Program Executive Officer
Integrated Warfare Systems

(PEO IWS)

Naval Sea Systems Command
Research & System Engineering
Warfare Systems Engineering and
Human Systems Integration Directorate
(NAVSEA 05H)

TECHNICAL REVIEW MANUAL (TRM)

Version 2.0

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Department of the Navy
Naval Sea Systems Command / Program Executive Office, Integrated Warfare Systems
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EXECUTIVE SUMMARY

The Program Executive Office for Integrated Warfare Systems (PEO IWS) and the, Naval Sea Systems Command, Research & Systems Engineering Warfare Systems Engineering and Human Systems Integration Directorate (NAVSEA 05H) require System Engineering Technical Reviews (SETRs) to be conducted of all systems to demonstrate that required systems engineering (SE) and associated efforts necessary for program advancement to the next development stage have been completed. SETRs are an integral part of the SE process and consistent with existing and emerging engineering standards. SETRs should be event-driven, and conducted when the system development has demonstrated sufficient maturity for review of progress in accordance with entrance criteria established for each review and acceptable level of risk.

While the Systems Engineering Operations Manual (SEOM) provides guidance on the SE process, this Technical Review Manual (TRM) describes each SETR in the overall technical review process and provides PEO IWS amplifying guidance on the preparation and conduct of PEO IWS SETRs. Objectives are identified for each SETR. References (a), (b), and (c) require programs to develop and deliver a Systems Engineering Plan (SEP) that describes all technical aspects of an acquisition program, and describe the overall technical approach, SE processes, resources, key technical task, activities and events along with the metrics and success criteria. Program Managers (PMs) are responsible to insure SETRs are planned and held for their program. The PM may tailor a program's SEP to their particular program circumstances. The SEP must include a description of any program-specific tailoring of SETRs and explain how the tailored SETR activities accomplish the objectives of the overall SETR process. Each SEP must be approved by the PEO IWS Technical Director (TD). In addition, SEPs for Acquisition Category (ACAT) I and II and special interest programs must be approved by the Assistant Secretary of the Navy (Research, Development, and Acquisition) Chief System Engineer (ASN RD&A CHSENG) prior to Milestone Decision Authority's (MDA) approval at each acquisition milestone and whenever a significant program change occurs.

Office of the Secretary of Defense (OSD) requirements for review and approval of SE products and processes are being implemented via the Naval Sea Systems Command's (NAVSEA's) Technical Authority (TA) and Certification process. Information Assurance (IA), always a consideration for the entirety of any development, is now made an explicit topic in development processes and reviews. The emerging importance of Open Architecture (OA), Intellectual Property (IP), Human Systems Integration (HSI), and Commercial Off-the-Shelf (COTS) issues are reflected in additional agenda items in all reviews. These engineering areas require assessment in emerging systems.

The point of contact for this manual is the PEO IWS Deputy Technical Director.

Approved by:

Patricia Hamburger Date: 12/18/09

P. Hamburger, PEO IWS TD and SEA 05H

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1.0 INTRODUCTION

1.1 Scope

ASN(RD&A) is the DON Component Acquisition Executive (CAE) responsible for DON acquisition including establishing policy and procedures and being responsible for all research, development, and acquisition per SECNAVINST 5430.7 series and SECNAVINST 5400.15 series.

PEOs, SYSCOM Commanders, and DRPMs are accountable for the specific responsibilities listed SECNAVINST 5400.15 series, including administration of assigned acquisition programs, and reporting directly to the CAE for such programs. PEOs, SYSCOM Commanders, DRPMs, and PMs have authority, responsibility, and accountability for life-cycle management of all acquisition programs within their cognizance. Title 10 U.S.C. § 1737 : US Code - Section 1737: Definitions and general provisions defines the term "program manager" with respect to a defense acquisition program as the member of the Acquisition Corps responsible for managing a program.

PEOs and DRPMs shall act for and exercise the programmatic authority of the Naval Acquisition Enterprise to directly supervise the management of assigned programs, maintaining oversight of cost, schedule, and performance, and make timely and forthright reports directly to the ASN(RD&A) for all matters pertaining to acquisition and will work with the SYSCOMs to ensure that technical authority processes are an integral part of their program execution and that acquisition issues pertaining to supportability of their systems are coordinated and addressed throughout the entire life cycle per SECNAVINST 5400.15 series. Programmatic authority for acquisition is exercised by Program Managers and is the management of all aspects of assigned programs from concept to disposal, including oversight of cost, schedule, and performance; and direction of life cycle management per SECNAVINST 5400.15 series.

Technical Authority is the authority, responsibility, and accountability to establish, monitor and approve technical standards, tools, and processes in conformance with applicable Department of Defense (DoD) and DON policy, requirements, architectures, and standards per SECNAVINST 5400.15 series to ensure the safety, reliability and performance of Navy products are practical, complete and meet programmatic needs.

ASN(RDA) directed the development of a common System Engineering Technical Review (SETR) process by the SYSCOMs and the institutionalization of this common SETR process which is to be led by a senior and independent person from the acquisition program (see policy memorandum Systems Engineering Technical Review Process for Naval Acquisition Programs dated 13 Jun 08). NAVSEAINST 5000.9, Virtual SYSCOM Naval SYSCOM Systems Engineering Policy, 2009 and the SETR Handbook provides for this common SETR process.

Emphasizing review preparations and procedures based on the Naval Systems Engineering (SE) Policy and Naval Systems Engineering Technical Review (SETR) Handbook,

this TRM identifies technical requirements, planning responsibilities, recording requirements, and roles for SETRs for programs within PEO IWS. This manual describes the overall PEO IWS/SEA 05H SETR process as well as the objectives and activities (including entrance and exit criteria) for each SETR. In so doing, this manual reflects policy that governs the SETR process and provides guidance for the conduct of SETRs for development and verification of new systems or system baseline upgrades.

In accordance with the Policy for SE in Department of Defense (DoD), each program is required to submit a System Engineering Plan (SEP) for Milestone Decision Authority (MDA) approval at each milestone review using the DoD Systems Engineering Plan Preparation Guide including addendums. The SEP describes all technical aspects of an acquisition program and describes the overall technical approach, SE processes, resources, key technical task, activities and events along with the metrics and success criteria. SETRs to be conducted by each program should be identified in the program's SEP. The SEP must include a description of any program-specific tailoring of the SETR and explain how the tailored SETR activities accomplish the objectives of the overall SETR process. Non-acquisition programs within PEO IWS shall prepare a modified SEP that includes as a minimum the Technical Review Planning portion of the DoD Systems Engineering Plan Preparation Guide. The modified SEP shall have the concurrence of the NAVSEA CHENG and be approved by the IWS Technical Director.

SETRs are independent reviews of programs for the benefit of the program manager. Technical Interchange Meetings (TIMs) and program Integrated Product Team (IPT) meetings are critical elements of the SETR process. The primary focus of each SETR assessment is on technical issues; however, SETRs should never exclude cost and schedule considerations when necessary to exercise sound judgment on technical risks and proposed solutions. In all cases, the term "system" implies the total system: products (hardware and software), processes (facilities, equipment, material, and procedures), and people (users, acquirers, developers, operators, and maintainers).

SETRs are held to assist the Program Manager (PM) and his management team in documenting technical requirements, synthesizing certifiable designs, assessing performance and risk, ensuring programs are on track to achieve deployment with required capabilities. SETRs are event-driven, and implement a technical assessment process that evaluates the maturing program design/progress over the life of the program.

PEO IWS/SEA 05H SETRs will be conducted in accordance with Department of Defense (DoD) and Department of the Navy (DON) policies and instructions. Emphasis is placed on review preparations and procedures based on the Naval SE Policy (ref (i)) and Naval SETR Handbook (ref (h)). Section 2.0 lists key references used in development of this manual. The DoD acquisition life cycle, including SECNAV 2-pass/6-gate reviews, and SETR milestones are shown in Figures (1) and (2) for a major program entering at either Milestone A or Milestone B. These figures show where the various SETRs fit within the acquisition life cycle requirements of higher authority.

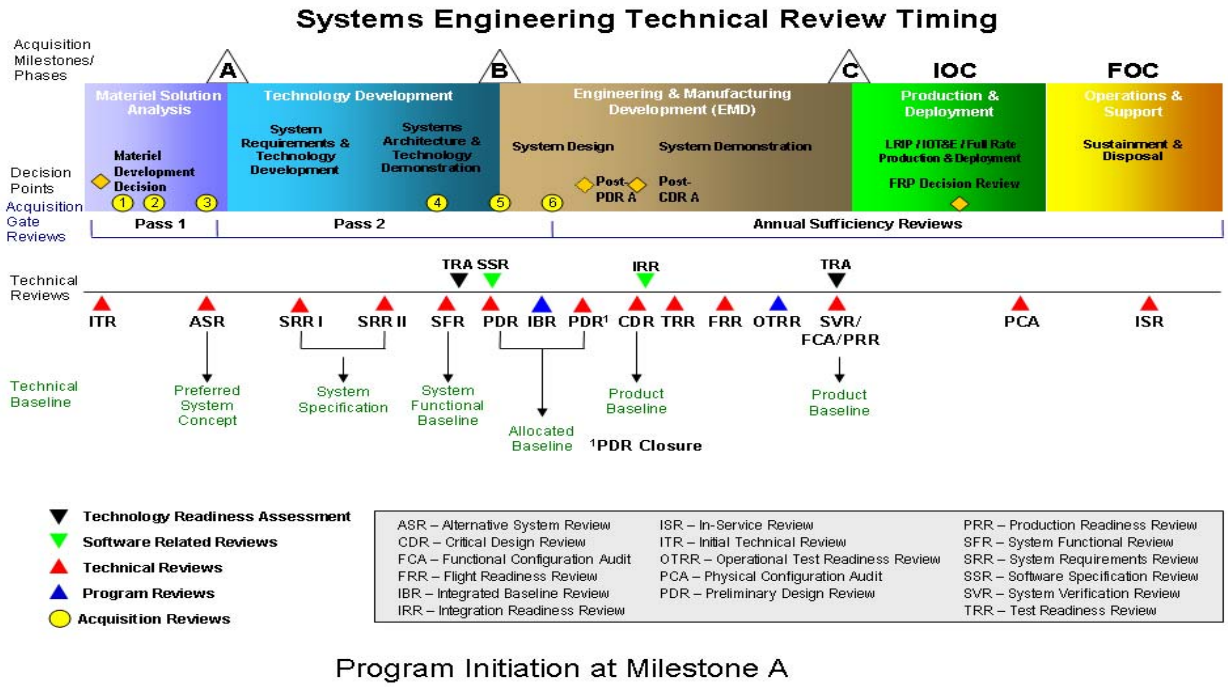

FIGURE 1. NAVSEAINST 5000.9 SYSTEMS ENGINEERING TECHNICAL REVIEWS FOR MILESTONE A PROGRAMS

Comments on Figure (1) and Figure (2) on the following page:

1) The Acquisition Gate Review line showing Secretary of the Navy's two pass/six gate review process in accordance with SECNAVINST 5000.2D dated 16 October 2008, ref (i).

2) The "Technical Review" line shows a program's SETRs based on program maturity across the life of a program.

1.2 Document Organization

Section 2 lists references upon which the SETR process is based.

Section 3 describes the purpose and objectives of SETRs that may apply to a program and general guidelines to conduct a SETR (scheduling, preparations, documentation, request for action, etc.).

Appendix A lists acronyms.

Appendix B lists document definitions.

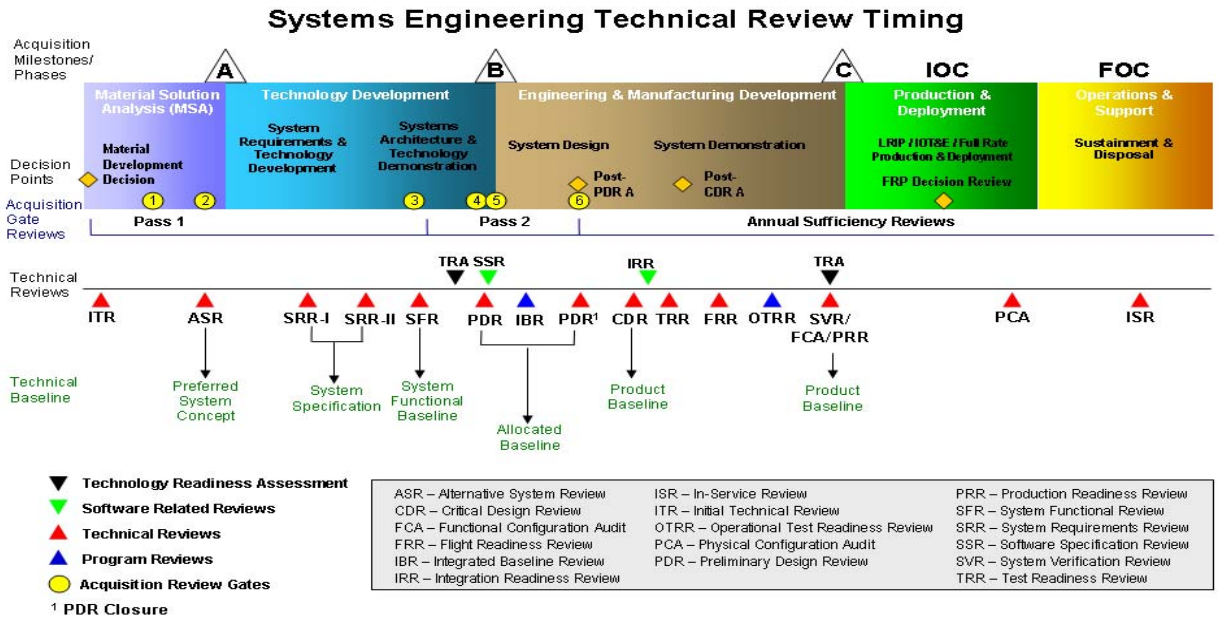

FIGURE 2. NAVSEAINST 5000.9 SYSTEMS ENGINEERING TECHNICAL REVIEWS FOR MILESTONE B PROGRAMS

Appendix C lists the SETRs, different types of projects, common topics of SETRs, and contains specific guidelines with a detailed description of each type of SETR, entrance and exit criteria, and recommended guidance for scheduling and content.

Appendix D provides a summary of SETR documentation providing a tabular listing of the documentation and artifacts associated with each review, and recommended architectural views for consideration at each review.

Appendix E provides for a Comment Review Matrix

1.3 Document Update

This document will be updated annually based on changes in relevant acquisition policies and instructions and lessons learned while executing the SETR processes in this manual. Also, the next annual update is planned to specifically address System of Systems, Family of Systems, interoperability, open architecture, Objective Architecture and the Appendices. Personnel are encouraged to provide comments as they are executing the processes herein during the year (vice waiting until the formal review and update cycle) and submitting these comments using the Comment Review Matrix.

2.0 REFERENCES

The SETR process and associated procedures of the PEO IWS and SEA 05H Technical Review Manual (TRM) are set forth to comply with the Naval SE Policy (ref (a)) and the Naval SETR Handbook (ref (b)). This TRM does not replace active acquisition, SE, and operational policies, instructions, notices, and directives, but is a tool meant to provide a framework from which to assist Program Managers (PMs), Systems Integration Program Managers (SIPMs), Program Lead Engineers and TDs, Program Offices, and others in preparing for and conducting SETRs.

Below are a few of the key references this manual is based upon (the list is not all inclusive):

a. DOD Directive 5000.01, *The Defense Acquisition System*, 12 May 2003

b. DOD Instruction 5000.02, *Operation of the Defense Acquisition System*, 8 December 2008

c. *Defense Acquisition Guidebook (DAG)*, Interim Version [2009]

d. SECNAVINST 5000.2D, *Implementation and Operation of the Defense Acquisition System and the Joint Capabilities Integration and Development System*, 16 October 2008

e. SECNAVINST 5400.15 series Department of the Navy (DoN) Research and Development, Associated Lifecycle Management, and Logistics Responsibilities and Accountability

f. VS-JI-22A, *Virtual SYSCOM Engineering and Technical Authority Policy*, 31 January 2007

g. ASN RDA Memo, *Systems Engineering Technical Review Process for Naval Acquisition Programs*, 13 June 2008

h. *Naval Systems Engineering Technical Review Handbook*, Version 1.0

i. NAVSEAINST 5000.9, *Virtual SYSCOM Naval SYSCOM Systems Engineering Policy*, 2009

j. Department of the Navy Joint letter, *Implementation of System Design Specification (SDS) Guidebook and associated system specific appendices*, 18 July 2008

k. *Department of the Navy System Design Specification (SDS) Guidebook*, 17 July, 2008

l. CJCSI 3170.01G, *Joint Capabilities Integration and Development System*, 1 March 2009

m. *DoD Systems Engineering Plan Preparation Guide*, Version 2.01, April 2008 with addendum v2 dated 02 July 2009

n. ASN RDA Memo, *Amplification of Policy for DON Systems Engineering Plan Review and Approval*, 16 November 2007

o. *Naval SYSCOM Risk Management Policy Instruction*, 21 July 2008

p. *Naval Systems Engineering Guide*, October 2004

q. *DoD Technical Review Checklist, https://acc.dau.mil/TechRevCklist*

3.0 SYSTEMS ENGINEERING TECHNICAL REVIEW (SETR)

3.1 General Background

SETRs are scripted events during which the system under development is independently assessed to determine the system's technical maturity and to assess if its development is proceeding according to plan. The purpose is to determine whether the risk of continued development justifies the commitment of resources. One outcome of a SETR might be the decision to modify the current plan with the goal of mitigating identified risk.

The establishment and tailoring of SETR schedules are to be described in the program's Systems Engineering Plan (SEP). The Program Management Office (PMO) technical lead or Chief Systems Engineer will have the primary role in developing the SEP. The NAVSEA CHENG shall designate in writing an independent technical authority (ITA)) to assist the PM in the development of the SEP and co-chair SETR events. Systems Command (SYSCOM) Technical Warrants (TWs) and the PEO IWS TD must be engaged to ensure quality, completeness, and acceptable level of risk.

As a system progresses through development, the system increases in technical content and maturity according to its development plan. System level SETRs are to be timed to correspond to specific levels of maturity in order to track progress and risk, and to exploit available information and documentation.

The timing of SETRs depends on two key items: the maturity of the system, and the development plan (e.g., Hardware Development Plan (HDP and Software Development Plan (SDP)) as expressed in the SEP and/or the developer's Systems Engineering Management Plan (SEMP). Involvement of stakeholders, peers, technical authorities, subject matter experts (SMEs), and senior leaders in SETRs is defined in the SEP. SETRs shall be scheduled at key points in the development schedule when the system has achieved a discrete stage of maturity and when the appropriate data is available to assess progress thereby facilitating an independent review, and to identify any variations from the plan or emerging factors that would represent potential risk. SETRs shall also be scheduled to support specific key decision points regarding the continuing development effort. SETRs shall be conducted on all relevant parts of the system, ranging from the entire system down to the lower-level elements (e.g., configuration items or sub-systems).

The focus of SETR assessments will change as a system and/or a product progresses through its development. Early in the process, the primary focus is on defining the requirements on which subsequent design and development activities will be based. SETRs conducted during the early stages of development usually focus on ensuring that top-level concepts and system definitions reflect user requirements. Once system level definition is complete, the focus is on design at sub-system levels and below.

Individual systems are rarely developed and rarely operate in isolation – there are typically multiple parallel development efforts taking place, ranging from the lowest level

products, up to the entire ship platform, and to Families of Systems (FoSs) which, as a whole, provide warfighting capabilities to the Navy. As a result, reviews often need to be conducted that assess a system's role in the context of other systems that may form a System of Systems (SoS). This is to ensure that interoperability and product line concerns are adequately addressed. The scope of the system will influence the content of SETRs as well as their timing, since they need to be coordinated with similar events for the other systems. Table C-1 in Appendix C compares different types of projects at different levels of scale and summarizes some of their important characteristics.

Developers are expected to exercise discipline in following their SEP. Failure to adhere to such plans generally results in significantly increased risks to the success of the program. The program or project managers (PMs), applicable TWs, the developers, and other stakeholders are responsible for closely monitoring adherence to the plans to ensure that all activities and events take place as scheduled; that the products and artifacts comply with their requirements; and that the processes defined are closely followed.

This TRM provides specific guidance including entrance and exit/closure criteria for SETRs traditionally utilized in single system development. However; a system in one context can be a subsystem in another (e.g., a radar is a subsystem of a combat system, a combat system is a subsystem of a warfare system). System of Systems Engineering (SoSE) crosses the boundaries of Major Program Manager (MPM) or PEO responsibilities.

The SoSE and Family of Systems Engineering (FoSE) processes are continuing to mature. It is the intent of PEO IWS to further revise this document, as well as existing SE instructions and guidance, to accommodate SoSE and FoSE processes as they mature. The SEP for a program will define the SETRs within a SoS context. The following paragraphs provide interim guidance for the application of SETRs in SoSE.

3.2 Objectives

SETRs have many objectives, including:

a. Assessing the development maturity based on technology maturity and technical development goals from the SEP, SE events and accomplishments, and empirical test data supporting progress to date.

b. Ensuring operational, functional, performance, Information Assurance (IA) and cost requirements, designs, technical performance measurements, and technical plans are being tracked and are on schedule.

c. Assessing the system requirements to ensure that the requirements are unambiguous, consistent, complete, feasible, verifiable, ranked for priority and stability, and traceable to top-level requirements (TLRs).

d. Demonstrating that the relationships, interactions, interdependencies, and interfaces between required items and externally interfacing items, system functions,

subsystems, and system elements (including usability and maintainability), as appropriate, have been addressed.

e. Ensuring open architecture (OA) in the emerging system; assessing the degree of Naval Enterprise reuse (availability and potential for component reuse); and critiquing any tradeoff decisions.

f. Ensuring that the results of trade studies are used to define concepts and that risks associated with alternatives have been analyzed.

g. Ensuring that technical designs will be usable by the target warfighter population, meet the Fleet requirements and have viable training options.

h. Ensuring that trade studies include IA and safety requirements and that the risks of failing to meet these requirements have been properly treated.

i. Confirming that the effects of technical risks on cost, schedule, and performance, as well as risk reduction measures, rationale, and assumptions made in quantifying the risks have been addressed.

j. Providing a forum for communication, coordination, and integration across all acquisition disciplines.

k. Establishing a common configuration baseline from which to proceed to the next level of design.

l. Confirming that continued development is warranted (with or without modifications to the program), and when it is not, identifying the technical measures necessary to preserve for reuse as much of the technology, hardware (HW), and software (SW) developed to date as possible. In the case where program redirection or restructuring is considered appropriate, the review should ensure that executable alternatives have been defined (discontinue development, or take corrective action on the products and/or processes of the current phase before proceeding to the next phase).

m. Verifying the system is ready for the appropriate level and type of testing or that appropriate approvals for production and certification have been granted

n. Identifying resources (e.g., people, funding, support assets, test facilities, as appropriate) required for continued development, testing, or production.

o. Reaching technical concurrence with stakeholders.

p. Provide a check of proposed design configuration versus specification and contractual requirements.

q. Evaluate systems configuration at different stages in terms of requirements.

3.3 Recommended SETRs and Levels

The recommended minimum selection of SETRs for a new system or baseline upgrade is noted below. This selection, and any additional reviews deemed necessary, should be called out in the program's SEP.

a. Initial Technical Review (ITR)

b. Alternative Systems Review (ASR) (system level)

c. System Requirements Review (SRR) (system level)

d. System Functional Review (SFR) (system level)

e. Software Specification Review (SSR) (subsystem level)

f. Preliminary Design Review (PDR) (system (defined by the program system engineer)/ subsystem (HW/SW) level (addressed herein))

g. Critical Design Review (CDR) (system (defined by the program system engineer)/subsystem (HW/SW) level (addressed herein))

h. Test Readiness Review (TRR)

i. System Verification Review (SVR)

j. Production Readiness Review (PRR)

k. Functional Configuration Audit (FCA) (system level)

l. Physical Configuration Audit (PCA) (system level)

ASR, SRR, SFR, PDR, CDR, TRR, FCA, and PCA will be conducted at the system level for those systems being managed as the system. SSRs, PDRs, CDRs and TRRs for those systems being managed at the subsystem or computer software component item (CSCI), should be conducted at the subsystem level.

Specific SETR agenda items for each review and specific timing for SETRs will be in accordance with the Technical Review Action Plan (TRAP) and procedural guidelines in the Naval SETR Handbook and appropriate references or alternatively in the program SEP or modified SEP for acquisition programs that do not require a SEP.

It should be noted that additional technical and programmatic reviews are depicted in Figures (1) and (2); requirements for these reviews are addressed in the SETR Handbook (ref (b)) and specific implementation recommendations in Appendices B and C.

3.4 Roles and Responsibilities

Participants assigned to support a program SETR should be familiar with the key positions, team, and SETR events. SETRs and the Extended Integrated Product Team (IPT) are co-chaired by the PM and the Independent Technical Authority (ITA) and other co-chairs as required. SETR events shall be co-chaired by the PM and the ITA as depicted in Figure 3. The co-chairs shall work together to plan, execute and document the SETRs and shall share information freely in a timely manner with each other.

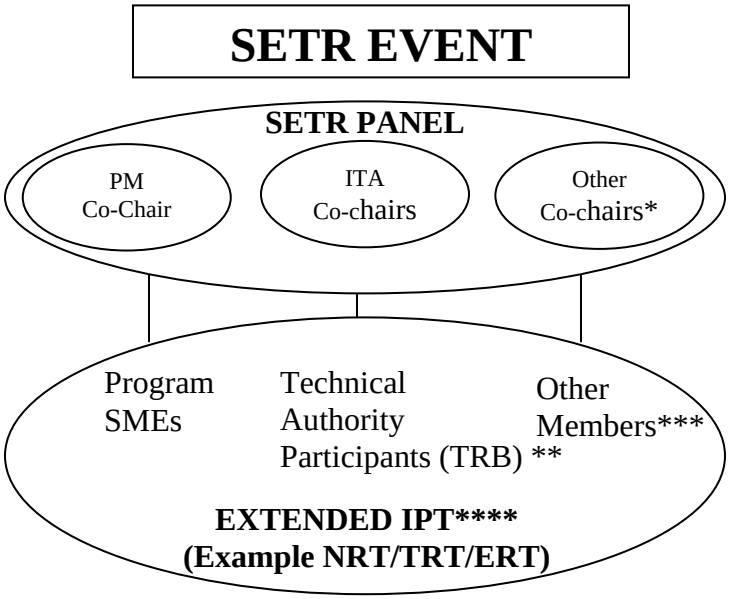

FIGURE 3. SYSTEMS ENGINEERING TECHNICAL REVIEWS (SETRs) CO-CHAIRS

*See section 3.4.4 for information about other co-chairs
** See section 3.4.7 for information about Technical Authority (TA) participants; TA participants are integral to the Extended IPT activities (not a separate review team) and report as required to the ITA. The identified Technical Authority Participants and the ITA is referred to as the Technical Review Board
*** Other Members – The Program Manager may include other members as part of the Extended Integrated Product Team (IPT) as required for a SETR event (i.e. legal, contracts)
****The Extended IPT is typically known as the Navy Review Team, Technical Review Team, Engineering Review Team – this is the team that reviews SETR artifacts and provides testimony to the SETR Panel as to their adequacy in addition this team typically provides for a cradle to grave program system engineering activities and test and evaluation activities

3.4.1 Program / Project Manager (PM)

As stated specifically in the SECNAVINST 5400.15C, “Program managers will be vested with the authority, accountability, and resources necessary to manage all aspects of assigned acquisition programs from concept development to demilitarization and disposal. Program

managers will exercise management authority, including selection and application, over core capabilities that support the acquisition, in-service support, and demilitarization and disposal of assigned weapons and IT systems"

The PM is responsible for planning, executing and documenting the overall SETR process for a program under review. The PM may propose to the NAVSEA CHENG's designated representative, SEA 05H / PEO IWS TD the ITA and or concur with the proposed ITA. SETR process planning begins during preparation of the program SEP. The planning must take into account the general timing and tailoring of SETR assessments; securing budget, schedule, and personnel resources; and coordinating with other program reviews, such as program baseline reviews and sponsor programmatic reviews (e.g., two-pass/six-gate review).

PM responsibilities for SEP development and SETR process planning are in the DoDI 5000.02, SECNAVINST 5000.2D, NAVSEAINST 5000.9 and the DoD Systems Engineering Plan Preparation Guide and Addendum and include the following:

a. Plan and prepare the SETR in a timely and effective manner.

b. Identify, allocate and fund resources necessary to accomplish the total SETR effort, including identification of supporting functions such as facilities and infrastructure.

c. Establish program Extended IPT as required.

d. Tailor the SETR consistent with good engineering judgment and program complexity and risk levels.

e. Schedule SETR assessments consistent with availability of supporting materials and adequate time for Naval Technical Authorities (TAs) to review those materials.

f. Establish areas of interest to focus the SETR assessments.

g. Tailor event-driven entry and closure criteria and include in the approved program SEP.

h. Plan to conduct incremental SETR assessments, as needed.

i. Review all systems functions, including human operational and maintenance functions.

j. Confirm that HW, human, and SW areas of interest are assessed with appropriate priorities.

k. Propose the SETR agenda, TA participants and other Extended IPT participants including co-chairs as appropriate.

l. Develop the TRAP/SEP/modified SEP as appropriate for the SETRs.

m. Co-chair the SETR event with the ITA and other co-chairs, capture action items and monitor closure of the SETR event and provide an event report for concurrence by the ITA and other co-chairs.

