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Acquisition

LIFE CYCLE SYSTEMS ENGINEERING

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This instruction implements AFPD 63-1, *Capability Based Acquisition System*, and AFPD 63-12, *Assurance of Operational Safety, Suitability, and Effectiveness (OSS&E)*. It also implements portions of AFPD 63-5, *Quality Assurance*; AFPD 63-10, *Aircraft Structural Integrity*; and AFPD 63-11, *Modification System.* It identifies elements of Air Force systems engineering (SE) practice and management required to provide and sustain, in a timely manner, cost-effective products and systems that are operationally safe, suitable, and effective. These efforts must be rigorously applied and managed, independent of whether Air Force, Government civilian, or contractor personnel accomplish any particular task. This instruction includes guidance for preparation and approval of the Systems Engineering Plan (SEP) in accordance with Department of Defense (DoD) policy for both space and non-space systems.

Air Force senior leadership has made numerous commitments to DoD and the Inspector General to improve the quality of Air Force products and systems, and the credibility and rigor of the processes by which they are developed, produced, integrated, tested, fielded, operated, maintained, sustained, and supported. This document honors these commitments by integrating many technical interests into a life cycle SE approach. It is the first increment of a structured approach to consolidate the technical aspects of Air Force acquisition policy and guidance.

This instruction applies to the development of all Air Force systems, manned and unmanned, regardless of Acquisition Category or life cycle phase. It also applies to production, fielding, and deployment; sustainment; operational support activities; test and evaluation (T&E); upgrades; and temporary and permanent modifications of all systems, including those operated by the Air National Guard and the Air Force Reserve. In addition, it applies to Science and Technology

(S&T) efforts; Advanced Technology Demonstrations (ATD); and Advanced or Joint Concept Technology Demonstration (ACTD or JCTD) programs.

Throughout this document the term "Program Manager" (PM) is used for consistency with DoD policy and documentation. Air Force organizations may use "System Program Manager" (SPM) as an equivalent to the DoDD 5000.1 "PM" term. Current versions of cited/referenced documents apply unless a specific version is identified.

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This document contains numerous electronic links to reference material in other publications. The complete Uniform Resource Locator (URL) address for hyperlinked documents, other than Air Force Policy Directives (AFPD) and Air Force Instructions (AFI), appears in the Interfacing Publications section at the end of the document; the chapters and appendices only contain the hyperlinks without the full URLs. All referenced AFPDs and AFIs can be found at **http://www.e-publishing.af.mil/pubs/majcom.asp?org=AF/**.

SUMMARY OF CHANGES

This Interim Change provides guidance on Development Planning (DP) and Early Systems Engineering (Early SE) to inform pre-acquisition decisions. It establishes responsibilities for operational capability requirements organizations to collaborate on up-front technical planning of prospective Air Force acquisition programs. Rigorous and robust DP and Early SE will significantly improve management of emerging operational capability requirements, and will contribute to the initiation of high-confidence acquisition programs.

It additionally establishes SAF/AQR, Chief Systems Engineer, and Center-Level Technical Authority responsibilities to provide independent technical advice and support to the AF Service Acquisition Executive (SAE), Program Executive Officers (PEO), Designated Acquisition Officials (DAO), and Program Managers (PM) for AF acquisition programs.

A margin bar indicates newly revised material.

1. LIFE CYCLE SYSTEMS ENGINEERING

1.1. Systems Engineering (SE). Systems engineering encompasses the entire set of scientific, technical, and managerial efforts needed to conceive, evolve, verify, deploy, support, and sustain a robust product, platform, system, or integrated system-of-systems (SoS) capability to meet user needs across the life cycle. SE may be referred to as a discipline, a methodology, an approach, a practice, a process, a set of processes and sub-processes, or various other terms; however, its fundamental elements – systematic technical processes and measurements – remain the same regardless of the collective nomenclature. SE provides a solid technical foundation that effectively unifies, integrates, and focuses the efforts of all stakeholders – researchers, acquirers, developers, users, operators, testers, trainers, maintainers, and sustainers – throughout the life cycle of a product or system. It develops a relevant technical knowledge base that is matured, maintained, and transferred in a disciplined manner for the entire life cycle of the concept, product, or system.

1.1.1.1. Non-Space Systems. The non-space life cycle as described in DoD Instruction (DoDI) 5000.2, *Operation of the Defense Acquisition System* covers Concept Refinement, Technology Development, System Development and Demonstration, Production and Deployment, and Operations and Support (O&S). Demilitarization and Disposal and reclamation also require disciplined application of the full spectrum of SE efforts. Chapter 4.3 of the Defense Acquisition Guidebook contains details of SE-related tasks during each phase, and phase entry/exit criteria.

1.1.1.2. Space Systems. For space systems, the life cycle includes a period of Concept Studies followed by Concept Development, Preliminary Design, Complete Design, and Build and Operations.

1.1.1.3. Information Technology (IT) Systems. For Air Force IT systems that fall within the scope of "IT Lean," the life cycle phases outlined in the IT Lean Guidebook are: Define Need, Design, Build & Test, and Release & Sustain. All other IT systems follow DoDI 5000.2.

1.1.2. Air Force SE Management Responsibilities. Program Manager (PM) and Chief/Lead Engineer responsibilities are typically not formally assigned prior to Milestone A. For science and technology (S&T) and early concept development efforts, the term "program" refers to the specific activity; a designated project or capability manager performs the SE tasks identified herein as PM and Chief/Lead Engineer responsibilities. Air Logistics Center (ALC) and related post-Milestone C SE efforts may be assigned to the applicable System Program Manager (SPM), System Support Manager (SSM), Product Group Manager (PGM) (including software), Commodity Manager, or Supply Chain Manager (SCM). When contractors are engaged to accomplish SE tasks, PMs and Chief/Lead Engineers must determine the need to include relevant performance incentives in solicitation, evaluation, award, and execution processes.

1.1.2.1. PM. The PM (or ALC designee, for sustainment efforts) is responsible to ensure application of SE across all program areas throughout the product or system life cycle (ref. *AFI 63-101, Operations of Capabilities-Based Acquisition System* and AFI 63-107, *Integrated Product Support Planning and Assessment*).

1.1.2.2. Chief/Lead Engineer. The Chief/Lead Engineer is the PM's designated technical authority in the disciplined execution of the SE process, including development of the Systems Engineering Plan (SEP) (Para. **1.1.3.1.1**). The Chief/Lead Engineer or designee is responsible to the PM for establishment, implementation, management, and control of SE activities necessary to develop and field robust products and systems that exhibit attributes of system security, OSS&E and Mission Assurance. These activities and processes include, but are not limited to, those identified in Para. **1.1.3**.

1.1.2.3. Chief Systems Engineer. A designated Systems Engineering (SE) Technical Authority responsible to the Program Executive officer (PEO) or Designated Acquisition Official (DAO) for a portfolio approach that applies, implements, and adheres to all directive publications across all programs and technology efforts, regardless of ACAT or life cycle phase.

1.1.2.4. Center-Level Technical Authority. A designated SE Technical Authority at each Product, test, and Logistics Center or equivalents is responsible to the Center Commander for assessing the adequacy of and adherence to Center-level and higher HQ-level SE policies, practices, guidance, tools, education, and training.

1.1.3. Air Force Implementation of SE Processes. SE begins with comprehensive planning. It addresses architecting, requirements development and management, design, technical management and control, and test and evaluation (T&E) / verification and validation (V&V). These fundamental elements must be accomplished on all development, acquisition, and sustainment projects. They are not to be implemented independently, but must be integrated to mutually reinforce each other. Program or project teams should tailor the breadth and depth of application of the various SE sub-elements and processes to the complexities and needs of their specific effort, commensurate with its point in the life cycle. "Tailor" does not mean "eliminate without adequate supporting rationale."

1.1.3.1. Planning. SE must be applied during concept development/refinement efforts, during technology development efforts, and from capability development

through sustainment for all products. SE planning must ultimately address the entire scope of technical effort required to conceive, develop, produce, integrate, verify, and field the system or solution, and sustain it through its life cycle.

1.1.3.1.1. SEP. Department of Defense (DoD) policy requires all programs to develop a SEP to capture SE planning. **Attachment 2** identifies SEP requirements for all Air Force efforts, including those that may not formally be identified as "programs" (*e.g.*, modifications managed at a Logistics or Test Center).

1.1.3.1.1.1. The SEP should be developed in concert with the technical planning supporting the Acquisition Strategy, the Initial Capabilities Document (ICD), and other relevant predecessor documents. It must remain consistent with the program's Life Cycle Management Plan (LCMP) (or legacy Product Support Master Plan [PSMP]), Capability Development Document (CDD), and Capability Production Document (CPD) as program planning and execution mature. With concurrence of the highest SEP signatory (refer to **Attachment 2**), existing legacy planning documentation may be updated to include additional required content for a SEP. Such documents will be subject to the review, update, and approval process described in **Attachment 2**.

1.1.3.1.1.2. The SEP must be reviewed annually, and updated as required throughout the life cycle of the program to reflect significant events such as changes in program office organization, a major supplier or contractor, or funding profiles. The PM or higher signature authority may also direct a SEP update. The PEO/DAO Chief Systems Engineer is responsible to ensure that all programs accomplish these reviews and updates. Space programs include the SEP in the integrated Program Summary (IPS).

1.1.3.1.2. Integrated Master Plan (IMP) and Integrated Master Schedule (IMS). The *Integrated Master Plan and Integrated Master Schedule Preparation and Use Guide* describes the IMP/IMS. The IMP/IMS must be integrated at all levels; contain sufficient detail about SE efforts, resources, monitoring, and control; and capture key events. Additional requirements for non-space systems IMP/IMS appear in AFI 63-101. For space systems, the SE content of the IMP/IMS is contained in the instructions for preparing the IPS.

1.1.3.2. Architecting. Architectural descriptions must conform to requirements of the DoD Architecture Framework (DoDAF), be linked to the Joint Capabilities Integration and Development System (JCIDS) and the AF capabilities-based requirements process (AFI 10-601, *Capabilities Based Requirements Development*), and be compliant with CJCSI 6212.01, *Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)*. The descriptions must be of sufficient detail to describe the product or system, interfaces and dependencies on other products and systems, and interoperability requirements. They should be developed as early as possible, and must be maintained throughout the life cycle. Legacy systems may use equivalent system and functional diagrams until the next modification or milestone. AFPD 33-4, *Enterprise Architecting,* contains additional detail on implementation of architectures in the Air Force.

1.1.3.3. Requirements Development and Management. All requirements, including those derived from external DoDAF-compliant architectures and higher levels within the system, must be traceable and documented. The Chief/Lead Engineer is the PM's designated technical authority responsible for managing and approving the translation of users' capability-based requirements (ref. AFI 10-601) into achievable technical (design, interface, manufacturing, verification) requirements for the product or system.

