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IEEE Standard for Technical Reviews and Audits on Defense Programs

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IEEE Standard for Technical Reviews and Audits on Defense Programs

Sponsor

Software & Systems Engineering Standards Committee
of the
IEEE Computer Society

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Abstract: The requirements for technical reviews and audits to be performed throughout the acquisition life cycle for the US Department of Defense (DoD) and other defense agencies are established in this standard. This standard provides the definition, description, and intent, as well as the entry/exit/success criteria, for each technical review and audit. It is to be used to establish agreement between acquirers and suppliers on the technical reviews and audits that are needed for the project, as well as the focus and expectations of each.

Keywords: 15288, acquirer-supplier agreement, alternative systems review, critical design review, defense acquisition program, defense acquisition program life cycle, flight readiness review, functional configuration audit, IEEE 15288.2™, integration readiness review, physical configuration audit, preliminary design review, production readiness review, software requirements and architecture review, software specification review, system functional review, system requirements review, system verification review, technical audit, technical review, test readiness review

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Introduction

This introduction is not part of IEEE Std 15288.2-2014, IEEE Standard for Technical Reviews and Audits on Defense Programs.

For effective and efficient application of ISO/IEC/IEEE 15288 on defense programs, additional requirements are needed for the assessment of those programs. ISO/IEC/IEEE 15288 is written in a general manner to address all types of systems and different modes of application. Thus, it does not have requirements specific to the use by defense projects that facilitate effective implementation of an acquirer-supplier agreement, such as use in DoD contracts. This standard responds to the needs of DoD and other defense agencies to have more specific and detailed requirements for technical reviews and audits as part of the assessment of projects during the life cycle.

The requirements and guidance in this standard have been written at the most general level possible so that they might meet not only DoD's needs but also those of other defense agencies, either by direct application or by tailoring for an agency's specific needs.

This standard was developed with input from government and non-government resources. This standard does not supersede or supplant any other law, regulation, directive, contractual provision, or requirement. Accordingly, users of this standard must verify, conform and complete the technical review and audit of any governmental programs to meet the requirements specified by the government at the time of the technical review and audit. The user is instructed to consult the governmental contact or commissioning party for specific instructions and requirements, which may be different from this standard. Users may also have to comply with other applicable laws, regulations, and agency requirements in the undertaking and completion of any such technical reviews and audits, including but not limited to confidentiality, security clearance, access to protected areas, and document management. It is the user's responsibility to determine all applicable laws and requirements.

Contents

IEEE Standard for Technical Reviews and Audits on Defense Programs

1. Overview

1.1 Scope

This standard establishes the requirements for technical reviews and audits to be performed throughout the acquisition life cycle for the US Department of Defense (DoD) and other defense agencies. This standard provides the definition, description, and intent, as well as the entry, exit and success criteria, for each technical review and audit. It is to be used to establish agreement between acquirers and suppliers on the technical reviews and audits that are needed for the project, as well as the focus and expectations of each technical review and audit.

1.2 Purpose

This standard is intended to elaborate the technical review and audit clause of ISO/IEC/IEEE 15288, System life-cycle processes, for use by the DoD and other defense agencies in acquiring systems (and parts thereof) or services. It amplifies ISO/IEC/IEEE 15288, subclause 6.3.2.3.a, for selection, negotiation, agreement, and performance of the necessary technical reviews and audits, while allowing tailoring flexibility for the variety of acquisition situations/environments when the technical reviews or audits are conducted. While primarily supporting the acquirer-supplier agreement mode, this standard also can be used to support the other modes such as use by organizations, projects, and process assessors.

NOTE—The acquirer-supplier mode is not necessarily limited to a government acquirer and corporate prime contractor supplier situation. For example, a service component program executive officer (PEO) might be considered the acquirer, and the applicable government program office/manager the supplier for internal government reviews. Depending on how a given service or other DoD agency operates, the government might be the acquirer and their systems engineering and technical assistance (SETA) contractor might be responsible for the conduct of a subset of the reviews in this standard. Similarly, a defense contractor could be the acquirer and a key subcontractor could be the supplier. In the case of a contractor's internal research and development (R&D), corporate management could be the acquirer and the company's R&D organization could be the supplier.[1]

1.3 Field of application

This standard addresses the needs of the defense community with respect to the incorporation, implementation, and execution of technical reviews and audits. IEEE Std 15288.1-2014, the standard that implements ISO/IEC/IEEE 15288 for application on defense programs, provides the defense-specific language and terminology to ensure the correct application of acquirer-supplier requirements for technical reviews and audits on a defense program, while this standard provides the implementation details to fulfill those requirements.[2]

1.4 Organization of this standard

Subclause 1.5 defines what it means for an organization, project, or other users such as process authors and assessors to claim conformance with this standard.

Clause 2 defines normative references, i.e., documents that are indispensable in the application of this standard.

Clause 3 provides definitions of terms peculiar to this standard, as well as acronyms and abbreviations used in this standard.

Clause 4 provides an overview of technical reviews and audits. It defines them, discusses their role in the US DoD acquisition life cycle, and their support of specific ISO/IEC/IEEE 15288 processes. It answers questions such as: "What are technical reviews and audits?" "Why perform them?" "Is there a standard set of them, and if so, what are they?"

Clause 5 specifies the minimum set of required properties for each technical review and audit that form the basis for agreement between defense program acquirers and suppliers.

Clause 6 provides the detailed criteria to be addressed for each technical review and audit contained in Clause 5.

Clause 7 provides, for each technical review and audit contained in Clause 5 of this standard, detailed, best-practice guidance for applying the detailed criteria of the corresponding portion of Clause 6 of this standard to various kinds of defense programs.

Annex A, Annex B, Annex C, and Annex D contain examples of other technical reviews that DoD acquisition programs may find useful, based on the complexity, nature, and domain of the systems that are being developed or acquired by those programs.

Annex E contains a bibliography.

[1] Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.

[2] ISO/IEC publications are available from the ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland (http://www.iso.org/). ISO/IEC publications are available in the United States from the American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036, USA (http://www.ansi.org/).

1.5 Conformance

1.5.1 General

The requirements in this standard are contained in Clause 5 and Clause 6. This standard provides requirements for a number of technical reviews and audits to be conducted throughout the acquisition life cycle of a system. Since particular projects or organizations may not need to use all of the reviews and audits provided by this standard, implementation of this standard may involve selecting a set of reviews and audits suitable to the project or organization. There are two ways that an implementation can be claimed to conform to the requirements of this standard. Any claim of conformance is cited in only one of the two forms below.

NOTE— Evidence of conformance can be as simple as including traceability from the requirements in this standard to the conforming policies, processes, and procedures. This could be provided by various means, including as a separate section in the traceability documentation for the system requirements or in the Systems Engineering Management Plan (SEMP).

1.5.2 Full conformance

A claim of full conformance declares the set of technical reviews and audits for which conformance is claimed. Full conformance is achieved by providing evidence that all of the mandatory requirements of the declared set of reviews and audits have been satisfied.

1.5.3 Tailored conformance

When this standard is used as a basis for establishing a set of technical reviews and audits that do not qualify for full conformance, the reviews and audits in this standard are selected or modified in accordance with the tailoring process defined in 5.1.1.2**.**

NOTE 1—In this document, the word *shall* is used to indicate a mandatory requirement. The word *should* is used to indicate a recommendation. The word *may* is used to indicate a permissible action. The word *can* is used for statements of possibility and capability.

NOTE 2—When this standard is used to help develop an agreement between an acquirer and a supplier, the contents of Clause 5 and Clause 6 can be selected for incorporation in the agreement with or without modification. In this case, it is more appropriate for the acquirer and supplier to claim compliance with the agreement than conformance with this standard.

NOTE 3—The acquirer request for proposal includes the intended tailoring of the requirements in this standard. However, the supplier may propose additional changes or alternatives during the steps to finalize the agreement.

Conformance to this standard can be claimed by a project or organization independent of a claim of compliance to a specific agreement.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ISO/IEC/IEEE 15288:2015(E), Systems & software engineering—System life cycle processes.[3]

IEEE Std 15288.1™-2014, IEEE Standard for Application of Systems Engineering on Defense Programs.[4, 5]

3. Definitions, acronyms, and abbreviations

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* and the *Department of Defense Dictionary of Military and Associated Terms* (Joint Publication 1-02) [B4] should be consulted for terms not defined in this clause.[6]

3.1 Definitions

acceptability criteria: A documented set of characteristics of a program's work products that if satisfied, forms a sufficient basis for judging each product's content to be acceptable to support a successful review or audit.

configuration audit: A detailed review of processes, product definition information, documented verification of compliance with requirements, and an inspection of products to confirm that products have achieved their required attributes or conform to released product configuration definition information.

entry criteria: Artifacts and other review or audit elements that must be completed before the review or audit can be conducted.

exit criteria: Review or audit elements that must be assessed, completed, and action items closed before successful completion of the technical review or audit can be declared.

review/audit outputs: Review or audit artifacts that are expected through conduct of the technical review or audit and that may be considered elements of exit criteria.

system: The product of an acquisition process that is delivered to the user.

NOTE—Although the term *system* can apply to any level of complexity or detail, when this standard is applied to a specific acquisition, the term *system* will refer to a given solution that satisfies the requirements of a particular acquirer-supplier agreement and may apply equally to the acquisition of a completely new system or to the addition or upgrade to an existing system.

system specification: The documented set of mandatory requirements for a system.

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[3] This publication is available from the Institute of Electrical and Electronics Engineers, Inc., 445 Hoes Lane, Piscataway, NJ 08854, USA (http://standards.ieee.org/).
[4] IEEE publications are available from the Institute of Electrical and Electronics Engineers, Inc., 445 Hoes Lane, Piscataway, NJ 08854, USA (http://standards.ieee.org/).
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[6] *IEEE Standards Dictionary Online* subscription is available at:
http://www.ieee.org/portal/innovate/products/standard/standards_dictionary.html.

NOTE—The more generic term is used for consistent terminology within this standard and includes terms such as System Performance Specification (SPS), System Requirements Document (SRD), and System/Subsystem Specification (SSS).

technical reviews: A series of systems engineering activities conducted at logical transition points in a system life cycle, by which the progress of a program is assessed relative to its technical requirements using a mutually agreed-upon set of criteria.

NOTE—Includes both incremental and system perspectives, as applicable, and considers technical maturity amidst programmatic constraints (cost/schedule), to ascertain readiness to proceed to subsequent activities with acceptable risk.

3.2 Acronyms and abbreviations

AoA	analysis of alternatives
ASR	alternative systems review
BIT	built-in test
C4I	command, control, communications, computer, and intelligence
CAI	critical application item
CAIV	cost as an independent variable
CARD	cost analysis requirements description
CCB	configuration control board
CDD	capability development document
CDR	critical design review
CDRL	contract data requirements list
CI	configuration item
CM	configuration management
CMP	configuration management plan
COMSEC	communications security
CONOPS	concept of operations
COTS	commercial off-the-shelf
CPD	capability production document
CPI	critical program information
CSC	computer software component
CSI	critical safety item
CSU	computer software unit
DMS	diminishing manufacturing sources
DoD	Department of Defense
DoDAF	Department of Defense architecture framework
DR	decision review
DSP	digital signal processor

DT	development test
DT&E	development test and evaluation
ECP	engineering change proposal
EDRAP	engineering data requirements agreement plan
EMC	electromagnetic compatibility
EMD	engineering and manufacturing development
EMI	electromagnetic interference
ESOH	environment, safety, and occupational health
EVM	earned value management
FCA	functional configuration audit
FD	full deployment
FMECA	failure modes, effects, and criticality analysis
FOC	full operational capability
FPGA	field programmable gate array
FRACAS	failure reporting and corrective action system
FRP	full-rate production
FRR	flight readiness review
HALT	highly accelerated life testing
HSI	human systems integration
HWCI	hardware configuration item
ICD	initial capabilities document
IEC	International Electrotechnical Committee
IEEE	The Institute of Electrical and Electronics Engineers
IMP	integrated master plan
IMS	integrated master schedule
IOC	initial operational capability
IOT&E	initial operational test and evaluation
IPT	integrated product team
IRR	integration readiness review
IRS	interface requirements specification
ISO	International Organization for Standardization
KPP	key performance parameter
KSA	key system attribute
LCC	life-cycle cost
LCCE	life-cycle cost estimate
LCSP	life-cycle sustainment plan
LFT&E	live fire test and evaluation

LRIP	low-rate initial production
M&S	modeling and simulation
MOE	measure of effectiveness
MOP	measure of performance
NDI	non-developmental item
NIST	National Institute of Standards and Technology
O&S	operations and support
OT	operational test
OTE	operational test and evaluation
OTA	operational test agency
OTRR	operational test readiness review
P&D	production and deployment
PCA	physical configuration audit
PDR	preliminary design review
PEO	Program Executive Office
PM&P	parts, materials, and processes
PMO	program management office
PP	program protection
PPP	program protection plan
PPSL	program parts selection list
PRR	production readiness review
PSP	product support plan
QA	quality assurance
R&D	research and development
R&M	reliability and maintainability
RAM-C	reliability, availability, maintainability, and cost
RTCA	real time casualty assessment
SAD	software architecture description
SAR	software requirements and architecture review
SCRM	supply chain risk management
SDP	software development plan
SE	systems engineering
SEE	software engineering environment
SEMP	Systems Engineering Management Plan
SEP	Systems Engineering Plan
SETA	systems engineering and technical assistance
SETR	systems engineering technical review

SFR	system functional review
SIL	system integration laboratory
SME	subject matter expert
SoS	system of systems
SPS	system performance specification
SRD	system requirements document
SRR	system requirements review
SRS	software requirements specification
SSE	system security engineering
SSR	software specification review
SSS	system/subsystem specification
STP	software test plan
SVD	software version description
SVR	system verification review
SWCI	software configuration item [(synonymous with computer software configuration item (CSCI)]

NOTE—The state of hardware technology progression has resulted in the functionality of software code being realized by its execution while embedded in devices that are not properly described as computers (e.g., DSPs, FPGAs). This standard uses SWCI to encompass the broader execution environment of software code.

T&E	test and evaluation
TBD	to be determined
TDP	technical data package
TEMP	Test and Evaluation Master Plan
TIM	technical interchange meeting
TMRR	technology maturation and risk reduction
TOC	total ownership cost
TPM	technical performance measure
TR	technical report
TRR	test readiness review
US	United States
V&V	verification and validation
VCRM	verification cross-reference matrix
WBS	work breakdown structure

4. Overview of technical reviews and audits

4.1 Technical reviews and audits defined

Technical reviews and audits are a foundation element of an effective systems engineering (SE) approach and form the backbone of a robust technical assessment process. Technical reviews and audits provide a venue for baselining technical requirements, evaluating the system's technical maturity, and identifying and assessing risks to system performance, cost, and schedule.

4.2 The role of technical reviews and audits in the US DoD acquisition life cycle

The ISO/IEC/IEEE 15288 Life Cycle Concepts subclause points out that every system has a life cycle and that per ISO/IEC/IEEE TR 24748-1 [B6], the typical system life-cycle stages include concept, development, production, utilization, support and retirement.[7] The stages describe the major progress and achievement milestones of the system through its life cycle and give rise to the primary decision gates of the life cycle. Organizations, in turn, use these decision gates to understand and manage the inherent uncertainties and risks associated with costs, schedule, and functionality when creating or utilizing a system.

Phases of the DoD acquisition life cycle include materiel solution analysis, technology maturation, and risk reduction (TMRR), engineering and manufacturing development (EMD), production and deployment (P&D), and operations and support (O&S). Technical reviews and audits are assessment tools that the DoD program organization uses to provide decision-makers sufficient information on the program's technical readiness to proceed to the next phase or to the next decision point within a phase.

Program affordability is and will be for the foreseeable future a major consideration in DoD programs. In that regard, all technical reviews should place some focus on affordability, address compliance with affordability goals, and assess the impact of affordability constraints.

NOTE—The Technical Reviews and Audits Overview section of the Defense Acquisition Guidebook [B2], Chapter 4, Systems Engineering, provides an illustration of the integration of the technical reviews and audits across the US DoD acquisition life cycle.

4.3 Technical reviews and audits in the context of Technical Management processes

ISO/IEC/IEEE 15288's Technical Management processes are concerned with managing the resources and assets allocated by an organization's management and with applying them to fulfill the agreements into which the organization enters. They are applied to the technical effort of projects, particularly to the planning in terms of cost, timescales and achievements; to the checking of actions that helps ensure they comply with plans and performance criteria; and to the identification and selection of corrective actions that recover shortfalls in progress and achievement.

Technical reviews and audits are system engineering activities that support the "assess the project" activity of the ISO/IEC/IEEE 15288 Project Assessment and Control process. The purpose of the Project Assessment and Control process is to help ensure that the program plans are aligned and feasible, to determine project status, technical and process performance, and to direct program execution to help ensure

[7] The numbers in brackets correspond to those of the bibliography in Annex E.

that performance is according to plans and schedules, within projected budgets and satisfies technical objectives.

During the DoD acquisition life cycle, a properly tailored series of technical reviews and audits provides key points throughout the life cycle to evaluate significant achievements and to assess technical maturity and risk. Project assessment is performed at major project decision points by means of these reviews and audits, and the results inform a project's technical management to enable any required project control actions that might include redirecting project activities and tasks as appropriate to correct identified deficiencies. Redirection may include re-planning as appropriate.

In order for a project's technical management to have a balanced information basis on which to base any required project control actions, each technical review or audit should be conducted from an integrated program viewpoint, including technical status and progress, cost and schedule status, and impacts and risk assessment, to help ensure that technical review decisions do not create unrecognized and unacceptable future program impacts.

4.4 Key participants for technical reviews and audits

4.4.1 General

Each technical review or audit should include knowledgeable participants as well as participants with sufficient objectivity to assess satisfaction of the pre-established review criteria. Based on the purpose and level of the review, the participants may include representatives from the acquirer or supplier organizations, or from both. A description of possible participants is provided in the paragraphs below.

4.4.2 Program manager

The program manager is the person responsible for the overall planning, budgeting, scheduling, execution, and control of all technical and management tasks required to produce and deliver a system. This includes oversight and management of the corresponding tasks of any suppliers with whom the acquirer has established agreements for delivery of products.

4.4.3 Systems engineer

The *Systems Engineer* (SE) refers to the program lead systems engineer, the chief engineer, or lead engineer with SE responsibility, and the SE staff responsible for SE processes and who plan, conduct, or manage SE activities in the program.

4.4.4 Review or audit chair

The chair is the person appointed in accordance with the policies and guidance of the acquirer (i.e., service or defense agency) to oversee and approve the technical review or audit preparatory actions, chair the technical review meeting(s) and manage the technical review or audit members, and coordinate and approve the closure actions and summary report.

4.4.5 Recorder

The recorder is the person charged with capturing the minutes of the technical review or audit meeting(s) and any other formal records directed by the chair.

4.4.6 Supplier

The supplier role is fulfilled by one or more people from the supplier's organization whose selection is dependent on the actions described in the specific Clause 6 table.

4.4.7 Program test lead

The program test lead is the person responsible for the overall program test and evaluation effort for development and operational tests. The program test lead for government organizations is typically called the chief developmental tester.

4.4.8 Program technical leads

The program technical leads for all relevant functional and specialty engineering areas are the people responsible for the overall program technical development effort for the system to be developed.

4.5 Program considerations for technical reviews and audits

4.5.1 Requirements for technical reviews and audits

Part of the defined content of the Systems Engineering Plan (SEP) that is required of all acquisition programs is a description of the program's overall technical approach, including the timing and criteria for the conduct of technical reviews and audits.

4.5.2 Technical reviews and audits across the program life cycle

The acquirer's SEP, and the supplier's Systems Engineering Management Plan (SEMP) where applicable, should define the technical reviews and audits selected for the program and their specific phasing across the program's life cycle. This standard provides application content for the following technical reviews and audits:

- Alternative systems review (ASR)
- System requirements review (SRR)
- System functional review (SFR)
- Preliminary design review (PDR)
- Critical design review (CDR)
- Test readiness review (TRR) [contained within the program's Test and Evaluation Master Plan (TEMP)]
- Functional configuration audit (FCA)
- System verification review (SVR)
- Production readiness review (PRR)
- Physical configuration audit (PCA)

Figure 1 depicts the relationship between these reviews and audits and the technical baselines across the acquisition life cycle.

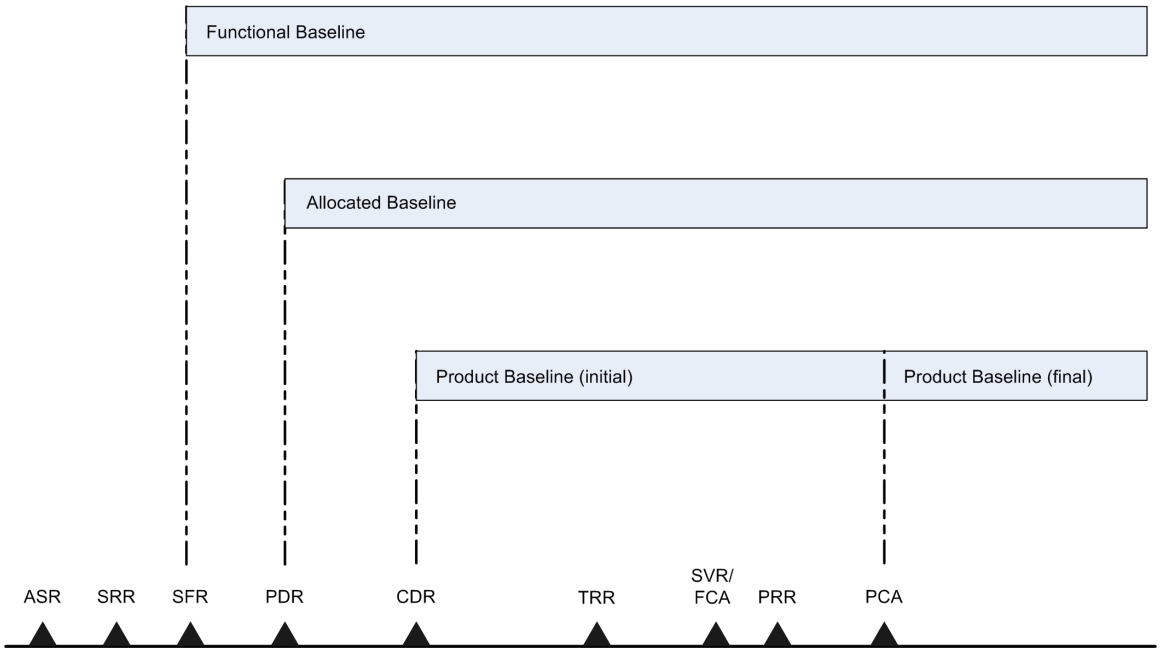

Figure 1— Relationship between technical reviews and audits and the technical baselines across the acquisition life cycle

Additionally, there are four annexes that contain examples of other technical reviews that DoD acquisition programs may find useful, based on the complexity, nature, and domain of the systems being developed or acquired by those programs. These annexes are as follows:

— Annex A: Software requirements and architecture review (SAR)

— Annex B: Software specification review (SSR)

— Annex C: Integration readiness review (IRR)

— Annex D: Flight readiness review (FRR)

4.5.3 Application of technical reviews and audits

The systems engineer for any given program should coordinate with the program manager and with the various program functional area experts (configuration manager, test manager, logistics manager, etc.) to ensure that planning for the program's technical reviews and audits is fully integrated with the overall program plans. Additionally, the systems engineer should coordinate this planning with the appropriate program executive office (PEO) personnel as applicable.

4.5.4 Multiple instances of technical reviews and audits

For complex systems, the acquirer may choose to conduct certain reviews and audits for one or more system elements depending on the interdependencies involved. These incremental system-element-level reviews or audits lead to an overall system-level technical review or audit.

This standard takes a minimalistic approach to defining the content of each technical review and audit such that the content for any given technical review or audit is intended to be sufficient to support each instance of that technical review or audit conducted by a given program.

4.5.5 Event-driven technical reviews and audits

Technical reviews of program progress should be event driven, and should be conducted when the system under development meets the review entrance criteria as documented in the SEP.

Technical reviews and audits are structured to be a comprehensive review (and in some instances approval) of the program's technical and cost baselines, and to provide confidence that each technical or cost baseline is mature enough to progress to the next stage of the program. Each technical review or audit should have defined entry and exit criteria tied to the required level of design/development maturity and applied across all requirements and technical disciplines.

In addition to entrance criteria, the program SEP should detail the specific chronology for the program's technical reviews and audits. This is especially important for evolutionary acquisition strategies using incremental development processes, or, for multi-component programs, i.e., joint service, interagency, or integration efforts with multiple independent contracts where the government is the integrator. The SEP's chronology should provide the planned sequence of technical reviews and audits and a notional placement of each one in the program's Integrated Master Schedule (IMS). The actual date for conducting any given technical review or audit will depend on satisfaction of the SEP's entrance criteria.

One good method for scheduling technical reviews or audits is to relate them to the documentation requirements for the specific technical review or audit. For example, schedule a PDR after the required system and hardware development specifications or software logical architecture, preliminary design and draft test plans are available, since the essence of the PDR is to assess the supplier's approach to meeting the requirements in these documents.

4.5.6 Systems engineering technical review team

The technical review team is the body responsible for conducting the technical review or audit. Under direction of the chair, the review team ensures the entrance criteria are met, evaluates the technical products under review, and documents action items as required to correct deficiencies found during the technical review or audit.

The review team is typically appointed by the program manager and normally includes the chair, systems engineer, various program functional and specialty engineering area experts (engineering, configuration manager, test manager, logistics manager, financial manager, contracting officer, etc.), system users and maintainers, certification authorities, and legal counsel as required.

The review team conducts the technical review or audit and assesses the review products according to the tailored acceptability criteria, in concert with the focus of the specific technical review or audit.

NOTE—The TRR will be documented within the program TEMP and chaired by the chief developmental tester.

4.5.7 Technical review or audit desired outcomes

A properly tailored series of technical reviews and audits provides key points throughout a program's acquisition life cycle to evaluate significant achievements and to assess technical maturity and risk. Successful completion of this series of reviews and audits provides the PEOs and program management offices (PMO) with several major desired outcomes:

a) A disciplined sequence of activities to define, assess, and control the maturity of the system's design and technical baseline, reducing risk over time

b) Confidence that the acquired system will meet all of its specification requirements

c) Confidence that the acquired system will be validated operationally effective and operationally suitable when deployed

d) Assessment results that support successful achievement of the outcomes listed for the ISO/IEC/IEEE 15288 Project Assessment and Control process

4.5.8 Elimination or combination of technical reviews and audits

Programs should not conduct technical reviews or audits that are unnecessary given the structure of the program's acquisition life cycle, e.g., where in the acquisition cycle the program will enter, or one-of-a-kind programs without a production requirement.

Eliminating or combining reviews or audits within the program's acquisition life cycle should be coordinated with the PEO and should be approved by the Milestone Decision Authority as documented in the program's approved SEP and acquisition strategy. The SEP should document when the acquirer will approve the critical work elements, products, and maturity metrics associated with the combined or deleted reviews or audits.

4.5.9 Technical review and audit risk assessment checklists

In order to help ensure the highest probability of success in conducting the selected list of technical reviews and audits for a given program, the systems engineer, in collaboration with the program's functional area experts, should document the following risk assessment checklists that help assess the risk of conducting any of the program's reviews or audits:

a) A "BEFORE" risk assessment checklist that documents the entry criteria necessary to start the technical review and the activities necessary to prepare for the review.

b) A "DURING" risk assessment checklist that documents the items to be addressed in the technical review agenda and the exit criteria necessary to close the review.

c) An "AFTER" risk assessment checklist that documents the follow-up actions after technical review completion.

4.5.10 Technical review and audit action items

All action items generated at a technical review or audit should be captured. Suggested action item categories are discussed below. Any action item that is satisfied prior to the conclusion of the review should be captured in the appropriate category below with a disposition of "Closed" with the appropriate supporting information.

a) *Request for action:* Critical action item required to close the technical review or audit.

b) *Request for information:* Action item to provide only information/data in support of the current technical review. Not required to close the technical review or audit.

c) *Action to minutes:* Action items that are not required to close each technical review or audit. Planned close-out date should be tied as an entry or completion criterion to a future milestone.

d) *Not accepted:* Category used to document any action items generated at a technical review or audit that were duplicates of other accepted action items or otherwise declined by the technical review or audit chair. A clear statement should be included in the action item database to indicate why each action item was categorized as "not accepted." This category should not be used to capture action items that were satisfied or closed prior to conclusion of the technical review.

4.5.11 Technical review and audit approval

At any given technical review or audit, the chair oversees and manages the review or audit. The technical review or audit itself is conducted by the technical review team and approved by the chair. Chair approval of any given technical review or audit should include the following:

a) Satisfying the exit criteria agreed upon for the technical review or audit

b) Approval of the disposition of the action items generated during the technical review or audit

c) Approval of the technical baseline, and cost baseline as applicable, evaluated during the technical review or audit

d) Confidence that the maturity of the technical baseline (and cost baseline as applicable) is sufficient to proceed to the next stage of the program

e) Assessment that the risks associated with the system are documented, have resourced and funded mitigation plans, and are at an acceptable level to support completing the technical review or audit

f) Chair approval in the formal closure documentation

4.5.12 Technical review and audit planning/conduct/reporting

4.5.12.1 General

In order to help provide sufficient quality in the assessment results that support successfully achieving the desired outcomes of a program's series of technical reviews and audits, the acquirer should ensure that certain tasks are accomplished across the planning, conduct, and reporting stages of that series of reviews and audits.

The program's systems engineer, as the person responsible for the overall program technical effort and performance, should coordinate the content and performance of the suggested tasks listed below with the assistance of the program's various functional area experts and subject matter experts (SME).

4.5.12.2 Technical review and audit planning

During technical review and audit planning, the acquirer should

a) Ensure that program acquisition plans and strategies provide for the conduct of the applicable technical reviews and audits, and that they are integrated into the milestone decision-making process.

b) Ensure that the program SEP contains the required content for the tailored series of technical reviews and audits. The TRR will be documented within the program TEMP.

c) Ensure that the required support from suppliers, including documentation and other applicable data, for each technical review or audit is incorporated in the applicable acquirer-supplier agreement(s).

d) Ensure that each technical review and audit is addressed in the IMS.

4.5.12.3 Technical review and audit conduct

During technical review and audit conduct, the acquirer should

a) Ensure that the applicable acquirer-organization SMEs and other applicable stakeholders are identified and notified with sufficient lead time to attend and contribute to the reviews and audits.

b) Ensure that the supplier provides the required supporting data in sufficient time prior to the reviews and audits for SME review prior to conducting the technical review session(s).

c) Develop, coordinate, and execute, in cooperation with the supplier, individual technical review and audit content agendas, exit criteria, and arrangements for the conduct of each technical review and audit.

d) Ensure that the preparation of appropriate technical review or audit material is coordinated with all review contributors and participants.

e) Organize and supervise the documentation of action items.

f) Ensure that the acquirer-supplier team satisfies the exit criteria for the technical review or audit.

NOTE—Although some of the actions in the list above typically are associated with the planning aspect for each technical review or audit in this standard, conduct of the technical review or audit includes some of the planning leading up to the review, not just the meeting that many associate with the term *conduct*.

4.5.12.4 Technical review and audit reporting

As part of technical review and audit reporting, the acquirer should

a) Ensure that the technical review or audit closure and approval (including the applicable content) are documented.

b) Ensure that the technical review or audit summary report is approved and distributed.

4.5.13 Technical reviews and audits in acquirer-supplier agreements

The required supplier support tasks for all program technical reviews and audits should be defined in the acquirer-supplier agreement. Careful consideration should be given before using the conduct of individual reviews or audits as a basis for progress or performance-based payments contained in the agreement. However, payments for successful closure of specific reviews or audits as part of the established award fee criteria may be considered.

Unless specifically provided for in the acquirer-supplier agreements, successful completion of technical reviews or audits does not affect the requirements, terms, and conditions set forth in those agreement(s).

Technical reviews and audits should not be used to

a) Constitute official acquirer acceptance of the design according to the acquirer-supplier agreement

b) Change responsibility as set forth in the acquirer-supplier agreement(s)

c) Change or affect ownership of the design

d) Relieve the supplier from meeting specification requirements as set forth in the acquirer-supplier agreement

The Technical Review and Audit process depends on objective documentation, analysis, and process plans. These documents are inherently part of the engineering process and are prepared to document the progress of a configuration managed design and historical design decisions. The correctness and completeness of these documents should be measured against clearly stated objective criteria defined in the acquirer-supplier agreement(s).

The program manager and systems engineer with assistance of the various program functional area experts should ensure that statements of work and contract data requirements list(s) (CDRL) in the acquirer-supplier agreements contain the required plans, specifications and analyses to support the Technical Review and Audit process.

A key technical plan that the acquirer should include in the supplier's CDRL is the supplier's SEMP. The SEMP documents the supplier's planning to implement and support each of the program's technical reviews and audits. The acquirer should ensure provisions are included in the acquirer-supplier agreement for the supplier to update the SEMP as required to ensure it remains aligned with the program SEP.

The SEP and SEMP should document the method and timing of the documentation delivery required for each technical review and audit such that they provide for acquirer SME review and adjudication of comments prior to the specific technical review or audit.

4.6 Media selection for products discussed in this standard

Various portions of this standard discuss specifications or the requirement to document other results. The focus of this standard in these cases is on content objectives and does not require any specific media (e.g., paper document) or any specific format.

5. Requirements for technical reviews and audits

5.1 General

This clause specifies the minimum normative properties for each technical review and audit to which defense program acquirers and suppliers shall agree. These properties are as follows:

a) Review or audit name

b) Purpose (why perform this technical review or audit?)

c) Description (what system properties does it address?)

d) Timing (when in the system life cycle or contract performance does it occur?)

e) Entry, content, and exit criteria

5.1.1 Clause 5 tailoring

5.1.1.1 Tailoring for a claim of full conformance

When claiming full conformance with the requirements of this standard, the acquirer shall tailor the contents of this clause only by deleting each technical review and audit not needed for the scope defined in a specific acquirer-supplier agreement.

5.1.1.2 Tailoring for a claim of tailored conformance

When claiming tailored conformance with the requirements of this standard, the acquirer shall tailor the contents of this clause by deleting each technical review and audit not needed for the scope defined in a specific acquirer-supplier agreement, and modifying as required the contents of the mandatory requirements in the remaining reviews and audits.

NOTE—Although certain technical reviews may be defined as mandatory, those definitions are beyond the scope of this standard since this standard is intended to be applicable to the largest possible domain of defense programs.