3.4.2 SYSCOMs

As specifically stated in the SECNAVINST 5400.15C, " The SYSCOM Commanders are responsible for: providing for in-service support; providing support services to PEOs and DRPMs without duplicating their management functions; and serving as the technical authority and operational safety and assurance certification authorities for their designated areas or responsibility" NAVSEA is the primary SYSCOM for PEO IWS.

3.4.3 Independent Technical Authority (ITA)

SETR events are conducted by the SETR Panel and Extended IPT. The Independent Technical Authority (ITA) is the designated representative of Technical Authority and is a co-chair of each SETR event specified in a program SEP, is assigned in writing by the NAVSEA CHENG's designated representative, SEA 05H / PEO IWS TD and has the responsibility to report in writing unresolved technical issues to the NAVSEA CHENG designated representative, SEA 05H / PEO IWS TD after a good faith effort to resolve the issue at the SETR Panel or Extended IPT. The ITA shall be independent from the Program and will normally be a senior individual from the NAVSEA TA chain with technical expertise relevant to the program, but can in some cases be an independent authority within the Naval Enterprise including the PEO infrastructure if so designated by the NAVSEA CHENG office. When approved by NAVSEA CHENG authority, a principal member of the TRB from the program or the Fleet may be assigned.

The role of the ITA includes the following responsibilities:

a. Oversight of the SETR process, co-chair of the SETRs as the ITA including all meetings of the TRB to review and discuss program materials.

b. Concurrence on the Extended IPT participants.

c. Concurrence on the TRAP/SEP/modified SEP as appropriate.

d. Concurrence on areas of interest.

e. Concurrence on entry and closure criteria.

f. Concurrence on the SETR Summary Report.

g. Facilitate participation of SMEs in the SETR process, such as early distribution of program materials to be reviewed and meeting announcements, as well as attention to scheduling convenient meeting locations.

h. Provide specific constructive feedback and viable recommended technical options during program execution as risks and issues arise.

i. Support the PM as required at the leadership level if recommendations will impact the cost, schedule and performance risk of the program.

In the event the PM and the ITA do not agree on findings, the issue(s) will be elevated to the next level authorities, the Program Executive Officer for Integrated Warfare Systems and the NAVSEA Chief Engineer.

3.4.4 Other Co-chairs

Integrated Warfare Systems development requires the participation across the Naval Enterprise to ensure that the combat systems and elements for integration on Naval platforms are accomplished in a timely, cost effective and quality manner. The PM may designate additional co-chairs that represent the interests of a significant partner that has a material interest in the system/product under development. An example is the designation of a ACB 12 CDR Missile Defense Agency (MDA) co-chair due to the requirements drivers for the development of Ballistic Missile Defense and the associated funding provided to ACB 12 from MDA.

The responsibilities of the other co-chairs typically include but are not limited to the following:

a. Co-chair the SETRs as required.

b. Provide subject matter experts (SMEs) and other Extended IPT participants as agreed to with the PM.

c. Concurrence on the TRAP/SEP/modified SEP as appropriate to their authorities.

d. Concurrence on areas of interest in alignment with their principle area of concern.

e. Concurrence on entry and closure criteria as appropriate to their authorities.

f. Concurrence on the SETR Event Report alignment with their principle area of concern.

g. Facilitate participation of SMEs in the SETR process, such as early distribution of program materials to be reviewed and meeting announcements, as well as attention to scheduling convenient meeting locations.

h. Provide specific constructive feedback and viable recommended technical options during program execution as risks and issues arise.

i. Support the PM as required at the leadership level if recommendations will impact the cost, schedule and performance risk of the program.

In the event the PM, ITA and other co-chairs do not agree on findings, the issue(s) will be elevated to the next level authorities, the Program Executive Officer for Integrated Warfare Systems and the NAVSEA Chief Engineer and the co-chair(s)' organizational Executive Officer.

3.4.5 SETR Panel

The SETR Panel is composed of the PM, ITA, other co-chairs and other selected panel members designated by the co-chairs. All co-chairs shall participate in the SETR planning, execution, and follow-up activities and shall keep all members apprised of program health including risks and issues. It is desired that the co-chairs will be the same individuals throughout an acquisition phase. The Panel shall be designated in writing prior to the SETR event. This provides for continuity and consistency of reviews. If there is a change in an individual panel member it is the responsibility of the respective organization to provide for an appropriate turn-over in a timely manner and obtain concurrence from the PM and ITA.

The SETR panel shall review, process and approve all Requests for Information (RFIs) and Requests for Actions (RFAs) during Panel assessments and deliberations and designate which are critical to close prior to the entering of a SETR event or closure of the SETR event underway (see section 3.6 paragraph 6 for further guidance).

3.4.6 Extended Integrated Product Team (IPT)

The success of SETRs depends on the body of technical reviewers used to review artifacts at all levels in order to collect and assess information that will be used to support the SETR review process. This review is accomplished while these artifacts are still under development to verify the artifacts conform to requirements and standards; to identify record and remove defects; to ensure product line factors/issues are considered; and to provide a basis for subsequent product approval at formal SETRs (e.g., SSR, PDR, CDR). This body is typically called a Navy Review Team (NRT), Technical Review Team, or Engineering Review Team (ERT). The mission of the Extended IPT is to assess the technical health of a program under review and to provide program management with an assessment of readiness to proceed into the next technical phase. Ideally the Extended IPT is a standing body with consistent membership that follows the evolution of the program throughout its acquisition life-cycle. The distinction between the Program SMEs and the Technical Authority participants is that TRB members shall not provide 'the' technical solution and then subsequently review and testify to 'their technical solution' adequacy.

These Review Teams are established by the PM at project inception and consist of technical staff independent of the developers, and typically include representatives from the PM, SYSCOMs including Technical Authority participants, Naval Laboratories, academia, and other members that represent the interest of other co-chairs that have a material interest in the development of the combat system and or products/elements. Review teams are used throughout the development effort by the PM as a resource to assist in tracking progress, assessing products, predicting risk, and ensuring quality. Review Team membership shall be selected to ensure the team has expertise to adequately cover all relevant topics and to ensure that all members are able to actively participate. The PM is responsible for establishment of the program Extended IPT and

shall use the approved SEP for determining the composition of the program Extended IPT; the PM may modify the Extended IPT membership as specified in the SEP upon recommendation and concurrence of the co-chairs.

Typical membership on the program IPT includes the following individuals:

a. PM or designee (Deputy PM)

b. TA participants (e.g.TWH)

c. Program Competency Leads or representatives, as needed

d. Performing Activity Leads or representatives, as needed

e. IPT briefer(s), as needed in accordance with SETR agenda

The Extended IPT shall participate during the planning, execution and documenting of all SETRs and shall keep the co-chairs informed in a timely manner of all risks and issues and provide for viable alternatives. The Extended IPT supports SETR assessments by preparing and assembling the program products to be presented to and reviewed by the SETR Panel. Extended IPT members also may brief the program accomplishments and supporting products to the SETR panel during the SETR events.

3.4.7 Technical Authority (TA) Participants

TA participants provide an independent assessment of engineering processes, products and risks associated with a program. TA participants are TWHs and or TWH pyramid members which are associated with specific aspects of the project and are responsible for supporting the PM and the program's System Engineer. The TA participants shall be designated in writing by the SETR Panel Co-chairs. In the event the PM, ITA and other co-chairs do not agree on membership, the issue(s) will be elevated to the next level authorities, the Program Executive Officer for Integrated Warfare Systems and the NAVSEA Chief Engineer and the co-chair(s)' organizational Executive Officer.

The TWHs and their pyramid ensure that processes are documented in the SEP, that they are executed with sufficient rigor, and that the resulting products meet acceptable standards. The TWHs guide the System Engineer in all standards implementations and ensure usability, supportability and interoperability of the final products. While the TWHs support the program, the program's System Engineer is responsible to the PM for engineering efforts within the program.

Ref (f) establishes the Navy's TA policy. Programs are to include TA representatives on IPTs to ensure quality, completeness and acceptable levels of risk. Programs must coordinate with NAVSEA CHENG or representative for TWH engagement in the program and assignment of TA representatives for SETR participation.

3.4.8 Technical Review Board (TRB)

The Technical Authority participants and the ITA collectively are referred to as the TRB. The Technical Authority (TA) participants are the TWHs or TWH pyramid individuals that participate in the Extended IPT as independent reviewers of SETR artifacts. The TA participants shall participate in all SETR processes and activities as integral members of the Extended IPT and shall assess the system under review with the objectives, criteria, and areas of interest developed during SETR process planning. Ideally, the TRB is a standing body with reasonably consistent membership that follows the evolution of a program through its development life cycle.

The mission of the ITA and TA participants is to provide for an independent assessment of the technical health of a program under review and to provide the Extended IPT and SETR Panel with an assessment of readiness to proceed into the next technical phase in a timely manner. A TA participant shall not provide for 'the' technical solution and then assess 'their' technical solution adequacy. If a TA participant is required to supply 'the' technical solution for the program under assessment, another TWH or TWH pyramid individual must be designated to the TA participant membership. The TA participants shall participate during the planning, execution, and documenting of all SETRs and shall keep the PM, PM's IPT and ITA informed in a timely manner of all risks and issues and provide for viable alternatives for resolution.

If a technical issue cannot be resolved or otherwise addressed at the Extended IPT or SETR Panel level, the TA participant and ITA will immediately inform in writing the NAVSEA Chief Engineer (CHENG) and PEO IWS of the risk/issue, impact to the program, alternatives considered and proposed way ahead.

3.4.9 Technical Interchange Meeting [TIM]

SETR TIMs are meetings and/or forums where the program Extended IPT members can interact and hold technical discussions and review supporting documentation, seek answers to technical questions, identify any potential issues, and prioritize follow-on topics.

3.5 Planning for Systems Engineering Technical Reviews

The SETR Panel co-chairs are responsible for planning SETRs and all parties have responsibilities that must be met satisfactorily to realize a successful outcome from the SETR assessment.

Moreover, although no single planning approach is mandated, the critical focus for all parties involved must remain on demonstrating and verifying the successful achievement of the pre-established entrance and exit criteria for the SETR assessment.

For each SETR assessment, the SETR Panel and Extended IPT participants must be designated in writing prior to the event. The co-chairs shall be designated early in the SETR assessment cycle.

The SETR panel concurs with the TRAP/SEP/modified SEP at the beginning of the SETR assessment cycle. The TRAP/SEP/modified SEP should be coordinated across the Extended IPT to ensure that all plans are supportable and executable. Once available, the TRAP/SEP/modified SEP should be distributed to all SETR Panel, and Extended IPT members.

Figure 4 depicts a typical timeline for SETR staffing and preparation purposes. The SETR Panel co-chairs shall assess progress toward meeting all entry criteria at a time sufficiently in advance of the formal review meeting to allow for correction of any shortcoming and deficiencies identified (45 days is a nominal period) and prior to the final agenda and letter being released announcing the SETR event. For all entry criteria that are assessed that will not be met by the SETR event, the SETR Panel co-chairs shall activate mitigation plans immediately to avoid a rescheduling of the SETR assessment meeting. If the entry criteria and critical entry related RFA/RFIs cannot be met in an adequate and timely manner, the SETR Panel Co-chairs must replan the SETR event(s) activities and provide the new plan in writing to the SETR Panel and Extended IPT. The SETR Event replan shall be concurred with by all co-chairs in writing. The determination to reschedule a SETR assessment meeting should be made no later than 15 days prior to the scheduled event.

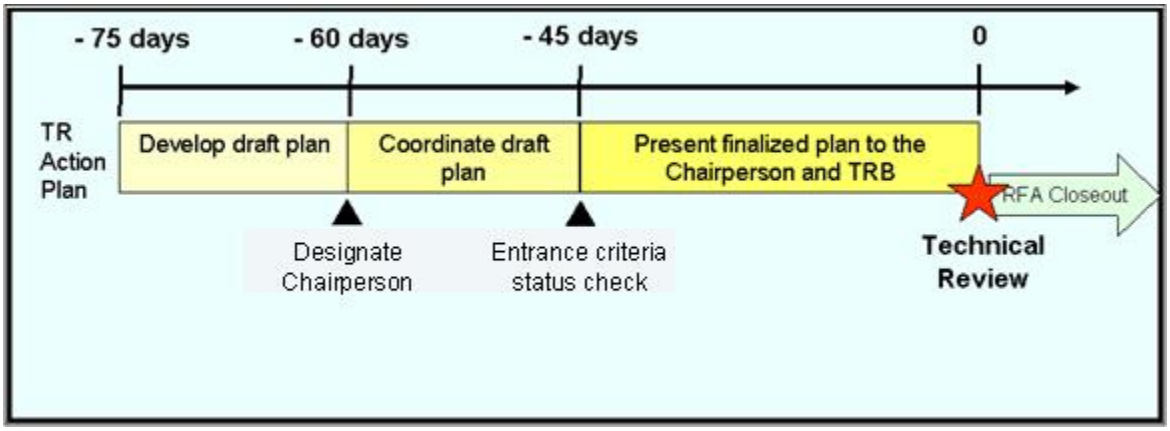

FIGURE 4. TYPICAL PLANNING TIMELINE FOR SETR ASSESSMENTS

3.5.1 Technical Review Action Plan (TRAP)/SEP/Modified SEP

The TRAP is prepared early in the SETR assessment cycle (see Figure 4 above). The TRAP is a useful tool for managing the expectations of the participants and stakeholders involved in a SETR because it communicates government expectations and success criteria. The PM may include the information required in a TRAP in the SEP body or appendix vice developing a separate document. For programs that are acquiring systems and products (elements) that do not require a SEP, a modified SEP shall be developed that includes the minimum information required of a TRAP.

The TRAP/SEP/modified SEP must be aligned with the technical approach defined in the SEP/modified SEP. The TRAP/SEP/modified SEP contains the minimum following information:

a. Program background, including tailoring of the SETR assessment.

b. Schedule of events leading to the formal SETR assessment meeting (including incremental subsystem reviews).

c. SETR Panel co-chair specific names, Extended IPT minimum membership organizations including the TA participants.

d. Entry criteria (including closeout actions and closure criteria of previous SETRs).

e. Proposed agenda, including areas of interest.

f. Closure criteria

g. Request For Action (RFA)/Request For Information (RFI) Process

3.5.2 Systems Engineering Technical Review (SETR) Agenda

The agenda contains elements that correlate to technical accomplishments within the pre-established areas of interest and evidence of successful fulfillment of entry and closure criteria for the SETR assessment. The program IPT and their representatives are expected to present these elements, with supporting documentation and products.

Planning the SETR meeting agenda involves assessing the status and complexity of the areas of interest and technical issues that must be addressed during the meeting. In most cases, the development of the agenda involves coordination across the Extended IPT and with the Performing Activities and associated developers. Moreover, although presentations about the areas of interest and technical issues provide focus for the meeting, adequate time and expertise for discussions during the meeting must be arranged for thorough coverage of the topics presented.

A draft agenda should be made available to the SETR Panel, Extended IPT membership, other SETR participants, and senior leadership at least 60 days prior to the SETR assessment meeting; the final agenda should be distributed 30 days prior to the SETR assessment meeting. The PM is responsible for distributing the draft and final agendas.

3.6 Systems Engineering Technical Review Preparation

The Extended IPT (e.g NRT) is responsible for assembling and making available the program products and artifacts to be reviewed during the SETR assessment as they are available in a timely manner to support review and comment/issue adjudication prior to final SETR preparations. These products must align with those identified in the program SEP, and they must be available for review by the Extended IPT as they are available. Also, the assemblage of products should provide a comprehensive view of work accomplished to date, as planned in the TRAP/SEP/modified SEP.

A listing and copies of the program products must be made available to the Extended IPT early in the SETR assessment period. Appendix D provides a recommended list of products to be reviewed at each SETR. The Extended IPT including the Technical Authority participants are expected to provide an informed and insightful assessment of the technical health of the program at the SETR meeting. To achieve this expectation, all Extended IPT including the TRB members must have adequate time to review and discuss the materials during TIMs held prior to the SETR meeting.

Recommend a series of Technical Interchange Meetings (TIMs) between SMEs be conducted as part of the SETR to discuss technical issues to reach consensus prior to the SETR. Incremental artifact review issues may also be discussed at the TIMs. During the TIMs, (Figure (5)), TRB members should discuss technical issues relevant to the technical health of the program and its supporting documentation, seek answers to technical inquiries, identify issues for potential RFA/RFI submissions, and begin to prioritize technical topics for follow-up at the SETR meeting and the subsequent Extended IPT recommendations to program management. One potential outcome of TIMs might be a request by the Extended IPT to the program for additional program products and information to support the SETR assessment.

In some situations, the TRB may uncover a need to examine specific topics or risk areas in greater detail than possible through TIMs with the Extended IPT. In these cases, focused topical TIMs with appropriate SMEs and other external resources should be conducted in advance of the formal SETR assessment meeting. The ITA shall notify the PM and other co-chairs of the need for topical TIM.

Minutes of all TIMs, including attendance list, topics discussed, action assignments, and outcomes should be documented by the Extended IPT and distributed to the Extended IPT membership and all TIM participants within 10 business days following each TIM.

RFA/RFI process will be handled per guidelines in the Naval SETR Handbook, (ref (b)). The formal RFA/RFI process is important for the orderly conduct of SETR assessments. The RFA/RFI process helps prevent inclusion of action items (AIs) and requests for additional information that do not support closure criteria for a SETR assessment. Formalizing the RFA/RFI process keeps focus on the identification and resolution of issues critical to completion of a SETR assessment. The SETR panel will review, process and approve all RFA/RFIs and the co-chairs shall determine the criticality of the RFAs to the closure of the specific SETR event in progress.

3.7 Conducting Formal SETR Meetings

All programs shall conduct SETRs and they should be tailored dependent upon the scope and complexity of the program. SETR events are jointly chaired by the SETR Panel co-chairs.

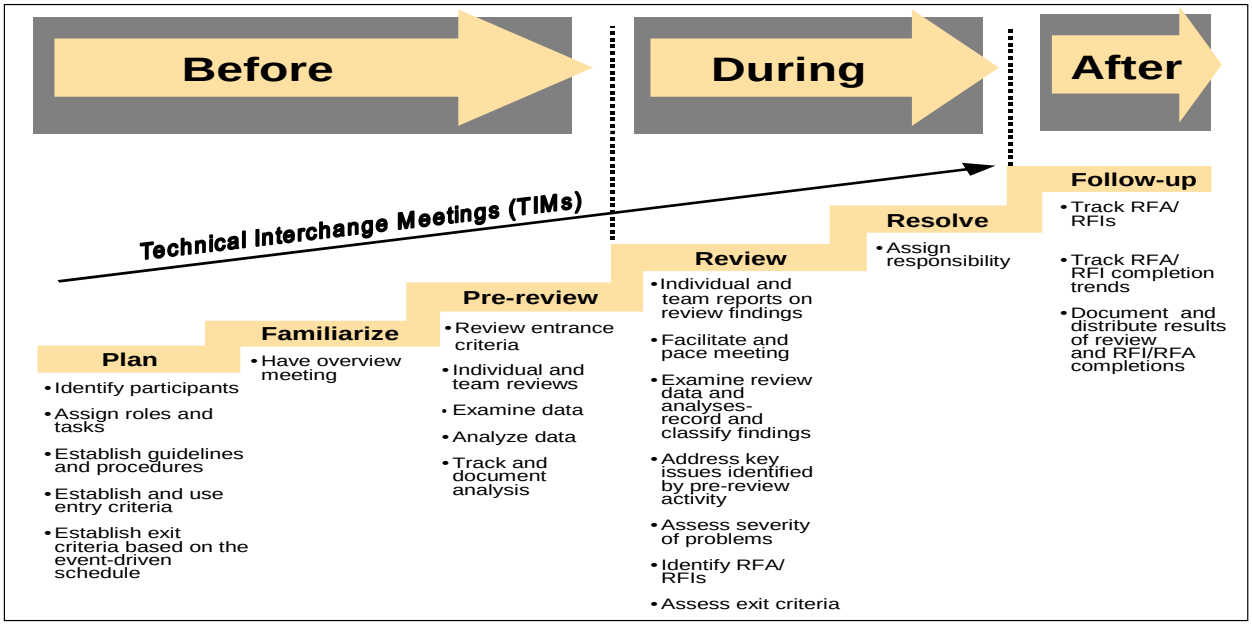

FIGURE 5. TYPICAL SETR PROCESS

3.7.1 SETR Assessment Meeting

No single format is used to conduct a SETR assessment meeting. However, it is expected that usual business conduct and rules of order apply. Also, the PM shall schedule the SETR assessment meeting at a time and place that allows all SETR co-chairs to attend and the maximum number of planned SETR panel and Extended IPT participants to attend.

Copies of the meeting announcement, agenda, and relevant technical data packages should be distributed prior to the SETR assessment meeting. Additional copies of the agenda and the RFA/RFI procedure should be available for distribution at the SETR assessment meeting. The agenda is the definitive plan for the conduct of the meeting.

Regardless of the format of the SETR assessment meeting, the primary focus of the meeting is to allow the SETR Panel to assess achievement of the established closure criteria by the program.

3.7.2 SETR Closure

A SETR is closed when all established exit criteria are met, all critical RFAs have been closed, and a letter designating closure is signed by the PM and concurred with by the other co-chairs. If the ITA and or other co-chair non-concurs with the closure of a SETR the issue shall be raised to the next level authorities, the Program Executive Officer for Integrated Warfare Systems and the NAVSEA Chief Engineer and the co-chair(s)' organizational Executive Officer.

If closure criteria cannot be met in thirty (30) days, the SETR Panel co-chairs must decide how to address and resolve them, such as at a future SETR, a follow-on session of the current SETR, or in extreme cases, restart of the current SETR assessment process. The SETR Panel co-chairs will jointly develop a Plan of Action and Milestones (POA&M) in writing within 10 business days, by which any outstanding closure criteria and critical RFA/RFIs must be resolved. SETRs are an assessment of the overall technical status of the program, its readiness to establish a specific baseline, and a determination of the risks in proceeding further. The SETR Panel co-chairs shall document what activities are allowed to progress and to what extent prior to the closure of a SETR event in the event the SETR event is not closed at the expected time.

3.7.3 Technical Review Summary Report (TRSR)

The TRSR shall be prepared and signed by the PM, and concurred with by the ITA and other co-chairs, and distributed by the PM to the PEO, NAVSEA CHENG, and MDA within 30 days of event. If this report does not report closure of the event, a subsequent memorandum shall document closure to the PEO, NAVSEA CHENG, and MDA with any updates to the TRSR. The PM may alternatively include all information required in the TRSR in a close out letter with enclosures. The TRSR describes the outcomes of the SETR meeting, including the following:

a. List of attendees, including name, functional area represented, phone number, and e-mail address.

b. Meeting minutes, including entry criteria status, closure criteria status, and SETR results.

c. ITA and other co-chair recommendations to PM pertinent to the technical health of the program and its readiness to enter the next phase of development.

d. List of all action items (includes critical RFAs), assignees, and due dates.

e. Identification of all system specification changes/modifications and all new performance and mission implications, as needed.

APPENDIX A: ACRONYMS

A	
ACAT	Acquisition Category
ACB	Advanced Capability Build
AI	Action Item
AoA	Analysis of Alternatives
APB	Acquisition Program Baseline
ASR	Alternative System Review
AT	Anti Tampering
ATE	Automatic Test Equipment
ATO	Authority to Operate
AVs	All Views
B	
BCA	Business Case Analyses
BCS	Baseline Comparison System
BIT	Built-in Test
C	
C&A	Certification and Accreditation
CBM	Condition Based Maintenance
CBM+	Condition Based Maintenance Plus
CDD	Capability Design Document
CDR	Critical Design Review
CE	Concept Exploration
CHENG	Chief Engineer
CHSENG	Chief Systems Engineer

CI	Configuration Item
CIDS	Critical Item Development Specification
CJCSI	Chairman of the Joint Chiefs of Staff Instruction
CM	Configuration Management
COE	Common Operational Environment
COI	Critical Operational Issue
CONOPS	Concept of Operations
COTS	Commercial Off-the-Shelf
CPD	Capability Production Document
CR	Change Request
CSC	Computer Software Component
CSU	Computer Software Unit
CTP	Critical Technical Parameters
D	
DA	Developing Activity
DAG	Defense Acquisition Guidebook
DBDD	Database Design Description
DMSMS	Diminishing Manufacturing Sources and Material Shortages
DoD	Department of Defense
DoDAF	DoD Architectural Framework
DON	Department of the Navy
DOTMLPF	Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities
DRM	Design Reference Mission
DT&E	Developmental Test and Evaluation
E	

EALs	Evaluated Assurance Levels
ECP	Engineering Change Proposal
EDM	Engineering Development Model
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ESOH	Environmental Safety and Occupational Health
ETR	Engineering Technical Review
EVM	Earned Value Metrics
F	
FCA	Functional Configuration Audit
FD	Fault Detection
FI	Fault Isolation
FOC	Full Operational Capability
FoS	Family of Systems
FoSE	Family of Systems Engineering
FQT	Formal Qualification Test
FRP	Full-Rate Production
G	
GFE	Government Furnished Equipment
GFI	Government Furnished Information
GIG	Global Information Grid
GOTS	Government Off-the-Shelf
H	
HDP	Hardware Development Plan
HSI	Human Systems Integration

HW	Hardware
HW CDR	Hardware Critical Design Review
HWCI	Hardware Configuration Item
HWCITP	Hardware Configuration Item Test Plan
I	
IA	Information Assurance
IBR	Integrated Baseline Review
ICD	Initial Capabilities Document
IDD	Interface Design Description
IDS	Interface Design Specification
ILS	Integrated Logistics Support
IMP	Integrated Master Plan
IMS	Integrated Master Schedule
IOC	Initial Operational Capability
IP	Intellectual Property
IPT	Integrated Product Team
IRS	Interface Requirements Specification
ISP	Information Support Plan
ISR	In-Service Review (added with no criteria)
IUID	Item Unique Identification
ITA	Independent Technical Authority
ITR	Initial Technical Review
IWS	Integrated Warfare Systems
J	
JROC	Joint Requirements Oversight Council

K	
KPP	Key Performance Parameter
KSA	Key System Attribute
L	
LCCE	Life Cycle Cost Estimates
LFT&E	Live Fire Test and Evaluation
LORA	Level of Repair Analysis
LRIP	Low-Rate Initial Production
M	
M&S	Modeling and Simulation
MDA	Milestone Decision Authority
MER	Manpower Estimate Report
MLDT	Mean Logistics Delay Time
MOSA	Modular Open Systems Approach
MP&T	Manpower, Personnel and Training
MPM	Major Program Manager
MTBF	Mean Time Between Failure
MTTR	Mean Time to Repair
N	
NAVSEA	Naval Sea Systems Command
NCOW RM	Net-Centric Operations and Warfare Reference Model
NDI	Non-Developmental Item
NEPA	National Environmental Policy Act
O	
OA	Open Architecture

OAAT	Open Architecture Assessment Tool
OPSITs	Operational Situations
OSD	Office of the Secretary of Defense
OT&E	Operational Test and Evaluation
OV	Operational View
P	
PART	Program Assessment Rating Tool
PBA	Performance Based Agreements
PBL	Performance Based Logistics
PCA	Physical Configuration Audit
PDR	Preliminary Design Review
PEO	Program Executive Office/Officer
PESHE	Program Environmental Safety and Health Evaluation
PHS&T	Packaging, Handling, Storage and Transportation
PIDS	Prime Item Development Specification
PM	Project Manager
PMO	Program Management Office
POA&M	Plan of Action and Milestones
POM	Program Objective Memorandum
PPP	Program Protection Plan
PR	Program Review
PRR	Production Readiness Review
PSC	Preferred System Concept
PSP	Product Support Plan
Q	

QAP	Quality Assurance Plan
R	
RCIP	Rapid Capability Improvement Program
RFA	Requests For Action
RFI	Request For Information
RFID	Radio Frequency Identification
RMA	Reliability, Maintainability, and Availability
RMP	Risk Management Plan
ROM	Rough Order of Magnitude
S	
SCI	Software Configuration Item
SDD	Software Design Description
SDF	Software Development Folder
SDP	Software Development Plan
SE	Systems Engineering
SEMP	Systems Engineering Master Plan
SEOM	Systems Engineering Operations Manual
SEP	Systems Engineering Plan
SETR	Systems Engineering Technical Review
SFR	System Functional Review
SIPM	Systems Integration Program Manager
SME	Subject Matter Expert
SoS	System of Systems
SoSE	System of Systems Engineering
SPS	Software Product Specification

SRD	Systems Requirements Document
SRR	System Requirements Review
SRS	Software Requirements Specification
SSDD	System/Subsystem Design Description
SSMP	Supply Support Management Plan
SSP	System Safety Plan
SSPM	Software Standards and Procedures Manual
SSR	Software Specification Review
SSS	System/Subsystem Specification
SVR	System/Software Verification Review
STAR	System Threat Assessment Report
STD	Software Test Description
STP	Software Test Plan
SUT	System Under Test
SV	System View
SW	Software
SW CDR	Software Critical Design Review
SW PDR	Software Preliminary Design Review
SW IR	Software Increment Review
SYSCOM	System Command
T	
T&E	Test & Evaluation
TA	Technical Authority
TD	Technical Director
TIM	Technical Interchange Meeting

TLRs	Top-Level Requirements
TPM	Technical Performance Measure or Measurement
TRAP	Technical Review Action Plan
TRB	Technical Review Board
TRM	Technical Review Manual
TRPPM	Training Planning Process Methodology
TSC	Theater Surface Combatants
TRL	Technology Readiness Level
TRR	Test Readiness Review
TV	Technical Standards View
TW	Technical Warrant
TWH	Technical Warrant Holder
U	
UID	Unique Identification
UUT	Unit Under Test
V	
V&V	Verification and Validation
W	
WBS	Work Breakdown Structure

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APPENDIX B: DOCUMENT AND TECHNICAL REVIEW DEFINITIONS

Note: any one program will use only a subset of these documents, although certain of them are required by policy and/or best practice. This list is provided to ensure completeness, not as a requirement for implementation.

