equipment. Changes to the system/end-item may affect the aforementioned items, and likewise, changes to those items may impact the system/end-item OSS&E assurance.

For recently fielded programs, the configuration management process established during acquisition should seamlessly support sustainment activities. The configuration management process must include a configuration status accounting (CSA) system that identifies the “as built” configuration of the items that constitute the system/end-item (see table 4-4 and section 7 of MIL-HDBK-61A) and supports changes to the configuration during sustainment. This process must also include support equipment (SE) and SE software because the SE may need an update due to obsolescence or enhanced capability independent of the associated system/end-item cycle. Regardless of how configuration is tracked when the system is fielded (e.g., G081, CAMS, or contractor system), the configuration must be managed to assure continued compliance with the OSS&E baseline. Configuration data should include configuration items (CIs), configuration equipment items (CEIs), computer software configuration items (CSCIs), drawing numbers, and computer program identification numbers (CPINs) along with the associated change history. Also, the data should include information such as part numbers, serial numbers, line replaceable units (LRUs), etc. Contractors developed illustrated parts breakdowns, primarily from engineering drawings and other official source data, are another source of configuration data.

The configuration may be updated through approval of an engineering change proposal (ECP) (see MIL-HDBK-61A paragraph 6.2, and AFI 63-1101, *Modification Management*) or a comparable SPO or contractor process or user via Modification Proposal, AF FORM 1067. Configuration control authority resides with the organization charged with program management or as delegated from the SM. A proposed modification (e.g., ECP) identifies changes to the system/end-item configuration that affect form, fit, function, or interface (and potentially the OSS&E baseline). Drawing numbers, part numbers, serial numbers, etc., as well as technical order changes, are reflected in the ECP. Upon receipt and review of the ECP, the configuration control authority convenes a configuration control board (CCB) to evaluate the change. If the board approves the change, the contractor, usually, is responsible for updating records, drawings, and technical data necessary to accurately reflect the current configuration. Updating should include the complete incorporation of the changes into the drawings, associated lists, part numbers, and engineering technical data in an efficient and timely manner. The responsible party (usually the contractor) is responsible for preparing the time compliance technical order (TCTO), but they do not issue it. TCTOs and associated TO changes are issued by the technical order management agency (TOMA) to modify fielded system/end-items. The Air Force (normally an ALC) also has the capability to develop and issue TCTOs (see TO 00-5-15 and AFMCMAN 21-1). The activity performing the TCTO documents compliance with the TCTO by completing an AFTO Form 349, “Maintenance Data Collection Record” (see TO 00-5-15, paragraph 6-19).

After the system/end-item is fielded, the user formally communicates problems to the managing activity through deficiency reporting databases in accordance with TO 00-35D-54 or Modification Proposal, AF FORM 1067. Category I deficiency reports (DRs) are those deficiencies that, if uncorrected, could cause death, severe injury, severe occupational illness, or major loss or damage to equipment or a system, or that directly restrict combat or operational readiness. CAT I DRs must be reported within 24 hours of discovery. CAT II DRs are deficiency reports that do not meet the criteria of CAT I DRs; are attributable to errors in workmanship or nonconformance to specifications, drawing standards, or other technical requirements; are required for tracking by agreement of the single manager and the using command point of contact; identify a problem for potential improvement; or identify a potential enhancement.

The “as built” configuration is updated after delivery by several methodologies depending on the nature of the change. The user (i.e., Air Mobility Command [AMC], Air Combat Command [ACC], Air Education and Training Command [AETC], etc.) and the system program offices (SPOs) should have a CSA system. If a system/end-item is organically maintained, the CSA system captures the "as-delivered" configuration plus all maintenance performed to-date after formal acceptance of the system/end-item. If a system/end-item is maintained by contractor logistics support (CLS), the contractor may be tasked to accomplish configuration status accounting to the level of detail specified in the contract. The user, ALC, or contractor may use the REMIS to load validation tables for serially tracked, time change, and life limited parts as a complement to their own maintenance data collection system (e.g., CAMS or G081). Maintaining the configuration is not difficult or time consuming but does require asserted effort. Coordination with the system/end-item configuration manager to ensure all required configuration data is procured and/or documented reduces configuration control complexity, particularly when provisioning for new spare assets. The are several questions that must be satisfied:

a. How and to what was the part qualified?

b. Was the engineering drawing updated?

c. Was the new configuration part coordinated and approved by the system/end-item manager?

These are critical, since the single manager has overall responsibility for the integrated system/end-item. In many cases, the parts are added to the commodity tech order but engineering has not released the system/end-item tech orders. Thus, the aircraft engineering drawings are not updated to reflect the latest parts configuration. Additionally, some parts are fielded before cataloging has occurred and the appropriate U.S. Air Force or DOD databases (D043A and REMIS) have not been updated. Only when all these tasks are accomplished should the part be installed on the system/end-item. The part must be validated and approved as a valid part prior to being used on a given weapon system. The lack of coordination, whether due to poorly written MOAs/SLAs or other agreements, can result in improper maintenance, incorrect parts issued, wrong supply items ordered, or inaccurate inspections performed.

For legacy systems and end-items with no formal process for maintaining current configuration baselines, the configuration baselines must be re-established. Configuration audits, tailored to the uniqueness of and their cost effectiveness for each system/end-item, may be necessary to determine the configuration data needed for OSS&E assurance. Before conducting the actual audits, the existing configuration control processes need to be evaluated. In addition, the process for user feedback on operational usage and maintenance used to aid in preserving and updating both the configuration and the OSS&E baselines should be evaluated. If the processes are sound and rigorously implemented, then the audits can be more limited in scope.

Since some legacy systems and end-items are over 40 years old and are scheduled to be fully retired in the next decade, the cost and extent of an audit are seen as limitations. Therefore, the focus of configuration audits should not be on confirming the entire physical configuration of the system/end-item in a full-blown audit. Rather, the focus should be to assess the configuration of the components that comprise the functions as defined in the OSS&E baseline. The audit should include the following to generate the necessary configuration information to support the OSS&E baseline:

a. System/end-item technical data review -- Validate that maintenance data is correct to sustain the performance and corresponding configuration to assure the OSS&E baseline. Review technical documentation pertinent to a specific system/end-item or support organization. This area is considered most important in determining adherence of the possessing units to maintenance and modification guidelines provided by Air Force instruction and the SPO. Areas of technical documentation review center on system/end-item maintenance, inspection, and historical records; time change item program adherence; and REMIS review for TCTO/modification compliance. Equipment specialists should have the primary responsibility during an audit to review these areas with engineering serving in a support role.

b. Physical configuration audit (PCA) -- Validate the product baseline; i.e., the system/end-item is configured as intended. This configuration audit is conducted to a level and sample size as necessary to compare the actual configuration of the system/end-item with the OSS&E baseline and approved configuration. A complete system/end-item configuration audit is rarely cost-effective, while a limited audit of specific areas provides useful feedback on the health of the configuration management process. Therefore, these audits should focus on problem areas such as unauthorized repairs or modifications. They should verify that authorized, nonstandard repairs, TCTOs, or modifications are performed and documented correctly and that installed equipment part numbers match the drawings and other technical data for equipment that directly impacts assurance of the OSS&E baseline. These audits should be conducted while the aircraft or end-item is down for scheduled maintenance, either at a depot or at an operational base, to minimize impact on the user. Equipment specialists are valuable support to engineering in this effort.

In using sampling to conduct a PCA, less than a 100% review of all hardware and documentation is performed. The Navy's configuration management guide suggests a 10-20% sampling rate of the system/end-item and documentation. If the audit uncovers few discrepancies, there is little risk to assume the remaining system/end-items in the fleet are also acceptable. However, if the audit uncovers many discrepancies, or major problems, a larger sample size may be required. Another means of determining system/end-item inspection sample size is by using the requirements of Air Force Materiel Command Instruction 21-102, Analytical Condition Inspection (ACI). This instruction requires SPOs to periodically inspect a certain portion of their system/end-item fleet in order to ensure against unknown defects causing future safety or economics issues. If defects are found as a result of the sampling inspection, a secondary sampling inspection should be conducted to rule out single-find defects. If no defects are found in this secondary sampling, then there is a 90 percent confidence that defects do not exist in more then 20 percent of the force. Conversely, if an additional defect is found, then additional action (periodic inspection requirement, physical baseline change, etc.) is required because the defect is considered to be pervasive throughout the fleet.

c. Off system/end-item support audits -- Ensure that qualified manufacturers/suppliers are providing quality parts, equipment, subassemblies, and subsystems for the system/end-item as related to the OSS&E baseline. Also, look for evidence that maintenance and repair sources are delivering quality products for the system or end-item. These support audits consist of two parts: 1) The first part is to be conducted at the SPO, not in conjunction with an audit at any operational unit. This part of the audit focuses on top-level supply and supportability issues applicable to the system/end-item health as a whole. This part of the assessment includes deficiency reports, failure and mishap trends, exhibit analyses, first article inspections and test evaluations, and assessments of reliability, maintainability, and supportability analyses. 2) The second part of the off system/end-item audit takes place at the operational unit and focuses on verification that local practices have been documented and are consistent with SPO practices, the technical workforce is properly trained and complies with TOs, and that TOs are properly maintained and updated. Program management should lead this effort and rely on engineering and technical experts to perform the evaluations and analyses. The program manager is responsible for coordinating with all inspection units to ensure the system/end-item is properly prepared; support personnel, facilities, tools, and equipment are available and accessible; records, drawings, technical orders, and documents are on hand; and other requirements for the audit are available. Lastly, the program manager ensures the results of the inspection are documented and coordinated, and that corrective action is taken where necessary.

The intent of an audit is to ensure the configuration is properly documented and maintained, and ratings provide feedback as to the level of compliance with approved documentation and practices. However, since the intent of a legacy audit is not to punish the unit for deviating from the baseline, some amount of diplomacy is required in feedback of results. Therefore, providing Unit Compliance Inspection (UCI) type ratings (in compliance, in compliance with comments, and not in compliance) may be beneficial.

When using a rating system, however, success and failure of the inspection requires definition. For OSS&E, ‘in compliance’ implies the unit maintains the system/end-item OSS&E baseline as defined in design and maintenance documentation with no findings worth noting. The only difference between this rating and ‘in compliance with comments’ is that some minor deviations from the baseline were noted. Although these deviations do not adversely affect system/end-item configuration or the governing processes to maintain that configuration for OSS&E, they may affect other program activities and should be corrected. Not in compliance implies the system/end-item is not maintained in accordance with these governing processes and impacts the OSS&E baseline (design documentation, technical orders, OSS&E directives, etc.). Unauthorized modifications, use of outdated technical data, and use of unapproved parts are examples that would constitute a ‘not in compliance’ rating. This must be corrected for OSS&E assurance.

For a system/end-item maintaining the FAA airworthiness certification, FAA Order 1800.66 identifies the activities and requirement for configuration tracking. For FAA certified systems and end-items, the configuration must be maintained unless changes are approved and appropriately documented in accordance with FAA procedures if they are airworthiness certified by the FAA, or in accordance with SPO procedures if they are just FAA type certified.

Appendix A.4 provides a list that may be used to help in ascertaining whether the configuration management system is working.

5.1.4 Test and evaluation

In order to establish and maintain operational safety, suitability, and effectiveness for Air Force systems and end-items, a sufficient amount of testing and evaluation is necessary and identified shortcomings corrected. The test and evaluation process is based on the scientific method and the principle of "predict - test - compare" to demonstrate system effectiveness and suitability. For many legacy systems and end-items, OSS&E data may be heavily dependent on data gathered during test and evaluations (T&E) performed over the life of the program. For newer, T&E provides some of the verification that the system/end-item achieved the desired requirements. For end-items, the T&E may serve as inputs to the system SM to initiate integration testing.

Various kinds of developmental test and evaluation (DT&E) are conducted throughout a system's life cycle to ensure the Air Force acquires and maintains systems which meet users' needs. Decision makers use DT&E results to verify the extent to which design risks have been minimized, verify contract performance, determine system safety, assess military utility and system reliability, and determine system readiness for dedicated operational test and evaluation. Guidance on planning, conducting, and reporting DT&E is found in AFI 99-101.

Various kinds of OT&E can be conducted during a system's life cycle to ensure the Air Force acquires and maintains operationally safe, effective, and suitable systems that meet user requirements. OT&E is conducted in as realistic an operational environment as practical to identify and help resolve deficiencies as early as possible. The test conditions for OT&E must be representative of both wartime stress and peacetime operational conditions. Dedicated OT&E will be considered complete when OT&E results indicate the system is operationally safe, effective, suitable, and meets users' operational requirements, and performs mission essential tasks. Additionally, the results will verify deficiencies have been corrected and fixes incorporated as agreed. At this point, the system will be shown to be operationally safe, suitable, and effective. Nevertheless, follow-on operational test and evaluation (FOT&E) continues to resolve critical operational issues (COIs), test issues, or areas not complete as the system enters the sustainment phase. Information on OT&E is contained in AFI 99-102.

Qualification operational test and evaluation (QOT&E) is the name used for OT&E when no significant research and development is required. It is used when evaluating military-unique portions and military applications of commercial off-the-shelf, nondevelopmental items, and Government furnished equipment. QOT&E is planned and conducted to the same standards and policies as IOT&E, including being conducted by AFOTEC. Candidate systems for QOT&E require little or no Government funded R&D, engineering, design, or integration efforts. QOT&E is funded by O&M (3400) or procurement (3010, 3020 or 3080) funds.

As the system is put into operational use, the need for modifications may arise. The system's capabilities may change, the threats against it may change, and there would thus be a need for additional evaluation, certification, and documentation in support of OSS&E assurance. Other related T&E information is available through the AT&L Knowledge Sharing System (previously the DoD deskbook).

5.1.5 Technical orders (TOs) and technical data

Current, valid, verified TOs, technical manuals (TM) and/or technical data are provided to the operational command, users, and management activities as appropriate. TOs are developed, acquired, managed, and maintained in accordance with TO 00-5 series TOs. For maintenance data assessment of legacy systems/end-items, there are two approaches analogous to the functional baseline approaches discussed in section 5.1.3. Either a paper trail to a maintenance data validation event should be established, or the measures of demonstrated user performance should be assessed. For either approach, it should be verified that all TOs are accurate and maintenance data updates have been incorporated. A checklist for a successful TO program is provided at Appendix A.5.

The source of information for TOs is the technical data (TD). TD includes engineering data, source data, schematic diagrams, flow diagrams, manufacturer's handbooks, manuscripts of O&M instructions, commercial technical manuals (TMs), and other system and equipment O&M procedures. Technical manuals are the commercial equivalent of TOs, except that TMs are not military orders issued by Air Force Chief of Staff. TOs, TMs and technical data identify procedures, operating limitations, and requirements necessary to preserve operational safety, suitability, and effectiveness baselines If TOs, TMs or approved procedures are not followed for maintenance or operations, then they do not help assure OSS&E.

5.1.5.1 TO policy

TOs are military orders issued in the name of the Air Force Chief of Staff and by order of the Secretary of the Air Force. Compliance with Air Force TOs is mandatory per AFPD 21-3. AFPD 21-3 applies to all personnel who acquire, manage, or use TOs. Air Force approved commercial publications are assigned TO numbers and managed in the TO system. Programs planning to manage commercial publication(s) outside the TO system must request a waiver from USAF/ILM.

5.1.5.2 Operations and maintenance in accordance with TOs

Operational and maintenance instructions are contained in TOs. All Air Force military systems and commodities, except those waived or excluded in TO 00-5-1, Chapter 2, should be operated and maintained according to procedures specified in military systems or commodity TOs. A checklist for a successful TO program is provided at Appendix A.5.

5.1.5.3 TO updates

A TO must reflect the current operating characteristics, maintenance, inspections, and production configuration of its related system/end-item and/or components. The system CE/LE is ultimately responsible for TO technical content accuracy. In practice, the technical content manager (TCM) has overall authority for managing the content of the TO and the responsibility to maintain the currency and accuracy of the TO throughout the program's life cycle. (Note: The TCM is the individual, usually an equipment specialist or engineer, responsible for maintaining the accuracy, adequacy, modification, classification, review, and currency of the technical content of TOs supporting assigned systems, commodities, or processes.)

5.1.5.4 Planning for sustainment/updates

After the Air Force formalizes TOs, the TOs enter the sustainment phase. Sustainment (also known as maintenance or updating) involves periodically updating TOs to maintain their currency and accuracy. Factors driving updates can include equipment modification where TO updates are covered as part of the cost of an engineering change proposal, correction of errors, approved AFTO 22s, and improved methods of performing procedures, among others. Sustainment continues to rescission of the TOs after the end-item or system is retired from the inventory.

To ensure adequate financial resources are available for regular TO updates, single managers must complete a Comprehensive Air Force Tech Order Plan (CAFTOP) Annex and a Technical Order Financial Requirements Brochure covering their assigned TOs (per TO 00-5-1, paragraph 1-4.3.9.3). The CAFTOP is a compendium of plans for managing the digitization, sustainment, and distribution of O&M technical orders. CAFTOP Annexes are updated as changes occur and are submitted annually to the responsible lead command in sufficient time to support the TO budgeting and funding process. Portions of the CAFTOP are also used to supply information for quarterly TO metrics. HQ AFMC/ENB collects the metrics information for submission to HQ USAF/ILMM.

Please refer to the Integrated Data Environment home page for more information regarding TO acquisition and sustainment.

5.1.5.5 Flight manuals

The Flight Manuals Program (FMP) publications are managed in accordance with AFI 11-215 and TO 00-5-1. HQ AFMC/DOO, the executive agent for flight manuals, maintains a single-source web page for all flight manuals issues. The SM appoints flight manual managers (FMM) who are technically qualified (preferably engineers) with military aircrew experience and/or previous experience as a FMM.

The responsibility for accuracy of the flight manuals' technical content resides with the CE/LE. In practice, the FMM manages the content, format, and accuracy of the flight manuals.

The FMM and the TO manager work together closely throughout TO development and sustainment activities, and follow similar processes for the most part. A few distinct differences follow:

a The FMM coordinates with the TO manager for FMP contracting, funding, numbering, printing, distribution, and indexing.

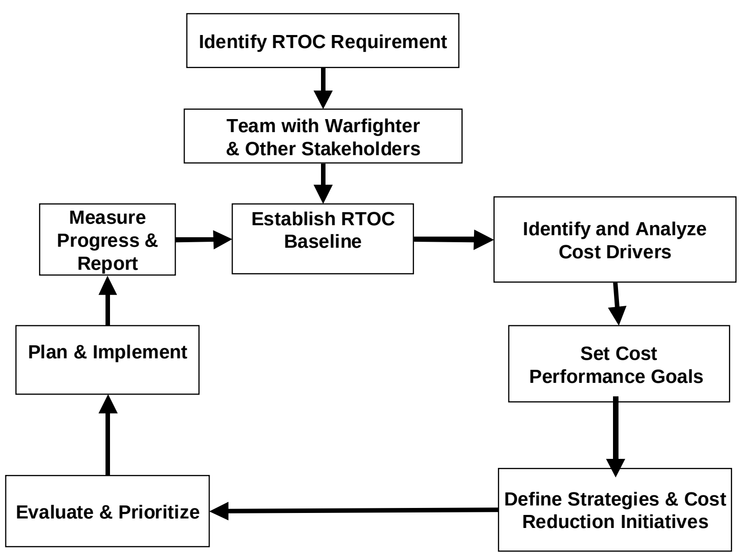
b The FMM coordinates all aerial refueling manual changes with the KC-135 and KC-10 FMM to ensure standardization of aerial refueling procedures.

c The FMM conducts an annual Flight Manual Review Conference (FMRC), unless postponed by the using commands, to review all outstanding routine AFTO 847s (vice AFTO 22) and other documents affecting FMP content. The FMM is the FMRC chairperson.

d The FMM ensures the minimum print quality for all FMP publications is Level III (good quality).

5.2 Total ownership costs (TOC)

In sustainment, the same reduced total ownership cost (RTOC) process is used that was implemented during acquisition phase. During sustainment, RTOC is applied from repair/throw-away decisions to purchasing unique/using existing equipment. When making these types of decisions, assessing total life cycle cost is necessary. For example, unique equipment could require establishment of a new repair/supply capability versus using the existing processes/facilities currently employed by programs. Obsolescence issues, upgrade development costs, and risks will not be shared among multiple programs. Cycle time and source(s) of repair also influence RTOC. RTOC does not dictate that the lowest cost is the correct choice. If the system/end-item is late to need or does not perform the intended function, then OSS&E is adversely impacted. The following website can provide additional information on RTOC: AFTOC data is https://aftoc.hill.af.mil, Air Force RTOC is www.safaq.rtoc.hq.af.mil and some performance data is available at http://semr.drc.com.



The key to conducting agile program sustainment planning activities is affordability. Two approaches that aid the SM in developing and sustaining program life cycle affordability are reduction in total ownership costs (RTOC), and cost as an independent variable (CAIV)RTOC and CAIV approaches should be developed using an integrated product development process and should be tailored to specific program affordability goals and operational requirements. If tailored appropriately, RTOC and CAIV can establish, early in a program, a comprehensive, cradle-to-grave approach to reduce the cost of products and activities used to acquire, operate, and sustain systems and end-items. RTOC and CAIV enable the SM to balance cost, schedule, and performance to the total obligation authority. However, these approaches also require the single manager to establish aggressive cost objectives, defined to some degree by the maximum level of acceptable risk. The SM evaluates and prioritizes risk in achieving performance and aggressive cost and schedule goals. By using RTOC and CAIV along with derived performance measurements (e.g., the OSS&E baseline) to actively manage acquisition, production, and sustainment phase trades, the SM can identify, analyze, and define cost drivers and generate potential affordability solutions to key sustainment issues. This is especially critical in the sustainment phase, when the operations and support (O&S) cycle often provides the SM a rich environment in which to identify risks. These risks are associated with funding the migration from procurement to O&S, deferred modernization, aging systems/end-items, increased maintenance, and increased O&S costs.

5.3 Inspections and maintenance (I&M)

This guidance establishes I&M procedures that preserve OSS&E for new and modified systems/end-items throughout the operational life. The following are the key elements of the I&M determination:

I. **Customer/user ORD requirements**: The correlation matrix within the ORD should provide sufficient detailed information to establish maintenance planning objectives.

   a. Identify maintenance requirements for maintenance concept development.

   b. Describe approach for contract versus organic maintenance.

   c. Identify scheduled I&M tasks and time phasing.

   d. Identify programmed I&M surveillance tasks such as nuclear hardness and structural integrity.

II. **Maintenance requirements and maintenance concept:** The maintenance requirements should be analyzed to determine level of maintenance required to support the maintenance concept, e.g., field and/or depot. An integrated field level maintenance (organizational/intermediate) together with depot level maintenance comprises the two-level maintenance concept used on Air Force systems. The maintenance concept and requirements process could drive various maintenance alternatives for the customer/user or SM. Field level maintenance may be performed either by Air Force personnel or under interim contractor support (ICS) or contractor logistics support (CLS), depending on the alternative most beneficial to the Air Force (see AFI 21-101, AFI 21-102, and AFI 21-107).