5.1.2 Accompanying detailed criteria

Each technical review and audit specified in this clause has a corresponding subclause in Clause 6 of this standard that contains detailed criteria for technical review or audit product acceptability, for technical review or audit preparation actions, for technical review or audit conduct and content, and for technical review or audit closure actions.

5.1.3 Detailed criteria tailoring

The acquirer and supplier shall achieve a tailored consensus on the content and criteria for each technical review or audit in this clause that is selected for a specific contract or other agreement during the agreement negotiations by deleting, modifying, or adding items in the tables of the four subordinate paragraphs for the corresponding subclause in Clause 6.

5.1.4 Detailed criteria normative content

The content of the subclause in Clause 6 corresponding to each technical review and audit specified in this clause shall become part of the normative content of that technical review or audit when tailoring is completed.

5.1.5 Detailed tailoring based on program type

Some programs may find the need to tailor the content of this standard at the program level to add numerous other reviews, based on program characteristics such as complexity, risk posture, nature, or specific domain. Some examples include Operational Readiness Review, System Readiness Review, and Transition Readiness Review. Tailoring at this level of detail is beyond the scope of this standard. Any tailoring required due to program type should be accomplished by service-level governance or acquirer PMOs or domains.

5.1.6 Clause 5 content application

5.1.6.1 Multiple instances of reviews and audits

Specific reviews or audits in this clause may be performed multiple times during the complete scope of work for a specific program. Multiple instances of a specific technical review or audit usually are performed to support an incremental approach that examines all the details of lower-level subsets of a complex system's hierarchy prior to a summary system-level technical review or audit. The content of this clause has been developed to state *what* actions and content should be included in each technical review or audit rather than the details of *how* those actions or content should be implemented so that the normative content of each subclause in this clause might be applied equally to each instance of its use.

5.1.6.2 Sequencing of multiple technical review or audit instances

If multiple instances of a given technical review or audit are incrementally performed for a system, the system-level technical review or audit shall be conducted only after all lower-level instances of that technical review or audit have been successfully performed and closed.

5.2 Alternative systems review (ASR)

5.2.1 ASR purpose

The ASR shall be conducted to help ensure the preferred materiel solution has the potential to affordably meet the user's needs and expectations, and that there is sufficient understanding of the technical maturity, feasibility, and risk of the proposed materiel solution.

5.2.2 ASR description

The ASR shall confirm that

a) The ASR-supported dialog between the end-user and the acquisition community leads to draft documentation of the preferred materiel solution’s functional and performance requirements.

b) The candidate materiel solutions considered in the analysis of alternatives (AoA) provide a broad and balanced evaluation of cost, schedule, performance, concepts of operations, and risk.

c) The preferred materiel solution resulting from the AoA has the best potential to be cost effective, affordable, operationally effective and suitable, and can be developed to provide a timely solution to the need at an acceptable level of risk.

d) Threshold requirements derived from the key performance parameters (KPP) and key system attributes (KSA) included in the draft capability development document (CDD) have been captured as threshold requirements in the system requirements documentation.

e) The decisions based on AoA recommendations, and additional constraints placed on the next phase of development are captured and documented.

5.2.3 ASR timing

The ASR shall be held after the system parameters for the preferred materiel solution are defined and that solution is balanced with cost, schedule, and risk.

5.2.4 ASR entry criteria

The ASR shall be conducted only after the following events have been successfully completed:

a) The acceptability criteria for each of the ASR technical review products have been established for the specific program by tailoring the contents of Clause 6, Table 1.

b) All preparatory actions in Clause 6, Table 2 as tailored for the specific program have been successfully accomplished to support conducting the technical review.

c) The acquirer and supplier concur that the preferred materiel solution, draft concept of operations (CONOPS), and technical plans support the case for a successful ASR as judged against the tailored product acceptance criteria.

d) Any prior technical reviews have been completed and their action items closed.

5.2.5 ASR content

5.2.5.1 Products to be reviewed at ASR

The following work products at a minimum shall be reviewed by the ASR team. Other products may be added as necessary during tailoring of Clause 6, Table 1 for the specific program.

a) Refined joint requirements

b) Initial architecture for the preferred materiel solution(s)

c) System functional and performance requirements documentation

d) Preferred materiel solution(s) documentation

e) Program risk assessment

5.2.5.2 Conduct of the ASR

ASR participants shall assess the ASR work products and judge the products' acceptability according to the applicable criteria in Clause 6, Table 1 as tailored for the specific program.

5.2.5.3 ASR outputs

a) The review team shall document sufficient assessment results to show the program has produced the following:

   1) An agreement on the preferred materiel solution to take forward into development
   2) Logical architectural constraints and drivers to address external interface requirements, standards, and system extensibility requirements
   3) A comprehensive rationale for the preferred materiel solution, including the results of the AoA that evaluated the relative cost, schedule, performance (hardware, human, software), and technology risks
   4) An updated (if necessary) risk and opportunity assessment and associated risk mitigation and opportunity handling plans
   5) Draft system requirements derived from the KPPs and KSAs
   6) Identification of critical technologies that will be prototyped

b) The ASR technical review summary report shall be distributed containing the following attachments:

   1) List of attendees
   2) Final copies of all presentations

3) Updated (if necessary) risk assessment, mitigation plans, and opportunity handling plans
4) Documented action items including those required for closure
5) The tailored Clause 6, Table 1 through Table 4 as completed following the technical review
6) Meeting minutes

5.2.6 ASR exit criteria

The ASR shall be deemed completed only after the following events have been successfully completed:

a) All action items submitted during the technical review have been appropriately addressed.
b) All actions listed in the action items required for review closure have been completed and approved by the required parties.
c) The preferred materiel solution documentation is complete and acceptable according to the pre-defined acceptance criteria, and the solution has the potential to meet user needs.
d) Each of the technical review products listed in Clause 6, Table 1 as tailored for the specific program meets all of its acceptability criteria, or has a corrective action plan documenting the corrective actions required to achieve acceptability.
e) The acquirer and supplier concur that the program risk level is acceptable.
f) The ASR chair formally closes the review.

5.3 System requirements review (SRR)

5.3.1 SRR purpose

The SRR shall be conducted to help ensure the level of understanding of top-level system requirements is adequate to support further requirements analysis and design activities, and that the system can proceed into initial system design with acceptable risk.

5.3.2 SRR description

The SRR shall confirm that

a) The acquirer and supplier mutually understand the system requirements and performance requirements as captured in the system specification documentation, and that those requirements
    1) Are consistent with the preferred materiel solution (including its support concept)
    2) Are consistent with program budget, schedule, risk, user and other program-specific constraints
    3) Are feasible given available technologies for the preferred system solution
    4) Adequately consider the maturity of interdependent system elements
    5) Have bi-directional traceability with the set of source documents
    6) Have verification methods that are defined and agreed upon
    7) Can meet the program's objectives with manageable risk
b) All system requirements and performance requirements derived from the initial capabilities document (ICD), draft CDD, other acquirer source documentation, and acquirer-accepted requirements previously provided by suppliers' mission analysis or other supplier in-house

requirements definition are documented; and consistent with budget, schedule, risk, other program and system constraints, and with end-user expectations.

c) Technical requirements from all acquisition documentation [e.g., program protection plan (PPP), TEMP, reliability, availability, maintainability, and cost (RAM-C) rationale report] are allocated to specifications.

d) The technical requirements, including statutory and regulatory requirements, have been correctly and completely represented in the set of system requirements and can be developed within program budget and schedule constraints.

e) The level of understanding of top-level system requirements is adequate to support further requirements analysis, decomposition, allocation, and design activities.

f) Tailorable, derived, and correlated requirements are established within the framework of a candidate system logical architecture and fully derived functional segments.

g) System performance requirements, non-tailorable design requirements, tailorable design requirements, available technology, and program resources (funding, schedule, staffing, and processes) are understood and will support further definition of the system logical architecture.

5.3.3 SRR timing

The SRR shall be held when the level of understanding of top-level system requirements is adequate to support further requirements analysis and design activities.

5.3.4 SRR entry criteria

The SRR shall be conducted only after the following events have been successfully completed:

a) The acceptability criteria for each of the SRR technical review products have been established for the specific program by tailoring the contents of Clause 6, Table 5.

b) All preparatory actions in Clause 6, Table 6 as tailored for the specific program have been successfully accomplished to support conducting the technical review.

c) The acquirer and supplier have received evidence that the system specification, technical plans, and program budget estimate are sufficiently mature to support the case for a successful SRR as judged against the tailored product acceptance criteria.

d) Any prior technical reviews have been completed and its action items closed.

5.3.5 SRR content

5.3.5.1 Products to be reviewed at SRR

The following work products at a minimum shall be reviewed by the SRR team. Other products may be added as necessary during tailoring of Clause 6, Table 5 for the specific program.

a) System specification
b) Technical plans
c) Program risk assessment
d) Program life-cycle cost estimate

5.3.5.2 Conduct of the SRR

SRR participants shall assess the SRR work products and judge the products' acceptability according to the applicable criteria in Clause 6, Table 5 as tailored for the specific program.

5.3.5.3 SRR outputs

a) The review team shall document sufficient assessment results to show the program has produced the following:

   1) An approved preliminary system specification
   2) A preliminary allocation of system requirements to hardware, human, and software subsystems, with bi-directional traceability between the allocated requirements and the source documents
   3) Documented external interface requirements
   4) An approved product support plan (PSP) with updates
   5) Technical plans that are current and address the full scope of work
   6) A software development plan (SDP) that adequately addresses the software-specific acceptability criteria in the tailored Clause 6, Table 5 technical plans section
   7) An updated (if necessary) risk and opportunity assessment and associated risk mitigation and opportunity handling plans
   8) A determination that the system requirements, preferred system solution, available technology, and program resources form a satisfactory basis for proceeding

b) The SRR technical review summary report shall be distributed containing the following attachments:

   1) List of attendees
   2) Final copies of all presentations
   3) Updated (if necessary) risk assessment, mitigation plans, and opportunity handling plans
   4) Documented action items including those required for closure
   5) The tailored Clause 6, Table 5 through Table 8 as completed following the technical review
   6) Meeting minutes

5.3.6 SRR exit criteria

The SRR shall be deemed completed only after the following events have been successfully completed:

a) All action items submitted during the technical review have been appropriately addressed.

b) All actions listed in the action items required for review closure have been completed and approved by the required parties.

c) Each of the technical review products listed in Clause 6, Table 5 as tailored for the specific program meets all of its acceptability criteria, or has a corrective action plan documenting the corrective actions required to achieve acceptability.

d) The acquirer and supplier concur that the program risk level is acceptable.

e) All affected baselines have been updated in the applicable configuration management (CM) system(s).

f) The SRR chair formally closes the review.

5.4 System functional review (SFR)

5.4.1 SFR purpose

The SFR shall be conducted to help ensure that the system under review can proceed into preliminary design with acceptable risk and that all system requirements and functional performance requirements derived from the approved preliminary system specification are defined and are consistent with the program budget, program schedule, risk, and other program and system constraints.

5.4.2 SFR description

The SFR shall confirm that

a) The system performance requirements, lower-level performance requirements, and plans for design and development form a satisfactory basis for proceeding to preliminary design.

b) Design decisions and supporting rationale are documented to support bi-directional traceability from the source of the requirement to the functional baseline and preliminary allocated baseline.

c) The lower-level performance requirements are fully defined and are consistent with the mature system concept.

d) The requirements analysis has progressed to the point that the proposed requirements baseline is accurate, comprehensive, and fulfills the user-specified performance requirements contained in the draft CDD.

e) Verification criteria and methods have been identified for all requirements, to be used during the SVR.

f) The preliminary allocated baseline reflects the proposed requirements baseline and is balanced with respect to performance, cost, schedule, risk, and potential for evolutionary growth.

g) The system functional baseline is technically achievable with regard to cost, schedule, and performance.

h) The life-cycle cost (LCC) for the evolving design is consistent with the program affordability constraints.

i) The preliminary physical architecture, program work breakdown structure, and contract work breakdown structure to be used subsequent to the SFR are all consistent.

j) Risks have been identified and mitigation plans are in place.

5.4.3 SFR timing

The SFR shall be held after the system functionality has been fully defined and all functional baseline documentation is complete.

5.4.4 SFR entry criteria

The SFR shall be conducted only after the following events have been successfully completed:

a) The acceptability criteria for each of the SFR technical review products have been established for the specific program by tailoring the contents of Clause 6, Table 9.

b) All preparatory actions in Clause 6, Table 10 as tailored for the specific program have been successfully accomplished to support conducting the technical review.

c) The acquirer program manager and systems engineer have received evidence that the system functional baseline is fully defined and sufficiently documented to support the case for a successful SFR as judged against the tailored product acceptance criteria.

d) Any prior technical review has been completed and its action items closed.

5.4.5 SFR content

5.4.5.1 Products to be reviewed at SFR

The following work products at a minimum shall be reviewed by the SFR team. Other products may be added as necessary during tailoring of Clause 6, Table 9 for the specific program.

a) System functional baseline documentation
b) Major system elements definition
c) Program risk assessment
d) Technical plans

5.4.5.2 Conduct of the SFR

SFR participants shall assess the SFR work products and judge the products' acceptability according to the applicable criteria in Clause 6, Table 9 as tailored for the specific program.

5.4.5.3 SFR outputs

a) The review team shall document sufficient assessment results to show the program has produced the following:

   1) An established system design traceable to the approved system specification (functional baseline).
   2) An updated (if necessary) risk and opportunity assessment and associated risk mitigation and opportunity handling plans.
   3) Current data to update the cost analysis requirements description (CARD) document, based on the supplier's proposed system functional baseline.
   4) An updated program development schedule including system and software critical path drivers.
   5) Initial requirement allocations to hardware configuration items (HWCI), software configuration items (SWCI), and humans.

b) The SFR technical review summary report shall be distributed containing the following attachments:

   1) List of attendees
   2) Final copies of all presentations
   3) Requirements compliance assessment to determine the degree to which each requirement in the system functional baseline documentation satisfies one or more of the requirements in the draft CDD
   4) Updated (if necessary) risk assessment, mitigation plans, and opportunity handling plans
   5) Documented action items including those required for closure

6) The tailored Clause 6, Table 9 through Table 12 as completed following the technical meeting minutes

5.4.6 SFR exit criteria

The SFR shall be deemed completed only after the following events have been successfully completed:

a) All action items submitted during the technical review have been appropriately addressed.

b) All actions listed in the action items required for review closure have been completed and approved by the required parties.

c) Each of the technical review products listed in Clause 6, Table 9 as tailored for the specific program meets all of its acceptability criteria, or has a corrective action plan documenting the corrective actions required to achieve acceptability.

d) The acquirer and supplier concur that the program risk level is acceptable.

e) All affected baselines have been updated in the applicable CM system(s).

f) The SFR chair formally closes the review.

5.5 Preliminary design review (PDR)

5.5.1 PDR purpose

The PDR shall be conducted to help ensure the preliminary design for the system under review is sufficiently mature and ready to proceed into detailed design and can meet the stated performance requirements within program budget, schedule, risk, and other program and system constraints.

5.5.2 PDR description

The PDR shall confirm that

a) All system-level functional and performance requirements baselined at SRR and SFR have been correctly decomposed or directly allocated to the lowest level of the specification tree for all system elements uniquely identified.

b) Sufficient requirements trades have been conducted, supported by systems engineering trade-off analyses, to influence the system physical architecture and allocated requirements.

c) The allocated baseline is complete.

d) The design as disclosed satisfies all requirements in the approved system specification.

e) All external interfaces to the system, as defined at the SRR, have been documented in interface control documents.

f) All system internal interfaces (system element to system element) have been documented in interface control documents.

g) The verification approach to demonstrate achievement of all allocated performance requirements has been documented.

h) All design constraints have been captured and incorporated into the allocated requirements and the design.

i) Bi-directional traceability exists between the source requirements and the design elements for all decomposed and allocated requirements.

j) All system hardware element physical architectures are complete.

k) All system hardware element development specifications are complete.

l) The software logical and physical architectures are complete to the extent specified in the SDP for the point in its life cycle at which PDR occurs, based on the selected life-cycle model(s).

m) The set of system elements comprising the preliminary system design can achieve the complete set of allocated system baseline requirements, and forms a satisfactory basis for proceeding into detailed design with acceptable risk.

n) All critical technologies have been demonstrated in a relevant environment and can be integrated into a system with acceptable risk.

o) Risks have been identified and mitigation plans are in place.

5.5.3 PDR timing

The PDR shall be held when the acquirer and supplier concur that the system-level preliminary design and allocated baseline documentation are complete, and prior to the beginning of detailed design.

5.5.4 PDR entry criteria

The PDR shall be conducted only after the following events have been successfully completed:

a) The acceptability criteria for each of the PDR technical review products have been established for the specific program by tailoring the contents of Clause 6, Table 13.

b) All preparatory actions in Clause 6, Table 14 as tailored for the specific program have been successfully accomplished to support conducting the technical review.

c) The acquirer and supplier concur that the allocated baseline and the program budget estimate are sufficiently mature to support the case for a successful PDR as judged against the tailored product acceptance criteria.

d) Any prior system element level or incremental PDRs on which this PDR is dependent have been completed and their action items closed, or documented action items required for closure are acknowledged.

5.5.5 PDR content

5.5.5.1 Products to be reviewed at PDR

The following work products at a minimum shall be reviewed by the PDR team. Other products may be added as necessary during tailoring of Clause 6, Table 13 for the specific program.

a) System allocated baseline documentation
b) System functional or allocated baseline documentation
c) Technical plans
d) Program risk assessment
e) Program life-cycle cost estimate

5.5.5.2 Conduct of the PDR

PDR participants shall assess the PDR work products and judge the products' acceptability according to the acceptability criteria in Clause 6, Table 13 as tailored for the specific program.

5.5.5.3 PDR outputs

a) The review team shall document sufficient assessment results to show the program has produced

1) Technical data for the allocated baseline that are complete, satisfy the system specification, and provide a sufficient foundation for detailed design to proceed.
2) Bi-directional traceability between all decomposed and allocated requirements to the lowest level of the specification tree, demonstrating that each and every function in the functional baseline has been allocated to one or more of the system elements, that the physical hierarchy is consistent with the functional baseline, and that there are no orphan system elements.
3) Technical plans that are current and address the full scope of work.
4) An updated (if necessary) risk and opportunity assessment, and associated risk mitigation and opportunity handling plans.
5) Feasibility, budget, and schedule that are determined to be within acceptable risk margins.
6) A program IMS that has been updated (including systems and software critical path drivers) and includes all activities required to complete CDR (assuming same developer responsible for PDR and CDR).
7) Updates to the CARD that reflect the design in the allocated baseline.
8) Evidence to inform realistic requirements for EMD contract specifications.
9) Interface requirements contained in system external interface control documentation and internal interface control documentation.

b) The PDR technical review summary report shall be distributed containing the following attachments:

1) List of attendees
2) Final copies of all presentations
3) Updated (if necessary) risk assessment, mitigation plans, and opportunity handling plans
4) Documented action items including those required for closure
5) The tailored Clause 6, Table 13 through Table 16 as completed following the technical review
6) Meeting minutes

5.5.6 PDR exit criteria

The PDR shall be deemed completed only after the following events have been successfully completed:

a) All action items submitted during the technical review have been appropriately addressed.
b) All actions listed in the action items required for review closure have been completed and approved by the required parties.
c) The content of corrective action plans for issues identified in the PDR is sufficiently complete and unambiguous to enable successful completion of all corrective actions.
d) Each of the technical review products listed in Clause 6, Table 13 as tailored for the specific program meets all of its acceptability criteria, or has a corrective action plan documenting the corrective actions required to achieve acceptability.
e) The acquirer and supplier concur that the program risk level is acceptable.
f) All affected baselines have been updated in the applicable CM system(s).
g) The PDR chair formally closes the review.

5.6 Critical design review (CDR)

5.6.1 CDR purpose

The CDR shall be conducted to help ensure that the detailed design for the system under review is adequate to proceed into fabrication, system integration, demonstration and test and can meet stated performance requirements within budget, schedule, risk, and other system constraints.

5.6.2 CDR description

The CDR shall confirm that

a) The initial product baseline is complete and describes the detailed design for production, fielding/deployment, and operations and support.

b) The system detailed design, down to the lowest system element level, is expected to satisfy the requirements of the system specification as derived from the CDD within current budget and schedule constraints.

c) The set of system elements comprising the detailed system design, including all internal and external interfaces, forms a satisfactory basis for proceeding into fabrication, integration and testing of pre-production versions of the system's HWCIs and SWCI(s) with acceptable risk.

d) The detailed design of each individual configuration item (CI) that is an integral part of the system under review can meet the stated performance and engineering specialty requirements of the CI development specifications within program budget, schedule, risk, and other program and system constraints.

e) The flowdown of requirements from the functional baseline to the lowest-level system detailed design element for each end item in the specification tree is complete and captured in each CI detailed design.

f) Bi-directional traceability exists between the source of the functional and allocated baselines and the lowest-level detailed design baselines.

g) The detailed designs for all external interfaces to the system satisfy the interface requirements contained in the system external interface control documentation defined at the PDR.

h) The detailed designs for all interfaces internal to the system elements satisfy the interface requirements contained in the system internal interface control documentation defined at the PDR.

i) Verification requirements to demonstrate achievement of all specified allocated performance characteristics have been documented.

j) All design constraints and considerations have been captured and incorporated into the allocated requirements and the detailed design.

k) All design items incorporate technologies that have been demonstrated in a relevant environment and can be integrated into a system with acceptable risk.

l) Critical manufacturing processes that affect the system's key characteristics have been identified and their capability to meet design tolerances has been demonstrated in a production-representative environment.

m) All system hardware element physical architectures and most detailed designs are complete.

n) Detailed designs are complete for all critical safety items (CSI) and critical application items (CAI).

o) Most system hardware element development specifications are complete.

p) Development specifications are complete for all CSIs and CAIs.

q) The software logical and physical architectures and detailed design are complete to the extent specified in the SDP for the point in its life cycle at which CDR occurs, based on the selected life-cycle model(s).

r) The program's decision management process documentation shows that key decisions are fully documented, executable and accompanied by sufficient rationale that supports each decision.

5.6.3 CDR timing

The CDR shall be held when the acquirer and supplier concur that the initial product baseline is complete, and when the system design is stable and is expected to meet system performance requirements and affordability goals.

5.6.4 CDR entry criteria

The CDR shall be conducted only after the following events have been successfully completed:

a) The acceptability criteria for each of the CDR technical review products have been established for the specific program by tailoring the contents of Clause 6, Table 17.

b) All preparatory actions in Clause 6, Table 18 as tailored for the specific program have been successfully accomplished to support conducting the technical review.

c) The acquirer and supplier concur that the initial product baseline and the program budget estimate is sufficiently mature to support the case for a successful CDR as judged against the tailored product acceptance criteria.

d) For the final CDR, any prior system element level or incremental CDRs have been completed and their action items closed.

5.6.5 CDR content

5.6.5.1 Products to be reviewed at CDR

The following work products at a minimum shall be reviewed by the CDR team. Other products may be added as necessary during tailoring of Clause 6, Table 17 for the specific program.

a) System product baseline documentation
b) System functional or allocated or product baseline documentation
c) Technical plans
d) Program risk assessment
e) Program life-cycle cost estimate

5.6.5.2 Conduct of the CDR

CDR participants shall assess the CDR work products and judge the products' acceptability according to the acceptability criteria in Clause 6, Table 17 as tailored for the specific program.

5.6.5.3 CDR outputs

a) The review team shall document sufficient assessment results to show the program has produced

    1) A documented system initial product baseline with approved HWCIs and SWCI(s).

2) Detailed design data for the initial product baseline that satisfy the system specification and that are sufficiently complete to support hardware fabrication and continued software implementation.
3) A documented and approved analysis with rationale supporting the conclusion that the initial product baseline satisfies the CDD.
4) Bi-directional traceability between all decomposed and allocated requirements to the lowest level of the specification tree and the system detailed design elements, demonstrating that each and every function in the functional baseline has been allocated to one or more of the system elements and that there are no orphan system elements in the detailed design.
5) Technical plans that are current and that address the full scope of work.
6) Corrective action plans for issues identified in the CDR.
7) An updated (if necessary) risk and opportunity assessment and associated risk mitigation and opportunity handling plans.
8) Feasibility, budget, and schedule that are determined to be within acceptable risk margins.
9) A program IMS that has been updated including fabrication, software implementation, test and evaluation, and critical path drivers.
10) Updates to the CARD based on the system initial product baseline.
11) An updated life-cycle sustainment plan (LCSP) including program sustainment development efforts and schedules based on current budgets, test evaluation results and firm supportability design features.

b) The CDR technical review summary report shall be distributed containing the following attachments:

1) List of attendees
2) Final copies of all presentations
3) Updated (if necessary) risk assessment, mitigation plans, and opportunity handling plans
4) Documented action items including those required for closure
5) The tailored Clause 6, Table 17 through Table 20 as completed following the technical review
6) Meeting minutes

5.6.6 CDR exit criteria

The CDR shall be deemed completed only after the following events have been successfully completed:

a) All action items submitted during the technical review have been appropriately addressed.
b) All actions listed in the action items required for review closure have been completed and approved by the required parties.
c) The content of corrective action plans for issues identified in the CDR is sufficiently complete and unambiguous to enable successful completion of all corrective actions.
d) Each of the technical review products listed in Clause 6, Table 17 as tailored for the specific program meets all of its acceptability criteria, or has a corrective action plan documenting the corrective actions required to achieve acceptability.
e) The acquirer and supplier concur that the program risk level is acceptable.
f) All affected baselines have been updated in the applicable CM system(s).
g) The CDR chair formally closes the review.

5.7 Test readiness review (TRR)

5.7.1 TRR purpose

The TRR shall be conducted to assess test objectives, test methods and procedures, test scope, safety, readiness for acquirer and supplier development test and evaluation (DT&E), and whether test resources have been properly identified and obtained.

5.7.2 TRR description

The TRR shall confirm that

a) The system or system element(s) are sufficiently mature and stable in configuration to begin testing.

b) The test procedures together with the planned test data to be collected are sufficiently robust to verify satisfaction of the requirements set for which the test is intended to address.

c) Disciplined test processes are in place and the test procedures have been validated prior to use.

d) Sufficient test personnel and their collective skill sets are available, and their roles and responsibilities have been clearly defined.

e) The test team understands the system or system element capabilities to be tested and any vulnerabilities and limitations of the system element(s) under test sufficiently well to conduct the testing accurately.

f) Sufficient test facilities, data collection systems, calibrated test support equipment, and logistics support necessary to perform the planned test is available and assigned to the task.

g) Risks to equipment and human safety have been identified, analyzed, and addressed to mitigate potential hazardous outcomes.

5.7.3 TRR timing

The TRR shall be held prior to any formal testing for the record, when the acquirer and supplier agree that all applicable documentation for the system elements under test are sufficiently complete and that all planning for personnel, test facilities, logistics and support equipment is sufficiently robust to support a successful test.

5.7.4 TRR entry criteria

The TRR shall be conducted only after the following events have been successfully completed:

a) The acceptability criteria for each of the TRR technical review products have been established for the specific program by tailoring the contents of Clause 6, Table 21.

b) All preparatory actions in Clause 6, Table 22 as tailored for the specific program have been successfully accomplished to support conducting the technical review.

c) All applicable test procedures have been validated for use in formal testing for the record, by dry runs or alternative methods.

d) The acquirer and supplier concur that the results of any preliminary functional or pre-qualification testing form a satisfactory basis for proceeding with the TRR.

e) Any prior system element level or incremental readiness reviews have been completed and their action items closed.

5.7.5 TRR conduct

5.7.5.1 Products to be reviewed at TRR

The following work products at a minimum shall be reviewed by the TRR team. Other products may be added as necessary during tailoring of Clause 6, Table 21 for the specific program.

a) System technical documentation
b) Test environment
c) Program execution and process control
d) Risk assessment
e) Program life-cycle cost estimate and schedules

5.7.5.2 Conduct of the TRR

TRR participants shall assess the TRR work products and judge the products' acceptability according to the acceptability criteria in Clause 6, Table 21 as tailored for the specific program.

5.7.5.3 TRR outputs

a) The review team shall document sufficient assessment results to show the program has produced the following:
    1) A documented plan for addressing technical issues and obstacles that might occur during conduct of the test
    2) An updated (if necessary) risk and opportunity assessment and associated risk mitigation and opportunity handling plans
    3) Lists of potential anomalies, limitations and system vulnerabilities for the planned test event
    4) Verification that all planned preliminary or informal tests have been conducted and that the results satisfactorily indicate that the formal test event can begin
    5) Verification that the system elements under test are sufficiently mature, defined and representative to accomplish the planned test objectives
    6) Verification that the necessary safety releases from the program office have been provided to the testers prior to any test activities using personnel
    7) Completed and approved test plans and procedures for the planned test event
    8) Complete identification and allocation of all required test resources to the planned test
    9) A recommendation on readiness to commence testing
b) The TRR summary shall be distributed containing the following attachments:
    1) List of attendees
    2) Final copies of all presentations
    3) Updated (if necessary) risk assessment, mitigation plans, and opportunity handling plans
    4) Documented action items including those required for closure
    5) The tailored Clause 6, Table 21 through Table 24 as completed following the technical review
    6) Recommendation on readiness to commence the formal test event
    7) Meeting minutes

5.7.6 TRR exit criteria

The TRR shall be deemed completed only after the following events have been successfully completed:

a) All action items submitted during the technical review have been appropriately addressed.
b) All actions listed in the action items required for review closure have been completed and approved by the required parties.
c) The content of corrective action plans for issues identified in the TRR is sufficiently complete and unambiguous to enable successful completion of all corrective actions.
d) Each of the technical review products listed in Clause 6, Table 21 as tailored for the specific program meets all of its acceptability criteria, or has a corrective action plan documenting the corrective actions required to achieve acceptability.
e) The acquirer and supplier concur that the risk level is acceptable.
f) The TRR chair formally closes the review.

5.8 Functional configuration audit (FCA)

5.8.1 FCA purpose

The FCA shall be conducted to ascertain that a CI's actual performance meets the requirements stated in the functional and allocated baseline documentation.

5.8.2 FCA description

The FCA shall confirm that

a) The CI's actual performance based on results of approved verification methods (test, demonstration, analysis, or inspection) satisfies the performance requirements in the functional and allocated baselines.
b) For those performance requirements that cannot be completely verified during testing, adequate analysis or simulation using approved methods has produced validated data to permit assessment of an acceptable risk level that system performance will satisfy those requirements.
c) The initial product baseline documentation (drawings, parts lists) accurately reflects the physical configuration for which the test data and any analysis and simulation data are verified.

5.8.3 FCA timing

The FCA shall be held when the acquirer and supplier concur that the CI development is complete and actual CI performance as documented in development test (DT), analysis, and simulation data is sufficient to show satisfaction of the functional and allocated baselines.

NOTE—A system-level FCA may be held concurrently with SVR.

5.8.4 FCA entry criteria

The FCA shall be conducted only after the following events have been successfully completed:

a) The acquirer has verified that actual CI performance satisfies the functional and allocated baselines.
b) The acceptability criteria for each of the FCA technical review products have been established for the specific program and CI by tailoring the contents of Clause 6, Table 25.

c) All preparatory actions in Clause 6, Table 26 as tailored for the specific program and CI have been successfully accomplished to support conducting the audit.

d) Any prior CI-level or incremental FCAs have been completed and their action items closed.

5.8.5 FCA content

5.8.5.1 Products to be reviewed at FCA

The following work products at a minimum shall be reviewed by the FCA team. Other products may be added as necessary during tailoring of Clause 6, Table 25 for the specific program and CI.

a) Functional, allocated and product baseline documentation
b) Program execution and process control
c) Verification results

5.8.5.2 Conduct of the FCA

FCA participants shall assess the FCA work products and judge the products' acceptability according to the acceptability criteria in Clause 6, Table 25 as tailored for the specific program and CI.

5.8.5.3 FCA outputs

a) The review team shall document sufficient assessment results to show the program has produced the following:

    1) Official, approved FCA minutes incorporating at a minimum the following items as part of the official record:

        i) All test plans, specifications, descriptions, procedures, reports, and test data that were reviewed by the FCA team

        ii) A complete list of successfully accomplished functional tests

        iii) A complete list of any functional tests required by the system specification or other test plans that have not yet been performed

        iv) Partial FCA completion status for any CIs whose functional test completion is contingent on higher-level integration testing

        v) Audit results for each of the work product categories assessed during the audit

        vi) Configuration identification documentation that comprehensively defines the system product baseline configuration that is the object of the FCA work products

    2) An FCA team assessment of the CI's satisfaction of its functional and allocated requirements

b) The FCA technical audit summary report shall be distributed containing the following attachments:

    1) List of attendees

    2) Final copies of any presentations given to the FCA team

    3) FCA minutes

    4) The FCA team's assessment of the CI's satisfaction of its functional and allocated requirements

5.8.6 FCA exit criteria

The FCA shall be deemed completed only after the following events have been successfully completed:

a) All action items submitted during the audit have been appropriately addressed.
b) All actions listed in the action items required for review closure have been completed and approved by the required parties.
c) The content of corrective action plans, if any, for issues identified in the FCA is sufficiently complete and unambiguous to enable successful completion of all corrective actions.
d) Each of the technical review products listed in Clause 6, Table 25 as tailored for the specific program and CI meets all of its acceptability criteria, or has a corrective action plan documenting the corrective actions required to achieve acceptability.
e) All baselines in the applicable CM system(s) are current and consistent with the audited FCA work products.
f) The FCA chair formally closes the audit.

5.9 System verification review (SVR)

5.9.1 SVR purpose

The SVR shall be conducted to verify that the as-tested system meets the requirements in the system functional baseline and is ready to proceed to the next phase with acceptable risk.

5.9.2 SVR description

The SVR shall confirm that

a) The system correctly and completely implements the system requirements, and system development and applicable implementation and integration are complete.
b) The system satisfies the requirements in the functional baseline and therefore has a high likelihood of meeting the user's requirements documented in the CDD or capability production document (CPD).
c) The product baseline documentation (drawings, parts lists) accurately reflects the physical configuration for which the test data and any analysis and simulation data are verified.
d) Complete, detailed, bi-directional traceability has been maintained between the system requirements and the current approved version of the product baseline.
e) System specification requirements allocated to commercial off-the-shelf (COTS) or government-furnished equipment items that do not have development specifications are satisfied with test results.

5.9.3 SVR timing

The SVR shall be held following completion of system-level DT&E, and CI-level FCAs.