DOCUMENTS:

Architecture Products. The DoD Architecture Framework (DoDAF) provides guidance on development of architecture descriptions through an integrated set of views, including Operational Views (OVs), System View (SVs), Technical Standards Views (TVs), and All Views (AVs). It defines the content for each view and summarizes when to generate and review each view and how applicable each view is to a specific lifecycle stage or key acquisition process. The technical review agendas in Appendix C define when each view should be created.

Capability Development Document (CDD). CDDs are used for Milestone B decisions. Each CDD will have a set of validated key performance parameters (KPPs) that will apply only to that increment of the evolutionary acquisition strategy. CJCSI 3170 discusses CDDs and their purpose in the requirements generation process.

Capability Production Document (CPD). CPDs are used for Milestone C decisions to document the as-built capabilities for a system. CPDs evolve from CDDs. CJCSI 3170 discusses CPDs and their purpose in the requirements generation process.

Certification and Accreditation (C&A) Plan. The C&A Plan identifies the approach, participants, and schedule of the C&A activities needed to achieve Authority to Operate (ATO).

Configuration Management (CM) Plan. The CM Plan describes the process for establishing and maintaining consistency of a product's performance, functional, IA and physical attributes with its requirements, design and operational information throughout its lifecycle.

Critical Item Development Specification (CIDS). The CIDS is a detailed specification applicable to a CI below the level of complexity of a prime item but which is critical from an engineering or logistics viewpoint.

a. A CI is engineering critical where one or more of the following applies:

   i. The technical complexity warrants an individual specification.

   ii. Reliability of the CI significantly affects the ability of the system or prime item to perform its overall function, or safety is a consideration.

   iii. The prime item can only be evaluated in a separate evaluation.

   iv. The CI impacts the IA robustness of the prime item.

b. A CI is logistics critical where the following apply:

i. Repair parts will be provisioned for the item.

ii. The contracting agency has designated the item for multiple source procurement.

iii. The part is COTS and may not be available throughout the lifecycle of the system and alternatives may need to be developed (could affect both software and hardware integration).

Design Reference Mission (DRM). The DRM provides comprehensive and authoritative Operational Situations (OPSITs) within the context of a joint force campaign that stress all aspects of the mission area designs in a way similar to that anticipated by warfighters. Four key features of the DRM are: (1) Threat Characterization; (2) OPSITs; (3) Composite Campaign; and (4) Mission Profiles.

Engineering Technical Review (ETR). An ETR is an artifact review held prior to a formal technical review. Its focus is narrower than a formal technical review, in that it reviews one or more specific artifacts that will contribute to the formal technical review assessment and it does not focus on the other entrance or exit criteria defined for the formal technical review. ETR participants are drawn from developer and TRB staff, usually a subset of the TRB that specializes in the area of the specific artifacts being reviewed. Comments resulting from the ETR are adjudicated and tracked to closure. Many of the comments are incorporated into the artifact prior to the formal technical review. The rest become part of the completion plan to exit the formal technical review.

Formal Qualification Test (FQT) Description. The FQT Description contains the detailed test specifications, procedures, test cases, and steps necessary to execute the FQT Plan.

Hardware Configuration Item Test Plan (HWCITP). The HWCITP describes the testing objectives, priorities, methods, specifications, traceability, metrics, and evaluation criteria for each hardware CI test.

Hardware Development Plan (HDP). The HDP provides a detailed description of the hardware development approach to be followed by the developers. The HDP is submitted initially as a part of the offeror's proposal, and after award is submitted to the Government for approval to serve as the command media for hardware development.

Human Systems Integration (HSI) Plan. The HSI Plan describes how Human Systems Integration (HSI) objectives and requirements contribute to readiness, force structure, affordability, performance effectiveness, and achievement of wartime operational objectives. The HSI Plan while balancing performance, schedule, and cost, establishes the overall approach and management plan for the application of human related requirements from the domains of manpower, personnel, training, human factors engineering and occupational health and safety as they apply to the design of systems. The HSIP describes how the Program Manager (PM) will meet HSI programmatic requirements and standards.

Initial Capabilities Document (ICD). The ICD captures capability shortfall in terms of integrated architectures; identifies critical capabilities to satisfy the requirement and best joint solutions. CJCSI 3170 discusses ICDs and their purpose in the requirements generation process.

Information Support Plan (ISP). The ISP includes the identification and documentation of information needs, infrastructure support, IT and NSS interface requirements and dependencies focusing on net-centric, interoperability, supportability and sufficiency concerns (DODI 4630.8).

Integrated Architecture. Integrated Architecture (per DoDD 4630.5) is an architecture consisting of multiple DoDAF views that facilitates integration and promotes interoperability FoS)/ SoS and compatibility among related architectures. An architecture description is defined to be an integrated architecture when products and their constituent architecture data elements are developed such that architecture data elements defined in one view are the same (i.e., same names, definitions, and values) as architecture data elements referenced in another DoDAF view. In this document "system architecture" refers to the systems view of the integrated architecture.

Intellectual Property (IP). IP requires permission or license for use; it includes inventions, trademarks, patents, industrial designs, copyrights, and technical information including software, data designs, technical know-how, manufacturing information and know-how, techniques, Technical Data Packages, manufacturing data packages, and trade secrets.

Integrated Product Team (IPT). An IPT is a formally chartered, multidisciplinary group of people, who are collectively responsible for delivering a defined product or process over a specified period of time.

Interface Control Document. The Interface Control Document, Data Item Description (DID) (DI-CMAN-81248A), depicts physical, functional, and performance interface characteristics of related or co-functioning items (CIs or components). An Interface Control Document is prepared to: establish and maintain compatibility between items having a common boundary, coordinate and control interfaces between co-functioning systems through change control, and record and communicate design decisions to participating design activities.

Interface Design Description (IDD). The IDD, DID (DI-IPSC-81436), describes the interface characteristics of one or more systems, subsystems, Hardware CIs (HWCIs), Software Configuration Items (SCI)s, manual operations, or other system components. An IDD may also describe any number of interfaces. The IDD can be used to supplement the SSDD DID (DI-IPSC-81432) or SDD DID (DI-IPSC-81435). The IDD and its companion IRS serve to communicate and control interface design decisions.

Interface Requirements Specification (IRS). The IRS, DID (DI-IPSC-81434), specifies the requirements imposed on one or more systems, subsystems, HWCIs, SCIs, manual operations, or other system components to achieve one or more interfaces among these entities. An IRS can cover any number of interfaces. The IRS can be used to supplement the SSDD and SRS as the basis for design and qualification testing of systems and SCI.

Key Performance Parameters (KPPs). KPPs are a critical subset of the performance parameters found in the DoD 5000 Series and are included in the performance portion of the Acquisition Program Baseline (APB). Each KPP has a threshold and an objective value. KPPs represent those capabilities or characteristics so significant that failure to meet the threshold value of performance can be cause for the concept or system selected to be re-evaluated or the program to

be reassessed or terminated. The Joint Requirements Oversight Council (JROC) validates KPPs for ACAT I and ACAT IA programs.

Manufacturing Plan. The Manufacturing Plan documents methods by which design is to be built. The Manufacturing Plan contains sequence and schedule of events at contractor and subcontractor levels that define use of materials, fabrication flow, test equipment, tools, facilities, and personnel. It reflects consideration and incorporation of manufacturing requirements in the design process and includes identification and assessment of design facilities. For systems and components that are designed to higher Evaluated Assurance Levels (EALs), the Manufacturing Plan identifies the physical and personnel controls needed in the manufacturing process to meet the designated level of IA robustness.

Naval Training Systems Plan (NTSP). The NTSP documents the training requirements for a system and is developed by the program office and approved by OPNAV N15 since it addresses manpower, personnel and training (MP&T) requirements for the system.

Peer Review. The peer review is a process for Component-based developments that is used to judge candidate technologies, administer testing, and adjudicate requirements conflicts. Peer reviews are conducted by industry IPTs under Government lead perform the component-to-component comparisons for best-of-breed selections; accept candidate functional implementations; review their development methodologies for sharability and reusability; then, determine the best candidate modules to pass forward for the next wave of functional integration.

PEO IWS/NAVSEA 05 Systems Engineering Operations Manual (SEOM). The System Engineering Operations Manual is a practical guidance document to be used by all personnel providing support or products to PEO IWS and NAVSEA 05. It outlines a disciplined Systems Engineering (SE) process for projects; describing unique elements such as project technical baselines and their respective specification requirements and provides an overview of Certification process requirements.

Prime Item Development Specification (PIDS). The PIDS documents system/subsystem requirements from the mission area SRD. PIDS are reviewed at the SFR to ensure all required systems engineering tradeoffs and analyses have been conducted and ensure all performance, cost and schedule milestones will be met with the minimum amount of risk. Additional information on PIDS can be found in PEO TSC 4810.3, Guidance for Prime Item Developments Specification Preparation.

Quality Assurance Plan (QAP). The QAP provides a detailed action plan describing all actions necessary to provide confidence that adequate technical requirements are established, that products and services conform to established technical requirements, and that satisfactory performance is achieved.

Risk Management Plan (RMP). The RMP provides a plan for identification, assessment, mitigation, and tracking of risks (e.g., issues, problems, undefined concerns).

Software Design Description (SDD). The SDD, DID (DI-IPSC-81435), describes the design of a SCI. Descriptions of the SCI-wide design decisions, the SCI architectural design, and the detailed design needed to implement the software are contained in the SDD. The SDD is used as

the basis for implementing software. It provides the acquirer visibility into the design and provides information needed for software support. SDDs may be supplemented by IDDs. For security-critical software items, the SDD describes the partitioning, isolation, and design of high-robustness functions.

Software Development Plan (SDP). The SDP provides a detailed description of the software development approach to be followed by the developers. The SDP is submitted initially as a part of the offeror's proposal, and after award is submitted to the Government for approval to serve as the command media for software development.

Software Product Specification (SPS). The SPS, DID (DI-IPC-81441), contains or references the executable software, source files, and software support information, including "as built" design information and compilation, build, and modification procedures, for a SCI. The SPS can be used to order the executable software and/or source files for a SCI and is the primary software support document for the SCI. Note: Different organizations have different policies for ordering delivery of software. These policies should be determined before applying the DID.

Software Requirements Specification (SRS). The SRS, DID (DI-IPSC-81433), specifies the functional and IA requirements for a SCI and the methods to be used to ensure that each requirement has been met. Requirements pertaining to the SCI external interfaces may be presented in the SRS or in one or more interface IRS referenced from the SRS. The SRS, possibly supplemented by the IRS, is used as the basis for design and qualification testing of a SCI.

Software Test Description (STD). The STD describes the test preparations, test cases, and test procedures to be used to perform qualification testing of a SCI or a software system or subsystem. For incorporation in the STD, test cases need to be defined prior to the CDR and the procedures need to be defined prior to the TRR.

Software Test Plan (STP). The STP describes plans for qualification testing of SCIs and software systems. It describes the software test environment to be used for the testing, identifies the tests to be performed, and provides schedules for test activities. There is usually a single STP for a project. The STP enables the acquirer to assess the adequacy of planning for SCI and, if applicable, software system qualification testing.

Systems Engineering Plan (SEP). The SEP establishes the overall plan for the SE management requirement for the system/subsystem, SCIs, and HWCIs during the total system life cycle of the project. The purpose of the document is to identify and describe the overall policies and methods for the SE management. The SEP should address HSI or a separate HSI Plan must be developed in consonance with the SEP. The SEP should be prepared in accordance with the latest version of the SEP Preparation Guide.

Systems Requirements Document (SRD). The SRD is the top-level description of technical performance (hardware, software and human) and IA requirements for a major capability and the methods used to ensure that each requirement has been met. The SRD describes the mission areas and helps to guide and focus early phases of system development. The functional baseline is documented in the SRD. The SRD specifies the requirements for a system or subsystem and

the methods to be used to ensure that each requirement has been met. Requirements pertaining to the system or subsystem's external interfaces may be presented in the SRD or in one or more IRSs. All functional requirements shall be traceable to high-level capabilities and shall be verifiable by a specified test method. All elements of the SRD will be reviewed at the SRR and the follow-on SFR. PEO TSC Instruction 4810.1 provides guidelines for the development of the SRD.

System/Subsystem Design Description (SSDD). The SSDD, DID (DI-IPSC-81432), can be used as a guide to SSDD development. The SSDD describes the system/subsystem-wide design and the architectural design of a system/subsystem. Requirements pertaining to the system or subsystem's external interfaces may be presented in the SSDD or in one or more IRSs referenced from the SSDD. Where the SSDD does not itself contain interface or database information, it shall incorporate the relevant IDDs and Database Decision Descriptions (DBDDs) by reference. The SSDD is used as the basis for design and qualification testing of a system or subsystem.

Test and Evaluation Master Plan (TEMP). The TEMP documents the overall structure and objectives of the test and evaluation (T&E) program. It provides the framework within which to detail T&E plans. It documents schedule and resource implications associated with the T & E program. The TEMP identifies the necessary developmental test and evaluation (DT&E), operational test, (OT), and live fire test and evaluation (LFT&E) activities. It relates program schedule, test management strategy and structure, and required resources to: (1) critical operational issues (COIs); (2) critical technical parameters (CTPs); (3) KPPs and operational performance parameters (threshold and objective criteria) derived from the DoD 5000 Series; (4) evaluation criteria; and, (5) major decision points.

Trade and Design Studies. Trade studies define concepts that best meet mission needs and IA needs and fine-tune selected concepts during the design process. The purpose of trade studies is to integrate and balance all engineering including human and IA requirements in the design of a system. A properly done trade study considers risks associated with alternatives. Trade/design studies ensure that user's needs are prioritized, alternative system configurations are assessed, and test methods are selected.

Work Breakdown Structure (WBS). The WBS is a product-oriented listing, in family tree order, of the hardware, software, HSI, services and other work tasks, which completely define a product or program. The listing results from project engineering during the development and production of a defense material item. A WBS relates the elements of work to be accomplished to each other and to the end product. For a more comprehensive description of the WBS see Work Breakdown Structures for Defense Materiel Items, MIL-HDBK-881A (Section 1.2 through 1.4.1).

SYSTEMS ENGINEERING TECHNICAL REVIEWS:

Initial Technical Review (ITR).The ITR is a multi-disciplined technical review to support the Program's initial Program Objective Memorandum (POM) submission. This review, conducted prior to POM, is held in advance of the actual cost estimate submission to allow time for issue resolution and proper executive level concurrence on process and results. The ITR ensures that the basis for the project's technical approach is of sufficient rigor to support valid cost estimation and enable independent assessment of that estimate.

Alternative System Review (ASR). The ASR is a multi-disciplined product and process assessment conducted at the system level to assess the emerging requirements against the user's needs and expectations and the alignment of system concepts with the external environment (systems, information networks, and infrastructure). The ASR will also assess any alternative system solutions to ensure the preferred system will be affordable, operationally effective, and can be developed in a timely manner and at an acceptable level of risk.

System (or Subsystem) Requirements Review (SRR). The SRR is a multi-disciplined product and process assessment conducted to assess the state of the requirements as defined for the system or subsystem as a result of the requirements analysis activity to ensure that defined system and performance requirements are consistent with cost (program budget), schedule (program schedule), and other system constraints and that the risk of proceeding further with the program are understood and acceptable. For iterative development approaches, the initial SRR reviews the total set of requirements. For each subsequent SRR, the focus is on new and updated requirements, or on requirements added in accordance with a build plan.

System Functional Review (SFR). The SFR is conducted to review and approve the technical description of the system, including its system requirements and architecture. The SFR assesses if all system requirements and functional performance requirements are defined and allocated to system elements and are consistent with cost, schedule, and other system constraints. It also determines that the risks of proceeding further with the program are understood and acceptable. Generally, the SFR assesses the system functional requirements as captured in system specifications and ensures that all required system performance is decomposed and defined. System performance is decomposed and traced to lower-level subsystem hardware, software, and human requirements. The SFR determines if the system's functional definition is decomposed to an appropriate level and that the developer is prepared to start preliminary design. A successful System SFR establishes the Functional Baseline of the system.

System and/or Subsystem Preliminary Design Review (PDR). The PDR is conducted to assess the state of the system architecture and the preliminary system design as captured in development specifications for each configuration item in the system; validate technology maturity and technical development plans with mature technology and to ensure that each function in the functional baseline is allocated to one or more system configuration items. Upon successful completion of the System PDR, the Allocated Baseline is established. Since the system architecture is defined by the collection of subsystems and CIs that form the system, the system PDR is a significant program decision point which allows the acquisition authority to assess progress; it should be conducted only after each subsystem and CI has had an opportunity to settle on a stable set of requirements.

System and/or Subsystem Critical Design Review (CDR). The CDR is conducted to assess the emerging detailed design of the system as captured in product specifications for each configuration item in the system (product baseline), and to ensure that each product in the product baseline has been captured in the detailed design documentation. Product specifications for hardware enable the fabrication of configuration items and may include production drawings. Product specifications for software (e.g. SDD) enable coding of a Computer Software Configuration Item (CSCI). The CDR is a significant program decision point that allows the acquisition authority to assess progress. In projects where multiple CDRs are planned, the first

CDR establishes an initial Developmental Baseline (optional). Subsequent CDRs should be held to coincide with major system builds.

System and/or Subsystem Test Readiness Review (TRR). The TRR is conducted to ensure that the system or subsystem under review is mature enough to proceed into formal test. Because formal testing is expensive, it is important to verify that the test can be conducted with a reasonable likelihood of success. TRR considers if the system is under configuration control and the planned test objectives, methods, procedures, and statistical analyses have been approved. The TRR also examines lower-level test results, test plans, test objectives, test methods and procedures to verify the traceability of planned tests to program requirements and to ensure that required test resources have been properly identified and coordinated.

System Verification Review (SVR) / System Functional Configuration Audit (FCA). The FCA is a formal review/audit audit to validate that the development of the system has been completed satisfactorily and that CIs have achieved the performance and functional characteristics specified in the functional and allocated baseline as demonstrated by the formal test just completed. The SVR focuses its assessment on the final system product, as evidenced in the production configuration, and determines if it meets the functional requirements documented in the functional, allocated, and product baselines. Successful completion of a SVR/FCA establishes the Product Baseline.

Production Readiness Review (PRR). The PRR is used in major acquisitions with substantial hardware/system development to assess if the system under review is ready for production and if the producer has accomplished adequate production planning without incurring unacceptable risks that breach thresholds of schedule, performance, cost or other established criteria. The PRR considers the full, production-configured system to determine that it correctly implements all system requirements and maintains traceability of final system requirements. The PRR also considers the readiness of manufacturing processes, quality systems, and production planning. A successful PRR creates a satisfactory basis for proceeding into Low-Rate Initial Production (LRIP) and Full Rate Production (FRP). The PRR may be conducted concurrently with the SVR or, for complex systems, may be conducted incrementally to identify and mitigate final design and production risks.

System Physical Configuration Audit (PCA). The PCA is conducted to verify that the as-built CIs for a system correlate to the body of artifacts used to represent each item (i.e., the documentation, the item components (including software code), the test results, and all other related items are consistent and complete) and to verify that all related design documentation matches the system specifications. Additionally, the PCA confirms that the manufacturing processes, quality control system, measurement and test equipment, and training are planned, followed, and controlled.

Software Specification Review (SSR). The SSR assesses the state of the requirements as defined for each CI as a result of the software requirements analysis activity. For iterative development approaches, the initial SSR reviews the total set of requirements, while in subsequent SSRs, the focus is on new and updated requirements, or on requirements added in accordance with a build plan.

Software Preliminary Design Review (SW PDR). The SW PDR assesses the state of the architectural design for each software CI. For iterative development approaches, the initial PDR reviews the initial top-level design. For each subsequent PDR, the focus is on changes to the top-level design necessitated by changed requirements and/or updates based on feedback from design work.

Software Critical Design Review (SW CDR). The SW CDR assesses the state of the detailed design for each software CI. For iterative development approaches, the initial CDR reviews the initial detailed design. For each subsequent CDR, the focus is on changes to the detailed design necessitated by changed requirements and/or updates based on feedback from design work.

Software Increment Review (SW IR). The SW IR is performed after each iteration, when the software is developed using an iterative approach. It focuses on the results of the previous iterations, including impacts to the requirements and the design, and reviews the plans for the next iteration, including any changes required by lessons-learned.

Software Test Readiness Review (SW TRR). The SW TRR is performed when a Formal Qualification Test is to be performed on the SW CI. TRRs are conducted to verify that the software CI is sufficiently mature to proceed to FQT. This is optional, since not all programs will perform individual CI level qualification testing. Some programs may test software CIs as part of a larger system configuration.

Software Verification Review (SVR). The SVR is performed when a FQT is conducted on the CI. It focuses on the results of the FQT and verifies that the CI has successfully implemented the allocated requirements.

Hardware Preliminary Design Review (HW PDR). The HW PDR assesses the state of the top-level design for each hardware CI, including interface definitions, error budgets, fault detection (FD) and fault isolation (FI) concepts, and integration impacts.

Hardware Critical Design Review (HW CDR). The HW CDR confirms detailed design and test plans are complete, the design is producible, and the hardware drawings are ready for fabrication.

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APPENDIX C: SPECIFIC TECHNICAL REVIEWS

TYPES OF REVIEWS:

At the system and subsystem level, the following types of reviews are described in this TRM. They are:

a. Initial Technical Review (ITR)

b. Alternative System Review (ASR)

c. System (Subsystem) Requirements Review (SRR)

d. System (Subsystem) Functional Review (SFR)

e. System (Subsystem) Preliminary Design Review (PDR)

f. System (Subsystem) Critical Design Review (CDR)

g. Test Readiness Review (TRR)

h. Functional Configuration Audit (FCA) / System Verification Review (SVR)

i. Physical Configuration Audit (PCA)

At the Configuration Item level, six types of reviews are described in this TRM. They are:

a. Software Specification Review (SSR)

b. Hardware Preliminary Design Review (HW PDR)

c. Software Preliminary Design Review (SW PDR)

d. Hardware Critical Design Review (HW CDR)

e. Software Critical Design Review (SW CDR)

f. Software Increment Review (SW IR)

For the CI level, the descriptions of the TRR, FCA, SVR, and PCA also apply.

TYPES OF PROJECTS:

TABLE C-1. ATTRIBUTES OF PROJECTS

Type of Project	Attributes
Major ship baselines	o Fixed end dates driven by shipyard schedules o Early hardware decisions constrain later software scope and architecture changes o Selection / technology refresh of computing electronics desired as late in the development cycle as possible
Advanced Capability Build (ACB)	o Periodic (e.g., 2 years) hardware and/or software upgrades with certification and test events before delivery o Content is pre-planned but build may be delivered with less than planned capability if problems arise o Software-only ACBs may field rapidly, ACBs with hardware changes will have longer fielding schedules
Capability Development ▪ Planned upgrade (e.g., budgeted effort) ▪ Rapid Capability Improvement Program (RCIP) ▪ Science and Technology (S&T) Transition	o Will generally start at the beginning of a fiscal year when funding is available o Variable duration – will fold into an ACB when ready o Will be tested individually, but will be certified as part of an ACB
Technology Insertion	o Computing environment (Hardware and Software) upgrade to resolve obsolescence issues or provide more processing capability

TOPICS COMMON TO TECHNICAL REVIEWS

Different technical reviews will include many of the same basic set of topics. They will differ based on the items being reviewed, and on when the review is conducted during the development effort. In particular, the entrance and exit criteria will be different for each review. There will also be variations in the topics presented and discussed. The set of common topics is described in this section. Specific guidance for how these topics are tailored for each review is presented in this appendix.

The common topics to be presented and discussed during a review are:

Purpose and Objective of the Review. A description of the purpose and objective of the review will be provided as well as the baseline to be established at completion of the review, when applicable. This will vary depending on which review is being conducted. It is very important that this limit the scope of the review to ensure that the review remains focused on its purpose and objective.

Identification of the Items to be Reviewed. A concise identification of the specific system element(s) being reviewed will be provided. This will vary from individual CIs, to subsystems, to the system itself, and finally to the SoS/FoS environment in which the system will operate. The placement of the item(s) under review needs to be shown within the context of its(their) operating environment as described in the System Landscape.

System Landscape. The System Landscape provides a brief overview of the total system with a focus on where the items under review fit into the overall system, as well as its role in the system's larger context (FoS/SoS). This brief overview is necessary to ensure that review attendees are all at the same level of familiarity and have the same perspective regarding the placement and role of the items being reviewed. This is important not only for those who do not have a day-to-day involvement with the development, but also for those who have a specific focus within the system to ensure that they maintain a system perspective. This overview is not intended to be a comprehensive discussion of the landscape, but rather a summary overview to establish a common perspective. Topics to be covered include (but are not limited to):

a. System Environment – A description of the environment in which the overall system will operate, including:

    i. The intended role and mission of the system

    ii. The operational environment of the system, including other systems with which it must interact/interoperate, and the associated interfaces

    iii. An overview of typical and important operational scenarios/usage patterns that the system will encounter

b. System Requirements – A description of the system requirements, their source, and their allocation to the items under review, including:

i. An overview of the requirements

ii. The allocation of system requirements to items under review

iii. System interfaces, including user interfaces/displays

iv. Requirements changes made since the last review (Requirements changes must be presented in the context of what specific quantitative performance requirements have been added, deleted, or changed since the last review and how those changes impact overall system performance)

v. Important requirements such as IA/security, safety critical, open systems conformance, and quality requirements

c. System Build Plans – A description of the build plan for the system, including:

i. The major capabilities to be provided in each system build and description of how requirements are assigned to builds

ii. Changes to this allocation subsequent to previous reviews

iii. Projected availability for testing

iv. Identification of any system builds that are intended for deployment

d. System Architecture – A description of the overall architecture of the system, including:

i. A description of the design layers of the system architecture

ii. An identification of all subsystems and CIs (SW and HW) and their relationships, including a description of their connections / interfaces and an architectural diagram that specifies where in the system the HW and SW will exist, down to the CI level

iii. A description of the source of all components (newly developed, modified from existing assets, COTS, Non-Developmental Items (NDI)) as well as a description of the IP rights assigned to the Government for these components

iv. A description of the degree of openness of the system, including the standards to which internal interfaces conform, the level of modularity, the reuse of existing assets in the system, and the intended future reuse of system components

v. A description of the IA technical and certification strategy defining the basic elements and how the individual system or SoS fits within the IA strategies of the other interfacing elements (other systems, SoS and the platform) to achieve an IA end –to- end defense in depth construct as required by ref (i)

Entry and Closure Criteria. An overview of the entrance criteria for the review, and an assessment by the TRB of whether the entrance criteria have been met shall be provided. Also, an overview of the closure criteria shall be provided to allow attendees to consider them as the review proceeds.

Summary of Findings and Issues. This section should identify the reviewers who participated on the TRB and in TIMs, and a description of the results of the review. This should include a description of the major findings and identification of outstanding issues. Results should also include summary statistics of comments received and disposition status of those comments. Recommended plans for resolving significant issues should be addressed. The PM should also provide a recommendation to the TRB Chairman as to whether he feels the exit criteria have been satisfied.

Program Plans and Current Status. A description of the overall program planning that emphasizes schedule and expected products shall be provided. A status report on current progress relative to the IMP, comparing expectations to actual work accomplished will be given. This report will include details from the IMS, and highlight any changes from this schedule, for both past efforts as well as future planning. Describe and report the metrics used to track technical progress. Provide assessments of the artifacts that are being developed and comparisons to planned attributes. Describe and report the metrics used to track technical attributes and quality.

Process Discipline. A description of the processes defined for development (including systems, software, and hardware), and an assessment of how closely actual effort has conformed to these processes will be provided, including a description of any development process changes since the last review and since program inception. Information about the SEP, HDP, Software Development Plan (SDP), CM Plan, Quality Assurance (QA) Plan, TEMP, System Safety Plan (SSP), Information Assurance (IA) Plan/Program Protection Plan (PPP), HSI Plan, Risk Management Plan (RMP) and any other plans that describe the development approach, descriptions of any process improvement activities performed, and any resulting process changes must be included.

Risk. Risk must provide a description of current risks associated with the item under review, including potential impacts and planned mitigation actions. It must also include overall system risks as well as SW and HW risks. Describe the metrics used to monitor risk and trigger events.

Assessment Against Exit Criteria. A review of the exit criteria together with an assessment of whether the review has demonstrated achievement of these criteria must be provided. The TRB Chairman makes the final assessment and provides that assessment to the PM. The assessment shall include a review of any RFA/RFIs assigned and that are required to fully meet all exit criteria that were not fully addressed.

SYSTEM AND SUBSYSTEM LEVEL REVIEW GUIDELINES:

Initial Technical Review (ITR)

A. ITR – Overall Guidance

1. Objective - The objective of the ITR is to support a proposed program's initial POM submission. This review is intended to ensure that the proposed program's technical approach is of sufficient rigor to support a valid (acceptable cost risk) cost estimate and enable an independent assessment of that estimate by cost, technical and program management subject matter experts. Additionally, the ITR ensures that historical and prospective cost drivers cost have been quantified to the maximum extent and that the range of uncertainty in these parameters have been captured and reflected in the proposed program's cost estimates.

2. Scope - The ITR shall consider the system as a whole and must properly capture the validated operational capabilities and performance constraints. The ITR assesses the envisioned requirements and conceptual approach of a proposed program and verifies that the requisite analyses of alternatives, capability assessments, modeling and simulation, research, development, test, engineering, logistic, and programmatic bases for the program reflect the complete spectrum of technical and developmental challenges and risks. The enabling/critical technologies, constraints, and cost/risk drivers are identified and quantified.