III. **Maintenance & inspection parameters determination:** The SM is responsible for conducting reliability centered maintenance (RCM) analysis and using the results to establish the initial inspection and maintenance requirements. If the system is operational, the SM uses field failure data and RCM principles to update inspection and maintenance requirements. The initial RCM analysis and all updating analyses are documented to preserve the history and rationale for maintenance tasks. This documentation provides a basis from which to monitor the effectiveness of the inspection and maintenance program and to establish an audit trail of all RCM decisions.

   Engineering analyses for maintenance should consist of the following, as a minimum, to assure OSS&E:

   a. Failure modes, effects, & criticality analysis (FMECA).

   b. Reliability centered maintenance (RCM) analysis (see AFMCI 21-103).

c. Repair level analysis (RLA) and maintenance task analysis.

d. Air Force integrity programs.

IV. **Tailoring for modifications:** The CE ensures that the I&M instructions are provided in the TOs to preserve system or end-item OSS&E assurance and continued airworthiness for the operational life of the system.

V. **I&M requirements for airworthiness certification:** Equipment/component malfunctions degrade system airworthiness. The I&M function, detailed in system and commodity tech orders, is required to restore airworthiness. The I&M function in conjunction with tech orders, facilities, training, and supply assures the restoration of airworthiness. The SM and CE should have sufficient insight into the above functions to assure airworthiness restoration after system and or equipment I&M. Military aircraft or engine systems that have civilian counterparts must also report relevant Deficiency Report data to the FAA via the FAA Flight Standard Difficulty Program. These systems may also obtain Service Difficulty Reports on common part deficiencies from the FAA (see TO-00-35D-54, paragraph 4.2.1.10).

5.4 Sources of maintenance and repair

The SM should determine that suitable processes are in place and are used for maintenance and repair of all elements of the system or end-item. This includes the basic structure, installed subsystems, and the parts which comprise them, such as engines, flight control, electrical power, etc. (including applicable group A and B equipment), and support equipment used for testing flight-safety-critical on-board systems/end-items. The SM of a particular system should rely on and have agreements with commodity SMs and the appropriate ALCs to support his/her determination. This determination is somewhat analogous to that described in the preceding paragraph. It should address how requirements are defined and compliance verified, a means to confirm that appropriate technical data for maintenance and repair is being used, and personnel are suitably qualified in its use. The SM may need to establish a hierarchical flowdown such as a work breakdown structure (WBS) to distinguish between maintenance and repair of the basic structure as opposed to parts repaired for reuse in flight-safety-critical subsystems. This is also done to determine the applicable commodity SMs and ALCs with whom his organization interfaces. This paragraph applies to both contractor/vendor and Government sources.

5.5 Sources of supply

The SM should determine that suitable processes are in place and used for the acquisition of parts to sustain systems and end-items. The SM is responsible for establishing appropriate sources of supply to support the OSS&E baseline. The processes should reflect flexible sustainment, whereby a determination is required as to whether the parts should be procured to performance versus design-to requirements. For either case, a subsequent review is required as to how such requirements are established and provided to candidate sources of supply. Requirements should be verified in terms of confirming that the parts provided meet the applicable performance and/or design-to requirements. The overall supplier/part selection process effort should pay particular attention to replacement of obsolete parts, parts provided by new sources of supply, and those insidious parts that may "fall through the crack." That is, those that are not parts of major group B equipment and not highly visible in periodic inspections of primary Group A hardware. The process assessment applies to parts acquired from contractors/vendors and parts acquired from Government sources. The latter case should also address processes for organically maintained software.

The need to obtain new sources of supply occurs throughout a system's life. This can occur because of an existing/previous supplier going out of business, discontinuation of a product line by a specific supplier, removal of the source from the qualified vendors list due to poor performance, etc. Regardless of the reason, it is incumbent upon the SM and CE/LE to ensure adequate requirements are established and actions are taken to obtain new supply sources while preserving the existing system OSS&E baseline.

There are several methods for restricting sources for parts procured using a specified design. The acquisition method code (AMC) and acquisition method suffix code (AMSC) will state whether or not the item is restricted to specified sources. It will also specify how the sources are restricted (such as a source controlled drawing or if an item requires engineering source approval by the design controlling activity). Reference Supplement 6 of the DOD Federal Acquisition Regulation Supplement for more information on the AMC/AMSC code. The requirements to meet, as a source, will depend on the criticality of the item, what method was used to restrict sources, where the part is used, etc. These may be identified in Source Qualification Statements, a Qualified Products List (QPL), a Preferred Products Selection List (PPSL), or other program documentation for critical parts that require a qualified source. For other parts, first article and deficiency reporting may be used monitor supply. The following are examples of how sources are restricted and methods of approving new sources. These are examples only.

a. Some items may be restricted to sources called out on a source-controlled drawing or on a QPL for a specification. These should be qualified by the organization that manages/owns the drawing or specification so they can be added to the list of sources on the drawing or QPL for a specification.

b. Some items are restricted to the OEM due to problems with the data used to manufacture the item (such as incorrect/incomplete data or proprietary data). Sufficient data to manufacture the item should be obtained or the rights to such data obtained before additional sources can be considered.

c. Some items are restricted to the sources called out on the AFMC Form 761 (AMSC "C" coded items). The method for approving additional sources is item dependent and is based on the criticality of the item and the reason for which the sources were restricted for the part. Below are examples of why an AMSC "C" code may be added:

(1) If special equipment is required to manufacture the part (such as special equipment required to machine a large part in one operation). In this case the contractor may be required to provide documentation to show they have the required equipment so they can be added as a source.

(2) If it is a problem item (such as an item made of materials that require special expertise to machine without warpage), new sources could be qualified based on similarity or by having the contractor manufacture a part and send it in for testing.

To qualify based on similarity, the contractor should provide documentation to show they have successfully manufactured a part that is similar in difficulty, material, and manufacturing processes.

5.6 Training

Accurate and effective training for operations and maintenance personnel is critically important to ensuring the OSS&E of air systems. The SM should ensure that a comprehensive training system is established to provide continuous, effective training for operations, maintenance, and program office and supply personnel. The training system is considered to be an integral part of the overall air system. The training system includes all system and subsystem specific training resources, operator and maintenance training devices/equipment, software support resources, computer-based instructional systems, unique support equipment, courseware for the computer-based instructional system, curriculum materials for aircrew and maintenance training, and instructional services required to support operator and maintenance training. The SM should ensure that processes are established to assure that the training system is updated concurrently with changes to the aircraft throughout its life cycle. The processes established should include comprehensive training task requirements analysis to ensure that critical training tasks are properly prioritized and allocated to the appropriate training media. The SM should ensure that the formal and informal training programs provide training to safely and effectively operate, employ, and support the aircraft. OSS&E training is available via ASC/ENSI, AFIT Virtual Schoolhouse, and HQ AFMC/ENPD.

5.7 Certifications

The purpose of obtaining certifications is to have documentation that assures operators and maintainers of a system's/end-item's integrity. One of the specific SM responsibilities is to obtain all required certifications for the system/end-item. Certifications required for OSS&E assurance must be initially established before operational use and then preserved throughout the system's operational life.

Additional information on specific certifications is provided in the following sections. The certifications are divided into two parts. Section 5.7.2 contains those certifications that the SM/CE is responsible for accomplishing or obtaining. Section 5.7.3 contains those that the SM/CE should review to ensure that specific types of equipment have their associated certifications. Section 5.7.4 identifies those processes that aid in obtaining certifications or provide additional support for OSS&E assurance.

Table II provides a list of required certifications, the source documents that require them, and the office of primary responsibility for certification.

TABLE II. List of certifications.

CERTIFICATION	POLICY/GUIDANCE	CERTIFICATION OPR
Air System Certifications		
Airworthiness certification	**AFPD 62-6**	**SM**
Global air traffic management (GATM) and navigation safety certifications	**AFPD 63-13**	**ESC/GA**
Cargo air transportability and airdrop technical approvals	**AFJI 24-223**	**ASC/ENFC (ATTLA)**
Primary flight reference	**AFI 11-202**	**AFFSA & AFFSDG**
Joint interoperability certification	**AFI 33-108**	**Joint Interoperability Test Command**
Air Force training system and device simulator certification program	**AFPAM 36-2211**	**MAJCOM**
Seek_Eagle – Stores Certification	**AFI 63-104**	**SM**
Dedicated operational test & evaluation readiness certification	**AFMAN 63-119**	**PEO, DAC or SM**
Nuclear certification program	**AFI 91-103**	**AFSC/SEW (TBD)**
Radio frequency (RF) spectrum	**AFI 33-120**	**Military Communication Electronics Board (MCEB) / JF-12 Working Group**
Laser radiation protection	**AFOSHSTD 48-139**	**AFMOA/SGO**

CERTIFICATION	POLICY/GUIDANCE	CERTIFICATION OPR
DoD International Air Traffic Control Radar Beacon System/Identification Friend or Foe/Mark XII System (AIMS) program office certification (IFF)	**DoD AIMS 97-900** **DoD AIMS 97-1000**	**AIMS PO**
System security certification and accreditation	**Public Law 100-235**	**SM Designee (usually the chief engineer)**
OTHER CERTIFICATIONS		
UHF SATCOM DAMA	**MIL-STD-188-181/182/183**	**Joint Interoperability Test Command** **(JITC)**
Cargo movement certification	**AFMAN 24-204** **AFI 24-201**	**AFMC LSO/LOPP**
Nuclear weapons program management	**AFI 63-103**	**SAF/AQQS** **(TBD)**
Nonnuclear munitions safety board (NNMSB) certification.	**AFI 91-205**	**AFSC/SEP**
National aerospace certification of authorization	**Form 7711-1**	**Operating MAJCOM through AFFSA to the FAA**
Mission Planning	**AFMSS and JMPS AF CERTIFICATION PLAN**	**MAJCOM**

5.7.1 Legacy system certifications

Some current certification requirements may not have existed when legacy systems/end-items were fielded. Obtaining current certifications is not required solely for OSS&E implementation. However, the program office should analyze the applicability of those requirements at the current point in the system/end-item life cycle and determine how current requirements could impact system/end-item OSS&E assurance. For legacy systems/end-items that were certified but for which the certification documentation cannot be located (within the SPO, ALC, contractor, or certifying agency), document how the flight manual, technical data, or other evidence demonstrates certification compliance. It is suggested that the SM/CE for these systems/end-items contact a certifying agency for which the SM is not the certifying official to ensure that the documentation is sufficient, since only the certifying agency can determine acceptable alternatives. The above guidance does not relieve the SM/CE from complying with certification requirements for new capabilities.

5.7.2 Air system certifications

5.7.2.1 Airworthiness certification

The Air Force is the responsible agent for certifying airworthiness for all aircraft it owns and operates, or leases. AFPD 62-6, *USAF Aircraft Airworthiness Certification,* establishes the requirement for airworthiness certification of USAF aircraft, and it applies to all U.S. Air Force aircraft, including those of the Air National Guard and U.S. Air Force Reserve. Airworthiness certification signifies adherence to airworthiness certification criteria established by the Airworthiness Certification Criteria Control Board (AC^3B). The SM for the aircraft is the airworthiness certification authority. See 11. Airworthiness Certification, for specifics on the airworthiness certification process.

5.7.2.2 Global air traffic management (GATM) and navigation safety certifications

New and evolving civil communication, navigation, surveillance/air traffic management (CNS/ATM) performance standards have been established to guarantee capability for access to worldwide controlled airspace. The program office develops the GATM and Navigation (Nav) Safety Certification Plan that characterizes required functionality, processes, and procedures necessary for civil CNS/ATM compliance and obtains certification from the GATO/MC2 program office. GATO/MC2 will perform GATM and Navigational safety architecture verification, and performance certification as required by AFPD 63-13 per the certification plan. The MAJCOM will approve the aircraft to operate with the requisite CNS/ATM airspace procedures and requirements as outlined in the certification plan. Documentation of this performance will be forwarded to the GATO/MC2 SPO, who will issue the appropriate letter of certification for that system. Recertification criteria, intervals, and sustainment requirements are required features of this plan.

5.7.2.3 Cargo air transportability and airdrop technical approvals

Any item of equipment that is proposed to be airlifted aboard US Air Force aircraft which, in its proposed shipping configuration, would be considered a "transportability problem item" must be submitted to ATTLA for approval and certification prior to airlift. In general, a cargo item may be considered problematic due to its physical size, weight, fragility, hazardous characteristics, or lack of adequate means of restraint. The certification process is governed by AFJI 24-223. See the ASC/EN website for additional guidance on the ATTLA processes.

5.7.2.4 Primary flight reference

A primary flight reference (PFR) is any display, or suite of displays or instruments, that provides all required information for flight and complies with the requirements of MIL-STD-1787 for information content and presentation. AFI 11-202V3 requires that any single medium PFR be endorsed by the Air Force Flight Standards Agency (AFFSA). Endorsement of a display consists of evaluation of the display symbology by the AF Flight Standards Development Group and AFFSA. It requires PFR performance evaluation for specific flight maneuvers described in MIL-STD-1787. Endorsement is required to ensure that aviators have the basic flight information required available at all times to safely operate the aircraft and in a format that conforms to flight standards and human factors design principles. Since flight with single-medium PFR without endorsement is not permitted, the term endorsement is considered equivalent to a certification.

5.7.2.5 Joint interoperability certification

All air systems and end-items developed and managed as part of the Aeronautical Enterprise must be interoperable with all other air systems that share or intersect operational missions. AFI 33-108 requires joint interoperability certification for any system that meets the following criteria:

a. Produces, uses, or exchanges information in any form electronically;

b. Passes information to or from other services, agencies, or countries; and

c. Is intended for operational use.

The Joint Interoperability Test Command (JITC) has been identified as the DoD certification agency for joint and combined interoperability and follows the processes outlined in CJCSI 6212.01A. The SM/CE for each applicable air system and end-item is responsible to ensure interoperability requirements are included in contractual documents. Using commands must also ensure their inclusion in the operational requirements. Documentation of this connectivity is forwarded to JITC for review and certification.

5.7.2.6 Air Force training system and device simulator certification program

Simulation certification (SIMCERT) is an operationally conducted program designed to ensure training systems and devices provide accurate, credible training in specific tasks. It also provides the operating command with an audit trail for training device effectiveness; provides a key quality assurance capability for contractor supported training or equipment; and compares the training system with the aircraft system to establish and document concurrency baselines. For ANG and AFRES, SIMCERT programs should align with the Lead MAJCOM SIMCERT program. SIMCERT should be done for all aircrew training devices (ATD) and other training devices as determined by the MAJCOM. AFPAM 36-2211 addresses the certification process. In concert with this process, the Air Force may also use FAA standards regarding the evaluation and qualification of aircraft training simulators/devices, as appropriate.

5.7.2.7 Seek Eagle - stores certification

A stores certification will be accomplished on all weapons (conventional and nuclear), suspension equipment, tanks, and pods carried externally or internally in accordance with AFI 63-104. The verification process includes safe upload and download procedures and flight limits for safe carriage, employment, jettison, safe escape, and ballistic accuracy verification. Recertification is required for any change that alters the characteristics of the suspension equipment, store, aircraft, or store loadout configuration. Flight clearance should be applied for through the Air Force Seek Eagle office (AFSEO) prior to any new flight testing or operation of air systems or end-items. The AFSEO provides a certification recommendation to the SM after successful verification of requirements.

5.7.2.8 Dedicated operational test & evaluation (DOT&E) readiness certification

At the completion of DT&E, systems are reviewed for readiness for dedicated operational test and evaluation (DOT&E). AFMAN 63-119 outlines a structured process to help identify risks and render assessments of system readiness to begin DOT&E. A standard framework or "process" is detailed in 33 "templates" which contain historical information and practical advice about how to reduce or eliminate risk. The DOT&E certification process helps document the pursuit of a credible and effective development program and transitions the program into DOT&E. Several of the templates deal with system support (support equipment, spares, data, training, etc.) which would carry on through the sustainment phase.

When the certification official gives final, written confirmation of system readiness for OT&E, the operational test agency (OTA) commander will acknowledge by “accepting” (or “not accepting,” if appropriate) before beginning DOT&E. This acceptance officially confirms the OTA’s agreement (or disagreement) with the certifying official’s assessments and conclusions. This process will be the primary certification method for programs in which the Air Force is the lead service.

DOT&E readiness certification is applicable to ACAT I-III, NDI, COTS, and off-the-shelf programs. The SM states that the system/end-item has been through all acquisition-related qualification, performance, and acceptance tests or analyses and meets the requirements on the specification. This is when the user verifies that the system or end-item procured meets the user’s requirements.

AFI 99-101 identifies the SM’s responsibilities for the conduct of DT&E. These include ensuring DT&E is conducted according to approved test plans and certifying that systems are ready for dedicated OT&E. AFI 99-102 outlines the SM’s responsibilities for the system progression from DT&E into dedicated OT&E, through the certification process.

5.7.2.9 Nuclear certification program

AFI 91-103 implements AFPD 91-1, *Nuclear Weapons and System Safety*. It defines the process for certifying hardware, software, and procedures used with nuclear weapon systems. It applies to organizations that design, develop, modify, evaluate, or operate nuclear weapon systems. It does not apply to the Air Force Reserve and Air National Guard.

5.7.2.10 Radio frequency (RF) spectrum

Radio frequency (RF) allocation/approval is a local, national, and international issue. Most portions of the RF spectrum are very congested. The processes that can be used to obtain certification for spectrum support for electromagnetic radiating equipment that will use the RF spectrum can be found in AFMAN 33-120. The Air Force Frequency Management Agency (AFFMA) decides which requests require international registration and assists the SM in obtaining necessary certifications and registrations.

5.7.2.11 Laser radiation protection

The criteria in AFOSH STD 48-139 represent the Air Force's minimum requirements for a laser radiation protection program. It assigns responsibilities for healthful and safe operations of laser systems and outlines the requirements of a proper protection program.

5.7.2.12 DoD International Air Traffic Control Radar Beacon System/Identification Friend or Foe/Mark XII System (AIMS) program office certification (IFF)

The DoD International Air Traffic Control Radar Beacon System Identification Friend or Foe (IFF) Mark XII/XIIA system program office (AIMS PO) administers the AIMS program. The AIMS PO has overall program management responsibility for controlling all changes to U.S. IFF MK XII/XIIA systems, approving improvements or modifications to existing AIMS equipment, and full-scale development or production of new AIMS equipment. The AIMS PO monitors interoperability, system effectiveness, configuration control, equipment proliferation, and performance.

The DoD AIMS program office receives guidance from SAF/AQID (DoD AIMS program action officer) and the DoD AIMS steering committee formed by charter from the Office of the Secretary of Defense (OSD). The DoD AIMS program performance standards are listed in the Joint Technical Architecture (JTA).

Services/organizations implementing modification programs involving AIMS systems or requirements should obtain coordination with the AIMS PO before initiating modifications or enhancements of AIMS systems and system components that change the original equipment configuration, interface, or performance. In addition, the AIMS program office approval is required prior to procuring commercial off-the-shelf (COTS) equipment to be used as replacement for an existing AIMS subsystem to assure compatibility/ interoperability. Manufacturers of COTS AIMS equipment are encouraged to obtain coordination with AIMS PO early in the design phase to facilitate program office approval for the equipment.

As a minimum, services/organizations implementing development, acquisition programs, or major modification/enhancement involving AIMS equipment, or procuring commercial off-the-shelf equipment to be used as replacement for an existing AIMS subsystem, should provide AIMS PO with the following data items for review and approval:

a. Equipment design/procurement specifications

b. Test plans, including test procedures proposed to verify performance

c. Test data, including test results

Box Level Certification: All Mark X/XII IFF transponders and interrogators installed on U.S. military platforms are required to be AIMS certified. This certification ensures an adequate level of performance and interoperability in varying environments within military combat identification and air traffic control (ATC) and civil ATC architecture.

Platform Certification: Each military platform is required to obtain DoD AIMS Program Office Certification of the installed IFF systems. Integration of a transponder or interrogator into each platform type should be validated to ensure required controls and indicators are implemented correctly. Each platform type must then be tested for installed AIMS performance. This verification consists of ground testing and a minimum number of flight tests to determine performance. See https://pma213.navair.navy.mil/mode5pr 00 for details and contact the AIMS (WR-ACL/LYGO – AIMS) program for access.

5.7.2.13 System security certification and accreditation

National policy for the security of telecommunication and information systems provides initial objectives, policies, and an organizational structure to guide the conduct of activities directed toward safeguarding systems that process national security information (Public Law 100-235, Computer Security Act of 1987 and DoD 5000.1, section 3.10 Information Assurance). DoD 8500.1, Information Assurance states that all programs shall be managed and engineered using best processes and practices to reduce information assurance (IA) risks.

In order to ensure that sensitive and/or classified information is not unknowingly released, systems processing or transmitting these types of data are assessed for potential shortfalls. The assessment of these systems could be accomplished via the certification and accreditation (C&A) process. The C&A process is used to analyze and approve a system to operate within test and operational environments with the assurance that national security information is safeguarded.

The concept of C&A applies to all automated information systems (AIS): existing and proposed systems/end-items, stand-alone systems, personal computers (PCs), microcomputers, minicomputers, mainframes, large central processing facilities, networks, distributed systems, telecommunication systems, etc. However, most of the guidance cited in support of C&A is specifically not applicable to weapon systems or is silent on the issue. The issue is further confused by the use of general terms, such as automated information systems (AIS) and information systems, which are not specifically defined. The terms are used such that they appear to be all-inclusive, but the definitions never explicitly include aircraft systems or national security systems. Most aircraft systems and support equipment operate in a dedicated, or system high, security mode. The security implementation is designed and verified as an inherent part of the systems engineering/system development process.

Due to the expense and time associated with the formal certification and accreditation process, the appropriate representatives from the using command, PEO, Air Force Materiel Command, system program office, Defense Intelligence Agency (DIA), and SAF/AQ as appropriate should make the decision to apply the formal C&A requirement to weapon systems and end-items. If the aircraft system has a C&A requirement, the ASC/EN website, https://www.en.wpafb.af.mil/software/software c&a.asp describes the C&A process.

5.7.3 Other certifications

The following certifications are associated with equipment or procedures that may be used on a system or end-item. The SM/CE is not required to obtain these certifications but should ensure the equipment has the appropriate certifications prior to implementing its use on the affected system or end-item.

5.7.3.1 UHF SATCOM DAMA

The Chairman, Joint Chiefs of Staff Instruction, CJCSI 6251.01, "Ultrahigh Frequency Satellite Communications Demand Assigned Multiple Access Requirements," 31 July 1996, mandates that "All users of nonprocessed UHF MILSATCOM are required to have DAMA terminals that are interoperable in accordance with MIL-STD-188-181, MIL-STD-188-182, and MIL-STD-188-183. All users who are unable to comply with this policy are required to submit a waiver." JITC certification will ensure compliance with the MIL-STDs, promote the joint interoperability of various-user equipment, and allow the customer to meet the JCS mandate. Additional information is available at the UHF SATCOM DAMA Web-Site.