1.1.3.4. Design. The Chief/Lead Engineer is responsible to ensure development of robust design solutions that balance technical and programmatic requirements, including considerations for additional capability increments. Robust designs are relatively insensitive to variations in manufacturing and operational environments, and accommodate change by incorporating attributes of scalability and expandability. Throughout sustainment, the Chief/Lead Engineer must ensure that the system does not deteriorate in robustness as a result of normal use or modifications.

1.1.3.5. Technical Management and Control. PMs and Chief/Lead Engineers must apply fundamental technical management processes (ref Defense Acquisition Guidebook, Para. 4.2.2.2) throughout the life cycle to integrate stakeholder efforts. They must simultaneously ensure that contractors, and other personnel supporting programs and technical efforts, adequately employ these processes. PMs and Chief/Lead Engineers must balance supportability, life cycle costs, performance, and schedule considerations in making program decisions.

1.1.3.5.1. Technical Reviews. Technical reviews assess design progress, technical risk, and program maturity at key points in the life cycle (ref Defense Acquisition Guidebook, Para. 4.5.8). For mature systems in sustainment, periodic reviews ensure system integrity. Reviews must be event-driven, with entrance and exit criteria established ahead of time as identified in the SEP. The PM and Chief/Lead Engineer (or designees) are responsible for co-chairing reviews, and identifying independent subject matter experts (SME) to participate as reviewers. All technical actions generated during reviews will be presented to the PM for approval via formal processes.

1.1.3.5.2. Technical Measurements. Programs and projects must use SE measurements in conjunction with reviews to monitor progress, assess risks, and identify potential problems. Typical measurements include technical performance measures (TPM), key performance parameters (KPP), leading indicators, and OSS&E characteristics. While some measures require significant user inputs, the Chief/Lead Engineer is responsible for overall management of technical measures.

1.1.3.5.3. Integrated Risk Management. Programs and projects must implement and document a risk management plan. Risk levels must be established and risk acceptance must be coordinated with the user in accordance with DoDI 5000.2. All risks must be identified, analyzed, mitigated, tracked, and controlled throughout the life cycle. The Chief/Lead Engineer is responsible for execution of the technical aspects of the risk management process.

1.1.3.5.4. Configuration Management (CM). Product and system characteristics,

including components, key processes, and methods used to verify compliance with design and performance requirements, must be documented. CM must include a change management process to approve and track changes and non-conformance to the configuration baselines. The PM is the decision authority for all changes to technical requirements, configurations, and baselines. The Chief/ Lead Engineer is responsible for implementation of the CM effort, and any decisions that the PM may delegate. The change management process must identify these authorities.

1.1.3.5.5. Data Management (DM). A structured DM process must be established in accordance with DoD 5010.12-M, *Procedures for the Acquisition and Management of Technical Data* and DoDD 8320.2, *Data Sharing in a Net Centric Department of Defense*. PMs and Chief/Lead Engineers must ensure data requested is consistent with the acquisition strategy, the solicitation, and sustainment planning.

1.1.3.5.6. Interface Management. Internal and external interface requirements for the system and its constituent elements must be established, documented, and managed. External interfaces must consider physical and functional interoperability and information exchange requirements with respect to constituent elements of SoS and families of systems (FoS). When properly documented, various operational and system architectural views will capture this information.

1.1.3.5.7. Decision Analysis. Key decisions must be based on clearly established criteria for trade studies or similar evaluations of alternatives. PMs and Chief/Lead Engineers must ensure that all studies, analyses, and decisions that impact the system architecture are documented in accordance with established Air Force Enterprise Architecture products and practices.

1.1.3.6. T&E/V&V. A structured T&E strategy and process must be established to provide early feedback to the requirements and acquisition processes according to AFI 99-103, *Capabilities-Based Test and Evaluation*, AFI 10-601, and AFI 63-101. When practicable, tests for different objectives should be combined, with the goal of more efficient test resource utilization. T&E/V&V activities should be integrated to the maximum extent possible to ensure early identification and resolution of deficiencies, minimize acquisition and operational risks, and ensure that fielded systems continue to perform as required in the face of changing operational requirements and threats.

1.1.4. Air Force SE Outcomes and Focus Areas. Robust products and systems that exhibit attributes of system security and OSS&E/Mission Assurance are a principal outcome of properly planned and applied SE. Further details on OSS&E/Mission Assurance appear in **Attachment 3**. Development, acquisition, and sustainment efforts must also address Environment, Safety, and Occupational Health (ESOH) Integration (**Attachment 4**); Human Systems Integration (HSI) (**Attachment 5**); Maintenance Engineering/Sustaining Engineering (ME/SE) (**Attachment 6**); Product and System Integrity (**Attachment 7**); and Software Engineering (**Attachment 8**). **Attachment 9** identifies additional technical considerations that carry varying degrees of weight during

the product/system life cycle. Early (pre-acquisition) SE and its relationship to Development Planning are discussed in **Attachment 10**.

1.2. System-of-Systems Engineering (SoSE). SoSE emphasizes interoperability among systems developed under different sponsorship, management, and primary acquisition processes. Families and systems of systems generally provide greater operational capability than individual systems alone can deliver. Among numerous other areas, SoSE must address HSI, architectures, and technical interoperability standards in order to ensure that the constituent systems will be compliant and compatible with interfacing systems in the FoS/SoS environment. It must also acknowledge that the configuration of the collective entity is dynamic.

1.3. Linkage to Capabilities-Based Assessment (CBA). The operational user or sponsoring organization (hereafter "sponsor"), generally a Major Command (MAJCOM), leads team efforts to identify capability gaps and shortfalls, and to identify potential solution approaches across the entire DOTMLPF (Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities) continuum. The sponsor prepares documentation required by the Joint Capabilities Integration and Development System (JCIDS) and in support of the Analysis of Alternatives (AoA). The implementing command provides technical subject matter experts (SMEs) to assist the sponsor, focusing on materiel approaches as well as materiel implications of DOT_LPF (non-materiel) approaches. The concept development organization (typically the Product Center XR) prepares other documentation required by the Defense Acquisition System in support of Materiel Development Decision (MDD) and other acquisition milestone (MS) reviews as needed.

1.4. Development Planning (DP). DP is the materiel contribution to AF or AF-led capability planning. DP collaboratively identifies and develops concepts (prospective materiel solutions) in response to operational capability needs, and provides early acquisition involvement in support of the lead command to ensure the launch of high-confidence programs. It considers the entire product/system life cycle (pre-concept to disposal) but brings its greatest leverage prior to the Materiel Development Decision (MDD).

1.4.1. Early Systems Engineering (Early SE). When tailored for the technical aspects of DP, the SE and SoSE processes in 1.1 and 1.2 are referred to as "Early SE," and are key mechanisms for accomplishing these activities prior to MDD and MS A.

1.4.2. Concept Characterization and Technical Description (CCTD). Concept developers (organizations and/or teams) and sponsors shall collaborate in developing and populating the Concept Characterization and Technical Description (CCTD) to capture decision-quality Early SE information about concepts (prospective materiel solutions) prior to the MDD and the AoA.

2. RESPONSIBILITIES AND AUTHORITIES

2.1. SAF/AQ will:

2.1.1. Appoint a Secretariat-level SE Technical Authority.

2.1.2. Ensure a rigorous SE approach is applied to development, integration, production, demonstration, T&E, V&V, and sustainment of concepts, technologies, systems, end

items, and FoS/SoS. This includes Early SE and DP activities in support of MDD and MS A.

2.1.2.1. Formulate policy and provide guidance for rigorous OSS&E assurance for Air Force operational systems and end items.

2.1.2.2. Coordinate with AF/A4/7 to ensure that applicable inspection, maintenance, maintenance training, supply, and repair source guidance addresses OSS&E assurance and preservation.

2.1.2.3. Formulate policy and provide guidance for DP in support of AF or AF-led CBA and early phases of acquisition. This includes analytical efforts associated with early DOTMLPF trade space characterization and concept evolution prior to MDD; it also covers transition of governance, management, and execution from DP to acquisition both before and after MS A.

2.1.3. Ensure PEOs, in conjunction with Lead/Using Commands, implement a disciplined life-cycle SE process that supports security/OSS&E/mission assurance of fielded systems by collaboration with operators, testers, maintainers, and sustainers (ref. AFI 63-101).

2.1.4. Ensure that all relevant risks and technical issues (including, but not necessarily limited to, those in Para. **1.2** and **Attachment 9**) are adequately addressed as part of the milestone review/decision process. This includes Early SE and DP activities in support of MDD and MS A.

2.1.5. Assign lead Air Force responsibility for Air Force elements of SoS. Develop Air Force SoSE processes and frameworks, in conjunction with SAF/XC, to include SoS integration and configuration, infrastructure experimentation, and provisional fielding.

2.1.6. Establish SE content of Air Force-level training requirements for PMs and SE practitioners.

2.1.7. Assure adequate maintenance of technical requirements documentation in support of SE implementation throughout the life cycle of Air Force systems and end items.

2.1.8. Ensure use of MIL-STD-882D System Safety methodology to integrate ESOH considerations into SE, in accordance with DoD policy.

2.1.9. Serve as acceptance authority for program ESOH risks classified “High” as defined by DoDI 5000.2.

2.1.10. Advise and assist SAF/XC in matters pertaining to SE aspects of IT Lean Process policy and guidance.

2.2. SAF/XC will:

2.2.1. Formulate architecture policy, guidance, and standards to facilitate the development of architecture data and integrated architectures to support the Air Force SE process.

2.2.2. Formulate policy for modeling and simulation (M&S) efforts, including but not limited to those performed in support of acquisition, T&E, training, and capability-based

analyses. Ensure M&S efforts conducted as part of the SE process employ commonly accepted standards and procedures.

2.2.3. Establish, with HQ USAF/A5, a linkage to capability objectives and solution sets identified in the Integrated Capabilities Review and Risk Assessment (I-CRRA) as innovations (*i.e.*, Battle Labs, ACTDs, JCTDs, etc.) and relevant Joint/Air Force experimentation programs associated with a capability. This linkage will ensure capabilities are captured in the Air Force Enterprise Architecture, help the Air Force make investment decisions, and provide additional guidance on SE and SoSE matters to PMs and PEOs.

2.2.4. Develop a framework to improve integration with Joint capabilities, and to explore and evaluate air and space effects supporting Joint combatant commanders' warfighting operations. The framework must include SoSE processes and strong SE principles, and must ensure Air Force IT systems are based on approved DoD IT Standards Registry (DISR) (DoD/Joint) interoperability standards in end-to-end SoS warfighting integration scenarios.

2.2.5. Direct IT Lean Process policy and guidance. In coordination with SAF/AQ, ensure that SE principles are reflected in the IT Lean Process to reinforce the application of robust SE to the IT lifecycle.