NOTE—The SVR may be held concurrently with system-level FCA.

5.9.4 SVR entry criteria

The SVR shall be conducted only after the following events have been successfully completed:

a) CDR has been successfully completed, all CDR action items have been closed and any corrective actions have been successfully completed.

b) The FCA has verified that the as-tested CIs satisfy the requirements in the functional and allocated baselines.

c) The acceptability criteria for each of the SVR technical review products have been established for the specific program by tailoring the contents of Clause 6, Table 29.

d) All preparatory actions in Clause 6, Table 30 as tailored for the specific program have been successfully accomplished to support conducting the technical review.

e) The acquirer and supplier concur that all system qualification testing and system-level DT&E have been successfully completed.

5.9.5 SVR content

5.9.5.1 Products to be reviewed at SVR

The following work products at a minimum shall be reviewed by the SVR team. Other products may be added as necessary during tailoring of Clause 6, Table 29 for the specific program.

a) System functional and product baseline documentation
b) Technical plans
c) Program execution and process control
d) Risk assessment
e) Program life-cycle cost estimate and schedule
f) Verification results

5.9.5.2 Conduct of the SVR

SVR participants shall assess the SVR work products and judge the products' acceptability according to the acceptability criteria in Clause 6, Table 29 as tailored for the specific program.

5.9.5.3 SVR outputs

a) The review team shall document sufficient assessment results to show the program has produced the following:

    1) Official, approved SVR minutes incorporating at a minimum the following items as part of the official record:

        i) The specific versions under configuration control of the system functional and product baselines examined during the technical review

        ii) List of all test plans, descriptions, procedures, reports and validated test data that were reviewed by the SVR team

        iii) Review results for each of the work product categories assessed during the technical review

    2) Verification that system requirements are fully satisfied in the system's current configuration

    3) An updated (if necessary) risk and opportunity assessment and associated risk mitigation and opportunity handling plans

    4) An SVR team assessment that the system (as documented in the current product baseline) has a low risk of failure during operational test and evaluation (OT&E)

b) The SVR technical review summary report shall be distributed containing the following attachments:

   1) List of attendees
   2) Final copies of any presentations given to the SVR team
   3) SVR minutes
   4) Updated (if necessary) risk assessment, mitigation plans, and opportunity handling plans
   5) The SVR team's recommendation that the program's technical readiness is sufficient to enter the Production and Deployment phase
   6) The SVR team's assessment that the system has a low risk of failure during OT&E

5.9.6 SVR exit criteria

The SVR shall be deemed completed only after the following events have been successfully completed:

a) All action items submitted during the technical review have been appropriately addressed.
b) All actions listed in the action items required for review closure have been completed and approved by the required parties.
c) The content of corrective action plans, if any, for issues identified in the SVR is sufficiently complete and unambiguous to enable successful completion of all corrective actions.
d) Each of the technical review products listed in Clause 6, Table 29 as tailored for the specific program meets all of its acceptability criteria, or has a corrective action plan documenting the corrective actions required to achieve acceptability.
e) The acquirer and supplier concur that the risk level is acceptable.
f) All baselines in the applicable CM system(s) are current and consistent with the audited SVR work products.
g) The SVR chair formally closes the review.

5.10 Production readiness review (PRR)

5.10.1 PRR purpose

The PRR shall be conducted to ascertain that the system design is ready for production and that the supplier has accomplished adequate production planning for entering low-rate initial production (LRIP) or full-rate production (FRP).

5.10.2 PRR description

The PRR shall confirm that

a) The supplier's production planning is sufficient to implement the product baseline within expected delivery schedules at targeted costs.
b) All required processes, materials, and skills required for production have been demonstrated in a pilot line environment.
c) The technical data package (TDP) is complete to the extent needed to support LRIP or FRP, such as drawings, comprehensive software documentation, specifications, standards, performance requirements, quality assurance (QA) provisions, and packaging details.

5.10.3 PRR timing

The PRR shall be held to support LRIP or FRP decisions.

5.10.4 PRR entry criteria

The PRR shall be conducted only after the following events have been successfully completed:

a) The action items from all previous technical reviews have been considered for production readiness impact and have been addressed as appropriate.
b) The acceptability criteria for each of the PRR technical review products have been established for the specific program by tailoring the contents of Clause 6, Table 33.
c) All preparatory actions in Clause 6, Table 34 as tailored for the specific program have been successfully accomplished to support conducting the technical review.
d) Any prior system element level or incremental PRRs have been completed and their action items have been either closed or have agreed-upon closure plans.

5.10.5 PRR content

5.10.5.1 Products to be reviewed at PRR

The following work products at a minimum shall be reviewed by the PRR team. Other products may be added as necessary during tailoring of Clause 6, Table 33 for the specific program.

a) Verified system product baseline documentation
b) Technical plans
c) Program execution and process control
d) Risk assessment
e) Program life-cycle cost estimate and schedule

5.10.5.2 Conduct of the PRR

PRR participants shall assess the PRR work products and judge the products' acceptability according to the acceptability criteria in Clause 6, Table 33 as tailored for the specific program.

5.10.5.3 PRR outputs

a) The review team shall document sufficient assessment results to show the program has produced the following:

    1) Official, approved PRR minutes incorporating at a minimum the following items as part of the official record:

        i) All plans, specifications, descriptions, procedures, reports and validated test data that were reviewed by the PRR team
        ii) A complete list of PRR attendees
        iii) Completed action item forms
        iv) Test results for pre-production and production processes
        v) Review results for each of the work product categories assessed during the technical review

vi) Configuration identification documentation that completely defines the system product baseline configuration that is the object of the PRR work products

2) A PRR team assessment that the following conditions have been adequately met:

i) The final system design is producible

ii) The program's production capability and capacity form a satisfactory basis for proceeding into LRIP and/or FRP

3) An updated (if necessary) risk and opportunity assessment, and associated risk mitigation and opportunity handling plans

b) The PRR technical review summary report shall be distributed containing the following attachments:

1) List of attendees
2) Final copies of any presentations given to the PRR team
3) PRR minutes
4) Updated (if necessary) risk assessment, mitigation plans, and opportunity handling plans
5) The PRR team's assessment of the system product baseline's satisfaction of all its functional and allocated requirements, and that it is producible within the program budget, schedule and acceptable risk levels

5.10.6 PRR exit criteria

The PRR shall be deemed completed only after the following events have been successfully completed:

a) All action items submitted during the technical review have been appropriately addressed.
b) All actions listed in the action items required for review closure have been completed and approved by the required parties.
c) The content of corrective action plans, if any, for issues identified in the PRR is sufficiently complete and unambiguous to enable successful completion of all corrective actions.
d) Each of the technical review products listed in Clause 6, Table 33 as tailored for the specific program meets all of its acceptability criteria, or has a corrective action plan documenting the corrective actions required to achieve acceptability.
e) The acquirer and supplier concur that the production risk level is acceptable.
f) All baselines in the applicable CM system(s) are current and consistent with the audited PRR work products.
g) The PRR chair formally closes the review.

5.11 Physical configuration audit (PCA)

5.11.1 PCA purpose

The PCA shall be conducted to determine conformance of the as-built configuration of a validated CI with its design documentation, and to verify the product baseline.

5.11.2 PCA description

The PCA shall confirm that

a) The drawing release system, nomenclature, unique identification numbers, part numbers, manufacturing processes, software development processes and documentation, quality control system, measurement and test equipment, and training are adequately planned, followed, and controlled.

b) The acceptance testing requirements, prescribed by the documentation, are adequate for acceptance of production units of the corresponding CI(s) by quality assurance activities.

c) All production-related activities (tooling, acceptance/inspection equipment, instructions, molds, jigs, and make-buy decisions) are focused on a validated and accurate design.

d) Any CIs that were affected or redesigned after completion of the FCA now meet all requirements allocated to the CIs.

e) Any testing deficiencies have been resolved and appropriate changes implemented.

f) Any system changes to the product baseline occurring after FCA (including changes during OT&E) have been incorporated into the product baseline.

g) The formal examination of the validated system confirms agreement with the configuration-controlled product baseline.

h) The TDP (as defined in MIL-STD-31000A [B9]) is complete to the extent needed to support program objectives.

5.11.3 PCA timing

The PCA shall be held after successful completion of OT&E and system validation, but prior to the full-rate production or full deployment (FD) decision review and operational use.

5.11.4 PCA entry criteria

The PCA shall be conducted only after the following events have been successfully completed:

a) A PRR if conducted has been successfully completed.

b) The acceptability criteria for each of the PCA technical review products have been established for the specific program and CI by tailoring the contents of Clause 6, Table 37.

c) All preparatory actions in Clause 6, Table 38 as tailored for the specific program and CI have been successfully accomplished to support conducting the technical review.

d) Any prior CI-level or incremental PCAs have been completed and their action items closed.

e) Successful completion of OT&E and resolution of OT&E results.

5.11.5 PCA content

5.11.5.1 Products to be reviewed at PCA

The following work products at a minimum shall be reviewed by the PCA team. Other products may be added as necessary during tailoring of Clause 6, Table 37 for the specific program.

a) Verified system product baseline documentation

b) Program execution and process control

c) Validation (OT&E) results

5.11.5.2 Conduct of the PCA

PCA participants shall assess the PCA work products and judge the products' acceptability according to the acceptability criteria in Clause 6, Table 37 as tailored for the specific program and CI.

5.11.5.3 PCA outputs

a) The review team shall document sufficient assessment results to show the program has produced the following:

   1) Official, approved, PCA minutes incorporating at a minimum the following items as part of the official record:

      i) All specifications, drawings, descriptions, procedures, and reports that were reviewed by the PCA team

      ii) A list of any differences between the configuration of the CI(s) qualified and the element(s) being audited

      iii) Audit results for each of the work product categories assessed during the audit

      iv) Configuration identification documentation that completely defines the system product baseline configuration that is the object of the PCA work products

   2) Approved hardware and software product baselines, TDP, and other baselined documentation

   3) Determination that the design and manufacturing documentation matches the formally qualified CI(s) assessed during the PCA

   4) Determination that the audited documentation can be used for full rate production or full deployment of the audited CI(s), or for replication of one-of-a-kind elements

b) The PCA technical audit summary report shall be distributed containing the following attachments:

   1) List of attendees

   2) Final copies of any presentations given to the PCA team

   3) PCA minutes

   4) The PCA team's certification that the CI(s) have been built in accordance with the drawings and specifications

5.11.6 PCA exit criteria

The PCA shall be deemed completed only after the following events have been successfully completed:

a) All action items submitted during the audit have been appropriately addressed.

b) All actions listed in the action items required for review closure have been completed and approved by the required parties.

c) The content of corrective action plans, if any, for issues identified in the PCA is sufficiently complete and unambiguous to enable successful completion of all corrective actions.

d) Each of the technical review products listed in Clause 6, Table 37 as tailored for the specific program and CI meets all of its acceptability criteria, or has a corrective action plan documenting the corrective actions required to achieve acceptability.

e) All baselines in the applicable CM system(s) are current and consistent with the audited PCA work products.

f) The PCA chair formally closes the audit.

6. Detailed criteria to be addressed for each technical review and audit

6.1 General

This clause contains the detailed criteria to be addressed for each technical review and audit contained in Clause 5 of this standard.

6.2 Alternative systems review (ASR) detailed criteria

6.2.1 ASR technical review products acceptability criteria

Table 1 lists the products that should be reviewed at ASR, and the associated acceptability criteria that should form a sufficient basis by which to assess each product's content as acceptable to support a successful ASR. Specific products and associated acceptability criteria shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 1—ASR technical review products acceptability criteria

Product	ASR acceptability criteria
Refined joint requirements	a) Joint context and initial CONOPS are updated to reflect current user position about capability gap(s), supported missions, interfacing/enabling systems in the operational environment; overall system of systems (SoS) context. b) Required related solutions and supporting references (ICD and draft CDD) are identified. c) Joint refined thresholds and objectives are initially stated as broad measures of effectiveness and suitability [e.g., measures of effectiveness (MOE), measures of suitability, and measures of performance (MOP)].
Initial architecture for the preferred materiel solution(s)	a) High-level description of the preferred materiel solution(s) is available and sufficiently detailed and understood to enable further technical analysis. b) SoS interfaces and external dependencies are adequately defined.
System functional and performance requirements documentation	a) The system requirements statements conform to the characteristics of well-formed requirements statements, enabling a clear understanding consistent with the ICD and draft CDD (if available). NOTE—ISO/IEC/IEEE 29148 contains a list of characteristics of well-formed requirements statements. b) System requirements are sufficiently understood to enable system functional definition. c) Draft system specification has sufficiently achievable requirements to allow for design trade space. d) Relationship between draft system specification and competitive prototyping objectives is established.

Product	ASR acceptability criteria
Preferred materiel solution(s) documentation	a) Completed AoA contains acceptable coverage of alternative solutions and adequate detail of analysis. b) Comprehensive rationale is available for the preferred materiel solution(s), including scoring results for the preferred system concept(s), based on the AoA. c) The draft CONOPS supports the details of the preferred system concept(s). d) Key assumptions and constraints associated with preferred materiel solution(s) are identified and support the conclusion that this solution can reasonably be expected to satisfy the ICD (or draft CDD if available) in terms of technical, operational, risk, and schedule/cost (affordability) criteria. e) Results of trade studies/technical demonstrations for concept risk reduction, if available. f) Initial producibility assessments of preferred system concept(s) indicate acceptable technology levels. g) System cost model has been updated, allocated to lower system element levels, and tracked against targets; production cost model is constructed. h) Initial hazard analysis/system safety analysis for preferred solution(s) is complete.
Program risk assessment	a) A comprehensive cost/schedule/technical risk assessment has been accomplished and mitigation plans are in development.

6.2.2 ASR preparation

Table 2 lists the actions that should be considered during preparation for the ASR. The responsible people listed are those most often tasked with the listed preparation actions, but the acquirer and supplier may agree to assign the actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 2—ASR technical review preparation actions

Responsible person	ASR preparation actions
Program manager	a) Approve, fund, and staff the ASR as planned by the systems engineer. b) Appoint an ASR chair no later than 45 days prior to the technical review, in coordination with the systems engineer. c) Ensure that a preliminary life-cycle cost estimate (LCCE) has been prepared and made available to all ASR participants 45 to 60 days prior to the technical review. d) Ensure the LCCE addresses hardware and software maintenance and support concepts.
Systems engineer	a) Ensure adequate plans are in place to complete the necessary technical activities for the ASR. b) Ensure results of all technical trade studies are captured in documents that are carried through to the next phase. c) Develop preferred materiel solution documentation. d) Ensure technical risk items are identified and analyzed, and appropriate mitigation plans are in place. This activity should include, for example, the identification of critical technologies and identification of key interfaces with supporting or enabling systems. e) Coordinate arrangements for ASR location and support. f) Ensure all of the technical review products whose acceptability criteria are defined in Table 1 are completed for the ASR. g) Ensure the preparation of all presentation material is coordinated across integrated product teams (IPT).
ASR chair	a) Determine ASR team membership. b) Approve the final ASR agenda. c) Identify any final Clause 6 ASR detailed criteria tailoring for the specific program. d) Identify any specific elements for in-depth review as required.

6.2.3 ASR conduct

Table 3 lists the technical review elements and associated content details that should be considered for the conduct of the ASR. Specific elements and their content details shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 3—ASR conduct elements

ASR technical review element	Content details
Introduction, agenda, administrative	a) Review location layout and safety procedures b) Security procedures if applicable c) Introduction of chair and team members d) Purpose of the technical review e) ASR agenda f) Action item procedures g) Risk assessment procedures h) Program overview i) Status of action items from previous technical reviews
System specification review	a) Overview of requirements categories and structure of the specification b) Requirements traceability to the ICD and CDD if available c) Relationship of requirements to prototyping objectives
Preferred materiel solution(s) documentation review	a) Rationale for the selected solution(s) based on the AoA results b) Key assumptions and constraints related to the selected solution(s) c) Trade studies supporting the AoA
Risk and mitigation review	a) Current risk/opportunity assessment and associated risk mitigation/opportunity handling plans b) Mitigation plans and their phasing, focusing on TMRR phase
Program cost estimate review	a) CARD contents related to preferred material solution b) LCCE build up, including coverage for research, development, test, and evaluation, production, military construction, military personnel, and O&S funding

6.2.4 ASR closure

Table 4 lists the actions that should be considered for ASR closure. The responsible people listed are those most often tasked with the listed closure actions. The acquirer and supplier may agree to assign the program manager and systems engineer actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included in accordance with the acquirer-supplier agreement to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 4—ASR closure actions

Responsible person	ASR closure actions
Program manager	a) Manage and approve changes to any baselined documentation as a result of the ASR b) If funding profiles are insufficient to support development, notify user/sponsor of funding shortfall and request funding profile adjustments c) Support preparation of the ASR summary report
Systems engineer	a) Organize and supervise the responses to all action items generated during ASR b) Support preparation of the ASR summary report c) Ensure technical documentation is updated if required as a result of ASR action items d) Ensure all information products required to be put under configuration control have been delivered to the configuration manager e) Monitor and control the execution of the ASR closure plans
ASR chair	a) Ensure preparation of the ASR summary report and formal ASR minutes with the support of the program manager and systems engineer b) Sign off final approval of all action items c) Approve the ASR minutes d) Approve and distribute the ASR summary report e) Prepare and distribute the formal ASR closure letter
Recorder	a) Collate all action items for submission to the ASR chair b) Prepare the ASR summary report and ASR minutes for signature and distribution by the ASR chair

6.3 System requirements review (SRR) detailed criteria

6.3.1 SRR technical review products acceptability criteria

Table 5 lists the products that should be reviewed at SRR, and the associated acceptability criteria that should form a sufficient basis by which to assess each product's content as acceptable to support a successful SRR. Specific products and associated acceptability criteria shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 5—SRR technical review products acceptability criteria

Product	SRR acceptability criteria
System specification	a) Supplier clearly demonstrates an understanding of the system requirements consistent with the ICD and draft CDD. b) System requirements are sufficiently detailed and understood to enable system functional definition and functional decomposition. c) System requirements are assessed to be verifiable. d) Requirements can be met given the technology maturity. e) External interfaces to the system have been documented. f) System requirements have been synthesized into conceptual architectures. g) System conceptual architecture alternatives are developed and assessed in the context of engineering trade space, technical requirements, system specification, risks (technical, programmatic, schedule, cost), LCC and cost as an independent variable (CAIV). h) The preliminary system conceptual architectures support implementation of operational concepts, interoperability objectives, and system and external interface requirements. i) The preliminary system conceptual architectures identify the interfaces to the global information grid. j) System operational and life-cycle sustainment requirements are defined and documented. k) Critical human safety and health requirements are documented. l) Hazardous materials management and pollution prevention requirements are documented. m) System command, control, communication, computer, and intelligence (C4I) requirements are assessed and preliminary performance is allocated across segments and subsystems. n) System security engineering (SSE), communications security (COMSEC), cybersecurity, and program protection (PP) anti-tamper security requirements are documented for each preliminary system conceptual architecture in accordance with DoD directives. o) Preliminary cybersecurity requirements for both hardware and software are documented that address system data protection, availability, integrity, confidentiality, and authentication, and non-repudiation and are consistent with the National Institute of Standards and Technology (NIST) risk management framework certification and accreditation requirements. p) Cybersecurity requirements are mapped for each preliminary logical architecture. q) Threat scenario assessments are completed, threat environments, categories of expected threats and their likelihood of occurrence are defined and correlated with preliminary system logical architectures, survivability and vulnerability KPPs are established for each assessed threat and correlated with the preliminary logical architectures.

Product	SRR acceptability criteria
System specification *(continued)*	r) SoS technical interface requirements are adequately defined, including interdependences associated with schedule, test, and configuration changes. s) Preliminary interoperability analyses are completed, ensuring compatibility and defining interrelationships between other interfacing systems and system users. t) A preliminary interoperability logical architecture is defined within each system preliminary design concept, based on the system and external interfaces. u) Software requirements analysis has allocated high-level software functionality to the applicable portions of the preliminary system logical architecture. v) Preliminary data management software requirements are documented (e.g., automatic file migration and transparent file retrieval, migration between hierarchical levels, utilities to report on media usage, and error detection). w) Hardware and software human systems integration (HSI) requirements have been documented consistent with DoD standards and implementation guidance (e.g., MIL-STD-1472 [B9], DoD HCI Style Guide [B3]) mapped to the preliminary system logical architectures, and coordinated with applicable acquirer organizations. x) Environmental qualification requirements (vibration, thermal, humidity, transport, etc.) are documented and correlated with the preliminary system logical architectures. y) Electromagnetic interference (EMI) and electromagnetic compatibility (EMC) requirements are documented and correlated with the preliminary system logical architectures. z) Preliminary quality and product assurance requirements and their associated verification criteria have been documented. aa) Supportability requirements have been documented, are consistent with the preliminary system logical architectures, and are traceable to the draft or validated CDD, ICD, CONOPS, and maintenance/sustainment concept. bb) Supplier has adequately expanded the system specification to reflect tailored, derived, and correlated design requirements. cc) Performance requirements of major subsystems are documented for each candidate system logical architecture. dd) Critical design and manufacturing requirements are documented, including requirements addressing COTS and diminishing manufacturing sources (DMS). ee) Preliminary reliability and maintainability (R&M) requirements are documented and subsystem allocations support the system specification requirements. ff) Preliminary parts, materials and processes (PM&P) requirements have been documented. gg) Bi-directional requirements traceability between the draft or validated CDD and the system specification has been documented. hh) Requirements allocations and associated rationale from the source documents to the system specification have been documented. ii) System specification is approved, including stakeholder concurrence, with sufficiently conservative requirements to allow for design trade space.

Product	SRR acceptability criteria
Technical plans	a) Supplier's SEMP is complete, adequate and aligned with the program SEP. b) Cost and critical path drivers have been identified. c) The program schedule is executable with an acceptable level of technical and cost risk. d) Adequate processes and metrics are in place for the program to succeed. e) Systems engineering is properly staffed. f) Program is executable within the existing budget. g) The SDP documents the preliminary identification of all software components (tactical, support, deliverable, non-deliverable, etc.) h) Software functionality in the system specification is consistent with the software sizing estimates and the resource-loaded schedule. i) Plans for developing critical algorithms to meet requirements are adequate and incorporated into budget and IMS. j) Programming languages and logical architectures, security requirements, and operational and support concepts have been identified. k) Hazards have been reviewed and mitigating courses of action have been allocated within the overall system design. l) Mission critical failure modes are identified and agreement has been reached for plans for mitigation or acceptance. m) Critical technologies have been identified, readiness assessed, and maturation plans developed. n) Software development strategy is complete and adequate. o) Draft verification methodologies and environments have been adequately defined for each specification requirement and are included in the requirements traceability. p) Overall DT&E approaches are defined for each system architectural concept. q) Development, qualification, and acceptance testing approaches are defined, including consideration for non-developmental items (NDI), COTS, and reuse items. r) The system safety program addresses critical human safety and health requirements. s) Preliminary verification methodologies for data gathering, reduction, and analysis are defined, including test environments, operations, data acquisition requirements, documentation, methods of analysis, and success criteria. t) Parts engineering design strategies and associated qualification/acceptance testing approaches are developed as they apply to the preliminary system architectural concepts, including risk assessments, technologies, sources of supply, and the common quality levels (i.e., reliability) of the parts. u) Review of budget margins and error allocations represent adequate understanding of requirements and any risks have plans and are managed. v) Initial plans for design address requirements that will drive stressing design solutions and associated specialized manufacturing requirements (extreme complexity, multiple or very tight tolerances, precision assembly, handling of fragile components, etc.) w) Initial plans for design include preliminary data storage logical architecture(s) consistent with computer resource growth margin requirements.

Product	SRR acceptability criteria
Technical plans *(continued)*	x) Certifying agencies have been identified and certification requirements are understood. y) Draft test plans have been developed in support of the TMRR phase. z) Acquirer and supplier CM strategies are complete and adequate. aa) The modeling and simulation (M&S) plan for life-cycle support, including LCC, total ownership costs (TOC), reliability, maintainability, availability, design models, training devices, system tactics, representation, and mission, etc. is complete, utilizes correctly translated system attributes to reflect operational performance, and is adequate to support system design, manufacturing, training, operation, and disposal. bb) The manufacturing and production strategy is complete and adequate. cc) IMS adequately identifies the critical path and is resourced at reasonable levels, based on realistic performance/efficiency expectations. dd) IMS includes early milestones for SSE, cybersecurity, COMSEC, and PP certification and accreditation timelines. ee) Unique work requirements for competitive prototyping have been identified. ff) Product support plan and sustainment concepts have been defined with the corresponding metrics. gg) R&M planning is complete and adequate.
Program risk assessment	a) Cost, schedule, and technical risks are identified, and mitigation plans are in place. b) Risk management plan is complete and adequate. c) Risk management process is in place demonstrated by documented execution results of existing mitigation plans.
Program life-cycle cost estimate	a) Preliminary CARD is consistent with the approved system specification. b) Preliminary software development estimates established with effort, schedule, and cost analysis. c) Updated cost estimate fits within the existing budget.

6.3.2 SRR preparation

Table 6 lists the actions that should be considered during preparation for the SRR. The responsible people listed are those most often tasked with the listed preparation actions, but the acquirer and supplier may agree to assign the actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 6—SRR technical review preparation actions

Responsible person	SRR preparation actions
Program manager	a) Approve, fund, and staff the SRR as planned in the SEP developed by the systems engineer. b) Manage and approve changes to the system specification. c) Establish the plan to SFR in applicable contract documents including the SEP, IMS, and IMP. d) Ensure the SEP includes objective SMEs to participate in the SRR. e) Coordinate a preliminary agenda between the program IPT and other acquirer SMEs no later than 30 days prior to the SRR. f) Appoint an SRR chair no later than 45 days prior to the technical review, in coordination with the systems engineer.
Systems engineer	a) Ensure all performance requirements, both explicit and derived, are defined and traceable (both directions) between requirements in the draft CDD including KPPs, KSAs, other system attributes, and the system specification. b) Ensure verification methods are identified for all system requirements. c) Ensure risk items associated with system requirements are identified and analyzed, and mitigation plans are in place. d) Coordinate arrangements for SRR location and support. e) Ensure all of the technical review products whose acceptability criteria are defined in Table 5 are completed for the SRR. f) Ensure the preparation of all presentation material is coordinated across IPTs. g) Ensure adequate plans are in place to complete the technical activities to proceed from SRR to the SFR. h) Ensure plans to proceed to SFR allow for contingencies.
SRR chair	a) Determine SRR team membership. b) Approve the final SRR agenda. c) Identify any final Clause 6 SRR detailed criteria tailoring for the specific program. d) Identify any specific elements for in-depth technical review as required.

6.3.3 SRR conduct

Table 7 lists the technical review elements and associated content details that should be considered for the conduct of the SRR. Specific elements and their content details shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 7—SRR conduct elements

SRR review element	Content details
Introduction, agenda, administrative	a) Review location layout and safety procedures b) Security procedures if applicable c) Introduction of chair and team members d) SRR agenda e) Action item procedures f) Program overview g) Status of action items from previous technical reviews
Requirements review	a) Specification tree and overall layout of system specification b) Requirements traceability, methodology, and completeness c) KPPs, MOPs, and MOEs d) Verification and certification requirements e) Interoperability f) Software g) Hardware h) System safety requirements i) Logistics and personnel requirements j) Resources requirements to support development
Technical plans review	a) SEMP—structure and details b) IMP and IMS c) M&S plan d) Software development strategy e) Technology maturation and management plan f) Specialty engineering plans g) Hazard mitigation plan if applicable h) Government and supplier CM plans i) Manufacturing and production strategy j) Product support plan and sustainment strategy
Risk and mitigation review	a) Risk management plan focusing on TMRR phase b) Risk identification, including system security threats, cyber vulnerabilities, cyber risks, operational risks, hazard and system safety analysis, environment, safety, and occupational health (ESOH), and supplier's ability to meet specification requirements c) Completed preliminary industrial base assessment identifying and prioritizing risk areas against assessment results
Program life-cycle cost estimate review	a) Preliminary CARD consistency with the approved system specification b) Preliminary software development estimates

6.3.4 SRR closure

Table 8 lists the actions that should be considered for SRR closure. The responsible people listed are those most often tasked with the listed closure actions. The acquirer and supplier may agree to assign the program manager and systems engineer actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 8—SRR closure actions

Responsible person	SRR closure actions
Program manager	a) Manage and approve changes to technical baselines resulting from SRR. b) If funding profiles are insufficient to support development, notify user/sponsor of funding shortfall and request funding profile adjustments. c) Support preparation of the SRR summary report.
Systems engineer	a) Organize and supervise the responses to all action items generated during SRR. b) Support preparation of the SRR summary report. c) Obtain concurrence between acquirer and supplier SMEs on requirements decomposition. d) Ensure all information products required to be put under configuration control have been delivered to the configuration manager. e) Ensure all IMP and IMS tasks associated with conduct of the SRR have been successfully completed and documented as such.
SRR chair	a) Ensure preparation of the SRR summary report and formal SRR minutes with the support of the program manager and systems engineer. b) Sign off final approval of all action items. c) Approve the SRR minutes. d) Approve and distribute the SRR summary report. e) Prepare and distribute the formal SRR closure letter.
Recorder	a) Collate all action items for submission to the SRR chair. b) Prepare the SRR summary report and SRR minutes for signature and distribution by the SRR chair.

6.4 System functional review (SFR) detailed criteria

6.4.1 SFR technical review products acceptability criteria

Table 9 lists the products that should be reviewed at SFR, and the associated acceptability criteria that should form a sufficient basis by which to assess each product's content as acceptable to support a successful SFR. Specific products and associated acceptability criteria shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 9—SFR technical review products acceptability criteria

Product	SFR acceptability criteria
System functional baseline documentation	a) Documentation is clear and unambiguous, enabling a clear understanding for assessment of achievability within cost and schedule constraints. b) Established functional baseline by mapping requirements to hardware, software, and human elements of the system. c) Documented performance requirements traced to draft or validated CDD requirements and reflecting clear linkage to the SoS context(s) (including use in multiple operational environments). d) Documented performance requirements reflect design considerations. e) Documented verification requirements, including testing, for FCA/SVR f) R&M requirements trace correctly to system functional design elements, which are supported by maintainer use case analysis. g) Bi-directional traceability between the system specification and the source documents has been documented.
Major system elements definition	a) Documented preliminary allocated requirements optimized through analyses (including functional analysis and sensitivity analysis), trade studies, and risk assessments. b) Documented element external interfaces.
Program risk assessment	a) Cost, schedule, and technical risks are identified, and mitigation plans are in place. b) Risk management process is in place demonstrated by documented execution results of existing mitigation plans.
Technical plans	a) Supplier's SEMP is complete, adequate and aligned with the program SEP. b) A detailed plan and schedule, sufficiently resourced to continue design and development, is established. c) Program life-cycle cost estimate is consistent with defined system functionality.

6.4.2 SFR preparation

Table 10 lists the actions that should be considered during preparation for the SFR. The responsible people listed are those most often tasked with the listed preparation actions, but the acquirer and supplier may agree to assign the actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 10—SFR technical review preparation actions

Responsible person	SFR preparation actions
Program manager	a) Approve, fund, and staff the SFR as planned in the SEP developed by the systems engineer. b) Chair the configuration control board (CCB) and manage and approve changes to the system specification. c) Establish the plan to PDR in applicable contract documents including the SEMP, IMS, and IMP. d) Ensure the SEP includes objective SMEs to participate in the SFR. e) Coordinate a preliminary agenda between the program IPT and other acquirer SMEs no later than 30 days prior to the SFR. f) Control the configuration of the government-controlled subset of the system functional baseline. g) Appoint an SFR chair no later than 45 days prior to the technical review, in coordination with the systems engineer.
Systems engineer	a) Ensure adequate plans are in place to complete the technical activities to proceed from SFR to PDR. b) Ensure plans to proceed to PDR allow for contingencies. c) Ensure all performance requirements, both explicit and derived, are defined and traceable (both directions) between requirements in the draft CDD including KPPs, KSAs, other system attributes, and the system specification. d) Ensure verification methods are identified for all requirements. e) Ensure risk items associated with the functional requirements are identified and analyzed, and mitigation plans are in place. f) Coordinate arrangements for SFR location and support. g) Ensure all of the technical review products whose acceptability criteria are defined in Table 9 are completed for the SFR. h) Ensure the preparation of all presentation material is coordinated across IPTs.
SFR chair	a) Determine SFR team membership. b) Approve the final SFR agenda. c) Identify any final Clause 6 SFR detailed criteria tailoring for the specific program. d) Identify any specific elements for in-depth technical review as required.

6.4.3 SFR conduct

Table 11 lists the technical review elements and associated content details that should be considered for the conduct of the SFR. Specific elements and their content details shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 11—SFR conduct elements

SFR review element	Content details
Introduction, agenda, administrative	a) Review location layout and safety procedures b) Security procedures if applicable c) Introduction of chair and team members d) SFR agenda e) Action item procedures f) Status of action items from previous technical reviews g) Overview of system functional decomposition, allocated baseline elements, and preliminary physical architecture
System functional baseline documentation review	a) System logical architecture development b) System, segment and subsystem design, and functional requirements allocations c) M&S methodology and results mapped to derived requirements and allocations d) Results of trade studies and their integration into the system design baseline e) Interoperability requirements integration into the system design baseline f) Software logical architecture and interfaces g) System, segment and subsystem verification and validation (V&V) strategy and verification cross-reference matrix (VCRM) contents h) DT&E and OT&E requirements, test criteria and execution strategy
Major system elements definition review	a) Details of the allocated baseline elements and bi-directional traceability to requirements sources b) Element interfaces c) Software logical architecture and interfaces d) KPP and technical performance measure (TPM) mapping to system design elements e) Use cases analysis and threat scenario alignment with requirements allocations to system design elements f) Environmental requirements correlation to system design elements g) R&M requirements correlation to system design elements h) System operational sustainment strategy i) Engineering disciplines and specialties coverage of system design elements, to include the following: 1) Parts, materials, and processes 2) Test and evaluation 3) Survivability and vulnerability 4) ESOH 5) Mass properties 6) System security engineering, cybersecurity, COMSEC, and program protection 7) Interoperability

SFR review element	Content details
Major system elements definition review *(continued)*	8) R&M 9) EMI and EMC 10) Human systems integration 11) Manufacturing and producibility 12) Life-cycle logistics 13) System safety 14) Contamination control 15) Quality assurance 16) Data storage (security, access, distribution, and delivery) j) Manufacturing and production strategy k) Product support plan and sustainment strategy
Risk assessment review	a) Mitigation plans and their phasing focusing on TMRR phase elements and associated risk of proceeding into design
Technical plans review	a) Updates and details as applicable for plans including: 1) SEMP 2) Modeling and simulation plan 3) Software development plan 4) Hazard mitigation plan 5) Draft system test plan(s) 6) Product support plan 7) Integration plan

6.4.4 SFR closure

Table 12 lists the actions that should be considered for SFR closure. The responsible people listed are those most often tasked with the listed closure actions. The acquirer and supplier may agree to assign the program manager and systems engineer actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 12—SFR closure actions

Responsible person	SFR closure actions
Program manager	a) Manage and approve changes to technical baselines resulting from SFR. b) If funding profiles are insufficient to support development, notify user/sponsor of funding shortfall and request funding profile adjustments. c) Support preparation of the SFR summary report.
Systems engineer	a) Organize and supervise the responses to all action items generated during SFR. b) Support preparation of the SFR summary report. c) Obtain concurrence between acquirer and supplier SMEs on requirements allocations, functional decomposition, and preliminary system design elements. d) Ensure all information products required to be put under configuration control have been delivered to the configuration manager. e) Ensure all IMP and IMS tasks associated with conduct of the SFR have been successfully completed and documented as such.
SFR chair	a) Ensure preparation of the SFR summary report and formal SFR minutes with the support of the program manager and systems engineer. b) Sign off final approval of all action items. c) Approve the SFR minutes. d) Approve and distribute the SFR summary report. e) Prepare and distribute the formal SFR closure letter.
Recorder	a) Collate all action items for submission to the SFR chair. b) Prepare the SFR summary report and SFR minutes for signature and distribution by the SFR chair.