5.7.3.2 Cargo movement certification

International, federal, and military regulations require the shipper to certify that hazardous material has been properly classified, described, marked, and labeled and is in proper condition for transportation. Attachment 11 of AFI 24-201 defines applicable regulations and AFMAN 24-204 list the certification requirements based on the mode and method of travel.

5.7.3.3 Nuclear weapons program management

AFI 63-103 outlines the procedures and responsibilities for managing the Air Force nuclear weapons program. It applies to Air Force personnel involved in the research, design, development, testing, acquisition, operation, maintenance, and modification of nuclear weapons and their related systems and subsystems.

5.7.3.4 Nonnuclear munitions safety board (NNMSB) certification.

NNMSB, as described in AFI 91-205, is the review and certification authority and the system safety group (SSG) for all nonnuclear munitions with only limited exceptions. As the review authority, the NNMSB mission includes various approvals and safety certification assessments conducted at specified points in various munitions acquisition phases. As a system safety group, the NNMSB mission includes providing design and qualification safety guidance to program management authorities during the system's life cycle. The NNMSB reviews and establishes design safety and qualification test criteria, standards, and requirements for nonnuclear munitions and related items. The NNMSB also provides guidance to program management authorities throughout the life cycle of munitions programs to ensure that the criteria which forms the basis for the safety certification review are receiving adequate consideration. In addition, the board maintains safety cognizance over all new or modified nonnuclear munitions, including those developed by the Air Force, obtained from other US military services, or obtained from foreign sources intended for Air Force operational use. If a munitions or equipment item is safety certified under the Air Force Nuclear Safety Certification Program (AFI 91-103), then the item is certified for nonnuclear use, provided the nonnuclear portion of the system was evaluated. Such nuclear certified munitions and equipment items are not reviewed by the NNMSB unless specifically requested.

5.7.3.5 National aerospace certification of authorization

Military aircraft, remotely piloted vehicles and autonomous flying platforms sometimes traverse civil air space without meeting all FAA/ICAO regulations. Waivers to the civil airspace rules are defined in 14 CFR 91.905. The process for granting waivers is identified in Chapter 18 of FAA Order 7210.3S, Facility Operation and Administration. The waiver request is submitted by the operating MAJCOM through AFFFSA to the FAA. Additional information is available through the FAA website for military equipment.

5.7.3.6 Mission planning

The mission planning (MP) systems consist of several certifications done by many groups. The MAJCOMs certify the MP system and the system/end-item interfaces and are operationally acceptable. AFOTEC may be tasked to provide a recommendation to the MAJCOM; however, AFOTEC’s evaluation terminates with data being loaded onto the media used to transfer the MP information to the system/end-item. ESC/ACU is the primary organizations charged with overall certification responsibility for the mission planning systems and can be most helpful in obtaining the MAJCOM certification.

5.7.4 Best practices

5.7.4.1 Stores integration

Stores integration is applicable during sustainment because upgrades to weapons (operational flight program (OFP) changes, etc.) could impact the OSS&E baseline. Stores integration is a multi-discipline, multi-functional effort to effectively combine an aircraft with stores. Stores integration is an overarching process that includes Seek Eagle and airworthiness certifications. Effective stores integration achieves compatibility, certification, and operational effectiveness. Compatibility means the ability of an aircraft and its stores to coexist and operationally function without unacceptable degradation to either the aircraft or store. Certification is the documentation of the specific aircraft and store compatibility in a formal publication that contains all information necessary for the appropriate, safe employment of a store on a specific aircraft. This certification supports the aircraft airworthiness certification. Operational effectiveness is established when the systems/end-items can accurately and effectively deliver the weapons on the intended target or, in the case of nondeliverable weapons (directed energy weapons), produce the intended effect on the target. In the case of nonweapon stores (external fuel tanks, targeting/electronic counter measures pods, or cargo pods), operational effectiveness is established when the intended mission can be performed. The stores integration process has been documented and is available at the ASC/EN Store Integration website.

5.7.4.2 Engine OSS&E and airworthiness

Successful completion of the airworthiness certification of USAF aircraft depends heavily upon the airworthiness of the engines. The Propulsion SPO (ASC/LP) has implemented a best practice for airworthiness certification of aircraft engines to support the aircraft airworthiness certification effort. The engine SM issues the certificate for a group of like-configured engines based on verified compliance with the engine related criteria in the *Airworthiness Certification Criteria*. Likewise for OSS&E, the propulsion SPO has accepted OSS&E responsibility for the systems they manage. Through SLAs and ICDs the propulsion SPO coordinates activity with the airframer and provides their engine OSS&E assurance as part of the overall system OSS&E assurance. See the propulsion Best Practices website for more information.

There are however, many programs that use engines outside the Propulsion SPO's management chain (e.g., F-117 and UCAV). The engine depot may be Navy, Army, or contractor owned, etc. The processes employed by those organizations should be understood and compared with guidance in this Mil-Handbook and the program-specific tailored airworthiness certification criteria (TACC). The SM may use the appropriate portions of those processes in establishing OSS&E compliance and certifying airworthiness.

5.7.4.3 Human system integration

The Human Systems SPO, 311 HSW/YA, has a safe-to-fly certification process for Government furnished or managed life support equipment. That process resides under the systems safety element of OSS&E, and supports the airworthiness certification for aircraft. HSW/YA works in conjunction with ASC/ENFC, Crew Systems, to define the safe-to-fly validation requirements, using the crew systems section of the *Airworthiness Certification Criteria* (MIL-HDBK-516) as a general guideline.

5.8 Operations and maintenance

To maintain OSS&E, systems and end-items must be maintained and operated in accordance with the approved technical information in the form of technical orders, technical manuals, and related data. The SM and MAJCOM for USAF aircraft that maintain FAA certification can decide to operate and maintain these aircraft with FAA approved maintenance and flight manuals and associated data.

5.9 Technology demonstrations

As in any system design, all facets and subsystems of the design must consider OSS&E. Advanced technology systems and end-items left to the user for continued operations fall under the OSS&E umbrella, and assurance of OSS&E is the responsibility of the managing organization.

5.9.1 Advanced technology demonstrator (ATD)

ATDs, such as the unmanned combat air vehicle (UCAV), are proof of concept technology demonstrators. These are not designed to provide a capability directly usable by operating commands. Since ATDs are not transitioned to a user, OSS&E is not necessarily applicable. However, ATDs have been used operationally in real-world situations. The guidance herein, appropriately applied, could improve the usefulness of ATDs in military operations and aid in establishing OSS&E when operational.

5.9.2 Advanced concept technology demonstrations (ACTD)

ACTDs (ref. OSD 5000.2R3), in contrast with ATDs, generally start from a collection of mature technologies or maturing key technologies in technology demonstration programs. These technologies are then integrated into a complete military capability for user evaluation. At the completion of the ACTD, the residual systems used in the evaluation are left with the user to provide a limited, usable operational capability. Therefore, initial OSS&E compliance must be established and assured as long as the system is in operational use. Additional buys beyond this residual capability constitute a new acquisition program categorized by the dollar value and risk. In this case, the business strategy, contract provisions, and funding should include the appropriate OSS&E assurance considerations described for new acquisitions.

5.9.3 Prototypes (pre-system development and demonstration)

A prototype can generally be described as an end product that reasonably evaluates the technical feasibility or military operational utility of a concept or system. The particulars, including the number of prototypes necessary, vary with the acquisition program. In most cases, a prototype demonstrates something less than the intended system/end-item and requires follow-on development. In that sense, the OSS&E assurance criteria and processes are similar to an ATD, primarily concerned with limited effectiveness and safety. As with ATDs, the responsibility to certify or obtain applicable certifications for these products rests with the SM. Certification of airworthiness for any flying system is required. Where a prototype is used to satisfy near-term needs, as in an ACTD, OSS&E needs to be appropriately expanded to include operational suitability. Similar to advanced technology programs, key product characteristics and processes need to be considered in the transition planning for follow-on development.

6. THE OSS&E BASELINE

The OSS&E baseline is a subset of the program baseline and consists of those key features and aspects that describe the system or end-item capabilities, require continuous tracking, and merit the attention of the SM and user in terms of operational system safety, operational suitability, and operational effectiveness. The OSS&E baseline consists of characteristics supported by measurable metrics. The OSS&E baseline captures the important top-level/critical design facets. These may be described in ORDs (e.g., key performance parameters), AF Task Forces Concept of Operations, specifications (e.g., acquisition program baseline), measures of effectiveness, measures of suitability, technical performance measurements, and other relative sources. If the preceding documents do not exist, then the user, together with the SM, must decide what are the important characteristics. The OSS&E baseline consists of characteristics that are not necessarily directly measurable field parameters. Metrics are the measurable parameters that allow the characteristics to be assessed (see section 6.2). Some metrics may require quantitative analysis or special facilities/test equipment to assess a particular characteristic (e.g., range fly-by for aircraft signature assessment).

6.1 Establishing the OSS&E baseline

AFPD 63-12 requires that the SM and operating command choose each characteristic for the OSS&E baseline. The number of characteristics chosen for the OSS&E baseline will vary by system/end-item; however, the minimum is three: one each for operational safety, suitability, and effectiveness. Multiple characteristics are recommended for safety, suitability, and effectiveness to more accurately define the overall health of the fleet.

A sample OSS&E baseline is depicted in table III. The, HQ AFMC website has some additional suggested OSS&E characteristics. Other sources for characteristics can be found in current reports listed in table IV. Due to the uniqueness of each program managed within the Aeronautical Enterprise, appropriate characteristics should be chosen to reflect each specific system, mission design series (MDS), and/or end-item. This document does not require formal reporting against the OSS&E baseline and encourages the use of existing reports, metrics, and other sources of information to maintain OSS&E assurance.

TABLE III. Sample OSS&E baseline.

SAFETY	SUITABILITY	EFFECTIVENESS
Cumulative Risk Hazard Index	Logistics Fill Rate	System Reach
Loss Rate	Mean Time Between Failure	Cargo Delivery Capability
Airworthiness Certification	Integrated Combat Turnaround Time	Defensive Countermeasures
Nuclear Surety Certification	Weapon System Reliability	Radar Cross Section
Air Transportability Certification	Frequency Spectrum Certification	Acoustic Signature
Stores Certification	GATM Certification	Gun Circular Error Probability

TABLE IV. Existing reports (not inclusive).

NAME	OPR
Senior Executive Management Report (SEMR)	Dynamics Research Corporation
Warfighters Support Briefing (WSB)	ALCs
Health of the Force (AMC & ACC)	MAJCOM
Quality Performance Indicators (QPI)	ALC
Internal program office metrics	SPO

6.2 OSS&E metrics

Metrics provide insight into continued assurance of the OSS&E characteristics. The metrics assess the safety, suitability, and effectiveness characteristics that the SM and user have agreed reflect the critical aspects of the program. Some characteristics are inherently metric in nature and do not require separate or additional metrics. Other characteristics may require several metrics to accurately describe the activities occurring impacting them. Ideally, the metrics should provide an indication of an unacceptable trend that could lead to failing to meet the OSS&E baseline. Good metrics should

a. Be imposed upon the organization controlling the process measured by the metric.

b. Be accepted as meaningful by the customer (using command, procuring agency, etc.).

c. Show how well goals and objectives are being met through processes and tasks.

d. Measure something useful (valid) and consistent over time (reliable).

e. Reveal a trend.

f. Be defined unambiguously. Since a particular metric can have a different meaning for different programs, a source should be identified to provide the metric and data/algorithms used to generate each metric.

g. Be economical to collect, based on the criticality of the parameter.

h. Timely.

i. Demonstrate clear cause-and-effect relationship with the associated OSS&E baseline characteristic.

The following steps explain the systematic process for establishing metrics and the OSS&E baseline characteristics:

a. Identify the purpose. Is the purpose aligned with the OSS&E baseline? What needs to be measured? Why? What is the end purpose?

b. Begin with the customer. What are their expectations? Define characteristics of the product, service, or process that can be measured, and if improved, would better satisfy expectations. Define who, what, when, why, and how in sufficient detail to permit consistent, repeatable, and valid measurements to take place.

c. Determine parameters to measure. Start with a blank sheet of paper. Examine existing metrics and plan new ones as necessary. Determine the current status and end goal.

d. Examine existing measurement systems. What do they measure? Do they measure processes or are they focused on outputs -- products or services for external customers? Has the data been accumulated over time? Create new, better sources only if clear answers are not forthcoming or the data is not useful in managing the OSS&E baseline.

e. Rate the metrics. Are consistent, repeatable, and valid measurements taking place?

f. Collect and analyze metric data over time. First, establish the existing program state, and then start acquiring metric data from the existing metrics or from the new ones generated. As the data accumulates over time, look for trends. Investigate special or common-cause effects on the data. Compare the data to interim performance levels. Have the proper tools been selected to collect and analyze the data collected?

g. Presenting results. Once steps a through f have been completed, the metrics are ready to be presented. The metrics should be integrated as necessary to allow comparison with the OSS&E baseline. The SM and user need to understand what phenomena are causing trends and define potential actions to improve negative trends. This is critical in maintaining the OSS&E baseline.

h. Initiate improvement goals. This step is the most important if improvement efforts are to become a reality! Metrics are a means to an end: the end is continuous improvement. Of course, when the improvements have been implemented, start over again. As improvement is an iterative process, so is the process of developing metrics to measure it. Over time, metrics may evolve to ensure the OSS&E baseline is maintained.

6.3 Preserving the OSS&E baseline

Preserving the OSS&E baseline requires commitment from all stakeholders, including the working level user, MAJCOM, SPO, supporting ALCs, and depots. Each organization must understand its role and the importance of documenting, coordinating, and reporting all activities that affect the OSS&E baseline. To that end, establishing good integration and communication is essential. Informal (formal if necessary) MOAs, SLAs, or other documented agreements are preferred (see section 7). The baseline characteristics and/or metrics may require updating based usefulness of the information (i.e., are user concerns still captured) or due to changing the system/end-item configuration. The following are the critical aspects for preserving the OSS&E baseline:

a. Systems and end-items need to have an established OSS&E configuration that is religiously updated to enable the continued assurance of the OSS&E baseline. Sufficient information/documentation needs to be identified so that all stakeholders are informed of impacts to the OSS&E baseline resulting from system degradation or modifications. Understanding how the program office, field, commodity managers, technology repair centers, contractor, and DCMA document configuration changes and share information is key. The users play an important role in satisfying this aspect in that they control and document changes implemented on their systems/end-items.

b. Preserving the OSS&E baseline requires that all changes impacting the system or end-item, including operation or maintenance outside of TO limits, are made known to the responsible managing organization. If the user, PGM, or other supporting activity does not follow the approved technical manuals, allows modifications outside the purview of the program office, or does not provide feedback to the program office on the status of approved modifications, the resulting configuration becomes an unknown. OSS&E cannot be assured in these cases because new modifications are assessed against an inaccurate documented baseline, not the "as flying" baseline. OSS&E also cannot be assured when operational changes are not coordinated with the SM or when the SM has not approved operation or maintenance outside of TO limits.

c. It is important to understand the impact of changes to the system or end-item (planned upgrades and field generated configuration changes to meet special mission requirements) because these may cause changes to the threshold values in metrics and/or the OSS&E characteristics. Depending on the extent of the modification, some parameters may appear to have no impact and others have a significant impact directly attributed to that change. It is critical that all changes include an evaluation of the impact on the OSS&E baseline and metrics, since build-up of small changes could eventually culminate into an undesired system effect. Ideally, if each configuration or usage change is properly processed and the applicable functional and product baselines are accurately maintained, there should be no unknown adverse consequences of accumulated change. However, particular attention should be given to at least two areas. The first involves an impact that can result from a large number of small degradations, where each by itself may receive little attention. Examples include changes impacting weight, center of gravity, drag, and overall system reliability. The second area involves changes in which subtle interface and subsystem interactions can occur. Examples include EMI effects and hardware-to-software and software-to-software interactions. The potential effects of cumulative changes should be considered during periodic OSS&E assessments.

d. The last aspect is to develop a process to compare the expected results of the modification to the actual impact on fielded OSS&E baseline capabilities. Careful analysis is necessary to ensure that one characteristic does not exceed expected values at the expense of another. The up-front trade studies should prevent this phenomenon; however, trades studies are not all encompassing. Typically, only the high value and critical aspects of the system or end-item are assessed in trade studies. The activities discussed in configuration management, provide the necessary linkage to OSS&E baseline characteristics and associated hardware & software. FOT&E can provide the operational experience necessary to verify that the OSS&E baseline has not been degraded.

6.3.1 Preservation feedback loop

The feedback process identifies whether the changes have improved the product. For feedback to be meaningful, an expected improvement should be assessed prior to incorporating a change to serve as a measuring stick. It is important to remember that feedback is a two-way flow. The MAJCOM wants to see how OSS&E is improving the field's experiences with the system or end-item and the SM wants to see increased efficiency in managing sustainment and the OSS&E baseline. Care should be taken to avoid a circular "do-loop." That is, tying a suitability issue to effectiveness and so on. (For example, due to insufficient spares for the radar, maintenance is using components previously found to be marginal, which reduces radar gain and range. Radar range is an effectiveness metric. However, it is ineffective due to the lack of "good" spares; hence, the "do-loop" is completed.)

FEEDBACK LOOP

User provides feedback		
Activities analyze:		
	Safety	
	Suitability	
	Effectiveness	
Analysis results in:	Risk	
	Alterations–	Cost
	Improved parts and support	
	Better training and manning	
	Engineering change proposals	
End result?		
	Improved readiness	

7. MANAGEMENT RELATIONSHIPS

The SM and CE are ultimately responsible for the continued OSS&E assurance of their program regardless of to whom they have delegated authority for portions of the sustainment effort. Informal and/or formal agreements (e.g., MOAs, SLAs, etc.) are necessary between the program office and supplier organizations to convey the information requirements from each other's organizations to assure OSS&E for the program. When a supplier provides support to multiple programs, a standard MOA/SLA should be developed. All programs and the supplier should agree to a single process for notification and coordination of modifications/upgrades. SLAs, MOAs, etc., are not required between the program office and user. These relationships are usually documented in an operating instruction, although it could be documented in the OSS&E plan Click to see a sample ALC MOA. Click for HQ AFMC/DR SLA information. Click to see ASC/SY MOAs/SLAs.

The MOAs/SLAs should provide a mutual understanding of each organization's mission and how this mission benefits the warfighter. In addition, they should describe a set of mutually sponsored initiatives that raise awareness of problems that negatively impact items being managed by another organization and, ultimately, that impact the system/end-item. MOAs/SLAs, etc. should identify the procedures responsible organization supplying components and address for making changes to the components installed on multiple platforms. Any change that could impact the operational safety, suitability, or effectiveness of the higher-level item should be identified to the SM of the higher-level system/end-item prior to incorporation. MOAs/SLAs or other agreements should be made with DLA, other supply chain management functions, or organizations that provide engineering authority (e.g., engines, landing gear, commodities, etc.). An example issue addressed in an SLA/MOA, etc., is technical data and TCTOs integration. The aircraft SPO handles companion TO changes and the item manager handles commodity TO changes. The two resulting TCTOs need to reference each other. The reason for this is that supply will handle the commodity activities but does not address the aircraft. Likewise, the SPO will handle the aircraft activities, but does not address commodities delegated to the item manager.

SLAs, MOAs, or other agreements should contain the following elements:

a. Define the OSS&E baseline and metrics applicable to the supplier organization.

b. Clarify how metrics roll up into the system-level metrics and OSS&E baseline and how that organization affects those metrics.

c. Establish the evaluation criteria, methodology, and data source for the metrics.

d. Define program office responsibilities to the supplier and how they will be accomplished:

(1) Define the data and information provided to the supplier.

(2) Ensure the supplier is a fully informed and participating member of the modification planning and execution process.

(3) Define the coordination process with the supplier for identifying and implementing modifications, upgrades, or other changes that could impact the OSS&E baseline.

(4) Provide detailed system/end-item performance analyses pertinent to the supplier's item.

(5) Be responsible to the supplier for continuous coordination and configuration control of the integrating function between the system/end-item and the supplier provided equipment.

(6) Ensure funding is planned.

(7) Work with the supplier in addressing equipment common across several platforms.

e. Define the supplier performance assessment in fulfilling the SLA/MOA:

(1) Completeness and quality of problem identification.

(2) Corrective action plans.

(3) Customer satisfaction.

(4) Reasonable and cooperative behavior.

(5) Timeliness.

(6) Rules for changing or canceling the SLA/MOA.

Example:

Issue: A serious design flaw was discovered. Improper steps were taken in reporting the issue that resulted in the MAJCOM becoming aware of the situation before the SPO.

Background: A subsystems engineer at a supporting organization discovers a significant flaw in a repair performed by a subcontractor. The flaw is caused by failure to follow approved procedures and potentially could result in loss of aircraft and/or life. The issue is disclosed when the supporting organization engineer talks with a MAJCOM counterpart during a routine telecon. At this point, the user is concerned and may take extreme measures, warranted or not.

Solution: The MOA between the SPO and supporting organization should identify the chain of command to report flaws discovered during any repair/refurbishment activities. All personnel should be trained in preserving OSS&E and familiar with all the MOAs associated with the equipment under their responsibility. Since the flaw could result in loss of aircraft and/or life, the fleet may need to be grounded until aircraft with defective parts are identified. The SM is responsible for continued airworthiness via OSS&E and grounding the fleet is his/her final determination. However, the SM should inform the user immediately of the grounding potential and work with user to establish work-arounds, inspections, or other means (e.g., spares availability) to minimize the impact to the warfighter

8. OTHER SYSTEMS ENGINEERING PROCESSES

8.1 System integrity

Core to the system/end-item integrity concept is an overarching set of tools and processes which enables the integration of sound engineering practices at the systems level, the impetus being the sustainment of operational safety, suitability, and effectiveness for the life of the system. The application of system integrity is to provide design marginal usage, status life usage, and prevent loss of system/end-item capability. This includes the ability to return systems to specification-level performance after repair/ overhaul activities.