2.2.6. Develop and promulgate policy for certification and accreditation of systems.

2.3. HQ USAF/A3/5 will:

2.3.1. Direct that operational capabilities documents address applicable and appropriate life cycle requirements, i.e., HSI, OSS&E assurance, Military Flight Operations Quality Assurance (MFOQA), Aircraft Information Programs (AIP), system security, fuel efficiency, etc.

2.3.2. Direct users to preserve baselined OSS&E characteristics of systems and end items for OSS&E assurance, including operation of systems and end items in accordance with approved TOs and technical data. Require users to report any degradation of baselined characteristics, or any changes in operational configuration, usage, or environment, to the responsible PM.

2.3.3. Direct that operational training policy supports OSS&E assurance.

2.4. HQ USAF/A4/7 will :

2.4.1. Support a rigorous approach to OSS&E assurance for Air Force operational systems and end items in accordance with AF SE policy and guidance.

2.4.2. Establish, operate, and maintain Air Force logistics information systems to support assurance of OSS&E, and to allow PMs and Chief/Lead Engineers insight into the usage, maintenance, and reliability of Air Force operational systems and end items.

2.4.3. Support implementation of life cycle guidance that applicable inspection, maintenance, maintenance training, supply, and repair source guidance addresses OSS&E assurance and preservation.

2.4.4. Ensure appropriate guidance directs that provisions for systems and end items be procured to appropriate technical data including specifications and standards, and maintained in accordance with approved TOs and technical data.

2.5. HQ USAF/TE will:

2.5.1. Direct that T&E policy and program-specific documentation support application of SE practices throughout the system life cycle.

2.5.2. Ensure T&E directives and documentation support T&E of systems and end items for OSS&E throughout their operational life.

2.6. HQ AFSC/AF/SE will:

2.6.1. Provide relevant mishap reports, investigation information, and recommendations be provided to the responsible PM for a system or end item involved in a mishap.

2.6.2. Provide guidance to program SE personnel for reviewing and assessing safety analyses, and recommend potential areas for further investigation and analysis.

2.6.3. Advocate for System Safety support so program SE efforts include mishap prevention programs and integration of ESOH considerations. This includes ATD/ACTD/JCTD projects.

2.6.4. Recommend policy and formulate guidance for application of MFOQA to support assurance of OSS&E, and to allow PMs and Chief/Lead Engineers insight into operational use of the aircraft system.

2.7. Program Executive Officers (PEO) (for systems in their portfolio), Air Logistics Center (ALC) Commanders/Directors (for systems/programs managed at ALCs), and Test Center Commanders/Directors (for systems/programs managed at Test Centers) will:

2.7.1. Ensure use of a rigorous SE approach in all programs within their portfolio, emphasizing OSS&E assurance and awareness of FoS/SoS considerations. This includes Early SE and DP activities in support of MDD and MS A, and use of process improvement tools such as self-assessments.

2.7.2. Appoint a Chief Systems Engineer as established in DoDI 5000.02.

2.7.3. Assign SE responsibility, to include assurance of OSS&E of fielded systems, to the appropriate PM for all systems and end items delivered to the user.

2.7.4. Serve as acceptance authority for program ESOH risks classified “Serious” as defined by DoDI 5000.2.

2.7.5. Direct that program budgets include certification and accreditation activities throughout the lifecycle of the system.

2.8. PEO/DAO Chief Systems Engineer appointees shall:

2.8.1. Review SEPs in the portfolio and oversee their implementation.

2.8.2. Assess the performance of subordinate lead or chief systems engineers assigned to individual programs in conjunction with the PEO/DAO and PM.

2.8.3. Ensure implementation of approved technical planning, documentation, and strategies. This includes Early SE and DP activities in support of MDD and MS A, and regular use of process improvement tools such as self-assessments.

2.8.4. Ensure coordination of technical planning (SEPs, strategies, risk assessments, etc.) between the cognizant ALC and Product Center PMs for fielded systems undergoing modifications managed within the PEO/DAO portfolio.

2.8.5. Support their respective PEOs/DAOs and provide independent SE advice for a PEO/DAO portfolio.

2.8.6. Verify program technical review entrance and exit criteria are met (as defined by a program's SEP) and verify all technical reviews include independent subject matter experts. This role may be transferred to an authority outside the program (*e.g.*, Center-level Technical Authority) with PEO/DAO approval.

2.8.7. Ensure full and complete technical information, issues, and risk are communicated during program reviews.

2.9. Air Force Materiel Command (AFMC) and Air Force Space Command (AFSPC) will:

2.9.1. Direct policy that defines application of a rigorous SE approach to the acquisition and sustainment of FoS, SoS, and systems by their respective Centers and the Air Force Research Laboratory (AFRL). This includes Early SE and DP activities in support of MDD and MS A, and use of process improvement tools such as self-assessments.

2.9.2. Support programs by:

2.9.2.1. Providing independent subject matter experts for technical reviews.

2.9.2.2. Providing assistance in SEP development and review.

2.9.3. Appoint a MAJCOM-level SE Technical Authority for space (AFSPC) and non-space (AFMC) programs.

2.9.4. Ensure SE-based technology transition guidance promotes early collaboration with AFRL and other research establishments to facilitate smoother and more rapid transition of emerging technology. This includes documentation of trade space decisions for use in subsequent life cycle phases, and support to Lead MAJCOMs in development of Analyses of Alternatives (AoA).

2.9.5. Establish MAJCOM policy and guidance to address processes and technical data, including specifications and standards, for assuring preservation of baselined OSS&E characteristics of systems and end items. These processes and standards may be tailored to individual programs in the four Air Force product lines (aircraft, weapons, command and control [C2], and space), as well as to ALCs for FoS maintenance and sustainment issues. Ensure data acquisition systems are compatible with the Logistics Enterprise Architecture (LogEA) as established by HQ USAF/A4/7.

2.9.6. Establish MAJCOM policy and guidance to ensure that personnel assigned to perform SE duties, including Early SE and DP activities in support of MDD and MS A, at AFRL and Product, Specialized, Test, and Logistics Centers receive SE training commensurate with their responsibilities for SE, system security, and OSS&E/mission

assurance. This includes regular use of process improvement tools such as self-assessments.

2.9.7. Work with Lead/Using Commands to identify procedures and processes for defining appropriate technical baselines when ATD or ACTD/JCTD assets remain with an operational user. Designate responsibility for OSS&E assurance for these items.

2.9.8. Direct that PMs and Chief/Lead Engineers for programs, systems, and end items in sustainment continue rigorous application of SE principles, and that appropriate decision-makers assess all relevant aspects of SE performance during program reviews, with a focus on assuring OSS&E of those systems.

2.9.9. Provide governance of DP prior to MDD to ensure effective management and execution. Serve as DP Single Point of Entry (DP SPE) for sponsor requests for materiel resources to support DP efforts. Prioritize and allocate sponsor requests consistent with AF priorities and the command Mission Assignment Process, considering current workload and awareness of capacity and resource availability. Maintain cognizance of DP efforts for which there is no established program.

2.10. Program Managers (PM) will:

2.10.1. Direct implementation of rigorous SE practices as described in Chapter 1.

2.10.2. Ensure that all relevant technical planning is documented in a SEP. Approve the SEP for the program or project. Execute the technical aspects of the program or project in accordance with the approved SEP. Provide a draft SEP at Acquisition Strategy Panel (ASP) meetings in order to ensure that all participants understand the linkages between the program's technology risks, the chief engineer's plan to manage those risks, and how these factors are addressed in and impact the acquisition strategy.

2.10.3. Provide information on relevant technical issues to the MDA's designated SE Technical Authority as part of the acquisition decision process. For Early SE and DP activities in support of MDD and MS A, provide CCTDs and relevant technical information to the likely MDA's designated SE Technical Authority.

2.10.4. Provide information on all identified hazards, implemented mitigation measures, and accepted residual risks to testers, operators, trainers, and maintainers as part of testing and fielding new or modified systems or end items.

2.10.5. Provide to safety investigations analyses of hazards that contributed to Class A and Class B mishaps. Recommend materiel risk reduction measures, especially those that minimize potential human error.

2.10.6. Direct availability of the technical knowledge base for use in reporting, inspections, audits, future program efforts (e.g., out-year increments), or by other DoD entities.

2.10.7. Determine, document, track, and maintain positive control of all system baselines, including OSS&E baselines, in conjunction with Lead/Using Commands and other users. Ensure cost, schedule, performance, and product support impacts on other interdependent systems caused by baseline changes are communicated to all affected stakeholders and decision makers.

2.10.8. Establish and document relationships and responsibilities for OSS&E assurance, and management of OSS&E baselines, with other organizations that support or interface with systems or end items that they manage.

2.10.9. Identify all required certifications supporting initial use, full operation, and OSS&E of the system or end item. Ensure that all certifications are maintained in support of OSS&E assurance unless otherwise directed.

2.10.10. Serve as acceptance authority for program ESOH risks classified "Medium" or "Low" as defined by DoDI 5000.2.

2.10.11. Direct accomplishment of appropriate T&E/V&V to ensure all baseline requirements are met. Support necessary activities to enable continuation of OSS&E/mission assurance throughout the operational life of systems and end items that they manage.

2.10.12. Direct integration of ESOH risk management and SE in accordance with MIL-STD-882D. Risk acceptance decisions are to be made at the appropriate management level in accordance with DoDI 5000.2 or NSS 03-01.

2.10.12.1. Require reviews of risk assessments, mitigation measure selections, and residual risk acceptance decisions in technical and program reviews.

2.10.12.2. Ensure compliance with AF implementation requirements (32 CFR 989) for the National Environmental Policy Act (NEPA).

2.10.12.3. Ensure that risk analyses include risks to program cost, schedule, and performance from statutory and regulatory ESOH compliance, as well as risks resulting from routine system operations and maintenance (O&M) and from mishaps.

2.10.13. Provide selection criteria and recommendations to the selection authority for maintenance, supply, and repair sources when the PM is not the selection authority. Select and qualify sources when they are the selection authority.

2.10.14. Ensure that manufacturing, supply, and repair entities maintain accountability for producing and delivering quality products.

2.10.15. Ensure proper control of system or end item configurations. This includes assessment of OSS&E assurance for all supply items not directly procured by the program, and for changes initiated by Lead/Using Commands.

2.10.16. Use fielded performance data from Air Force maintenance, deficiency reporting, system integrity, operational instrumentation, and mishap reporting systems to continuously evaluate system and end item performance in support of OSS&E assurance.

2.10.17. Track and take appropriate action on mishap recommendations involving a managed system or end item to ensure OSS&E.

2.10.18. Ensure that Total Ownership Cost (TOC) impacts are considered when approving changes in design, operational use, configuration, maintenance procedures, or part substitutions.

2.10.19. Advocate technology insertion into the system or end item to optimize the balance of operation and support costs, performance, and sustaining OSS&E.

2.10.20. Maintain technical planning interfaces with anticipated receiving organization(s) when preparing to transition DP efforts after MDD.