3. Timing - The ITR should be conducted well in advance of the actual POM or Program Review (PR) cost estimate submission to allow time for issue resolution and proper executive level concurrence on process and results. While the ITR may first be accomplished well in advance of program initiation or even prior to an Initial Capabilities Document (ICD) or Capability Development Document (CDD), the ITR may be repeated as necessary to support POM or PR cycles, major changes in scope, breach of Acquisition Program Baseline Agreement, or following ICD or CDD approvals.

4. Documentation - Documentation shall be provided to the TRB in enough detail to ensure that a Program's technical approach is of sufficient rigor to support a valid (acceptable cost risk) cost estimate and enable an independent assessment of that estimate by cost, technical and program management subject matter experts. Documentation associated with this technical review is summarized in Appendix D of this TRM.

B. ITR – Topics

1. System Landscape - The purpose of this topic is to ensure that the system stakeholders understand the operational need for the proposed program. This overview is necessary because many attendees at the ITR will not have had the luxury of having exposure to development information. At a minimum, the following topics shall be considered as part of the ITR agenda to convey this information.

a. Program Purpose - The proposed program should be described in enough detail to convey the envisioned requirements and conceptual approach.

b. Requisite Analysis of Alternatives - The requisite analyses of alternatives, capability assessments, modeling and simulation, research, development, test, engineering, logistic, and programmatic bases for the program should be described in sufficient detail to ensure that they reflect the complete spectrum of technical and developmental challenges and risks.

c. Enabling/Critical Technologies - The enabling/critical technologies, constraints, and cost/risk drivers of this proposed program should be described in sufficient detail to ensure that all are identified and quantified.

d. Constraints - The constraints and cost/risk drivers of the proposed program should be described in sufficient detail to ensure that all are identified and quantified.

e. Historic Cost Drivers - The historical and prospective drivers of system cost that have been quantified to the maximum extent and the range of uncertainty in these parameters that have been captured and reflected in the cost estimates of the proposed program.

2. System Alternative Concepts - The system concepts that have been under consideration shall be described to convey understanding of the options that have been explored to date. Topics discussed should include alternative concept descriptions in the areas below, as well as topics that convey the Preferred System Concept (PSC) decision-making process and outcome.

a. System Architecture – The preliminary integrated architecture of each alternative concept should be described in enough detail to convey understanding of the partitioned subsystems as well as external and internal interface boundaries. The plan for the Analyses of Alternatives (AoAs) prepared at the appropriate level of detail for this phase of the proposed program should be reviewed. Differences in architectures between concept alternatives should be explained including differences in allocation of tasks between automation and humans and differences in the IA robustness of alternative architectures.

b. Key Technologies - Critical/enabling technologies that are being considered for each alternative concept should be described in regards to performance; the state of the art in the technology area; potential cost of the technology versus alternative manpower costs; and the impact of the technology on personnel, training and product and logistics support.

c. Technology Risks and Abatement Approaches - All key technologies being considered shall be described in terms of risk to the program, human performance and system performance.

d. Performance Assessment Approach - The approach to estimating the performance aspects of the system concepts and their architectures should be defined and reviewed. When available, the ICD should be reviewed

e. Cost Estimates - The basic technical and programmatic guidance, tailored to suit the scope and complexity of the proposed program, which was followed to ensure that all pertinent technical cost drivers are addressed.

f. Operational Impacts - Any key operational considerations that impact the conceptual approach or envisioned requirements of the proposed Program Interoperability Requirements shall be reviewed. Any impacts of the selected technologies, architecture, interfaces, and performance shortfalls or excess upon any external systems, current doctrine, user needs, logistics, or other operational considerations, such as operational environments that are expected to be particularly challenging to human performance, survivability, and health and safety shall be reviewed.

g. IA Impacts – Any key IA considerations that impact cost estimation for the proposed program shall be described.

h. Logistics Impacts - Ensure maintenance and logistics planning and constraints have been considered in determining the Supportability Objectives.

i. HSI Impacts – HSI high driver functions including human-performed activities that impose high demands on manning, required training or advanced skill sets, are labor intensive, impose high HSI risks, high workloads, or high performance complexities, are error prone, require excessive training, or are unsafe. HSI should be initially implemented through a Top Down Requirements Analysis (TDRA) directed at providing the analyzed requirements, allocation concepts, workload estimates, human task models, system metrics, and manpower models necessary for influencing design with human requirements and considerations.

3. System Development Plans – In support of the POM submission, the envisioned requirements and conceptual approach of the proposed Program shall be presented in sufficient detail to: 1) verify that the requisite analyses of alternatives, capability assessments, modeling and simulation, research, development, test, engineering, logistic, and programmatic bases for the program reflect the complete spectrum of technical and developmental challenges and risks; 2) ensure that the enabling/critical technologies, constraints, and cost/risk drivers have been identified and quantified; 3) demonstrate how technical and programmatic guidance have been tailored to suit the scope and complexity of the proposed program; and 4) ensure that all pertinent technical cost drivers are addressed:

a. Requirements Documentation - The status of the requirements documentation (Preliminary Integrated Architectures, Draft AoA, ICD, CDD, Supportability Objectives, Best Materiel Approach(es) and capability assessments) should be described, along with a proposed development and approval schedule.

b. Key System Requirements - The enabling/critical technologies, constraints, and cost/risk drivers are identified and quantified.

c. Development Schedule - An overview of the proposed system development and acquisition schedule (i.e. draft milestone schedule) used as a basis for the cost estimation should be presented. This schedule should clearly demonstrate the modeling and simulation, research, development, test, engineering, logistic, and programmatic bases reflected in the proposed program cost and schedule estimation.

d. Overall Acquisition Cost - The process of estimating the overall acquisition cost (including Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities (DOTMLPF) costs over the lifecycle summarizing whether changes to manpower, facilities personnel and training, or human factors engineering modifications can enhance system to meet capability gap) and plans for completion of this estimate shall be provided and reviewed.

C. ITR – Entrance and Exit Criteria

1. Entrance criteria for an ITR are:

a. AoA Plan, Supportability Objectives, Preliminary Integrated Architecture, and Best Materiel Approach(es) prepared.

b. Preliminary cost estimates for POM submission have been prepared and available 45-60 days (notional) prior to review.

c. Assumptions underlying cost estimation documented to facilitate understanding of the technical approach and its relevance to the proposed POM submission.

d. Plans for risk assessment and mitigation, including evolving external environment have been reviewed to determine feasibility.

e. Preliminary SEP developed and reviewed.

f. Preliminary ISP developed and reviewed

2. Exit criteria for an ITR are:

a. AoA Plan, Supportability Objectives, Preliminary Integrated Architecture and Best Materiel Approaches capture key features of the proposed program, such as system description, technical characteristics, risks, operational concepts, acquisition strategy, IA planning and test and facilities requirements. This documentation is thorough, complete and provides sufficient detail to support the proposed POM submission. This includes identification of key program cost drivers, development costs, production costs, facilities and infrastructure costs, and operations and support costs.

b. Preliminary cost estimates for POM submission have been prepared and reviewed. Assumptions underlying cost estimation have been documented and support the technical approach and its relevance to the proposed POM submission. Appropriate architecture products have been reviewed and, where appropriate, approved.

c. Appropriate architecture products have been reviewed and, where appropriate, approved.

d. Risk assessment and mitigation plans have been reviewed and approved.

e. The Preliminary SEP has been reviewed and updated.

f. The Preliminary ISP has been reviewed and updated.

Alternative System Review (ASR)

A. ASR – Overall Guidance

1. Objective - The objective of the ASR is to analyze and select PSC(s) which: provides a cost effective, operationally effective, and suitable solution to identified needs; meets established affordability criteria; includes manpower and personnel constraints, and can be developed to provide a timely solution to needs at an acceptable level of risk and with acceptable levels of IA.

2. Scope - The ASR shall consider the system as a whole, but may require definition of lower level technologies, risks, and implementation issues at the subsystem or major CI level that critically impact system performance, IA robustness, risk, cost or schedule.

3. Timing - The ASR is conducted late during the Concept Exploration (CE) stage of the Concept and Technology Development Phase of acquisition process. The ASR should be held prior to approval of a set of system technical requirements, but after a set of mission and/or user needs has been established.

4. Documentation - Documentation shall be provided to the TRB that shall describe the alternatives and analyses conducted on those alternatives in enough detail to allow a sufficient review and formation of conclusions by the TRB. Documentation associated with this technical review is summarized in Appendix D of this TRM.

B. ASR – Topics

1. System Landscape - The purpose of this topic is to ensure that the system stakeholders understand the operational need for this system, the needs of the user that should be met by this system, and the operational environment in which this system will be required to operate. This overview is necessary because many attendees at the ASR will not have had the luxury of having continuous exposure to development information. At a minimum, the following topics shall be considered as part of the ASR agenda to convey this information.

    a. System Purpose - The system's mission area(s) should be described in enough detail to convey the understanding of the OPSITs in which this system must perform, survive, and be maintained.

    b. Existing System Shortfalls - Shortfalls of existing systems should be described in order to explain the need for this system acquisition, and to convey the important attributes and limitations of other systems to the development community. Legacy system replacement and HSI shortfalls and constraints should also be addressed. These should include capabilities and limitations of the expected system user(s); the needs of that user in system operation; manpower and personnel constraints; potential improvements in human performance, workload, survivability, health and safety over predecessor system(s); and, the results of any applicable functional needs analysis/functional solutions analysis.

c. Threat/Targets - The threats and/or targets of this system should be described in sufficient detail to understand the challenges presented to the system in terms of its mission and/or survivability.

d. Design Reference Mission (DRM) - The development and status of the systems design-to set of scenarios, campaigns, situations, and threat/target design-to characterization should be described in order to convey the utilization of the DRM in the context of this system's development, as well as review its status to assure progress.

e. Operational Requirements Status - The status of a documented and approved set of operational requirements should be described, with key operational requirements reviewed to gain a context for performance estimation while addressing manpower, personnel, and training optimization.

f. Operational Architecture – A set of OVs should be available and reviewed for each mission area that will be the focus of subsequent system development. These views may be system-specific or may be developed for a mission-area in which the system is a participating element. The following views should be available to support the ASR:

   i. AV-1 – Overview and Summary Information – identifies the scope, purpose, intended users, and operational environment for the mission area or for the system and each applicable mission area for which it will be a participating node

   ii. AV-2 – Integrated Dictionary – captures the definition of all terms used in the other architecture view products

   iii. OV-1 – Operational Concept Graphic – shows the operational concept for each mission area for which the system will be a participant

   iv. OV-2 – Operational Node Connectivity Description – describes the information need lines between operational nodes for each applicable mission area for which the system will be a participant

   v. (Optional) OV-3 – Operational Information Exchange Matrix – shows the operational data elements and related attributes that need to flow between operational nodes. This view is used when the information exchanges are too complex to show in an OV-2.

   vi. OV-4 – Organizational Relationship Chart – shows the operational nodes and organizational relationships between the nodes which will be controlling or using the system or acting on information from the system

   vii. OV-5 – Operational Activity Model – shows the operational activities required to perform the mission areas supported by the system, based on the Unified Joint Task List

viii. OV-6c – Operational Event Trace Description – shows sequences of activities required to execute a given mission and responsible operational nodes (as identified in the OV-2) for performing each activity

ix. OV-7 – Logical Data Model – defines the meaning of, and the relationships between, the data that pertains to the mission area

g. When applicable (e.g., SoS applications), the following should be addressed:

i. SoSE IPT

ii. DoD net-centric strategies

iii. DoD Data Strategy

iv. DoD IA Strategic Plan

v. DoD Enterprise Services Strategy

vi. Government Enterprise Strategy (GES)

01. Net-Centric Operations and Warfare Reference Model (NCOW RM)

02. Baseline Comparison System (BCS)

03. AoA performed at a system level

04. Performance Based Agreements (PBA)

- System level performance metrics
- Warfighter requirements

05. Support Concepts

- Each design alternative
- Sensitivity analyses
- Initial and recurring logistics resources included in AoA

06. Performance, life cycle cost, logistics footprint, and risk for each system

07. Supportability

- Logistics support
- Life Cycle SE approach

- Interoperability requirements
- Risks and mitigation plans

08. Training Planning Process Methodology (TRPPM)

09. Support Equipment:

- Support equipment strategies and diagnostics concepts
- AoA systems concepts reflects trade-offs between Built In Test (BIT), other on board diagnostics, Automatic Test Equipment (ATE), and manual testing

2. System Alternative Concepts - The system concepts that have been under consideration shall be described to convey understanding of the options that have been explored to date. Topics discussed should include alternative concept descriptions in the areas below, as well as topics that convey the PSC decision-making process and outcome.

   a. System Architecture - The system architecture of each alternative concept should be described in enough detail to convey understanding of the partitioned subsystems as well as external and internal interface boundaries. Analyses of Alternatives (AoAs) prepared at the appropriate level of detail for this phase of the program should be reviewed. Differences in architectures between concept alternatives should be explained including differences in allocation of tasks between automation and humans and differences in the IA robustness of alternative architectures. Plans for the development of products associated with architecture views should be defined and reviewed. Whether the PSC and all alternative system concepts chosen to proceed into the technology development phase are aligned with the Net-Centric Operational and Warfare Functional Concept and the Global Information Grid (GIG) must be determined (where applicable). The degree of OA (openness) of the emerging system shall be assessed using the Open Architecture Assessment Tool (OAAT), as shall its availability and potential for component reuse. A modular Open System Approach (MOSA) may be performed using the Program Assessment and Rating Tool (PART) in lieu of the OAAT. Any tradeoff and market analysis decisions made shall be critiqued and any IP issues impacting reuse shall be addressed as design and implementation proceed (e.g., a need to customize proprietary COTS products).

   b. Key Technologies - Key technologies that are being considered for each alternative concept should be described in regards to performance; the state of the art in the technology area; potential cost of the technology versus alternative manpower costs; and the impact of the technology on personnel, training approaches, concepts, devices and systems and logistics support.

c. Technology Risks and Abatement Approaches - All key technologies being considered shall be described in terms of risk to the program, to human and system performance, workload, safety, survivability, and quality of life. Critical technical elements shall be identified and a Technology Readiness Level (TRL) assigned to each. Abatement approaches shall be described for any technologies assessed to have a TRL of 6 or less.

d. Performance Assessment Approach - The approach to estimating the performance aspects of the system concepts and their architectures should be defined and reviewed. The key metrics that were used shall also be defined and the approach to their measurement reviewed. The relationship of these metrics to KPPs shall also be identified.

e. Performance Estimates - The estimates of performance for each system concept shall be reviewed. The system performance aspects that define the meeting of user needs and requirements shall be reviewed, as well as discriminating system and human performance estimates that will assist in the selection of the PSC shall be presented and reviewed. The estimated performance shall be compared to any specified KPPs and Key System Attributes (KSAs).

f. Operational Impacts - Any key operational consideration that impacts the selection of each concept alternative shall be defined and reviewed. Any impacts of the selected technologies, architecture, interfaces, and performance shortfalls or excess upon any external systems, current doctrine, human performance, training, logistics, or other operational considerations shall be reviewed.

g. IA Impacts – Any key IA considerations that impact the C&A risks for concept alternatives shall be described.

h. Logistics Impacts-Ensure maintenance and logistics planning and constraints, Packaging, Handling, Storage and Transportation (PHS&T) have been considered in the AoA and alternative support concepts evaluated.

i. Technical Performance Measures (TPMs) - The selection of TPMs to utilize throughout the system development process shall be discussed and an initial set of measures may be proposed and reviewed. The total set of TPMs shall include the means to assess hardware, software, and human performance. The relationship of proposed TPMs to any KPPs shall be shown.

j. Risk Assessment Measures - The selection of metrics to assess risk and the effectiveness of mitigation upon those risks shall be reviewed and an initial set defined. (Initial (RMP and Risk Database should be established). A demonstrated understanding of the impact of the highest risks upon performance, cost, and schedule shall be shown.

k. Alternative Selection Decision Approach - The selection methodology and decision-making process shall be reviewed to assure that the PSC has the potential

to meet user needs, program risk, cost, and schedule considerations, and to assure stakeholder investment in the decision.

l. Preferred Concept Selection - The outcome of the alternative concept selection decision shall be reviewed and the PSC standing in regards to the decision-making criteria shall be described. Product considerations should include the following:

i. Forecast for the physical and operational maintenance environment

ii. Functional characteristics of the proposed system

iii. Use of embedded diagnostics, prognostics, and similar maintenance enablers

iv. Rough Order of Magnitude (ROM) for the system's Life Cycle Cost Estimates (LCCE)

v. Preferred evolutionary acquisition approach

vi. Technology spirals and development increments

Reliability, Maintainability, and Availability (RMA) measures should also be addressed in the PSC selection including Operational Availability, Mean Time Between Failure (MTBF), Mean Time To Repair (MTTR) and Mean Logistics Delay Time (MLDT), FD/FI and false alarm. The measure should also include consideration of RMA testability and Integrated Logistics Support (ILS) design analyses and testing.

i. TRB Recommendation - The TRB's recommendation to agree with or reject the PSC based upon their independent review of material and analyses provided shall be presented.

3. System Development Plans – In support of a subsequent Milestone B decision to formally establish a program, draft plans for the remainder of the system development through test and production shall be presented.

a. Requirements Documentation - The status of the requirements documentation (DoD 5000, Draft SRD, TLRs, ICD and CDD) should be described, along with a proposed development and approval schedule. A document hierarchy scheme should also be presented.

b. Key System Requirements - If available, the current key system requirements and/or allocations to subsystems may be presented to convey progress towards development of system requirements set.

c. Development Schedule - An overview of the proposed system development and acquisition schedule (i.e. draft milestone schedule) should be presented, including test and operational evaluation.

d. Draft Work Breakdown Structure - A decomposition of the tasks and products to be created during a subsequent system development phase should be presented. This forms the basis for schedule and cost estimates.

e. Near Term Schedule and Costs - Detailed schedule and cost estimates associated with the next level of development shall be provided.

f. Overall Acquisition Cost - The process of estimating the overall acquisition cost (including DOTMLPF costs over the lifecycle) and plans for completion of this estimate shall be provided and reviewed.

C. ASR – Entrance and Exit Criteria

1. Entrance criteria for an ASR are:

a. Viable alternative system concepts have been defined and described.

b. Alternative concepts have been analyzed in regard to their potential to satisfy user needs.

c. Draft system Work Breakdown Structure (WBS), draft functional baseline, and draft system specification for preferred approach reviewed to determine feasibility and risk.

d. Plans for the next level of system development have been reviewed to determine feasibility and risk.

e. Test and Evaluation strategy prepared.

f. Documents and products in the ASR technical data package (See Appendix D) have been reviewed and assessed.

2. Exit criteria for an ASR are:

a. PSC is traceable to and can satisfy mission/operational/IA needs and other identified customer requirements.

b. Appropriate architecture products have been reviewed and, where appropriate, approved.

c. Progress has been demonstrated toward the balance of system technical requirements (including interoperability and system services) with the preferred concept's risk, cost, and schedule.

d. A performance and system safety risk assessment has been performed and technology development, implementation and maturation plans have been reviewed and approved.

e. Critical accomplishments, success criteria, and metrics have been defined for preferred system and accepted for next development phase or continued technical effort including technical exit criteria.

f. Draft specification tree and planned system WBS for the preferred system's next phase of technical effort, traceable to the physical architecture, have been defined and accepted.

g. Risk mitigation plan has been reviewed and approved.

h. Project technical status in the Preliminary SEP has been updated including decisions made during the ASR.

System (Subsystem) Requirements Review (SRR)

A. SRR – Overall Guidance

1. Objective - The objective of the SRR is to ensure that the operational requirements have been successfully represented by the system requirements, that the system design has the potential of meeting these system requirements when acceptably balanced with cost, schedule, and technical risk, and that the plans for moving ahead with system development are reasonable and of acceptable risk

2. Scope - The SRR is conducted to confirm that user requirements are translated into specific system requirements. It demonstrates progress in converging on viable, traceable system requirements that are balanced with cost, schedule, and risk.

   An SRR shall be held to define and approve the system requirements, to define and approve the system requirements relationships to the operational requirements and any higher level system requirements, to review the initial allocation of major system requirements to system components (subsystems and/or CIs), to review and approve the qualification approach for the system requirements, and to approve plans for continuation of the system development.

   The SRR shall be held at the system level, where the acquisition authority has been placed, to oversee the development of the system. Subsystem requirements reviews can be held if deemed appropriate. A thorough review of the system architecture and development plans that will guide the system development process shall also be accomplished, and all lower level requirement reviews should show how they incorporate into this architecture and plan. A SRR may also be conducted at the SoS level. Throughout this section, the term “system” may also be applied to subsystems of a system or to an overall SoS.

3. Timing - The SRR is typically conducted during the Technology Development and prior to the Engineering and Manufacturing Development Phase. The SRR should be held in conjunction with a Technology Readiness Assessment and after the operational requirements have stabilized and have been approved, but prior to any detailed design decisions.

4. Documentation - Documentation shall be provided to the TRB that shall describe the system requirements, the requirements documentation tree, the system architecture and its estimated performance, and future system development plans in enough detail to allow a sufficient review and formation of conclusions by the TRB. Documentation associated with this technical review is summarized in Appendix D of this TRM.

B. SRR – Topics

1. System Landscape - The purpose of this topic is to provide an overall perspective of where the system fits into the operational environment. This overview is necessary because many attendees at the SRR will not have had the luxury of having continuous exposure to development information. The main focus of the landscape is to first, review

a. System Mission - The mission of the system should be described in enough detail to give the reviewing body understanding of the need for this system, the manner in which it will be utilized in the operational forces, and the capabilities the system must provide to the operator to ensure mission success.

b. Operational Requirements Development - The operational requirements should be delineated in enough detail to allow the review body to understand if the system requirements will meet and/or exceed the operational needs. Interfaces with joint programs are established and presented.

c. Design Reference Mission (DRM) - The scenarios, campaigns, and threats that comprise the DRM for the system shall be described and reviewed. The manner in which the DRM shall be utilized in subsequent system development shall be delineated, and the status of its development should be given. Additionally, the CDD, Concept of Operations (CONOPS), and System Threat Assessment Report (STAR) shall be described. If the project is not using a CDD, CONOPS or STAR, the documents being used in their place shall be described along with the rationale for these documents.

d. T&E Planning – Initial T&E planning shall be described. This description should include T&E staffing, strategy and should address requirement for a TEMP.

e. RM Processes – Initial RM Processes should be defined including description/status of the RMP.

f. IA - The IA technical and certification specifics should be defined and specified to the level of detail associated with the system development.

g. HSI – The initial HSI requirements are derived through a TDRA which steers system design strategies that support total system performance (including human performance), optimizes total system /operator performance, and reduces total ownership costs.

2. System Architecture – The purpose of this topic is to review the initial architectural design of the system, including, but not limited to review of the appropriate DoDAF architecture products (see Appendix D). The system architecture starts with a context diagram that clearly delineates the scope of the system, followed by a functional and physical decomposition of the system. The functional view of the system architecture should describe the system functions, their interactions, allocation of system performance requirements to those functions, and relationships of system functions to operational functions. The physical architecture should describe the subsystems and components that

comprise the system and the assignment of functions to those components. Components may be hardware, software or a combination of both. The system architecture will be evaluated based on its potential for meeting the system requirements within reasonable bounds of cost, schedule, and technical risk shall be assessed. The degree of OA (openness) of the emerging system shall be assessed using the OAAT, as shall its availability and potential for component reuse. A MOSA may be performed using the PART in lieu of the OAAT. Any tradeoff and market analysis decisions made shall be critiqued and any IP issues impacting reuse shall be addressed as design and implementation proceed (e.g., a need to customize proprietary COTS products).

a. System Boundary - The delineation of the system apart from other systems and its natural and threat environment shall be described. Systems that will provide or receive services or data, along with systems that will physically or operationally interact with the system under development shall be identified. The system description shall include identification of all interfaces where the allocation of functions between automation and human performance are described and analyzed with respect to operational advantage can affect overall system performance. Also any systems that will interact with the system under development for the purposes of achieving operational goals (e.g., SoS interoperability) shall be identified.

b. Functional Architecture - The functions to be performed by the system shall be described and decomposed in enough detail to convey understanding of the partitioned functions to the subsystem and component level, as well as internal and external functional interface boundaries. The functional architecture description shall also include the relationship of system functions to functions described in the operational architecture. The functional architecture can be described using functional decomposition or an object-oriented design approach. Unless otherwise specified in the approved SEP, an SV-4 shall capture the functional description of the system and an SV-5 shall capture the mapping of system functions to operational functions for any applicable operational architectures in which the system is a participating node.

c. Internal System Structure - The division of the system into subsystems shall be described and approved. Major foreseen interface relationships between the major divisions shall be described and approved. The boundaries between safety-critical, security-critical and non-critical functions shall be described.

d. System States and Modes - Any and all unique states of the system shall be described, along with all static and dynamic modes identified. The system requirements presented in this review shall be defined in terms of the state and/or mode to which they apply.

e. System Trades and Analyses - The major architectural trades that have been identified shall be defined and reviewed for completeness. Results of system boundary trades, functional requirements allocation between subsystems, HSI considerations and HSI risk migrations as part of the architectural trade analysis, and cost/schedule/risk balance trades completed to date should be reviewed.

f. System Concept Description - The KPPs, technologies, overall system concept, and anticipated human performance requirements shall be described to convey the system detail and modeling being used for system assessment, and the conceptual design progress. The differences between the system concept used at this review and the concept that was presented at the ASR, if applicable, shall be described.

g. System Effectiveness and Performance Assessment - Results of system effectiveness and performance assessment shall be reviewed and approved to assure that reasonable solutions exist to meeting the system requirements, and that these solutions are acceptable in terms of likely cost, schedule and risk.

h. TRB Recommendation - TRB recommendations to agree with, modify, or reject the presented architecture, based upon their independent review of the documentation and analyses submitted, should be presented.

3. System Requirements - A thorough review of the system-level requirements shall be undertaken, and all system level requirements in the topics below shall be approved. This review shall assure that the functional, operational and IA requirements have been successfully represented by the system requirements including traceability from operational requirements to operational architecture products to system architecture products to system requirements including CTPs and Critical Operational Issues (COIs).

a. Requirements Documentation - The documentation that holds the system level requirements shall be presented and its status of development should be shown. The requirements documentation tree of which it is part shall be presented and approved.

b. Threat - The required threat (including IA threat) to which the system mission requirements apply shall be reviewed and approved. The DRM threat set should be compared to the required threat set to assure that its bounds are understood.

c. System Capability Requirements - All system capabilities that are derived from the operational needs and conditions for this system shall be described, and all requirements, including potential human performance considerations that are derived from these capabilities shall be reviewed.

d. Other Requirements - All other requirements not relating to mission capabilities, such as logistics, product support maintenance, training, safety, IA, and QA shall be reviewed and approved. Specifically, these should include the following where applicable:

i. Program Environmental, Safety, and Health Evaluation (PESHE), hazard materials and system safety.

ii. Environmental, Safety and Occupational Health (ESOH)

iii. Training concept

iv. Manpower and personnel requirements for both organic and contractor support

v. Computer Resources and Automated Information Technology:

vi. Information Support Plan (ISP)

vii. Computer resource constraints identified in the ICD

viii. Radio Frequency Identification (RFID)

ix. Item Unique Identification (IUID)

e. Diminishing Manufacturing Sources and Material Shortages (DMSMS) System Qualification Requirements - The manner by which these system requirements shall be qualified shall be described and reviewed. Qualifications methods such as inspection, analysis, demonstration, and test should be assigned to each system requirement and reviewed.

f. Subsystem Requirements Allocation - The process of allocating requirements from the system-level to the subsystem level shall be described, and major system requirements allocations to subsystems including software safety, security and privacy requirements shall be shown and reviewed.

g. Interface Requirements - The internal and external interfaces will be fully defined, documented, and accepted by all affected parties to enable functional decomposition and presented to the TRB.

h. TRB Recommendation - The TRB's recommendation to agree with or reject the presented requirements, based upon their independent review of the documents and analyses submitted, should be presented.

4. System Development Plans - Plans for continuation of system development shall be presented and reviewed to assure that adequate preparation has occurred and that the approved system architecture and requirements have been integrated into those plans.

a. Development Schedule - An overview of the remaining schedule of the entire system development and acquisition shall be reviewed, showing major reviews, experimentation, tests, and expected deployment dates.

b. Near Term Schedule and Costs - The near term plans for the next level of development shall be provided and reviewed, including costs and schedule for the entire next phase.

c. Overall Acquisition Costs - The estimation of cost for the overall acquisition program shall be described and its progress provided and reviewed.

d. CM - The approach to management of the system requirements, architecture, and design shall be described and reviewed. The special CM requirements of security-critical elements shall be described.

e. HSI Planning – The approach to HSI and the HSI Plan shall be described and reviewed HSI requirements shall be addressed/incorporated in the SEP; therefore, no stand-alone document will be required.

f. System Safety Program - The Environment, Safety and Occupational Health (ESOH), PESHE, and National Environmental Policy Act (NEPA) compliance should be reviewed.

g. Logistics Planning – System logistics considerations have been included including:

i. Planned maintenance capabilities

ii. Preliminary manpower and personnel requirements

iii. Sustainment planning parameters recorded in the CDD

iv. Product support acquisition strategy

v. Acquisition Program Baseline (APB)

vi. Lean Six Sigma / theory of constraints concepts, Condition Based Maintenance Plus (CBM+) principles, and other systems engineering practices and methodologies used throughout the acquisition and sustainment phases

vii. Product Support Plan (PSP) and DMSMS Plan developed/updated

viii. Initial Operational Capability (IOC) / Full Operational Capability (FOC) dates established

ix. Performance Based Logistics (PBL) considered for all support areas including technical assistance, support equipment, distance support, and training

x.System level performance metrics been established

xi. PHS&T Plan developed

xii. IUID/RFID requirements defined

xiii. Diminishing Manufacturing Sources and Material Shortages (DMSMS) defined

xiv. RM&A including Design Reference Mission Profile (DRMP), Operational Availability, MTBF, MTTR and MLDT, FD/FI and False Alarm defined

xv. BIT and onboard diagnostics requirements specified in the system specification and TEMP (where applicable)

xvi. Initial maintenance concept substantiated by Level of Repair Analysis (LORA) and documented

xvii. Optimum maintenance concept identified for the service readiness improvement plan, Condition Based Maintenance (CBM), CBM(+), and time base maintenance requirements been identified for special skills, maintenance and operator labor hours by rate by year, and number of personnel by rate, by maintenance level, and by year

h. Manpower, Personnel & Training – includes ensuring TRPPM conducted and that manpower and personnel requirements have been identified for both organic and contractor support.

i. TRB Recommendation - The TRB's recommendation to agree with or reject the presented plans for the next phase of development, based upon their independent review of the plans submitted, should be presented.