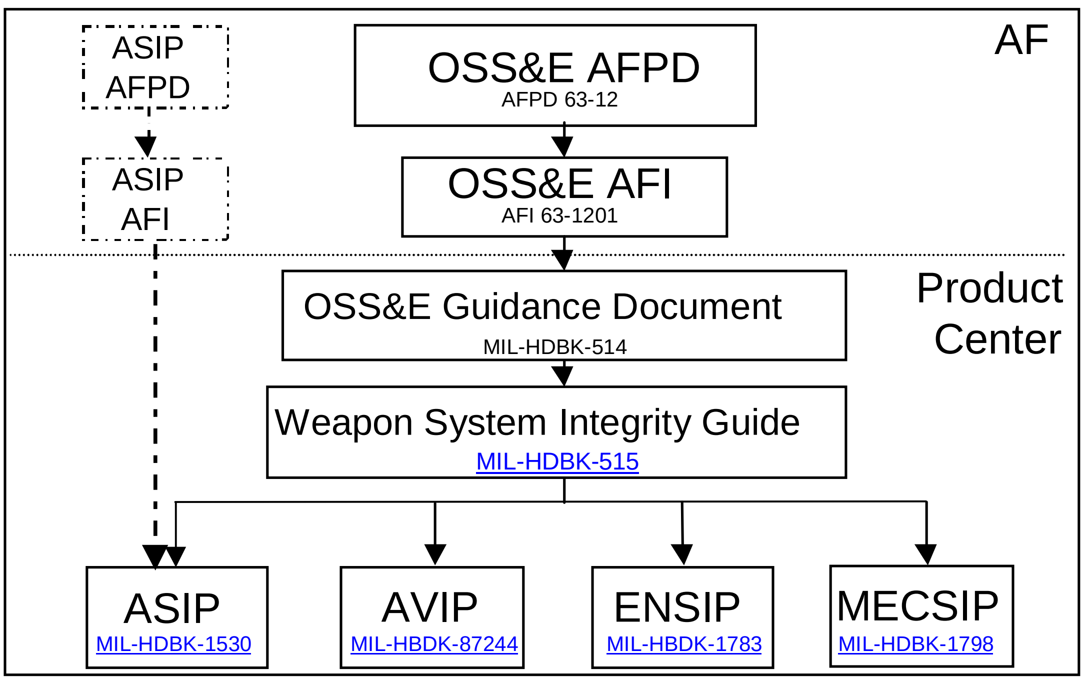


FIGURE 2. OSS&E and Weapon System Integrity Guide relationship.

The Weapon System Integrity Guide (WSIG) is intended to provide guidance on how to integrate the existing integrity programs within systems engineering, resulting in a more efficient and cohesive approach to engineering. The above diagram depicts the integrity approach and provides links to the integrity programs. In order to accomplish this, the Systems Integrity Guidance document contains three basic thrusts. First, to integrate the efforts called out in the various integrity programs; namely, the aircraft structural integrity program (ASIP), engine structural integrity program (ENSIP), mechanical equipment and subsystems integrity program (MECSIP), and avionics/electronics integrity program (AVIP). Second, to synergistically integrate or coordinate specific integrity program efforts/tasks with related efforts in other various systems engineering disciplines and efforts. And third, to place increased emphasis on the sustainment portion of the life cycle.

System integrity applies to more than just new developments. It applies to system/end-item modifications; commercial off-the-shelf (COTS) equipment; use of form, fit, function, and interface (F^3I) interchangeable equipment; equipment changes in use; service life extension; and all of the corresponding changes in sustainment needed to maintain the integrity of performance.

Integrity programs provide the guidance through which design margins are initially established and subsequently sustained via the use or modification of inspection, repair/overhaul, and/or replacement intervals (based on the life used and/or margin remaining). This may also be achieved through the implementation of redundant or reconfigurable systems/architectures that mitigate the loss of a function performed by an individual item. Maintenance actions taken to repair or replace defects/items restore performance and life consistent with, or exceeding, the original manufacturers' specifications (unless those specifications or required life have changed). This necessitates a process that can ensure the correctness and completeness of TOs or technical manuals, engineering dispositions, and training at all levels.

The WSIG establishes the guidelines and processes necessary to synergistically apply the integrity concept across all appropriate elements of the system/end-item. The specific integrity programs that must be implemented vary with the specific application. For example, the applicable programs for an avionics upgrade to an existing platform certainly differ from a new start program. System integrity helps ensure that the proper integrity programs are always applied, whether it is a development, modification, or sustainment program.

The efforts delineated in the WSIG shown on figure 3 are basic in nature and are in no way all-inclusive. Within the WSIG, these basic efforts have been coalesced into nine basic groups, spread across the phases of development and sustainment. The thought process involved with reviewing each effort falls into one of three categories: 1) the effort has been satisfied via currently available information; 2) the effort has been undertaken to gather the appropriate information; and 3) this effort is not relevant for the design under consideration. In other words, efforts are met through knowledge: either that knowledge is already established, knowledge is gained through some activity, or the activity being evaluated is irrelevant. This course of action ensures that all efforts are evaluated for applicability.

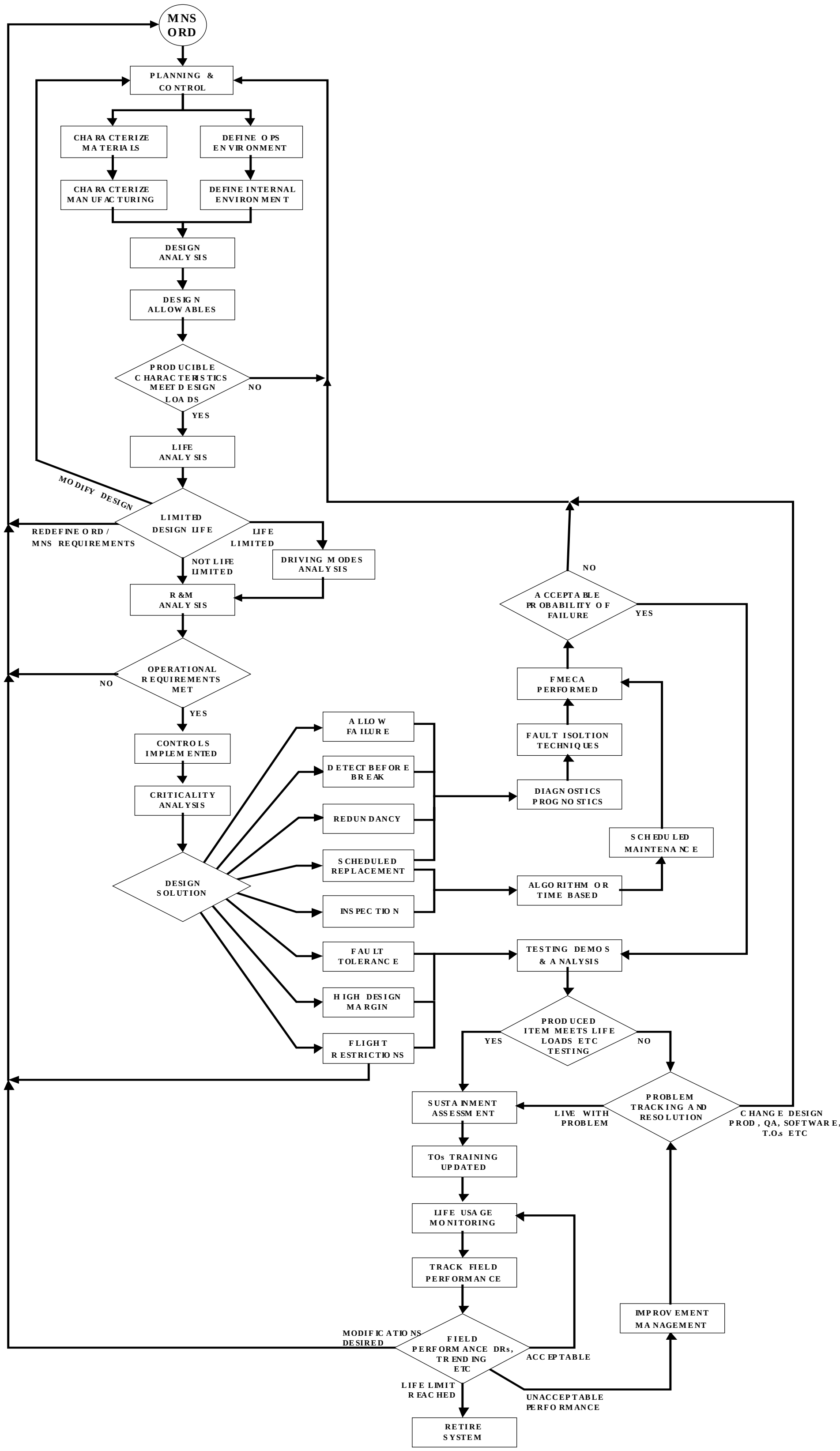


FIGURE 3. Weapon system integrity development process.

8.2 Integrated risk management

Risk management is the practice of controlling risk and determining how risks impact performance, schedule, and cost. During sustainment, risk management should focus on two important decisions in maintaining the OSS&E baseline. The first is to identify and assess the risks to the OSS&E baseline from employing the existing systems and processes, including the ability to capture the appropriate information. The second is assessing risks to the OSS&E baseline caused by system/end-item modifications, the interactions between safety, suitability and effectiveness (e.g., adding capability to enhance effectiveness may degrade suitability), and again, the ability to gather the needed data. The DoD risk management concept is based on the principles that risk management is forward-looking, structured, informative, and continuous. The ASC Integrated Risk Management (IRM) process is consistent with the DoD risk management concept and structure in all aspects.

IRM differs from ORM in that IRM includes schedule, cost, and developmental risks. The focus of ORM is in the operational employment of the system/end-item. IRM is more applicable to updates and new acquisitions during sustainment. The key to successful risk management (IRM and ORM) is early planning and aggressive execution. The ASC Integrated Risk Management (IRM) process is based on DoD risk management studies and embodies the DoD concept, principles, and keys to good risk management. IRM is consistent with the Defense Acquisition Deskbook, the DSMC Risk Management Guide and structure and AFMCP 63-101, *Acquisition* Risk Management. Integrated risk management consists of four separate, but closely related, subprocesses. The four IRM subprocesses are detailed below and depicted on figure 4.

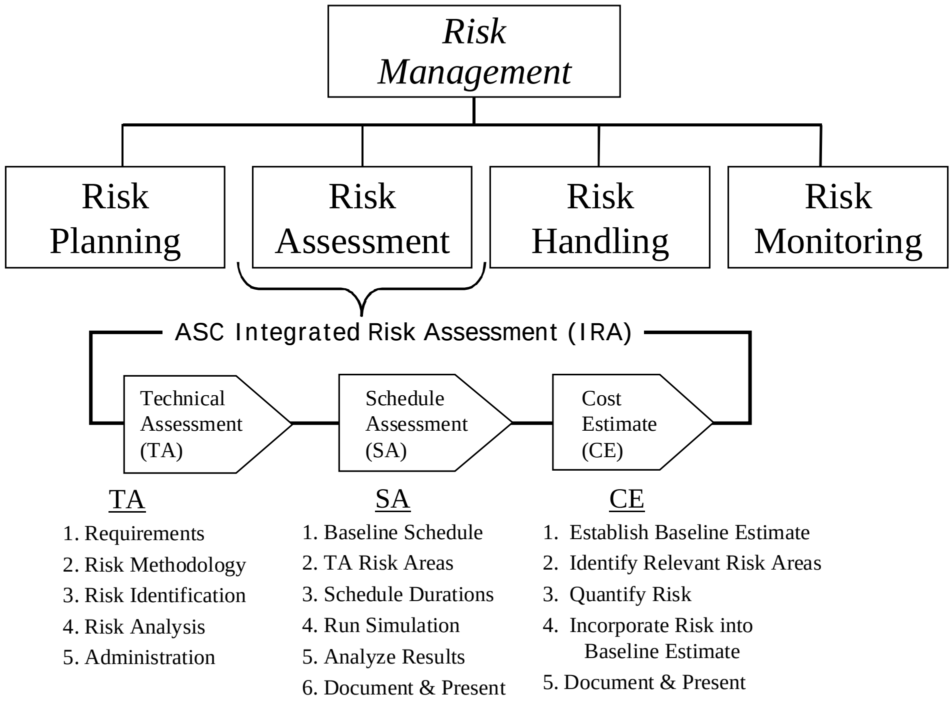


FIGURE 4. Integrated risk management/assessment activities.

Integrated risk management (IRM) is applicable to all phases and aspects of any acquisition or modernization program, in any phase of the life cycle. Integrated risk management is a key element in the disciplined engineering process and an essential component in the DoD's strategy for acquiring and sustaining systems in an environment of diminishing resources. A disciplined, comprehensive risk management structure involves the early and continuous identification of critical program risks, and the establishment and monitoring of risk handling plans. When properly implemented, an effective risk management program facilitates identification of areas that require special attention and sets realistic, executable technical, schedule, and cost objectives. IRM provides an approach to manage risk, not just avoid risk.

a. <u>Risk Planning</u> is the process of developing and documenting organized, comprehensive, and interactive strategies and methods for performing risk management. Risk planning includes activities to identify and track risk areas, develop risk mitigation plans, perform risk assessments to determine how risks have changed, and ensure adequate resources are identified. The plan documents the who, what, when, and where of risk management.

b. <u>Risk Assessment</u> is the process of identifying and analyzing risks. These risks could impact the likelihood of assuring OSS&E. Risk identification is the process of examining the program, processes, requirements, and critical technologies to identify and document risk areas. Risk analysis is the process of examining each identified risk, isolating the cause, and determining the impact. Risk impact is defined in terms of its probability of occurrence, its consequences, and its relationship to other risk areas or processes. The integrated approach includes a technical assessment, schedule assessment, and a cost estimate to identify potential risks and impacts.

c. <u>Risk Handling</u> is the process that identifies, evaluates, selects, and implements options in order to set risk at acceptable levels given program constraints and objectives. This includes the specifics on what should be done, when it should be accomplished, who is responsible, and the cost impact. The most appropriate strategy is selected from these handling options and documented in a risk-handling plan.

There are several risk-handling options at the discretion of the program manager. The first choice for a risk-handling option is generally risk avoidance. This involves changing the requirements to a level that lowers the risk to an acceptable level but still meets the program objectives. However, risk control (or risk mitigation) is the most used form of risk handling. This option involves taking active steps to minimize the risk's impact on program objectives. Another option is risk prevention or transfer, also called risk abatement. This approach re-allocates design requirements to those system elements that can achieve the system requirements at a lower risk. The last option is risk assumption. With this approach, the program will accept the risk without engaging in any special effort to control the risk. This last option is only acceptable if the execution chain understands the full potential of the risk.

d. <u>Risk Monitoring</u> is the process that systematically tracks and evaluates the performance of risk handling actions against established metrics or indicators throughout the acquisition/modernization process and develops and executes further risk handling options as appropriate. Risk monitoring is truly a management function. It is important for this part of the risk management process to work so that well-established indicators and metrics are developed and used. Indicators are parameters that answer the question, "How am I doing today?" While metrics address, "How I am doing today compared to how I was doing yesterday?" To make this work, it is important to determine what parameters should be measured.

8.2.1 Integrated risk assessment

The integrated risk assessment (IRA) process accomplishes the IRM risk assessment. Synergism is applied to integrate the risk assessment process. This is specifically accomplished by having all team members of the assessment process work cooperatively and by requiring all players--the program office, the contractor, the vendors, the suppliers and the customer--to participate in all stages of the assessment. Integrated risk assessments (IRAs) are accomplished throughout the life cycle of a program. Early in the program life cycle, it is critical to use the IRA results to help develop the program's acquisition strategy as well as assisting in cost, schedule, and performance trades. Then, during source selection, an IRA is used to assess the contractors' proposals. After contract award, IRAs are completed during major milestone reviews or whenever deemed necessary to assess the program's risks. The IRA approach should be carried-over to sustainment and applied to modifications and system/end-item upgrades.

As mentioned earlier, the three parts of the IRA are the technical assessment, the schedule assessment, and the cost estimate. These parts are undertaken simultaneously. The technical team begins its portion by holding a session to assess the potential risks in the program. Concurrently, the other teams are developing a baseline schedule and a baseline cost estimate to be used during/for the assessment. These three teams work very closely to ensure each team understands what the other teams need. For example, the schedule team members attend the technical assessment meetings to ensure the technical team understands the potential risks that might impact the schedule. In turn, the schedule team provides the technical team with an understanding of what they need to accomplish an assessment of the schedule. The cost team also works closely with the technical and schedule teams to ensure each team fully understands the risks identified and how these risks impact cost. It is important to remember that the primary purpose of the IRA is to identify and analyze program risks in order to address the challenges of meeting performance, schedule, and cost objectives. Figure 4 shows the relationship between IRM and the IRA.

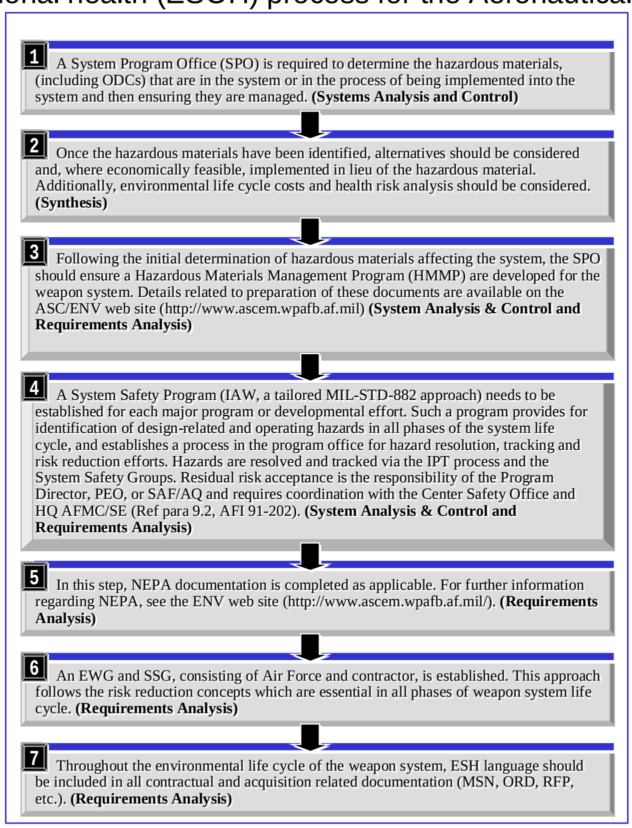
8.3 Requirements definition

This section addresses the requirements definition process as it pertains to sustainment, and, specifically to OSS&E. Requirements analysis is a systems engineering activity that is used to translate a user's need into a definitive set of functional and performance requirements that form the basis for system qualification. During sustainment, there are many ways that the user will identify the need to modify, upgrade, or enhance a system. New capabilities/requirements may be a result of deficiency reports (DRs), operational requirements documents, or a Modification Proposal, AF Form 1067, depending on the magnitude and scope of the required capability. Enhancing capabilities or correcting deficiencies with existing systems or manuals may be identified through AFTO Form 22, AF Form 847, and DRs. The AFMC Software Requirements Review Process (SRRP) is one mechanism for the user to identify the need to modify, upgrade or enhance system software during sustainment (reference AFMCPD 63-4 & AFMCI 63-401). One key method of identifying the need to change an existing system is assessing the OSS&E baseline via their associated metrics. This will identify degradation to the existing system capabilities. However, it does not identify when new capabilities are needed. Updates to the OSS&E baseline and associated metrics are required as existing capabilities are enhanced or new capabilities are added that affect the OSS&E baseline (or if an existing metric is determined to be insufficient). Whichever method is used to establish the new, needed capability, the operational and contractual requirements should be reflected in the OSS&E baseline with sufficient visibility to ensure the desired results are maintained. Key to requirements definition is ensuring traceability of requirements and design throughout the system life cycle. Requirements definition and the corresponding verification requirements are documented in the system performance specifications or other appropriate documents. Traceability of design is accomplished through configuration management practices. OSS&E assurance emphasizes the need for specification content to include performance requirements that yield a safe, suitable, and effective system.

8.4 Environmental, safety, and occupational health (ESOH)

8.4.1 Process overview

The environmental, safety, and occupational health (ESOH) process for the Aeronautical Enterprise uses a disciplined systems engineering process and involves support from system safety, operational risk management (ORM), and ESOH personnel. Over the life of the system/end-item consideration for risk to life, health, property, and environment due to deployment is considered. Particular emphasis is given to the integration of ESOH costs in the calculation of total ownership costs (TOC). This section documents the process and tools available to ensure that ESOH considerations are maintained during OSS&E assurance.



8.4.2 Tasks

The steps to integrate ESOH during the system/end-item life cycle are summarized at the right. This effort involves determining life cycle costs for ESOH, using the lessons learned from other systems/end-items, and incorporating these during sustainment. ESOH supports OSS&E assurance by ensuring that ESOH related requirements/issues/ modifications that arise from operational use, configuration changes, maintenance repairs, and part substitutions do not degrade the system or end-item OSS&E baseline. The environmental managers ensure their NEPA documentation addresses air conformity, noise (community and occupational), threatened and endangered species, and environmental justice. As part of the formal NEPA analysis process, the system safety hazard tracking process is used in the identification of potential NEPA and ESOH issues:

a. Providing ESOH considerations for inclusion in ORM assessments.

b. Working with the environmental working group (EWG) and ensuring that TOs and technical data identify procedures when using products via a waiver. The approved hazardous materials are controlled prior to implementation through tracking and updating the associated TOs.

c. Coordinating review of procedures for the proper use of new/replacement materials.

d. Working closely with system safety to address safety hazards that are associated with ESOH vulnerabilities to ensure the risks are identified, eliminated, or reduced to an acceptable level of risk. This is documented through the NEPA process.

Addressing all aspects of ESOH and ensuring personnel are appropriately trained to comply with ESOH and NEPA requirements.

8.4.3 Points of contact

The POCs for addressing ESOH are listed below.

Organization	Point of Contact
Wright-Patterson AFB	ASC/ENVV
Edwards AFB	AFFTC/EM
Robins AFB	WR-ALC/EM
Hill AFB	OO-ALC/EMP
Tinker AFB	OC-ALC/IET

8.5 Manufacturing and quality assurance

Manufacturing and quality assurance principles and practices are critical to supporting the OSS&E elements outlined in AFI 63-1201. Fabrication, assembly, and functional checkout processes provide the link between the design and a fielded system. As such, the manufacturer controls these manufacturing operations both in-house and at the suppliers' to assure the design features that impact OSS&E are faithfully transformed into hardware that preserves the OSS&E baseline. To do this, manufacturing engineering considerations are integrated with the design early in the development phases. The intent is to balance issues critical to affordability, producibility, and product performance early in the program when manufacturing guidance has the most impact on program life cycle cost and performance. The selection of COTS/NDI equipment is also important, since information may be limited on these types of products.

a. Quality management systems are implemented to ensure the as-delivered configuration matches the as-designed configuration. Ideally, the quality system should focus on defect prevention by mapping key product characteristics to key manufacturing processes and controlling those processes through a variability reduction program. These key processes and controlling techniques are maintained throughout the life of the equipment so that the OSS&E baseline is not degraded. New suppliers/vendors should be made aware of the key manufacturing/QA characteristics critical to sustaining the OSS&E baseline. As a minimum, the quality system assures that nonconformity is identified and properly dispositioned so as not to degrade the OSS&E baseline.

b. Identification of key product characteristics plays a critical role in maintaining a disciplined engineering process by guiding design engineers through an analysis of the most critical product characteristics. Basic engineering tasks include the identification of key product characteristics and design limits, as well as identification of key production processes and capabilities. These tasks should be performed early in the development phase for new/modified equipment. Documented product characteristics provide a unique communication tool that links requirements, design, manufacturing, and support directly with maintaining OSS&E.

c. Matching the original key product characteristics with process capabilities of new suppliers/vendors ensures the manufacturing processes can consistently produce hardware that meets design tolerances. During early development, the manufacturer collects process data, calculates process capabilities, and provides feedback to the designers on their ability to meet proposed tolerances. These assessments can also be used in evaluating the supplier/vendors ability to provide replacement/second source items or produce modifications to items to enhance product capability.

d. Production cost modeling is used to develop, understand, and evaluate the production elements of total ownership costs. Production cost modeling can be used to assess the impacts of design options on manufacturing costs during development, production, and sustainment.

e. Pre-award surveys, manufacturing management/production capability reviews, and production readiness reviews are conducted to assess the capability and capacity of current and potential sources of supply, repair, and maintenance. These reviews provide an opportunity to evaluate elements such as a facility's tooling, manufacturing process capabilities, quality systems, and production control systems to ensure they can deliver quality products and preserve the OSS&E baseline.

f. Depot capability & capacity assessments are similar to the reviews above, and focus on the ability of depots to repeatedly deliver quality products.