2.11. Chief/Lead Engineers will:

2.11.1. Develop the technical strategy to support the overall acquisition strategy for the program or project. Document this strategy in the SEP.

2.11.2. Be responsible and accountable to the PM for consistent SE application throughout the product, system, or end item life cycle. This includes establishment, execution, management, and control of SE processes. This includes Early SE and DP activities in support of MDD and MS A, and regular use of process improvement tools such as self-assessments.

2.11.3. Provide information on relevant technical issues to the MDA's designated SE Technical Authority as part of the acquisition decision process. This includes Early SE and DP activities in support of MDD and MS A.

2.11.4. Develop, maintain, and preserve documentation of the technical knowledge base for use in reporting, inspections/audits, future program efforts (out-year increments), or by other DoD entities.

2.11.5. Implement a consistent and rigorous process for development, establishment, and control of technical requirements.

2.11.6. Develop and maintain the content of all required baseline technical data.

2.11.7. Be responsible and accountable to the PM for technical assessments for required certifications. Ensure these certifications are accomplished, or supporting documentation is available, before relevant need dates.

2.11.8. Maintain technical visibility of all components used in their systems, to include all supply items (*e.g.,* Defense Logistics Agency, Air Force, Navy, Army, etc.), and Lead/Using Command or Air Reserve Component initiated changes. Accountability or responsibility for system or end item performance may not be delegated. However, Chief/Lead Engineers may, during the operational life of their systems, delegate authority for technical activities to technically competent organic or contractor entities capable of performing those activities.

2.11.9. Ensure continuous evaluation of system and end item performance by using fielded performance data from Air Force maintenance systems, deficiency reporting systems, mishap reporting systems, operational instrumentation systems, and integrity programs.

2.11.10. Chair, or select appropriate designee(s) to chair, technical reviews and working groups. Approve independent SME participants nominated by program or project team members.

2.11.11. Ensure risk management and mishap recommendations involving a managed system or end item are tracked and acted upon to provide continuing OSS&E assurance.

2.11.12. Implement robust HSI and System Security Engineering (SSE) processes as part of the overall SE effort.

2.11.13. Ensure use of fielded system performance data to develop sustainment actions (*e.g.*, integrity programs, MFOQA, "Lead-the-Fleet" programs, inspections, maintenance, training, tests, HSI and ESOH risk assessments, etc.) to prevent OSS&E degradation.

2.11.14. Coordinate changes to HSI characteristics and OSS&E baselines with other Product and/or Logistics Centers when systems or end items involve more than one product line.

2.11.15. Use TO 00-35D-54, "USAF Deficiency Reporting, Investigating, and Resolution" to investigate and identify root cause of deficiencies. Ensure Deficiency Report closures include consideration of impacts to product quality, reliability, and OSS&E.

2.11.16. Maintain visibility of product quality at manufacturing, supply, and repair entities. Provide selection and qualification criteria for new sources of supply.

2.11.17. Monitor available data sources such as Federal Aviation Administration (FAA) Airworthiness Directives, advisories and alerts, Original Equipment Manufacturer service literature, the AF Deficiency Reporting System (G021), Government/Industry Data Exchange Program (GIDEP), AF safety mishap reporting system, etc., for information relevant to their engineering responsibilities.

2.11.18. Evaluate potential TOC impacts of changes in operational use, maintenance procedures, configuration, or part substitutions, including those recommended by external sources (Para. **2.11.17**).

2.11.19. Investigate areas for technology insertion into the system or end item to optimize the balance of O&S costs, performance, and maintaining OSS&E.

2.11.20. Coordinate technical planning (SEPs, strategies, risk assessments, etc.) with other cognizant PMs and Chief/Lead Engineers for fielded systems undergoing modifications managed at a Product Center.

2.11.21. Confer with the Center Test Authority on test-related issues as necessary.

2.12. Lead/Using Commands and other Air Force users will:

2.12.1. Submit requests for materiel (AFMC and AFSPC) resources in support of developing concepts to meet operational capability needs through the DP SPE for prioritization of resources and to ensure visibility of all stakeholder interests. Products may include, but should not be limited to, JCIDS documents and AoA Study Guidance/Plans (AFPD 10-6, AFI 10-601, and AFI 10-604).

2.12.2. Develop capability baselines in conjunction with Air Force SMEs and the PM.

2.12.3. Require coordination of any new operational change to the system or end item with the PM responsible for the system or end item.

2.12.4. Require coordination of any new or modified configuration or maintenance procedure with the PM responsible for the system or end item prior to implementation. Obtain PM approval of changes to configurations and maintenance procedures.

2.12.5. Require key personnel involved in requirements development and OSS&E baseline maintenance to be trained in a rigorous SE approach as described in Chapter 1.

2.12.6. Ensure that operation and maintenance training supports the continued use of systems and end items consistent with preservation of their OSS&E baselines.

2.12.7. Establish and maintain OSS&E baselines for systems or end items acquired directly.

2.12.7.1. Report any degradation of baselined characteristics to the responsible Command-designated individual or organization.

2.12.7.2. Direct policy and guidance to subordinate units to assure the preservation of baselined characteristics.

2.12.7.3. Establish processes and technical standards to assure the preservation of baselined characteristics.

2.12.8. Ensure that operators, testers, and maintainers apply Operational Risk Management (ORM) to systems and end items.

2.12.8.1. Use System Safety hazard data provided by the PM as the baseline for applying ORM to the system or end item.

2.12.8.2. Work with PMs responsible for systems and end items to assess newly identified hazards, or to reassess identified hazards where an identified risk appears to be incorrect or mitigation measures do not appear to be adequate.

2.12.9. Provide HQ USAF/A4/7 with a current listing of responsible organizations for managed systems and end items.

2.13. Air Education and Training Command (AETC) will:

2.13.1. Establish and maintain the Air Force Center for Systems Engineering (CSE) at the Air Force Institute of Technology (AFIT) to:

2.13.1.1. Promulgate and document case studies of SE implementation during concept definition, acquisition, and sustainment.

2.13.1.2. Facilitate collaborative SE efforts among DoD, the Services, Defense agencies, other Government organizations, industry, professional organizations, and academia.

2.13.1.3. Provide SE expertise for Advisory Boards and Review Panels.

2.13.1.4. Provide a forum to shape academic curricula for Air Force SE educators.

2.13.1.5. Facilitate SE education including graduate degrees, certificate programs, and professional continuing education.

2.13.1.6. Assist with development of Air Force guidance on SE processes and practices.

2.13.1.7. Recommend and coordinate with Air Force organizations on development of SE policy.

2.13.2. Ensure that operation and maintenance training courses provide instruction on the importance of OSS&E and ORM.

2.14. Center-Level Technical Authority appointees shall:

2.14.1. Identify cross-functional and cross-organizational teams to support Program Support Reviews (PSR); coordinate AF-led technical reviews and processes (*e.g.*, Technology Readiness Assessments (TRA), SEP reviews, technical risk assessments, and assessments of manufacturing readiness) with SAF/AQR; report review findings to SAF/AQR in support of Air Force Review Boards (AFRB).

2.14.2. Ensure coordination of technical planning (SEPs, strategies, risk assessments, etc.) between the cognizant ALC and Product Center PMs for fielded systems undergoing modifications managed by a Product Center.

2.14.3. Assist PEOs/DAOs in the appointment of Chief Systems Engineers, and assess performance of PEO/DAO Chief Systems Engineers assigned to a Center, in conjunction with the applicable PEO/DAO.

2.14.4. Assess the adequacy of and adherence to Center-level and higher HQ-level SE policies, practices, guidance, tools, education, and training.

Sue C. Payton
Assistant Secretary of the Air Force for Acquisition

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFPAM 63-1701, *Program Protection Planning*

AFPD 33-4, *Enterprise Architecting*

AFPD 60-1, *Air Force Standardization Program*

AFPD 61-1, *Management of Science and Technology*

AFPD 63-1, *Capability Based Acquisition System*

AFPD 63-5, *Quality Assurance*

AFPD 63-10, *Aircraft Structural Integrity*

AFPD 63-11, *Modification System*

AFPD 63-12, *Assurance of Operational Safety, Suitability, and Effectiveness*

AFPD 63-17, *Technology and Acquisition Systems Security Program Protection*

AFI 10-601, *Capabilities-Based Requirements Development*

AFI 14-205, *Geospatial Information and Services (GI&S)*

AFI 20-101, *Product Support Strategic Planning Procedures*

AFI 21-104, *Selective Management of Selected Gas Turbine Engines*

AFI 21-118, *Improving Air and Space Equipment Reliability and Maintainability*

AFI 60-101, *Materiel Standardization*

AFI 60-106, *The United States Air Force International Military Standardization Program*

AFI 63-101, *Operations of the Capabilities-Based Acquisition System*

AFI 63-107, *Integrated Product Support Planning and Assessment*

AFI 63-1001, *Aircraft Structural Integrity Program*

AFI 90-901, *Operational Risk Management*

AFI 91-202, *The U.S. Air Force Mishap Prevention Program*

AFI 91-204, *The U.S. Air Force Safety and Investigation Reporting System*

AFI 99-103, *Capabilities-Based Test and Evaluation*

CJCSI 3170.01, *Joint Capabilities Integration and Development System*
http://www.dtic.mil/cjcs_directives/cdata/unlimit/3170_01.pdf

Defense Acquisition Guidebook **http://akss.dau.mil/dag/DoD5000.asp?view=document**

DoD 4120.24-M, *Defense Standardization Program Policies and Procedures*
http://www.dtic.mil/whs/directives/corres/html/412024m.htm

DoDD 5000.1, *The Defense Acquisition System*
http://akss.dau.mil/dag/DoD5000.asp?view=document&doc=1

DoDI 5000.2, *Operation of the Defense Acquisition System*
http://akss.dau.mil/dag/DoD5002/Subject.asp

DoD 5010.12M, Procedures for the Acquisition and Management of Technical Data
http://www.dtic.mil/whs/directives/corres/pdf/501012m_0593/p501012m.pdf

DoDD 8000.1, Management of DoD Information Resources and Information Technology
http://www.dtic.mil/whs/directives/corres/html2/d80001x.htm

Guidance for the Use of Robust Engineering in Air Force Programs
http://cse.afit.edu/docs/SE Guide Final 6 Jan R2 Robust Engineering.pdf

Implementing Systems Engineering Plans in DoD – Interim Guidance
http://www.acq.osd.mil/ds/se/publications.htm

Integrated Master Plan and Integrated Master Schedule Preparation and Use Guide
http://www.acq.osd.mil/ds/se/ed/publications/IMP_IMS_Guide_v9.pdf

IT Lean Guidebook **https://www.safxc.hq.af.mil/Lean_Reeng/Guidebook.htm**

Manufacturing Development Guide **http://engineering.wpafb.af.mil/mdg/mdg.asp**

MIL-STD-882D, *Department of Defense Standard Practice for System Safety*
https://www.afmc-mil.wpafb.af.mil/HQ-AFMC/SE/docs/systems/882d.pdf