6.5 Preliminary design review (PDR) detailed criteria

6.5.1 PDR technical review products acceptability criteria

Table 13 lists the products that should be reviewed at PDR, and the associated acceptability criteria that should form a sufficient basis by which to assess each product's content as acceptable to support a successful PDR. Specific products and associated acceptability criteria shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 13—PDR technical review products acceptability criteria

Product	PDR acceptability criteria
System allocated baseline documentation	a) Analysis of system performance is complete and is assessed to meet requirements traceable to the validated CDD. b) Trade studies related to the design of the system and its lowest level specified CIs are complete and documented, including the rationale for selection of the preferred alternative. c) Interoperability functional performance requirements are allocated to all system, segment and subsystem preliminary designs. d) Preliminary design satisfies design considerations and demonstrates consistency with a standard implementation framework such as department of defense architecture framework (DoDAF) 2.0 or equivalent. e) System operational functions and environments for the preliminary design are traceable to the supplier's CONOPS and the allocated baseline. f) Preliminary system-level design is producible and assessed to be within the production budget. g) Preliminary long lead production requirements are developed and documented. h) PM&P allocated requirements are incorporated into the preliminary design. i) Mass properties margins (average or complex) are established for PDR and correlated with the preliminary design, including allowable growth allocations and metrics. j) SSE, COMSEC, cybersecurity, and PP security requirements are allocated and incorporated into the preliminary design in accordance with DoD policies, directives, and system specifications. k) EMI control processes and procedures are developed for the preliminary design, and EMI/EMC allocated requirements are incorporated into the preliminary design. l) User interface hardware and software allocated requirements for operators, users, maintainers, and sustainers are incorporated into the preliminary design. m) Contamination control processes and procedures are developed for the preliminary design. n) Hazardous materials management and pollution prevention allocate requirements are incorporated into the preliminary design. o) Data storage analysis identifies reliability, maintainability, and availability requirements for storage systems environments. p) The preliminary data storage physical architecture fully addresses elements, including communications and processing capacity. q) The data storage logical architecture defines a complete list of data receivers to include both computer and human agents. r) The level of user integrity (e.g., access control lists) has been

Product	PDR acceptability criteria
System allocated baseline documentation *(continued)*	identified that enables the system requirements to be met. s) DT&E elements are correlated with the preliminary design. t) OT&E allocated requirements are incorporated into the preliminary design. u) Assessment of the technical effort and design indicates potential for OT&E success (operationally effective and suitable). v) The preliminary design incorporates all survivability, vulnerability, and threat allocated requirements for all categories of expected threats, threat environments and their likelihood of occurrence. w) A draft critical technologies list is documented. x) All CSIs and CAIs are identified. y) System safety allocated requirements are incorporated into the preliminary design. z) Preliminary hazard analyses are completed and a prioritized list of safety hazards is documented. aa) ESOH allocated requirements are incorporated into the preliminary design. bb) Functional failure modes, effects, and criticality analysis (FMECA) is completed. cc) R&M allocated requirements are supported by the preliminary design. dd) Program's reliability growth planning strategy and growth curve supports key program milestones needed to meet the CDD threshold at initial operational test and evaluation (IOT&E), and is adequate to grow to the specification value, considering the test schedule and resources. ee) Results from the R&M analyses are used in O&S cost estimates, availability analyses, provisioning plans (spares and repair parts), and maintenance concept. ff) Environmental qualification requirements are incorporated into the design and are addressed in the requirements traceability documentation. gg) Estimate of system reliability and maintainability is updated, based on engineering analyses, initial test results, or other sources of demonstrated reliability and maintainability. hh) Quality and product assurance allocated requirements are incorporated into the preliminary design. ii) Appropriate margins are established at the segment, subsystem, and component levels as applicable. jj) Requirements allocation and derivation from system to segment, subsystem and component levels are complete, traceable to the preliminary design and all "to be determined" (TBD) items are being tracked to resolution. kk) Interface definitions at the inter-segment and inter-subsystem levels are complete, documented, and traceable to the preliminary design and all TBDs are being tracked to resolution. ll) Preliminary ground support equipment designs if applicable are traceable to the system allocated baseline and to the preliminary design. mm) Supportability allocated requirements are incorporated into the preliminary design. nn) Key allocated performance requirements are traceable to the system's preliminary design at the segment, subsystem, and component levels as applicable. oo) Key allocated performance requirement parameters developed and assessed at SFR are implemented in each major subsystem and

Product	PDR acceptability criteria
System allocated baseline documentation *(continued)*	component preliminary design. pp) All deficiencies identified as a result of any testing performed to date, including those related to technology deficiencies identified at SFR, have been correlated with the applicable portions of the preliminary design, impacts have been assessed, and candidate design changes to correct the deficiencies have been identified. qq) The documented results of any prototyping done to date provide evidence that the technical approach is adequate and the risk levels for the corresponding design approach are acceptable. rr) Prototypes implemented to date correctly implement the corresponding portions of the functional baseline and are consistent with the preliminary physical architecture. ss) The physical and functional interfaces of each prototype implemented to date satisfy the corresponding allocated requirements, and validate the sufficiency of the applicable external interface requirements levied on the system for its interaction with facilities and personnel. tt) Computer system and software logical architecture designs have been established; all computer SWCIs, HWCIs, computer software components (CSCs), and computer software units (CSUs) have been defined. uu) The preliminary design is consistent with the end-to-end processing capabilities and capacities needed for mission operations as indicated by the system performance analysis results. vv) Preliminary growth margin requirements are documented for computer resources (memory and storage capacity, processor throughput, communications bandwidth, etc.) ww) Software requirements specifications (SRS) and interface requirement specifications (IRS), including verification plans, are complete and baselined for all SWCIs for the planned builds up to this point, and satisfy the system functional requirements. xx) Software functionality in the preliminary design is consistent with resources expended per the IMS and the software metrics. yy) Interface control documents trace all software interface requirements to the SWCIs and CSUs. zz) Preliminary software design has been defined and captured for the builds up to this point. aaa) System end-to-end data flow is complete and documented in the preliminary design. bbb) All required software-related documents are baselined and delivered for the builds up to this point. ccc) System allocated baseline documentation is sufficiently complete and correct to enable detailed design to proceed with proper CM.
System functional or allocated baseline documentation	a) Preliminary design (hardware, software, human procedures), including interface descriptions is complete, satisfies all requirements in the system functional baseline and is under CM without any major TBDs or open items. b) System, segment, subsystem, and component-level interfaces are baselined and are under configuration control. c) C4I allocations are incorporated into the preliminary design across segments, subsystems, and components.

Product	PDR acceptability criteria
System functional or allocated baseline documentation *(continued)*	d) The threat scenario operational and environmental allocations are incorporated into the preliminary design and are traceable to all segments, subsystems, and components. e) Test requirements and test data collected to date for the preliminary design are traceable to operational requirements via specifications and VCRMs. f) Bi-directional requirements traceability among functional and allocated baselines and the preliminary design is complete, consistent, and has been approved by all applicable stakeholders.
Technical plans	a) Supplier's SEMP is complete, adequate and aligned with the program SEP. b) Integrating activities of any lower-level PDRs have occurred; identified issues are documented in action plans. c) Plan to CDR is accurately documented in the SEP and SEMP, as well as in the IMP and IMS. d) Program is properly staffed by both the acquirer and supplier. e) Technical performance measures have been identified to track technical progression of design maturity concern areas. f) Plans documenting the system, segment, subsystem, and component V&V approaches are developed for the preliminary design. g) Preliminary V&V plans are traceable to the preliminary design correlating all test objectives, test environments and test resources with allocated requirements. h) Preliminary V&V plans address data acquisition, reduction, analysis and documentation, and success criteria. i) Hazardous materials management and pollution prevention processes and procedures are verified and baselined. j) Test bed(s) and test facilities chosen based on the preliminary design are deemed adequate to perform system, segment, subsystem, and interface requirements verification (e.g., for critical HWCIs and SWCIs, arrangements for procuring and scheduling the use of V&V resources—simulators, test beds, test facilities—have been demonstrated). k) Design development planning is completed and baselined. l) Program schedule, as depicted in the updated IMS is executable within acceptable technical and cost risks. m) Program is executable with the existing budget. n) Trade studies and system producibility assessments are under way. o) All critical manufacturing processes have been defined, characterized, and documented. p) Failure reporting and corrective action system (FRACAS) is established. q) Logistics (sustainment) and training systems planning and documentation are sufficiently complete to support the technical review. r) LCSP is approved, including updates on program sustainment development efforts and schedules based on current budgets and firm supportability design features. s) LCSP includes software support requirements. t) LCSP addresses DMS, PM&P guidelines, and counterfeit parts risk management. u) Long-lead and key supply chain elements are identified, to include strategic materials risk.

Product	PDR acceptability criteria
Technical plans *(continued)*	v) Software plans have sufficient content to demonstrate that 1) Computer systems and software design and development approach have been confirmed through analyses, demonstrations, and prototyping in a relevant environment. 2) Software increments have been defined and capabilities allocated to specific increments. 3) Software trade studies addressing COTS, reuse, and other software-related issues are completed. 4) Software development process is defined in a baselined software development plan and reflected in the IMP and IMS. 5) Software development schedules reflect supplier software processes and IMP/IMS software events for current and future development phases. 6) Software development environment and test/integration labs have been established with sufficient fidelity and capacity. 7) Software metrics have been defined and a reporting process has been implemented; metrics are being actively tracked and assessed. 8) Testability requirements—built-in test (BIT), false alarm rate, fault isolation, fault detection—have been identified and the required software support documented as requirements so that they can be tested in the proposed design. 9) TEMP addresses all SWCI plans, test facilities, and test plans, including testing required to support incremental approaches and regression tests. 10) Software development estimates [i.e., size, effort (cost), and schedule] are updated. w) Hardware plans have sufficient content to demonstrate that 1) The hardware design/development approach has been confirmed through analyses, demonstrations, and prototyping in a relevant environment. 2) Hardware trade studies addressing COTS, reuse, and other software-related issues are completed. 3) The major phases of the program's hardware design and development process are defined in a hardware development plan and reflected in the IMP and IMS. 4) Hardware development schedules reflect supplier hardware processes and IMP/IMS hardware design and development events. 5) Hardware development environment (e.g., computer modeling and design tools) and test/integration labs have been established with sufficient fidelity and capacity. 6) Hardware metrics have been defined and a reporting process has been implemented; metrics are being actively tracked and assessed. 7) R&M and testability requirements—BIT, false alarm rate, fault isolation, fault detection—have been identified and the required hardware support documented as requirements so that they can be tested in the proposed design. Also, requirements for detailed design have been identified such as thermal, vibration, shock environments, and highly accelerated life testing (HALT). 8) TEMP addresses all HWCI plans, test facilities, and test

Product	PDR acceptability criteria
Technical plans *(continued)*	plans, including testing required to support incremental approaches and regression tests. 9) Hardware development estimates [i.e., number of HWCIs, effort (cost) and schedule] are updated.
Problem risk assessment	a) Cost, schedule, and technical risks are identified, and mitigation plans are in place. b) Risk management process is in place demonstrated by documented execution results of existing mitigation plans.
Program life-cycle cost estimate	a) System cost model has been updated, allocated to lower system element levels, and tracked against targets; production cost model constructed. b) Updated CARD is consistent with the proposed allocated baseline.

6.5.2 PDR preparation

Table 14 lists the actions that should be considered during preparation for the PDR. The responsible people listed are those most often tasked with the listed preparation actions, but the acquirer and supplier may agree to assign the actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 14—PDR technical review preparation actions

Responsible person	PDR preparation actions
Program manager	a) Approve, fund, and staff the system PDR as planned in the SEP developed by the systems engineer. b) Manage and approve changes to the segment, subsystem and system element development specifications well enough in advance to allow successful execution of the PDR delivery of an acceptable allocated baseline at the PDR. c) Establish the plan to CDR in applicable contract documents including the SEMP, IMS, and IMP. d) Ensure the SEP includes objective SMEs to participate in the PDR. e) Appoint a PDR chair, in coordination with the systems engineer, no later than 45 days prior to the technical review. f) Coordinate a preliminary agenda between the program IPT and other acquirer SMEs no later than 30 days prior to the PDR.
Systems engineer	a) Ensure that the pre-established PDR criteria have been met, including measurement status of the program's technical metrics that demonstrate acceptable progress and developmental maturity of the system design to achieve a successful PDR. b) Ensure the system allocated baseline and physical architecture are complete and consistent. c) Ensure the set of system elements comprising the preliminary system design can achieve the complete set of system allocated baseline requirements. d) Ensure assessments and risks associated with all design constraints are conducted, documented and provided in the technical review material. e) Ensure verification methods are defined for all decomposed and allocated requirements. f) Ensure risk items associated with allocated requirements are identified and analyzed, and mitigation plans are in place. g) Provide supplier organization(s) the opportunity to participate in the PDR planning. h) Coordinate arrangements for PDR location and support. i) Ensure all of the technical review products whose acceptability criteria are defined in Table 13 are completed for the PDR. j) Ensure the preparation of all presentation material is coordinated across IPTs. k) Ensure adequate plans are in place to complete the technical activities to proceed from PDR to the CDR. l) Ensure plans to proceed to CDR allow for contingencies.
PDR chair	a) Determine PDR team membership. b) Approve the final PDR agenda. c) Identify any final Clause 6 PDR detailed criteria tailoring for the specific program. d) Identify any specific elements for in-depth technical review as required.

6.5.3 PDR conduct

Table 15 lists the technical review elements and associated content details that should be considered for the conduct of the PDR. Specific elements and their content details shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 15—PDR conduct elements

PDR review element	Content details
Introduction, agenda, administrative	a) Review location layout and safety procedures b) Security procedures if applicable c) Introduction of chair and team members d) Purpose of the review e) PDR agenda f) Action item procedures g) Risk assessment procedures h) Program overview i) Status of action items from previous technical reviews
Allocated baseline and comparison with functional baseline	a) Updated specification tree to the system element level and description of requirements allocation process including technical budgets b) Requirements traceability, methodology and completeness to the system element level c) System physical architecture and design, correspondence of elements (hardware, software, manual procedures) to the specification tree and allocated requirements d) Trade studies, FMECA, and other studies and analyses e) System internal and external interfaces f) Updates to KPPs, MOPs, and MOEs g) Established metrics and measures h) Verification and certification requirements as allocated to system elements i) Preliminary design's support for interoperability j) Software logical architecture and development status k) Preliminary software design for the increments up to this point l) Test and certification requirements and initial test planning m) Logistics and personnel requirements n) Training requirements o) Resources requirements to support development
Technical plans review	a) IMP and IMS b) M&S support to PDR and subsequent M&S plans for CDR, TRR, etc. c) Software development plan maturity d) Software development environment and test and integration labs e) Manufacturing plan and processes f) Specialty engineering plans g) Hazard mitigation plan if applicable h) Government and supplier configuration CM plans i) Certification and accreditation plans j) Updates to product support plan and sustainment strategy k) Updates to LCSP including software support requirements and supportability features in the preliminary system design

PDR review element	Content details
Risk and mitigation review	a) Risk identification and mitigation, including: 1) Consideration of V&V resource requirements in support of the preliminary design 2) Consideration of producibility assessments of key technologies to support manufacturing 3) Consideration of test resources and availability 4) Consideration of ESOH 5) Consideration of ongoing industrial base assessment (diminishing manufacturing sources and material shortages, obsolete parts, etc.) 6) Consideration of unique software risks
Program life-cycle cost estimate review	a) Updates to the CARD to align it with the allocated baseline b) Updated software development estimates from detailed system-element level inputs c) Earned value baseline

6.5.4 PDR closure

Table 16 lists the actions that should be considered for PDR closure. The responsible people listed are those most often tasked with the listed closure actions. The acquirer and supplier may agree to assign the program manager and systems engineer actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 16—PDR closure actions

Responsible person	PDR closure actions
Program manager	a) Manage and approve changes to technical baselines resulting from PDR. b) If funding profiles are insufficient to support development, notify user/sponsor of funding shortfall and request funding profile adjustments. c) Support preparation of the PDR summary report.
Systems engineer	a) Determine the root cause of problems, identify corrective actions, and manage to completion. b) Monitor and control the execution of the PDR closure plans. c) Organize and supervise the responses to all action items generated during PDR. d) Support preparation of the PDR summary report. e) Ensure all information products required to be put under configuration control have been delivered to the configuration manager. f) Ensure all IMP and IMS tasks associated with conduct of the PDR have been successfully completed and documented as such.
PDR chair	a) Ensure preparation of the PDR summary report and formal PDR minutes with the support of the program manager and systems engineer. b) Sign off final approval of all action items. c) Approve the PDR minutes. d) Approve and distribute the PDR summary report. e) Prepare and distribute the formal PDR closure letter.
Recorder	a) Collate all action items for submission to the PDR chair. b) Prepare the PDR summary report and PDR minutes for signature and distribution by the PDR chair.

6.6 Critical design review (CDR) detailed criteria

6.6.1 CDR technical review products acceptability criteria

Table 17 lists the products that should be reviewed at CDR, and the associated acceptability criteria that should form a sufficient basis by which to assess each product's content as acceptable to support a successful CDR. Specific products and associated acceptability criteria shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 17—CDR technical review products acceptability criteria

Product	CDR acceptability criteria
System product baseline documentation	a) Key product characteristics whose variation has a significant influence on product fit, performance, service life, or manufacturability have been identified to support production decisions. b) Initial product baseline documentation is sufficiently complete and correct to enable hardware fabrication and software implementation to proceed with proper CM and within the production budget. c) Trade studies related to the design of the system and its lowest level specified CIs are complete and documented, including the rationale for selection of the preferred alternative. d) Detailed design demonstrates bi-directional traceability among all considerations: allocated and physical requirements, engineering trade study results, technology selections and technical, programmatic, schedule and cost risks. e) Bi-directional traceability has been documented between the CDD, the CPD and the system design specifications. f) Detailed design captures the survivability and vulnerability threat allocations incorporated into the preliminary design for all categories of expected threats, threat environments and their likelihood of occurrence. g) All COTS items have been assessed and found to satisfy the requirements allocated to them and that they introduce no unexpected system attributes or behavior. h) R&M and testability analyses are complete and results demonstrate that the detailed design supports all R&M and testability requirements. i) Every requirement in the allocated baseline has a documented verification method and associated success criteria that are consistent with the verification cross-reference documentation. j) Interoperability functional performance requirements are allocated to all system CI detailed designs. k) Detailed design satisfies all design considerations and demonstrates consistency with a standard implementation framework such as DoDAF 2.0 or equivalent. l) Detailed design satisfies sustainment and HSI requirements. m) The detailed design incorporates all allocated ESOH requirements. n) The detailed design incorporates all allocated quality assurance requirements. o) 100% of CSIs and CAIs have completed drawings, specifications and instructions. p) Initial product baseline includes documented and approved detailed interface designs for all external devices required to interconnect with the system for its operation, support, maintenance and disposal. q) System operational functions and environments for the detailed design are

Product	CDR acceptability criteria
System product baseline documentation *(continued)*	traceable to the supplier's CONOPS and the allocated baseline. r) All development and off-the-shelf specifications are complete and validated by production, verification and operations organizations, and by specialty engineering groups. s) The detailed design is producible and assessed to be within the production budget. t) Long lead production requirements are defined and documented. u) The initial product baseline contains design alternatives for all strategic materials and component suppliers. v) Critical technologies list is updated and alternate sources for critical technologies are documented. w) System safety allocated requirements are incorporated into the detailed design. x) All hazard analyses are completed, and the detailed design incorporates all requirements derived from the prioritized list of safety hazards. y) PM&P allocated requirements are incorporated into the detailed design. z) Program's reliability growth planning curve supports key program milestones needed to meet the CDD threshold at IOT&E. Changes, if any, to the reliability growth strategy from the previous curve at PDR are addressed, and the curve is adequate to grow to the specification value, considering the test schedule and resources. aa) Results from the R&M analyses are used in O&S cost estimates, availability analyses, provisioning plans (spares and repair parts), and maintenance concept. bb) A level of repair analysis has been completed and the results documented. cc) The product baseline prescribes all necessary form, fit, and function characteristics and selected functional characteristics designated for production test requirements and production acceptance testing. dd) Mass properties margins (average or complex) are established for CDR and correlated with the detailed design, including allowable growth allocations and metrics. ee) SSE, COMSEC, cybersecurity, and PP security requirements are implemented into the detailed design in accordance with DoD policies, directives, and system specifications. ff) EMI control processes and procedures including EMI susceptibility are reflected in the detailed design. gg) User interface hardware and software allocated requirements for operators, users, maintainers, sustainers, and disposers are incorporated into the detailed design. hh) Contamination control processes and procedures are incorporated into the detailed design in order to meet production, mission operations, maintenance, and disposal requirements. ii) Growth margin requirements are documented for computer resources (memory and storage capacity, processor throughput, communications bandwidth, etc.) jj) Data storage reliability, maintainability, and availability requirements for storage systems environments are incorporated into the detailed design. kk) The data storage system design fully addresses communications and processing capacity. ll) The data storage system design defines a complete list of data receivers to include both computer and human agents. mm) The level of information security (e.g., user access control lists, data

Product	CDR acceptability criteria
System product baseline documentation *(continued)*	control, data protection, awareness of data state) incorporated into the detailed design satisfies the allocated system requirements. nn) DT&E assessment to date is consistent with the product baseline and indicates the potential for test and evaluation success. oo) OT&E allocated requirements are incorporated into the detailed design. pp) Assessment of the technical effort and detailed design indicates potential for OT&E success (operationally effective and suitable). qq) Detailed design documentation for all CSIs and CAIs is complete. rr) Detailed FMECA is completed. ss) Thermal, vibration, and shock environments; and HALT requirements are supported by the detailed design. tt) Results of critical design analyses used to develop final critical parts and long lead items are complete and address technologies, sources of supply, and reliability. uu) The detailed design incorporates all environmental parameters impacting parts performance. vv) R&M allocated requirements are supported by the detailed design. ww) Estimate of system reliability and maintainability is updated, based on engineering analyses, initial test results, or other sources of demonstrated reliability and maintainability. xx) Software functionality in the approved initial product baseline is consistent with the updated software metrics and resource-loaded schedule.
System functional or allocated or product baseline documentation	a) Detailed design (hardware, software, human procedures), including interface descriptions is complete, satisfies all requirements in the system functional baseline, and is under CM without any TBDs or open items. b) System, segment, subsystem and component-level interfaces are baselined and are under configuration control. c) C4I allocations are incorporated into the detailed design. d) The threat scenario operational and environmental allocations are incorporated into the detailed design and are traceable to all CIs and components. e) Test requirements and test data collected to date for the detailed design are traceable to operational requirements via specifications and VCRMs. f) Requirements trace among functional, allocated, and product baselines is bi-directional, complete, and consistent.
Technical plans	a) Supplier's SEMP is complete, adequate and aligned with the program SEP. b) PDR is successfully completed; all PDR action items are closed and corrective actions completed. c) Integrating activities of any lower-level CDRs have occurred; identified issues are documented in action plans. d) Plan to TRR is accurately documented in the SEP as well as the IMP and IMS. e) Program is properly staffed. f) Adequate processes and metrics are in place for the program to succeed. g) A draft certification plan has been developed and covers all required system certifications (e.g., statutory, safety, environmental, airworthiness, others as required).

Product	CDR acceptability criteria
Technical plans *(continued)*	h) Hazardous materials management and pollution prevention processes and procedures are verified and baselined. i) Process control plans have been developed for critical manufacturing processes. j) Plans documenting the system, segment, subsystem and component V&V approaches and methods are defined and traced into the detailed design. k) The test bed(s) and test facilities updates based on the detailed design are deemed adequate to perform system, segment, subsystem and interface requirements verification (e.g., for critical HWCIs and SWCIs, arrangements for procuring and scheduling the use of V&V resources—simulators, test beds, test facilities—have been demonstrated). l) All test plans are documented and include resource requirements and test schedules. m) Training plans for DT&E and OT&E are defined and approved. n) Program schedule as depicted in the updated IMS is executable within acceptable technical and cost risks. o) Program is executable with the existing budget and the approved initial product baseline. p) All critical manufacturing processes have been defined, characterized, updated for the detailed design, and the capability to meet design tolerances has been determined. q) Materials and tooling are available to meet the pilot line schedule. r) A parts management plan has been documented and flowed down to suppliers. s) The FRACAS is functional. t) Plans have been documented for reaching manufacturing readiness level 8 to support initial production efforts. u) Logistics (sustainment) and training systems planning and documentation are sufficiently complete to support the CDR. v) LCSP is approved, including updates on program sustainment development efforts and schedules based on current budgets, test, and evaluation results; and firm supportability design features. w) LCSP includes software support requirements. x) LCSP addresses DMS, PM&P guidelines, and counterfeit parts risk management. y) Long-lead procurement plans are in place, and key supply chain assessments are complete, to include strategic materials risk. z) HSI plans adequately translate applicable items from the following categories into the detailed design: 1) Concept of operations 2) Key manual operations 3) Key information to be inserted 4) Transformation of information from algorithms to user-friendly vernacular 5) Anticipated workload at operator/user stations aa) Software plans have sufficient content to demonstrate that 1) Computer systems and software detailed design approach have been confirmed through analyses, demonstrations, and prototyping in a relevant environment. 2) Software increments and their corresponding capabilities have been

Product	CDR acceptability criteria
Technical plans *(continued)*	defined. 3) Software trade studies addressing COTS, reuse, and other software-related issues are completed and the results incorporated into the detailed design. 4) The software development process defined in the baselined software development plan and reflected in the IMP and IMS will support implementation of the defined software increments. 5) Software development schedules reflect supplier software processes and IMP/IMS software events for current and future development phases. 6) Software development environment and test/integration labs have sufficient fidelity and capacity to support software and system integration, and acceptance testing. 7) Software metrics are being actively tracked, assessed and reported. 8) R&M and testability requirements—BIT, false alarm rate, fault isolation, fault detection) have been incorporated into the detailed design. 9) TEMP addresses all SWCI plans, test facilities, and test plans, including testing required to support incremental approaches and regression tests. 10) Software development estimates [i.e., size, effort (cost), and schedule] are updated. bb) Hardware plans have sufficient content to demonstrate that 1) The hardware detailed design approach has been confirmed through analyses, demonstrations, and prototyping in a relevant environment. 2) The major phases of the program's hardware development and fabrication process defined in a baselined hardware development plan and reflected in the IMP and IMS will support program hardware fabrication within program budget and schedule targets. 3) Hardware development schedules reflect supplier hardware processes and IMP/IMS hardware fabrication milestone events. 4) Hardware test/integration labs have sufficient fidelity, and capacity to support hardware integration and test, and system acceptance testing. 5) Hardware metrics are being actively tracked, assessed and reported. 6) R&M and testability requirements—BIT, false alarm rate, fault isolation, fault detection) have been incorporated into the detailed design. 7) TEMP addresses all HWCI plans, test facilities, and test plans, including testing required to support incremental approaches and regression tests. 8) Hardware fabrication estimates [i.e., number of HWCIs, effort (cost), and schedule] are updated.
Program risk assessment	a) Cost, schedule, and technical risks are identified, and mitigation plans are in place. b) Risk management process is in place demonstrated by documented execution results of existing mitigation plans.
Program life-cycle cost estimate	a) System production cost model has been updated, allocated to lower system CI levels, and tracked against targets. b) Updated CARD is consistent with the approved initial product baseline.

6.6.2 CDR preparation

Table 18 lists the actions that should be considered during preparation for the CDR. The responsible people listed are those most often tasked with the listed preparation actions, but the acquirer and supplier may agree to assign the actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 18—CDR technical review preparation actions

Responsible person	CDR preparation actions
Program manager	a) Approve, fund, and staff the system CDR as planned in the SEP developed by the Systems Engineer. b) Control configuration of acquirer-controlled baselines (functional, allocated) that impact the system of interest; convene the CCB when changes are warranted; communicate the results of the CCB to relevant stakeholders no later than 30 days prior to CDR. c) Manage and approve changes to the segment, subsystem, and system element development specifications well enough in advance to allow successful execution of the CDR delivery of an acceptable product baseline at the CDR. d) Establish the plan to SVR in applicable contract documents including the SEMP, IMS, and IMP. e) Ensure the SEP includes objective SMEs to participate in the CDR. f) Appoint a CDR chair, in coordination with the systems engineer, no later than 45 days prior to the technical review. g) Coordinate a preliminary agenda between the program IPT and other SMEs no later than 30 days prior to the CDR.
Systems engineer	a) Ensure that the pre-established quantifiable CDR criteria have been met, including measurement status of the program's technical metrics that demonstrate acceptable progress and developmental maturity of the system detailed design to achieve a successful CDR. b) Ensure the system initial product baseline and physical architecture are complete and consistent. c) Ensure the initial product baseline documentation is sufficiently complete and correct to support the CDR. d) Ensure the set of system elements comprising the detailed system design can achieve the complete set of allocated system baseline requirements. e) Ensure assessments and risks associated with all design constraints are conducted, documented and provided in the technical review material. f) Ensure verification methods are defined for all decomposed and allocated requirements. g) Ensure risk items associated with allocated requirements are identified and analyzed, and mitigation plans are in place. h) Provide supplier organization(s) the opportunity to participate in the CDR planning. i) Coordinate arrangements for CDR location and support. j) Ensure all of the technical review products whose acceptability criteria are defined in Table 17 are completed for the CDR. k) Ensure the preparation of all presentation material is coordinated across IPTs.
CDR chair	a) Determine CDR team membership. b) Approve the final CDR agenda. c) Identify any final tailoring of the Clause 6 CDR detailed criteria for the specific program. d) Identify any specific elements for in-depth technical review as required.

6.6.3 CDR conduct

Table 19 lists the technical review elements and associated content details that should be considered for the conduct of the CDR. Specific elements and their content details shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 19—CDR conduct elements

CDR review element	Content details
Introduction, agenda, administrative	a) Review location layout and safety procedures b) Security procedures if applicable c) Introduction of chair and team members d) Purpose of the technical review e) CDR agenda f) Action item procedures g) Risk assessment procedures h) Program overview i) Status of action items from previous technical reviews
Initial product baseline and comparison with functional and allocated baselines	a) Updated specification tree to the system element level and description of requirements allocation process including assignment of technical budgets to the detailed design b) Requirements traceability, methodology and completeness to the system element level of the detailed design c) System physical architecture and detailed design of system elements (hardware, software, human manual procedures), correspondence of elements to the specification tree, and allocated requirements d) Trade studies, FMECA and other studies and analyses e) Detailed designs of system internal and external interfaces f) Detailed design implementation of system safety requirements g) Updates to KPPs, MOPs, and MOEs h) Status updates for established metrics and measures i) Verification and certification requirement methods and success criteria as allocated to system elements j) Detailed design support for interoperability k) Threat scenario allocations to detailed design elements l) Test and certification requirements updates m) Logistics and personnel requirements n) Training requirements o) Resources requirements to support production, integration acceptance test and evaluation
Technical plans review	a) IMP and IMS b) Staffing plans c) M&S support to CDR and subsequent M&S plans for production, test and evaluation d) Software development plan updates to support software incremental implementation, integration and test e) Software development environment and test and integration labs f) Long lead procurement plans g) Manufacturing plan and processes h) Process control plans

CDR review element	Content details
Technical plans review *(continued)*	i) Hazard mitigation plan if applicable j) Government and supplier CM plans k) Certification and accreditation plans l) Detailed test plans for integration, CI acceptance, DT&E, and OT&E support m) Training plans n) Updates to product support plan and sustainment strategy o) Updates to LCSP including software support requirements and supportability features in the detailed system design
Risk and mitigation review	a) Risk identification and mitigation, including: 1) Consideration of V&V resource requirements in support of detailed design 2) Consideration of test resources and current availability ESOH risks are known and being mitigated 3) Consideration of ongoing industrial base assessment (diminishing manufacturing sources and material shortages, obsolete parts, etc.) 4) Consideration of CI fabrication 5) Consideration of unique software
Program life-cycle cost estimate review	a) Updates to the CARD to align it with the initial product baseline b) Updated software implementation and hardware production estimates from detailed SWCI and HWCI inputs; and test and integration plans

6.6.4 CDR closure

Table 20 lists the actions that should be considered for CDR closure. The responsible people listed are those most often tasked with the listed closure actions. The acquirer and supplier may agree to assign the program manager and systems engineer actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 20—CDR closure actions

Responsible person	CDR closure actions
Program manager	a) Manage and approve changes to technical baselines resulting from CDR. b) Assume acquirer control of the initial product baseline class I configuration changes as defined in accordance with the program's CM policy or plan. c) If funding profiles are insufficient to support development, notify user/sponsor of funding shortfall and request funding profile adjustments. d) Support preparation of the CDR summary report.
Systems engineer	a) Determine the root cause of problems, identify corrective actions and manage to completion. b) Monitor and control the execution of the CDR closure plans. c) Organize and supervise the responses to all action items generated during CDR. d) Support preparation of the CDR summary report. e) Determine the root cause of problems, identify corrective actions, and manage to completion. f) Monitor and control the execution of the CDR closure plans.