During the sustainment phase, the activities listed above are just as appropriate, although they are typically applied to depot operations and new equipment designs, as opposed to original equipment manufacturers. For example, depots maintain a quality management system that assures the maintenance they perform results in products that continue to be within the original drawing tolerances. If key characteristics have been identified as part of the original drawing package, the depots should continue to control those characteristics by controlling the processes that create those characteristics. Ideally, metrics that track process capabilities for each critical process should be used. For more details on key characteristics and process control, please see the Manufacturing Development Guide.

A robust quality management system is equally important for ground-based systems to assure design requirements are faithfully transformed into hardware and software products that meet OSS&E requirements.

8.6 Anti-tampering

Anti-tampering (AT) is defined as the systems engineering activities intended to prevent and/or delay exploitation of critical technologies in U.S. systems. Since this is a broad definition of the security effort, it is expanded for clarification: AT applies to the deployable military system, not research or support technology. It is not limited to classified systems. The Military Critical Technologies List (MCTL) is a starting point for developing a cost-effective AT approach. The anti-tamper goal is to design the system to prevent tampering and exploitation in contrast to protecting information. AT is specifically concerned with the consequences when the U.S. forfeits control of the system; for example, if the system is

a. Sold (e.g., via FMS or commercial sale),

b. Lost behind enemy lines (e.g., F-117 shot down in Bosnia), or

c. Dropped behind enemy lines (e.g., smart bomb that does not explode).

The intent of anti-tamper is to preserve the U.S. technological advantage, with a goal of delaying exploitation by 10 years. Common criteria for implementing AT would result in clearly defining AT requirements, promoting reuse of technologies and methods, and allowing for quicker insertion of AT capability. The reuse of technology can also reveal classified details and vulnerabilities.

There is currently no AT certification requirement. However, a good AT program should

a. Prevent development of adversarial countermeasures.

b. Minimize potential lost military advantage.

c. Extend economic advantage (FMS increases purchase quantities and reduces per-unit cost of systems).

Most modern avionics systems are difficult to exploit unless one has the hardware, the technical data/manuals, and the test equipment. Key technology is often in software, manufacturing rules, tools, or processes; thus, acquiring the hardware may not automatically allow an adversary to exploit a capability.

Since many key capabilities are contained in software, there is need for vigilance concerning all nonvolatile storage devices (read only memory, data transfer module, etc.). Deletion of all operational software at shutdown is a viable option for some aircraft systems.

For electronics hardware, the move to the use of commercial parts makes physical protection of most processor and memory component technology meaningless. For example, if the same "Power PC" chip is available at a commercial computer store, then there is no point in trying to protect that chip in a military system.

Some key hardware devices may require physical hardware protection, for example:

a. Antenna arrays,

b. Radar transmit/receive modules,

c. Low observables technology, and

d. Focal plane arrays.

For specific anti-tamper methods, contact ASC/ENAE or ASC/ENAC.

The following documents provide guidance on establishing an anti-tamper program for systems and end-items:

a. Public Law 100-235 - Protect critical information.

b. DoD 5200.39-R - Procedures for technology protection, provides detailed guidance (currently in draft).

c. AFI 31-701, Program protection plan, requires an AT appendix, usually classified.

Organizations and individuals involved in developing specific anti-tamper programs for systems and end-items include:

a. OSD/AT&L - DoD executive agent,

b. SAF/AQL - AF executive agent,

c. AFRL/XPJ - AT technology development, and

d. AFMC/DRR - AT focal point for Air Force programs.

Additional information may obtained at the Anti-Tamper Managers website.

9. PRE-AWARD/ACQUISITION PLANNING

During sustainment, acquisition of new or modification to, components, equipment, support equipment, etc. will be necessary. Maintaining the OSS&E baseline requires attention to contract requirements, open dialog with the user, and understanding the OSS&E baseline. OSS&E assurance begins with traditional generation of requirements.

Analysis and iteration of requirements leads to a solicitation or contract change. It is critical to contract those elements that provide the basis for establishing and/or continuing OSS&E assurance. The following are the recommended contract elements:

a. Specifications that address those aspects of the system/end-item that relate to operational safety, suitability, and effectiveness. Example: Identify the SM and user documented key/critical OSS&E characteristics for the system or end-item.

b. An integrated master plan (IMP) with those program activities and success criteria to be accomplished by milestone event to fulfill program requirements. Examples: Incremental verification of requirements by reviewing modeling, simulation, and analysis test reports; and component, subsystem, and system checkouts. The SM should identify certification requirements. A list of certifications can be found in section 5.7

c. Statement of work (SOW) task implementing the processes described in section 4. Example: Provisions for ensuring that data necessary to support OSS&E is provided or made available to the Government, subcontractors, vendors, and other supporting organizations. A configuration management system that not only establishes the configuration baseline, but also emphasizes the processes, procedures, and management relationships necessary to maintain the OSS&E baseline throughout the system's life.

OSS&E policy does not necessarily levy new requirements on systems and end-items but rather ensures key processes are documented, kept current, and adhered to throughout the entire life of the system/end-item. In general, the acquisition strategy defines how OSS&E assurance will be implemented and continued throughout the operational life, and delineates sharing of data to subcontractors, vendors, and external organizations. Acquisition processes which are critical to achieving OSS&E, such as risk management, system safety, configuration management, etc., should already be addressed as part of the acquisition management plan through existing Air Force policy and guidance and/or commercial best practices. Legacy programs may not possess the above information; however, varying levels of OSS&E assurance will have been accomplished at the system/end-item level. The procurement contract, in this case, should emphasize the following for OSS&E assurance:

a. Access to system/end-item OSS&E data and other information (subsystem, component level etc.,) as necessary to support the new procurement or modification of equipment/components,

b. Access to existing system's CI specifications in order to assess the continuing health of OSS&E,

c. Critical manufacturing issues,

d. Critical functions,

e. Responsibilities to interface with the OEM and coordinate activities with system/end-item management organization (e.g., associated contract agreement),

f. Sources of maintenance, repair, and supply are defined with an emphasis on preserving OSS&E,

g. Warranties,

h. Logistics support, and

i. Tech data rights.

These should all be considered to ensure OSS&E compliance throughout the entire life of the system/end-item. More information on the pre-award process and the OSS&E-related ASP charts are available at the ACE web site.

10. UNIT COMPLIANCE INSPECTION (UCI) CHECKLIST

The OSS&E UCI checklist provides a basis for assessing compliance of Air Force and AFMC OSS&E policy by all responsible organizations. The best way to pass the OSS&E UCI is to achieve and document full OSS&E compliance (AFMC goal is FY 05). Demonstrated continuous application of OSS&E, as described within this military handbook, meets the requirements of the UCI checklist.

Each system/end-item SM must know the current OSS&E implementation level and have documented evidence that indicates achievement of said level. Typically, the IG will look for proof that OSS&E is actively being applied by all organizations associated with the system or end-item. The IG usually confirms that processes are in-place and followed (via SLAs, MOAs, or other agreements).

The UCI section entitled “Evidence of Compliance” contains the criteria to be used to evaluate compliance to the associated OSS&E policy. All documentation used to demonstrate compliance must be both readily available for use and current in its content. Where documentation describes processes, those processes must be in practice.

The compliance evidence identifies methods of demonstrating compliance; however, alternative or program-unique methods may also be used. For specific OSS&E policy requirements, it may not be necessary to create new documentation to demonstrate compliance. As an alternative, existing documentation, such as single acquisition management plans, systems engineering master plans, configuration management plans, etc., can and should be used where clear demonstration of compliance with individual OSS&E policy requirements can be shown.

The complete OSS&E UCI checklist can be accessed at the following web-site: https://www.afmc-mil.wpafb.af.mil/HQ-AFMC/EN/deskbook/checklst/osseuciv1.doc.

11. AIRWORTHINESS CERTIFICATION

11.1 Overview

A key aircraft certification required under the OSS&E umbrella is airworthiness. There are a number of acceptable approaches whereby the initial airworthiness certification and subsequent recertifications may be accomplished, depending upon the aircraft design/acquisition philosophy as well as the current system life cycle phase and current airworthiness certification status. It is up to the CE to apply good engineering judgement in tailoring the certification process to fit the individual circumstances. The chosen approach should be carefully considered, documented, and coordinated to avoid confusion and conflicts during the initial certification and subsequent recertification efforts required after reportable system modifications. In all cases, once initial airworthiness certification is established, it must be preserved throughout all phases of the program (see figure 5).

FIGURE 5. Airworthiness certification process.

11.2 Airworthiness tenets

Airworthiness cannot be assured unless all four of the tenets shown on figure 6 are adequately addressed. The top two tenets are addressed during the airworthiness certification process. The bottom two tenets are essential for maintaining airworthiness and are addressed as part of OSS&E assurance.

FIGURE 6. Four airworthiness tenets.

11.2.1 Airworthiness terminology clarification

In order to ensure an understanding of the term "airworthiness certification," an important distinction is made between the property of airworthiness and the repeatable airworthiness certification process.

Airworthiness is the property of a particular air system configuration to safely attain, sustain, and terminate flight in accordance with the approved usage and limits.

Airworthiness certification is a repeatable process that results in a documented decision by the SM that an aircraft system has been judged to be airworthy. That is, it meets the approved set of criteria established by the Airworthiness Certification Criteria Control Board, as defined in MIL-HDBK-516 *Airworthiness Certification Criteria*. An alternative to Air Force certification is for the aircraft system to carry the appropriate Federal Aviation Administration (FAA) certificates. Airworthiness certification is intended to verify that the aircraft system can be safely maintained and safely operated by fleet pilots within its described and documented operational environment. The ASC/EN website contains additional information on airworthiness certification.

Practitioners may better understand airworthiness certification as it relates to safety-of-flight (SoF) determinations. SoF is defined as the property of a particular air system configuration to safely attain, sustain, and terminate flight within prescribed and accepted limits for injury/death to personnel and damage to equipment, property, and/or environment. This might be considered as a subset of the airworthiness "property" definition, with the stipulation that a greater amount of risk is understood and accepted by the SM. An even greater amount of risk is generally accepted when accomplishing first flight of an air vehicle, and the flight envelope is generally adjusted accordingly. SoF determinations generally apply to test aircraft operated in a test environment by flight test pilots under tightly defined, controlled, and monitored conditions. SoF determinations are typically limited to aircraft undergoing test and evaluation.

Figure 7 illustrates how first flight, SoF, and airworthiness certification relate to OSS&E during development of an aircraft system or development of a major modification. It is centric, time-based in that it starts at the center with utilization of a subset of the airworthiness certification criteria employed for first flight determinations. It then moves out to include verification of an expanded design envelope that constitutes full SoF for all primary functions on the air vehicle. Next, all remaining applicable airworthiness certification criteria as well as the remaining specification requirements are verified during developmental test and evaluation (DT&E). After the SM has certified airworthiness and readiness for dedicated operational test & evaluation (DOT&E), the system can enter DOT&E. As the system's ability to perform its operational mission safely and effectively and efforts to establish supply sources, maintenance, training, etc. are further verified as being ready for sustainment, it moves to full OSS&E compliance at or before IOC.

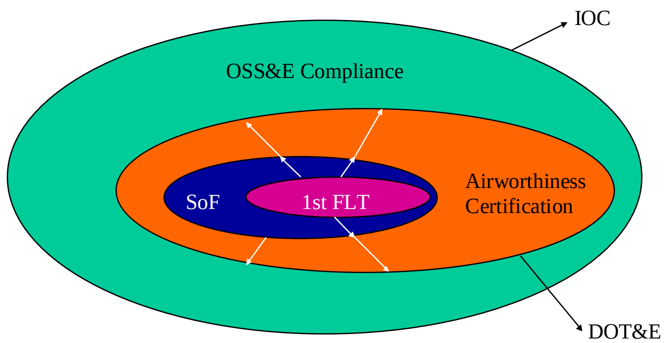


FIGURE 7. First flight, safety of flight, airworthiness certification, and OSS&E relationship.

11.2.2 Airworthiness tenet #1: Validated design

The aircraft design must be proven to meet an approved set of safety-of-flight criteria.

The aircraft design (including new aircraft and all modifications that are incorporated for product improvement or to correct deficiencies) must meet the criteria in MIL-HDBK-516, *Airworthiness Certification Criteria* as tailored by the CE and approved by the SM. Alternatively, the design may be proven to meet the FAA Federal Aviation Regulations (FARs) for aircraft procured under AFPD 62-4 and AFPD 62-5. In all cases, the certification basis is captured in a TACC document approved by the SM.

For modifications/upgrades to systems that were airworthiness certified by a different organization from the one performing the modification/upgrade, contact the original certifying organization for assistance.

The term 'proven' in the context of this tenet means that compliance to the applicable airworthiness criteria of the design has been verified by a means acceptable to the certifying organization. The acceptable methods may include flight or ground test, analysis, demonstration, modeling, simulation and analysis (MS&A), inspection, previously verified, or by similarity to proven capability. The CE is responsible for ensuring the adequacy of the methods of compliance.

11.2.3 Airworthiness tenet #2: Built per design

The air system must be built in accordance with the approved design.

In meeting this tenet, the airworthiness approving organization should ensure that a review of the aircraft drawings at the appropriate level is conducted to verify that the design presented for airworthiness certification complies with the approved configuration. In addition, it should ensure that critical process capabilities and quality standards exist, and that production allowances and tolerances are within acceptable limits. The review includes all documentation (i.e., drawings, shipping data, as-built records, historical records for GFE, or any other appropriate document) that verifies the tenet.

11.2.4 Airworthiness tenet #3: Properly maintained and operated

The air system must be operated and maintained by qualified personnel in accordance with approved documentation and procedures.

To preserve airworthiness, the SM must ensure a comprehensive set of maintenance and flight manuals are in place and used on the air system.

The air system must be operated within its approved operational envelope as described in the flight manuals, and the aircraft records for each aircraft should be properly maintained.

Any and all failures (in-flight or on-ground) to any flight-critical element should be recorded, the nature of the failure determined and the failure reported to the SM and the CE. This information should be reported and recorded in the deficiency reporting system in accordance with TO 00-35D-54 and accident investigation, reporting and record keeping in accordance with DODI 6055.7. Program and user system safety representatives should also be sought out and integrated into the resolution effort, depending upon criticality of the failure. Additionally, the failure of any flight-critical FAA certified component on a USAF system that is common to the commercial fleet should be reported via the FAA's Service Difficulty Reporting System.

The SM should work with the appropriate contractor or Government organization to ensure all personnel maintaining and preserving the air system are qualified and competent, and training is current to perform assigned tasks. During any program phase in which contractor personnel will accomplish maintenance, the SM should ensure all necessary language is in the support contract to preserve airworthiness of the system.

The SM should verify that any special procedures required to preserve airworthiness of the air system are approved. Minimum essential subsystem lists (MESLs) define those systems that must be operational for accomplishment of specific missions. However, AFI 21-103 states that the "MESL does not determine airworthiness or SoF; technical data, maintenance crews and aircrew judgement alone determine airworthiness. Do not use the MESL to gauge 'go/no go' decisions."

The SM is the approval authority for all configuration changes to the air system. Unapproved modifications to the air system are not to be tolerated, because they invalidate the airworthiness certification. If an unapproved configuration is discovered in the fleet, the SM/CE must take immediate action to address the airworthiness risk and to correct the discrepancy. Subsequent reviews and random configuration examinations should be accomplished to ensure configuration control processes are robust and being followed (see section 5.1.3)

The maintainers are responsible for maintaining airworthiness of the aircraft within the limits established in the maintenance manuals. Certain maintainers are given the special authority to clear red **X** conditions, thereby indicating that the aircraft is again safe to fly. Changes to maintenance procedures and repairs beyond the scope of the maintenance manuals require prior approval from the SM.

The operating MAJCOM is responsible for operational airworthiness. This is done by establishing aircrew training and evaluation requirements and by defining operating procedures for each MDS. They are also responsible for overseeing aircraft configuration and for fleet interoperability and commonality. The MAJCOM also designates the waiver authority for operating procedures.

11.2.5 Airworthiness tenet #4: Accepted by the aircrew

The air system must be accepted by the operating crew as being in a condition for safe operation.

This tenet addresses the airworthiness "state" of the aircraft as determined by the traditional flight crew walk around. It addresses the state of the air system in terms of aircraft records (e.g., the AFTO Form 781s), failure states of redundant subsystems, and the completion of any preflight preparation activities that may be required. It also addresses the condition of the aircraft relative to wear and deterioration (e.g., skin corrosion, window delaminating/crazing, fluid leaks and tire wear as determined by the ground crew's pre/post/thru or basic post-flight inspection).

The SM must assure that sufficient training is made available to the flight crew for detecting unsafe aircraft conditions and in making judicious decisions to continue the mission or require maintenance action. The aircrew must have sufficient training to detect airworthiness problems prior to accepting the aircraft for the mission and during the mission.

The aircraft commander is responsible for ensuring airworthiness of the aircraft, within the limits established by the flight manual and the operating procedures established by the lead command, before flight. The waiver authority for operational instructions is defined by the operating MAJCOM. Deviations from flight manual limits require SM approval, except in emergency conditions.

11.3 Airworthiness policy

There are currently three Air Force Policy Directives that govern how the Air Force certifies the airworthiness of aircraft it owns. The relationship of these policies as well as the interrelationship to the overarching OSS&E policy is shown on Figure 8.

11.3.1 Air Force Policy Directive 62-4, *Standards of Airworthiness for Passenger Carrying Commercial Derivative Transport Aircraft*

This policy directive is focused upon ensuring that USAF commercial derivative passenger aircraft maintain high levels of safety and ensuring that the Air Force does not duplicate processes/activities already performed by the FAA. The SM must seek to obtain and maintain the Type Certificate (TC) for the military configuration unless a waiver has been granted by AF/XO. These design certifications are used to support the airworthiness certification process established by the Air Force. AFI 21-107 addresses sustaining these aircraft. Maintaining total FAA type certification is the preferred method of assuring airworthiness.

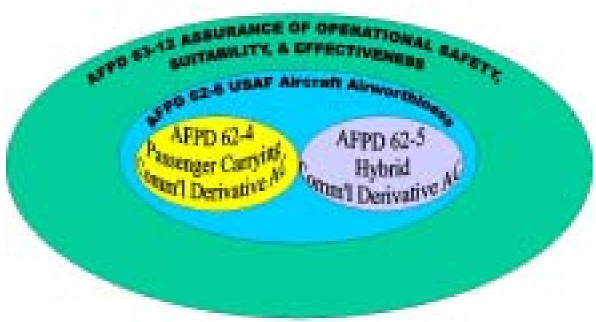


FIGURE 8. OSS&E and Airworthiness policy relationships.

11.3.2 Air Force Policy Directive 62-5, *Standards of Airworthiness for Commercial Derivative Hybrid Aircraft*

AFPD 62-5 is focused on establishing high levels of safety in design. It also accounts for those situations in which the Air Force can take advantage of an established level of performance and lower costs. It achieves this by procuring a commercial product that is then modified to perform a mission different from the civilian counterpart/baseline aircraft. AFPD 62-5 gives preference to civil airworthiness standards for these commercial derivative, hybrid aircraft. It allows the SM to determine to what extent the modifications should be FAA type certified (i.e., design is approved by the FAA). However, the aircraft must be in an FAA certified configuration when it is used for passenger carrying missions unless a waiver is obtained from HQ AF/XO.

11.3.3 Air Force Policy Directive 62-6, *USAF Aircraft Airworthiness Certification*

Aircraft owned and operated by the Air Force are considered public use aircraft (per the Federal Aviation Regulation definition) and, therefore, the Air Force is the responsible agent for these aircraft. AFPD 62-6 establishes the requirement for airworthiness certification by the responsible single managers of all USAF aircraft, including those operated by the Air National Guard and U.S. Air Force Reserve.

Additionally, AFPD 62-6 directs the creation of the Airworthiness Certification Control Board (AC^3B), with representatives from many organizations across the Air Force, and chaired by ASC/CC. This board is chartered with establishing and maintaining the airworthiness certification criteria used by the aircraft single managers to certify aircraft airworthiness. The approved criteria are documented in MIL-HDBK-516, *Airworthiness Certification Criteria*.

11.4 Single manager (SM) and CE/LE responsibilities for airworthiness certification

The specific responsibilities of the SM for airworthiness certification are as defined in AFPD 62-6.

The CE/LE has the technical authority for the system or end-item and is responsible and accountable to the SM to

a. Define the applicable airworthiness criteria (the certification basis) for the aircraft system to be certified.

b. Ensure the necessary processes (e.g., compliance methods) are in place to obtain an airworthiness certificate for each “model” or “like-configured” group of aircraft, or for each aircraft.

c. Make a documented recommendation to the SM with respect to safety-of-flight assessment prior to first flight of a new aircraft or of modifications to an existing aircraft.

d. Provide technical content for operating and maintenance manuals that ensure continued airworthiness of the system.

e. Ensure that all modifications to the system meet the airworthiness criteria that currently apply to the system.

f. Review all airworthiness advisories and alerts for applicability to the system and provide disposition recommendations to the SM. If the system is a commercial derivative, review all FAA issued airworthiness directives and service bulletins pertaining to the system, and incorporate changes as necessary.

g. Identify to the SM the need for changes to the AC3B-approved Airworthiness Certification Criteria. These proposed changes should be forwarded to ASC/ENSI (the AC3B’s secretariat) for distribution and consideration by the AC3B during the next MIL-HDBK-516 update cycle.

11.5 Airworthiness Certification Criteria, MIL-HDBK-516

This foundational document is to be used by the single manager, chief engineer, and contractors to define and tailor their airworthiness programs from the outset. They may also use it to assess the viability and quality of their airworthiness plans and activities throughout the program. These criteria apply at any point or phase in a program where an airworthiness determination is required. This document should be used throughout the life of the air vehicle and applied whenever there is a change to the functional or product baseline.

Included as an appendix to MIL-HDBK-516 is a cross reference table, which references Joint Service Specification Guides, Federal Aviation Regulations, handbooks, standards, etc., applicable to each airworthiness criterion. The cross-reference table should be consulted to aid in developing the TACC when issues arise with respect to specific criteria, an interpretation is required, or guidance on appropriate measurable parameters is needed. This table also includes points of contact (with phone numbers) who may assist in understanding the intent, scope, and application of specific criteria.