C. Entrance and Exit Criteria

1. Entrance criteria for a SRR are:

a. ASR and AIs from ASR completed.

b. A system concept description has been developed that shows the changes to the system concept as presented at the ASR (if applicable).

c. User operational requirements analyzed and translated into system-specific functional and performance requirements for mission capabilities.

d. Technology validation and demonstration plans complete and closure plans on technical demonstrations and maturation’s achieving required progress.

e. Risks identified, quantified, and reflected in the risk mitigation actions achieving required progress.

f. Total system approach to satisfying and verifying requirements (including interfaces) for the primary system functions identified (draft system and initial development specifications).

g. The system architecture (including OA requirements) has been defined.

2. Exit criteria for a SRR are:

a. Appropriate architecture products have been reviewed and, where appropriate, approved.

b. System requirements traceable to approved ICD and CDD have been approved. FoS/SoS requirements are allocated and approved where applicable.

c. The system architecture has been reviewed and judged adequate to proceed to SFR. Software functionality in system specification is consistent with software sizing estimates and resource-loaded schedule.

d. System option decisions completed.

e. Support strategy defined and accepted.

f. Documents and products in the SRR technical data package (see Appendix D) have been reviewed and assessed by the TRB.

g. KPPs defined, quantified, and documented.

h. IMS/IMP have been developed and plans for the next set of system development activities have been accepted.

i. SEP developed and implemented; project technical status in the SEP has been updated.

j. Program schedule is executable within budget.

k. RFA/RFIs from ASR have been satisfactorily addressed.

l. System safety risk analysis and mitigation planning for at least the high, serious, and medium risks are reviewed and approved.

System (Subsystem) Functional Review (SFR)

A. SFR – Overall Guidance

1. Objective - The objective of the SFR is to review and approve the technical description of the system, including its system requirements and architecture, and to establish the functional baseline for the system.

2. Scope - The SFR is conducted to demonstrate convergence on, and achievability of, system requirements and their suitability to guide preliminary design. The SFR is primarily concerned with the overall review of the system requirements and their ability to satisfy operational and suitability requirements, the system architecture and allocation of system requirement to architectural elements (subsystems and CIs), and accomplishment of SE management activities.

   The SFR sets the baseline for engineering development at lower levels in the system architecture, accompanied by analysis, trade studies, Modeling and Simulation (M&S), to achieve an optimum definition of the major system elements, with associated functional and performance requirement allocations for both human and automation. This activity results in the final version of the system requirements specification and the system architecture description. It also results in draft versions of performance specifications for subsystems and key components below the system level. These documents define the system functional baseline and the draft allocated baseline.

   The SFR shall be held at the system level, where the acquisition authority has been placed, to oversee the development of the system. Subsystem functional reviews can be held if deemed appropriate. An SFR may also be conducted at the SoS level. Throughout this section, the term “system” may also be applied to subsystems of a system or to an overall SoS.

3. Timing - The SFR is typically conducted during the Technology Development Phase and before significant effort has been expended on subsystem and component preliminary design.

4. Documentation - Documentation shall be provided to the TRB in enough detail to allow a sufficient review and formation of conclusions by the TRB. Documentation associated with this technical review is summarized in Appendix D of this TRM.

B. SFR Topics

1. System Landscape - The purpose of this topic is to provide an overall perspective of where the system fits into the overall service environment. This overview is necessary because many attendees at the SFR will not have had the luxury of having continuous exposure to development information. The main focus of the landscape is to reveal how well the system’s requirements (including internal and external interfaces) are being defined, allocated and scheduled for development. Identified functional requirements shall be analyzed to determine the lower level functions

2. System Specification - Performance specifications define the complete performance required of the product, and system operators and maintainers, the intended use, service environmental conditions, maintainability and necessary interfaces and interchangeability characteristics. They cover form, fit, function and interfaces.

   The System Requirements Document (SRD) is the top-level description (specification) of functional, both human and automation performance and human performance requirements related to the recommended automation strategy, and IA requirements for a major capability. It addresses effectiveness and suitability requirements and allocates interoperability requirements. And also contains the verification methods used to ensure that each requirement has been met. The functional requirements are traceable to the SRD and ICD/CDD. The SRD, when approved, defines the functional baseline of the system.

3. System Architecture and Interfaces – The functional architecture should be described in enough detail to convey understanding of the partitioned functions as well as external and internal functional interface boundaries. The functional architecture should be explained including allocation of requirements between automation and humans, including the IA robustness. Products associated with architecture views (operational, system, and technical) should be defined and reviewed. The degree of OA of the emerging system shall be assessed using the OAAT, as shall its availability and potential for component reuse. A MOSA may be performed using the PART in lieu of the OAAT. Any tradeoff decisions made shall be critiqued and any IP issues impacting reuse shall be addressed.

   The system architecture shall be captured in a System Architecture Description Document (SADD) or System/Subsystem Design Description (SSDD). Use of models to define the architecture and manage requirements allocation to architecture elements is highly encouraged. In this case, documentation should be extracted from the model to assure consistency, and the model should be accessible to TRB reviewers. See the System Architecture description under the SRR section for more specific architecture topics.

4. Risk Assessment - The integration of RM within overall program management is the responsibility of the PM. Risk is normally associated with cost, schedule, or technical impact. A RMP is updated and the results of the risk assessment (identifying and analyzing risks) shall be presented to verify that the risks associated with the system development (technical impact) are at acceptable levels for engineering development. If not, risk mitigation plans must be developed and approved.

5. Trade Studies and Analysis Reports - Trade studies and analyses are formal decision making methodologies used to make choices and resolve conflicts during the SE process. During SFR, an assessment shall be presented to: (a) verify correct allocation of human and automation performance requirements, (b) verify that the design selections have been optimized and constraints identified, and (c) determine performance requirements for lower-level functions when higher-level performance and functional requirements cannot be readily resolved to the lower-level.

6. TPM - TPM is an analysis and control technique that is used to: (a) project the probable performance of a selected technical parameter over a period of time, (b) record the actual performance observed of the selected parameter, and (c) through comparison of actual versus projected performance, and assist the PM in decision making. The total set of TPMs shall include the means to assess hardware, software, and human performance. These parameters will be key indicators for evaluation of technical performance achieved and will thereby contribute to assuring that requirements are met. An assessment of the TPM data analysis will be presented to identify progress toward achieving system performance within budget and schedule constraints.

7. Product Plans - Draft enabling product plans (e.g., PSP, DMSMS. reliability, maintainability, and availability management plans, HSI Plan, software test Plans, SDP, and maintenance concept/planning documents), including the SEP as well as product support planning, shall be provided to the TRB and a summary of comments presented during the SFR.

8. Test & Evaluation Planning - T&E planning should be discussed including TEMP updates since SRR, Test Strategy, test planning, and completion of the Software Test Plan. Test requirements should be traceable to system and functional requirements and assigned a verification method. Provisions for assessment of user interface usability and maintainability of the system to mission performance objectives and in complaint to human performance standards. RMA test planning should also be included.

9. Development Schedule - An overview of the remaining schedule of the entire system development and acquisition shall be reviewed including updates to the IMS/IMP since SRR and showing major reviews, experimentation, tests, and expected deployment dates.

10. Software Development Approach – The software development approach and plans must be documented in the SDP, and discussed at the review. Key topics include a discussion of the Software development environment (with an emphasis of verifying that the tools and facilities are appropriate and sufficient for anticipated development).

C. SFR – Entrance and Exit Criteria

1. Entrance criteria for a SFR are:

a. SRR completed and RFA/RFIs from SRR completed.

b. System's functional architecture, manpower analysis and documentation, and draft allocated configuration documentation establish the adequacy, completeness, suitability, trainability, and achievability of function, performance and IA requirements (sufficient design and systems analyses including assessment and quantification of cost, schedule, and risk).

c. Critical technologies for people, product, and process solutions verified for availability, achievability, human-machine interface performance, training, maintainability, and readiness for transition.

d. SE and SW development processes are completely defined and plans for the next phase established.

e. Documents and products in the SFR technical data package (see Appendix D) have been reviewed and assessed by the TRB.

2. Exit criteria for a SFR are:

a. Appropriate architecture products have been reviewed and, where appropriate, approved.

b. Installed environments (e.g. environmental, power, footprint) have been accepted.

c. Software development environment defined (with an emphasis of verifying that the environment is appropriate and sufficient for anticipated development) and accepted.

d. Software development approach presented, with concurrence on approach among software SMEs.

e. Implementation schedule accepted and executable within the anticipated cost and technical risks.

f. Progress toward establishing Software Development Environment is satisfactory.

g. Preliminary design criteria and margins accepted.

h. External and internal interface defined/preliminary interface specifications accepted.

i. Baseline support/resources requirements accepted.

j. System defined and accepted and system level requirements shown to be achievable.

k. Allocation of requirements to subsystem level approved.

l. Plans for the next level of system development have been accepted.

m. Functional baseline approved and system requirements and architecture documents placed under configuration control.

n. TEMP completed and testing approaches accepted among all stakeholders.

o. CIs have been defined.

p. System functional definitions and functional decomposition detailed enough to support preliminary design.

q. Known risks are manageable for implementation of the functional requirements into a preliminary design.

r. Project technical status in the SEP has been updated with decisions made during the SFR.

s. The project with approved functional baseline is executable within the existing cost and schedule budget

System (or Subsystem) Preliminary Design Review (PDR)

A. (Sub) System PDR – Overall Guidance

1. Objective - The primary objective of the System (or subsystem) PDR is to review and approve the system architecture as defined by the allocation of requirements to the subsystems and CIs, thereby creating the allocated baseline. The System PDR is also to review the progress being made in the development effort, the system build plans, adherence to process, and the integration and test approaches. The System PDR is considered complete upon reaching concurrence on the allocated baseline and on agreement that the level of risk for continuing development is acceptable.

2. Scope - Using the functional baseline as a governing requirement, the System Architecture is defined in terms of requirements allocated to subsystems and CIs as well as a description of the modes of interaction among these elements. This preliminary design sets forth the functions, performance, and interface requirements that will govern design of the items below the system level. The System PDR is conducted to confirm that the approach for system/subsystem detailed design (as an integrated composite of people, product, and process solutions) satisfies the Functional Baseline; risks are mitigated with closure plans for remaining risks demonstrating required progress; and the total system is ready for detailed design and that the Acquisition Strategy as developed and documented addresses a plan to satisfy Human Systems Integration (HSI) requirements for each domain addressed in the Capability Development Document (CDD) / Capability Production Document (CPD), including minimum standards for those domains not specifically addressed in the CDD / CPD.

3. Timing - The System PDR is typically conducted during the Technology Development phase just prior to entering the Engineering and Manufacturing Development phase. Data collection begins after successful completion of the SFR and continues up to the formal PDR meeting. The System PDR should not be conducted before all subsystems and CIs have been able to reconcile and accept their allocated requirements, and the aggregation of subsystems and CIs presents an integrated and consistent structure. This may require scheduling the review after SW and HW development has produced early builds or prototypes as a means of assessing the feasibility of the requirements and their allocation to the CIs as a part of the allocated baseline.

4. Documentation - Documentation shall be provided to the TRB in enough detail to allow a sufficient review and formation of conclusions by the TRB. Documentation associated with this technical review is summarized in Appendix D of this TRM.

B. System PDR – Topics

1. System Landscape – The purpose of this topic is to review the documentation including, but not limited to the appropriate architecture products (OVs, SVs, TVs, and AVs) and to provide a perspective of where the subsystems and CIs fit into the

overall system. This overview is necessary because many attendees at the PDR will not have had the luxury of having continuous exposure to development information. The main focus of the landscape is to reveal how well the systems, subsystem, and Software Configuration Item (SCI) requirements are being scheduled and managed.

a. System Architecture – An identification of all system CIs and their relationships, including a description of all connections/interfaces between the CIs. This description will be presented so that the relationships of the different builds are also identified (if the system is to be developed in multiple builds). The degree of OA (openness) of the emerging system shall be assessed using the OAAT, as shall its availability and potential for component reuse. A MOSA may be performed using the PART in lieu of the OAAT Any tradeoff decisions made shall be critiqued and any IP issues impacting reuse shall be addressed as design and implementation proceed (e.g., a need to customize proprietary COTS products). Topics to be presented include:

    i. An overview of the system requirements

    ii. The allocation of system requirements to CIs

    iii. Human-machine interfaces, including displays

    iv. The allocation of requirements to each system build together with any requirements deltas

    v. The interfaces between the CIs, broken out into builds

    vi. The layers of the architecture (if layers have been defined)

    vii. Locations of new and reused software (including COTS, NDI, legacy, and GFI)

    viii. Plans for how reused CIs will meet IA requirements

    ix. Reliability, Supportability, and Maintainability

    x. Electromagnetic Environmental Effects (E3) and Spectrum Supportability

    xi. Producibility

    xii. Organization structure; manpower estimate including a determination of feasible approaches to reduce manning and skill levels

    xiii. Updated IMS

b. Requirements Flow-Down – A description of how the system requirements are allocated to the various CIs as traced through the requirement documents and databases (e.g., System/Subsystem Specification (SSS), SRS, IRS, IDDs),

including a breakdown of how the requirements are allocated across builds, and provide references so that reviewers can examine documentation defining which SRS requirements are allocated to which builds. This topic also includes descriptions of:

i. Requirements changes made since SSR/SFR

ii. Security critical / IA requirements

iii. Net-Centric Operations and Warfare Policy Requirements

iv. Quality requirements (including reliability, availability and maintainability)

v. Requirements supporting test and analysis (i.e., log files)

vi. Safety critical requirements

c. System Build Plans – A description of the build plan for the System, including any builds that are to be prepared for deployment. This shall include:

i. Dates when technical agreements are needed on the content of the various requirements and design documentation

ii. Software data rights that have been procured by the Government, and the Government's plans for maintenance and upgrade of the software over its life cycle

iii. The physical security and software security implementation required to be consistent with the security level of the software and any data or crypto stored and managed by the software during both development and operational use

d. Test Processes - Test processes are detailed in the TEMP (where applicable) and the overarching T&E strategy. In SoS and FoS reviews, this will address the end-to-end testing of SoS / FoS distributed services. This also includes identification of all certification test requirements.

2. Integrity of SE Processes – A general description of the system development processes/methods being followed as well as tools to be used (as documented in the SEP and SEMP). Include a detailed explanation of any process and tool changes that have been made since the SFR, including rationale on why the changes were made and an assessment of the impact of these changes on the development plan. Also include any changes to the CM Plan and processes and a description of the measures to be used in assessing human performance and operator workload (cognitive/temporal/physical), and that the Manpower Estimate Report (MER) has been completed and approved.

3. System Progress – A description of the progress made in system development as compared to the plan.

a. System Landscape – A general description of the system landscape, including an overview of the environment within which the system will operate. System's architecture with identification of all subsystems and CIs. Detailed documentation defining the System's architecture will be made available for the System PDR review members for review off-line. Include an identification of where, within the architecture, development/new and reuse components will be located (including NDI, COTS, legacy and government furnished information (GFI)). Describe how reused components will meet IA and safety requirements. Describe plans for integration of GOTS/ COTS components during future COTS refresh cycles. Also, describe where industry and government standards are applied.

b. Maturity of Functional/Subsystem Design – The TRB will assess the completeness of the design, focusing on topics in the following list. The results of the TRB assessment will be provided at the PDR to a level of detail sufficient for decision-making. The assessment is focused on:

   i. Allocation of each CI's functionality and algorithms

   ii. Definitions of all CIs in terms of interfaces, allocated functionality, and algorithms

   iii. Initial considerations for technology refresh planning, including logistical support and training

   iv. Software requirements allocated to GOTS/COTS and reused software

c. Performance Estimates – A description of the CI's performance requirements and how the architecture supports these. Such requirements include:

   i. Data and processing accuracy and precision requirements, including computational and algorithmic, reject rates, tolerances, and numerics

   ii. Execution time requirements (including latency, timing and synchronization)

   iii. Sizing requirements (including main memory, auxiliary memory (e.g., disk))

   iv. Capacity requirements, including throughput and functional capacities (e.g., number of tracks)

   v. Usability, human performance, operator workload requirements, maintainability, and supportability

   vi. Any changes since SFR will be described in detail, including the reasons for such changes

d. System Metrics – A description of the core required metrics are contained in the PEOIWS Instruction on Software Development, Verification and Validation (V&V), Design Reuse, and Metrics Policy (ref (j)).

e. Assessment of DA Progress – The TRB will, prior to the System PDR meeting, assess the plans and the progress made by the developing activity (DA). The assessment will cover the areas listed above, but at a more detailed level, with the purpose of determining whether sufficient progress has been made in development to allow continuation of development with acceptable risk. This portion of the assessment will cover:

i. Requirements Stability – The degree to which the system requirements have been stabilized

ii. System Architectural Design – A completeness, maturity, and appropriateness of the design as proposed by the DA. Areas of focus include:

01. CI identification and definition

02. Functionality allocated to the CIs

03. Interfaces between CIs

04. Algorithms to be implemented by the CIs

iii. Software Development Process – The quality of the planned processes to be applied as well as the level of adherence to the processes defined for the detailed design phase

iv. Other changes made since SFR including a thorough explanation of the changes and the reason for the change

4. Testing – A description of the test plans and procedures that will be applied to the system.

a. System Test Plans – The maturity and completeness of the developer's plan for testing the system including the TEMP when applicable. An overview of the test approaches planned for system testing and lower-level testing, including:

i. The relationship to system-level testing, including plans for multi-SCI testing and system integration testing

ii. The test environment defined

iii. Test evolution across builds

iv. Allocation of test approaches to and verification method for each SRS-level requirement

v. Traceability of test requirements

vi. Criteria to be used to assess compliance (including correlation to performance goals)

vii. Requirements and design features supporting data extraction and test analysis

viii. Facilities and test resources defined and included in T&E planning.

ix. Special test equipment

x. T&E Facilities availability to meet schedule

xi. HSI (human performance, MP&T, safety and survivability) verification

xii. Automated tools

xiii. Other special topics that affect the test approach

xiv. Changes since SSR and how these changes affect the program plan are to be included

b. Lower-level Tests –

i. Special handling for mission safety critical requirements and components

ii. A description of the tests to be performed on the components, from unit level to top-level component level, including:

01. Degree of coverage planned for the tests, both structural (statement coverage, branch coverage, path coverage) and functional

02. How the lower-level tests are coordinated with CI-level testing

c. TEMP – Where applicable, updates to the TEMP shall be addressed including:

i. How the T&E strategy meets the TEMP requirements

ii. How the TEMP reflects Net-Centric Operations and Warfare requirements

iii. How the TEMP address metrics and test procedures to ensure that human integration requirements for each domain are delivered and satisfy the CDD / CPD requirements

5. Risk – A summary of the RM processes and risk database items identified for the CIs that have the potential to impact successful completion of the CIs, covering all topics including staffing, training, logistics, shall be highlighted along with mitigation plans and plans and progress toward resolution.

6. Logistics – A discussion of Logistics planning and processes to include:

    a. Service training systems plan been development and validation

    b. Training Outline and Curricula Design

    c. Training Devices / Simulators

    d. Initial Training Requirements (Navy Training System Plan reviewed)

    e. Supply Support Management Plan (SSMP)

    f. Provisioning technical documentation being procured to support end items that have parts subject to failure / replacement and require maintenance at any level

    g. Organic Support if required

    h. Supply Chain Management / PBL Management as required

    i. Short term and longer term full rate production requirements include the time phasing of all resource requirements (e.g., personnel, machines, tooling, measurement system, supply chain)

    j. Warranties integrated in logistics support strategy

    k. PHS&T

    l. Maintenance Planning including PBL and legacy systems

7. Environmental Issues – A discussion of environmental planning and issues to include ESOH requirements, PESHE updates since SSR/SFR, hazard materials and system safety.

C. System PDR – Entrance and Exit Criteria

1. Entrance criteria for the System PDR are:

    a. Documentation complete for all architectural design, test plans, and software processes and tools in the PDR technical data package (see Appendix D) have been reviewed and assessed by TRB.

    b. Operator and maintainer task descriptions specified

    c. Previous technical review completed and all RFA/RFIs from previous review have been closed.

    d. Software metrics have been collected and are ready for presentation.

    e. Plans for the next level of system development have been established.

2. Exit criteria for the System PDR are:

   a. Architecture products have been reviewed and, where appropriate, approved; integrated architecture SVs and TVs support the operational architecture, CDD/CPD, ISP, and Net-Ready Key Performance Parameter (NR-KPP).

   b. Design analysis/definition complete:

      i. All top-level components (CIs) are identified

      ii. Component interfaces, allocated functionality, and algorithms needed to implement the functionality are defined and accepted

   c. Test plans concurred in:

      i. Requirements are mapped to test/verification approaches

      ii. Test strategies, including those for the lower-level testing, are fully defined and accepted (to include structural coverage goals for SCI unit test)

   d. Processes: Development processes are fully defined in the SEP/SDP or equivalent documents, are adequate for continued development, and have been accepted.

   e. Empirical data on critical and frequent operator tasks and decisions that will be necessary to measure human performance has been identified.

   f. All tools required for the next phase are in place and ready for use, including tools for user interface, prototyping, and operator testing.

   g. Risks are known and manageable; risk mitigation plans are in place and compatible with the equipment and SW development schedule.

   h. Program/project schedule executable within cost and schedule; plans for the next phase of system development have been accepted.

   i. Project technical status in the SEP including decisions made at the PDR has been updated and approved.

   j. Allocated Baseline documentation placed under configuration control (CIs and their allocated requirements as defined by design specifications and software segment specifications).

   k. Allocated Baseline, or equivalent, has been established, is complete, and is under configuration control.

System (or Subsystem) Critical Design Review (CDR)

A. System CDR – Overall Guidance

1. Objective - The objective of the System (or Subsystem) CDR is to assess the completeness of the detailed design and how it supports the performance requirements as well as overall progress being made in developing the system.

2. Scope – System CDRs are conducted to demonstrate that the system/subsystem detailed design and the test plans are sufficiently complete and stable, and will fully support system requirements. Many programs use drawing release as a metric for measuring design completion. The System CDR is not considered complete until the successful completion of at least one HW CDR and SW CDR for each CI.

3. Timing - System CDRs are conducted during the Engineering and Manufacturing Development phase. The first System CDR should not be conducted until at least one system build has been performed so that sufficient information is available to assess the emerging detailed design. Subsequent system CDRs should be held to correspond to major system builds, but no more frequently than once every 3 months and no less frequently than once every 6 months. CDR activity extends from the time of the TRB reviews through the formal CDR meetings.

4. Documentation - Documentation shall be provided to the TRB in enough detail to allow a sufficient review and formation of conclusions by the TRB. Documentation associated with this technical review is summarized in Appendix D of the TRM.

B. System CDR – Topics

1. System Landscape - The purpose of this topic is to review the documentation including, but not limited to the appropriate architecture products (OVs, SVs, TVs, and AVs) and to provide a perspective of where the SCI fits into the overall system. This overview is necessary because many attendees at the CDR will not have had the luxury of having continuous exposure to development information. The main focus of the landscape is to reveal how well CIs (and system's) requirements are being scheduled and managed. The degree of OA (openness) of the emerging system shall be assessed using the OAAT, as shall its availability and potential for component reuse. A MOSA may be performed using the PART in lieu of the OAAT. Any tradeoff decisions made shall be critiqued and any IP issues impacting reuse shall be addressed as design and implementation proceed (e.g., a need to customize proprietary COTS products). Topics to be presented include:

   a. An overview of the system requirements

   b. The allocation of system requirements to CIs

   c. User interfaces, including displays

d. The allocation of requirements to each system build together with any requirements deltas

i. The interfaces between the CIs, broken out into builds

ii. The layers of the architecture (if layers have been defined)

iii. Locations of new and reused software (including GOTS/ COTS, NDI, legacy, and GFI)

iv. Plans for how reused CIs will meet IA requirements

2. Integrity of System Engineering Development Process - A general description of the system development processes/methods being followed as well as tools to be used (as documented in the SEP and the SEMP). Include a detailed explanation of any process and tool changes that have been made since the PDR, including rationale on why the changes are made and an assessment of the impact of these changes on the development plan.

3. System Progress - A description of the progress made in system development as compared to the plan defined in the system development landscape.

a. SCI Landscape - A general description of the system's landscape, including an overview of the CI's architecture with identification of all CIs, and a description of the changes made since this topic was reviewed at PDR. Detailed documentation defining the SCI's architecture will be made available for the CDR review members for review off-line. Include an identification of and how reused components will meet IA requirements and where, within the architecture, new and reuse components will be located (including NDI, GOTS/ COTS, legacy and GFE/GFI). Describe plans for the integration of GOTS/COTS components during future COTS refresh cycles. Also describe where industry and government standards are applied.

i. Include an overview of the system's architecture with identification of all CIs, and a description of the changes made since this topic was reviewed at PDR. Detailed documentation defining the CI's architecture will be made available for the CDR review members for review off-line.

b. Maturity of Detailed Design - The TRB will assess the completeness of the detailed design relative to what was planned for the system at the time the CDR is being held, focusing on the topics in the following list:

i. All internal and external CI interfaces shall be completely defined (all data items, types, invocations)

ii. The internal design for all CIs shall be defined, as demonstrated by the completion of

iii. All operator task descriptions are fully defined and supported

iv. Allocation of functionality and algorithms to the constituent components within all CIs

v. Definitions of all CI components and units in terms of interfaces, allocated functionality, and algorithms

vi. No new software units should need to be defined for the build under review

vii. All software algorithms shall be defined and allocated

c. Performance Estimates - A description of the system's performance requirements and how detailed design supports these. Such requirements include:

i. Data and processing accuracy and precision requirements, including computational and algorithmic, reject rates, tolerances, and numerics

ii. Execution time requirements (including latency, timing and synchronization)

iii. Sizing requirements (including main memory, auxiliary memory (e.g., disk))

iv. Capacity requirements, including throughput and functional capacities (e.g., number of tracks)

v. Measures of human performance and operator workload (cognitive/temporal/physical) that demonstrate human and system performance requirements will be satisfied

vi. Any changes since PDR will be described in detail, including the reasons for such changes

d. Software Metrics - A description of the core required metrics shown are contained in the PEO IWS Instruction on Software Development, Verification and Validation (V&V), Design Reuse, and Metrics.

e. Assessment of Progress – The TRB will, prior to the System CDR meeting, assess the plans and the progress made by the DA. The assessment will cover the areas listed above, but at a more detailed level, with the purpose of determining whether sufficient progress has been made in detailed design to allow initiation of additional coding. The assessment shall cover:

i. Requirements Stability - The degree to which the system and CI requirements have stabilized.

ii. Architectural Design Changes - A detailed description of any changes made since PDR of:

01. CI and CI design identification and definition

02. Functionality allocated to the CIs and their internal components

03. Interfaces between CIs and their internal components

04. Algorithms to be implemented by the CI and their internal components

05. Functionality allocated to operators, including operator job descriptions

06. Other changes made since PDR including a thorough explanation of the changes and the reason for the change

iii. Software Development Process - The quality of the planned processes to be applied as well as the level of adherence to the processes defined for the coding phase

iv. Configuration Control of Documentation

01. System, software, and hardware design documents are complete and under CM control

02. Interface Design Documents (IDDs) are complete and under CM control

03. Reliability, Maintainability and Built-in-Test (BIT) requirements defined, documented and under CM control.

4. Testing - A description of the test plans and procedures that will be applied to the SCI.

a. Test Approach - An overview of the tests planned for the system and CI-level, including:

i. The relationship to system-level testing, including plans for multi-SCI testing, and system integration testing

ii. The test environment including Modeling and Simulation capabilities and limitations.

iii. Test evolution (across builds)

iv. Allocation of test approaches and verification methods to each SRS-level requirement

v. Detailed test schedule with test interdependencies

vi. Criteria to be used to assess compliance

vii. Requirements and design features supporting data extraction and test analysis

viii. Special test equipment

ix. HSI verification

x. Evaluation of human performance capabilities within design parameters

xi. Automated tools

xii. Special handling for mission safety critical requirements and components

xiii. Other special topics that affect the test approach including certification test requirements

xiv. Government and contractor T&E facilities

xv. Training requirements for DT&E and Operational Test and Evaluation (OT&E) (when required)

xvi. Changes since PDR and how these changes affect the program plan are to be included.

b. FQT Descriptions - A description including the maturity and completeness of the DA's plans for testing the system and its CIs, both at the system level and at lower levels, as well as the completeness and adequacy of the test descriptions, and focusing on the topics in the following list.

i. Test cases (input data) for each system/CI requirement

ii. Expected results

iii. Criteria to be used to assess compliance (including correlation to performance goals)

iv. Other changes made since PDR including a thorough explanation of the changes and the reason for the change

c. Lower-level Tests -A description of the tests to be performed on the CI components, from unit level to top-level component level, including:

i. Degree of coverage planned for the tests, both structural (e.g. statement coverage, branch coverage, path coverage) and functional

ii. Special handling for mission or safety critical requirements and components

iii. How the lower-level tests are coordinated with system and CI-level testing

5. Risk - A summary of the Risk Database items identified for the system and its CIs that have the potential to impact successful completion of the system, covering all topics including staffing, training, and logistics, shall be highlighted along with mitigation plans and plans and progress toward resolution. Based on an updated risk assessment, any changes to risk since PDR shall be specifically addressed.