National Security Space (NSS) Acquisition Policy 03-01
https://www.safus.hq.af.mil/usa/usap/space/documents/nss_acq_pol-icy03-01%2027%20Dec_signed_update.pdf

Policy Addendum for Systems Engineering **http://www.acq.osd.mil/se/publications.htm**

Policy for Implementing Systems Engineering in DoD
http://www.acq.osd.mil/se/publications.htm

Systems Engineering Plan (SEP) Preparation Guide
http://www.acq.osd.mil/se/publications.htm

SEP Focus Areas for Technical Planning **http://www.acq.osd.mil/se/publications.htm**

TO 00-35D-54, "USAF Deficiency Reporting, Investigation, and Resolution"
http://www.tinker.af.mil/shared/media/document/AFD-061214-036.pdf

References for the Practice and Management of SE

MIL-STD-499B, *Systems Engineering* (not released)

EIA-632, *Processes for Engineering a System*

IEEE 1220, *Application and Management of the Systems Engineering Process*

ISO 15288, *System Life Cycle Processes*

Abbreviations and Acronyms

ACAT—Acquisition Category

ACTD—Advanced Concept Technology Demonstration

AETC—Air Education and Training Command

AFI—Air Force Instruction

AFIT—Air Force Institute of Technology

AFMC—Air Force Materiel Command

AFPD—Air Force Policy Directive

AFRL—Air Force Research Laboratory

AFSPC—Air Force Space Command

AIP—Aircraft Information Program

ALC—Air Logistics Center

AoA—Analysis of Alternatives

ASP—Acquisition Strategy Panel

ATD—Advanced Technology Demonstration

C2—Command and Control

C4ISR—Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance

CDD—Capability Development Document

CM—Configuration Management

COTS—Commercial Off-The-Shelf

CPD—Capability Production Document

CSE—Center for Systems Engineering

DISR—DoD IT Standards Registry

DM—Data Management

DoD—Department of Defense

DoDAF—DoD Architecture Framework

DoDD—DoD Directive

DoDI—DoD Instruction

EIA—Electronic Industries Alliance

EMC—Electromagnetic Compatibility

ESOH—Environment, Safety, and Occupational Health

HAF—Headquarters Air Force

FAA—Federal Aviation Administration

HAF—Headquarters Air Force

HSI—Human Systems Integration

ICD—Initial Capabilities Document

I-CRRA—Integrated Capabilities Review and Risk Assessment

IEEE—Institute of Electrical and Electronics Engineers

IMP—Integrated Master Plan

IMS—Integrated Master Schedule

ISO—International Standards Organization

IT—Information Technology

JCIDS—Joint Capabilities Integration and Development System

JCTD—Joint Concept Technology Demonstration

KDP—Key Decision Point

KPP—Key Performance Parameter

LCMP—Life Cycle Management Plan

LSE—Logistics Support Element

M&S—Modeling and Simulation

MAJCOM—Major Command

MDA—Milestone Decision Authority

ME/SE—Maintenance Engineering / Sustaining Engineering

MFOQA—Military Flight Operations Quality Assurance

MIL-STD—Military Standard

MOSA—Modular Open Systems Approach

MS—Milestone

NDI—Non-Developmental Item

NEPA—National Environmental Policy Act

NSS—National Security Space

O&M—Operations and Maintenance

O&S—Operations and Support

ORM—Operational Risk Management

OSJTF—Open Systems Joint Task Force

OSS&E—Operational Safety, Suitability, and Effectiveness

PESHE—Programmatic Environment, Safety, and Occupational Health Evaluation

PEO—Program Executive Officer

PGM—Product Group Manager

PM—Program Manager

PSMP—Product Support Master Plan

RDS—Records Disposition Schedule

RF—Radio Frequency

RMP—Risk Management Plan

S&T—Science and Technology

SCM—Supply Chain Manager

SE—Systems Engineering

SEP—Systems Engineering Plan

SME—Subject Matter Expert

SoS—System of Systems

SoSE—System of Systems Engineering

SPM—System Program Manager

SSE—System Security Engineering

SSM—System Support Manager

TEMP—Test and Evaluation Master Plan

T&E—Test and Evaluation

TCTO—Time Compliance Technical Order

TO—Technical Order

TOC—Total Ownership Cost

TPM—Technical Performance Measure

URL—Uniform Resource Locator

V&V—Verification and Validation

Terms

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

Baseline—A description of any system or end item, with associated limitations, must be understood, acknowledged, and maintained during operational deployment, use, experimentation, exercises, training, and maintenance of the system or end item. The baseline is established in development and updated as changes (threat, operational usage, aging, etc.) and improvements are made to the system or end item. The baseline generally includes configuration data (specifications, drawings, and software code listings), capabilities documents, TOs, Time Compliance Technical Orders (TCTO), certifications, training, maintenance facilities, spare parts, threat scenarios, etc.

End Item—Equipment that can be used by itself to perform a military function. A final product when assembled or completed, and ready for issue/deployment.

Family of Systems (FoS)—A set of systems that provides similar capabilities through different approaches to achieve similar or complementary effects, *e.g.*, track moving targets. A FoS could include unmanned or manned aerial vehicles with appropriate sensors, a space-based platform, or a special operations capability. Each family member can provide a degree of capability with differing characteristics of persistence, accuracy, timeliness, etc. (CJCSI 3170.01).

Human Systems Integration (HSI)—A disciplined, unified, and interactive systems engineering approach to integrate human considerations into system development, design, and life cycle management to improve total system performance and reduce costs of ownership. The major categories or domains of HSI are: manpower, personnel, training, human factors engineering, safety and occupational health, survivability, and habitability.

Integrated Program Summary (IPS)—For space programs, the IPS provides a concise record that documents accomplishments, status, and plans at each KDP and Build Approval. The IPS consolidates a minimum set of pre-approved material (*e.g.*, capability documents, acquisition strategy, Test and Evaluation Master Plan [TEMP]) with newly generated material that covers relevant subject matter; it serves as the starting point for independent program reviews. Enclosure 4 to NSS 03-01 contains details of IPS content.

Interoperability—The ability of systems, units, or forces to provide data, information, materiel, and services to, and accept (receive) the same from, other systems, units, or forces; and to use the data, information, materiel, and services so exchanged to enable them to operate effectively together. Examples include weapons that use the same size ammunition in order to use common stocks, or compatible nozzles and receptacles to permit ground and in-flight refueling of other nations' aircraft. Other examples include network-centric Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) systems that describe their output information with tagged meta-data, searchable by users who can find and pull it from anywhere on the network.

IT Lean Process—The IT Lean Process is a streamlined acquisition process for IT that establishes clearly defined phases, activities, and decision points. It is based on the DoD 5000 process, but is streamlined to accommodate the need to rapidly develop and field IT systems.

Logistics Support Elements (LSE)—LSEs encompass the logistics services, materiel, and transportation required to support continental United States-based and worldwide-deployed forces (CJCSI 3170.01). They include: maintenance planning; manpower and personnel; supply support; support equipment; technical data; training and training support; computer resources support; facilities; packaging, handling, storage, and transportation; and design interface.

Milestone Decision Authority (MDA)—The designated individual with overall responsibility for a program. The MDA has the authority to approve entry of an acquisition program into the next phase of the acquisition process, and is accountable for cost, schedule, and performance reporting to higher authority, including congressional reporting (DoDD 5000.1).

Mission Assurance—An integrated engineering-level assessment of analysis, production, verification, validation, operation, maintenance, and problem resolution processes performed over the lifecycle of a program by which an operator/user determines that there is an acceptable level of risk to employment of a system or end item to deliver an intended capability in an

intended environment. The objective of the assurance process is to identify and mitigate design, production, and test deficiencies that could impact mission success.

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.

OSS&E Baseline—A description of the OSS&E characteristics and limitations of any system, system increment, end item, or end item increment that must be understood, acknowledged and maintained during operational use, deployment, experimentation, exercises, training, and maintenance of the system or end item. The OSS&E baseline is established in development and updated as changes (threat, operational usage, aging, etc.) and improvements are made to the system or end item. The OSS&E baseline can include the configuration baseline (specifications, drawings, and software code listings), capability documents, TOs, certifications, training, maintenance facilities, spare parts, threat scenarios, etc.

Programmatic Environment, Safety, and Occupational Health Evaluation (PESHE)—The PESHE documents the status of ESOH hazard identification, assessment, mitigation, verification, and residual risk assessment, and the National Environmental Policy Act (NEPA) compliance schedule. It describes the PM's strategy for integrating across the ESOH disciplines and into systems engineering using MIL-STD-882D System Safety methodology, provides a repository for ESOH risk data, and provides a method for tracking progress.

Program Manager (PM)—The individual specifically designated to be responsible for the life cycle management of a system or end item. The program manager is vested with full authority, responsibility, and resources to execute and support an approved Air Force program. The PM is accountable for credible cost, schedule, and performance reporting to the MDA (DoDD 5000.1).

Science and Technology (S&T)—The Air Force S&T Program contains all basic and applied research efforts, and advanced technology development efforts that are executed by AFRL (AFPD 61-1).

System—A specific grouping of subsystems, components, or elements designed and integrated to perform a military function.

System of Systems (SoS)—A set or arrangement of interdependent systems that are related or connected to provide a given capability; the loss of any part of the system will significantly degrade the performance or capabilities of the whole (CJCSI 3170.01). A configuration of systems in which component systems can be added or removed during use; each provides useful services in its own right; and each is managed for those services. As a single entity, generally irrespective of configuration, the SoS exhibits synergistic, transcendent capabilities.

System-of-Systems Engineering (SoSE)—The process of planning, analyzing, organizing, and integrating the capabilities of a mix of existing and new systems into an SoS capability that is greater than the sum of the capabilities of the constituent parts. SoSE emphasizes interoperability among systems developed under different sponsorship, management, and primary acquisition processes.

System Security Engineering—SSE is the vehicle for integrating security into the overall SE process. The purpose of SSE is to eliminate, reduce, or control through engineering and design any characteristics that could result in the deployment of systems with operational security

deficiencies. It helps identify, evaluate, and eliminate or contain system vulnerabilities to new or postulated security threats in the operational environment. SSE must be applied to new acquisition efforts (including off-the-shelf and non-developmental items) and to modifications of existing systems and end items, in order to minimize the operational costs of protecting deployed systems. An SSE program that supports economical achievement of overall program objectives, and takes into account the strategy outlined in the Program Protection Plan, should be in place no later than the Technology Development phase. SSE must be integrated into all other technical planning, and should be documented in the program SEP.

Systems Engineering (SE)—An interdisciplinary approach encompassing the entire set of scientific, technical, and managerial efforts needed to evolve, verify, deploy, and support an integrated and life-cycle-balanced set of system solutions that satisfy customer needs. **Figure A1.1** and **Figure A1.2** are two common graphical representations of the SE process, as applied to development of a product or system from a set of defined requirements.