Responsible person	CDR closure actions
Systems engineer *(continued)*	g) Document the plan to SVR in the SEP and elsewhere as appropriate. h) Ensure plans to proceed to SVR allow for contingencies. i) Ensure all information products required to be put under configuration control have been delivered to the Configuration Manager. j) Ensure all IMP and IMS tasks associated with conduct of the CDR have been successfully completed and documented as such.
CDR chair	a) Ensure preparation of the CDR summary report and formal CDR minutes with the support of the program manager and systems engineer. b) Sign off final approval of all action items. c) Approve the CDR minutes. d) Approve and distribute the CDR summary report. e) Prepare and distribute the formal CDR closure letter.
Recorder	a) Collate all action items for submission to the CDR chair. b) Prepare the CDR summary report and CDR minutes for signature and distribution by the CDR chair.

6.7 Test readiness review (TRR) detailed criteria

6.7.1 TRR technical review products acceptability criteria

Table 21 lists the products that should be reviewed at TRR, and the associated acceptability criteria that should form a sufficient basis by which to assess each product's content as acceptable to support a successful TRR. Specific products and associated acceptability criteria shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 21—TRR technical review products acceptability criteria

Product	TRR acceptability criteria
System technical documentation	a) Supplier's SEMP is complete, adequate, and aligned with the program SEP. b) The TEMP is current and approved. c) The requirements to be verified by the test event include all approved changes. d) The configuration of the system or system element(s) under test is clearly defined. e) Any design changes made to the system element(s) under test since CDR will not adversely affect the formal test event. f) The system elements under test are under configuration control by the CM organization and the configuration of each hardware and software element of the system element(s) under test is documented. g) The system elements under test are judged sufficiently mature to begin the formal test event planned. h) No catastrophic or critical problems or deficiencies are open for the system element(s) under test, where the problem criticality levels are as defined in the program's system safety policy or plan. i) All changes to the test plan have been approved. j) The approved test plan with changes incorporated is robust enough to ensure the full verification of all requirements to be verified by the test event. k) The test plan is consistent with the required verification methods and levels for the requirements planned for verification by the test event. l) The test procedures for each test case together with the planned test input data and drivers are correct, complete, and sufficiently robust to verify all of the requirements allocated to the test case. m) The test procedures are consistent with the required verification methods and levels.

Product	TRR acceptability criteria
System technical documentation *(continued)*	n) The test procedures are sufficiently detailed to be repeatable. o) The test procedures are in compliance with the approved test plan. p) All redlines from dry-run testing have been incorporated into the test procedures. q) Bi-directional traceability that is correct, complete, and consistent is provided between the requirements to be verified by the formal test event and the test procedures and test cases in which the requirements will be verified. r) The test procedures' steps are identified where each requirement's verification is completed. s) The acquirer and supplier agree on the test report content. t) A detailed description of the planned test event sufficiently defines how it will verify each requirement allocated to the system element(s) under test. u) Test plans and procedures adequately support the cybersecurity requirements and interoperability as required. v) Test plans and procedures are sufficient to verify all system security and supply chain risk management requirements allocated to the system element(s) under test. w) System-level tests stress the system within the intended mission environment(s). x) Evaluation of performance data for the system element(s) under test shows it appropriately depicts that performance of the system element(s) under test as tested in the test conditions. y) R&M scoring guidelines have been documented and agreed to by the acquirer and supplier.
Test environment	a) The test environment, including all hardware, software, emulators, and simulators is sufficiently robust to adequately verify the requirements to be verified. b) The test environment has the required components to support verification of system security requirements. c) Sufficient validation has occurred prior to the planned test event to ensure that the test environment will correctly perform the functions necessary to support the test event. d) The test environment is under configuration control by the CM organization and the configuration of each component of the test environment is documented. e) Data reduction procedures and responsibilities are documented and accepted.
Program execution and process control	a) Personnel roles and responsibilities are documented, clear, and concise both for the acquirer and the supplier, including test witnessing requirements, and are agreed to by the acquirer and supplier. b) Processes to be followed during test execution are defined and documented and will result in a controlled and disciplined test execution. c) Appropriate security test facilities, test equipment, schedules, and personnel are adequate and available to support the planned test event. d) Any test limitations will not affect the ability to verify the planned requirements. e) The anomaly reporting system is functional. f) The FRACAS is functional. g) Logistics and supply support for testing is adequate. h) Review of production logs confirms that the system elements under test have been manufactured in accordance with approved process and material specifications. i) The presence and role of QA personnel are sufficient to ensure 1) The test process is followed. 2) Test execution rigorously follows the test procedures with any deviations documented as redlines.

Product	TRR acceptability criteria
Program execution and process control *(continued)*	3) All problems or deficiencies encountered during testing are appropriately documented. 4) The test log faithfully documents the execution of the test, including test start, test end, interruptions and anomalies.
Risk assessment	a) Technical risks are identified, and mitigation plans are in place. b) Risk management process in place demonstrated by documented execution results of existing mitigation plans associated with the purpose of the review.
Program life-cycle cost estimate and schedules	a) Test schedules have been finalized and are feasible. b) Hour-by-hour test schedules for the formal test event are documented, including justification for the timeline based on dry run test timing.

6.7.2 TRR preparation

Table 22 lists the actions that should be considered during preparation for the TRR. The responsible people listed are those most often tasked with the listed preparation actions, but the acquirer and supplier may agree to assign the actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 22—TRR technical review preparation actions

Responsible person	TRR preparation actions
Program manager	a) Approve, fund, and staff the TRR as planned in the TEMP developed by the chief developmental tester. b) Ensure the scope of the TRR(s) is addressed in the TEMP. c) Assure all required safety documentation has been approved and all required safety releases have been procured. d) Appoint a TRR chair, in coordination with the chief developmental tester, no later than 45 days prior to the technical review. e) Coordinate a preliminary agenda between the program IPT and other SMEs no later than 30 days prior to the TRR.
Systems engineer	a) Ensure that the pre-established quantifiable TRR criteria have been met. b) Ensure verification methods and success criteria are defined for all decomposed and allocated requirements. c) Ensure risk items associated with allocated requirements are identified and analyzed, and mitigation plans are in place. d) Coordinate arrangements for TRR location and support. e) Ensure all of the technical review products whose acceptability criteria are defined in Table 21 are completed for the TRR. f) Ensure the preparation of all presentation material is coordinated across IPTs.
TRR chair	a) Determine TRR team membership. b) Approve the final TRR agenda. c) Identify any final tailoring of the Clause 6 TRR detailed criteria for the specific program. d) Identify any specific elements for in-depth technical review as required.

6.7.3 TRR conduct

Table 23 lists the technical review elements and associated content details that should be considered for the conduct of the TRR. Specific elements and their content details shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 23—TRR conduct elements

TRR review element	Content details
Introduction, agenda, administrative	a) Review location layout and safety procedures b) Security procedures if applicable c) Introduction of chair and team members d) Purpose of the technical review e) TRR agenda f) Action item procedures g) Risk assessment procedures h) Program overview i) Status of action items from previous technical reviews j) Overall test and evaluation (T&E) program overview and how planned tests support the overall program
System technical documentation	a) Requirements planned to be verified during this test event b) Any changes to these requirements that have been approved since the previous technical review c) Required verification methods, and verification level(s) for each requirement planned to be verified during this formal test event d) Any changes to the design of the system element(s) under test that have occurred since the previous technical review that affect the planned testing e) Any changes to the test plan(s) that cover the planned test that have occurred since the previous technical review f) Critical technologies are addressed in the test plans and test procedures g) Description of the test methodology and data collection to be used along with test procedures h) Description of test driver data and scenarios to be used with the test procedures i) Results of any dry runs, including anomalies encountered and any anticipated problems with requirements verification j) Bi-directional traceability among the test cases, test procedures, design documentation of the system element(s) under test, and the requirements documentation covering the requirements to be verified k) Hardware and software descriptions, and human procedures and user manuals required for the system element(s) under test l) Specific configuration of the system element(s) under test including version(s) or release(s) of software; configuration identification, and status accounting documentation for the system element(s) under test m) All known hardware and software problems or deficiencies at the start of the test event for the system element(s) under test, along with their severity levels and expected impacts to testing n) Expected test results with success criteria and how the test results will affect the program o) Status of program metrics

TRR review element	Content details
Test environment	a) Description of the test environment including hardware, software, automated test equipment, test tools, simulators, emulators, drivers, etc. b) Confirmation by the CM organization that the test environment is validated and under configuration control c) Status of validation performed on the test environment to ensure it correctly performs the functions necessary to support the formal test event d) All known test environment problems or deficiencies and their expected impact on the testing e) Any test limitations or other conditions that might impact conduct of the formal test event
Program execution and process control	a) Test personnel and their roles and responsibilities, including both acquirer and supplier personnel, and CM and QA personnel as well as test team personnel performing the test procedures b) Test processes being implemented including both the nominal process and retest process(es) when test anomalies are encountered that require corrections c) The anomaly adjudication process to determine whether and how testing can be continued after an anomaly has occurred during test execution d) A recorded process for managing the requirements verification status for the system element(s) under test (i.e.., fully verified, partially verified, not verified) following test completion and data analysis
Program risk assessment	a) Risk identification and mitigation, including consideration of all current hazards, and the next planned formal test event
Program life-cycle cost estimate and schedules	a) Detailed test schedules for the formal test event b) Review of the current program schedule showing the phasing of the planned formal test event in the overall T&E plan

6.7.4 TRR closure

Table 24 lists the actions that should be considered for TRR closure. The responsible people listed are those most often tasked with the listed closure actions. The acquirer and supplier may agree to assign the actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 24—TRR closure actions

Responsible person	TRR closure actions
Program manager	a) Manage and approve changes to any baselined documentation as a result of the TRR. b) If funding profiles are insufficient to support further test and evaluation, notify user/sponsor of funding shortfall and request funding profile adjustments. c) Support preparation of the TRR summary.
Systems engineer	a) Monitor and control the execution of the TRR closure plans. b) Organize and supervise the responses to all action items generated during TRR. c) Support preparation of the TRR summary. d) Ensure all information products required to be put under configuration control have been delivered to the configuration manager. e) Ensure all IMP and IMS tasks associated with conduct of the TRR have been successfully completed and documented as such.
TRR chair	a) Ensure preparation of the TRR summary and formal TRR minutes with the support of the program manager and systems engineer. b) Sign off final approval of all action items. c) Approve the TRR minutes. d) Approve and distribute the TRR summary. e) Prepare and distribute the formal TRR closure letter.
Recorder	a) Collate all action items for submission to the TRR chair. b) Prepare the TRR summary and TRR minutes for signature and distribution by the TRR chair.

6.8 Functional configuration audit (FCA) detailed criteria

6.8.1 FCA technical review products acceptability criteria

Table 25 lists the products that should be reviewed at FCA, and the associated acceptability criteria that should form a sufficient basis by which to assess each product's content as acceptable to support a successful FCA. Specific products and associated acceptability criteria shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 25—FCA technical review products acceptability criteria

Product	FCA acceptability criteria
Functional, allocated and product baseline documentation	a) CI performance has been verified against the allocated baseline, and integrated functional performance has been verified against the functional baseline. b) Adequately detailed requirements verification traceability documentation exists outlining the method for verification for each requirement in the CI specification. c) All approved engineering change proposals (ECP), requests for deviation, and requests for waiver have been incorporated into the system product baseline. d) All CSIs and CAIs have been identified, documented and are being effectively managed. e) For software, a technical understanding is reached on the validity and the degree of completeness of the software test reports and as appropriate, computer system operator's manual, software user's manual, and the system diagnostic manual. f) System product baseline is maintainable per the configuration management plan (CMP).
Program execution and process control	a) The CCB is processing configuration changes in accordance with the CMP and maintaining the proper configuration baselines. b) Audit of PDR and CDR minutes shows that all technical review findings have been addressed, all action items closed and corrections listed in corrective action plans have been successfully completed for the baseline documentation being audited.
Verification results	a) Each requirement listed in the requirements verification traceability documentation has been successfully verified in accordance with the identified methodology based on all available test data, analysis, or inspection. b) The CI demonstrated the capability to satisfy KPP and KSA thresholds based on available test data, analysis or inspection. c) The CI satisfies TPM thresholds as verified by available design documentation, test data, analysis, or inspection. d) CI acceptance test reports are complete, have been reviewed, and deficiencies have been addressed. e) Audit of supplier test procedures and results shows compliance with specification requirements as mapped down to the lowest level end item in the requirements verification traceability documentation, and that formal test data is complete and accurate as judged against the test procedures. f) For CIs that failed initially to pass quality assurance test provisions, analysis shows cause of failure has been determined and appropriate corrections have been made to both the CIs and the associated engineering data prior to being subjected to requalification.

6.8.2 FCA preparation

Table 26 lists the actions that should be considered during preparation for the FCA. The responsible people listed are those most often tasked with the listed preparation actions, but the acquirer and supplier may agree to assign the actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 26—FCA preparation actions

Responsible person	FCA preparation actions
Program manager	a) Approve, fund, and staff the FCA as planned in the SEP developed by the Systems Engineer. b) Continue to control class I changes to the system initial product baseline. c) Establish the plan to SVR, PRR and PCA in applicable acquirer-supplier agreement documents including the SEMP, IMS, and IMP. d) Ensure the SEP includes objective SMEs to participate in the FCA. e) Appoint a FCA chair, in coordination with the systems engineer, no later than 45 days prior to the audit. f) Coordinate a preliminary agenda between the program IPT and other SMEs no later than 30 days prior to the FCA.
Systems engineer	a) Develop and execute the FCA plans with established quantifiable technical review criteria, carefully tailored to satisfy program and CI objectives. b) Develop a checklist to be used to ensure that all required documentation, hardware and computer software is available at the FCA for the CI(s) to be audited. c) Ensure that the pre-established technical FCA criteria have been met. d) Ensure all requirements in the system specification have been verified through the appropriate verification method(s) and have been appropriately documented. e) Coordinate arrangements for FCA location and support. f) Ensure all of the audit products whose acceptability criteria are defined in Table 25 are completed for the FCA. g) Ensure the preparation and assembly of all audit material and any presentations required to be given to the FCA team are coordinated across IPTs.
Supplier	a) Submit the final draft product specification(s) for the CI(s) to be audited to the acquirer for review prior to conduct of the FCA. b) Prior to the FCA date, submit the following information to the acquirer: 1) Names and roles of individuals who will participate in the FCA, including the test manager. 2) Identification of the CI(s) to be audited: i) Nomenclature ii) Specification identification number(s) iii) CI number(s) iv) Current listing of all deviations and waivers against the CI(s) either requested of, or approved by, the acquirer v) Status of the test program to test system elements (CIs) with automatic test equipment if applicable
FCA chair	a) Determine FCA team membership. b) Approve the final FCA agenda. c) Identify any final tailoring of the Clause 6 FCA detailed criteria for the specific program and CI. d) Identify any specific elements for in-depth technical review as required.

6.8.3 FCA conduct

Table 27 lists the technical review elements and associated content details that should be considered for the conduct of the FCA. Specific elements and their content details shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 27—FCA conduct elements

FCA review element	Content details
Introduction, agenda, administrative	a) FCA location layout and safety procedures b) Security procedures if applicable c) Introduction of chair and team members d) Purpose of the audit e) FCA agenda f) Action item procedures g) Risk assessment procedures h) Program overview and verification test status i) Status of action items from previous technical reviews
System product baseline and comparison with functional and allocated baselines	a) Test program structure, plans, procedures, testing accomplished, test results b) A briefing to the FCA team for each CI being audited that delineates the test results and findings for each CI. At a minimum, the briefing should include CI requirements that were not met along with a proposed solution to each deficiency, an account of the ECPs incorporated and tested, as well as proposed and a general presentation of the entire CI test effort delineating problem areas as well as accomplishments c) Bi-directional requirements traceability, methodology, and completeness to the CI level between the product baseline and the verification test results d) Verification and certification requirement methods and success criteria as allocated to system elements e) Test and certification requirements updates f) Actual system performance verification against the allocated baseline and the functional baseline g) Test reports—coverage of testing and verification results
Program execution and process control review	a) CCB process and CMP consistency

6.8.4 FCA closure

Table 28 lists the actions that should be considered for FCA closure. The responsible people listed are those most often tasked with the listed closure actions. The acquirer and supplier may agree to assign the program manager and systems engineer actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 28—FCA closure actions

Responsible person	FCA closure actions
Program manager	a) If funding profiles are insufficient to support activities leading to SVR, PRR and PCA, and to support production, notify user/sponsor of funding shortfall and request funding profile adjustments. b) Acknowledge FCA completion with the indication that successful FCA performance satisfies the requirements for conduct of the FCA. c) Support preparation of the FCA summary report.
Systems engineer	a) Monitor and control the execution of the FCA closure plans. b) Organize and supervise the responses to all action items generated during FCA. c) Support preparation of the FCA summary report. d) Produce corrective action plans if required and manage to completion. e) Ensure the supplier records FCA accomplishment in the applicable system element development records. f) Document the plan to SVR, PRR, and PCA in the SEP and elsewhere as appropriate. g) Ensure adequate plans and resources are in place to accomplish the necessary technical activities among FCA, SVR, PRR, and PCA, and that these plans allow for contingencies. h) Ensure all information products required to be put under configuration control have been delivered to the configuration manager. i) Ensure all IMP and IMS tasks associated with conduct of the FCA have been successfully completed and documented as such.
Supplier	a) Record FCA accomplishment in the applicable system element development records. b) Support production of the FCA summary report and formal FCA minutes.
FCA chair	a) Ensure preparation of the formal FCA summary report and formal FCA minutes with the support of the program manager and systems engineer. b) Sign off final approval of all action items. c) Approve the FCA minutes. d) Approve and distribute the FCA summary report. e) Prepare and distribute the formal FCA closure letter.
Recorder	a) Collate all action items for submission to the FCA chair. b) Prepare the FCA summary report and FCA minutes for signature and distribution by the FCA chair.

6.9 System verification review (SVR) detailed criteria

6.9.1 SVR review products acceptability criteria

Table 29 lists the products that should be reviewed at SVR, and the associated acceptability criteria that should form a sufficient basis by which to assess each product's content as acceptable to support a successful SVR. Specific products and associated acceptability criteria shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 29—SVR technical review products acceptability criteria

Product	SVR acceptability criteria
System functional and product baseline documentation	a) Review of CI(s) and system-level test and analysis results verifies documented achievement of functional requirements through the appropriate documented verification methods. NOTE—Verification testing may include developmental, operational (e.g., early operational assessments, operational assessments), or live fire testing. b) Bi-directional traceability has been documented among the CDD, the CPD, and the system specifications. c) System-level performance has been verified as satisfactory against the functional baseline. d) The system has demonstrated the capability to satisfy all KPP and KSA thresholds based on all available test data, analysis, and inspection. e) Certification activities are sufficiently underway with all certifying agencies. f) Logistics support analysis and maintenance task analysis are complete and the results incorporated into the LCSP. g) Audit of the operation and support documents shows consistency with the LCSP. h) Assessment of the documented system product baseline for the initial production system shows a low risk of operational test failure during IOT&E.
Technical plans	a) Supplier's SEMP is complete, adequate and aligned with the program SEP. b) Detailed plans and schedules have been established and sufficiently resourced to proceed into initial production or initial deployment for the system to be used in OT&E. c) The SEP and supplier's SEMP have been updated as required to adequately address the production and deployment phase of acquisition. d) Adequate life-cycle logistics planning has been conducted and results are documented in the LCSP. e) A training plan that adequately supports OT&E is consistent with the system product baseline and has been reviewed and approved. f) The TEMP is up-to-date, signed, and being properly executed. g) The CMP has been updated as required.

Product	SVR acceptability criteria
Program execution and process control	a) Adequate processes and metrics are in place for the program to succeed. b) Critical program information (CPI) is being adequately managed and protected. c) The CCB is processing configuration changes in accordance with industry standards, supplier instructions, processes and procedures, and maintaining the proper configuration baselines. d) Configuration changes have been identified as required for reliability growth to ensure threshold compliance at initial operational capability (IOC).
Risk assessment	a) Technical risks are identified, and mitigation plans are in place. b) Risk management process is in place demonstrated by documented execution results of existing mitigation plans associated with the purpose of the review.
Program life-cycle cost estimate and schedule	a) The CARD or other verified cost estimate has been updated and accurately reflects the as-tested system product baseline. b) The system is producible within the production budget. c) The acquirer/supplier IMS is resourced at reasonable levels based on realistic performance and efficiency expectations. d) Earned value management (EVM) status supports transition to production.
Verification results	a) New or additional qualification data since CI-level FCAs as determined by review of the FCA minutes indicate successful results as judged against the system specification. b) All system specification qualification test requirements have been successfully completed.

6.9.2 SVR preparation

Table 30 lists the actions that should be considered during preparation for the SVR. The responsible people listed are those most often tasked with the listed preparation actions, but the acquirer and supplier may agree to assign the actions to different people or organizations depending on a given program's organizational structure Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 30—SVR preparation actions

Responsible person	SVR preparation actions
Program manager	a) Approve, fund, and staff the SVR as planned in the SEP developed by the systems engineer. b) Continue to control class I changes to the system product baseline. c) Ensure the SEP includes objective SMEs to participate in the SVR. d) Appoint an SVR chair, in coordination with the systems engineer, no later than 45 days prior to the technical review. e) Coordinate a preliminary agenda between the program IPT and other SMEs no later than 30 days prior to the SVR.
Systems engineer	a) Develop and execute the SVR plans with established, quantifiable, technical review criteria, carefully tailored to satisfy program objectives. b) Ensure that the pre-established technical SVR criteria have been met. c) Ensure all requirements in the system specification have been verified through the appropriate verification method(s) and have been appropriately documented. d) Ensure technical risk items associated with the verified system product baseline are identified and analyzed, and mitigation plans are in place. e) Coordinate arrangements for SVR location and support. f) Ensure all of the technical review products whose acceptability criteria are defined in Table 29 are completed for the SVR. g) Ensure the preparation and assembly of all audit material and any presentations required to be given to the SVR team are coordinated across IPTs.
Supplier	a) Submit any new or additional qualification data since FCA to the acquirer for review prior to conduct of the SVR. b) Prior to the technical review, submit the names and roles of individuals who will participate in the SVR.
SVR chair	a) Determine SVR team membership. b) Approve the final SVR agenda. c) Identify any final tailoring of the Clause 6 SVR detailed criteria for the specific program. d) Identify any specific elements for in-depth technical review as required.

6.9.3 SVR conduct

Table 31 lists the technical review elements and associated content details that should be considered for the conduct of the SVR. Specific elements and their content details shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 31—SVR conduct elements

SVR technical review element	Content details
Introduction, agenda, administrative	a) SVR location layout and safety procedures b) Security procedures if applicable c) Introduction of chair and team members d) Purpose of the audit e) SVR agenda f) Action item procedures g) Risk assessment procedures h) Program overview and status i) Status of action items from previous technical reviews
System functional and product baseline documentation	a) Identification and results of any new or additional CI(s) qualification data since FCA b) Bi-directional requirements traceability, methodology and completeness to the CI level between the functional baseline and the verification test results c) Actual system performance verification against the functional baseline d) Test reports—coverage of testing and verification results e) Resources requirements to support production, initial deployment, operational test and evaluation
Technical plans review	a) SEP and supplier SEMP—coverage for OT&E, production and deployment b) LCSP—consistency with the as-tested system product baseline c) Training plan—consistency with the as-tested system product baseline and support for OT&E d) TEMP adequacy to support remaining system testing and evaluation e) CMP—support for all program CM requirements and CCB functions
Program execution and process control review	a) CCB process and CMP consistency b) Details of currently established manufacturing, production, and quality assurance processes and metrics
Risk and mitigation review	a) Risk identification and mitigation including consideration of the initial production of the system to be used in OT&E or formal test event
Program life-cycle cost estimate and schedule review	a) Consistency between the CARD, IMS, and EVM status

6.9.4 SVR closure

Table 32 lists the actions that should be considered for SVR closure. The responsible people listed are those most often tasked with the listed closure actions. The acquirer and supplier may agree to assign the program manager and systems engineer actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 32—SVR closure actions

Responsible person	SVR closure actions
Program manager	a) Manage and approve changes to any baselined documentation as a result of the SVR. b) If funding profiles are insufficient to support activities leading to PRR or PCA, and to support production, notify user/sponsor of funding shortfall and request funding profile adjustments. c) Support preparation of the SVR summary report.
Systems engineer	a) Monitor and control the execution of the SVR closure plans. b) Organize and supervise the responses to all action items generated during SVR. c) Support preparation of the SVR summary report. d) Produce corrective action plans if required and manage to completion. e) Ensure the supplier records SVR accomplishment in the applicable system element development records. f) Ensure technical risk items associated with the as-tested system product baseline are identified and analyzed, and that mitigation plans are in place. g) Document the plan to PRR and PCA in the SEP and elsewhere as appropriate. h) Ensure adequate plans and resources are in place to accomplish the necessary technical activities leading to PRR and PCA, and that these plans allow for contingencies. i) Ensure all information products required to be put under configuration control have been delivered to the configuration manager. j) Ensure all IMP and IMS tasks associated with conduct of the SVR have been successfully completed and documented as such.
Supplier	a) Record SVR accomplishment in the applicable system element development records. b) Support preparation of the SVR summary report and formal SVR minutes.
SVR chair	a) Ensure preparation of the SVR summary report and formal SVR minutes with the support of the program manager and systems engineer. b) Sign off final approval of all action items. c) Approve the SVR minutes. d) Approve and distribute the SVR summary report. e) Prepare and distribute the formal SVR closure letter.
Recorder	a) Collate all action items for submission to the SVR chair. b) Prepare the SVR summary report and SVR minutes for signature and distribution by the SVR chair.

6.10 Production readiness review (PRR) detailed criteria

6.10.1 PRR technical review products acceptability criteria

Table 33 lists the products that should be reviewed at PRR, and the associated acceptability criteria that should form a sufficient basis by which to assess each product's content as acceptable to support a successful PRR. Specific products and associated acceptability criteria shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 33—PRR technical review products acceptability criteria

Product	PRR acceptability criteria
Verified system product baseline documentation	a) System product baseline is stable and under proper configuration control to enable hardware fabrication and system software production during low-rate production. b) The system product baseline is producible as verified by the results of any incremental lower-level PRRs or by production modeling and analysis. c) Applicable production-related DoD directives, statutory and regulatory guidance, threshold design and certification standards, and public law have been adequately represented in the manufacturing and production processes in the system product baseline. d) Production processes have satisfied all TPM thresholds as verified by all available design documentation, test data, analysis, and inspection. e) All identified production critical technologies have demonstrated adequate technical maturity in accordance with the technology maturation plans. f) Adequate manufacturing maturity of the system product baseline has been demonstrated. g) All CSIs and CAIs have been identified, documented, and are being effectively managed. h) Technologies are mature and proven in the final form, in operational environments. i) Manufacturing processes are stable and have been demonstrated in a pilot line environment. j) Adequate production line processes and metrics are in place for the delivery of on-time quality products. k) The audit trail from the initial product baseline established at CDR accurately tracks all incorporated and unincorporated system product baseline changes that have occurred since CDR.
Technical plans	a) Supplier's SEMP is complete, adequate and aligned with the program SEP. b) Prior readiness reviews are completed, action items closed, and corrective action plans successfully completed. c) Supply chain is stable and adequate to support planned LRIP and FRP. d) The manufacturing plan is up-to-date and reflects the planned LRIP and FRP operations. e) The manufacturing plan contains sufficient planning to address the following: 1) Methods for certifying the qualification of the machines, equipment and procedures used in complex or critical operations 2) Required cleanliness, contamination, and corrosion controls 3) Required control of physical environment (temperature, humidity, lighting, work area arrangements, etc.)

Product	PRR acceptability criteria
Technical plans *(continued)*	4) Critical item quality control and verification at production use point 5) Electrostatic discharge control 6) Nondestructive evaluation methods and techniques, as applicable 7) Completed item inspection and test records review prior to shipment 8) Statistical process control, if applicable f) A manufacturing maturation plan has been developed for any item assessed to not have the industrial capability in place to support LRIP. g) Program is properly staffed with qualified production, quality (engineering and assurance), and manufacturing personnel. h) The product acceptance system including acceptance test procedures and associated equipment has been validated and put under configuration control. i) Production facilities are ready and required personnel are trained and certified as required. j) Delivery schedule is executable (technical/cost risks, long lead items). k) Diminishing manufacturing sources and material shortages plan is in place and mitigates the risk of obsolescence during LRIP and FRP. l) The CMP has been updated as required to support production. m) The SEP and supplier SEMP have been updated as required to adequately address the production and deployment phase of acquisition.
Program execution and process control	a) Adequate processes and metrics are in place to ensure the system product baseline is maintained throughout the production and deployment phase of acquisition. b) The following items at a minimum have been successfully verified in a pilot line environment: 1) Manufacturing technology solutions 2) Manufacturing processes 3) Quality targets 4) Special personnel skills 5) Successful performance of all special test equipment and special inspection equipment c) CPI is being adequately managed and protected d) The CCB is processing configuration changes in accordance with industry standards, supplier instructions, processes, and procedures; and maintaining the proper configuration baselines.
Risk assessment	a) Technical risks are identified, and mitigation plans are in place. b) Risk management process is in place demonstrated by documented execution results of existing mitigation plans associated with the purpose of the review.
Program life-cycle cost estimate and schedule	a) System as designed is producible within the production budget. b) Production cost model is based on the stable detailed design and supply chain, and has been validated. c) IMP and IMS have sufficient details of planned tasks for production and deployment to achieve acceptable risk. d) The acquirer/supplier IMS is resourced at reasonable levels based on realistic performance and efficiency expectations. e) The CARD or verified cost estimate has been updated and accurately reflects the current system product baseline. f) EVM status supports transition to production.

6.10.2 PRR preparation

Table 34 lists the actions that should be considered during preparation for the PRR. The responsible people listed are those most often tasked with the listed preparation actions, but the acquirer and supplier may agree to assign the actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 34—PRR preparation actions

Responsible person	PRR preparation actions
Program manager	a) Approve, fund, and staff the PRR as planned in the SEP developed by the systems engineer. b) Continue to control class I changes to the system product baseline. c) Establish the plan to PCA in applicable acquirer-supplier agreement documents including the SEMP, IMS, and IMP. d) Ensure the SEP includes objective SMEs to participate in the PRR. e) Determine if the readiness of manufacturing processes, quality management system, and production planning (facilities, tooling and test equipment capacity, personnel development and certification, process documentation, inventory management, suppler management, etc.) provide low-risk assurances for supporting LRIP and FRP. f) Appoint a PRR chair, in coordination with the systems engineer, no later than 45 days prior to the technical review. g) Coordinate a preliminary agenda between the program IPT and other SMEs no later than 30 days prior to the PRR.
Systems engineer	a) Develop and execute the PRR plans with established quantifiable review criteria, carefully tailored to satisfy program objectives. b) Ensure that the pre-established technical PRR criteria have been met to ensure the production capability forms a satisfactory, affordable, and sustainable basis for proceeding into LRIP and FRP. c) Advise the program manager on whether production capability forms a satisfactory, affordable, and sustainable basis for proceeding into LRIP and FRP. d) Ensure adequate plans and resources are in place to proceed from PRR to PCA and FRP decision review (DR). e) Ensure plans to proceed to PCA and FRP allow for contingencies. f) Ensure production implementation supports overall performance and R&M requirements. g) Coordinate arrangements for PRR location and support. h) Ensure all of the technical review products whose acceptability criteria are defined in Table 33 are completed for the PRR. i) Ensure the preparation and assembly of all technical review material and any presentations required to be given to the PRR team are coordinated across IPTs.
Supplier	a) Submit the final draft product specification(s) for the system product baseline element(s) to be audited to the acquirer for review prior to conduct of the PRR. b) Prior to the PRR date, submit the following information to the acquirer: 1) Names and roles of individuals who will participate in the PRR; specifically, identify the test manager(s) 2) Identification of the system product baseline element(s) to be

Supplier *(continued)*	reviewed: i) Nomenclature ii) Specification identification number(s) iii) CI number(s) iv) Current listing of all deviations and waivers against the CI(s) either requested of, or approved by, the acquirer
PRR chair	a) Determine PRR team membership. b) Approve the final PRR agenda. c) Identify any final tailoring of the Clause 6 PRR detailed criteria for the specific program. d) Identify any specific elements for in-depth technical review as required.