11.5.1 General guidance for creating the applicable certification basis

While the airworthiness certification criteria are intended to be all-inclusive and comprise the minimum set of safety criteria necessary for an air vehicle system, they must be tailored for application to a specific aircraft MDS or configuration. Not all of the criteria apply to every type of aircraft, and platform-unique criteria may need to be added to fully address safety aspects of unique configurations. To tailor the airworthiness criteria, the CE should identify nonapplicable, specific criteria, as appropriate (e.g., armament/stores integration on an aircraft that does not include guns, weapons, external fuel tanks, or internally/externally carried weapons or pods). The CE must also document the rationale for identifying these criteria as nonapplicable. The applicable criteria may not be deleted or modified in any way (e.g., margins of safety for structure). However, the CE may supplement the applicable criteria by adding specific, measurable parameters for an MDS or configuration (e.g., 16-g crash load capability of passenger seats and supporting structure). The CE may also develop additional criteria as needed for a given application (e.g., ground station for a UAV) in order to identify a complete (necessary and sufficient) set of criteria against which to judge airworthiness.

11.5.2 Creating the certification basis for a legacy system

MIL-HDBK-516 and existing aircraft documentation (e.g., specifications, reports, technical manuals, FAA type certificates) should be the primary source of specific criteria and supplemental, measurable parameters for developing the certification basis for each legacy MDS. For different configurations within a MDS, the TACC document should define applicability of specific criteria, where necessary. The TACC document then serves as the basis for defining applicable airworthiness certification criteria for future modifications.

11.5.3 Creating the certification basis for a new, commercial derivative system

A TACC document is required for the acquisition of aircraft with full FAA type certification. The SM then lists the FAA type certification as the certification basis for airworthiness certification (AFPD 62-6, para 2.8.1). MIL-HDBK-516 airworthiness criteria should also be defined in the certification basis of the TACC document for any unique design features required to meet Air Force mission requirements that the FAA will not certify. The SM should approve the TACC before the start of system-level qualification testing.

Passenger carrying, commercial derivative aircraft must comply with Federal Aviation Administration (FAA) airworthiness criteria and must maintain their type certification throughout the service life of the aircraft (AFPD 62-4 and AFI 21-107). Noncompliant design features are documented on FAA form 8130-2 after HQ AF/XO grants waiver approval. The TACC document must also address these noncompliant features in addition to listing the FAA type certification basis.

Commercial derivative, hybrid aircraft must comply with FAA airworthiness criteria to the extent practical throughout the service life of the aircraft (AFPD 62-5). Unless a TACC is provided in the RFP, a task to develop a TACC document should be included in the RFP/SOO. The document should also be included in the contractual specification, either directly or by reference, to identify the airworthiness criteria for the portion of the design that will not be FAA certified. The final TACC document, capturing any additional design features that the FAA will not certify, should be approved by the SM before the start of system-level qualification testing to support airworthiness certification prior to DOT&E.

11.5.4 Creating the certification basis for a new developmental system

Certification basis development should be initiated in the first phase of development for a new system and updated for the RFP of each subsequent phase. Early in the development program, the SM and CE should ensure the contractor has a statement of work task to develop a draft TACC document that can be used to guide the engineering development and test/verification efforts. This ensures that all applicable criteria are identified and eventually verified via qualification testing. The TACC document should be included in a contractual specification, either directly or by reference. Each update must be complete enough to support safety-of-flight determinations for the air vehicle configurations to be tested during the instant development phase. The final version, for the production or initial operational configuration, should be approved by the SM before the start of system-level qualification testing to support airworthiness certification prior to DOT&E.

11.5.5 TACC document content

It is important to identify the following items in each TACC document:

a. Date/Revision/Single Manager: This information is provided to establish configuration control of the TACC document. The issuing program office should expect to maintain this document and the supporting information under configuration control for the life of the system.

b. Mission Design Series Description: A clear description of the system configuration, including airframe identifier, engine types and quantity, crew and passenger capabilities, and the exact tail numbers/serial numbers of the aircraft covered by the certification is necessary to clearly distinguish the MDS to be certified from any similar configurations. Technical manual applicability is generally a good guide for determining logical groupings.

c. Certification Basis: This is the subset of MIL-HDBK-516 airworthiness certification criteria and/or FAA type certifications that have been identified as applicable for the system being certified. The certification basis may be identified by reference to MIL-HDBK-516 citing the respective issuance date, identifying those specific criteria deemed to be not applicable, and including any additional, unique criteria that the single manager deems necessary to identify to ensure safe operation of the system. Be sure to accomplish a thorough scrub of the criteria to identify only the criteria that apply to the system being certified, as verification of nonapplicable criteria will be impossible (e.g., aerial refueling probe criteria mistakenly identified as applicable to a non probe-equipped aircraft). For nonapplicable and SM-added criteria, provide associated rationale to support the decision. Note that for aircraft with FAA certified portions, the FAA certification basis is included in the aircraft certification basis identified in the TACC document.

d. Supplemental Data: This section includes or provides the location of material that supplements the airworthiness certification basis. It includes specifications, instructions, and maintenance procedures for maintaining the airworthiness certification of the design, and provides specific measurable parameters (i.e., “hard numbers”) to ensure safe flight of the system.

e. Limitations: This section identifies the location of limits, temporary restrictions, and procedures that the operator must utilize and observe to safely operate the system.

A sample TACC document is provided on the ASC/EN airworthiness website (https://www.en.wpafb.af.mil/oss&e/oss&e_aw_tools.asp). This sample illustrates a suggested format, but it is not a mandated format for presenting TACC document information.

11.5.6 Draft TACC document coordination

AFMC/EN memo, *Review of Tailored Airworthiness Certification Criteria*, dated 28 Jan 02, directs that ASC/EN coordinate on all TACCs prior to SM approval. This process was established to strengthen the airworthiness certification process across the Aeronautical Enterprise and establish an AFMC-level best practice to assure technical consistency.

The focus of these ASC/EN reviews is ensuring proper and complete application of MIL-HDBK-516 to the system under consideration, as well as ensuring consistency across the Aeronautical Enterprise. Coordination reviews have resulted in many clarifications with respect to intent of specific criteria, applicability, and corrections to specific tailored criteria. Misidentification of nonapplicable criteria as applicable, or applicable criteria as nonapplicable, has been a common error during certification basis definition.

When the draft TACC document has been developed and coordinated internally by the program office, a copy of the document should be forwarded to ASC/ENSI. ASC/ENSI will forward the document to the appropriate subject matter experts (SMEs) for review. Specific criteria issues are generally resolved between the SMEs and the TACC submitter to minimize review time. After the SMEs complete their review, ASC/ENSI generates a summary of issues identified (resolved and unresolved), and forwards it to ASC/EN with a recommendation for coordination. ASC/ENSI then forwards a copy of the coordination to the submitting office. The SPO should seek coordination by the user, per established SPO procedures, before single manager approval of the TACC document.

Alternatively, if specifically requested when submitting the draft TACC document for coordination, ASC/ENSI will reply to the submitter with a listing of all SME comments that require resolution. Upon receipt of the comment responses from the submitting office, the appropriate ASC/EN technical director conducts a review of the responses prior to ASC/EN coordination. ASC/ENSI then forwards a copy of the coordination to the submitting office The SPO should seek coordination by the user before single manager approval of the TACC document.

11.6 Initial airworthiness certification

There are five basic steps to completing the initial airworthiness certification process. Each of these steps is explained in detail below. An overview of the initial certification process is shown on figure 9.

11.6.1 Step 1: Define the configurations to be certified

Given the task of certifying an aircraft design to be airworthy, start by defining the actual aircraft configurations to which the certification will apply. This can be especially vexing for certification efforts on legacy aircraft. A good guide to groupings that can be covered by a common airworthiness certification is technical manual applicability. If a group of MDS aircraft is covered by a common set of technical manuals, then it is very likely that a single TACC document will suffice for all of them.

11.6.2 Step 2: Develop and coordinate the TACC document

A TACC document is developed primarily to identify the certification basis that applies to a MDS or group of MDS aircraft. After the TACC document is approved, it is used as a checklist to evaluate the baseline aircraft and the airworthiness impacts of future configuration and procedural changes. ASC/EN coordinates on the draft TACC document for the MDS. It is recommended to also allow the user coordinate on it prior to SM approval for use in establishing and maintaining airworthiness of the air vehicle. The approved TACC document should be maintained as a permanent and active documentation of the certification basis used throughout the service life of the aircraft system. The certification basis should be changed thereafter only to include new criteria needed to address mission/capability changes.

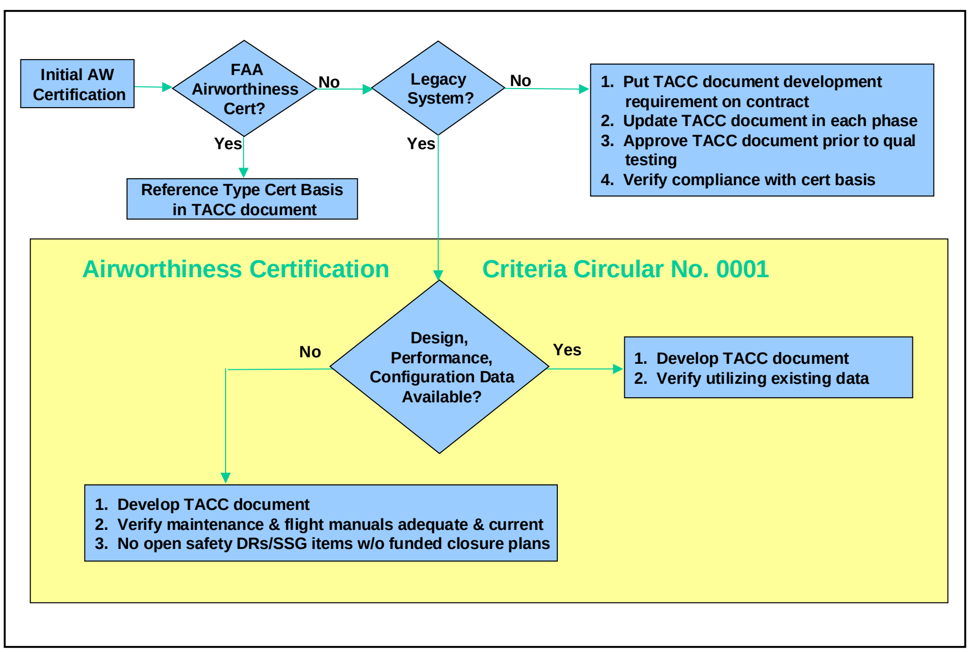


FIGURE 9. Initial airworthiness certification.

11.6.3 Step 3: Identify supporting data to enable certification basis compliance

After the TACC document has been coordinated and approved, the program office must determine if adequate data is available to support verification efforts or if additional data can be collected. For new developmental aircraft systems, ensure sufficient technical effort is defined in the SOW/SOO to enable verification of the certification basis defined in the TACC document. Development of a certification basis to verification task cross reference matrix may be an effective tool to ensure that all certification criteria are adequately addressed.

For legacy systems, the program office should gather all currently available and applicable existing documentation: technical manuals, specifications, test data, maintenance data, demonstrations, analyses, inspections, configuration data, usage data, mishap rate, FAA type certificates, etc. The amount of data readily available will become an important decision-making tool for legacy system SMs and CEs when it comes time to verify compliance with the certification basis.

At this point it is also necessary to review and validate the program's change process. Does the program have an effective change process, and has it been followed throughout the program? The existence of a disciplined change process can be used to mitigate the need to revalidate individual past changes; however, if it is determined that the change process compliance has been inadequate, some criteria may require reverification. Based upon the data gathered/available, the SM/CE can now determine the appropriate method/procedure for verifying and documenting compliance.

11.6.4 Step 4: Verify and document certification basis compliance

11.6.4.1 First-time airworthiness certification of a legacy air systems

Legacy aircraft system program offices face the daunting task of certifying airworthiness perhaps many years after the initial development work was completed. Original data may no longer be available for verifying compliance with a specific, applicable criterion. Clearly, no one would suggest that the day AFPD 62-6 was issued all the operational aircraft in the Air Force fleet suddenly became non-airworthy. Further, paragraph 2.5.1 of the policy requires that certification of legacy aircraft be achieved in a cost-effective manner consistent with safety.

Because of tight budgets and the various ages of fielded systems, an alternative approach to airworthiness certification of legacy air systems that complies with the intent of AFPD 62-6 is warranted. Some legacy systems may not have an adequate paper trail from the original qualification to the current fleet configuration. For other systems, excessive effort would be required to search existing data for evidence of compliance with the airworthiness certification basis. In such cases, the approach suggested below is a reasonable and technically viable alternative for chief engineers and single managers to follow for first-time certification of airworthiness.

Single managers with operational aircraft in the field as of the date of first issuance of AFPD 62-6 (1 Oct 00) may, for the first time only, certify aircraft airworthiness if the following conditions are met:

a. The TACC document has been coordinated with ASC/EN and the user, when appropriate, and approved by the SM.

b. Based on the certification basis, the chief engineer has determined that it is technically sound to certify aircraft airworthiness after the following conditions have been verified:

(1) The flight manuals correctly characterize aircraft performance and maintenance and repair manuals are adequate and up-to-date.

(2) There are no open (without funded closure plans) deficiency reports or safety recommendations that suggest the aircraft is not performing within the acceptable level of risk to which the aircraft will be managed in accordance with the technical data.

11.6.4.2 New developmental aircraft

Normal specification verification procedures (analysis/test/inspection/demonstration) are followed to ensure compliance with the certification basis. This effort can also generate data to support the required first flight safety-of-flight determination as well, and these documented results can then be utilized as the basis for compliance.

11.6.4.3 First flight readiness reviews

The SM must provide approval for first flight early in the airworthiness certification process to develop additional verification data during flight testing of a developmental system. It is the responsibility of the SM, in coordination with the CE, to make a positive determination that the aircraft, including deployable internal or external stores, is safe for first flight. The SM may request a first flight executive independent review team to assist in verification of readiness for first flight. The SM should use an appropriate subset of the certification basis to guide the readiness decision. This subset is a result of tailoring to reflect only those applicable criteria that apply to the reduced operational envelope, configurations, and conditions that are expected during the first flight. As the flight and operational envelope is expanded and additional system configurations are added, additional evaluation of criteria must be accomplished to ensure continued SoF. As the test program is completed and the verification effort winds down, all applicable airworthiness criteria should be verified creating a clear path to airworthiness certification.

11.6.5 Step 5. Certify airworthiness and notify ASC/EN

When compliance has been verified using one of the methods above, the SM signs an airworthiness certificate for each model, or like-configured group of aircraft, or for each aircraft. When certification is issued for a group of aircraft, each aircraft within that group must comply with the airworthiness certification documentation. An airworthiness certificate template, for both fleet and individual aircraft certifications, may be found at https://www.en.wpafb.af.mil/oss&e/oss&e_aw_tools.asp.

The aircraft system must be in compliance with all applicable criteria before the SM can certify airworthiness without temporary restrictions. AFPD 62-6 requires written notification to ASC/EN after the SM has certified airworthiness. A copy of the SM approved TACC document and the airworthiness certificate (provide a sample if each aircraft is issued a unique certificate) must be provided with the notification.

This airworthiness certification process results in a documentation package as depicted on figure 10. If temporary restrictions are implemented, a list should be included with the notification package. This documentation must be maintained and must be readily accessible until the aircraft is decommissioned.

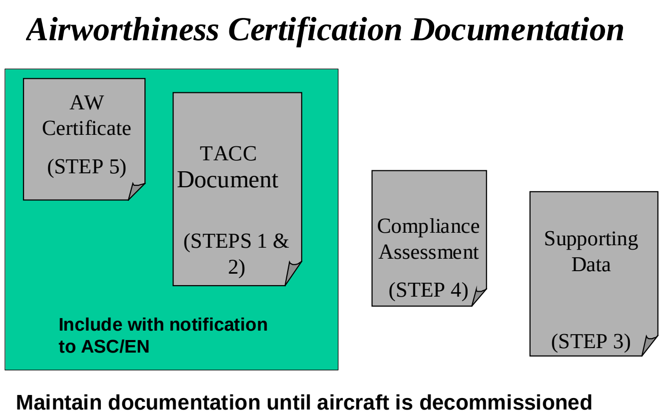


FIGURE 10. Airworthiness certification documentation.

A copy of the certificate should be included in the aircraft records (AFTO Form 781s) or physically displayed in the aircraft to reinforce the directive that unauthorized modifications will invalidate the airworthiness certification. It also provides reassurance to the aircrew that the aircraft design, as produced, is airworthy.

11.6.6 Airworthiness certification with temporary restrictions

As an aircraft system progresses through its airworthiness certification process, it may become evident that the aircraft can't be proven compliant with all criteria defined by the TACC certification basis. An assessment of the criticality of the affected items with respect to airworthiness of the platform should be accomplished. Airworthiness certification with temporary restrictions can be provided while awaiting additional data, documentation updates, or implementation of design changes to correct deficiencies when the operational risk assessment indicates an acceptable level of risk. Appropriate restrictions and limitations should be identified in the appropriate technical manuals. The SM can lift these constraints after corrective actions have been accomplished and compliance with the affected certification basis items has been verified. A list of any temporary restrictions should be included with the ASC/EN notification package.

For example, an aircraft design calls for a drag chute to be installed for full airworthiness certification of a particular configuration, but the safety of the drag chute systems has not yet been totally verified. These aircraft could potentially be operated with a restriction on field length, etc., and the drag chute actuation system disabled. Before the restrictions could be lifted, and an unrestricted airworthiness certificate issued, the drag chute system would have to be verified in compliance with the certification basis.

11.7 Airworthiness certification of commercial derivative aircraft

Use of commercial derivative aircraft in meeting Air Force missions is the preferred approach for obtaining certain aircraft types in a cost effective manner, and is particularly effective when similar missions are to be flown (e.g., passenger transportation). To the military user unaccustomed to commercial certification procedures, the FAA certification process may seem unusually complicated. In reality it is a process that has developed over 50 years and is accepted worldwide as the premier method of certifying aircraft.

There are three FAA certifications relevant to safety of flight of air vehicles: 1) type certification, which addresses conformance of the design to prescribed airworthiness standards; 2) production certification, which addresses the production of aircraft under an approved FAA production system; and 3) airworthiness certification, which addresses both conformance to type design and the maintenance of a state of airworthiness of a particular aircraft throughout its operational life.

FAA type certification approves the aircraft design for a specific aircraft model, and it applies to all like-configured aircraft of that model. Type certification also includes approval of flight and technical manuals used for operation and maintenance. The FAA approves major modifications via an amended type certificate or a supplemental type certificate.

In contrast, FAA airworthiness certification applies to each aircraft tail number. It attests to the aircraft conforming to the configuration that was type certified and produced by an FAA-approved production facility and maintained in accordance with its type design definition by an FAA approved maintenance program. The Air Force less frequently acquires, and rarely maintains, the FAA airworthiness certification (by tail number) throughout the life of its systems. The Air Force generally approves its own maintenance programs, which are outside the realm of FAA airworthiness certification.

It should be noted that the FAA certifications do not address military suitability and effectiveness. The SM/CE must address suitability and effectiveness with respect to the planned acquisition/support methodology and the certification aspects. To evaluate military suitability and effectiveness, the SM should follow the same procedures for non-FAA certified vehicles outlined elsewhere in this document.

The airworthiness standards of the Federal Aviation Regulations, a subset of Title 14 of the Code of Federal Regulations, include clauses 14 CFR xx.1301 and 14 CFR xx.1309. The former states that if a device is on an aircraft it must "function as intended," and the latter requires proof of safe operation of the airplane with all equipment operating as intended. The FAA rarely interprets these functionality requirements as a formal requirement to meet military specifications. Most often, the FAA requires the procuring agency to state that the system complies with 1301. The FAA assures compliance with 1309. Note: xx indicates the FAR Part that applies (e.g., Part 23 for commuter aircraft and Part 25 for transport aircraft).

FAA type certification, which is more frequently obtained by the Air Force, is sufficient basis for AF airworthiness certification for similar usage and environment. The SM/CE needs assurance that if the aircraft is to be operated in a more severe environment or manner than its civil counterparts, it is designed (modified) and maintained accordingly. For example, a civilian certified business jet could be procured and utilized as a trainer, complete with associated low-level training spectra and all of the abuse a trainer sees in its typical service life. The trainer aircraft will see many more pressure and takeoff/landing cycles in a given timeframe than its civil counterpart. It is up to the SM/CE to ensure that the impacts of this expected usage are accounted for in both the design and the life maintenance aspects of OSS&E.

11.7.1 Acquisition and sustainment scenarios

The following paragraphs address the most common scenarios seen with commercial derivative aircraft. The listing is in priority order in accordance with AFPDs.

11.7.1.1 FAA full certification (type, production, and airworthiness) obtained and maintained throughout the life of the system.

In this instance, the SM accepts the certifications as airworthiness approval but concentrates on the aircraft's suitability and effectiveness in the intended mission. By maintaining FAA full certification (type and airworthiness) throughout the life of the system, the SM relies on the FAA to assure safety of flight throughout the system's life. The AF must comply with all FAA reporting and maintenance requirements. The aircraft must have civil registration (i.e., N number), all modifications must be FAA certified, and AF usage must be comparable to civil usage for this option to be used.

11.7.1.2 FAA type certification obtained during acquisition and maintained throughout sustainment.

In this scenario, FAA type certification is obtained during acquisition, but FAA airworthiness certification cannot be obtained due to military nonconformities or other special mission needs. Nonconformities are military required design features that are determined to not be certifiable by the FAA. These nonconformities must be shown to comply with the *Airworthiness Certification Criteria* via the USAF airworthiness certification process. This is the most common approach used with commercial derivative, transport aircraft. The AF and the FAA, following procedures in FAA Order 8130.2, must jointly accept the military nonconformities. This approach requires close coordination with the contractor and careful contracting to assure the unique military-use FAA type certification is maintained throughout the life of the system. The support contract for the system should address all requirements to maintain the aircraft to its type design and perform all FAA-directed actions required to maintain airworthiness. These actions include reporting specific failures to the FAA (see section 5.3).

11.7.1.3 FAA type certification does not include all planned Air Force use.

FAA type certification includes approval of the flight envelope and use as defined by the manufacturer for commercial operation. In many cases, the Air Force may want to operate the aircraft outside of the FAA-approved envelope. Examples are aerial refueling as receiver and/or tanker, extended spins for trainers, and operation at altitudes above the certified maximum altitude. To ensure verification of safety within these specific, non-FAA-certified regions of flight, the SM should create and verify the applicable certification basis in a TACC document. Sustainment should follow the AFPDs, and airworthiness should be maintained following commercial practices and procedures as closely as possible.