System Safety—The DoD SE methodology for integrating environment, safety, and occupational health considerations as documented in MIL-STD-882D, Department of Defense Standard Practice for System Safety.

Figure A1.1. Systems Engineering "Engine" (from DAU).

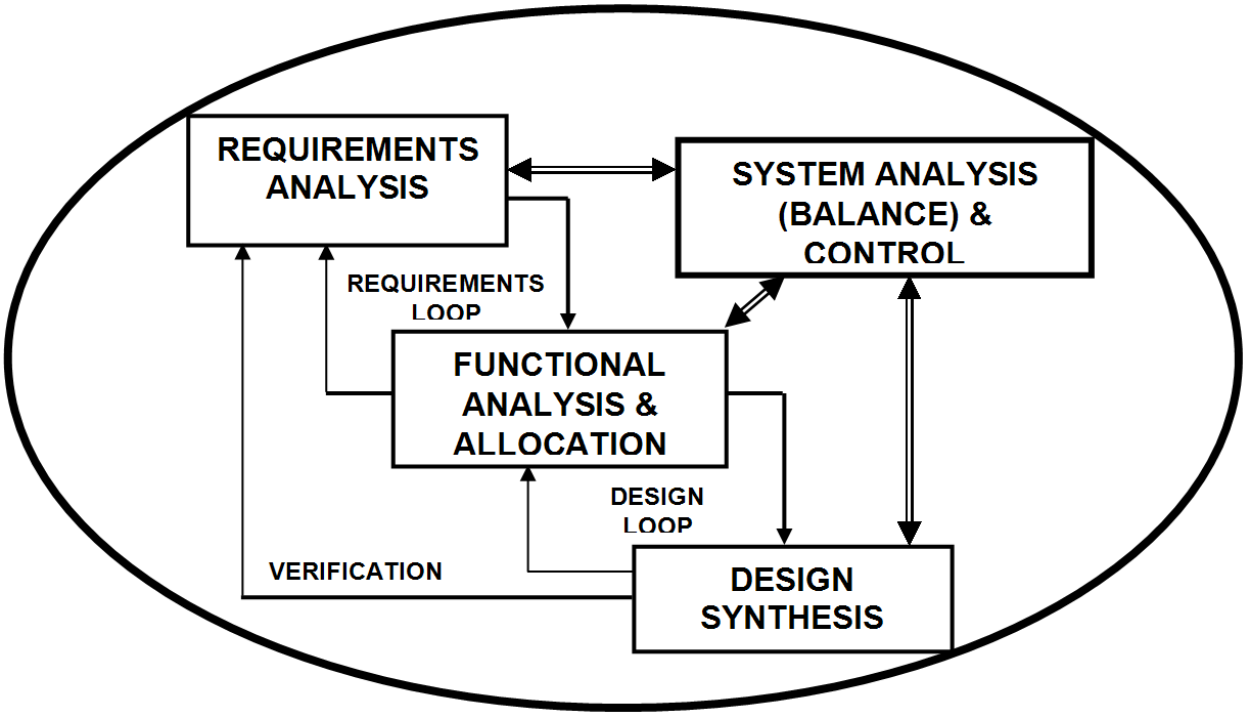
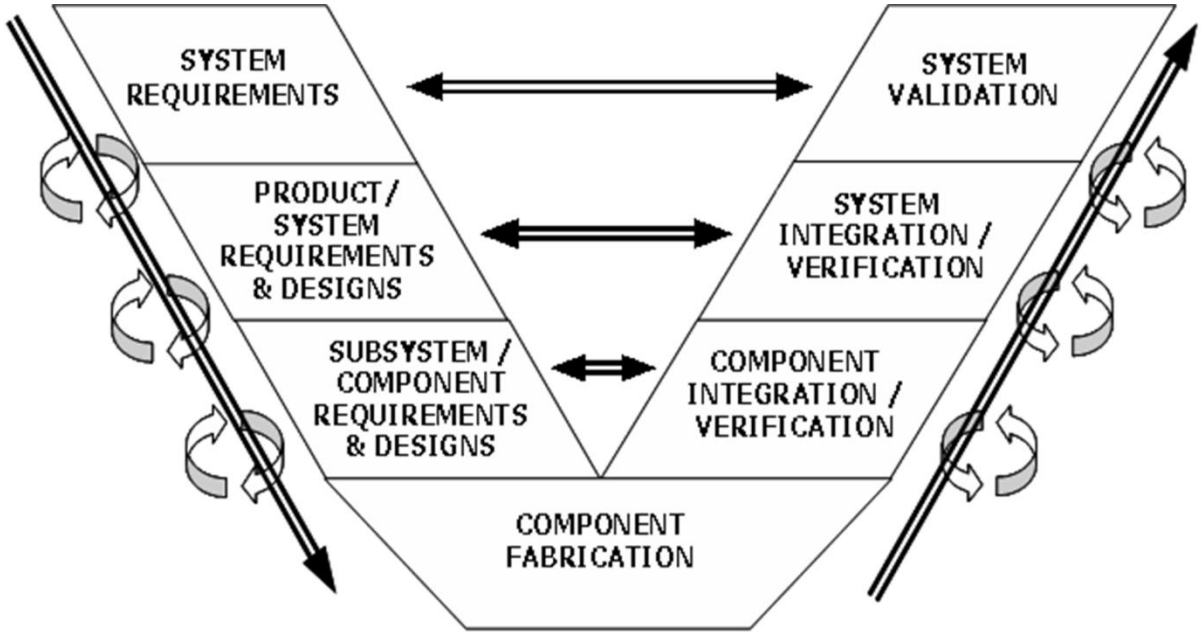


Figure A1.2. Systems Engineering "V" Diagram (adapted from Forsberg and Mooz).


SYSTEM
REQUIREMENTS
SYSTEM
VALIDATION
PRODUCT/
SYSTEM
REQUIREMENTS
& DESIGNS
SYSTEM
INTEGRATION /
VERIFICATION
SUBSYSTEM /
COMPONENT
REQUIREMENTS
& DESIGNS
COMPONENT
INTEGRATION /
VERIFICATION
COMPONENT
FABRICATION

Attachment 2

SEP SUBMITTAL AND SIGNATURE REQUIREMENTS

Life Cycle Phase / Event	Pre-Acquisition Effort	Acquisition Program (1) (all ACAT)	Sustainment Activity (non-ACAT) (1, 2)	
			SPMs/SSMs (3)	PGMs/SCMs (3)
All ASPs (Draft copy)	X	X	X	X
Concept Decision	X			
All Milestone (MS) / Key Decision Point (KDP) Reviews		X		
SEP Reviews / Updates (2, 4)	X	X	X	X
Signatories (initial submittals and updates)				
CE (5)	X	X	X	X
PM (5)	X	X	X	X
Center SE Technical Authority	X	X	X	X
PEO		X		
Center Commander/Director	X		X	
SAE		X (6,7)		
DAE		X (8)		

NOTE:

1. All programs that are Post-MS/KDP C require a SEP, regardless of whether program management responsibility is assigned to a Product Center or a Logistics Center.

2. Consistent with AFI 63-1101 Para. 1.2.3, SEPs are not required for programs scheduled for final decommissioning within five years of the date of this AFI. Programs with a SEP in place are exempt from annual reviews/updates within five years of scheduled final decommissioning; however, execution of SEP efforts shall continue through decommissioning.

3. SPM - System Program Manager; SSM - System Support Manager; PGM - Product Group Manager (including software); SCM - Supply Chain Manager.

4. Annual SEP review is mandatory. Significant program changes (*e.g.*, supplier/subcontractor, organization, funding, etc.) require a SEP update, with signature requirements determined locally.

5. "CE" is assigned Chief Engineer/Lead Engineer (designated project/capability manager for pre-acquisition efforts); "PM" is Program Manager (assigned SSM, PGM, or SCM for ALC efforts).

6. SEP shall be coordinated through SAF/AQR and the cognizant HAF Capability Directorate.

7. ACAT I and non-delegated ACAT II programs only.

8. ACAT ID/IAM programs only; DoD Space MDA is final signatory for space programs.

Attachment 3

OPERATIONAL SAFETY, SUITABILITY, AND EFFECTIVENESS (OSS&E) / MISSION ASSURANCE

A3.1. Organizations responsible for preserving OSS&E of Air Force systems or end items must ensure that operational use, configuration changes, maintenance repairs, aging, part substitutions, and similar activities and events do not degrade baselined characteristics of systems or end items over their operational life.

A3.1.1. OSS&E addresses:

A3.1.1.1. Operational Safety. The condition of having acceptable risk to life, health, property, and environment caused by a system or end item when employing that system or end item in an operational environment. This requires a formal risk management process (Para. **1.1.3.5.3**).

A3.1.1.2. Operational Suitability. The degree to which a system or end item can be placed satisfactorily in field use, with consideration given to availability, compatibility, transportability, interoperability, reliability, maintainability, wartime use rates, full-dimension protection, operational safety, human factors, architectural and infrastructure compliance, manpower supportability, logistics supportability, natural environmental effects and impacts, and documentation and training requirements.

A3.1.1.3. Operational Effectiveness. The overall degree of mission accomplishment of a system or end item used by representative personnel in the environment planned or expected (*e.g.*, natural, electronic, threat) for operational employment, considering organization, doctrine, tactics, information assurance, force protection, survivability, vulnerability, and threat (including countermeasures; initial nuclear weapons effects; and nuclear, biological, and chemical contamination threats).

A3.1.2. OSS&E baselines must be documented and maintained for the entire operational life of the product, system, or end item.

A3.1.2.1. Planning to establish and maintain the initial OSS&E baseline should be documented in the program SEP submitted for Milestone/KDP B. The planning must be updated in the SEP submitted for Milestone/KDP C, and the initial baseline definition must be included with this submittal. The baseline must identify training, inspection, and maintenance procedures.

A3.1.2.2. OSS&E baselines must be updated to reflect any modifications or changes to the product, system, or end item. "Modification" includes demilitarization of items that may be reconstituted for return to service, or weapon systems that may be cannibalized for parts.

A3.1.2.3. Preservation of baseline OSS&E characteristics includes ensuring the currency and accuracy of training, inspection, and maintenance procedures.

A3.1.3. Operators, maintainers, sustainers, and other personnel responsible for accomplishing tasks associated with assuring OSS&E must:

A3.1.3.1. Link the SE System Safety process with operators' and maintainers' application of Operational Risk Management (ORM), and investigation and reporting of mishaps involving the system.

A3.1.3.2. Ensure that operators and maintainers are properly trained, using approved procedures, to preserve OSS&E baselines.

A3.1.3.3. Maintain products and systems according to approved Technical Orders (TO).

A3.1.3.4. Ensure availability of current, valid, verified TOs and technical data to Lead/Using Commands and other users.These documents must clearly identify procedures and requirements necessary to preserve OSS&E baselines, and any operational limitations of systems or end items.