6. Logistics – A discussion of Logistics issues including COTS/GOTS obsolescence issues, supply chain management/PBL management, PSP, DMSMS, system training plans and projected material support date.

7. Environmental Issues – A discussion of environmental issues including ESOH requirements, PESHE updates since PDR, hazard materials and system safety.

C. System CDR – Entrance and Exit Criteria

1. Entrance criteria for a System CDR are:

   a. For the initial System CDR, at least one system build has been performed, and the design of the system is sufficiently mature to warrant establishing the initial Developmental Baseline (optional). For subsequent CDRs, at least one system build has been completed since the last System CDR, or a period of six months has transpired.

   b. All System PDR RFA/RFIs closed, and all actions items from previous System CDRs have been closed.

   c. Software metrics collected and ready for presentation.

   d. Plans for the next phase of system development have been established.

   e. Documents and products in the CDR technical data package (see Appendix D) have been reviewed and assessed by the TRB.

   f. New risks since PDR have been identified, quantified, and reflected in the risk mitigation actions.

   g. Software Design Document(s) (SDDs) complete and ready to be placed under configuration control.

   h. Software Interface Design Document(s) (IDDs) complete and ready to be placed under configuration control.

   i. Preliminary test procedures for software integration and systems testing submitted for review.

2. Exit criteria for a System CDR are:

   a. Appropriate architecture products have been reviewed and, where appropriate, approved.

   b. Design maturity and completeness:

      i. All system and CI components are identified.

ii. For each component, its interfaces, allocated functionality, and algorithms needed to implement the functionality are fully defined and accepted as correct.

iii. Measures of human performance and operator workload (cognitive/temporal/physical) that demonstrate human and system performance requirements will be satisfied

c. Test plans:

i. All test cases (including input values, expected output, and evaluation criteria) have been fully defined and accepted

ii. The degree of coverage of the test cases against the requirements for the build under review has been shown to be 100%

iii. For lower level testing, test strategies are fully defined and appropriate (to include structural coverage goals for unit test)

d. Software development processes are fully defined in the SDP are appropriate for coding and unit test, and have been accepted.

e. All tools required for fabrication are in place and ready for use.

f. Risks have mitigation plans in place that are compatible with the SW development schedule.

g. Plans for the next level of system development have been accepted.

h. Technology refresh approach is identified, including training and logistic support.

i. Operator and maintainer task descriptions approved.

j. Project technical status in the SEP including decisions made at the CDR has been updated.

k. Program schedule is executable within the anticipated cost and technical risks.

l. Approved preliminary Product (development) Baseline documentation (including artifacts documenting the CIs) has been placed under configuration control.

Test Readiness Review (TRR)

A. TRR – Overall Guidance

1. Objective - The objective of the TRR is for the contracting agency to determine whether the developer and all associated activities are mature enough and sufficient progress has been made in development and test planning to begin formal product (CI/subsystem/system) testing with an acceptable likelihood of successfully passing formal testing. Also considered in this test process are requirements for IA and HSI. This is accomplished by demonstrating the preparedness of personnel, plans, and test resources.

2. Scope - During the TRR, the contracting agency assesses test objectives, procedures, safety, resources and testing coordination. The contracting agency also reviews the results of informal testing, configuration of the Unit Under Test (UUT)/System Under Test (SUT), and any updates to the operation and support documents. A successful TRR is predicated on the contracting agency's determination that the test procedures, informal test results, and configuration of the UUT form a satisfactory basis for proceeding into formal CI testing.

3. Timing - The TRR is conducted after the CDR in the Engineering and Manufacturing Development Phase. The TRR must be completed successfully before the initiation of formal testing. TRRs may be held if deemed necessary when the system proceeds through different phases of testing.

4. Documentation - Documentation shall be provided to the TRB in enough detail to allow a sufficient review and formation of conclusions by the TRB. Documentation associated with this technical review is summarized in Appendix D.

B. TRR – Topics

1. System Landscape - The purpose of this topic is to review the documentation including, but not limited to the appropriate architecture products (OVs, SVs, TVs, and AVs) and to provide an overall perspective of the system. This overview is necessary because many attendees at the TRR will not have had the luxury of having continuous exposure to development information. The main focus of the landscape is to describe the system architecture including all CIs and system requirements.

    a. System Architecture - Identification of all CIs to be tested, including a description of all connections/interfaces between the HWCIs, SCIs, and operators/maintainers. The degree of OA (openness) of the system shall be assessed using the OAAT, as shall its availability and potential for component reuse. A MOSA may be performed using the PART in lieu of the OAAT. Any tradeoff decisions made shall be critiqued and any IP issues impacting reuse shall be addressed (e.g., a need to customize proprietary COTS products). Topics will include:

i. An overview of the total system requirements as defined in the system specifications

ii. Organizational description of operators and maintainers associated with the system

iii. The allocation of system requirements to CI as defined in the individual CI critical item development specifications

iv. User interfaces, including displays

v. The connectivity among system CIs as defined in the IDSs

vi. Top Level and Detailed Drawings

vii. Identification of all NDIs, GFE, and legacy equipment

b. CI Identification - An identification of the specific CI for which the TRR is being conducted. This description includes an overview of its functional and performance requirements as defined and any associated SCI and firmware documentation.

c. Requirements Flow-Down - A description of how the TEMP requirements are allocated to the various CIs as traced through the requirement documents and databases. This topic also includes descriptions of:

i. Requirements changes made since CDR

ii. Security requirements

iii. Environmental requirements (including shock, vibration, electromagnetic compatibility (EMC)/electromagnetic interference (EMI), temperature, humidity)

iv. Safety requirements

v. Quality requirements (including reliability, availability and maintainability)

vi. Requirements supporting test and analysis are traceable to CDD/CPD and KPPs

vii. Requirements tracked, traced, and modeled in automated tool

2. Test Process - An overview of the test approaches planned for the system including:

a. Specification qualification (see Appendix D)

b. The test environment including M&S capabilities and limitations

c. The test scenarios

d. Test user characteristics

e. Descriptions of sample test cases (input data)

f. Criteria to be used to assess compliance

g. Previous metrics from other phases of testing that support the case that system level testing should proceed

h. Special handling for mission safety critical requirements and components

i. Test failure flow diagram to determine test continuation, termination or restart (retest philosophy)

j. Operational scenarios evaluated by the use of human in the loop testing where humans play the identical role that they will have under representative conditions when the system is operational.

3. Testing - The purpose of testing is to verify technical performance, operational effectiveness, operational suitability, and IA robustness; and it provides essential information in support of decision- making. The TRR determines the completeness of test procedures and their compliance with test plans and descriptions.

   a. Test overview - An overview of the testing plans including:

      i. Test Scope

      ii. Test Objectives

      iii. Test Schedule with interdependencies

      iv. Test Methodology

      v. Scenario Summary

      vi. Testing Architecture and Configuration

      vii. Testing Roles and Responsibilities for all test resources

   b. Test readiness and limitations - An overview of system and test resource readiness and limitations including:

      i. HW

      ii. SW (including M&S required for test conduct)

      iii. Networks

iv. Platforms

v. Land based test sites

vi. Data collection centers

vii. Test user availability and training requirements

viii. Test administration training and personnel

ix. Test support equipment

x. Human performance measures (including time to perform, time to respond, accuracy, error rates, time to train, time to maintain, communications accuracy, accuracy of team performance, maintenance of situation awareness, probability of success or other similar measures)

xi. Key metrics from system level testing

xii. Test Ranges

xiii. Other Test Resources

c. Analysis and Report Plan - An overview of the plan to ensure that the test results are traceable to the configuration of the system at the time of test and to report the results of the test including:

i. Data Management Review

ii. Test Analysis Review

iii. Criteria for Certification of the system (includes Interoperability and IA certifications)

iv. Performance Expectations

v. Operational Expectations

vi. Conclusions

4. Assessment – Prior to the TRR meeting, TRB will, assess the plans and the developer's progress against these plans. This assessment will determine whether the system is mature enough and sufficient progress has been made in development and test planning to initiate testing. The TRB assessment will be provided at the TRR at a level of detail that will enable the TRR to make a Go / No Go decision for the test. The assessment shall cover:

a. The completeness, appropriateness, and maturity of the system test plans when applied to the as-built version of the system.

b. The completeness, maturity, and appropriateness of the test design for each CI requirement and whether it will support the system verification.

c. The quality of the criteria to be used to assess compliance (including correlation to performance goals).

d. A description of the lower-level tests performed on CI components, modules and subsystems, including special handling for mission safety critical requirements and components, and degree of coverage planned for the tests.

e. A description of the changes made since CDR including a thorough explanation of the changes and the reason for the change.

5. Risk - A summary of the Risk Database items identified for the system that have the potential to impact successful completion of the system, covering all topics including staffing, training, and logistics, shall be highlighted along with mitigation plans and plans and progress toward resolution.

6. Metrics – Software metrics identified for the S/W CDR as well as CDR metrics for hardware will be presented and considered in the assessment of test readiness.

C. TRR – Entrance and Exit Criteria

1. Entrance criteria for a TRR are:

a. TRR planned in accordance with the procedures established in the test plan.

b. System/software test plans, procedures and test description changes have been approved.

c. Metrics demonstrating that operator testing, subsystem testing and CI informal testing have been successfully completed.

d. Testing deficiencies have been resolved and required changes implemented.

e. Documents and products in the CDR technical data package (see Appendix D) have been reviewed and assessed by the TRB.

f. Configuration of system under test defined and accepted; all items are in an approved baseline (i.e. under CM/Configuration Control).

g. Status of test resources documented.

h. Test limitations are documented; where applicable, test abort and/or hold-fire guidelines have been established in test plans.

i. Summary of problem status is documented, including all known discrepancies of test support equipment.

j. CDR successfully completed; all CDR RFA/RFIs completed.

k. Roles and responsibilities of all test participants defined and accepted.

2. Exit criteria for a TRR are:

a. Any changes to architecture products (OVs, SVs, TVs, and AVs) have been reviewed and, approved.

b. Test personnel, test users, facilities, support equipment, procedure manuals and UUT are ready for test.

c. Test procedures comply with test plans.

d. Test scenarios are representative of anticipated operational environment.

e. Test plans demonstrate that successful accomplishment will fulfill test requirements, including IA and Anti-Tamper (AT), where applicable.

f. Test configuration is accepted.

g. Test analysis and report plans accepted.

h. Certification criteria for the system are accepted.

i. TEMP and Test Strategy reviewed and approved (if required).

j. All test program and safety risks identified and mitigation plans approved or risk accepted and safety releases have been signed.

k. Updates to facilities plan/strategy that supported the CDR have been incorporated.

l. SW components for system under test frozen and under CM.

m. Test program executable within cost, schedule, and performance risks.

n. Project technical status in the SEP has been updated including decisions made at the TRR.

Functional Configuration Audit (FCA) / System/Software Verification Review (SVR)

A. FCA/SVR – Overall Guidance

1. Objective - The objective of the FCA, also known as the System /Software Verification Review (SVR), is to verify that the actual performance of the system or software CI meets the requirements stated in the system performance specification. It ensures that all CIs comply with the technical performance description in its HW, SW, and IRSs.

2. Scope - The FCA/SVR verifies that test results indicate successful completion of all requirements specified in DoD 5000 requirements documents. It confirms completeness of CIs and system verifications, completeness of support, production, training, deployment and disposal planning. The FCA traces test results back to functional requirements and verifies that all requirements have been met.

3. Timing - The FCA/SVR is conducted in the system's production and deployment phase on prototype, pre-production or first production article during LRIP. The technical assessments and decisions made in FCA/SVR will be presented to support the full-rate production go-ahead decision.

4. Documentation - Documentation shall be provided to the TRB in enough detail to allow a sufficient review and formation of conclusions by the TRB. Documentation associated with this technical review is summarized in Appendix D of the TRM.

B. FCA/SVR – Topics

1. System Landscape - The purpose of this topic is to review the documentation including, but not limited to the appropriate architecture products (OVs, SVs, TVs, and AVs) and provide an overall perspective of where the system fits into the overall service environment. This overview is necessary because many attendees at the FCA will not have had the luxury of having continuous exposure to development information. The main focus of the landscape is to reveal how well the system's requirements, including internal and external interfaces, are being met. This FCA validates the customer's needs, and the relationship of these needs to the system and subsystem technical performance descriptions.

    a. System Architecture - The system architecture should be described in enough detail to verify that the as-built system satisfies the system requirements, including external and internal functional interface boundaries. The system architecture should be explained including allocation of requirements between automation and humans, including the IA robustness. Products associated with architecture views (OV, SV, TV, and AV)) should be defined and reviewed. The degree of OA (openness) of the emerging system shall be assessed using the OAAT, as shall its availability and potential for component reuse. A MOSA may be performed using the PART in lieu of the OAAT. Any tradeoff decisions made shall be critiqued and any IP issues impacting reuse shall be addressed (e.g., a need to customize proprietary COTS products). Topics to be presented include:

i. CONOPS development

ii. Computer and software security plan including safety

iii. Requirements Management Plan

iv. Organization Structure

v. CM process

vi. Installation control diagrams

vii. PSP

2. Process - A general description of the system production processes/methods being followed including incorporation of producibility requirements in the system as well as tools to be used. Include a detailed explanation of any process and tool changes that have been made since development plans were initially released, including rationale on why the changes were made and an assessment of the impact of these changes on the development plan.

3. Testing - Tests are to be accomplished with approved test procedures and validated data sufficient to insure CI performance as set forth in the specification and meets quality assurance provisions. An overview of the test approaches and test descriptions planned for the system include:

a. System-level testing including plans for standalone CI testing

b. Performance and environmental qualification

c. Test environment

d. Test evolution and methodology

e. Allocation of test approaches to each test requirement

f. Reliability, Maintainability Survivability, and BIT tests

g. Criteria to be used to assess compliance

h. Requirements and design features supporting data extraction and test analysis

i. Special test equipment

j. HSI verification

k. Automated tools

l. Special handling for mission safety critical requirements and components

m. Other special topics that affect the test approach including Model of DT and OT test data (when applicable)

4. Test descriptions - The TRB will assess the completeness of the test descriptions, focusing on the topics in the following list.

   a. Test cases (input data) for each requirement:

      i. Criteria to be used to assess compliance (including correlation to performance goals)

      ii. A description of the lower-level tests performed on the components, modules and subsystems

      iii. Special handling for mission safety critical requirements and components

      iv. Degree of coverage planned for the tests

      v. All Engineering Change Proposals (ECPs)/Change Requests (CRs) that have been approved shall be reviewed to ensure that they have been technically incorporated and verified

      vi. Interface requirements testing

      vii. SW Test Reports

      viii. PDR and CDR findings incorporated and completed.

5. Assessment - The FCA/SVR team shall assess if the developer's test procedures and results are in compliance with specification requirements and ensure that the test results are traceable to the configuration of the system at the time of test. The results of the assessment will be provided at the FCA to a level of detail sufficient for decision-making. In particular, the assessment will ensure that system safety requirements, HSI requirements and environmental requirements have been verified. Test reports, procedures, and data used by the FCA/SVR shall be a matter of record in the FCA/SVR minutes.

6. Risk –The Risk Assessment shall be updated and a summary of the Risk Database items identified for the system that have the potential to impact successful completion of the mission, covering all topics including RMP updates, staffing, training, and logistics, shall be highlighted along with mitigation plans and progress toward resolution.

7. Metrics – Metrics will be reported consistent with and updating those reported at CDR.

8. Logistics – The FCA/SVR assessment will also address the following logistics topics:

a. PBL/Business Case Analyses (BCA)

b. Maintenance

c. Product Support/PSP

d. Nomenclature

e. GOTS/COTS/NDI technology refresh planning

f. Unique Identification (UID) requirements incorporation

g. Supportability

h. Supply support

i. Facilities Management Plan

j. Training Materials

k. PHS&T

l. DMSMS and obsolescence

C. FCA/SVR – Entrance and Exit Criteria

1. Entrance Criteria for a FCASVR are:

a. TRR successfully completed and all RFA/RFIs from TRR completed.

b. Items to be audited are identified.

c. Test plans, specifications, descriptions, procedures, and reports for the CIs to be audited are supplied.

d. A complete list of successfully accomplished functional tests and a complete list of functional tests required by the specification but not yet performed.

e. Pre-production and production test results available.

f. Metrics have been collected and are ready for presentation.

g. TRB has reviewed and assessed all available products.

h. RM planning has been updated for production.

i. SE planning has been updated for production.

j. Metrics have been established for production.

k. PESHE has been updated.

l. PSP, DMSMS Plan and Facilities Management Plan have been updated.

m. IMS has been updated to support testing.

2. Exit Criteria for a FCA/SVR are:

a. Any changes to architecture products (OVs, SVs, TVs, and AVs) have been reviewed and, where appropriate, approved.

b. System/Products have achieved requirements.

c. System/Products have satisfied the characteristics as specified in the specifications, interface specifications, and other baseline documentation.

d. Test plans, descriptions and procedures have been completed.

e. The system produced successfully verified the customer's needs as they relate to the system and subsystem technical performance descriptions (functional and allocated baselines).

f. Readiness issues for continuing design, continuing verifications, production, training, deployment, operations, support, and disposal have been resolved.

g. Facilities Management Plan includes all required facilities to support initial training, IOC and FOC; required facilities are either available for occupancy or under construction.

h. Remaining programmatic and safety risks are known and manageable; level ofsystem safety risk has been approved by the appropriate TAs.

i. Program/project schedule executable with anticipated cost and technical risks.

j. Technical assessments and decisions support the FRP go-ahead decision.

k. Project technical status in the SEP has been updated with decisions made during the FCA/SVR.

Physical Configuration Audit (PCA)

A. PCA – Overall Guidance

1. Objective - The objective of the PCA is to establish a high level of confidence in the physical configuration of the as-built version of a system in order to establish the product baseline. It is the formal examination of the as-built versions of the CIs against their design documentation as built by specified processes.

2. Scope - The PCA is a major CM activity to verify the specifications are an accurate representation of the product, as built by the specified processes and as represented by the technical data (drawings and software artifacts) used to produce and accept the product. The system PCA is a roll-up of the entire hardware and software end item PCAs. The PCA also may validate the developer's supporting production processes and other system elements impacted by the SVR. Approval at this review certifies that the technical data package is complete, accurate, and proven.

3. Timing - The PCA establishes the product baseline. The system PCA is conducted at the conclusion of all subsystem and CI PCAs. Subsystem and CI level PCAs are conducted on the delivery of the first article of CIs and those that are a reprocurement of CIs already in the inventory shall be identified and selected jointly by the contracting agency and the contractor.

4. Documentation - Documentation shall be provided to the TRB in enough detail to allow a sufficient review and formation of conclusions by the TRB. Documentation associated with this technical review is summarized in Appendix D.

B. PCA – Topics

1. System Landscape - The purpose of this topic is to review the documentation including, but not limited to the appropriate architecture products (OVs, SVs, TVs, and AVs) and to provide an overall perspective of the system. This overview is necessary because many attendees at the PCA will not have had the luxury of having continuous exposure to development information. The main focus of the landscape is to describe the system architecture including all CIs and system requirements.

    a. System Architecture - An identification of all system CIs and their relationships, including a description of all connections/interfaces between the HWCIs and SCIs. The degree of OA (openness) of the system shall be assessed using the OAAT, as shall its availability and potential for component reuse. A MOSA may be performed using the PART in lieu of the OAAT. Any tradeoff decisions made shall be critiqued and any IP issues impacting reuse shall be addressed (e.g., a need to customize proprietary COTS products). Topics will include:

        i. An overview of the total system requirements as defined in the system specifications

ii. The allocation of system requirements to each of the CIs comprising the system as defined in the individual CI critical item development specifications

iii. User interfaces, including displays

iv. The connectivity among system CIs as defined in the IDSs

v. Identification of all NDIs, GFE, and legacy equipment

b. CI Identification - An identification of the specific CI for which the PCA is being conducted, based on the system architecture. This description includes:

i. An overview of its functional and performance requirements as defined and any associated SCI and firmware documentation

ii. Specifications of interfaces and protocols

iii. Additions or changes made to GOTS/COTS equipment including the supporting market research, upgrade strategy and future COTS refresh issues

iv. Where the CI fits into the system

v. Where the CI fits into the system production and deployment schedules

c. Requirements Flow-Down - A description of how the system requirements are allocated to the various CIs as traced through the requirement documents and databases. Identify any requirements that may be applicable to the production equipment, but not to the Engineering Development Model (EDM). In addition, a breakdown of the requirements relative to SCI/firmware builds associated with the particular CI should be provided. This topic also includes descriptions of:

i. Requirements changes made since CDR and testing

ii. Design error budgets for meeting allocated requirements

iii. Ship integration requirements

iv. System security/IA requirements

v. Environmental requirements (including shock, vibration, EMC/EMI, temperature, humidity)

vi. Safety critical requirements (including Critical Safety Items)

vii. Quality requirements (including reliability, availability and maintainability) and Quality Control Plans/Manuals

viii. Requirements supporting test and analysis

d. Equipment and SCI/Firmware Build Plans - A description of how the equipment and SCI/firmware build plans for the CI are consistent with the overall system production planning, including dates when technical agreements are needed on the content of the various requirements and design documentation.

2. Process - A general description of the system production and deployment processes/methods being followed as well as tools to be used (as documented in the SDP). Includes software revision control, shipping, receiving and storage, and purchase control process descriptions as well as a detailed explanation of any process and tool changes that have been made since the SDP was initially released, along with rationale on why the changes were made and an assessment of the impact of these changes on the development plan. Also includes a description of the processes to be used in developing the HSI and in evaluating its usability. A discussion of any internal system audits performed previously should be included.

3. Testing - An overview of the test approaches planned for the system including:

   a. System-level testing including plans for stand-alone CI testing

   b. Specification qualification

   c. The test environment

   d. Criteria to be used to assess compliance

   e. Special handling for mission safety critical requirements and components

   f. Inspection process for data rights claims

   g. Other special topics that affect the test approach

4. Test Descriptions - The TRB will assess the completeness of the test descriptions, focusing on the topics in the following list. The results of the assessment will be provided at the PCA to the level of detail required to support a go/no go decision for FRP.

   a. Test cases (input data) for each CI requirement

   b. Criteria to be used to assess compliance (including correlation to performance goals)

   c. A description of the lower-level tests performed on the CI components, modules and subsystems, including:

      i. Special handling for mission safety critical requirements and components

      ii. Degree of coverage planned for the tests

5. Assessment - TRB will, prior to the PCA meeting, assess the plans and the progress made by the DA. The assessment determines whether sufficient progress has been made in development to allow production of the architectural design. The results of the TRB assessment will be provided at the PCA to a level of detail required to support a go/no go decision for FRP. The assessment shall cover:

    a. Specification Quality - The completeness, appropriateness, and maturity of the system specifications (behavioral, performance, and quality) when applied to the as built version of the system.

    b. Interface Design - The completeness, maturity, and appropriateness of the interfaces defined for the system and whether they will support the system specification.

    c. Processes - The quality of the planned processes to be applied as well as the level of adherence to the processes defined for the production and deployment phase.

    d. Other changes made since CDR and testing including a thorough explanation of the changes and the reason for the change.

6. Risk - The Risk Assessment shall be updated and a summary from the RMP and Risk Database shall be presented of the risk items and mitigation plans identified for the SCI that may impact successful completion of the SCI, covering all topics including staffing, training, and logistics.

C. PCA – Entrance and Exit Criteria

1. Entrance Criteria for a PCA are:

    a. FCA/SVR successfully completed and all RFA/RFIs from FCA/SVR completed.

    b. Procedures for established in the CM plan.

    c. Specifications (see Appendix D) have been completed.

    d. The subsystem and CI PCAs have been successfully completed.

    e. TRB has reviewed and assessed all available products.

    f. All required documentation has been baselined.

    g. Changes to previous baselines have been documented and completed.

    h. Testing deficiencies have been resolved and required changes implemented.

    i. System processes are current, repeatable and can be executed.

    j. Qualification testing completed.

2. Exit Criteria for a PCA are:

   a. Any changes to architecture products have been reviewed and, where appropriate, approved.

   b. Physical CIs meet product specifications.

   c. Performing activities demonstrate that SE, production, test and logistics processes conform with SE, production, test and logistics documentation (respectively).

   d. System accepted and placed under configuration control.

   e. The delivered system meets all shore interface and support infrastructure requirements.

   f. Plans for FRP approved.

   g. Product Baseline is approved.

   h. Project technical status in the SEP has been updated with decisions made during the PCA.

CONFIGURATION ITEM LEVEL REVIEW GUIDELINES

Software Specification Review (SSR)

A. SSR – Overall Guidance

1. Objective – The objective of an SSR is to determine the state of the requirements for a SW CI, and to assess whether these requirements are sufficiently mature to continue development.

2. Scope – The SSR shall focus on the requirements status for a specific SW CI. The SSR shall provide a context for this CI within the system as a whole, to ensure that it supports the overall system requirements. The SSR shall describe the build plan for the CI, and describe how this plan meshes with the build plans for the rest of the system. The SSR shall also provide a description of the software development processes/methods being followed as documented in the SDP, with emphasis on the special processes needed for safety-critical and security-critical software, as well as tools that are to be used.

3. Timing – SSRs are conducted in the Technology Development phase. An SSR will be conducted for each iteration of each software CI when the development plan calls for multiple SW CI builds, or once for each CI when only one build is planned. The first SSR will be held after the initial allocation of system requirements to SW CIs has been performed, and after this allocation has been refined and made appropriate for SW development.

   Multiple SSRs for multiple SW CIs may be scheduled so that they occur sequentially within the same time period for convenience of scheduling. For efficiency, topics that are common across SCIs (such as in the System Landscape) are presented, during the SSR for the first SCI being reviewed and may be abbreviated for the remainder as long as there is substantial commonality of attendees across the multiple SSRs. Where commonality of attendees across multiple SSRs is absent, the landscape information must be repeated at each such SSR.

4. Documentation – Documentation shall be provided to the TRB in enough detail to allow a sufficient review and formation of conclusions by the TRB. Documentation associated with this technical review is summarized in Appendix D of the TRM.

B. SSR Contents

1. System Landscape – A review of the architecture of the system identifying where the CI fits within the overall system, and the role it plays relative to the overall system requirements. This overview is necessary to ensure that all attendees have the same perspective on the context and role of the CI.

   a. System Architecture – An identification of all system CIs (both HW CIs and SW CIs), their allocated requirements and their inter-relationships, including a description of all interfaces. This description will be presented so that the

relationships among the different builds are also identified (if the system is to be developed in multiple builds). The degree of OA (openness) of the emerging system shall be assessed using the OAAT, as shall its availability and potential for component reuse. A MOSA may be performed using the PART in lieu of the OAAT Any tradeoff decisions made shall be critiqued and any IP issues impacting reuse shall be addressed as design and implementation proceed (e.g., a need to customize proprietary COTS products). Technical data to be presented include but are not limited to:

i. An overview of the system requirements

ii. The allocation of requirements and any requirements delta for each system build

iii. The allocation of system requirements to SCIs

iv. Identification of safety-critical, security-critical and non-critical SCIs

v. The interfaces between the CIs, broken out into builds

vi. The layers of the architecture (if layers have been defined)

vii. User interfaces, including displays and the rational for their selection

viii. Operator job descriptions, based on functions allocated to humans

ix. Planned locations for new and reused software (including COTS, NDI, legacy, and GFI)

x. Plans for how reused software will meet IA requirements

b. SCI Identification – An identification of the specific SCI whose SSR is being conducted, based on the system architecture. This description includes:

i. An overview of its requirements

ii. Where the SCI fits into the system architecture (including appropriate layers)

iii. Where the SCI fits into the system build plan

c. Requirements Flow-Down – A description of how the system requirements are allocated to the various CIs as traced through the requirements documents and databases (e.g., SSS, SRS, IRS, IDDs). Include a breakdown of how the requirements are allocated across builds, and provide references so that reviewers can examine documentation defining which SRS requirements are allocated to which builds. This topic also includes descriptions of:

i. System requirements changes made since SFR

ii. Safety critical requirements

iii. IA requirements

iv. Quality requirements (including reliability, availability, maintainability)

v. Requirements supporting test and analysis (e.g., log files)

vi. HSI requirements

d. SCI Build Plan – A description of how the build plan for the SCI is consistent with the overall system build plan, including dates when technical agreements are needed on the content of the various requirements and design documentation artifacts.

2. Software Development Process – A general description of the software development processes/methods being followed as well as tools that will be used, as documented in the SDP. Include a detailed explanation of any process and tool changes that have been made since the SDP was initially released, including rationale on why the changes were made and an assessment of the impact of these changes on the development plan. Also include a description of the processes and measures to be used in developing any user interfaces, including plans for and results of usability analyses and trade-off studies, and the impact on operator performance and workload.