11.7.1.4 The FAA type certificate does not extend to the actual delivered flight vehicle.

In this case, modifications to an FAA type certified design are not FAA type certified. The SM must therefore employ the previously defined USAF airworthiness certification process.

11.7.2 Waivers for commercial derivative aircraft

AFPD 62-4 allows waivers to be sought "after all possible solutions to resolving FAR issues have been exhausted." AFPD 62-5 requires hybrid aircraft to be "in compliance or modified to comply with FAA airworthiness standards" when used for passenger-carrying missions. HQ AF/XO is the final authority to resolve or waive compliance with FAR regulatory requirements when the aircraft is used for passenger carrying missions.

The following should be verified and documented by the SM/CE to support the waiver request (step 4 on figure 11):

a. The proposed design must be shown to be required in order to fulfill a mission need,

b. No FAA certifiable design alternatives exist,

c. The proposed design can't be certified through an FAA equivalent level of safety finding or special condition, and

d. A risk assessment shows that the design won't compromise Air Force airworthiness requirements.

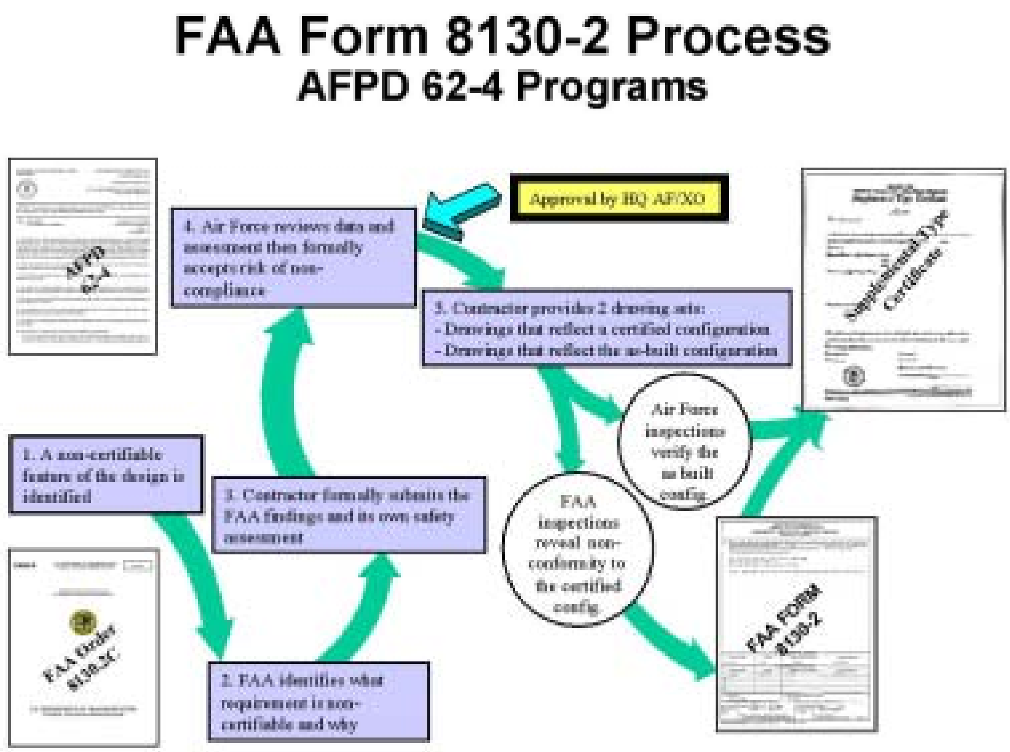


FIGURE 11. Waiver process.

11.8 Acceptance of airworthiness certifications from other Government agencies, foreign civil airworthiness authorities, and foreign military authorities

DoD acceptance of others' airworthiness certifications depends largely on knowledge of the process and criteria that are used to verify safety of flight. The SM/CE must assess in sufficient detail the process the other agency uses to assure that the level of safety is consistent with that established by the USAF process outlined herein prior to acceptance of the other agency's certification. Levels of acceptable risk and operational usage may be significantly different and, therefore, must be considered. This is especially true when considering acceptance of foreign military certifications.

Foreign civil airworthiness authorities (CAA) may or may not have established reciprocal/bilateral agreements with the FAA defining the degree of acceptance of the CAA's type certification. If in doubt as to the status of the foreign government's certification authority and competency/acceptability level, it may be best to contact the FAA to obtain a current status/ruling.

Bilateral agreements provide an alternative means for the FAA to make its findings by making maximum practicable use of the certification system of another CAA. Through bilateral agreements, the FAA recognizes the competency of the exporting CAA to conduct airworthiness certification functions in a manner comparable to the FAA. Bilateral agreements also commit these authorities to fully cooperate and assist the FAA in the timely resolution of safety issues that may arise after aircraft exported under the bilateral agreements enter into service on the U.S. registry.

11.9 Preserving airworthiness

Throughout the air system operational life, it is the responsibility of the SM to assure that the airworthiness of the air system is not compromised. Frequently, there are system problems identified in DRs, accident/incident reports, etc. that may indicate airworthiness problems. These should be reviewed continuously by the SM in coordination with the CE, to determine what impact, if any, they may have on safety of flight. If, for any reason, the SM believes airworthiness is compromised, he/she should contact the lead MAJCOM and discuss the implications, including consideration of any restrictions that should be imposed or grounding of the affected aircraft. If it is then determined that a modification is required to correct the problem, the SM must recertify the aircraft airworthiness when the appropriate verifications have been completed.

If unauthorized modifications to an aircraft are discovered, it is the responsibility of the SM to declare the affected aircraft non-airworthy until the effect of the modification can be assessed and dealt with accordingly.

11.9.1 Compliance with MIL-HDBK-516 updates

New airworthiness criteria are developed based upon feedback from airworthiness implementers, new technology development, annual reviews, etc., and are published following approval by the AC^{3}B. Particularly during the initial, formative period of USAF airworthiness certification, there may be substantive changes to MIL-HDBK-516. The following guidance is therefore provided regarding compliance with the updated MIL-HDBK-516 with respect to various aircraft certification cases:

Aircraft that are airworthiness certified: Compliance with the latest update to MIL-HDBK-516 is required when making reportable modifications. New criteria for the unmodified portion of the aircraft should be verified in the same manner as the initial airworthiness certification for a legacy aircraft.

Aircraft with approved TACC documents: If an update to MIL-HDBK-516 is published after a TACC document is approved, but before initial airworthiness certification is completed, the approved certification basis may be used to complete the certification effort. However, to simplify future recertifications, the SM may elect to upgrade the TACC document immediately to include all applicable criteria from the updated MIL-HDBK-516.

Aircraft with no approved TACC document: Compliance with the last update to MIL-HDBK-516 is mandatory.

11.10 Airworthiness recertification due to modifications

11.10.1 Reportable modifications

AFPD 62-6 directs that single managers provide written notification to ASC/EN confirming aircraft airworthiness certification. Furthermore, the Aeronautical Enterprise commander requires written notification for updates to the initial certification due to major modifications (ASC/CC Memorandum, 19 Jul 01). Since various definitions of the term "major modification" currently exist in AF vernacular, a distinction must be made when determining which modifications significantly impact airworthiness to require airworthiness recertification and reporting by the single manager.

All modifications require an airworthiness assessment. All permanent modifications that result in a significant impact on airworthiness require written notification of airworthiness recertification to ASC/EN. The following are examples of modifications that may significantly impact airworthiness:

a. Changes that affect structural integrity, propulsion/drive system operation (including software), aircraft performance, aerodynamic characteristics (including drag, control response, and stability), electromagnetic characteristics, navigational system effectiveness, flight control system power requirements, weight and balance, life support systems, aircrew station noise levels, or significant software revisions.

b. Changes that result in restricted aircrew vision or performance, or that increase the danger to the crew or passengers in the event of an accident; emergency egress.

c. Modification to the exterior contour/mold line of the air vehicle (addition/removal of antenna, wing fence, ventral fin, vortex generator, air induction system, auxiliary inlets, etc.).

d. Modification of the displays, or changes to annunciation or critical information presented to the aircrew which may affect situational awareness, aircraft control, weapons launch, etc.

e. Aircraft modifications incorporating a source of energy or that can be energized to potentially emit any form of hazardous radiation, such as explosive ordnance, explosive or flammable fluids, laser energy, and so forth.

f. Changes that affect the operating limits and/or emergency procedures prescribed by the operator's flight manual.

g. Modification to weapons release/firing system, including stores management system and associated weapons system software.

h. Operation of carry-on equipment required for mission operation in flight. Airworthiness impact occurs when operation of that equipment can measurably affect the airworthiness of the aircraft system, subsystem, or allied equipment. Characteristics of such carry-on equipment operation include:

(1) Equipment that energizes emission of electromagnetic energy that can affect any aircraft, subsystem, or allied equipment controls, indicators, or displays, or that can affect the effectiveness of the navigational system.

(2) Equipment that emits light or sound energy that can raise aircrew station noise levels, or that can distract and degrade aircrew performance.

(3) Equipment that cannot be secured with existing restraints during takeoff and landing phases, thereby increasing the danger to the operator, crew, or passengers in the event of an accident.

(4) Equipment energized to emit any form of radiation, gases, liquids, or debris that may be hazardous, such as explosive ordnance, explosive or flammable fluids, laser energy, and so forth.

(5) Any equipment having an intended use that is in lieu of a standard aircraft system, subsystem, or component function.

(6) Equipment that is utilized in a crew station where emergency egress may be degraded through obscuration or some effect on ejection injury potential.

i. Installation of equipment, including nondevelopmental items (NDI) or commercial-off-the-shelf (COTS), and the effects of its installation on the authorized configuration.

j. Changes that affect the prescribed limits for continued airworthiness. These changes include additions, deletions, or reconfiguration of hardware and material substitutions, software revisions, and any repair or replacement not currently authorized in the technical orders.

11.10.2 Modification airworthiness certification criteria

As the Air Force works toward total fleet airworthiness certification, a particular aircraft design currently undergoing modification may or may not have approved TACC to be used by the modification program as a checklist for their verification efforts. In both cases (approved TACC or not), ensuring all appropriate criteria are addressed and subsequently verified imparts good technical discipline in the modification engineering efforts. This is accomplished by developing and obtaining ASC/EN coordination on a modification airworthiness certification criteria (MACC) document for each reportable modification. Note that modifications by themselves are not airworthiness certified; that is, only the complete aircraft with the modification incorporated is certified. A MACC document should identify only those criteria applicable to the modified area(s) of the aircraft after analyses have shown that all other criteria can be verified by similarity from the original certification (no changes to the function, environment, or usage spectrum). The MACC document should also include a description of the aircraft covered, supplemental data, and limitations that apply to the modification. The MACC document is a subset of the TACC document that should include any unique or updated MIL-HDBK-516 criteria needed to recertify airworthiness after the modification.

Obtain ASC/EN and user coordination early in the modification process on both the draft MACC document and the updated draft TACC document if it requires an update due to modification (e.g., updated MIL-HDBK-516, change in criteria applicability). When a DSO manages the modification, the SM and CE for the modification program provide evidence that airworthiness criteria applicable to the modification have been properly verified and the SM for the platform issues the certification. In all cases, the SM uses the latest TACC to certify airworthiness.

For a reportable modification to an aircraft with an approved TACC document, a MACC must be developed comprised of those TACC and MIL-HDBK-516 criteria applicable to the modification as described above. However, if a new version of MIL-HDBK-516 has been published since the TACC document was approved, all current, applicable MIL-HDBK-516 criteria must be addressed by updating the TACC certification basis to the latest MIL-HDBK-516 version. In this situation, it would be prudent for the modification office and the SM/CE to establish a division of verification responsibilities early in the modification planning. Complete the modification design and utilize this MACC as a checklist to verify compliance with applicable criteria, then update the aircraft TACC document to reflect the new certification basis and recertify airworthiness. The data used for verification of the MACC is utilized to verify the applicable portions of the updated TACC, and the MACC document becomes historical. New criteria from the updated MIL-HDBK-516 that are not addressed in the MACC should be verified in the same manner as the initial airworthiness certification.

For a reportable modification to an aircraft without an approved TACC document, the MACC can be developed by determining the appropriate subset of the current version of MIL-HDBK-516 against which to evaluate the modification. The MACC document should identify those criteria applicable to the modified area(s) of the aircraft. The MACC and the results of the modification's verification effort are subsequently utilized by the aircraft program office for incorporation into the aircraft's initial TACC verification for airworthiness certification. At this point, the MACC document becomes historical.

Flowcharts of the above processes can be found at the ASC/EN website (https://www.en.wpafb.af.mil/oss&e/oss&e_aw_tools.asp).

11.10.2.1 First flight assessments for major modifications

It is the responsibility of the SM, in coordination with the CE, to make a positive determination that the modified aircraft design is safe for first flight. Use the MACC and TACC documents' certification basis as a starting point to guide the readiness decision. Tailor the certification basis criteria further, if necessary, to reflect only those criteria applicable to the reduced operational envelope, configurations, and conditions that are expected during the first flight. As the flight and operational envelope is expanded and additional system configurations are added, additional evaluation of criteria must be accomplished to ensure continued SoF. As the test program is completed and the verification effort winds down, all applicable airworthiness criteria should be verified creating a clear path to recertification of airworthiness.

11.11 Alerts & advisories process

The process for identifying, developing, issuing, and maintaining airworthiness alerts and advisories is an ASC/EN process executed for the benefit of the USAF in conjunction with the USAF AC^{3}B. AFMCI 63-1201 requires that the product centers review/analyze all product line mishap reports and notify applicable single managers of possible trends or systemic problems affecting their systems. For the Aeronautical Enterprise, ASC/EN will issue airworthiness alerts and airworthiness advisories as appropriate to fulfill this requirement. SMs are responsible for putting appropriate processes in place to address and disposition airworthiness alerts and advisories. Further information on airworthiness alerts and advisories is provided in ENOI-18 (https://www.en.wpafb.af.mil/oi/ENOI_18.pdf).

12. NOTES

12.1 Intended use

This military handbook provides guidance for implementing and preserving the operational safety, suitabilty, and effectiveness of all USAF Aeronautical Enterprise systems and end-items, including those Air Force procured systems and end-items managed for other governments.

12.2 Subject term (key word) list

acquisition planning

aircraft

air system

airworthiness

baseline

certification

configuration management

end-item

engineering process

integrity program

interoperability

logistics

maintenance

modification

operational risk management

reliability

subsystem

supply

sustainment planning

systems engineering

test and evaluation

training

weapon system

APPENDIX

A.1 SCOPE

A.1.1 Purpose

This appendix contains the references, definitions, OSS&E plan format memo and plan outlines, and the configuration management, operational risk management, and technical order plan checklists. This appendix is for guidance only.

A.2 APPLICABLE DOCUMENTS

A.2.1 General

The documents listed below are not necessarily all of the documents referenced herein but are the ones that are needed in order to fully understand the information provided by this handbook.

A.2.2 Government documents

A.2.2.1 Specifications, standards, and handbooks

The following specifications, standards, and handbooks form a part of this document to the extent specified herein.

SPECIFICATIONS

DEPARTMENT OF DEFENSE

MIL-PRF-49506	Performance Specification Logistics Management Information (LMI)

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-188-181	Single-Access 5 KHz and 25 KHz UHF Satellite Communications Channels
MIL-STD-188-182	Interoperability Standard for 5 KHz UHF DAMA Terminal Waveform
MIL-STD-188-183	Interoperability Standard for 25 KHz TDMA/DAMA Terminal Waveform (Including 5- and 25-KHz Slave Channels)
MIL-STD-882	Standard Practice for System Safety
MIL-STD-1366	Interface Standard for Transportability Criteria

MIL-STD-1787	Aircraft Display Symbology

HANDBOOKS

DEPARTMENT OF DEFENSE

MIL-HDBK-61	Configuration Management Guidance
MIL-HDBK-500	Key Supplier Processes for Aviation and Space Sectors Acquisition and Sustainment Programs
MIL-HDBK-515	Weapon Systems Integrity Guide
MIL-HDBK-516	Airworthiness Certification Criteria
MIL-HDBK-1530	Aircraft Structural Integrity Program (ASIP), General Guidelines for
MIL-HDBK-1783	Engine Structural Integrity Program (ENSIP)
MIL-HDBK-1798	Mechanical Equipment & Subsystem Integrity Program (MECSIP)
MIL-HDBK-87244	Avionics/Electronics Integrity Program (AVIP)

(Unless otherwise indicated, copies of specifications, standards, and handbooks are available from the Standardization Documents Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094. Copies of documents indicating a distribution limitation (statement D) may be ordered from ASC/ENOI, 2530 Loop Rd West, Bldg. 560, Wright-Patterson AFB, OH 45433-7101; order online at https://www.en.wpafb.af.mil/engstds/engstds.asp).

A.2.2.2 Other Government documents, drawings, and publications

The following other Government publications form a part of this document to the extent specified herein.

FEDERAL AVIATION ADMINISTRATION

FAA Order 8130.2C

FAR 45	Government Property

(Copies of Federal Aviation Administration Regulations may be viewed at http://www.faa.gov, or may be obtained from the Federal Aviation Administration, 800 Independence Ave., SW, Washington, DC 20591.)

DEPARTMENT OF DEFENSE

DoD REGULATIONS

DoD 5000.2-R	Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs

DoD 5010.12-M	Procedures for the Acquisition and Management of Technical Data

DoD INSTRUCTIONS

CJCSI 6251.01	Chairman, Joint Chiefs of Staff Instruction: Ultrahigh Frequency Satellite Communications Demand Assigned Multiple Access Requirements

AIR FORCE PUBLICATIONS

AIR FORCE INSTRUCTIONS

AFI 10-601	Mission Needs and Operational Requirements Guidance and Procedures
AFI 10-602	Determining Logistics Support and Readiness Requirements
AFI 10-901	Lead Operating Command--Communications and Information Systems Management
AFI 11-215	Flight Manuals Program (FMP)
AFI 16-1002	Modeling and Simulation Support to Acquisition
AFI 21-101	Maintenance Management of Aircraft
AFI 21-103	Equipment Inventory, Status, and Utilization Reporting
AFI 21-107	Maintaining Commercial Derivative Aircraft
DLAD 4155.24/ AR 702-7/ SECANAVINST 4855.5B/ AFI 21-115	Product Quality Deficiency Report Program
AFI 21-402	Engineering Drawing System
AFI 21-403	Acquiring Engineering Data
AFI 32-7061	The Environmental Impact Analysis Process
AFI 32-7080	Pollution Prevention Program
AFI 32-7086	Hazardous Materials Management
AFI 63-104	The SEEK EAGLE Program
AFI 63-107	Product Support Management Plan
AFI 63-1001	Aircraft Structural Integrity Program (ASIP)

AFI 63-1101	Modification Management
AFI 63-1201	Assurance of Operational Safety, Suitability & Effectiveness
AFI 63-1301	Assurance of Global Air Traffic Management Performance Certification
AFI 90-901	Operational Risk Management
AFI 91-202	The U.S. Air Force Mishap Prevention Program
AFI 91-204	AFMC Sup 1 Safety Investigations and Reports
AFI 99-101	Developmental Test and Evaluation
AFI 99-102	Operational Test and Evaluation
AFJI 24-223	DoD Engineering for Transportability

AIR FORCE POLICY DIRECTIVES

AFPD 21-3	Technical Orders
AFPD 21-4	Engineering Data
AFPD 62-4	Standards of Civil Airworthiness for Passenger Carrying Commercial Derivative Transport Aircraft
AFPD 62-5	Standards of Civil Airworthiness for Commercial Derivative Hybrid Aircraft
AFPD 62-6	USAF Aircraft Airworthiness Certification
AFPD 63-1	Acquisition System
AFPD 63-10	Aircraft Structural Integrity
AFPD 63-11	Modification System
AFPD 63-12	Assurance of Operational Safety, Suitability & Effectiveness
AFPD 63-13	GATM and Navigational Safety Certification for USAF Aircraft
AFPD 99-1	Test and Evaluation Process

AIR FORCE MATERIEL COMMAND INSTRUCTIONS

AFMCI 21-101	Depot Maintenance Activation Planning (DMAP)
AFMCI 21-102	Analytical Condition Inspection (ACI) Programs
AFMCI 21-103	Reliability-Centered Maintenance (RCM) Programs
AFMCI 61-102	Technology Transition Planning

AFMCI 63-1201	Assurance of Operational Safety, Suitability & Effectiveness

AIR FORCE MANUALS

AFMAN 23-110	USAF Supply Manual
AFMAN 63-119	Certification of System Readiness for Dedicated Operational Test and Evaluation
AFMCMAN 21-1	Air Force Materiel Command Technical Order System Procedures

AIR FORCE PAMPHLETS

AFMCPAM 63-101	Acquisition Risk Management
AFPAM 36-2211	Guide for Management of Air Force Training Systems

(Copies of Air Force publications may be viewed at http://www.e-publishing.af.mil.)

AIR FORCE TECHNICAL ORDERS

TO 00-5-1, AF Technical Order System

TO 00-5-15, Air Force Time Compliance Technical Order (TCTO) System

TO 00-5-3, AF Technical Manual Acquisition Procedures

TO 00-35D-54, USAF Deficiency Reporting and Investigating System

TO 00-20-5, Aerospace Vehicle /Equipment Inspection and Documentation

TO 00-20-1, Aerospace Equipment, Maintenance, General Policies and Procedures

The TO Index is only used to check various information (pub date, TO manager, etc) about tech orders. See https://www.toindex-s.wpafb.af.mil/. For 00 series tech orders, see http://www.ide.wpafb.af.mil/toprac/Category_00_TOs.htm. For all other TO requests, order from either JCALS or ATOMS.

OTHER

Aeronautical Systems Center, Engineering Technical Processes

ASC/EN – SMC/SD Systems Engineering Guide

Commercial Aircraft Certification, paper at NAECON, 15 July 1998

Defense Systems Management College (DSMC) Risk Management Guide

Manufacturing Development Guide

Weapon System Integrity Guide

Joint Service Specification Guides

NON-GOVERNMENT PUBLICATIONS

The following non-Government documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the latest issue of the DoDISS, and supplement thereto.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

ASME Y14.24-M-1989	Types and Applications of Engineering Drawings
ASME Y14-34M-1989	Parts Lists, Data Lists, and Index Lists
ASME Y14.100M-1998	Engineering Drawing Practices

(Copies of ASME publications may be obtained from ASME, 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300; or by calling 1-800-843-2763, ext. 228. Order on-line at: http://www.asme.org/catalog.

ENGINEERING INDUSTRY ASSOCIATION

EIA -649, National Consensus Standard for Configuration Management

(Copies of Engineering Industry Association standards may be obtained from Engineering Industries Alliance (EIA), Technology Strategy and Standards Department, 2500 Wilson Boulevard, Arlington, VA 22201. Visit the EIA website at http://www.eia.org/technology.)

SOCIETY OF AUTOMOTIVE ENGINEERS

SAE-AIR5022, Reliability and Safety Process Integration

SAE-ARP5580, Failure Modes, Effects, and Criticality Analysis Procedures

(Application for copies should be addressed to SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001. Order electronic standards online at http://www.sae.org/technicalcommittees/index.htm.)