6.10.3 PRR conduct

Table 35 lists the technical review elements and associated content details that should be considered for the conduct of the PRR. Specific elements and their content details shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 35—PRR conduct elements

PRR review element	Content details
Introduction, agenda, administrative	a) PRR location layout and safety procedures b) Security procedures if applicable c) Introduction of chair and team members d) Purpose of the technical review e) PRR agenda f) Action item procedures g) Risk assessment procedures h) Program overview i) Status of action items from previous technical reviews
Verified system product baseline documentation review	a) Production engineering—focus on how the product has been designed for producibility, and what planning has been accomplished to ensure methods, processes, and test equipment have been defined and are available to support manufacturing and production operations b) Product assurance—focus on how quality has been designed into the product and how product quality will be pursued and verified c) System element qualification test planning, conduct, and results d) Engineering release and configuration status accounting details for all system product baseline elements e) Technical readiness consistent with technology maturity targets
Technical plans review	a) Production/manufacturing plan—details for facilities, processes, equipment, and personnel b) SEP and supplier SEMP—coverage for production and OT&E c) Training plan—coverage for required personnel skills and certifications to support production d) Production test plan—coverage for all planned production testing e) CMP—support for product baseline configuration control during production

PRR review element	Content details
Technical plans review *(continued)*	f) LCSP—coverage for planning applicable to production g) Quality management plan—coverage for continuous improvement, supplier quality management systems, statistical process control, lot acceptance, quality assurance provisions, inspection/test procedures, and accept/reject criteria h) R&M plan—coverage for reliability growth including environmental stress screening/highly accelerated stress screen, FRACAS, and Failure Review Board incorporation
Program execution and process control review	a) Production management—focus on how well the manufacturing organization is structured and managed b) Production operations—focus on how manufacturing and production will be planned and executed. Include production schedule, cost per unit and acceptance testing c) Manufacturing readiness consistent with manufacturing readiness planning in the SEP d) Configuration management and control during production e) Status of industrial resources, both at supplier's and subcontractor/vendor locations f) Status and management of materials and purchased parts, inventory control, vendor management g) Status and management of diminishing manufacturing sources, material shortages, and obsolete parts issues h) Personnel skill development and certification
Risk and mitigation review	a) Risk identification and mitigation, including: 1) Consideration of producibility trade studies 2) Consideration of manufacturing, production, and quality risks 3) Consideration of ESOH risks
Program life-cycle cost estimate and schedule review	a) Updated production cost estimates b) IMP and IMS production task identification and descriptions c) Consistency among the CARD, IMS, and production earned value data

6.10.4 PRR closure

Table 36 lists the actions that should be considered for PRR closure. The responsible people listed are those most often tasked with the listed closure actions. The acquirer and supplier may agree to assign the program manager and systems engineer actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 36—PRR closure actions

Responsible person	PRR closure actions
Program manager	a) Manage and approve changes to any baselined documentation as a result of the PRR. b) If funding profiles are insufficient to support activities leading to PCA, and to support production, notify user/sponsor of funding shortfall and request funding profile adjustments. c) Acknowledge PRR completion with the indication that successful PRR performance satisfies the requirements for conduct of the PRR. d) Support preparation of the PRR summary report.
Systems engineer	a) Monitor and control the execution of the PRR closure plans. b) Organize and supervise the responses to all action items generated during PRR. c) Support preparation of the PRR summary report. d) Produce corrective action plans if required and manage to completion. e) Ensure the supplier records PRR accomplishment in the applicable system element development records. f) Document the plan to PRR in the SEP and elsewhere as appropriate. g) Ensure adequate plans and resources are in place to accomplish the necessary technical activities, and that these plans allow for contingencies. h) Ensure all information products required to be put under configuration control have been delivered to the configuration manager. i) Ensure all IMP and IMS tasks associated with conduct of the PRR have been successfully completed and documented as such.
Supplier	a) Record PRR accomplishment in the applicable system element development records. b) Support preparation of the PRR summary report and formal PRR minutes.
PRR chair	a) Ensure preparation of the formal PRR summary report and formal PRR minutes with the support of the program manager and systems engineer. b) Sign off final approval of all action items. c) Approve the PRR minutes. d) Approve and distribute the PRR summary report. e) Prepare and distribute the formal PRR closure letter.
Recorder	a) Collate all action items for submission to the PRR chair. b) Prepare the PRR summary report and PRR minutes for signature and distribution by the PRR chair.

6.11 Physical configuration audit (PCA) detailed criteria

6.11.1 PCA review products acceptability criteria

Table 37 lists the products that should be reviewed at PCA, and the associated acceptability criteria that should form a sufficient basis by which to assess each product's content as acceptable to support a successful PCA. Specific products and associated acceptability criteria shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 37—PCA technical review products acceptability criteria

Product	PCA acceptability criteria
Verified system product baseline documentation	a) The system product baseline is complete and accurately reflects the configuration of the representative production item that was inspected and validated through OT&E. b) All operation and support documents are complete and conform to any data item descriptions contained in the acquirer-supplier agreement. c) Supporting processes used by the supplier to produce the CI(s) are adequate to support production. d) Released engineering documentation and quality control records are complete and accurately reflect the "as-built" or "as-coded" configuration of the CI(s). e) Final product specifications for CI(s) are complete and traceable to their allocated requirements. f) Traceability is complete from design documentation to build plans. g) All differences between manufacturing of EMD assets and production assets are identified. h) The as-designed parts, materials, and processes (PM&P) list is complete. i) All required certifications have been successfully completed by all certifying agencies. j) The product baseline specification(s) for the CI(s) have been reviewed and validated to assure that they adequately define the CI(s) and the necessary testing, mobility/transportability, and packaging requirements for the production of the CI(s). k) The drawings to be controlled by the acquirer have been compared with the equipment to ensure that the latest drawing changes have been incorporated into the equipment, that part numbers used for support by the acquirer agree with the drawings, and that the drawings are complete and adequately describe the equipment. l) The deliverable software has been compared to the listing of deliverables contained in the software version description (SVD). All required changes have been incorporated into both the specifications and the deliverable software, and the listing in the specifications exactly match the software being delivered. m) The deliverable software listing and related documentation have been compared to the listing of deliverables contained in the SVD to ensure that all documentation required for use of the software is correctly identified in the SVD. n) Comparison of run-time code generated from the software listings being audited matches the run-time code that successfully passed OT&E. o) The parts being used in the hardware design as listed on the drawing parts lists and as installed in the audit article have been compared to the applicable program parts selection list (PPSL) to ensure that only approved parts are being used.

Product	PCA acceptability criteria
Program execution and process control	a) All technical baselines—functional, allocated and product—are complete, current and consistent and are under configuration control. b) The CCB is processing configuration changes in accordance with industry standards, supplier instructions, processes, and procedures, and maintaining the proper configuration baselines.
Validation (OT&E results)	a) Acceptance test procedures and test results are consistent with the corresponding product specification requirements. b) The acceptance test procedures have been reviewed to ensure that the testing has been properly completed and certified. c) The PCA articles have been examined to ensure that the inspection/receiving document adequately defines the hardware/software and that all applicable deficiencies are listed on the inspection/receiving document.

6.11.2 PCA preparation

Table 38 lists the actions that should be considered during preparation for the PCA. The responsible people listed are those most often tasked with the listed preparation actions, but the acquirer and supplier may agree to assign the actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 38—PCA preparation actions

Responsible person	PCA preparation actions
Program manager	a) Approve, fund, and staff the PCA as planned in the SEP developed by the systems engineer. b) Continue to control class I changes to the system product baseline. c) Ensure the plan to FRP DR is contained in the applicable acquirer-supplier agreement documents including the SEMP, IMS, and IMP. d) Ensure the SEP includes objective SMEs to participate in the PCA. e) Appoint a PCA chair, in coordination with the systems engineer, no later than 45 days prior to the technical review. f) Coordinate a preliminary agenda between the program IPT, the supplier and other SMEs no later than 30 days prior to the PCA.
Systems engineer	a) Develop and execute the PCA plans with established quantifiable technical review criteria, carefully tailored to satisfy program objectives. b) Coordinate with CM and manufacturing SMEs and the production facility to develop an efficient approach to the PCA. c) Identify methods of examining the production-representative CI(s) (e.g., disassembly, inspection, and reassembly) and verify the CI(s) against related design documentation. d) Coordinate arrangements for PCA location and support. e) Ensure all of the audit products whose acceptability criteria are defined in Table 37 are completed for the PCA. f) Ensure the preparation and assembly of all audit material and any presentations required to be given to the PCA team are coordinated across IPTs.
Supplier	a) Submit the final product specification(s) for the system product baseline CI(s) to be audited to the acquirer for review prior to conduct of the PCA.

Responsible person	PCA preparation actions
Supplier *(continued)*	b) Submit documentation of inspection and test at point of manufacture as applicable for any end-items procured from subcontractors. c) Prior to the PCA date, submit the following information to the acquirer: 1) Names and roles of individuals who will participate in the PCA 2) Identification of the system product baseline CI(s) to be audited: i) Nomenclature ii) Specification identification number(s) iii) CI number(s) iv) Serial number(s) v) Drawing and part number(s) vi) Identification number(s) vii) Software inventory numbering system viii) Current listing of all deviations and waivers against the element(s) either requested of, or approved by, the acquirer
PCA chair	a) Determine PCA team membership. b) Approve the final PCA agenda. c) Identify any final tailoring of the Clause 6 PCA detailed criteria for the specific program. d) Identify any specific elements for in-depth technical review as required.

6.11.3 PCA conduct

Table 39 lists the technical review elements and associated content details that should be considered for the conduct of the PCA. Specific elements and their content details shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table 39—PCA conduct elements

PCA review element	Content details
Introduction, agenda, administrative	a) PCA location layout and safety procedures b) Security procedures if applicable c) Introduction of chair and team members d) Purpose of the audit e) PCA agenda f) Action item procedures g) Risk assessment procedures h) Program overview i) Status of action items from previous technical reviews
System product baseline	a) Status of drawings (including computer-aided design artifacts) and associated manufacturing instructions: 1) Number, title, approval date, discrepancies, comments 2) Comparisons of selected part numbers with the PPSL 3) Consistency of dimensions, tolerances, and finishes between drawings and manufacturing instructions 4) Identification of special processes 5) Incorporation of all approved changes 6) Identification of any differences between the physical configuration of CI(s) at FCA and PCA.

System product baseline *(continued)*	b) Status of deliverable software code, documentation, and media: 1) Software source listings and other product specification content 2) Design description consistency between top-level and low-level descriptions 3) Coverage of software users, programmers, operators and diagnostics manuals related to any data item descriptions included in the acquirer-supplier agreement 4) Actual CI delivery media—conformance with applicable requirements in the acquirer-supplier agreement c) Status of any nonconforming material d) Status of training material and support of training plan e) Status of certifications f) Approach to production acceptance testing g) Validation and completeness of non-software related operations and maintenance documentation h) Resources requirements to support production and deployment
Program execution and process control review	a) CCB process and CMP consistency b) FCA minutes for each CI being audited c) PCA minutes for each lower level CI d) Engineering release system—status and history of changes and configurations; traceability between assembly-level and low-level part numbers, and associated specifications e) Quality control system f) Manufacturing/production/construction process control
Validation (OT&E) results	a) Consistency of acceptance test procedures and results with the corresponding product specification requirements b) Review of completed and certified acceptance test procedures c) Review of the inspection/receiving document that defines the hardware/software, including any lists of deficiencies

6.11.4 PCA closure

Table 40 lists the actions that should be considered for PCA closure. The responsible people listed are those most often tasked with the listed closure actions. The acquirer and supplier may agree to assign the program manager and systems engineer actions to different people or organizations depending on a given program's organizational structure. Specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program. Responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table 40—PCA closure actions

Responsible person	PCA closure actions
Program manager	a) If funding profiles are insufficient to support activities leading to, and supporting production, notify user/sponsor of funding shortfall and request funding profile adjustments. b) Determine that the readiness of manufacturing processes, quality management system and production planning (e.g., facilities, tooling and test equipment capacity, personnel, certification, process documentation, inventory management, supplier management) provide low risk assurances for supporting FRP or FD. c) Support preparation of the PCA summary report. d) Coordinate preparation of the PCA certification package.

Responsible person	PCA closure actions
Systems engineer	a) Support preparation of the PCA certification package. b) Monitor and control the execution of the PCA closure plans. c) Organize and supervise the responses to all action items generated during PCA. d) Support preparation of the PCA summary report. e) Produce corrective action plans if required, including any additional acceptance or qualification testing required by the PCA team, and manage to completion. f) Ensure the supplier records PCA accomplishment in the applicable system element development records. g) Ensure that the pre-established technical PCA criteria have been met to ensure the production capability forms a satisfactory, affordable, and sustainable basis for proceeding with FRP/FD. h) Advise the program manager on whether production capacity forms a satisfactory, affordable, and sustainable basis for proceeding with FRP. i) Ensure adequate plans and resources are in place to get from PCA to IOC and full operational capability (FOC). j) Ensure plans to get to FOC allow for contingencies. k) Ensure production implementation supports overall performance and R&M requirements. l) Ensure all information products required to be put under configuration control have been delivered to the configuration manager. m) Ensure all IMP and IMS tasks associated with conduct of the PCA have been successfully completed and documented as such.
Supplier	a) Record PCA accomplishment in the applicable system element development records. b) Support preparation of the PCA summary report and formal PCA minutes.
PCA chair	a) Ensure preparation of the PCA summary report and formal PCA minutes with the support of the program manager and systems engineer. b) Sign off final approval of all action items. c) Approve the PCA minutes. d) Approve and distribute the PCA summary report. e) Prepare and distribute the formal PCA closure letter.
Recorder	a) Collate all action items for submission to the PCA chair. b) Prepare the PCA summary report and formal PCA minutes for signature and distribution by the PCA chair. c) Prepare the contents of the PCA certification package.

7. Technical review and audit application guidance for defense programs

7.1 General

For each technical review and audit contained in Clause 5 of this standard, this clause provides detailed, best-practice guidance for applying the detailed criteria of the corresponding portion of Clause 6 of this standard to various kinds of defense programs.

While the technical reviews and audits included in this standard all address the system that is the object of a particular acquirer-supplier agreement, there may be enabling systems with applicability to the requirements in the technical reviews. The supplier of the system under review may have no obligation under the associated acquirer-supplier agreement to ensure that any needed enabling systems are available and ready for use when required. Since the enabling systems will have their own life cycle, the responsibility for the development or acquisition of enabling systems should be clearly documented in the acquirer-supplier agreement for the system under review.

7.2 Alternative systems review (ASR) application guidance

The following is a set of observed good practices for consideration:

a) The AoA Report may not be complete for ASR, but the AoA itself should be complete for the technical review.

b) The high-level conceptual architectural description of the preferred materiel solution(s) should be communicated with artifacts that enable clear understanding by technical review team members that are not conversant with the standard artifacts produced within structures such as DoDAF or native formats of system modeling tools if employed.

c) The program risk assessment should address the relative risk(s) associated with the use of COTS/NDI versus a new design. Carefully consider whether COTS/NDI is a requirement or is satisfying a requirement specified by the logical architecture.

d) The program cost estimate should include planned investments for technology development to mature design and manufacturing technologies.

e) The proposed KPPs should address the complete performance required by the systems' intended operating environment, including net-centric and net-ready KPP requirements as appropriate.

f) Prototyping required by a given program should occur in the TMRR phase. Therefore, the ASR should identify critical technologies that will be prototyped.

g) The program manager should tailor the ASR to the technical scope and risk of the system, and address the ASR in the SEP.

h) In order to help ensure a comprehensive and balanced assessment of all ASR work products and proper recording of the activities and decisions, ASR participants should include the following, as applicable:
   1) Program management
   2) Systems engineering
   3) Software engineering
   4) Hardware engineering
   5) Domain specialists and specialty engineers
   6) Logistics
   7) Test and evaluation
   8) All certification authorities

9) System users
10) Cost estimating team
11) Legal counsel, if required
12) Contracting officers
13) Recorder or secretary

NOTE—These roles do not dictate that a single individual is provided for each role. A single individual may perform more than one of these roles within the team. Depending on the complexity of the system, more than one individual may also be assigned to a specific role.

7.3 System requirements review (SRR) application guidance

The following is a set of observed good practices for consideration:

a) In order to help ensure the requirements are thoroughly and properly understood, the SEP should include the requirement to conduct an SRR. If there are competing contractual efforts, an SRR should be held with each participating developer.

b) The request for the SRR chair should occur at least 60 days prior to conduct of the technical review.

c) The understanding of requirements and verification procedures, and the supplier's ability to comply with the system specification, should be covered in the technical risk assessment.

d) The ability of the requirements set documented in the system specification to achieve the capabilities specified in the draft CDD within the program budget and schedule should be included in the program execution risk assessment.

e) Of critical importance to the SRR is the understanding of the risks inherent in the supplier's proposed system concept and products and processes. The SRR needs to assess the risks to be at an acceptable level consistent with the IMP, IMS, and to be manageable by the acquisition agency.

f) A work breakdown structure (WBS) is defined as a function of the element partitioning performed during the system logical architecture development. If the WBS is declared before the availability of the initial system logical architecture, it will ultimately constrain the architecture.

g) The PPP should cover countermeasures which address foreign collection, malicious content insertion and supply chain threats to the initial system CPI, critical functions, and components.

h) In order to help ensure a comprehensive and balanced assessment of all SRR work products and proper recording of the activities and decisions, SRR participants should include the following, as applicable:
   1) Program management
   2) Systems engineering
   3) Software engineering
   4) Hardware engineering
   5) Domain specialists and specialty engineers
   6) Logistics
   7) Test and evaluation
   8) All certification authorities
   9) System users
   10) Cost estimating team
   11) Legal counsel, if required
   12) Contracting officers
   13) Recorder or secretary

   NOTE—These roles do not dictate that a single individual is provided for each role. A single individual may perform more than one of these roles within the team. Depending on the complexity of the system, more than one individual may also be assigned to a specific role.

7.4 System functional review (SFR) application guidance

The following is a set of observed good practices for consideration:

a) In order to help ensure that the functional baseline fully satisfies performance requirements and that the program can begin preliminary design with acceptable risk, the SEP should include the requirement to conduct an SFR. If there are competing contractual efforts, an SFR should be held with each participating developer.

b) The request for the SFR chair should occur at least 90 days prior to conduct of the technical review.

c) The acquirer should establish government configuration control of the functional baseline at the successful conclusion of the SFR which will eventually be verified through FCA leading up to the system-level FCA or the SVR.

d) Since the SFR is the first technical review that begins to allocate requirements to separated subsystems and organizational IPTs, program teams must create interface design documents at this point in order to define areas of responsibility and constraints requiring coordination across IPTs.

e) Successful completion of the SFR does not represent concurrence from the procuring authority that future design maturity will result in acceptable system performance. The SFR, as a component of the systems engineering technical review (SETR) process, serves as technical monitoring of program execution by senior functional area experts. The supplier remains responsible for the system design/performance requirements within the terms of the contract.

f) In order to help ensure a comprehensive and balanced assessment of all SFR work products and proper recording of the activities and decisions, SFR participants should include the following, as applicable:

1) Program management
2) Systems engineering
3) Software engineering
4) Hardware engineering
5) Domain specialists and specialty engineers
6) Logistics
7) Test and evaluation
8) Configuration management
9) All certification authorities
10) System users
11) Cost estimating team
12) Legal counsel, if required
13) Contracting officers
14) Recorder or secretary

NOTE—These roles do not dictate that a single individual is provided for each role. A single individual may perform more than one of these roles within the team. Depending on the complexity of the system, more than one individual may also be assigned to a specific role.

7.5 Preliminary design review (PDR) application guidance

The following is a set of observed good practices for consideration:

a) For complex systems, a PDR may be conducted incrementally for each subsystem or system element, depending on the scope and complexity of the system.

b) If incremental PDRs are held, it is important that all conflicts or other issues arising from the results of the incremental PDRs be resolved before conducting the system-level PDR.

c) The request for the PDR chair should occur at least 90 days prior to conduct of the technical review.

d) The PDR technical review criteria should be tailored to best support the program's technical scope and risk.

e) For software intensive systems, the SAR or SSR should be completed before the system-level PDR is held.

f) In order to help ensure a comprehensive and balanced assessment of all PDR work products, PDR participants from both the acquirer and supplier should include the following, as applicable:

1) Program management
2) Systems engineering
3) Software engineering
4) Hardware engineering
5) Domain specialists and specialty engineers
6) Logistics
7) Test and evaluation
8) Configuration management
9) All certification authorities
10) System users
11) Cost estimating team
12) Legal counsel, if required
13) Contracting officers
14) Recorder or secretary

NOTE—These roles do not dictate that a single individual is provided for each role. A single individual may perform more than one of these roles within the team. Depending on the complexity of the system, more than one individual may also be assigned to a specific role.

g) Assessment of the allocated baseline should assure that technical budget allocations (weight, power, cooling, etc.) have been properly allocated to one or more system elements with acceptable design growth margins.

h) Since multiple teams are usually performing detailed design in parallel for subsystems or elements of the total system, system-level coordination and problem resolution often become difficult. A robust and efficient cross-team communication system should be established, both within the supplier's organization and between the supplier team leads and their acquirer counterparts, to minimize the chances of rework and the associated cost and schedule impact from conflicting interpretations of the interface requirements by the various design groups.

i) Some design decisions made at the PDR may precipitate discussions with the operational requirements community because they could have an impact on the CDD. Depending upon the nature/urgency of the capability required and the current state of technology, incremental development may be necessary.

j) Margins should be defined by acquirer-supplier agreement requirements documents, domain specialists, product history, supplier internal company command media, or military standards and handbooks.

7.6 Critical design review (CDR) application guidance

The following is a set of observed good practices for consideration:

a) For complex systems, a CDR may be conducted incrementally for each subsystem or CI, depending on the scope and complexity of the system.

b) If incremental CDRs are held, it is important that all conflicts or other issues arising from the results of the incremental CDRs be resolved before conducting the system-level CDR.

c) The system-level CDR assesses the system design as captured in product specifications for each CI in the system's initial product baseline, and helps ensure that each CI in the initial product baseline has been captured in the detailed design documentation.

d) The request for the CDR chair should occur at least 90 days prior to conduct of the technical review.

e) The CDR technical review criteria should be tailored to best support the program's technical scope and risk.

f) In order to help ensure a comprehensive and balanced assessment of all CDR work products, CDR participants from both the acquirer and supplier should include the following, as applicable:

1) Program management
2) Systems engineering
3) Software engineering
4) Hardware engineering
5) Domain specialists and specialty engineers
6) Logistics
7) Test and evaluation
8) Configuration management
9) All certification authorities
10) System users
11) Cost estimating team
12) Legal counsel, if required
13) Contracting officers
14) Recorder or secretary

NOTE—These roles do not dictate that a single individual is provided for each role. A single individual may perform more than one of these roles within the team. Depending on the complexity of the system, more than one individual may also be assigned to a specific role.

g) Assessment of the allocated baseline against the initial product baseline should assure that technical budget allocations (weight, power, cooling, etc.) have been properly implemented in the detailed design.

h) As a rule of thumb, "initial product baseline complete" can be satisfied by achievement of all of the following:

1) 75% to 90% of the manufacturing and hardware, build-to drawings and associated instructions are complete.

2) 100% of all critical component (e.g., components containing critical technologies) drawings are complete.

3) Detailed software design content is documented in all SWCI design documents as applicable for the software increments up to this point in the selected software life cycle model, and for interface design documents, as applicable.

7.7 Test readiness review (TRR) application guidance

The following is a set of observed good practices for consideration:

a) For complex systems, a TRR may be conducted incrementally for each subsystem or CI, depending on the scope and complexity of the system.

b) If incremental TRRs are held, it is important that all conflicts or other issues arising from the results of the incremental TRRs be resolved before conducting the system-level TRR.

c) The system-level TRR assesses test objectives, test methods and procedures, scope of tests, and safety, and confirms that required test resources have been properly identified and coordinated to support planned tests.

d) The request for the TRR chair should occur at least 60 days prior to conduct of the technical review.

e) The TRR technical review criteria should be tailored to best support the program's technical scope and risk.

f) In order to help ensure a comprehensive and balanced assessment of all TRR work products, TRR participants from both the acquirer and supplier should include the following, as applicable:

1) Program management
2) Chief developmental tester
3) Lead DT&E organization
4) Operational test agency (OTA)
5) Test facilities/ranges
6) Configuration management
7) Systems engineering
8) Software engineering
9) Hardware engineering
10) Domain specialists and specialty engineers
11) Logistics
12) Test and evaluation
13) All certification authorities
14) System users
15) Cost estimating team
16) Legal counsel, if required
17) Component T&E organization
18) Contracting officers
19) Recorder or secretary

NOTE—These roles do not dictate that a single individual is provided for each role. A single individual may perform more than one of these roles within the team. Depending on the complexity of the system, more than one individual may also be assigned to a specific role.

g) Assessment of the program's remaining risks at the time of TRR should take into account that the level of specific risk will vary as the system proceeds from component level to system level testing.

h) TRR scope should be tailored in accordance with the technical scope and risk of the system or system element(s) under test, but the TRR should under no circumstances be tailored out of the program's T&E plans.

i) Any TRR tailoring should be documented in the program TEMP or should be described as part of the chief developmental tester's coordination of the TRR agenda and content with the technical review chair and members.

j) The test plans, procedures, and results should undergo a peer review to determine the applicability, effectiveness and completeness of any formal test event, and the review results should be used to update plans and procedures for remaining program testing.

k) TRR can be used prior to any test in any program phase, but is specifically to be conducted prior to, and in support of, system-level DT.

l) If a given program chooses to conduct IRRs as part of the system's incremental integration phases, the TRR for any specific system element(s) under test should be conducted after the corresponding IRR(s) are complete for that system element(s) under test.

m) Any specific TRR should assess the planned formal test event's contribution to the system's operational suitability evaluation by considering items such as any special needs for the number of operating hours, environmental testing, maintenance demonstrations, specific testing profiles, or other unique test requirements.

n) For systems under live fire test and evaluation (LFT&E) oversight, TRRs should assess the formal test event's planned test results for support of the following:

1) Personnel survivability.
2) System vulnerability.
3) System recoverability from battle damage, and battle damage repair capabilities and issues.

4) Real time casualty assessment (RTCA) during IOT&E to ensure assumptions supporting RTCA remain consistent with LFT&E results.
5) Sufficient testing of the system under realistic combat conditions.
6) Collecting LFT&E results early enough in the program life cycle to allow time to correct any design deficiencies that are found

o) For operational test readiness review (OTRR):

1) The system technical documentation should provide the technical review team with a clear understanding of available system performance to meet the CDD or CPD.
2) Operational requirements defined in the CDD/CPD must match the requirements documented in the TEMP to be verified during OT&E.
3) DT&E results should indicate that development test (DT) objectives and performance thresholds identified in the TEMP have been satisfied, or are projected to meet system maturity for the ICD/CDD/CPD as appropriate.
4) DT&E data and reports should be provided to the OTA no later than 30 days prior to the planned commencement of operational test (OT) unless otherwise agreed by the OTA.
5) System operating, maintenance, and training documents should be provided to the OTA 30 days prior to the OTRR, unless otherwise agreed to by the OTA.
6) Logistic support, including spares, repair parts, and support/ground support equipment should be available as documented. Discuss any logistics support which will be used during OT&E, but will not be used with the system when fielded (e.g., supplier-provided depot level maintenance).
7) The OT&E manning of the system should be assessed to be adequate in numbers, rates, ratings, and experience level to simulate normal operating conditions.
8) Training has been completed and is representative of that planned for fielded units.
9) The system provided for OT&E, including software, should be production representative. Differences between the system provided for test and production configuration should be addressed at the OTRR.
10) Threat information (e.g., threat system characteristics and performance, electronic countermeasures, force levels, scenarios, and tactics), to include security classification required for OT&E, should be available to satisfy OTA test planning.
11) The system should be demonstrated as safe to use as planned in the concept of employment. Any restrictions to safe employment should be stated. The ESOH program requirements should have been satisfied. The system complies with all environmental, safety, and occupational health/hazardous waste requirements, where applicable. ESOH hazardous waste reviews and reports have been provided to the OTA. When an energetic is employed in the system, weapon system explosives safety review board criteria for conduct of test should have been met.
12) All software should be sufficiently mature and stable for field introduction. All software trouble reports should be documented with appropriate impact analyses. There should be no outstanding trouble reports that
    i) Prevent the accomplishment of an essential capability;
    ii) Jeopardize safety, security, or other requirements designated “critical”;
    iii) Adversely affect the accomplishment of an essential capability and no work-around solution is known; or
    iv) Adversely affect technical, cost, or schedule risks to the project or to life-cycle support of the system, and no work-around solution is known.
13) For programs with interoperability requirements (e.g., information exchange requirements in ICD/CDD/CPDs), appropriate authority has approved the integrated support plan; and joint

interoperability test command concurs that program interoperability demonstrated in development has progressed sufficiently for the phase of OT to be conducted.

14) Approval of spectrum certification compliance and spectrum supportability has been obtained.

15) For information technology systems, including national security system, the system has been assigned a medium access control and confidentiality level. System certification accreditation documents, including the system security authorization agreement and the authority to operate or interim authority to operate, have been provided to the OTA.

16) The TRR should discuss the contingency of holding a break of test configuration review at the conclusion of planned test. Considerations that may warrant a break of test configuration review include complexity of test setup to retest, amount of anomalous or out-of-family results, or timing of the SVR relative to completion of the test.

7.8 Functional configuration audit (FCA) application guidance

The following is a set of observed good practices for consideration:

a) For complex systems, an FCA may be conducted incrementally for each subsystem or CI, depending on the scope and complexity of the system. Each increment should address a specific system functional area, and document any discrepancies that are found in the performance capabilities of that increment.

b) If incremental FCAs are held, it is important that all conflicts or other issues arising from the results of the incremental FCAs be resolved before conducting the system-level FCA.

c) A system-level FCA assesses performance of the system against the functional baseline, and may be conducted in conjunction with the system-level SVR, which examines more than just system functionality. The main difference in focus between the two activities is that a system-level FCA focuses primarily on verification of the functional baseline, while SVR assesses system functionality as well as other implementation details to include program readiness to proceed into the production and deployment phase.

d) The system-level FCA assesses the collected test, analysis, and M&S results of the system product baseline after completion of acceptance and development testing, and verifies that actual system performance satisfies the functional and allocated baseline requirements.

e) When a full-up system prototype is not part of the program's acquisition strategy, the FCA is used to validate system element functionality. Other system-level analysis is then used to ascertain whether program risk warrants proceeding to system initial production for OT&E. Verification of system performance is later accomplished on a production system.

f) Drawings of HWCI parts that are to be provisioned should be selectively sampled to assure that test data essential to manufacturing are included on, or furnished with, the drawings.

g) The request for the FCA chair should occur at least 45 days prior to conduct of the technical review.

h) The FCA technical review criteria should be tailored to best support the program's technical scope and risk.

i) FCA requirements should be included in the work scope of the acquirer-supplier agreement.

j) An FCA for system software elements should be delayed until after integration testing.

k) In order to help ensure a comprehensive and balanced assessment of all FCA work products, FCA participants from both the acquirer and supplier should include the following, as applicable:

1) Program management
2) Configuration management

3) Systems engineering
4) Design engineering
5) Domain specialists and specialty engineers
6) Computer-aided design and manufacturing
7) Production
8) Test and evaluation
9) All certification authorities
10) System users
11) Cost estimating team
12) Legal counsel, if required
13) Contracting officers
14) Recorder or secretary

NOTE—These roles do not dictate that a single individual is provided for each role. A single individual may perform more than one of these roles within the team. Depending on the complexity of the system, more than one individual may also be assigned to a specific role.

7.9 System verification review (SVR) application guidance

The following is a set of observed good practices for consideration:

a) SVR may be held concurrently with the system-level FCA due to the overlap of system documentation to be assessed. The main difference in focus between the two activities is that a system level FCA focuses primarily on verification of the functional baseline while SVR assesses system functionality as well as other implementation details to include program readiness to proceed into the production and deployment phase. When a program determines that a separate SVR is required, the supplier should notify the acquirer when the collected test, analysis and verification results of all system element(s) are sufficient to support SVR.

b) For complex systems, an SVR may be conducted incrementally for each subsystem or CI, depending on the scope and complexity of the system. Each increment should address a specific system functional area and document any discrepancies that are found in the performance capabilities of that increment.

c) If incremental SVRs are held, it is important that all conflicts or other issues arising from the results of the incremental SVRs be resolved before conducting the system-level SVR.

d) The request for the SVR chair should occur at least 45 days prior to conduct of the technical review.

e) The SVR technical review criteria should be tailored to best support the program's technical scope and risk.

f) SVR requirements should be included in the work scope of the acquirer-supplier agreement.

g) The SVR should address system support elements (both hardware and software) like diagnostics, peculiar test equipment and software, and training equipment and software.

h) The SVR should address for the following items all changes or additions generated since completion of formal qualification testing and the FCA to help ensure the as-tested product baseline has incorporated all the updates:

   1) ECPs
   2) Specification change notices
   3) Specification revisions
   4) Interface control document changes
   5) Manufacturing or production process changes

i) In order to help ensure a comprehensive and balanced assessment of all SVR work products, SVR participants from both the acquirer and supplier should include the following, as applicable:

1) Program management
2) Configuration management
3) Systems engineering
4) Design engineering
5) Domain specialists and specialty engineers
6) Computer-aided design and manufacturing
7) Production
8) Test and evaluation
9) Logistics
10) All certification authorities
11) System users
12) Cost estimating team
13) Legal counsel, if required
14) Contracting officers
15) Recorder or secretary

NOTE—These roles do not dictate that a single individual is provided for each role. A single individual may perform more than one of these roles within the team. Depending on the complexity of the system, more than one individual may also be assigned to a specific role.

7.10 Production readiness review (PRR) application guidance

The following is a set of observed good practices for consideration:

a) For complex systems including software-intensive systems, a PRR may be conducted incrementally for each subsystem or CI, depending on the scope and complexity of the system. Each increment should address a specific system functional area and document any discrepancies that are found in the manufacturing readiness of that increment.

b) If incremental PRRs are held, it is important that all conflicts or other issues arising from the results of the incremental PRRs be resolved before conducting the system-level PRR.

c) The PRR technical review criteria should be tailored to best support the program's technical scope and risk, and should be documented in the program SEP.

d) PRR requirements should be included in the work scope of the acquirer-supplier agreement.

e) The PRR is designed as a system-level preparation tool and should be used for assessing risk as the system transitions from development to FRP. It should not be completely eliminated from the program development plan.

f) PRRs are often applied on large volume production contracts. Some low volume production contracts (e.g., single unit manufacturing builds) may utilize other terms or reviews, such as a manufacturing readiness review. If used, this may be addressed through tailoring of 6.10 of this standard.

g) Production readiness topics should be addressed throughout the program development phases prior to entering the P&D phase to be used as risk assessment items in other technical reviews such as SFR, PDR, and CDR.

h) PRRs are usually conducted in an incremental fashion prior to a system-level PRR which occurs before LRIP or FRP decisions. In its earlier stages, the PRR concerns itself with gross-level manufacturing concerns such as the need for identifying high-risk and low-yield manufacturing processes or materials, or the requirement for manufacturing development effort to satisfy design requirements. The reviews become more refined as the design matures, dealing with such concerns as adequate production planning, facilities allocation, incorporation of producibility-oriented

changes, identification and fabrication of tools and test equipment, long-lead item acquisitions, etc. Software PRRs should also be used to confirm compliance with applicable regulatory and legislative requirements such as the Clinger-Cohen Act.

i) A PRR for system software elements should be delayed until after final top-level system integration testing.

j) A follow-on PRR may be appropriate in the P&D phase for the supplier and/or major vendors if:

1) Changes in materials and/or manufacturing processes since CDR are required when entering or during the P&D phase.
2) Production start-up or re-start occurs after a significant shutdown period.
3) Production start-up is with a new supplier.
4) The manufacturing site is relocated.

k) In order to help ensure a comprehensive and balanced assessment of all PRR work products, PRR participants from both the acquirer and supplier should include the following, as applicable:

1) Program management
2) Configuration management
3) Systems engineering
4) Design engineering
5) Software engineering
6) Domain specialists and specialty engineers
7) Computer-aided design and manufacturing
8) Manufacturing and production
9) Parts, material, and process control
10) Test and evaluation
11) All certification authorities
12) System users
13) Cost estimating team
14) Legal counsel, if required
15) Contracting officers
16) Recorder or secretary

NOTE—These roles do not dictate that a single individual is provided for each role. A single individual may perform more than one of these roles within the team. Depending on the complexity of the system, more than one individual may also be assigned to a specific role.