3. SCI Progress – A description of the progress made in SCI development as compared to its development plan.

a. SCI Landscape – A general description of the requirements and implementation constraints allocated to the SCI, including:

i. Capabilities allocated to the SCI from the system

ii. Functional description of the SCI's requirements and how these functions support its allocated capabilities

iii. Interfaces and capabilities of the SCI that support operator tasks and decisions

iv. Interfaces and capabilities of the SCI that implement safety or security-critical functions

v. Interfaces between the SCI and other CIs within the system (hardware and software)

vi. Interfaces between the SCI and external entities (hardware and software outside of the system)

vii. Algorithms to be defined and implemented in the SCI, including their maturity

viii. Identification of candidate new and reused components (including Non-Developmental Item (NDI), COTS, legacy, and GFI) to be used in the SCI

ix. Plans for how reused components will meet IA requirements

x. Plans for integration of COTS components during future COTS refresh cycles

xi. A description of where industry and Government standards are to be applied

xii. Other changes made since SFR including a thorough explanation of the changes and the reason for the change

b. Performance Requirements – A description of the SCI's performance requirements. Such requirements include:

i. Data and processing accuracy and precision requirements, including computational and algorithmic, reject rates, tolerances, and numerics

ii. Execution time requirements (including latency, timing, and synchronization)

iii. Sizing requirements (including main memory, auxiliary memory (e.g., disk))

iv. Capacity requirements, including throughput and functional capacities (e.g., number of tracks)

v. Any changes since SFR or the last SSR will be described in detail, including the reasons for such changes

c. Software Metrics – A description of the core required metrics are contained in the PEO IWS Instruction on Software Development, Verification and Validation (V&V), Design Reuse, and Metrics Policy. Earned Value Metrics (EVMs) will be included when required by contract; otherwise equivalent progress metrics are required.

4. SCI Test Plans – An overview of the test approaches planned for qualification of the requirements, including:

a. The relationship to system level testing, including plans for multi-SCI and system integration testing

b. The planned test environment

c. Test evolution across builds

d. Allocation of test approaches to each SRS-level requirement (e.g., demonstration, test, and inspection)

e. Planned level of testing to be applied to each requirement (e.g., system, SCI, unit)

f. Requirements and design features supporting data extraction and test analysis

g. Special test equipment

h. HSI verification

i. Critical and frequent operator tasks and decisions or user interface components for which empirical performance data will be collected

j. Automated tools

k. Degree of coverage planned for the unit tests, both structural (statement coverage, branch coverage, path coverage) and functional

l. Special handling for mission or safety critical requirements and components.

m. Other special topics that affect the test approach

n. Changes since SFR or the last SSR and how these changes affect the program plan are to be included

5. Assessment of Progress – The TRB will, prior to the SSR meeting, assess the plans and the progress made by the DA. The assessment will cover the areas listed above, but at a more detailed level, with the purpose of determining whether sufficient progress has been made in development to allow initiation of architectural design. The results of the TRB assessment will be provided at the SSR to a level of detail sufficient for decision-making. The assessment shall cover:

   a. Requirements Quality – The completeness, appropriateness, and maturity of the SCI requirements (behavioral, performance, and quality) when applied to the system mission, and as evaluated against operational scenarios. This includes assessment of any algorithms specified as design constraints.

   b. Requirements Stability – The degree to which the SCI requirements have been stabilized.

   c. Interface Design – The completeness, maturity, and appropriateness of the interfaces defined for the SCI and whether they will support the SCIs requirements.

   d. Software Development Process – The quality of the planned processes to be applied as well as the level of adherence to the processes defined for the requirements analysis phase.

   e. Requirements Testability – The degree to which the requirements facilitate qualification.

f. Other Changes – Other changes made since SFR including a thorough explanation of the changes and the reason for the change.

6. Risk – A summary of the RMP shall be presented. Risk items, mitigation plans and progress toward resolution for open risks having the potential to impact successful completion of the SCI, covering all topics including staffing, training, and logistics, shall be highlighted. These risks are entered into a risk database.

C. SSR – Entrance and Exit Criteria

1. Entrance criteria for a SSR are:

a. Documentation is complete for software requirements, software processes, and tools. If an incremental approach is being used, the documentation must be complete for the increment.

i. SRSs and external IRSs for the SCI to be reviewed are completed and distributed for review and comment

ii. Software Development Folder (SDF) formats established

iii. Software Development tools for establishment and maintenance of Software Development Environment in place and operational

iv. Baseline higher-level (system and subsystem) specifications (SSDD) accepted

b. Software metrics have been collected are ready for presentation.

c. Software-related item performance specifications validated.

d. SW CI requirements are traced to higher-level (subsystem and system) requirements.

e. Cost, schedule, and performance risks identified, quantified, and prioritized.

f. Software RMP established and risk analysis performed.

g. SE:

i. Common Operational Environment (COE) performance analysis performed

ii. Functional Architecture for Embedded M&S developed

iii. Functional Architecture reviewed for System Safety Critical Functions

h. Critical and frequent operator tasks and decisions or user interface components for which empirical performance data will be collected. Operator job descriptions are complete.

i. Software Quality requirements established (i.e. correctness, reliability, efficiency, integrity, usability, maintainability, testability, flexibility, portability, reusability and interoperability including those relating to the SRSs and IRSs.

j. Testing:

i. Qualification requirements that identify applicable levels and methods of testing for the software requirements that comprise all Mission Applications (SCIs) have been agreed to

ii. Test Resources and Infrastructure identified and cost identified accordingly for various levels of testing

2. Exit criteria for a SSR are:

a. Appropriate architecture products have been reviewed and, where appropriate, approved.

b. Requirements maturity and completeness:

i. All SCI requirements are defined and accepted as stable, or are identified as subject to change

ii. All user interfaces are identified and accepted with critical formats and interactions defined, with usability requirements or objectives specified

iii. Inputs, processing, and outputs are defined and accepted for all functions

iv. All interfaces between the SCI and all other CIs both internal and external to the system are defined and accepted as stable. In particular, interoperability requirements are fully identified and defined, accepted, and correlated to mission requirements and scenarios.

v. All interface-level data elements are defined and accepted, including data type, size, format, units, range of values, accuracy and precision

vi. SCI performance requirements are defined and accepted, including those for execution time, storage requirements, and similar constraints

vii. Quality requirements are defined (e.g., portability, integrity, maintainability, and reusability) and accepted

viii. All safety and mission-critical and security/IA requirements are identified

ix. Implementation constraints (such as required algorithms, designs, and components to be reused) are identified

x. IA constraints (such as how IA requirements constrain component reuse)

c. Requirements traceability - All SCI level requirements are mapped to system-level requirements and all system level requirements are mapped to SCI-level requirements.

d. Test plans - For the SCI, all requirements are mapped to test approaches that are appropriate for the nature of the requirement.

e. Processes - SW development processes are fully defined in the SDP or equivalent document (e.g., Software Standards and Procedures Manual (SSPM)), and are accepted as appropriate for coding and unit test.

f. Tools - All tools required for architectural design phase are in place and ready for use.

g. Risks are identified in a Risk Database and have mitigation plans in place that are compatible with the SW development schedule.

h. RFA/RFIs - All RFA/RFIs have been assigned to responsible parties with defined due dates, and concrete plans in place that are compatible with the SW development schedule.

i. Project technical status in the SEP has been updated with decisions made during the SSR.

Hardware Preliminary Design Review (HW PDR)

A. HW PDR – Overall Guidance

1. Objective - The objective of the HW PDR is to review the architectural design of the CI to verify its compliance to its allocated requirements, the planned test approaches, and the overall progress being made in developing the CI, as it fits into the total system. The HW PDR is considered complete when the review panel has determined that progress has been sufficient for continued development

2. Scope - The HW PDR focuses on the architectural design of the CI and its relation to the allocated requirements and its role within the overall system. This architectural design defines the functions, performance, and interface requirements that will govern internal design of the CI. The HW PDR also covers the approach to be used for detailed design to ensure that it is adequate for continued development.

3. Timing - The PDR is conducted in the Technology Development phase just prior to the Engineering and Manufacturing phase. In effect, the PDR activity extends from the time of the TRB reviews through the formal PDR meeting, which serves as a capstone. A PDR will be held separately for every HWCI within the system. Multiple PDRs may be scheduled so that they occur sequentially within the same time period for convenience of scheduling, but they must be distinct and standalone. For efficiency, topics that are common across CIs (such as in the System Landscape) may be presented once, during the PDR for the first CI being reviewed.

4. Documentation - Documentation shall be provided to the TRB in enough detail to allow a sufficient review and formation of conclusions by the TRB. Documentation associated with this technical review is summarized in Appendix D.

B. HW PDR – Contents

1. System Landscape - The purpose of this topic is to review the documentation including, but not limited to the appropriate architecture products (OVs, SVs, TVs, and AVs) and to provide a perspective of where the HWCI fits into the overall system. This overview is necessary because many attendees at the HW PDR will not have had the luxury of having continuous exposure to development information. The main focus of the landscape is to reveal how well the HWCIs and systems requirements are being scheduled and managed.

    a. System Architecture - An identification of all HWCIs and their relationships, including a description of all connections/interfaces between the HWCIs and SCIs. The degree of OA (openness) of the emerging system shall be assessed using the OAAT, as shall its availability and potential for component reuse. A MOSA may be performed using the PART in lieu of the OAAT. Any tradeoff decisions made shall be critiqued and any IP issues impacting reuse shall be addressed as design and implementation proceed (e.g., a need to customize proprietary COTS products). Topics to be presented include:

i. An overview of the total system requirements as defined in the system specifications

ii. The allocation of requirements to each of the HWCIs under review that comprise comprising the system as defined in the individual HWCI critical item development specifications

iii. The allocation of requirements to any SCI hosted by the HWCI under review

iv. User interfaces, including displays

v. The connectivity among system HWCIs as defined in the interface design specifications (IDSs)

vi. Identification of all NDIs, government furnished equipment (GFE), and legacy equipment

vii. Operator and maintainer job descriptions

viii. Organization Structure

ix. Update to IMS

b. HWCI Identification - An identification of the specific HWCI for which the PDR is being conducted, based on the system configuration. This description includes:

i. An overview of the requirements as defined in the specification and any associated SCI/firmware documentation

ii. Where the HWCI fits into the system architecture

iii. Where the HWCI fits into the system development schedule

c. Requirements Flow-Down - A description of how the system requirements are allocated to the various HWCIs as traced through the requirement documents and databases, identifying any requirements that may be applicable to the production equipment, but not to the EDM. In addition, a breakdown of the requirements relative to SCI/firmware builds associated with the particular HWCI should be provided. This topic also includes descriptions of:

i. Requirements changes made since the previous review

ii. Safety critical requirements

iii. Quality requirements (including reliability, availability and maintainability)

iv. Requirements supporting test and analysis

v. Design error budgets for meeting allocated requirements

vi. Ship integration requirements

vii. System security/IA requirements

viii. Environmental requirements (including shock, vibration EMC/ EMI, nuclear, temperature, humidity, salt, spray)

d. Equipment SCI/Firmware Build Plans - A description of how the equipment and SCI/firmware build plans for the HWCI are consistent with the overall system development plan, including dates when technical agreements are needed on the content of the various requirements and design documentation.

2. Integrity of System Development Planning Process - A general description of the equipment development process/methods being followed as well as tools to be used (as documented in the HDP). Include a detailed explanation of any process and tool changes that have been made since the SSR/SFR, including rationale on why the changes are made and an assessment of the impact of these changes on the development plan. Also include any changes to the CM Plan and process and description of the processes and methodologies for assessing the ergonomics and operational suitability of hardware configurations.

3. HWCI Progress - A description of the progress made in HWCI development as compared to the planning defined in the system landscape.

4. HWCI Landscape – Provides a general description of the intra-HWCI landscape, including an overview of the HWCI's configuration with identification of HWCIs. Include an identification of where, within the architecture, development/new and reuse components will be located (including NDI, GOTS/ COTS, legacy and GFE). Describe how reused components will meet IA requirements. Also describe where industry and government standards are applied.

e. Maturity of Functional/Subsystem Design - The TRB will assess the completeness of the design, focusing on topics in the following list. The results of the TRB assessment will be provided at the PDR to a level of detail sufficient for decision-making. A detailed description of:

i. HWCI identification and definition

ii. Functionality allocated to the subsystems of the HWCI

iii. Algorithms to be implemented by any embedded SCI/firmware

iv. Interfaces among the subsystems of the HWCI

v. Design approach for computing capacity, storage capacity, and communication bandwidth budgets

vi. Analog processing designs

vii. Physical interfaces

viii. Other changes made since SRR/SFR including a thorough explanation of the changes and the reason fore the change. This is where metrics such as requirements stability are addressed.

ix. FD/FI concept

x. Design approach for achieving environmental compatibility

f. Performance Estimates - A description of the HWCI's performance requirements and how the subsystem architecture supports these including design margins. Such requirements include:

i. Performance analysis of proposed equipment versus requirements

ii. Impact of various hardware configurations on human performance, relative to predecessor systems and alternative technologies

iii. Data and processing accuracy and precision requirements, including computational and algorithmic, reject rates, tolerances, and numerics

iv. Execution time requirements (including latency, timing and synchronization)

v. Sizing requirements (including main memory, auxiliary memory (e.g., disk))

vi. Capacity requirements, including throughput and functional capacities (e.g., number of tracks)

vii. Any changes since SSR will be described in detail, including the reasons for such changes

g. Metrics – Metrics should include plan vs. specified parameters. The variety of hardware does not lend itself to a chart (e.g. A computer would have many different metrics than water pumping system); however this does not absolve the PM and/or SE from determining the metrics by which the particular hardware will be documented. These metrics should also include applicable EVMs where implemented by contract and the program's WBS. Once determined, these metrics should also be used to status HWCI progress in the HW CDR.

5. Testing - A description of the test plans and procedures that will be applied to the HWCI.

a. Test Plans - An overview of the test approaches planned for HWCI testing, including:

i. The relationship to system-level testing, including plans for standalone HWCI testing and system integration testing

ii. Performance and environmental qualification

iii. The test environment defined

iv. Test evolution

v. Allocation of test approaches and verification method to each test requirement

vi. Traceability of test requirements

vii. Criteria to be used to assess compliance (including correlation to performance goals)

viii. Requirements and design features supporting data extraction and test analysis

ix. Facilities and test resources defined and included in T&E planning

x. Test facilities and resources available to meet schedule.

xi. Special test equipment and their allocated performance requirements

xii. HSI verification

xiii. Automated tools

xiv. Other special topics that affect the test approach

xv. Changes since SSR/SFR and how these changes affect the program plan are to be included

b. Lower-level Tests - Special handling for mission safety critical requirements and components. A description of the plans for lower-level tests to be performed on the HWCI components, modules and subsystems, including degree of coverage planned for the tests, both functional and environmental.

6. Risk – RM process and all open risks having the potential to place the successful completion of the HWCI in jeopardy shall be presented along with their associated mitigation plans and progress to date. These risks, covering all topics including performance, environmental operability/survivability, staffing, training, logistics, GOTS/COTS Refresh issues, IA, are entered into the Risk Database.

7. Logistics - A discussion of Logistics planning and processes to include PSP, PBL strategy, supply support, sustainment strategies, unique ID strategy, preliminary production processes, GOTS/COTS obsolescence, manpower and training, parts and material selection, maintenance planning, DMSMS, and PBL BCA.

8. Environmental Issues - A discussion of environmental planning and issues to include ESOH requirements, PESHE updates since SSR/SFR, hazard materials and system safety.

C. HW PDR – Entrance and Exit Criteria

1. Entrance criteria for a HW PDR are:

   a. Design documentation and test plans complete; the H/W PDR technical data package (see Appendix D) has been reviewed and assessed by TRB.

   b. Previous technical review completed and all SFR RFA/RFIs are closed.

   c. Metrics have been collected and are ready for presentation.

   d. Plans for the next phase of system development have been established.

2. Exit criteria for a HW PDR are:

   a. Architecture products have been reviewed and, where appropriate, approved.

   b. Analysis definition complete:

      i. All subsystems are identified

      ii. Each subsystem, its interfaces, allocated functionality, and algorithms needed to implement the functionality are defined and accepted

      iii. Error budgets have been established for critical system parameters

      iv. FD/FI concept supports availability requirements

      v. Environmental, operator/maintainer and ship integration impacts are addressed in design

   c. Test plans concurred in:

      i. Requirements for the HWCI are mapped to test approaches

      ii. Appropriate test strategies for the lower-level testing are fully defined and accepted

   d. Development processes are fully defined and accepted.

   e. All tools required for the next phase are in place and ready for use.

   f. Risks are known and manageable and Risk Database reflects that risks have mitigation plans in place that are compatible with the equipment development schedule.

g. Plans for the next phase of system development have been accepted.

h. Project technical status in the SEP has been updated including decisions made during the HW PDR.

i. Approved documentation placed under configuration control. (If the Hardware PDR completes the Allocated Baseline, then the Allocated Baseline is placed under configuration control. Otherwise this occurs upon completion of the Software PDR).

Software Preliminary Design Review (SW PDR)

A. SW PDR – Overall Guidance

1. Objective - The objective of the SW PDR is to review the architectural design of the CI to verify its compliance to the requirements established during the SSR, the planned test approaches, and the overall progress being made in developing the CI, as it fits into the total system. The SW PDR is considered complete when the review panel has determined that progress has been sufficient for continued development.

2. Scope – The SW PDR focuses on the architectural design of the CI and its relation to the allocated requirements and its role within the overall system. This architectural design defines the functions, performance, and interface requirements that will govern internal design of the CI. The SW PDR also covers the approach to be used for detailed design to ensure that it is adequate for continued development.

3. Timing - The PDR is conducted in the Technology Development phase and just prior to the Engineering and Manufacturing Development phase. In effect, the PDR activity extends from the time of the TRB's reviews through the formal PDR meeting, which serves as a capstone. A PDR will be held separately for every SCI. Multiple PDRs may be scheduled so that they occur sequentially within the same time period for convenience of scheduling, but they must be distinct and standalone. For efficiency, topics that are common across SCIs (such as in the System Landscape) may be presented once, during the PDR for the first SCI being reviewed.

4. Documentation - Documentation shall be provided to the TRB in enough detail to allow a sufficient review and formation of conclusions by the TRB. Documentation associated with this technical review is summarized in Appendix D of the TRM.

B. SW PDR – Topics

1. System Landscape - The purpose of this topic is to review the documentation including, but not limited to the appropriate architecture products (OVs, SVs, TVs, and AVs) and to provide a perspective of where the SCI fits into the overall system. This overview is necessary because many attendees at the PDR will not have had the luxury of having continuous exposure to development information. The main focus of the landscape is to reveal how well the SCIs (and system's) requirements are being scheduled and managed.

    a. System Architecture - An identification of all system SCIs and their relationships, including a description of all connections/interfaces between the SCIs. This description will be presented so that the relationships of the different builds are also identified (if the system is to be developed in multiple builds). The degree of OA (openness) of the emerging system shall be assessed using the OAAT, as shall its availability and potential for component reuse. A MOSA may be performed using the PART in lieu of the OAAT. Any tradeoff decisions made shall be critiqued and any IP issues impacting reuse shall be addressed as design and

implementation proceed (e.g., a need to customize proprietary COTS products). Topics to be presented include:

i. An overview of the system requirements

ii. The allocation of system requirements to SCIs

iii. User interfaces, including displays

iv. The allocation of requirements to each system build together with any requirements deltas

v. The interfaces between the CIs, broken out into builds

vi. The layers of the architecture (if layers have been defined)

vii. Locations of new and reused software (including COTS, NDI, legacy, and GFI)

viii. Plans for how reused CIs will meet IA requirements

ix. Organization Structure

x. Update to the IMS

b. SCI Identification - An identification of the specific SCI for which the PDR is being conducted, based on the system architecture. This description includes:

i. An overview of the requirements

ii. Where the CI fits into the system architecture (including layers as appropriate)

iii. Where the SCI fits into the system build plan

c. Requirements Flow-Down - A description of how the system requirements are allocated to the various CIs as traced through the requirement documents and databases (e.g., SSS, SRS, IRS, IDDs), including a breakdown of how the requirements are allocated across builds, and provide references so that reviewers can examine documentation defining which SRS requirements are allocated to which builds. This topic also includes descriptions of:

i. Requirements changes made since SSR/SFR

ii. Security critical requirements

iii. Quality requirements (including reliability, availability and maintainability)

iv. Requirements supporting test and analysis (i.e., log files)

v. Safety critical requirements

d. SCI Build Plans - A description of how the build plan for the SCI is consistent with the overall system build plan, including dates when technical agreements are needed on the content of the various requirements and design documentation.

2. Integrity of Software Development Process - A general description of the software development processes/methods being followed as well as tools to be used (as documented in the SDP). Include a detailed explanation of any process and tool changes that have been made since the SSR/SFR, including rationale on why the changes are made and an assessment of the impact of these changes on the development plan. Also include a description of the CM Plan and process and measures to be used in assessing human performance and operator workload (cognitive/temporal/physical).

3. SCI Progress - A description of the progress made in SCI development as compared to the plan defined in the system development landscape.

   a. SCI Landscape - A general description of the intra-SCI landscape, including an overview of the SCI's architecture with identification of all CSCs. Detailed documentation defining the SCI's architecture will be made available for the PDR review members for review off-line. Include an identification of where, within the architecture, development/new and reuse components will be located (including NDI, GOTS/COTS, legacy and GFI). Describe how reused components will meet IA and safety requirements. Describe plans for integration of GOTS/ COTS components during future COTS refresh cycles. Describe the level of openness being achieved and how this meets Naval OA guidelines. Also, describe where industry and government standards are applied.

   b. Maturity of Functional/Subsystem Design - The TRB will assess the completeness of the design, focusing on topics in the following list. The results of the TRB assessment will be provided at the PDR to a level of detail sufficient for decision-making. The assessment is focused on:

      i. Allocation of each CSC's functionality and algorithms to its consistent Computer Software Units (CSUs)

      ii. Definitions of all CSUs in terms of interfaces, allocated functionality, and algorithms

      iii. Software requirements allocated to GOTS/COTS and reused software

      iv. Initial considerations for technology refresh planning, including logistical support and training

   c. Performance Estimates - A description of the SCI's performance requirements and how the architecture supports these. Such requirements include:

i. Data and processing accuracy and precision requirements, including computational and algorithmic, reject rates, tolerances, and numerics

ii. Execution time requirements (including latency, timing and synchronization)

iii. Sizing requirements (including main memory, auxiliary memory (e.g., disk))

iv. Capacity requirements, including throughput and functional capacities (e.g., number of tracks)

v. Usability, human performance, and operator workload requirements

vi. Any changes since SSR will be described in detail, including the reasons for such changes

d. Software Metrics – A description of the core required metrics are contained in the PEO IWS instruction on Software Development, Verification and Validation (V&V), Design Reuse, and Metrics Policy.

e. Assessment of Progress - The TRB will, prior to the PDR meeting, assess the plans and the progress made by the DA. The assessment will cover the areas listed above, but at a more detailed level, with the purpose of determining whether sufficient progress has been made in development to allow initiation of detailed design. This portion of the assessment will cover:

i. Requirements Stability - The degree to which the SCI requirements have been stabilized.

ii. Architectural Design - A completeness, maturity, and appropriateness of the design as proposed by the DA. Areas of focus include:

01 CSC identification and definition

02 Functionality allocated to the CSCs

03 Interfaces between CSCs

04 Algorithms to be implemented by the SCI or CSCs

f. Software Development Process - The quality of the planned processes to be applied as well as the level of adherence to the processes defined for the detailed design phase

g. Other changes made since SSR including a thorough explanation of the changes and the reason for the change

4. Testing - A description of the test plans and procedures that will be applied to the CI.

a. SCI Test Plans - The maturity and completeness of the DA's plan for testing the SCI. An overview of the test approaches planned for SCI testing and lower-level testing, including:

b. The relationship to system-level testing, including plans for multi-SCI testing and system integration testing

c. The test environment defined

d. Test evolution across builds

e. Allocation of test approaches and verification method to each SRS-level requirement

f. Criteria to be used to assess compliance (including correlation to performance goals)

g. Requirements and design features supporting data extraction and test analysis

h. Traceability of test requirements

i. T&E Facilities availability to meet schedule

j. Special test equipment

k. HSI verification

l. Automated tools

m. Facilities and test resources defined and included in T&E planning

n. Other special topics that affect the test approach

o. Changes since SSR and how these changes affect the program plan are to be included

5. Lower-level Tests – Special handling for mission safety critical requirements and components. A description of the tests to be performed on the components, from unit level to top-level component level, including:

   a. Degree of coverage planned for the tests, both structural (statement coverage, branch coverage, path coverage) and functional

   b. How the lower-level tests re-coordinated with SCI-level testing

6. Risk - A summary of the RM process and Risk Database items identified for the SCI that have the potential to impact successful completion of the SCI, covering all topics including staffing, training, and logistics, shall be highlighted along with mitigation plans and plans and progress toward resolution.

C. SW PDR – Entrance and Exit Criteria

1. Entrance criteria for a SW PDR are:

   a. Documentation complete for all architectural design, test plans, and software processes and tools in the PDR technical data package (see Appendix D) have been reviewed and assessed by TRB.

   b. Operator and maintainer task descriptions.

   c. Previous technical review completed and all RFA/RFIs from previous review have been closed.

   d. Software metrics have been collected and are ready for presentation.

   e. Plans for the next level of system development have been established.

2. Exit criteria for a SW PDR are:

   a. Architecture products have been reviewed and, where appropriate; approved (integrated architecture SVs and TVs support the operational architecture, CDD/CPD, ISP, and Net-Ready Key Performance Parameter (NR-KPP)).

   b. Design analysis/definition complete:

      i. All top-level components (CSCs) are identified

      ii. Component interfaces, allocated functionality, and algorithms needed to implement the functionality are defined and accepted

   c. Test plans concurred in:

      i. Requirements, for the SCI, are mapped to test approaches

      ii. Test strategies, for the lower-level testing, are fully defined and accepted (to include structural coverage goals for SCI unit test)

   d. Processes: Development processes are fully defined in the SDP or equivalent document, are adequate for coding and unit test, and have been accepted.

   e. Empirical data on critical and frequent operator tasks and decisions that will be necessary to measure human performance has been identified.

   f. All tools required for the next phase are in place and ready for use, including tools for user interface, prototyping, and operator testing.

   g. Risks are known and manageable and have mitigation plans in place that are compatible with the equipment and SW development schedule.

h. Plans for the next phase of system development have been accepted; the project is executable within the approved cost and schedule budget and allocated baseline.

i. Project technical status in the SEP has been updated including decisions made during the PDR.

j. Approved Allocated Baseline documentation has been placed under configuration control (CIs and their allocated requirements as defined by design specifications and software segment specifications).

Hardware Critical Design Review (HW CDR)

A. HW CDR – Overall Guidance

1. Objective - The objective of the HW CDR is to provide the opportunity to assess the completeness of the detailed design and how it supports the performance requirements as well as overall progress being made in developing the system.

2. Scope - The HW CDR is conducted to demonstrate that the system/subsystem detailed design and the test plans are complete, meet system capability requirements, meets performance parameters, and that the system is ready for fabrication. A rough rule of thumb is the design should be at least 85% complete. Many programs use drawing release as a metric for measuring design completion.

3. Timing - The CDR is conducted during the Engineering and Manufacturing phase. In SoS developments, where HWCIs may be already developed systems, these do not require additional CDRs; in these large-scale applications, the PM may tailor the review process to address critical systems. Multiple CDRs may be scheduled. For efficiency, topics that are common across the CIs (such as in the System Landscape) may be presented once, during the CDR sequence for the first CI being reviewed as long as there is substantial commonality of attendees across the multiple CDRs. Where commonality of attendees across multiple CDRs is absent, the landscape information must be repeated at each such CDR.

4. Documentation - Documentation shall be provided to the TRB in enough detail to allow a sufficient review and formation of conclusions by the TRB. Documentation associated with this technical review is summarized in Appendix D of the TRM.

B. HW CDR – Topics

1. System Landscape - The purpose of this topic is to review the documentation including, but not limited to the appropriate architecture products (OVs, SVs, TVs, and AVs) and provide a perspective of where the HWCI fits into the overall system. This overview is necessary because many attendees at the CDR will not have had the luxury of having continuous exposure to development information. The main focus of the landscape is to reveal how well HWCIs and system requirements are being scheduled and managed.

    a. System Architecture - An identification of all system HWCIs and their relationships, including a description of all connections/interfaces between the HWCIs and SCIs. The degree of OA (openness) of the emerging system shall be assessed using the OAAT, as shall its availability and potential for component reuse. A MOSA may be performed using the PART in lieu of the OAAT. Any tradeoff decisions made shall be critiqued and any IP issues impacting reuse shall be addressed as design and implementation proceed (e.g., a need to customize proprietary COTS products). Topics to be presented include:

i. An overview of the total system requirements as defined in the system specifications

ii. The allocation of system requirements to each of the HWCIs comprising the system as defined in the individual HWCI critical item development specifications

iii. User interfaces, including displays

iv. The connectivity among system HWCIs as defined in the IDSs

v. Identification of all NDIs, GFE, and legacy equipment

vi. Manning concept

b. HWCI Identification - An identification of the specific HWCI for which the CDR is being conducted, based on the system architecture. This description includes:

i. An overview of its requirements as defined and any associated SCI and firmware documentation

ii. Where the HWCI fits into the system

iii. Where the HWCI fits into the system development schedule

c. Requirements Flow-Down - A description of how the system requirements are allocated to the various HWCIs as traced through the requirement documents and databases. Identify any requirements that may be applicable to the production equipment, but not to the EDM. In addition, a breakdown of the requirements relative to SCI/firmware builds associated with the particular HWCI should be provided. This topic also includes descriptions of:

i. Requirements changes made since PDR

ii. Safety critical requirements

iii. Quality requirements (including reliability, availability and maintainability)

iv. Requirements supporting test and analysis

v. Design error budgets for meeting allocated requirements

vi. Ship integration requirements

vii. System security/IA requirements

viii. Environmental requirements (including shock, vibration, EMC/EMI, temperature, humidity)

ix. Processes for assessing the ergonomics and suitability of hardware configurations

x. Maintainability and Built-in-Test (BIT) requirements

d. Equipment and SCI/Firmware Build Plans - A description of how the equipment and SCI/firmware build plans for the HWCI are consistent with the overall system development plan, including dates when technical agreements are needed on the content of the various requirements and design documentation.