A.3 DEFINITIONS AND ACRONYMS

A.3.1 Definition of terms

A.3.1.1 Allocated baseline

The current, approved documentation for a CI to be developed, which describes in performance terms the functional and interface characteristics that are allocated from those of the higher level CI and the verification required to demonstrate achievement of those specified characteristics. (MIL-HDBK-61A)

A.3.1.2 Airworthiness

The property of a particular air system configuration to safely attain, sustain, and terminate flight in accordance with the approved usage and limits.

A.3.1.3 Airworthiness certification

Airworthiness certification is a repeatable process that results in a documented decision by the SM that an aircraft system has been judged to be airworthy. In other words, it meets the approved set of criteria established by the Airworthiness Certification Criteria Control Board, *Airworthiness Certification Criteria),* or the aircraft system carries the appropriate Federal Aviation Administration (FAA) certificates. Airworthiness certification is intended to verify that the aircraft system can be safely maintained and safely operated by fleet pilots within its described and documented operational envelope.

A.3.1.4 Airworthiness certification criteria

The airworthiness certification criteria (MIL-HDBK-516) establish the criteria to be used in the determination of airworthiness of all Air Force flight vehicles. It is a foundational document to be used by the single manager, chief engineer, and contractors to define and tailor their airworthiness programs from the outset, and to assess the viability and quality of their airworthiness plans and activities throughout the program. These criteria must be used throughout the life of the air vehicle and applied whenever there is a change to the functional or product baseline, or where an airworthiness determination is required.

A.3.1.5 Assurance

A planned and systematic pattern of actions necessary to provide confidence that expected performance is achieved.

A.3.1.6 Baseline (OSS&E)

A description of the OSS&E parameters and limitations of any system or end-item that must be understood, acknowledged, and maintained during operational deployment, use, experimentation, exercises, training, and maintenance of the system or end-item. These should be measurable, top-level parameters that characterize system performance, capabilities, and certifications that merit the attention of using command and program office senior leadership. Examples include key performance parameters and acquisition program baselines.

A.3.1.7 Baseline metrics (OSS&E)

AFI 10-901 states that the lead command (LC) during sustainment deals with analyzing the fielded system's performance against operational needs. This is accomplished using a predetermined set of metrics developed by the LC and users, to determine how and when to modify or replace a system, equipment, commodity, and/or service and ensure satisfying user requirements and initiate corrective action. These parameters should be the same (or a subset) of those used by the SM to assure preservation of the OSS&E

baseline throughout the operational life of the system or end-item. Multiple metrics may be required to assess the baseline characteristics.

A.3.1.8 Clearance

A contractor or Government source signed, written statement that indicates the fitness of a particular component item or principal item for use in a particular application as established by the achievement of specified criteria.

A.3.1.9 Commercial off-the-shelf

Any item evolving from or available in the commercial sector; any combination of items customarily combined and sold to the general public.

A.3.1.10 Configuration control

(1) A systematic process which ensures that changes to released configuration documentation are properly identified, documented, evaluated for impact, approved by an appropriate level of authority, incorporated, and verified. (2) The configuration management activity concerning: the systematic proposal, justification, evaluation, coordination, and disposition of proposed changes; and the implementation of all approved and released changes into (a) the applicable configurations of a product, (b) associated product information, and (c) supporting and interfacing products and their associated product information. [Ref: EIA STANDARD - 649]

A.3.1.11 Configuration management

A management process for establishing and maintaining consistency of a product's performance, functional, and physical attributes with its requirements, design and operational information throughout its life. [Ref: EIA STANDARD - 649]

A.3.1.12 End-item

Equipment that can be used by itself to perform a military function or provides an enhanced military capability to a system and has a distinct management activity to control its technical and performance baseline. Examples include the LANTIRN, 60K-loaders, AN/ALE-45 Countermeasures Dispenser, and Aircraft Tow Bars.

A.3.1.13 Functional baseline

The approved configuration documentation describing a system's or top-level configuration item's performance (functional, inter-operability, and interface characteristics) and the verification required to demonstrate the achievement of those specified characteristics. (MIL-HDBK-61A)

A.3.1.14 Hazard

(a) A condition that is a prerequisite to a mishap. [Ref: MIL-STD-882C]; (b) Any real or potential condition that can cause injury, illness, or death to personnel; damage to or loss of a system, equipment or property; or damage to the environment. [Ref: MIL-STD-882D]

A.3.1.15 Interface

The performance, functional, and physical attributes required to exist at a common boundary. [Ref: EIA-649]

A.3.1.16 Integrated risk management (IRM)

A risk management approach for use in the acquisition of new systems, end-items, and equipment based upon four attributes. Those attributes are 1) risk management planning, 2) risk assessment, 3) risk mitigation, and 4) risk management control.

A.3.1.17 Integrity

Refers to the essential characteristics of a system, subsystem, or equipment that allows specific performance, reliability, safety, and supportability to be achieved under specified operational and environmental conditions over a specific service life. [Ref: MIL-HDBK-87244]

A.3.1.18 Joint program

Any acquisition system, subsystem, component, or technology program involving a strategy that involves funding by more than one DoD component, during any phase of the system's life cycle.

A.3.1.19 Lead engineer (LE)

The individual responsible for all end-item or system technical activities, including engineering and configuration changes, in support of the end-item SM or system chief engineer (CE).

A.3.1.20 Materiel safety program manager (MSPM)

The individual responsible for tracking to completion a mishap recommendation on each center's aircraft. Provides mishap information to appropriate offices/individuals (after limited use data training has been received) to preclude similar mishaps and malfunctions on similar systems. The MSPM serves as the SM's focal point for all data requests going to AFMC.

A.3.1.21 Mishap

An unplanned event or series of events resulting in death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment. [Ref: MIL-STD-882D]

A.3.1.22 Modification airworthiness certification criteria (MACC)

A working document comprised of a tailored set of airworthiness criteria applicable to a reportable modification plus a description of the aircraft covered, supplemental data, and limitations that apply to the modification. The MACC document is a subset of the TACC document and includes other unique or updated MIL-HDBK-516 criteria needed to recertify airworthiness after the modification. This is a temporary document applicable only to the aircraft being modified and may lead to an update to the TACC document.

A.3.1.23 Nondevelopmental Item

Any item that was previously developed and used exclusively for governmental purposes by a Federal agency, a state or local government, or a foreign government with which the United States has a mutual defense cooperation agreement. NDI can require minor modification in order to meet the requirements of the agency. Items that are developed and will soon be used by the federal, a state or local government, or a foreign government are also considered NDI.

A.3.1.24 Operational effectiveness

The overall degree of mission accomplishment of a system used by representative personnel in the environment, planned or expected (e.g., natural, electronic, threat), for operational employment of the system. Operational effectiveness considers organization, doctrine, tactics, survivability, vulnerability, and threat (including countermeasures, initial nuclear weapons effects, and nuclear, biological, and chemical contamination threats).

A.3.1.25 Operational risk management (ORM)

A decision-making process to systematically evaluate possible courses of action, identify risks and benefits, and determine the best course of action for any given situation. [Ref: AFI 90-901]

A.3.1.26 Operational safety

The condition of having acceptable risk to life, health, property, or environment caused by a system or subsystem when employed in an operational environment. This involves the identification of hazards, assessment of risk, determination of mitigating measures, and acceptance of residual risk.

A.3.1.27 Operational suitability

The degree to which a system can be satisfactorily dispatched into field use. Consideration is given to availability, compatibility, transportability, interoperability, reliability, wartime use rates, maintainability, safety, human factors, manpower supportability, logistics supportability, natural environmental effects and impacts, and documentation and training requirements.

A.3.1.28 Operational test and evaluation (OT&E)

Testing and evaluation conducted in as realistic an operational environment as possible to estimate the prospective system's operational effectiveness and operational suitability. In addition, OT&E provides information on organization, personnel requirements, doctrine, and tactics. It may also provide data to support or verify material in operating instructions, publications, and handbooks (AFM 11-1) [Ref: AFI 99-102]

A.3.1.29 Performance

A measure characterizing a physical or functional attribute relating to the execution of an operation or function. Performance attributes include quantity (how many or how much), quality (how well), coverage (how much area, how far), timeliness (how responsive, how frequent), and readiness (availability, mission/operational readiness). Performance is an attribute to be measured for all systems, people, products, and processes including those for development, production, verification, deployment, operations, support, training, and disposal. Thus, supportability parameters, manufacturing process variability, reliability, and so forth are all performance measures. [Ref: EIA -649]

A.3.1.30 Product baseline

The approved technical documentation which describes the configuration of a CI during the production, fielding / deployment and operational support phases of its life cycle. The product baseline prescribes:

a. All necessary physical or form, fit, and function characteristics of a CI,

b. The selected functional characteristics designated for production acceptance testing, and

c. The production acceptance test requirements (MIL-HDBK-61A)

When used for reprocurement of a CI, the product baseline documentation also includes the allocated configuration documentation to ensure that performance requirements are not compromised.

A.3.1.31 Public use aircraft

Aircraft used only in the service of a government or a political subdivision. It does not include any Government-owned aircraft engaged in carrying persons or property for commercial purposes.

A.3.1.32 Reportable modification

Those air system modifications determined by the chief engineer to result in a significant airworthiness impact. Note: All modifications require an airworthiness assessment, but not all are reportable. For the purposes of airworthiness certification reporting, per AFPD 62-6, paragraph 2.8.7, the chief engineer will conduct an assessment of all permanent modifications and will provide written notice requiring airworthiness recertification to ASC/EN on only those deemed reportable. See airworthiness certification, section 12, for examples of reportable modifications.

A.3.1.33 Safety

Freedom from those conditions that can cause death, injury, occupational illness, or damage to or loss of equipment or property, or damage to the environment. [Ref: MIL-STD-882D]

A.3.1.34 Safety critical

A term applied to a condition, event, operation, process, or item whose proper recognition, control, performance, or tolerance is essential to safe system operation or use; e.g., safety-critical function, safety-critical path, safety-critical component. Describes items that, if they fail, have the potential for catastrophic or critical consequences to personnel or equipment. The determining factor is the consequence of failure, not the probability that the failure or consequences would occur.

A.3.1.35 Safety of flight

The property of a particular air system configuration to safely attain, sustain, and terminate flight within prescribed and accepted limits for injury/death to personnel and damage to equipment, property, and/or environment. Typically associated with flight test; however, it could apply to T-1 modifications.

A.3.1.36 Single manager (SM)

A system program director (SM). [Ref: AFPD 63-1]

A.3.1.37 System

A specific grouping of components or elements designed and integrated to perform a military function. System examples include the A-10 weapon system (including the air vehicle, support equipment, training equipment, engines, diagnostics, ground station, and technical data), F101 engine, and C-17 Automatic Test System.

A.3.1.38 System chief engineer

The individual responsible for all system technical activities, including engineering and configuration changes, in support of a system program director (SM).

A.3.1.39 System safety

The application of engineering and management principles, criteria, and techniques to achieve acceptable mishap risk, within the constraints of operational effectiveness and suitability, time, and cost, throughout all phases of the system life cycle. [Ref: MIL-STD-882D]

A.3.1.40 Systems engineering

An interdisciplinary approach encompassing the entire technical effort to evolve, verify, field, and support an integrated and life cycle balanced set of people, product, and process solutions that satisfy customer needs.

A.3.1.41 System program director (SM)

The individual directing an Air Force system program office (SPO) who is ultimately responsible and accountable for decisions and most resources in overall program execution of a military system. The SM is the single person, identified in a program management directive (PMD), who is charged with cost, schedule, performance (including sustainment) of a program.

A.3.1.42 Tailored airworthiness certification criteria (TACC)

The document comprising the set of airworthiness certification criteria that are applicable to a particular MDS or group of MDS aircraft (the certification basis), including a description of the aircraft, supplemental data, and limitations.

A.3.2 Acronyms

ACAT I	Acquisition category I
ACC	Air Combat Command
ACTD	advanced concept technology demonstration
AC^3B	Airworthiness Certification Criteria control board
AE	Aeronautical Enterprise
AEB	Aviation Engineering Board
AETC	Air Education and Training Command
AFAE	Air Force acquisition executive
AFFSA	Air Force Flight Standards Agency
AFI	Air Force instruction
AFJI	Air Force joint instruction
AFMC	Air Force Materiel Command
AFMCI	AFMC instruction
AFMCMAN	AFMC manual
AFOSH	Air Force Occupational Safety and Health

AFPAM	Air Force pamphlet
AFPD	Air Force policy directive
AFRES	Air Force Reserves
AFTO	Air Force technical order
AIMS	Air Traffic Control Radar Beacon System Identification Friend or Foe Mark XII/XIIA System
AIP	aircraft information program
AIR	aerospace information report
AIS	automated information system
AIWG	aircraft information working group
ALC	air logistics center
AMC	Air Mobility Command
ANG	Air National Guard
ARP	aerospace recommended practice
ASC	Aeronautical Systems Center
ASIP	aircraft structural integrity program
AT	anti-tampering
ATC	air traffic control
ATTLA	Air Transportability Test Loading Agency
ATD	advanced technology demonstration or aircrew training device
ATM	air traffic management
AVCL	air vehicle clearance level
AVIP	avionics/electronics integrity program
C&A	certification & accreditation
CAA	civilian aviation authority
CAMS	core automated maintenance system

CAIV	cost as an independent variable
CANN	cannibalization
CAT I	category I (deficiency reports)
CCB	configuration control board
CCP	contract change proposal
CDRL	contract data requirements list
CE	chief engineer
CEI	configuration equipment item
CFR	Code of Federal Regulations
CI	configuration item
CLS	contractor logistics support
CM	configuration management
CMS	configuration management system
CNS	communication, navigation, surveillance
COI	critical operational issues
CONOPS	concept of operations
CORR	commander's operational readiness review (CORR)
COTS	commercial off-the-shelf
CPIN	computer program identification number
CSA	configuration status accounting
CSCI	computer software configuration item
DO 43A	Air Force master item identification database
DAC	designated acquisition commander
DAMA	demand assigned multiple access
DCMA	Defense Contract Management Agency
DLA	Defense Logistics Agency

DOC	designated operational capability
DoD	Department of Defense
DR	deficiency report
DRIS	deficiency reporting and investigation system
DSMC	Defense Systems Management College
ECO	engineering change order
DT&E	development test & evaluation
ECP	engineering change proposal
EMI/EMC	electromagnetic interference/compatibility
EMD	engineering & manufacturing development
EMSEC	emission security
ENSIP	engine structural integrity program
FAA	Federal Aviation Administration
FAR	Federal Acquisition Regulations or Federal Aviation Regulations
F^3I	form, fit, function, and interface
FMECA	failure modes effects and criticality analysis
FMM	flight manual manager
FMP	Flight Manuals Program
FMRC	Flight Manual Review Conference
FOT&E	follow-on operational test and evaluation
GATM	global air traffic management
GIDEP	Government and Industry Data Exchange Program
HQ	headquarters
ICAO	International Civil Aviation Organization
ICS	interim contractor support
IFF	identification friend or foe

IMP	integrated master plan
IMS	integrated master schedule
IOC	initial operational capability
IPB	illustrated parts breakdown
I&M	inspection and maintenance
IPT	integrated product team
IRM	integrated risk management
JITC	Joint Interoperability Test Command
JTA	joint technical architecture
KPP	key performance parameter
LC	lead command
LE	lead engineer
LRIP	low rate initial production
LRU	line replaceable units
MACC	modification airworthiness certification criteria
MAJCOM	major command
MCEB	Military Communications Electronics Board
MCTL	Military Critical Technologies List
MDA	milestone decision authority
MDS	mission design series
MECSIP	mechanical equipment and subsystems integrity program
METL	mission essential tasks list
MOA	memorandum of agreement
MOU	memorandum of understanding
MS	milestone
MS&A	modeling, simulation and analysis

MSPM	materiel safety program manager
NAECON	National Aerospace & Electronics Conference
NDI	nondevelopment item
NNMSB	Nonnuclear Munitions Safety Board
OEM	original equipment manufacture
OPR	office of primary responsibility
ORD	operational requirements document
ORM	operational risk management
O&S	operations and support
OSS&E	operational safety, suitability & effectiveness
OTA	operational test activity
OT&E	operational test and evaluation
PC	personal computer
PEO	program executive officers
PFR	primary flight reference
PID	program introduction document
PMD	program management directive
PRR	production readiness review
QA	quality assurance
QPI	quality performance indicators
QOT&E	qualification operational test & evaluation
QT&E	qualification test & evaluation
RCM	reliability centered maintenance
REMIS	reliability and maintainability information system
RF	radio frequency
RFP	request for proposal

RLA	repair level analysis
RTO	responsible test organization
RTOC	reduction in total ownership cost
SAE	Society of Automotive Engineers
SATCOM	satellite communications
S&EI	system and end-item
SEMR	senior executive management report
SIMCERT	simulation certification
SLA	service level agreements
SM	single manager
SMC	Space and Missile Systems Center
SoF	safety of flight
SOO	statement of objectives
SOW	statement of work
SPO	system program office
SSG	system safety group
SSM	system safety manager or system support manager (at an ALC)
TACC	tailored airworthiness certification criteria
TBD	to be determined
TC	type certification
TCM	technical content manager
TCTO	time compliance technical order
TM	technical manual
TMCR	technical manual contract requirements document
TO	technical order

TOC	total ownership cost
TOMP	technical order management plan
TOVP	technical order verification plan
UAV	unmanned air vehicle
UCI	unit compliance inspection
UHF	ultra-high frequency
USAF	United States Air Force
VTM	verification team manager
WSB	warfighters support briefing
WSIG	Weapon System Integrity Guide

A.4 ORM CHECKLIST

Was the problem identified and defined?	Yes___	No___
Could the problem be solved by any other risk management process?	Yes___	No___
Were the six steps used in the correct sequence?	Yes___	No___
Was the method for risk identification identifiable?	Yes___	No___
Were the risks listed?	Yes___	No___
Were the risks analyzed?	Yes___	No___
Were the causes of the risks listed?	Yes___	No___
Was the risk exposure assessed?	Yes___	No___
Was the risks' severity assessed?	Yes___	No___
Were the risks' probabilities of occurrence assessed?	Yes___	No___
Were the risk assessments completed by prioritization?	Yes___	No___
Were control options identified?	Yes___	No___
Were the effects of the control options identified?	Yes___	No___
Were the control measures prioritized?	Yes___	No___
Were control options selected?	Yes___	No___
Were decisions to implement selected controls implemented?	Yes___	No___
Was the decision made by the appropriate level of command?	Yes___	No___
Was the implementation guidance clear and understandable?	Yes___	No___
Was accountability established for implementation of controls?	Yes___	No___
Was support for the control measure provided?	Yes___	No___
Was the implementation of the control supervised?	Yes___	No___
Was the outcome of the control reviewed?	Yes___	No___
Was feedback provided on the success of the control measure?	Yes___	No___
Was the ORM process reinitiated if necessary?	Yes___	No___

A.5 CONFIGURATION MANAGEMENT CHECKLIST

Is the managing activity's configuration control process documented and operating? (MIL-HDBK-61A, paragraph 6.1.1.3)	Yes___	No___
Is the configuration control authority identified and documented? (MIL-HDBK-61A, paragraph 6.1.1.3)	Yes___	No___
Do Class I engineering change proposals (ECPs) identify impacts to OSS&E? (MIL-HDBK-61A, Tables 6-3 through 6-6)	Yes___	No___
Are Class I ECPs tracked from initial request to contractual authorization and incorporation into the hardware or software? (MIL-HDBK-61A, paragraph 6.2, and Figure 7-2)	Yes___	No___
Is the managing activity's deficiency reporting process documented and operating? (While documenting the process is not a requirement of TO 00-35D-54, it is still a good practice.)	Yes___	No___
If a system/end-item is organically maintained with two or three level maintenance, does the managing activity have access to CAMS or G0-81 to obtain the exact configuration of the system/end-item?	Yes___	No___
If a system/end-item is maintained by contractor logistics support, does the contractor have access to CAMS or G0-81 to input modification/maintenance activities? Does the managing activity have access to the contractor's configuration status accounting system? (MIL-HDBK-61A, paragraph 7.2)	Yes___	No___
Are the CSA and maintenance data collection systems user-friendly (e.g., Windows point and click versus memorizing various screens)?	Yes___	No___
Has the user received proper training to perform maintenance actions to the system/end-item?	Yes___	No___
Has the user accurately recorded modifications and maintenance actions to the system/end-item?	Yes___	No___
Are drawings, technical documentation, and hardware issues (i.e., review of historical and maintenance records, inspection of system/end-item for unauthorized modifications, failure/mishap analysis) properly documented and updated.	Yes___	No___
Does the user's chain of command enforce proper maintenance and recording of maintenance actions?	Yes___	No___
Is there an approved memorandum of agreement (MOA) between the managing activity, the user to delineate responsibilities for maintaining the current configuration of the system/end-item? Is the MOA enforced?	Yes___	No___
"Yes" answers to all of the above questions indicate a good configuration management system that will accurately identify the current configuration of a system/end-item. "No" answers jeopardize the accuracy of the configuration.		

A.6 TECHNICAL ORDER PROGRAM CHECKLIST (NOT ALL INCLUSIVE)

A.6.1 Prior to contract award

1. Assist in developing a Government concept of operations (GCO).

2. Develop a draft TO management plan (TOMP) and tech order related request for proposal (RFP) inputs (see DoD 5010.12-M and TO 00-5-3 for RFP guidance).

3. Hold a TO planning & requirements conference.

4. Finalize TOMP and RFP inputs.

A.6.2 After contract award

1. Hold a TO guidance conference.

2. Refine TOMP and draft a TO verification plan (TOVP)

3. Plan for TO sustainment/updates via the annual comprehensive Air Force tech order plan (CAFTOP).

CONCLUDING MATERIAL

Custodian:
Air Force - 11

Preparing Activity:
Air Force - 11

Review Activities
Air Force - 70, 71, 84

(Project: SESS-0037)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7, and send to preparing activity.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-HDBK-514	2. DOCUMENT DATE (YYYYMMDD) 20030328

3. DOCUMENT TITLE
OPERATIONAL SAFETY, SUITABILITY, AND EFFECTIVENESS FOR THE AERONAUTICAL ENTERPRISE

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First, Middle Initial)*	b. ORGANIZATION	
c. ADDRESS *(Include Zip Code)*	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON *(if applicable)*	**7.DATE SUBMITTED** (YYYYMMDD)

8. PREPARING ACTIVITY

a. NAME ASC/ENOI (AF-11)	b. TELEPHONE *Include Area Code)* (1) Commercial (937)255-6296/-6282 (2) AUTOVON 785-6296/-6282
c. ADDRESS *(Include Zip Code)* 2530 LOOP ROAD WEST WRIGHT-PATTERSON AFB, OH 45433-7101	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman road, Suite 2533, Ft. Belvoir, VA 22060-2533 Telephone (703) 767-6888 AUTOVON 427-6888