A3.1.3.5. Use only parts approved by the PM (or Chief/Lead Engineer, as delegated) in the system.

A3.1.3.6. Obtain and maintain all required certifications, (*e.g.*, airworthiness, space flightworthiness, SEEK EAGLE, Information Assurance, Nuclear Surety, Non-Nuclear Munitions Safety Board, Force Protection, Interoperability, etc.) prior to system or end item operational use. Certifications are directed under separate, standalone Air Force policy and guidance.

A3.1.3.7. Maintain and document configuration control of the system.

A3.1.3.8. Report any required changes in use or maintenance to the PM.

A3.1.3.9. Document and track faults for trend analysis.

A3.1.3.10. Analyze ESOH mishap data.

A3.1.3.11. Actively monitor health of aging systems or end items by applying fully integrated efforts to assess the ongoing integrity of critical aspects, and support fleet viability assessments.

A3.1.3.12. Initiate modifications/improvements necessary to assure OSS&E.

A3.1.3.13. Ensure approved testing is completed, and identified deficiencies are corrected or accepted by the user, before validating OSS&E baselines.

A3.1.4. Additional OSS&E considerations include:

A3.1.4.1. Integrity Programs. PMs must ensure that effective and integrated integrity programs are designed into and implemented on all new or modified systems (Para. **1.1.4**).

A3.1.4.2. Military Flight Operations Quality Assurance (MFOQA). PMs must assure that effective and integrated MFOQA programs are designed into and implemented on all new or modified systems.

A3.1.4.3. Inspections and Maintenance. Inspections and maintenance procedures must be reviewed to prevent OSS&E degradation. This includes use of fielded system or end item performance data to maintain OSS&E.

A3.1.4.4. Deficiency Reporting (DR). A DR program (TO 00-35D-54) ensures that all validated Deficiency Reports are tracked to actual resolution of the deficiency. A critical

characteristic of a robust DR process is the timeliness with which the PM ensures that deficiencies are resolved. Deficiencies must not be formally closed until resolved to the satisfaction of the originator.

A3.1.4.5. Technology Demonstrations. OSS&E restrictions or limitations must be provided for Advanced Technology Demonstration (ATD), Advanced Concept Technology Demonstration (ACTD), Joint Concept Technology Demonstration (JCTD), and experimental leave-behind systems and end items. Organizations responsible for preservation of OSS&E baselines must be identified for any items left with a user for continued operations (Para. **2.9.7**).

Attachment 4

ENVIRONMENT, SAFETY, AND OCCUPATIONAL HEALTH (ESOH) INTEGRATION

A4.1. ESOH considerations must be integrated into the SE process using MIL- STD- 882D system safety practices. SE ESOH efforts must appear in the SEP, the Risk Management Plan (RMP), and the Programmatic Environment, Safety, and Occupational Health Evaluation (PESHE). The initial SEP must identify the basic strategy to integrate ESOH into SE; PESHE elements should be incorporated into the RMP and the IMP/IMS.

A4.1.1. ESOH hazards (including hazardous materials usage) must be eliminated where practicable, and risks minimized where the hazards cannot be eliminated. An ESOH hazard tracking system must be used to record identified hazards, initial risk assessments, risk mitigation measures, residual risk levels, and residual risk acceptance decisions throughout the life of the program.

A4.1.2. ESOH risks include those resulting from routine system operations and maintenance (O&M) and mishaps, as well as risks to program cost, schedule, and performance from requirements to comply with ESOH laws and regulations. Technical and program reviews must include ESOH risk management status.

A4.1.3. The PESHE documents the status of ESOH hazard tracking, and the National Environmental Policy Act (NEPA) compliance schedule. It describes the PM's strategy for integrating across the ESOH disciplines into SE, provides a repository for ESOH risk data, and provides a method for tracking progress.

Attachment 5

HUMAN SYSTEMS INTEGRATION (HSI)

A5.1. HSI considers all human-related domains in an integrated manner. It must be addressed throughout the life cycle, and must be consistently integrated into SE implementation to balance total system performance (hardware, software, and human), OSS&E assurance, survivability, safety, and affordability. HSI employs human factors engineering to design systems that effectively utilize manpower; provide effective training; can be operated and maintained by users; and are suitable (habitable and safe with minimal environmental and occupational health hazards) and survivable (for both the crew and equipment). Additional HSI information appears in DoDI 5000.2, Chapter 6 of the Defense Acquisition Guidebook, and the LCMP (AFI 63-107).

A5.1.1. PMs and Chief/Lead Engineers must establish a comprehensive plan early in the acquisition process to address HSI factors in balancing system performance with TOC, and to ensure that product/system designs accommodate the characteristics of the user population that will operate, maintain, and support them. HSI planning should define the division of roles and responsibilities with ESOH for the overlapping domains of safety and occupational health. HSI planning should be documented in the SEP.

A5.1.2. HSI must be included in all key acquisition documents.

A5.1.3. All HSI-related specialty engineering activities must be fully integrated into the SE processes to address the needs of the human-in-the-loop aspects of the system being developed, with specific emphasis on O&M considerations.

A5.1.4. HSI requirements must be considered as either functional or performance capabilities during trade studies.

A5.1.5. HSI requirements must be tested and evaluated with appropriate feedback mechanisms for assuring OSS&E.

A5.1.6. Technical requirements must include HSI performance metrics.

Attachment 6

MAINTENANCE ENGINEERING / SUSTAINING ENGINEERING (ME/SE)

A6.1. PMs and Chief/Lead Engineers must employ ME/SE principles. ME/SE involves the review, assessment, definition, and resolution of hardware deficiencies revealed throughout the life cycle, including development and production as well as operational service. ME/SE returns the item to existing specified performance requirements. Typical ME/SE activities include:

A6.1.1. Identification of Deficiencies. PMs and Lead/Using Commands must identify technical and supportability deficiencies on operational systems (AFI 21-104, AFI 21-118, AFI 63-501, and TO 00-35D-54).

A6.1.2. Analysis and Development of Corrective Action. PMs must analyze identified deficiencies to determine the cause and develop corrective action options. They must determine if the problem is a system deficiency, and must assess the potential for correcting the problem. This assessment typically includes a business case analysis or economic analysis to determine the relative life cycle costs associated with various corrective action strategies and options.

A6.1.3. Implementation of Corrective Actions. Funded corrective actions derived from ME/SE activities, whether addressing configuration or maintenance issues, must include OSS&E verification requirements, and must be approved by the PM for incorporation into fielded systems. Managers of ME/SE projects must collaborate with the PM and Chief/Lead Engineer of the affected system in project planning and implementation.

A6.1.4. Metrics. ME/SE metrics must be indicators of the overall sustainment health of a system.

Attachment 7

PRODUCT AND SYSTEM INTEGRITY

A7.1. The integrity process provides life management analyses and data necessary to maintain OSS&E by planning for operational support activities that monitor and report on system safety, suitability, and effectiveness characteristics. Weapon system integrity programs ensure that system-level performance and safety requirements will be met under any combination of design usage environments throughout the operational life of a system. PMs and Chief/Lead Engineers must:

A7.1.1. Establish, evaluate, and substantiate the system (airframe, weapon, space, missile, C2, etc.) integrity to preserve OSS&E.

A7.1.2. Acquire, evaluate, and apply operational usage data to provide a continual update of system integrity.

A7.1.3. Provide quantitative information for decisions on force structure planning, inspection and modification priorities, and related operational and support decisions.

A7.1.4. Provide a basis for improving system integrity criteria and methods of design, evaluation, and substantiation for future systems and modifications.

A7.1.5. Provide a fully integrated monitoring system that includes all relevant aspects of system integrity, *e.g.*, aircraft structures, engine structures, mechanical equipment and subsystems, avionics/electronics.

Refer to the following documents:

AFPD 63-10, *Aircraft Structural Integrity*

AFI 63-1001, *Aircraft Structural Integrity Program*

MIL-STD-1530, "Aircraft Structural Integrity Program"

MIL-HDBK-515 (USAF), "Weapon System Integrity Guide (WSIG)"

MIL-HDBK-1783, "Engine Structural Integrity Program"

MIL-HDBK-1798A, "Mechanical Equipment and Subsystems Integrity"

MIL-HDBK-87244 (USAF), "Avionics/Electronics Integrity"

Attachment 8

SOFTWARE ENGINEERING

A8.1. Software engineering and acquisition considerations must be addressed throughout the product or system life cycle, beginning with pre-Milestone/KDP A activities, and must be documented in the SEP. Software engineering practitioners and managers must:

A8.1.1. Estimate software development and integration efforts at high (80-90%) confidence levels.

A8.1.2. Ensure baselines are realistic and compatible with the Expectation Management Agreement for the program or project.

A8.1.3. Manage computer systems and software-specific risks as an integral part of the program risk management process.

A8.1.4. Identify software-related strengths, weaknesses, and experience for all developer team members with significant software development responsibilities.

A8.1.5. Ensure developer teams apply effective software development processes.

A8.1.6. Ensure the program office supports developer teams.

A8.1.7. Collect and analyze Earned Value Management data at the software level.

A8.1.8. Employ a core set of basic software metrics.

A8.1.9. Plan and develop life cycle software support capabilities and options.

A8.1.10. Support the transfer of lessons learned to future programs by providing feedback to affected organizations.

Attachment 9

ADDITIONAL SE PROGRAM AREAS OF CONSIDERATION

This list is not all-inclusive. Items are listed alphabetically to eliminate any perception of relative importance. PMs and Chief/Lead Engineers must ensure that these considerations are addressed as part of SE implementation (refer to Para. **1.1.3**), or provide rationale for their elimination.

A9.1. Aircraft Information Programs (AIP)

A9.2. Commercial Off-The-Shelf (COTS)/Non-Developmental Items (NDI)

A9.3. Corrosion Prevention and Mitigation

A9.4. Deployment

A9.5. Diminishing Manufacturing Sources

A9.6. Electromagnetic Compatibility (EMC) and Radio Frequency (RF) Management

A9.7. Information Assurance

A9.8. Infrastructure and Facilities

A9.9. Integrated Diagnostics

A9.10. Interoperability

A9.11. Intelligence Integration

A9.12. Logistics Support Elements (Product Support Elements) including but not limited to

A9.12.1. Design Interface

A9.12.2. Material Management

A9.12.3. Technical Data Management (including data rights, drawings, and T.O.s)

A9.12.4. Support Equipment

A9.12.5. Maintenance Planning and Management

A9.12.6. Facilities

A9.12.7. Packaging, Handling, Shipping, and Transportability

A9.12.8. Manpower and Personnel

A9.12.9. Training

A9.13. Manufacturing and Quality Assurance

A9.14. Military Flight Operations Quality Assurance (MFOQA)

A9.15. Modeling and Simulation

A9.16. Modular Open Systems Approach (MOSA)

A9.17. Parts, Materials, and Processes

A9.18. Producibility

A9.19. Reliability, Availability, and Maintainability

A9.20. Security

A9.21. Specifications and Standards

A9.22. Standardization

A9.23. Supportability

A9.24. Survivability/Vulnerability

A9.25. System Safety

A9.26. System Security Engineering

A9.27. Technology Maturation and Transition

A9.28. Technology Obsolescence

A9.29. Total Ownership Cost (TOC)

A9.30. Training

Attachment 10

DEVELOPMENT PLANNING

A10.1. General. DP is the materiel contribution to AF or AF-led capability planning, and must consider the entire product/system life cycle from pre-concept to disposal. The acquisition community plays a critical role in early analyses of technical issues, risks, and resources that inform sponsors and decision makers about the feasibility of prospective solutions to address operational capability needs. DP therefore brings its greatest leverage prior to MDD. Prior to MDD, DP execution falls under the oversight of the implementing command; thereafter, oversight of execution of DP efforts is a Milestone Decision Authority (MDA) responsibility.