7.11 Physical configuration audit (PCA) application guidance

The following is a set of observed good practices for consideration:

a) For complex systems, a PCA may be conducted incrementally for each subsystem or CI, depending on the scope and complexity of the system. Each increment should address a specific system functional area and document any discrepancies that are found in the product baseline of that increment.

b) If incremental PCAs are held, it is important that all conflicts or other issues arising from the results of the incremental PCAs be resolved before conducting the system-level PCA.

c) PCA should be planned well in advance of the production delivery or full deployment schedule so as to allow sufficient time for correcting any deficiencies found during the PCA that could compromise the production delivery/full deployment schedule.

d) One of the major objectives of the PCA is to verify that the design documentation and other elements of the system technical data package match the element(s) being examined. For a hardware PCA, the as-built hardware system is examined and compared with its build-to design documentation. A software PCA is an examination of the as-coded total system software against its

design or deliverable documentation; for unique software the actual source code is compared with its associated design documentation; and, for COTS software, it involves verification of correct documentation to support use of the software versions actually being delivered on the applicable media.

e) Unless program requirements dictate otherwise, the selection of the subset of drawings and other system product baseline items for audit examination should be done using a valid sampling basis.

f) In addition to conducting the PCA on the first production article of the system element(s) to be audited, a PCA should also be conducted on the first production article produced by a new supplier.

g) PCA is normally conducted when the acquirer plans to take control of the product detail design or is acquiring the TDP. When the acquirer does not plan to control the detailed design or purchase the system TDP, the supplier should conduct an internal PCA to define the starting point for controlling the detailed design of the system and to establish the product baseline.

h) The PCA technical review criteria should be tailored to best support the program's technical scope and risk.

i) PCA requirements should be included in the work scope of the acquirer-supplier agreement.

j) If the PCA team determines that additional qualification or acceptance testing is required to provide an adequate basis for acceptance of production units of the system element(s) being audited, the PCA chair should ensure the testing requirements are contained in the applicable PCA corrective action plan(s) and the acquirer and supplier should negotiate the applicable changes to the acquirer-supplier agreement required to accomplish the additional testing.

k) A PCA for system software elements should be delayed until after final integration testing.

l) In order to help ensure a comprehensive and balanced assessment of all PCA work products, PCA participants from both the acquirer and supplier should include the following, as applicable:

1) Program management
2) Configuration management
3) Systems engineering
4) Design engineering
5) Domain specialists and specialty engineers
6) Computer-aided design and manufacturing
7) Production
8) Test and evaluation
9) All certification authorities
10) System users
11) Cost estimating team
12) Legal counsel, if required
13) Contracting officers
14) Recorder or secretary

NOTE—These roles do not dictate that a single individual is provided for each role. A single individual may perform more than one of these roles within the team. Depending on the complexity of the system, more than one individual may also be assigned to a specific role.

Annex A

(informative)

Software requirements and architecture review (SAR)

A.1 General

Some department of defense (DoD) domains may require a SAR due to the nature and complexity of the system(s) being developed.

A.2 Annex A purpose

Annex A provides for the SAR the corresponding content contained in Clause 5, Clause 6, and Clause 7 of this standard for the reviews covered in those clauses.

A.3 Annex A tailoring

If a specific program requires a SAR, Annex A content changes status as defined in A.4.

A.4 Application of Annex A content

For programs that require a SAR, the content of A.5, A.6, and A.7 assume the status and are applied as listed in Table A.1.

Table A.1—Annex A content status and application

Annex A subclause	Content status	Application
A.5	Becomes normative	Is a normative addition to Clause 5 of this standard.
A.6	Becomes normative when tailored	Is a normative addition to Clause 6 of this standard as tailored for the program.
A.7	Remains informative	Is added as application guidance to Clause 7 of this standard.

A.5 Requirements for a SAR

A.5.1 SAR purpose

The SAR shall be conducted to confirm that a selected set of system software elements' requirements, logical architecture, test planning, development processes, and current state of development form a satisfactory basis for proceeding to the preliminary software design cycle.

A.5.2 SAR description

The SAR shall confirm that

a) The software requirements and architectural design are adequate for meeting the higher-level requirements allocated to software.

b) The software requirements and architectural design are sufficiently mature to proceed with dependent software and system development activities.

c) The software processes are sufficiently defined, mature, and effective for developing the software needed to meet system requirements and operational needs, and are suitable for the program scope and complexity.

d) The software test plans are sufficiently robust to ensure thorough testing of the software products to demonstrate that the software requirements are verified in the target environment.

e) The software development and test environments are established and have adequate capability and capacity to meet the software development and test requirements and schedules.

f) The software requirements specifications (SRS), IRS, software test plan(s) (STP), software architecture description (SAD), and software operational concept document form a satisfactory basis for proceeding to preliminary software design.

g) The software development risk is manageable.

h) The software development costs and schedules are consistent with program costs and schedules.

A.5.3 SAR timing

A.5.3.1 SAR event-based scheduling

The SAR shall be held after the system functional review (SFR), when the selected set of software elements' requirements and logical architecture have been sufficiently defined to evaluate the supplier's responsiveness to and interpretation of the system, subsystem, or prime item-level requirements.

A.5.3.2 SAR scheduling constraints for software life-cycle model

Due to differences in the state of the various software development products as a function of the chosen software life-cycle model, the following additional timing constraints apply:

a) When the software element(s) under review are being developed using a waterfall life-cycle model, the SAR shall be completed prior to conducting the system preliminary design review (PDR).

b) When the software element(s) under review are being developed using an incremental or evolutionary life-cycle model, the SAR shall be conducted at the conclusion of the software architectural design for each incremental or evolutionary build.

A.5.4 SAR entry criteria

The SAR shall be conducted only after the following events have been successfully completed:

a) The acceptability criteria for each of the SAR technical review products have been established for the specific program by tailoring the contents of Table A.2.

b) All preparatory actions in Table A.3 as tailored for the specific program have been successfully accomplished to support conducting the technical review.

c) All documentation in support of the SAR has been completed to the degree to satisfactorily support the technical review.

A.5.5 SAR content

A.5.5.1 Products to be reviewed at SAR

The following work products at a minimum shall be reviewed by the SAR team. Other products may be added as necessary during tailoring of Table A.2 for the specific program.

a) Software technical documentation

b) Technical plans

c) Program execution and process control

d) Risk assessment

e) Program cost and schedule estimates

A.5.5.2 Conduct of the SAR

SAR participants shall assess the SAR work products and judge the products' acceptability according to the applicable criteria in Table A.2 as tailored for the specific program.

A.5.5.3 SAR outputs

a) Key SAR outputs shall include the following:

   1) Approved software requirements and logical architecture baselines that are under configuration control

   2) Updated software cost and schedule estimates consistent with the level of completeness defined in the software development plan (SDP), based on the selected life-cycle model

   3) An updated (if necessary) risk and opportunity assessment and associated risk mitigation and opportunity handling plans

   4) A SAR team assessment that the SRS, IRS, STP, SAD, and software operational concept document form a satisfactory basis for proceeding with software preliminary design

   5) A SAR team assessment that the software requirements and logical architecture baselines can be implemented within constraints of the budget, schedule and performance requirements

   6) Official, approved SAR minutes incorporating at a minimum the following items as part of the official record:

      i) All specifications, descriptions, plans, and analysis reports that were reviewed by the SAR team

      ii) A complete list of SAR attendees

      iii) Completed action item forms

      iv) Review results for each of the work product categories assessed during the technical review

      v) Configuration identification documentation that completely defines the software requirements and logical architecture baselines that are the object of the SAR work products

A.5.6 SAR exit criteria

The SAR shall be deemed completed only after the following events have been successfully completed:

a) All action items submitted during the technical review have been appropriately resolved.

b) All actions listed in the action items required for closure have been completed and approved by the required parties.

c) The content of corrective action plans, if any, for issues identified in the SAR is sufficiently complete and unambiguous to enable successful completion of all corrective actions.

d) Each of the technical review products listed in Table A.2 as tailored for the specific program meets all of its acceptability criteria, or has a corrective action plan documenting the corrective actions required to achieve acceptability.

e) The acquirer and supplier concur that the risk level is acceptable.

f) All baselines in the applicable configuration management (CM) system(s) are current and consistent with the audited SAR work products.

g) The SAR chair formally closes the review.

A.6 SAR detailed criteria

A.6.1 SAR review products acceptance criteria

Table A.2 lists the products that should be reviewed at the SAR, and the associated acceptability criteria that should form a sufficient basis by which to assess each product's content as acceptable to support a successful SAR. If a given program requires a SAR, specific products and associated acceptability criteria shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table A.2—SAR technical review products acceptability criteria

Product	SAR acceptability criteria
Software technical documentation	a) The higher-level requirements allocated to software are complete, consistent, and stable. b) Software requirements including interface requirements have been specified to the level of completeness called for in the SDP based on the selected software life-cycle model. c) Software requirements are correct, complete, consistent, feasible, verifiable, and unambiguously stated. d) Software requirements include necessary requirements derived from the system and software logical architecture, system operational concepts, trade studies, and design decisions. e) Each software requirement and interface requirement has one or more valid verification methods and levels specified, and those methods and levels are sufficient to fully verify the requirement. f) Software operational concepts include nominal and off-nominal scenarios, including workloads, for all defined system states and modes that are consistent with the system and software logical architectures. g) Software operational concepts include information exchange with external interfacing systems and are consistent with system operational concepts. h) The software logical architecture has been defined to the level of completeness called for in the SDP based on the selected software life-

Product	SAR acceptability criteria
Software technical documentation *(continued)*	cycle model and the architectural views, including physical, logical developmental process and behavioral are correct, complete, consistent, and unambiguous. i) The software logical architecture has been elaborated to the lower level of detail sufficient to address implementation of all allocated requirements. j) The software logical architecture satisfies the functional and performance requirements allocated to each state and mode. k) The software physical architecture adequately addresses the selected COTS software products, unmodified reuse software, modified reuse software, newly-developed software, programming language(s) to be used, and installation and configuration design decisions. l) The software physical architecture fully integrates any reusable software items (e.g., COTS, government off-the-shelf, modified and unmodified software, and NDI software), and will enable all software requirements to be met, including instances where reusable software elements are directed by the customer, which may result in a constraint to the architecture. m) The software logical architecture adequately addresses all external and internal interfaces including human-system interactions. n) The software logical and physical architectures adequately address all applicable standards. o) The software logical architecture adequately addresses end-to-end processing including mission timelines and all interoperability requirements. p) The software logical architecture adequately addresses the high-level design of all files, shared memory, operational database management, and storage and access methods. q) The software logical architecture adequately addresses operational database management and control. r) The software logical architecture adequately addresses supportability, including integrated hardware-software diagnostics, fault detection, isolation, localization, and repair. s) The software logical architecture adequately addresses R&M requirements allocated to the SWCIs. t) Computing resources have been selected and appropriately incorporated into the top-level system hardware and software physical architecture and will enable all software requirements to be met. u) Engineering analyses, models, and simulations adequately demonstrate that the software physical architecture addresses safety, cybersecurity, human systems integration, and use of reusable software. v) Engineering analyses, models, and simulations adequately demonstrate that the software physical architecture together with the selected computer resources will meet the key performance parameters (KPP). w) A preliminary performance analysis at the current point in the development life cycle indicates that the software physical architecture together with the selected computer resources has an acceptable likelihood of meeting the performance requirements with adequate margins. x) Engineering analyses and trade studies for human systems integration demonstrate the adequacy of the software physical architecture and computer resources that have been selected for the operators to perform their required roles within the required timelines. y) Software qualification test plans have been defined to the level of completeness called for in the SDP based on the selected software life-cycle model. z) Software qualification test plans are valid, complete, stable, and consistent with the software physical architecture and higher-level test plans.

Product	SAR acceptability criteria
Software technical documentation *(continued)*	aa) All software requirements are allocated to the tests described in the software qualification test plans where they will be verified. bb) The software master build plan is complete, feasible, executable, and consistent with the software requirements, software physical architecture, and software qualification test plans. cc) All traceability information is bi-directional, complete, and consistent with the software requirements, software logical architecture elements, and software qualification test plans, and the parent requirements.
Technical plans	a) The SDP is consistent with the integrated master plan (IMP), SEMP, and any other software-related engineering and management plans. b) The SDP fully describes the selected software development life-cycle model(s) that are feasible, appropriate for program scope and complexity, and used consistently by all team members. c) The SDP includes an integrated set of effective processes, methodologies, tools, and environments that cover all software team members, are suitable for the domain, and are appropriate for program scope and complexity. d) The SDP adequately addresses all applicable software standards, processes, procedures, and conventions. e) The SDP includes a sound software risk management plan that is integrated with the program risk management plan. f) Effective software risk handling plans (mitigation as well as other handling methods) are in place, and risk handling activities are being performed in accordance with the plans.
Program execution and process control	a) The supplier has demonstrated that the software processes, standards, procedures, and conventions are being followed as appropriate for the current point in the life cycle. b) An effective program-level risk management process including the software risk management process has been demonstrated to be effectively functioning. c) The program's defined software measures and metrics are sufficient for meeting the program's information needs, and are being collected, analyzed, reported, and used for management and technical decision-making as appropriate at the current point in the life cycle. d) Adequate corrective actions have been defined to address the underlying problems indicated by software metrics that are outside of documented thresholds. e) The existing and planned software engineering environment (SEE) is integrated with the system engineering environment across all software team members for the software under review. f) The SEE and the software test environment(s) have adequate capability and capacity to meet the software development and test requirements and schedules. g) Technical performance measures (TPM) are being collected, analyzed, reported, and used for managing the software-related KPPs and utilization of all critical computer resources. h) Adequate corrective actions have been defined to address the underlying problems indicated by software TPMs that are outside of documented thresholds. i) The supplier has demonstrated that corrective actions have been initiated, managed, and tracked to closure for metrics or TPMs that are outside of documented thresholds. j) The program's software problem and deficiency reporting system is operational and has demonstrated its effectiveness in implementing and verifying solutions to documented problems, prioritized by their severity.

Product	SAR acceptability criteria
Risk assessment	a) Technical risks are identified, and mitigation plans in place. b) Risk management process is in place demonstrated by documented execution results of existing mitigation plans associated with the purpose of the review.
Program cost and schedule estimates	a) Software cost models have been calibrated with realistic software cost drivers based on actual data, both for the current program and past history, and are used to update software cost and schedule estimates. b) Software size estimates are supportable based on history, are consistent with the software requirements and software physical architecture, and have sufficient margins to cover the estimated risk at the current point in the life cycle. c) Software schedule items have been integrated into the IMS with critical path dependencies identified. d) Software resources planned for sustainment are consistent with the progress and rate of development.

A.6.2 SAR preparation

Table A.3 lists the actions that should be considered during preparation for the SAR. The responsible people listed are those most often tasked with the listed preparation actions, but the acquirer and supplier may agree to assign the actions to different people or organizations depending on a given program's organizational structure. If a given program requires a SAR, the specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement. If a given program requires a SAR, responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table A.3—SAR technical review preparation actions

Responsible person	SAR preparation actions
Program manager	a) Approve, fund, and staff the SAR as planned in the Systems Engineering Plan (SEP) developed by the systems engineer. b) Appoint a SAR chair no later than 45 days prior to the technical review, in coordination with the systems engineer and program lead software engineer. c) Coordinate a preliminary agenda between the program integrated product team (IPT) and other acquirer subject matter experts (SME), no later than 30 days prior to the SAR.
Systems engineer	a) Ensure adequate plans are in place to complete the technical activities to proceed from SAR to PDR. b) Ensure all of the technical review products whose acceptability criteria are defined in Table A.2 are completed for the SAR.
Program lead software engineer	a) Coordinate arrangements for SAR location and support. b) Coordinate requirements for the SAR chair with the systems engineer and program manager. c) Coordinate the preliminary SAR agenda with the systems engineer and program manager. d) Ensure the preparation of all presentation material is coordinated across IPTs.
SAR chair	a) Determine SAR team membership. b) Approve the final SAR agenda. c) Approve any final Clause A.6 SAR detailed criteria tailoring for the specific program. d) Identify any specific elements for in-depth technical review as required.

A.6.3 SAR conduct

Table A.4 lists the technical review elements and associated content details that should be considered for the conduct of the SAR. If a given program requires a SAR, specific elements and their content details shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table A.4—SAR conduct elements

SAR review element	Content details
Software technical documentation review	a) Requirements: 1) Parent requirements allocated to software 2) Software functional, performance, non-functional, and interface requirements 3) Software-related external and intersegment or element interface requirements. 4) Interface control documents with software-to-software and software-to-hardware interface requirements b) Software operational concepts c) Software architectural design: 1) Software architectural design description 2) Top-level computer system hardware-software architectural design description d) Engineering analyses: 1) Software engineering analyses, trade studies, modeling, and simulation results 2) Hardware-to-software engineering analyses, hardware vs. software trade studies, integrated hardware-software M&S results e) Integration and verification: 1) Software master build plan (allocation of requirements, functionality, and architectural components to builds) 2) Software qualification test planning f) Traceability: 1) Bi-directional traceability between higher-level requirements allocated to software (including interface requirements) and software requirements (including interface requirements) 2) Bi-directional traceability between software requirements (including software interface requirements) and software logical architecture elements 3) Bi-directional traceability between software requirements (including software interface requirements) and software qualification tests 4) Bi-directional traceability among requirements and verification methods and verification integration levels 5) Bi-directional traceability among builds and software requirements, software logical architecture elements, and software qualification tests

SAR review element	Content details
Technical plans review	a) SDP structure, content, consistency with chosen software development life-cycle model b) Other software-related program plans (e.g., system engineering management plan, risk management plan, integrated master plan, CM plan, quality assurance plan) c) System-level (hardware and software) specialty engineering plans (e.g., reliability, safety, supportability, security, cybersecurity, human systems integration) d) Plans and status of the software engineering environment (SEE) e) Plans and status of the software test environments, including test beds, test facilities, hardware, software, simulators, and other testing tools
Program execution and process control review	a) Program change control system and CCB organization and operation b) Software problem and deficiency report status c) Software measures, metrics definitions, and status reports d) Software TPM reports
Risk assessment review	c) Risk identification and mitigation, including consideration of the following: 1. Software requirements, size, and complexity 2. Selection and use of reusable software 3. Population, update, control, and validation of databases 4. System and software architectural choices 5. Computing resources, including margins 6. Computer hardware and software technology 7. Software schedules 8. Software development, integration, and verification processes and tools
Program cost and schedule review	a) Software size, effort, cost, and staffing estimates b) Software schedules c) Higher-level schedule(s) including the IMS d) Initial and final developer report, and data dictionary for applicable builds e) Updates to the life-cycle cost (LCC) and cost as an independent variable (CAIV) studies presented at the system requirements review (SRR) in support of each software logical architecture. For example: 1) LCC and CAIV modeling and analyses as they are applied and correlated with cost models depicting projected program development, operational and sustainment costs completed, as well as projected cost impacts to other external systems 2) LCC and CAIV methodologies addressed by trade studies

A.6.4 SAR closure

Table A.5 lists the actions that should be considered for SAR closure. The responsible people listed are those most often tasked with the listed closure actions. The acquirer and supplier may agree to assign the program manager and systems engineer actions to different people or organizations depending on a given program's organizational structure. If a given program requires a SAR, the specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement. If a given program requires a SAR, responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table A.5—SAR closure actions

Responsible person	SAR closure actions
Program manager	a) If funding profiles are insufficient to support development, notify user/sponsor of funding shortfall and request funding profile adjustments. b) Support development of the SAR summary report.
Systems engineer	a) Organize and supervise the responses to all action items generated during SAR. b) Support development of the SAR summary report.
Program lead software engineer	a) Organize and supervise the detailed documentation of all action items assigned during the SAR. b) Support development of the SAR technical review summary report.
SAR chair	a) Ensure preparation of the SAR summary report with the support of the program manager, systems engineer, and program lead software engineer. b) Sign off final approval of all action items. c) Prepare the formal SAR completion letter.
Recorder	a) Collate all action items for submission to the SAR chair. b) Prepare the SAR summary report and SAR minutes for signature and distribution by the SAR chair. c) Prepare the SAR closure letter for signature by the SAR chair.

A.7 SAR application guidance

The following is a set of observed good practices for consideration:

a) The SAR may be conducted in place of the software specification review (SSR) if the software logical architecture is sufficiently mature, and it is consistent with the selected software life cycle as defined in the SDP.

b) The scope of the SAR should be tailored to be consistent with the technical scope of the overall program.

c) The request for the SAR chair should occur at least 60 days prior to conduct of the technical review.

d) The positioning of the SAR in the software development life cycle is dependent upon the life-cycle model in use for the software under review:

   1) In the waterfall life-cycle model, the software is developed in a "once through" fashion where the sequence of software requirements definition, software architectural and detailed design, software implementation and software testing occurs only once. For the waterfall life-cycle

model the SAR is conducted at the completion of the software architectural (high-level) design.

2) In an incremental life-cycle model, the software requirements are *defined* first. Then, the software is developed in a series of builds where each build adds to the previous build and enhances its capabilities. In the incremental life-cycle model, each build consists of a once-through sequence of software requirements *assessment*, software architectural and detailed design, software implementation and software testing. For the incremental life-cycle model, the SAR is conducted iteratively at the conclusion of the software logical and physical architecture design for each incremental build. The full set of software requirements for the software under review is reviewed in the build-1 SAR, while the software logical and physical architectures and other information are reviewed in an incremental fashion as each build proceeds.

3) An evolutionary life-cycle model is similar to the incremental life-cycle model, with the exception that, in the evolutionary life-cycle model, each of the builds is based upon the requirements allocated to the software build from the parent specification. In the evolutionary life-cycle model, each build consists of a once-through sequence of software requirements *definition*, software architectural and detailed design, software implementation, and software testing.

d) The software life-cycle model(s) in use, the positioning of the SAR(s) within the life-cycle model(s), and the relationship of the positioning of the SAR(s) with respect to the other major reviews defined in this standard as tailored for the specific program, should be defined in the SDP.

e) In order to help ensure a comprehensive and balanced assessment of all SAR work products, SAR participants from both the acquirer and supplier should include the following, as applicable:

1) Program management
2) Configuration management
3) Systems engineering
4) Software engineering
5) System safety
6) Logistics
7) Test and evaluation
8) All certification authorities
9) System users
10) Cost estimating team
11) Legal counsel, if required
12) Contracting officers
13) Recorder or secretary

NOTE—These roles do not dictate that a single individual is provided for each role. A single individual may perform more than one of these roles within the team. Depending on the complexity of the system, more than one individual may also be assigned to a specific role.

Annex B

(informative)

Software specification review (SSR)

B.1 General

Some department of defense (DoD) domains may require an SSR due to the nature and complexity of the system(s) being developed.

B.2 Annex B purpose

Annex B provides for the SSR the corresponding content contained in Clause 5, Clause 6, and Clause 7 of this standard for the reviews covered in those clauses.

B.3 Annex B tailoring

If a specific program requires an SSR, Annex B content changes status as defined in B.4.

B.4 Application of Annex B content

For programs that require an SSR, the content of B.5, B.6, and B.7 assume the status and are applied as listed in Table B.1.

Table B.1—Annex B content status and application

Annex B subclause	Content status	Application
B.5	Becomes normative	Is a normative addition to Clause 5 of this standard.
B.6	Becomes normative when tailored	Is a normative addition to Clause 6 of this standard as tailored for the program.
B.7	Remains informative	Is added as application guidance to Clause 7 of this standard.

B.5 Requirements for an SSR

B.5.1 SSR purpose

The SSR shall be conducted to help ensure the software requirements baseline of the system element(s) under review is sufficiently mature and stable to support a reasonable expectation that the preliminary design and ultimately the software solution will be judged operationally effective and suitable.

B.5.2 SSR description

The SSR shall confirm that

a) All system requirements allocated to software have been decomposed and allocated to the lowest level of the software logical architecture.

b) Bi-directional traceability exists between the allocated software requirements and the set of source documents, including the system specification and the CDD.

c) All allocated software functional, performance, non-functional, interface, and statutory and regulatory requirements form an acceptable basis to enable completion of the software preliminary design within program budget, schedule, and risk targets.

d) All allocated requirements have verification methods that are defined, documented and agreed upon.

e) The software requirements specification(s) (SRS), software IRS, preliminary software integration plan, preliminary user documentation descriptions, and the concept of operations (CONOPS) description form a satisfactory basis to help ensure successful completion of the preliminary software design.

B.5.3 SSR timing

The SSR shall be held between the system functional review (SFR) and the system preliminary design review (PDR), following full system functional definition at SFR, and when the acquirer and supplier agree that the software requirements baseline is sufficiently complete and stable to support a successful SSR.

B.5.4 SSR entry criteria

The SSR shall be conducted only after the following events have been successfully completed:

a) The acceptability criteria for each of the SSR technical review products have been established for the specific program by tailoring the contents of Table B.2.

b) All preparatory actions in Table B.3 as tailored for the specific program have been successfully accomplished to support conducting the technical review.

c) All documentation in support of SSR has been completed to the degree to satisfactorily support SSR.

d) The system requirements review (SRR) and SFR have been completed and their action items closed.

B.5.5 SSR content

B.5.5.1 Products to be reviewed at SSR

The following work products at a minimum shall be reviewed by the SSR team. Other products may be added as necessary during tailoring of Table B.2 for the specific program.

a) Software technical documentation
b) Technical plans
c) Program execution and process control
d) Risk assessment
e) Program cost and schedule estimates

B.5.5.2 Conduct of the SSR

SSR participants shall assess the SSR work products and judge the products' acceptability according to the applicable criteria in Table B.2 as tailored for the specific program.

B.5.5.3 SSR outputs

a) Key SSR outputs shall include the following:

   1) An approved allocated software requirements baseline that is complete, consistent, and includes all required categories of software requirements (functional, performance, non-functional, interface, and statutory and regulatory)
   2) A complete and consistent allocation of all software requirements with bi-directional traceability between the allocated requirements and the source requirements documents
   3) Technical plans that are current and address the full scope of work
   4) A software development plan (SDP) that adequately addresses the software-specific acceptability criteria in the tailored Table B.2 technical plans subclause
   5) An updated (if necessary) risk and opportunity assessment, and associated risk mitigation and opportunity handling plans
   6) An SSR team determination that the software requirements baseline, supporting documentation, and program resources form a satisfactory basis for proceeding
   7) Official, approved SSR minutes incorporating at a minimum the following items as part of the official record:
      i) All specifications, descriptions, plans, and analysis reports that were reviewed by the SSR team
      ii) A complete list of SSR attendees
      iii) Completed action item forms
      iv) Review results for each of the work product categories assessed during the technical review
      v) Configuration identification documentation that completely defines the software requirements baseline that is the object of the SSR work products

b) The SSR technical review summary report shall be distributed containing the following attachments:

   1) Final copies of all presentations
   2) Updated risk assessment and mitigation plans
   3) Documented action items including those required for closure
   4) The tailored SSR detailed criteria tables as completed following the technical review
   5) Meeting minutes

B.5.6 SSR exit criteria

The SSR shall be deemed completed only after the following events have been successfully completed:

a) All action items submitted during the technical review have been appropriately resolved.
b) All actions listed in the action items required for closure have been completed and approved by the required parties.
c) The content of corrective action plans, if any, for issues identified in the SSR is sufficiently complete and unambiguous to enable successful completion of all corrective actions.
d) Each of the technical review products listed in Table B.2 as tailored for the specific program meets all of its acceptability criteria, or has a corrective action plan documenting the corrective actions required to achieve acceptability.

e) The acquirer and supplier concur that the risk level is acceptable.

f) All baselines in the applicable configuration management (CM) system(s) are current and consistent with the audited SSR work products.

g) The SSR chair formally closes the review.

B.6 SSR detailed criteria

B.6.1 SSR technical review products acceptance criteria

Table B.2 lists the products that should be reviewed at SSR, and the associated acceptability criteria that should form a sufficient basis by which to assess each product's content as acceptable to support a successful SSR. If a given program requires an SSR, specific products and associated acceptability criteria shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table B.2—SSR technical review products acceptability criteria

Product	SSR acceptability criteria
Software technical documentation	a) The software requirements baseline is complete, stable and under configuration control. b) The software's low-level performance requirements have been evaluated and determined to be consistent with the system CONOPS. c) Bi-directional traceability exists between all allocated software requirements at the lowest level and the source requirements documents. d) All allocated software requirements have verification methods defined, documented and agreed upon between the acquirer and supplier, and the traceability between the requirements and their verification methods is contained in the verification cross reference documentation. e) The software analysis and allocation process has accounted for the required interaction(s) between the software functionality and performance and the applicable hardware items and their associated interface control documents, and the corresponding software interface requirements are captured in the software interface requirements documentation. f) Critical program information (CPI) protection and any required anti-tamper requirements applicable to software have been included in the allocated software requirements. g) Open architecture requirements applicable to software have been included in the allocated software requirements. h) Cybersecurity requirements applicable to software have been included in the allocated software requirements. i) Any declassification requirements for classified information stored in computer or electronic data storage systems that are applicable to software have been included in the allocated software requirements. j) Any logistics support requirements applicable to software have been included in the allocated software requirements. k) Any certification requirements applicable to software have been included in the allocated software requirements. l) Software requirements for M&S have been included in the allocated software requirements. m) Safety-critical software element(s) have been identified as applicable and have been included on the program's critical safety item (CSI) list.

Product	SSR acceptability criteria
Technical plans	a) The SDP has been updated as required by the results of the software requirements analysis and allocation process. b) The software engineering environment (SEE) has been defined in the SDP and is sufficient to support the program's planned software development life cycle. c) A draft software test plan (STP) exists that will enable scheduling of test facilities and ensure availability of test resources. d) The Test and Evaluation Master Plan (TEMP) has been updated as required by the results of the software requirements analysis and allocation process. e) A draft software integration plan has been completed and defines the verification(s) planned at each integration step.
Program execution and process control	a) The CCB is processing configuration changes in accordance with industry standards, supplier instructions, processes and procedures, and maintaining the proper configuration baselines. b) Changes to the software requirements baseline are made only through a formal change process that assesses the cost, schedule, technical performance, and resources impacts of the change, and the change process is managed by the CCB. c) Any changes made to the requirements since the SFR are documented in the configuration status accounting records. d) Any safety-critical software element(s) have been addressed in the program's system safety plan. e) The quality assurance plan has been updated to include all required software quality assurance and quality engineering requirements.
Risk assessment	a) Technical risks are identified, and mitigation plans are in place. b) Risk management process is in place demonstrated by documented execution results of existing mitigation plans associated with the purpose of the review.
Program cost and schedule estimates	a) Preliminary software development estimates have been established with effort, schedule and cost analysis. b) Updated cost estimate fits within the existing budget. c) Software schedule items have been integrated into the integrated master schedule (IMS) with critical path dependencies identified.

B.6.2 SSR preparation

Table B.3 lists the actions that should be considered during preparation for the SSR. The responsible people listed are those most often tasked with the listed preparation actions, but the acquirer and supplier may agree to assign the actions to different people or organizations depending on a given program's organizational structure. If a given program requires a SSR, the specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement. If a given program requires a SSR, responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table B.3—SSR technical review preparation actions

Responsible person	SSR preparation actions
Program manager	a) Approve, fund, and staff the SSR as planned in the Systems Engineering Plan (SEP) developed by the systems engineer. b) Appoint an SSR chair no later than 45 days prior to the technical review, in coordination with the systems engineer and program lead software engineer. c) Coordinate a preliminary agenda between the program IPT and other acquirer subject matter experts (SME) no later than 30 days prior to the SSR.
Systems engineer	a) Ensure adequate plans are in place to complete the technical activities to proceed from SSR to PDR. b) Ensure any changes to the requirements since SFR are documented in the SSR presentation material. c) Ensure verification methods are identified for all requirements. d) Ensure risk items associated with the functional requirements are identified and analyzed, and mitigation plans are in place. e) Ensure all of the technical review products whose acceptability criteria are defined in Table B.2 are completed for the SSR.
Program lead software engineer	a) Coordinate arrangements for SSR location and support. b) Coordinate requirements for the SSR chair with the systems engineer and program manager. c) Coordinate the preliminary SSR agenda with the systems engineer and program manager. d) Ensure the preparation of all presentation material is coordinated across IPTs.
SSR chair	a) Determine SSR team membership. b) Approve the final SSR agenda. c) Identify any specific elements for in-depth technical review as required.

B.6.3 SSR conduct

Table B.4 lists the technical review elements and associated content details that should be considered for the conduct of the SSR. If a given program requires an SSR, specific elements and their content details shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table B.4—SSR conduct elements

SSR review element	Content details
Introduction, agenda, administrative	a) Review location layout and safety procedures b) Security procedures if applicable c) Introduction of SSR chair and team members d) SSR agenda e) Action item procedures f) Purpose of the technical review
Software program overview	a) Schedule b) Measures and metrics c) Software risks d) Software life-cycle support concept e) Changes to requirements since SFR
Software technical documentation review	a) Functional overview of the software elements including inputs, processing, and outputs of each function b) Overall performance requirements of each element including execution time, storage requirements, and similar constraints c) Architectural overview of the system and software elements d) Expected software criticality level for each software element e) Expected classification level for each software element if applicable, and declassification requirements f) Control flow and data flow at the architectural level for each of the software functions g) Quality factor requirements (i.e., correctness, reliability, efficiency, integrity, usability, maintainability, testability, flexibility, portability, reusability, and interoperability) h) All interface requirements among the software elements, and among all other system elements and interfaces external to the system i) Verification matrix or other documentation that identifies applicable verification levels and methods for all requirements allocated to the software element(s) j) Any special delivery or installation requirements k) Mission requirements of the system and how the software element(s)' functionality supports it l) Operational and support requirements for the software element(s) m) Functions and characteristics of the computer system(s) within the overall system n) Updates since the previous technical review to all previously delivered technical documentation
Technical plans review	a) Structure and content of the SDP b) Structure and content of the quality assurance plan c) Structure and content of the TEMP d) Any actions or procedures deviating from approved plans

SSR review element	Content details
Program execution and process control review	a) Details of the SEE including physical facilities, development computer resources, target system computing resources, software development tools, and models b) Details of any other development, integration and test facilities involved in the system software development, integration, verification, production, and life-cycle support c) Structure and operation of the CCB
Risk assessment review	a) Risk identification and mitigation including consideration of software technical risks and development execution risks
Program cost and schedules review	a) Updated program cost estimates with respect to current software development budget b) Software milestone schedules c) Inclusion of software milestone schedule events in the IMS and critical path events

B.6.4 SSR closure

Table B.5 lists the actions that should be considered for SSR closure. The responsible people listed are those most often tasked with the listed closure actions. The acquirer and supplier may agree to assign the program manager and systems engineer actions to different people or organizations depending on a given program's organizational structure. If a given program requires a SSR, the specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement. If a given program requires a SSR, responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table B.5—SSR closure actions

Responsible person	SSR closure actions
Program manager	a) Manage and approve changes to technical baselines resulting from SSR. b) Support development of the SSR summary report. c) If funding profiles are insufficient to support development, notify user/sponsor of funding shortfall, and request funding profile adjustments.
Systems engineer	a) Organize and supervise the responses to all action items generated during SSR. b) Support development of the SSR summary report.
Program lead software engineer	a) Organize and supervise the detailed documentation of all action items assigned during the SSR b) Support development of the SSR summary report.
SSR chair	a) Ensure preparation of the SSR summary report with the support of the program manager, systems engineer, and program lead software engineer. b) Sign off final approval of all action items. c) Prepare the formal SSR completion letter.
Recorder	a) Collate all action items for submission to the SSR chair. b) Prepare the SSR summary report and SSR minutes for signature and distribution by the SSR chair. c) Prepare the SSR closure letter for signature by the SSR chair.