A10.1.1. The acquisition community must support the requirements community in collaborative development of evolutionary roadmaps to align current and future operational capabilities with development and deployment schedule needs, within the constraints of affordability and technical risk. The sponsor leads the JCIDS CBA (ref. CJCSI 3170.01 and AFI 10-604), development of the Initial Capabilities Document (ICD), discussions on the Analysis of Alternatives (AoA) Study Guidance (with the Director, Cost Assessment and Program Evaluation (DCAPE) for potential and designated ACAT I and IA programs in preparation for MDD, and the early part of the Materiel Solution Analysis (MSA) phase including the AoA.

A10.2. Early SE. When tailored for the technical aspects of DP, the SE and SoSE processes in 1.1 and 1.2 are referred to as "Early SE." Concept developers will use these fundamental technical and technical management processes to translate CBA-identified operational capability needs into concepts (prospective materiel solutions) that can address those needs. Figure A10.1 shows the principal Early SE activities, their linkage with CBA, and their relationship to pre- and post-MDD events. Early SE consists of three major "phases": Trade Space Characterization, Candidate Solution Sets Characterization, and Implementation Analysis. Well-executed Early SE yields concepts that track to operational and functional (sustainability, reliability, producibility, etc.) needs, and better decision support information prior to initiating an acquisition program.

A10.2.1. Trade space characterization should start during CBA. It should establish the user's most critical "value elements" associated with actualizing a new or enhanced capability, but should not start to point to a specific solution. As initial ideas and potential approaches start to evolve into actual concepts (prospective materiel solutions), various considerations will frame the next set of development and refinement efforts (Examination Point 1). Table A10.1 contains some of these considerations; categories (columns) are notional and not all-inclusive, and the listing is not in any priority order.

A10.2.2. Candidate solution sets characterization represents a traditional SE approach to analyze and refine system and SoS concepts. It is not intended to reduce the solution set to a single concept; instead, the goal is to further develop viable candidates or families of candidates as prospective solutions (Examination Points 2 and 3).

A10.2.3. Implementation analysis involves assessments of the military utility and programmatic viability of each concept. It ensures realistic estimates of acquisition resources, schedules, and costs are available to support the MDD investment decision (Examination Points 4 and 5).

Figure A10.1. Early SE Activities with Linkages to CBA and Pre-/Post-MDD Events.

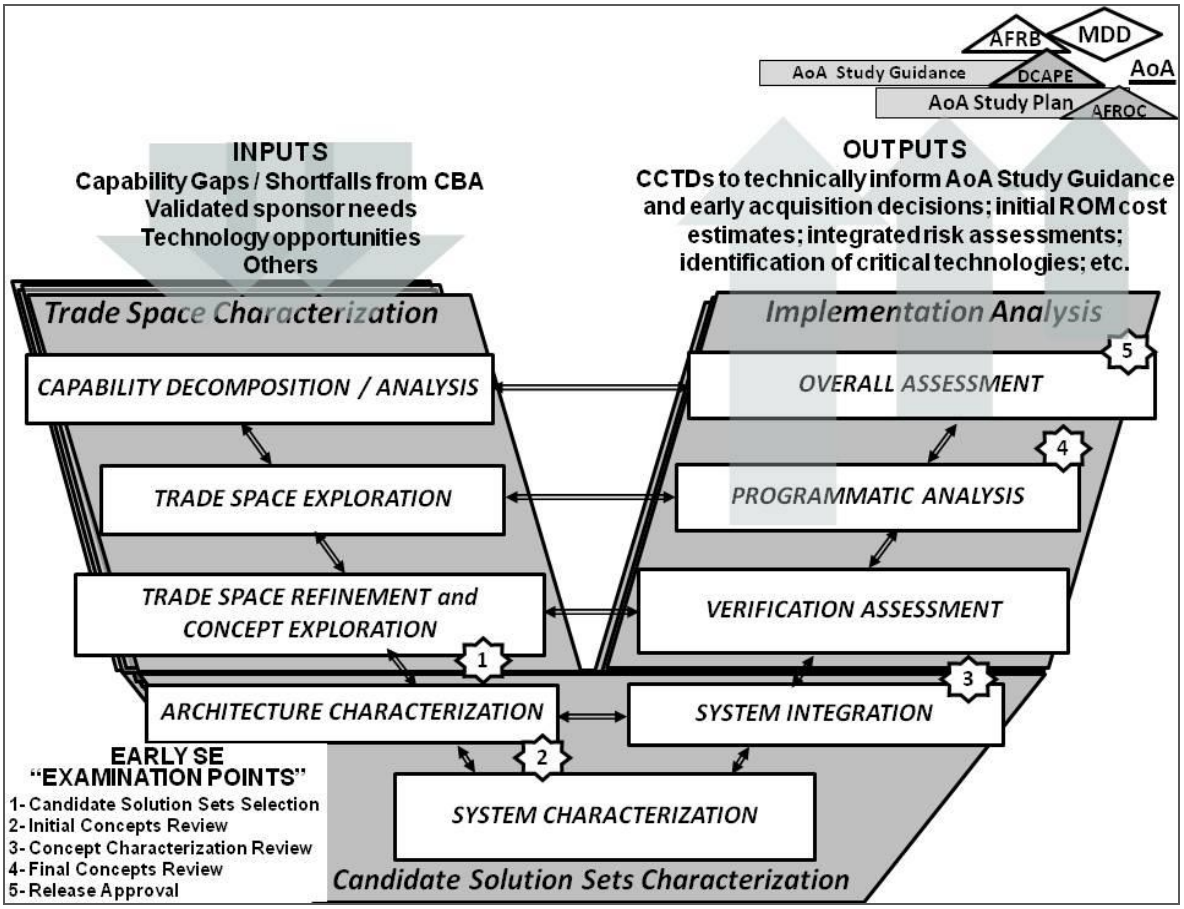


Table A10.1. Some DP Stakeholder Considerations.

OPERATIONAL	TECHNICAL	PROGRAMMATIC	OTHER
Military worth	Timeliness	Affordability	Environmental
Legacy systems transition	System-of-Systems (SoS) and architecture implications	Acquisition intelligence	Policy
Vulnerability	Technology	Industrial base	Politics
Doctrine	Data density and throughput	Participation of other Services, Agencies, partner nations, etc.	Other enablers

A10.3. Concept Characterization and Technical Description (CCTD). The CCTD is a key Early SE artifact that provides evidence of traceability from capability need to materiel requirements. It supports both the sponsor and the acquirer in developing appropriate technical analyses, the investment business case for MDD, and implementation-focused risk assessments – the products of implementation analysis. The sponsor also uses CCTDs to inform DCAPE development of the AoA Study Guidance (ref AFI 63-101, 3.35.2.1.4).

A10.3.1. A CCTD contains factual descriptions of the technical aspects and top-level risks of a concept (or family of related concepts), and reflects the analytical basis and decision history of its evolution to that point. CCTDs document not only why certain concepts move forward to meet capability needs, but why other concepts have been eliminated from further development and analysis. In this manner, historical traceability is retained in the event capability needs are modified, thereby permitting later efforts to get a "running start" when revisiting the trade space. At any point in time, the CCTD will be at a level of fidelity (completeness) commensurate with concept maturity (i.e., the amount of technical analysis accomplished and documented).

A10.3.2. Concept development organizations shall provide CCTDs to SAF/AQR 120 days before the AFROC review of the AoA Study Plan to enable SAF/AQR to validate the concept(s) and make informed technical recommendations. CCTD reviews and approvals are outlined in Table A10.2.

A10.3.3. Following MDD, the CCTD should form the basis of technical documentation prepared by the AoA Study Team. Relevant data, including that generated and added to these documents during the AoA, will eventually be transferred to the program office team established to manage follow-on technical efforts leading to Milestone A and throughout the Technology Development phase (ref AFI 63-101, 3.36.2).

A10.3.4. CCTDs should be retained for potential future use as technologies mature and operational needs evolve over time.

A10.3.5. Programs that have already completed or are in the late stages of an AoA, if directed to go back to accomplish MDD, may use AoA documentation in support of MDD in lieu of producing CCTDs.

Glossary of References and Supporting Information.

Development Planning (DP). DP is the materiel contribution to AF capability planning. It is a collaborative process bridging warfighter-identified capability needs to planning for acquisition of materiel solutions. DP supports the trade space evaluation of emerging capability needs, includes system-of-systems assessments, identifies and assesses technology maturity and risk drivers, and incorporates comprehensive life cycle planning contributing to initiation of a high-confidence acquisition program

Table A10.2. CCTD Responsibilities.

TASK / ACTION	Potential and designated ACAT I programs	Potential and designated ACAT II and III programs	Examination Point (ref Figure A10.1)
Lead CCTD development	Concept Development Organization Chief Engineer	Concept Development Organization Chief Engineer	1,2,3,4,5
Approve CCTD for release	Concept Development Organization Director	Concept Development Organization Director	4,5
Review CCTD for	Center-Level Technical	In accordance with	5

technical sufficiency; concur with release to outside organization(s)	Authority	Center policy (1)	
Coordinate (indicate endorsement of concept(s) from capabilities/ requirements perspective)	Sponsor Director of Requirements	In accordance with sponsor policy (1)	
Review concept(s) in each CCTD for evidence of adequate technical planning	SAF/AQR (2)	SAF/AQR (1, 2)	
Recommend concept(s) at investment decision review (AFRB prior to or serving as MDD)	SAF/AQR (recommendation to SAE)	In accordance with Center policy (recommendation to MDA)	
Recommend concept(s) in support of AFROC validation of AoA Study Plan	SAF/AQR (recommendation to SAE)	In accordance with Center policy (recommendation to MDA)	

(1) - Timing and formality of external review/coordination determined by originating organization.

(2) - OAS and SAF/AQR engagement during development is suggested to facilitate later reviews / recommendations, particularly for potential ACAT I programs