B.7 SSR application guidance

The following is a set of observed good practices for consideration:

a) Acquisition programs that have an incremental software development approach should conduct an SSR for each increment.

b) The scope of the SSR should be tailored to be consistent with the technical scope of the overall program.

c) The request for the SSR chair should occur at least 60 days prior to conduct of the technical review.

d) It is helpful if the SSR is conducted as a buildup technical review to PDR, and the content requirements of the SSR should be considered as prerequisites for the system-level PDR.

e) The program's software lead engineer should conduct subsystem- or lower-level technical interchange meetings (TIM) to review requirements maturity and readiness for SSR, to establish completeness of documentation, adjudicate requirements disagreements, and to ensure SSR presentation material accurately represents the status of the software effort.

f) The lower-level TIMs should begin at least 60 days prior to SSR.

g) Problems identified during the lower-level TIMs should be resolved prior to SSR rather than be documented as issues during SSR.

h) Any SSR presentation material required for program or software certification(s) should be provided to the applicable certification authorities as early as possible in order to provide sufficient time for those authorities' analysis to judge the certification status by the time of the SSR.

i) In order to help ensure a comprehensive and balanced assessment of all SSR work products, SSR participants from both the acquirer and supplier should include the following, as applicable:

    1) Program management
    2) Configuration management
    3) Systems engineering
    4) Software engineering
    5) System safety
    6) Logistics
    7) Test and evaluation
    8) All certification authorities
    9) System users
    10) Cost estimating team
    11) Legal counsel, if required
    12) Contracting officers
    13) Recorder or secretary

    NOTE—These roles do not dictate that a single individual is provided for each role. A single individual may perform more than one of these roles within the team. Depending on the complexity of the system, more than one individual may also be assigned to a specific role.

Annex C

(informative)

Integration readiness review (IRR)

C.1 General

Some department of defense (DoD) domains may require an IRR due to the nature and complexity of the system(s) being developed.

C.2 Annex C purpose

Annex C provides for the IRR of the corresponding content contained Clause 5, Clause 6, and Clause 7 of this standard for the reviews covered in those clauses.

C.3 Annex C tailoring

If a specific program requires an IRR, Annex C content changes status as defined in C.4.

C.4 Application of Annex C content

For programs that require an IRR, the content of C.5, C.6, and C.7 assume the status and are applied as listed in Table C.1.

Table C.1—Annex C content status and application

Annex C subclause	Contents status	Application
C.5	Becomes normative	Is a normative addition to Clause 5 of this standard.
C.6	Becomes normative when tailored	Is a normative addition to Clause 6 of this standard as tailored for the program.
C.7	Remains informative	Is added as application guidance to Clause 7 of this standard.

C.5 Requirements for an IRR

C.5.1 IRR purpose

The IRR shall be conducted to assess the readiness of a defined set of system hardware and software elements that are under configuration control to begin integrated hardware-software testing.

C.5.2 IRR description

The IRR shall confirm that

a) The specific hardware and software elements to be used in integrated testing represent a system configuration that has a reasonable expectation of being judged operationally effective and suitable.

b) Prior element-level testing produced adequate evidence that the specific hardware and software elements planned for integration testing are sufficiently mature to support successful integration.

c) The supplier's test planning, objectives, methods and procedures, scope and resources are adequate to begin subsystem integration testing in the laboratory.

d) Clear and complete traceability exists between the planned tests to the applicable program, engineering data, analysis, and certification requirements.

e) Known anomalies in the specific hardware and software elements to be used in integrated testing are assessed at sufficiently low risk to provide a reasonable expectation of integration test success.

f) The tool sets to use for integration testing in the system integration laboratory (SIL) or other equivalent system integration facilities have been verified to provide sufficient operational environment fidelity for integration testing, and are under configuration control.

C.5.3 IRR timing

The IRR shall be held prior to fully integrated system-level hardware-software testing (which is addressed in the test readiness review) after element-level tests have been successfully completed and groups of hardware and software elements are ready for subsystem or equivalent level integrated testing.

C.5.4 IRR entry criteria

The IRR shall be conducted only after the following events have been successfully completed:

a) The acceptability criteria for each of the IRR technical review products have been established for the specific program by tailoring the contents of Table C.2.

b) All preparatory actions in Table C.3 as tailored for the specific program have been successfully accomplished to support conducting the technical review.

c) All applicable test procedures have been validated for use in formal testing for the record, by dry runs or alternative methods.

d) All documentation in support of IRR has been completed to the degree to satisfactorily support IRR.

C.5.5 IRR content

C.5.5.1 Products to be reviewed at IRR

The following work products at a minimum shall be reviewed by the IRR team. Other products may be added as necessary during tailoring of Table C.2 for the specific program.

a) System technical documentation
b) Test environment
c) Program execution and process control
d) Risk assessment
e) Program cost and schedule estimates

C.5.5.2 Conduct of the IRR

IRR participants shall assess the IRR work products and judge the products' acceptability according to the applicable criteria in Table C.2 as tailored for the specific program.

C.5.5.3 IRR outputs

a) Key IRR outputs shall include the following:

   1) Verification that the system elements under test are sufficiently mature, defined and representative to accomplish the planned test objectives
   2) Completed and approved test plans and procedures for the planned formal test event
   3) Complete identification and allocation of all required test resources to the planned test
   4) Verification that all planned preliminary or informal tests have been conducted and that the results satisfactorily indicate that the formal test event can begin
   5) Lists of any known anomalies and hardware or software limitations as a result of prior element-level testing, and a determination that their risk to the planned testing is sufficiently low to proceed
   6) A documented contingency plan for addressing technical issues, obstacles, or problems that might occur during conduct of the test
   7) An updated (if necessary) risk and opportunity assessment and associated risk mitigation and opportunity handling plans
   8) IRR team verification that test planning, objectives, methods and procedures, scope and resources are adequate to begin subsystem integration testing in the laboratory
   9) An IRR team recommendation to commence formal integration testing

b) The IRR summary report shall be distributed containing the following attachments:

   1) List of attendees
   2) Final copies of all presentations
   3) Updated risk assessment and mitigation plans
   4) Documented action items including those required for closure
   5) The tailored IRR detailed criteria tables as completed following the technical review
   6) Recommendation on readiness to commence the formal test event
   7) Meeting minutes

C.5.6 IRR exit criteria

The IRR shall be deemed completed only after the following events have been successfully completed:

a) All action items submitted during the technical review have been appropriately resolved.
b) All actions listed in the action items required for closure have been completed and approved by the required parties.
c) The content of corrective action plans, if any, for issues identified in the IRR is sufficiently complete and unambiguous to enable successful completion of all corrective actions.
d) Each of the technical review products listed in Table C.2 as tailored for the specific program meets all of its acceptability criteria, or has a corrective action plan documenting the corrective actions required to achieve acceptability.
e) The acquirer and supplier concur that the risk level is acceptable.
f) All baselines in the applicable configuration management (CM) system(s) are current and consistent with the audited IRR work products.
g) The IRR chair formally closes the review.

C.6 IRR detailed criteria

C.6.1 IRR technical review products acceptance criteria

Table C.2 lists the products that should be reviewed at IRR, and the associated acceptability criteria that should form a sufficient basis by which to assess each product's content as acceptable to support a successful IRR. If a given program requires an IRR, specific products and associated acceptability criteria shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table C.2—IRR technical review products acceptability criteria

Product	IRR acceptability criteria
System technical documentation	a) The Test and Evaluation Master Plan (TEMP) is current, approved, and includes sufficient structure and objectives to support integration testing. b) The requirements to be verified by the formal integration test under review include all approved changes. c) The configuration of the hardware and software elements under test is clearly defined. d) The design of the hardware and software elements under test is current and includes all approved baseline changes. e) The hardware and software elements under test are under configuration control by the CM organization. f) The hardware and software elements under test are judged sufficiently mature to begin formal integration testing. g) Any applicable key performance parameters (KPP) or key system attributes (KSA) to be verified during the integration test under review have been traced into the applicable test cases. h) Any anomalies or deficiencies are documented and assessed at low risk. i) The approved test plan is robust enough to ensure the full verification of all requirements to be verified by the integration test under review. j) The test plan is consistent with the required verification methods and levels for the requirements planned for verification by the integration test under review. k) The test procedures are consistent with the required verification methods and levels. l) The test procedures for each test case, together with the planned test input data and drivers, are correct, complete, and sufficiently robust to verify all of the requirements allocated to the test case. m) The test procedures are sufficiently detailed to be repeatable. n) The test procedures are in compliance with the approved test plan. o) The system safety aspects of the test configuration and its environment have been evaluated, the safety approaches have been deemed adequate, and have been incorporated as required into the relevant integration test procedures. p) The cybersecurity and program protection plans are sufficient to support integration testing. q) Bi-directional traceability that is correct, complete, and consistent is provided between the requirements to be verified by the integration test under review and the test procedures and test cases in which the requirements will be verified.

Product	IRR acceptability criteria
Test environment	a) The SIL (or equivalent) and facility configuration is stable, under configuration control, and meets the integration testing requirements. b) The test environment, including all hardware, software, emulators, and simulators is sufficiently robust to adequately verify the requirements to be verified. c) The test environment has the required components to support verification of system security requirements. d) Sufficient validation has occurred prior to the planned formal test event to ensure that the test environment will correctly perform the functions necessary to support the integration test under review.
Program execution and process control	a) Personnel roles and responsibilities are documented, clear, and concise, both for the acquirer and the supplier including test witnessing requirements, and are agreed to by the acquirer and supplier. b) Processes to be followed during test execution are defined and documented and will result in a controlled and disciplined test execution. c) Appropriate security test facilities, test equipment, schedules, and personnel are adequate and available to support the planned integration test. d) The anomaly reporting system is functional. e) The failure reporting and corrective action system (FRACAS) is functional. f) The presence and role of QA personnel are sufficient to ensure that 1) The test process is followed. 2) Test execution rigorously follows the test procedures with any deviations documented as redlines. 3) All problems or deficiencies encountered during testing are appropriately documented. 4) The test log faithfully documents the execution of the test, including test start, test end, interruptions and anomalies.
Risk assessment	a) Technical risks are identified, and mitigation plans are in place. b) Risk management process is in place demonstrated by documented execution results of existing mitigation plans associated with the purpose of the review.
Program cost and schedule estimates	a) Test schedules have been finalized and are feasible. b) Updated cost estimate fits within the existing budget. c) Earned value management (EVM) status supports transition to integration testing in the laboratory.

C.6.2 IRR preparation

Table C.3 lists the actions that should be considered during preparation for the IRR. The responsible people listed are those most often tasked with the listed preparation actions, but the acquirer and supplier may agree to assign the actions to different people or organizations depending on a given program's organizational structure. If a given program requires an IRR, the specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement. If a given program requires an IRR, responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table C.3—IRR technical review preparation actions

Responsible person	IRR preparation actions
Program manager	a) Approve, fund, and staff the IRR as planned in the Systems Engineering Plan (SEP) developed by the systems engineer. b) Appoint an IRR chair no later than 90 days prior to the technical review, in coordination with the systems engineer and program test lead. c) Coordinate a preliminary agenda between the program integrated product team (IPT) and other acquirer subject matter experts (SME) no later than 30 days prior to the IRR.
Systems engineer	a) Ensure adequate plans are in place to complete the technical activities for the integration testing phase and to proceed from integration testing to the test readiness review (TRR). b) Ensure all of the technical review products whose acceptability criteria are defined in Table C.2 are completed for the IRR.
Program test lead	a) Coordinate arrangements for IRR location and support. b) Coordinate requirements for the IRR chair with the systems engineer and program manager. c) Coordinate the preliminary IRR agenda with the systems engineer and program manager. d) Ensure the preparation of all presentation material is coordinated across IPTs.
IRR chair	a) Determine IRR team membership. b) Approve the final IRR agenda. c) Approve any final Clause C.6 IRR detailed criteria tailoring for the specific program. d) Identify any specific elements for in-depth technical review as required.

C.6.3 IRR conduct

Table C.4 lists the technical review elements and associated content details that should be considered for the conduct of the IRR. If a given program requires an IRR, the specific elements and their content details shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table C.4—IRR conduct elements

IRR review element	Content details
Introduction, agenda, administrative	a) Review location layout and safety procedures b) Security procedures if applicable c) Introduction of chair and team members d) Purpose of the technical review e) IRR agenda f) Action item procedures g) Risk assessment procedures h) Program overview i) Overall test and evaluation (T&E) program overview and how the planned integration test(s) support the overall program
System technical documentation	a) Requirements planned to be verified during the integration test under review b) Any changes to these requirements that have been approved since CDR c) Required verification methods and verification level(s) for each requirement planned to be verified during the integration test under review d) Any changes to the design of the hardware and software elements under test that have occurred since CDR that affect the integration test under review e) Any changes to the test plan(s) that cover the integration test under review that have occurred since CDR f) Test procedures and test cases for the integration test under review including setup, execution, data capture, and data analysis/reduction g) Description of test driver data and scenarios to be used with the test procedures h) Results of any dry runs, including anomalies encountered and any anticipated problems with requirements verification i) Bi-directional traceability among the test cases, test procedures, design documentation of the hardware and software elements under test, and the requirements documentation covering the requirements to be verified j) Hardware and software descriptions, and human procedures and user manuals required for the integration test under review k) Specific configuration of the hardware and software elements under test including version(s) or release(s) of software; configuration identification and status accounting documentation for the hardware and software elements under test l) All known problems or deficiencies at the start of the test for the hardware and software elements under test, along with their severity levels and expected impacts to testing m) Expected test results with success criteria and how the test results will affect the program n) Status of program metrics

IRR review element	Content details
Test environment	a) Description of the SIL (or equivalent) including hardware, software, automated test equipment, test tools, simulators, emulators, drivers, etc. b) Confirmation by the CM organization that the test environment is validated and under configuration control c) Status of validation performed on the test environment to ensure it correctly performs the functions necessary to support the planned integration test d) All known test environment problems or deficiencies and their expected impact on the testing e) Any test limitations or other conditions that might impact conduct of the integration test
Program execution and process control	a) Test program staffing—organization, acquirer-supplier interfaces, resource levels b) Test personnel roles and responsibilities, including both acquirer and supplier personnel, and CM and QA personnel as well as test team personnel performing the test procedures c) Test processes being implemented including both the nominal process and retest process(es) when test anomalies are encountered that require corrections d) The anomaly adjudication process to determine whether and how testing can be continued after an anomaly has occurred during test execution e) A recorded process for managing the requirements verification status for the hardware and software elements under test (e.g., fully verified, partially verified, not verified) following test completion and data analysis
Risk assessment	a) Risk identification and mitigation including consideration of risks affecting the integration activity under review
Program cost and schedule estimates	a) Current program cost estimate and relation to integration test budget b) Detailed test schedules for the planned integration test c) Review of the current program schedule showing the phasing of the planned formal test event in the overall T&E plan

C.6.4 IRR closure

Table C.5 lists the actions that should be considered for IRR closure. The responsible people listed are those most often tasked with the listed closure actions. The acquirer and supplier may agree to assign the program manager and systems engineer actions to different people or organizations depending on a given program's organizational structure. If a given program requires an IRR, the specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement. If a given program requires an IRR, responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table C.5—IRR closure actions

Responsible person	IRR closure actions
Program manager	a) If funding profiles are insufficient to support development, notify user/sponsor of funding shortfall and request funding profile adjustments. b) Support development of the IRR summary report.
Systems engineer	a) Organize and supervise the responses to all action items generated during IRR. b) Support development of the IRR summary report.
Program test lead	a) Organize and supervise the detailed documentation of all action items assigned during the IRR. b) Support development of the IRR summary report.
IRR chair	a) Ensure preparation of the IRR summary report with the support of the program manager, systems engineer and program test lead. b) Sign off final approval of all action items. c) Prepare the formal IRR completion letter.
Recorder	a) Collate all action items for submission to the IRR chair. b) Prepare the IRR summary report and IRR minutes for signature and distribution by the IRR chair. c) Prepare the IRR closure letter for signature by the IRR chair.

C.7 IRR application guidance

The following is a set of observed good practices for consideration:

a) For complex systems where there are numerous subsystems or lower level elements, or where the various subsystems and elements progress at different rates, it may be appropriate to conduct multiple IRRs.

b) The request for the IRR chair should occur at least 60 days prior to conduct of the technical review.

c) If multiple IRRs are held, it is important that all conflicts or other issues arising from the results of the IRRs be resolved before conducting the TRR.

d) Program managers and product leads should tailor the IRR requirements to the specific planned tests and identified risk levels of the specific program.

e) The degree of technical review for any specific IRR is directly related to the risk level associated with performing the planned integration tests and to the importance of the test results to the overall program success.

f) Specific IRRs should be tailored according to the technical scope and risk of the hardware and software elements under test.

g) If an incremental life-cycle development model has been chosen, then the acquisition documentation will only need to be completed to the point defined in the software development plan (SDP) for the increment associated with a given IRR.

h) In order to help ensure a comprehensive and balanced assessment of all IRR work products, IRR participants from both the acquirer and supplier should include the following, as applicable:

1) Program management
2) Configuration management
3) Systems engineering
4) Software engineering
5) Hardware engineering
6) Logistics
7) Test and evaluation
8) System users
9) Cost estimating team
10) Legal counsel, if required
11) Contracting officers
12) Recorder or secretary

NOTE—These roles do not dictate that a single individual is provided for each role. A single individual may perform more than one of these roles within the team. Depending on the complexity of the system, more than one individual may also be assigned to a specific role.

Annex D

(informative)

Flight readiness review (FRR)

D.1 General

Some department of defense (DoD) domains may require an FRR due to the nature and complexity of the system(s) being developed.

D.2 Annex D purpose

Annex D provides for the FRR the corresponding content contained in Clause 5, Clause 6, and Clause 7 of this standard for the reviews covered in those clauses.

D.3 Annex D tailoring

If a specific program requires an FRR, Annex D content changes status as defined in D.4.

D.4 Application of annex D content

For programs that require an FRR, the content of D.5, D.6, and D.7 assume the status and are applied as listed in D.1.

Table D.1—Annex D content status and application

Annex D subclause	Content status	Application
D.5	Becomes normative	Is a normative addition to Clause 5 of this standard.
D.6	Becomes normative when tailored	Is a normative addition to Clause 6 of this standard as tailored for the program.
D.7	Remains informative	Is added as application guidance to Clause 7 of this standard.

D.5 Requirements for an FRR

D.5.1 FRR purpose

The FRR shall be conducted to help ensure that the flight vehicle and its test environment are ready to proceed into flight testing.

D.5.2 FRR description

The FRR shall confirm that

a) All applicable airworthiness standards have been met.

b) All flight test objectives have been clearly stated and documented.

c) All flight test data requirements have been clearly identified.

d) An acceptable risk management plan is defined, approved, and implemented.

e) Each configuration expected to be evaluated within the flight test effort has been clearly specified both in the flight test plan and the flight clearance.

f) All previous component, subsystem, and manufacturing test results provide an acceptable basis for proceeding with the planned tests.

g) All applicable disciplines concur with the scope of the effort that has been identified and how this effort will be executed to derive the data necessary to help ensure the system is ready to initiate and conduct flight tests or flight operations.

D.5.3 FRR timing

The FRR shall be held after CDR and test readiness review (TRR) completion, nominally two weeks prior to the first flight of any new flight vehicle.

D.5.4 FRR entry criteria

The FRR shall be conducted only after the following events have been successfully completed:

a) The acceptability criteria for each of the FRR technical review products have been established for the specific program by tailoring the contents of Table D.2.

b) All preparatory actions in Table D.3 as tailored for the specific program have been successfully accomplished to support conducting the technical review.

c) A flight clearance has been issued by the applicable technical authority.

d) All documentation in support of FRR has been completed to the degree to satisfactorily support the technical review.

D.5.5 FRR content

D.5.5.1 Products to be reviewed at FRR

The following work products at a minimum shall be reviewed by the FRR team. Other products may be added as necessary during tailoring of Table D.2 for the specific program.

a) System technical documentation
b) Test environment
c) Program execution and process control
d) Risk assessment
e) Program cost and schedule estimates

D.5.5.2 Conduct of the FRR

FRR participants shall assess the FRR work products and judge the products' acceptability according to the applicable criteria in Table D.2 as tailored for the specific program.

D.5.5.3 FRR outputs

a) Key FRR outputs shall include
   1) Verification that the flight vehicle configuration is mature, stable, under configuration control and representative to accomplish the planned flight test objectives
   2) Verification that the program office has provided the necessary safety releases to the testers prior to conducting any flight testing
   3) Verification that all prior ground tests and other informal tests of the flight vehicle and its various systems have been satisfactorily completed and that the results support entry into flight testing
   4) Completed and approved flight test plans and procedures for the planned flight test(s)
   5) Complete identification and allocation of required test resources to the planned flight test(s)
   6) A documented contingency plan for addressing technical issues and obstacles that might occur during flight testing, including flight abort conditions and procedures
   7) An updated (if necessary) risk and opportunity assessment, and associated risk mitigation and opportunity handling plans
   8) An FRR team assessment that the flight vehicle, its test environment, and all test team personnel are ready to being flight testing
b) The FRR summary report shall be distributed containing the following attachments:
   1) List of attendees
   2) Final copies of all presentations
   3) Updated risk assessment and mitigation plans
   4) Documented action items including those required for closure
   5) The tailored FRR detailed criteria tables as completed following the technical review
   6) Recommendation on readiness to commence the formal test event
   7) Meeting minutes

D.5.6 FRR exit criteria

The FRR shall be deemed completed only after the following events have been successfully completed:

a) All action items submitted during the technical review have been appropriately resolved.
b) All actions listed in the action items required for closure have been completed and approved by the required parties.
c) The content of corrective action plans, if any, for issues identified in the FRR is sufficiently complete and unambiguous to enable successful completion of all corrective actions.
d) Each of the technical review products listed in Table D.2 as tailored for the specific program meets all of its acceptability criteria, or has a corrective action plan documenting the corrective actions required to achieve acceptability.

e) The acquirer and supplier concur that the risk level is acceptable.

f) All baselines in the applicable configuration management (CM) system(s) are current and consistent with the audited FRR work products.

g) The FRR chair formally closes the review.

D.6 FRR detailed criteria

D.6.1 FRR technical review products acceptance criteria

Table D.2 lists the products that should be reviewed at FRR, and the associated acceptability criteria that should form a sufficient basis by which to assess each product's content as acceptable to support a successful FRR. If a given program requires an FRR, specific products and associated acceptability criteria shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table D.2—FRR technical review products acceptability criteria

Product	FRR acceptability criteria
System technical documentation	a) System requirements and capabilities: 1) Final specifications are complete and under configuration control. 2) All build-to drawings are complete and under configuration control. 3) All allocated system requirements have been traced to their verification plans. 4) Technical performance measures (TPM) have been traced to test plans and procedures. 5) Key performance parameters (KPP) have been traced to test plans and procedures. 6) Software media including loading instructions and version description are under configuration control. 7) The engineering data requirements agreement plan (EDRAP) or equivalent addresses all required flight test data and has been signed. 8) Threshold safety of flight requirements for anticipated configurations are documented. 9) All software to be used on the flight vehicle has been evaluated in the laboratory, has been deemed safe to fly, and verified to support flight test objectives. 10) Regression testing and retest plans are complete. b) Test, evaluation, and product certification: 1) All flight test objectives are documented in the Test and Evaluation Master Plan (TEMP) and are traceable to the CDD, and to the CPD as applicable. 2) All flight test engineering data requirements in the EDRAP (or equivalent) are supported by instrumentation. 3) Instrumentation requirements for flight test are understood and documented. 4) Data reduction and analysis roles and responsibilities are defined.

Product	FRR acceptability criteria
System technical documentation *(continued)*	5) All flight test plans have been completed and are approved. 6) All flight test procedures are complete and contain pass/fail criteria that are consistent with the verification levels and methods in the system specification. 7) Flight test plans and procedures contain all applicable test witnessing requirements and are agreed to by all affected parties. 8) Flight test requirements supporting modeling and simulation (M&S) have been documented. 9) All test plans required for certification(s) have been coordinated with the applicable certification authorities. 10) The flight clearance covers all flight vehicle configurations planned for flight testing. 11) Reliability and maintainability (R&M) scoring guidelines have been documented and agreed to by the acquirer and supplier.
Test environment	a) The configuration of the test hardware and software is documented. b) The accuracy, calibration and repeatability of all tools and test equipment are adequate to verify conformance with flight test requirements. c) The test configuration and test setup (both for the flight vehicle and the ground support systems) implement the intended environment as closely as possible, and any deviations are judged acceptable for R&M.
Program execution and process control	a) Acquirer and supplier test team responsibilities are documented. b) Critical flight test support has been identified and coordinated. c) The program's problem and deficiency reporting and tracking process is functional. d) The failure reporting and corrective action system (FRACAS) is functional. e) Test item maintainers, data collectors, flight test crew, and testers have been trained in operation of all system configurations planned for flight testing. f) Planned flight testing is adequately resourced (personnel, test articles, facilities, data systems, support equipment, logistics, spares, funding).
Risk assessment	a) Technical risks are identified, and mitigation plans are in place. b) Risk management process is in place demonstrated by documented execution results of existing mitigation plans associated with the purpose of the review.
Program cost and schedule estimates	a) Updated cost estimate for flight testing fits within the existing budget. b) Flight test schedule items have been finalized and have been integrated into the integrated master schedule (IMS) with critical path dependencies identified through flight test completion. c) The IMS includes flight envelope clearance or expansion critical path events. d) Earned value supports transition to flight testing.

D.6.2 FRR preparation

Table D.3 lists the actions that should be considered during preparation for the FRR. The responsible people listed are those most often tasked with the listed preparation actions, but the acquirer and supplier may agree to assign the actions to different people or organizations depending on a given program's organizational structure. If a given program requires a FRR, the specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement. If a given program requires a FRR, responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table D.3—FRR technical review preparation actions

Responsible person	FRR preparation actions
Program manager	a) Approve, fund, and staff the FRR as planned in the Systems Engineering Plan (SEP) developed by the systems engineer. b) Appoint an FRR chair no later than 60 days prior to the technical review, in coordination with the systems engineer and program test lead. c) Coordinate a preliminary agenda between the program integrated product team (IPT) and other acquirer subject matter experts (SME) no later than 30 days prior to the FRR.
Systems engineer	a) Ensure all of the technical review products whose acceptability criteria are defined in Table D.2 are completed for the FRR. b) Coordinate preparatory technical interchange meetings (TIM) among all affected program teams and disciplines sufficiently early to prepare for FRR, and carry any outstanding actions or issues forward to the FRR. c) Ensure flight clearance authorities have access to all critical data, CDR and TRR results, and risk assessment in sufficient time to issue clearance for flight testing. d) Ensure all FRR presentation material is coordinated across program teams.
Program test lead	a) Coordinate arrangements for FRR location and support. b) Coordinate requirements for the FRR chair with the systems engineer and program manager. c) Coordinate the preliminary FRR agenda with the systems engineer and program manager. d) Ensure the test team supplies all test-related presentation material to the systems engineer sufficiently early to support team coordination.
FRR chair	a) Determine FRR team membership. b) Approve the final FRR agenda. c) Approve any final Clause D.6 FRR detailed criteria tailoring for the specific program. d) Identify any specific elements for in-depth technical review as required.

D.6.3 FRR conduct

Table D.4 lists the technical review elements and associated content details that should be considered for the conduct of the FRR. If a given program requires an FRR specific elements and their content details shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement, to support a given program.

Table D.4—FRR conduct elements

FRR review element	Content details
Introduction, agenda, administrative	a) Review location layout and safety procedures b) Security procedures if applicable c) Introduction of chair and team members d) Purpose of the technical review e) FRR agenda f) Action item procedures g) Risk assessment procedures h) Program, schedule, and technical overview i) Overall test and evaluation (T&E) program overview and how the planned flight testing supports the overall program
System technical documentation review	a) New system elements and modifications since CDR b) System configuration(s) planned for flight testing c) Specification and drawing status d) Flight test requirements (including certification and R&M), applicable TPMs, and KPPs e) Safety-of-flight requirements corresponding to system configuration(s) f) Requirements traceability to test documentation g) Overview of the software to be used for flight testing, including test status to date h) Structure, content, and status of the TEMP i) Flight test objectives j) Flight test engineering data requirements and instrumentation status to support data collection k) Flight test plans and procedures content and status l) Flight test support to M&S m) Technical basis for flight clearance
Test environment review	a) Flight test hardware and software configuration, including flight vehicle and ground support b) Capability and calibration status of all test support equipment c) Test configuration as related to the operational environment, and discussion of differences
Program execution and process control review	a) Resources allocations to flight test (personnel, test articles, facilities, data systems, support equipment, logistics, spares, funding) b) Test team roles and responsibilities c) Critical flight test support requirements and status d) Test team training status e) Problem and deficiency reporting system status and review of action items from CDR (and prior reviews if applicable) f) Program metrics status
Risk assessment review	a) Risk identification and mitigation including consideration of elements impacting successful flight testing

FRR review element	Content details
Program cost and schedule estimates review	a) Current program cost estimates and relation to flight test program budget b) Flight test schedule events including envelope clearance or expansion c) IMS status and flight test event critical path dependencies d) Earned value management (EVM) status

D.6.4 FRR closure

Table D.5 lists the actions that should be considered for FRR closure. The responsible people listed are those most often tasked with the listed closure actions. The acquirer and supplier may agree to assign the program manager and systems engineer actions to different people or organizations depending on a given program's organizational structure. If a given program requires a FRR, the specific actions shall be deleted, modified, or additional items included, in accordance with the acquirer-supplier agreement. If a given program requires a FRR, responsibilities shall be assigned to people or organizations in accordance with the acquirer-supplier agreement.

Table D.5—FRR closure actions

Responsible person	FRR closure actions
Program manager	a) If funding profiles are insufficient to support further test and evaluation, notify user/sponsor of funding shortfall and request funding profile adjustments. b) Support development of the FRR summary report.
Systems engineer	a) Organize and supervise the responses to all action items generated during FRR. b) Support development of the FRR summary report.
Program test lead	a) Organize and supervise the detailed documentation of all action items assigned during the FRR. b) Support development of the FRR summary report.
FRR chair	a) Ensure preparation of the FRR summary report with the support of the program manager, systems engineer and program test lead. b) Sign off final approval of all action items. c) Prepare the formal FRR completion letter.
Recorder	a) Collate all action items for submission to the FRR chair. b) Prepare the FRR summary report and FRR minutes for signature and distribution by the FRR chair. c) Prepare the FRR closure letter for signature by the FRR chair.

D.7 FRR application guidance

The following is a set of observed good practices for consideration:

a) For complex systems where there are numerous subsystems or major system element groupings, it may be appropriate to conduct multiple FRRs at the subsystem level.

b) The FRR scope should be tailored to the technical scope of the specific system, subsystem or group of system elements to be reviewed.

c) The request for the FRR chair should occur at least 60 days prior to conduct of the technical review.

d) The systems engineer, in conjunction with the chief flight test engineer or organizational-level chief engineer, should recommend to the program manager whether or not to conduct an FRR for major modifications to an existing flight vehicle.

e) Typical changes to an existing flight vehicle that require an FRR include but are not limited to

1) Configuration changes such as new engine(s)
2) Significant changes to electrical or hydraulic systems
3) Significant changes to vehicle guidance and control systems
4) New wings or other major airframe changes or modifications
5) Major upgrades to flight control hardware or software
6) Changes to the number or material selection of propellers or rotors
7) Changes to material selection for thermal control systems of space vehicles
8) Changes in vehicle utilization or mission
9) Changes that affect safety, security, or other flight-worthiness-related attributes

e) An FRR is typically not required for ongoing developmental testing changes or modifications such as the following:

1) Minor software changes that can be fully tested in the laboratory and that do not affect safety of flight.
2) Expansions to a flight envelope previously reviewed in a flight clearance pre-planning meeting.
3) Minor changes to weapons, stores, or other deployable items that do not affect release, safe separation, or delivery.
4) Minor changes to weight or balance.
5) Wing dressings such as vortex generators, fences, porous wing fold fairing covers, etc.

f) The systems engineer should conduct a pre-FRR prior to the actual FRR with the purpose of identifying critical issues and risks that need resolution prior to the FRR. The pre-FRR should be held sufficiently in advance of FRR to adjudicate any resulting action items.

g) In order to help ensure a comprehensive and balanced assessment of all FRR work products, FRR participants from both the acquirer and supplier should include the following, as applicable:

1) Program management
2) Program test and evaluation team lead
3) Program security representative
4) Configuration management
5) Systems engineering
6) Software engineering
7) Hardware engineering
8) Logistics
9) Chief test engineer, chief test pilot, and appropriate flight test engineering team members
10) Lead instrumentation engineer
11) All certification authorities
12) System safety
13) System users
14) Cost estimating team
15) Legal counsel, if required
16) Contracting officers
17) Recorder or secretary

NOTE—These roles do not dictate that a single individual is provided for each role. A single individual may perform more than one of these roles within the team. Depending on the complexity of the system, more than one individual may also be assigned to a specific role.

Annex E

(informative)

Bibliography

Bibliographical references are resources that provide additional or helpful material but do not need to be understood or used to implement this standard. Reference to these resources is made for informational use only.

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