2. Development Process - A general description of the equipment development process/methods being followed as well as tools to be used. Include a detailed explanation of any process and tool changes that have been made since the PDR, including rationale on why the changes are made and an assessment of the impact of these changes on the HDP.

3. HWCI Progress - A description of the progress made in HWCI development as compared to the planning defined in the system landscape.

a. HWCI Landscape – Provide a general description of the intra-HWCI landscape, including an overview of the HWCI's configuration with identification of HWCIs. Include an identification of where, within the architecture, development and reuse components will be located (including NDI, GOTS/COTS, legacy and GFE). Describe how reused HWCIs will meet IA requirements. Also, describe where industry and government standards are applied.

b. Maturity of Functional/Subsystem Design - The TRB will assess the completeness of the design. The results of the assessment will be provided at the CDR to a level of detail sufficient for decision-making. Assessment should address:

i. HWCI identification and definition

ii. Functionality allocated to each module of each subsystem of the HWCI

iii. HW electrical, mechanical and thermal design including identification of all electrical and mechanical components

iv. Ergonomics and operational suitability of HW configurations

v. Identification of fabrication techniques/methodologies

vi. Environmental protection design

vii. Interfaces among the subsystems of the HWCI

viii. Design approach for computing capacity, storage capacity, and communication bandwidth budgets

ix. Analog processing designs

x. Physical interfaces

xi. Other changes made since PDR including a thorough explanation of the changes and the reason for the change. This is where metrics such as requirements stability are addressed

xii. FD/FI design

xiii. Technology-refresh approach

c. Performance Estimates - A description of the HWCI's performance requirements and how the subsystem design (for HWCIs) / detailed design (for SCIs) support these. Such requirements include:

i. Performance analysis of proposed equipment design versus requirements

ii. Data and processing accuracy and precision requirements, including computational and algorithmic, reject rates, tolerances, and numerics

iii. Execution time requirements (including latency, timing and synchronization)

iv. Sizing requirements (including main memory, auxiliary memory (e.g., disk))

v. Capacity requirements, including throughput and functional capacities (e.g., number of tracks)

vi. Impact of various hardware configurations on human performance, relative to predecessor systems and alternative technologies

vii. Any changes since PDR will be described in detail, including the reasons for such changes

d. Metrics – Metrics appropriate to the particular development must be determined, published and agreed to (recommend that they be in contract) and should include (EVMs (if contracted) or equivalent and the program’s WBS.

4. Testing - A description of the test plans and procedures that will be applied to the HWCI.

a. Test Approach - An overview of the test approaches planned for the HWCI, including:

i. The relationship to system-level testing, including plans for standalone HWCI testing and system integration testing

ii. Performance and environmental qualification

iii. The test environment

iv. Test evolution

v. Allocation of test approaches and verification methods to each test requirement

vi. Criteria to be used to assess compliance

vii. Requirements and design features supporting data extraction and test analysis

viii. Government and contractor T&E facilities

ix. Special test equipment

x. HSI verification

xi. Automated tools

xii. Special handling for mission safety critical requirements and components

xiii. Detailed test schedule with test interdependencies

xiv. Other special topics that affect the test approach, including certification requirements

xv. Changes since PDR and how these changes affect the program plan are to be included.

b. Formal Qualification Test (FQT) Descriptions - The TRB will assess the completeness of the HWCI test descriptions, focusing on the topics in the following list. The results of the assessment will be provided at the CDR to a level of detail sufficient for decision making.

i. Test cases (input data) for each CI requirement

ii. Criteria to be used to assess compliance (including correlation to performance goals)

iii. Special handling for mission safety critical requirements and components

c. Lower-level Tests - A description of the plans for lower-level tests to be performed on the HWCI components, modules and subsystems, including:

i. Degree of coverage planned for the tests, both functional and environmental

ii. Special handling for mission safety critical requirements and components

5. Risk - All open risks having the potential to place the successful completion of the HWCI in jeopardy shall be presented along with their associated mitigation plans and progress to date.

6. Logistics – A discussion of logistics issues including COTS/GOTS obsolescence issues, supply chain management/PBL management, PSP, DMSMS. system training plans and projected Material Support Date.

7. Environmental Issues – A discussion of Environmental issues including ESOH requirements, PESHE updates since PDR, hazard materials and system safety.

8. HSI – A discussion of HSI analysis addressing staffing requirements by work center and training, and any special skill requirements. Concepts reflect concerns for manning and skill levels of personnel; concepts for maintainability design and conform to ASTM 1166 including accessibility.

C. HW CDR – Entrance and Exit Criteria

1. Entrance criteria for a HW CDR are:

   a. All HW PDR RFA/RFIs closed.

   b. Technology Readiness Assessment (TRA), detailed design documentation, and test plans complete.

   c. SW & HW IP/licenses for development and production tools/system components identified.

   d. Metrics collected and ready for presentation.

   e. Plans for the next phase of system development have been established.

   f. Documents and products in the HW CDR technical data package (see Appendix D) have been reviewed and assessed by the TRB.

2. Exit criteria for a HW CDR are:

   a. Architecture products have been reviewed and, where appropriate, approved.

   b. Design maturity and completeness:

      i. All subsystems, modules and components are identified

      ii. For each subsystem, its design supports all interfaces, allocated functionality, reliability, maintainability, availability, and survivability

      iii. For each subsystem, the design is producible based on an assessment of manufacturing processes and components availability

iv. Each subsystem meets allocated performance requirements

v. Hardware electrical, mechanical and thermal designs support environmental requirements

vi. Ergonomics and operational suitability of hardware configurations are satisfied

vii. Algorithms to be implemented by any associated SCI/firmware are well defined and accepted

viii. Design meets computing capacity, storage capacity, and communication bandwidth budgets

ix. Physical interfaces have been identified

x. Other changes made since PDR are thoroughly explained. This is where metrics such as requirements stability are addressed

xi. FD/FI design is complete

xii. Technology refresh approach is identified

xiii. Operator and maintainer job descriptions approved

c. Test plans:

i. All requirements are mapped to test procedures

ii. For lower level testing, test procedures are fully defined and appropriate

iii. For lower level testing, test strategies are fully defined and appropriate (to include structural coverage goals for unit test)

d. Development processes are fully defined in the SEMP or equivalent document.

e. All tools required for fabrication are in place and ready for use.

f. Facilities management planning or strategy has been completed with timeline for required facilities (e.g., piers, hangars, dry-dock upgrades, simulator facilities, warehouses, magazines etc.) to support the system.

g. Risks are known and manageable and have mitigation plans in place that are compatible with the equipment development schedule.

h. Plans for the next phase of system development have been accepted; project is executable within existing cost and schedule budget.

i. Previous technical review successfully completed and all RFA/RFIs closed.

j. Project technical status in the SEP has been updated including decisions made during HW CDR.

Software Critical Design Review (SW CDR)

A. SW CDR – Overall Guidance

1. Objective - The objective of the SW CDR is to provide the opportunity to assess the completeness of the detailed design and how it supports the performance requirements as well as overall progress being made in developing the system.

2. Scope - The SW CDR focuses on the detailed design of the CI and its relation to the allocated requirements and its role within the overall system. This architectural design defines the functions, performance, and interface requirements that will govern coding and testing of the CI. The SW CDR also covers the approach to be used for detailed design to ensure that it is adequate for continued development

3. Timing - The SW CDR is conducted during the Engineering and Manufacturing Development phase. Multiple CDRs may be scheduled. For efficiency, topics that are common across SCIs (such as in the System Landscape) may be presented once, during the CDR sequence as long as there is substantial commonality of attendees across the multiple CDRs. Where commonality of attendees across multiple CDRs is absent, the landscape information must be repeated at each such CDR. In effect, the SW CDR activity extends from the time of the TRB reviews through the system-level CDR meeting, which serves as a capstone. HW and SW CDRs may be combined into a single CDR; however, all exit criteria for both HW and SW CDRs must be accomplished for a successful CDR.

4. Documentation - Documentation shall be provided to the TRB in enough detail to allow a sufficient review and formation of conclusions by the TRB. Documentation associated with this technical review is provided in Appendix D of the TRM.

B. SW CDR – Topics

1. System Landscape - The purpose of this topic is to review the documentation including, but not limited to the appropriate architecture products (OVs, SVs, TVs, and AVs) and to provide a perspective of where the SCI fits into the overall system. This overview is necessary because many attendees at the CDR will not have had the luxury of having continuous exposure to development information. The main focus of the landscape is to reveal how well SCIs (and system's) requirements are being scheduled and managed.

    a. System Architecture - An identification of all system CIs (both HWCIs and SCIs) and their relationships, including a description of all connections/interfaces between the CIs as well as interfaces between the CIs and the operators/maintainers. This description will be presented so that the relationships of the different builds are also identified (if the system is to be developed in multiple builds). In the event of multiple CDR reviews for multiple CIs, it may be worthwhile to devote one solely to a review of the Software Architecture Design. The degree of OA (openness) of the emerging system shall be assessed using the OAAT, as shall its availability and potential for component reuse. A

MOSA may be performed using the PART in lieu of the OAAT. Any tradeoff decisions made shall be critiqued and any IP issues impacting reuse shall be addressed as design and implementation proceed (e.g., a need to customize proprietary COTS products). Topics will include:

i. An overview of the total system requirements

ii. The allocation of system requirements to SCIs

iii. User interfaces including displays

iv. The growth of requirements for each system build including any training required

v. The interfaces between the SCIs, broken out into builds

vi. The layers of the architecture (if layers have been defined)

vii. Locations of new and reused software (including GOTS/COTS, NDI, legacy, and GFI)

viii. Plans for how reused software will meet IA requirements

ix. Organizational description of operators and maintainers associated with the system

b. SCI Identification - An identification of the specific SCI for which the CDR is being conducted, based on the system architecture. This description includes:

i. An overview of its requirements

ii. Where the SCI fits into the system (including layers as appropriate)

iii. Where the SCI fits into the system build plan

c. Requirements Flow-Down - A description of how the system requirements are allocated to the various SCIs as traced through the requirement documents and databases (e.g., SSS, SRS, IRS, and IDDs). Include a breakdown of how the requirements are allocated across builds, and provide references so that reviewers can examine documentation defining which SRS requirements are allocated to which builds. This topic also includes descriptions of:

i. Requirements changes made since PDR

ii. Safety critical requirements

iii. Quality requirements (including reliability, availability and maintainability)

iv. Requirements supporting test and analysis (e.g., log files)

d. SCI Build Plans

i. A description of how the build-plan for the SCI is consistent with the overall system build plan, including dates when technical agreements are needed on the content of the various requirements and design documentation

2. Integrity of Software Development Process - A general description of the software development processes/methods being followed as well as tools to be used (as documented in the SDP). Include a detailed explanation of any process and tool changes that have been made since the PDR, including rationale on why the changes are made and an assessment of the impact of these changes on the development plan.

3. SCI Progress - A description of the progress made in SCI development as compared to the plan defined in the system development landscape.

4. SCI Landscape - A general description of the intra-SCI landscape, including an overview of the SCI's architecture with identification of all CSCs, and a description of the changes made since this topic was reviewed at PDR. Detailed documentation defining the SCI's architecture will be made available for the CDR review members for review off-line. Include an identification of and how reused components will meet IA requirements and where, within the architecture, new and reuse components will be located (including NDI, GOTS/COTS, legacy and GFE/GFI). Describe plans for the integration of GOTS/COTS components during future COTS refresh cycles. Also describe where industry and government standards are applied.

a. Include an overview of the SCI's architecture with identification of all CSCs, and a description of the changes made since this topic was reviewed at PDR. Detailed documentation defining the SCI's architecture will be made available for the CDR review members for review off-line.

5. Maturity of Detailed Design - The TRB will assess the completeness of the detailed design, focusing on the topics in the following list:

a. All CSU interfaces shall be completely defined (all data items, types, invocations)

b. All CSU requirements shall be defined

c. All operator task descriptions are fully defined and supported by CSUs

d. Allocation of each CSCs functionality and algorithms to its constituent CSUs

e. Definitions of all CSUs in terms of interfaces, allocated functionality, and algorithms

f. No new software units should need to be defined for the build under review

g. All CSU algorithms shall be defined and allocated, including pseudo-code where appropriate

h. Performance Estimates - A description of the SCI's performance requirements and how detailed design supports these. Such requirements include:

   i. Data and processing accuracy and precision requirements, including computational and algorithmic, reject rates, tolerances, and numerics

   ii. Execution time requirements (including latency, timing and synchronization)

   iii. Sizing requirements (including main memory, auxiliary memory (e.g., disk))

   iv. Capacity requirements, including throughput and functional capacities (e.g., number of tracks)

   v. Measures of human performance and operator workload (cognitive/temporal/physical) that demonstrate human and system performance requirements will be satisfied

   vi. Any changes since PDR will be described in detail, including the reasons for such changes

i. Software Metrics - A description of the core required metrics are contained in the PEO IWS instruction on Software Development, Verification and Validation (V&V), Design Reuse, and Metrics Policy.

j. Assessment of Progress – The TRB will, prior to the CDR meeting, assess the plans and the progress made by the DA. The assessment will cover the areas listed above, but at a more detailed level, with the purpose of determining whether sufficient progress has been made in detailed design to allow initiation of coding. The assessment shall cover:

   i. Requirements Stability - The degree to which the SCI requirements have been stabilized

   ii. Architectural Design Changes - A detailed description of any changes made since PDR of:

   iii. CSC identification and definition

      01. Functionality allocated to the CSCs

      02. Interfaces between CSCs

      03. Algorithms to be implemented by the SCI or CSCs

      04. Functionality allocated to operators, including job descriptions

      05. Other changes made since PDR including a thorough explanation of the changes and the reason for the change

iv. Software Development Process - The quality of the planned processes to be applied as well as the level of adherence to the processes defined for the coding phase

v. Configuration Control of Documentation

01. Software Design Documents (including SDDs) are complete and under CM control

02. Interface Design Documents (IDDs) are complete and under CM control

03. Reliability, Maintainability and Built-in-Test (BIT) requirements defined, documented and under CM control

6. Testing - A description of the test plans and procedures that will be applied to the SCI.

a. Test Approach - An overview of the tests planned for the SCI-level, including:

i. The relationship to system-level testing, including plans for multi-SCI testing, and system integration testing

ii. The test environment including M&S capabilities and limitations.

iii. Test evolution (across builds)

iv. Allocation of test approaches and verification methods to each SRS-level requirement

v. Criteria to be used to assess compliance

vi. Requirements and design features supporting data extraction and test analysis

vii. Government and contractor T&E facilities

viii. Special test equipment

ix. HSI verification

x. Evaluation of human performance capabilities within design parameters

xi. Automated tools

xii. Special handling for mission safety critical requirements and components

xiii. Detailed test schedule with test interdependencies

xiv. Other special topics that affect the test approach including certification where applicable

xv. Changes since PDR and how these changes affect the program plan are to be included

b. Functional Qualification Test (FQT) Descriptions - A description including the maturity and completeness of the DA's plans for testing the SCI, both at the SCI level and at lower levels, as well as the completeness and adequacy of the SCI test descriptions, and focusing on the topics in the following list.

i. Test cases (input data) for each SCI requirement

ii. Expected results

iii. Criteria to be used to assess compliance (including correlation to performance goals)

iv. Other changes made since PDR including a thorough explanation of the changes and the reason for the change

c. Lower-level Tests -A description of the tests to be performed on the SCI components, from unit level to top-level component level, including:

i. Degree of coverage planned for the tests, both structural (e.g. statement coverage, branch coverage, path coverage) and functional

ii. Special handling for mission or safety critical requirements and components

iii. How the lower-level tests are coordinated with SCI-level testing

7. Risk - A summary of the Risk Database items identified for the SCI that have the potential to impact successful completion of the SCI, covering all topics including staffing, training, and logistics, shall be highlighted along with mitigation plans and plans and progress toward resolution. Any changes to risk since PDR shall be specifically addressed.

8. Logistics – A discussion of COTS/GOTS obsolescence issues, PSP, DMSMS, system training plans and projected Material Support Date.

9. System Safety – A discussion of all System Safety issues.

10. HSI – Design concepts are presented for all human machine interfaces.

C. SW CDR – Entrance and Exit Criteria

1. Entrance criteria for a SW CDR are:

a. Detailed design documentation is sufficiently complete to initiate coding. Test (procedures and cases, and software processes and tools) plans are complete.

b. SW & HW IP/licenses for development and production tools/system components identified.

c. PDR successfully completed and all PDR RFA/RFIs closed.

d. Software metrics collected and ready for presentation.

e. Plans for the next phase of system development have been established.

f. Documents and products in the S/W CDR technical data package (see Appendix D) have been reviewed and assessed by the TRB.

g. Updated Risk Assessment; new risks since PDR have been identified, quantified, and reflected in the risk mitigation actions.

h. Software Design Document(s) (including SDDs) complete and ready to be placed under configuration control.

i. Software Interface Design Document(s) (IDDs) complete and ready to be placed under configuration control.

j. Preliminary test procedures for software integration and systems testing submitted for review.

2. Exit criteria for a SW CDR are:

a. Architecture products have been reviewed and, where appropriate, approved.

b. Design maturity and completeness:

i. All SCI components (CSCs, CSUs) are identified

ii. For each component, its interfaces, allocated functionality, and algorithms needed to implement the functionality are fully defined and accepted as correct

iii. Measures of human performance and operator workload (cognitive/temporal/physical) that demonstrate human and system performance requirements will be satisfied

c. Test plans:

i. All test cases (including input values, expected output, and evaluation criteria) have been fully defined and accepted

ii. The degree of coverage of the test cases against the requirements for the build under review has been shown to be 100%

iii. For lower level testing, test strategies are fully defined and appropriate (to include structural coverage goals for unit test)

d. Software development processes are fully defined in the SDP or equivalent document (e.g., SSPM), are appropriate for coding and unit test, and have been accepted.

e. All tools required for fabrication are in place and ready for use.

f. Risks are known and manageable and have mitigation plans in place that are compatible with the SW development schedule.

g. Plans for the next level of system development have been accepted.

h. Technology refresh approach is identified, including training and logistic support.

i. Project technical status in the SEP has been updated including decisions made during CDR.

Software Increment Review (SW IR)

A. SW IR – Overall Guidance

1. Objective - The objective of the SW IR is to assess the overall progress being made in developing the SCI against the established plan when an incremental approach is being followed.

2. Scope - Using the SRS as a governing requirement, the design for the SCI takes three forms: architectural design, expressed in terms of requirements for the SCI's major architectural components; detailed design, expressed in terms of code units, their interfaces and their algorithms; and code design, expressed in terms of the source code or higher abstraction. This design sets forth the functions, performance, and interface requirements that will govern design of the items within each SCI level. The SW IR reviews the results from the increment just completed, including the CIs requirements, architectural and detailed design, test approaches, and test results to confirm that that development progress is following accepted plans; that the approach for all levels of design satisfies the SRS; that risks are mitigated with closure plans for remaining risks that demonstrate require progress; and that the SCI is ready for continued development (such as the next increment).

3. Timing - The SW IR is conducted during the Engineering and Manufacturing Development phase after a CI increment is completed.

4. Documentation - Documentation shall be provided to the TRB in enough detail to allow a sufficient review and formation of conclusions by the TRB. Documentation associated with this technical review is provided in Appendix D of the TRM.

B. SW IR – Topics

1. System Landscape - The purpose of this topic is to review the documentation including, but not limited to the appropriate architecture products (OVs, SVs, TVs, and AVs) and to provide a perspective of where the SCI fits into the overall system. This overview is necessary because many attendees at the SW IR will not have had the luxury of having continuous exposure to development information. The main focus of the landscape is to reveal how well the SCI's (and system's) requirements are being scheduled and managed.

    a. System Architecture - An identification of all system SCIs and their relationships, including a description of all connections/interfaces between the SCIs. This description will be presented so that the relationships of the different builds are also identified (if the system is to be developed in multiple builds). The degree of OA (openness) of the emerging system shall be reviewed and reassessed using the OAAT as shall its availability and potential for component reuse. A MOSA may be performed using the PART in lieu of the OAAT. Any tradeoff decisions made shall be critiqued and any IP issues impacting reuse shall be addressed as design and implementation proceed (e.g., a need to customize proprietary COTS products). Topics to be presented include:

i. An overview of the system requirements

ii. The allocation of system requirements to SCIs

iii. User interfaces, including display screens

iv. The growth of requirements for each system build (both planned and actual)

v. The interfaces between the CIs (both HW and SW) broken out into builds

vi. The layers of the architecture (if layers have been defined)

vii. Locations of new and reused software (including GOTS/COTS, NDI, legacy, and GFI)

viii. Plans for how reused CIs will meet IA requirements

b. SCI Identification - An identification of the specific SCI for which the SW IR is being conducted, based on the system architecture. This description includes:

i. An overview of the requirements

ii. Where the SCI fits into the system architecture (including layers as appropriate)

iii. Where the SCI fits into the system build plan noting that builds may include spirals for each SCI

c. Requirements Flow-Down - A description of how the system requirements are allocated to the various CIs as traced through the requirement documents and databases (e.g., SSS, SRS, IRS, IDDs), including a breakdown of how the requirements are allocated across builds, and provide references so that reviewers can examine documentation defining which SRS requirements are allocated to which builds. This topic also includes descriptions of:

i. Requirements changes made since SSR and the previous SW IR

ii. Security critical requirements

iii. Quality requirements (including reliability, availability and maintainability)

iv. Requirements supporting test and analysis (i.e., log files)

v. Safety critical requirements

d. SCI Build Plans - A description of how the build plan for the SCI is consistent with the overall system build plan, including dates when technical agreements are needed on the content of the various requirements and design documentation.

The content of the build plan is the key driver behind the timing and content of the SW IR as it defines the activities to be performed and progress to be made.

2. Integrity of Software Development Process - A general description of the software development processes/methods being followed as well as tools to be used (as documented in the SDP). Include a detailed explanation of any process and tool changes that have been made since the SSR, including rationale on why the changes are made and an assessment of the impact of these changes on the development plan. Also include a description of the measures to be used in assessing human performance and operator workload (cognitive/temporal/physical).

3. SCI Progress - A description of the progress made in SCI development as compared to the SCI Build Plan defined in the system development landscape.

    a. SCI Landscape - A general description of the intra-SCI landscape, including an overview of the SCI's architecture with identification of all CSCs and a description of any changes made since this topic was reviewed at previous SW IRs (if any). Detailed documentation defining the SCI's architecture will be made available for the SW IR review members for review off-line. Include an identification of where, within the architecture, development/new and reuse components will be located (including NDI, GOTS/COTS, legacy and GFI). Describe how reused components will meet IA requirements. Describe where industry and government standards are applied.

    b. Maturity of Design - The TRB will assess the completeness of the design, focusing on topics in the following list. The mixture of topics will vary depending on the activities performed and the artifacts developed. In particular, for iterative developments, each review will include aspects of all levels of design with the earlier reviews emphasizing the architectural level and the later reviews emphasizing the detailed design and code level. The focus of the review is to ensure that the progress made is consistent with the planned progress and that the quality of the products is consistent with expectations. The results of the TRB assessment will be provided at the SW IR to a level of detail sufficient for decision-making. The assessment is focused on:

        i. Allocation of SCI requirements to its architectural components (CSCs)

        ii. Definitions of all CSCs in terms of interfaces, allocated functionality, and algorithms

        iii. Allocation of each CSC’s functionality and algorithms to its CSUs

        iv. Definitions of all CSUs in terms of interfaces, allocated functionality, and algorithm

        v. Completeness and appropriateness of any behavioral and design models and prototypes used to develop the design, as well as the information gained from applying such models/prototypes

vi. Results of any unit, component, and SCI-level tests performed including a summary of anomalies observed and recorded

vii. Initial considerations for technology refresh planning, including logistical support and training

c. Performance Estimates - A description of the SCI's performance requirements and how the architecture and design support these. Such requirements include:

i. Data and processing accuracy and precision requirements, including computational and algorithmic, reject rates, tolerances, and numerics

ii. Execution time requirements (including latency, timing and synchronization)

iii. Sizing requirements (including main memory, auxiliary memory (e.g., disk))

iv. Capacity requirements, including throughput and functional capacities (e.g., number of tracks)

v. Usability, human performance, and operator workload measures

vi. Any changes since SSR and previous SW IRs will be described in detail, including the reasons for such changes

d. Software Metrics – A description of the core required metrics are contained in the PEO IWS instruction on Software Development, Verification and Validation (V&V), Design Reuse, and Metrics Policy.

e. Assessment of Progress - The TRB will, prior to the SW IR meeting, assess the build plans established for the SCI and the actual progress made by the DA. The purpose is to determine whether sufficient progress has been made in development to allow continuation of design. This assessment will cover:

i. Requirements Stability - The degree to which the SCI requirements have been stabilized.

ii. Architectural Design - Completeness, maturity, and appropriateness of the design as proposed by the DA. Areas of focus include:

01. CSC identification and definition

02. Functionality allocated to the CSCs

03. Interfaces between CSCs

04. Algorithms to be implemented by the SCI or CSCs

iii. Software Development Process - The quality of the planned processes to be applied, as well as the level of adherence, to the processes defined in the SDP.

iv. Other changes made since SSR and the previous SW IR including a thorough explanation of the changes and the reason for the change

4. Testing - A description of the test plans and procedures that will be applied to the SCI including an overview of the tests planned for SCI-level testing including the relationship to system level testing, plans for multi-CSC testing and system integration testing. Included are changes since previous SW IRs and these changes affect the program plan.

   a. SCI Test Plans - The maturity and completeness of the DAs plan for testing the SCI. An overview of the test approaches planned for SCI testing and lower-level testing, including:

      i. The relationship to system-level testing, including plans for multi-SCI testing and system integration testing

      ii. The test environment defined

      iii. Test evolution across builds

      iv. Allocation of test approaches and verification methods to each SRS-level requirement

      v. Criteria to be used to assess compliance (including correlation to performance goals)

      vi. Requirements and design features supporting data extraction and test analysis

      vii. Government and contractor T&E facilities

      viii. Traceability of test requirements

      ix. Special test equipment

      x. HSI verification

      xi. Automated tools

      xii. Other special topics that affect the test approach

      xiii. Changes since SSR and how these changes affect the program plan are to be included

   b. Lower-level Tests - A description of the tests to be performed on the SCI components, from unit level to top-level component level, including:

      i. Special handling for mission safety critical requirements and components

ii. Degree of coverage planned for the tests, both structural (e.g., statement coverage, branch coverage, path coverage) and functional

iii. How the lower-level tests re-coordinated with SCI-level testing

c. FQT Descriptions - When performed at the SCI level, FQT descriptions shall include the maturity and completeness of the DA's plans for performing formal qualification tests of the SCI, focusing on the topics in the following list:

i. Test cases (input data) for each SCI requirement

ii. Expected results

iii. Criteria to be used to assess compliance (including correlation to performance goals)

iv. Other changes made since the SSR and previous SW IR including a thorough explanation of the changes and the reason for the change

5. Risk - A summary of the Risk Database items identified for the SCI that have the potential to impact successful completion of the SCI, covering all topics including staffing, training, and logistics, shall be highlighted along with mitigation plans and plans and progress toward resolution. Any changes to risk since the previous SW IR shall be specifically addressed.

C. SW IR – Entrance and Exit Criteria

1. Entrance criteria for a SW IR are:

a. Documentation complete for all planned artifacts and activities performed.

b. Operator and maintainer task descriptions.

c. All RFA/RFIs from previous review have been closed.

d. Software metrics have been collected and are ready for presentation.

e. Plans for the next phase of SCI development have been established.

f. TRB has reviewed and assessed all available products.

2. Exit criteria for a SW IR are:

a. Architecture products have been reviewed and, where applicable, approved.

b. Design analysis/definition complete relative to plan:

i. All components are identified as planned

ii. Each component's interfaces, allocated functionality, and algorithms needed to implement the functionality are defined and accepted

iii. Measures of human performance and operator workload (cognitive/temporal/physical) that demonstrate human and system performance requirements will be satisfied

c. Test plans are complete relative to plan:

i. SCI requirements are mapped to test approaches

ii. Appropriate test strategies, for the lower-level testing, are fully defined and accepted (to include structural coverage goals for SCI unit test)

d. Processes: Development processes are fully defined in the SDP or equivalent document are appropriate for coding and unit test, have been accepted, and have been followed.

e. Empirical data on critical and frequent operator tasks and decisions that will be necessary to measure human performance have been identified.

f. All tools required for the next stage of development are in place and ready for use, including tools for user interface, prototyping, and operator testing.

g. Risks are known and manageable and have mitigation plans in place that are compatible with the equipment and SW development schedule.

h. Plans for the next stage of development (leading to the next SW IR) have been accepted.

i. Project technical statuses in the SEP and in the SDP (if required) have been updated and approved.

j. Allocated Baseline documentation placed under configuration control.

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APPENDIX D: TECHNICAL REVIEW DOCUMENTATION MATRIX

Table D-1 provides a matrix of typical information and document items that correspond to the reviews described in this TRM. This is provided for information purposes only, as a way of assisting to ensure that adequate data is available for conducting reviews. There are many alternate forms that this information can take, including as databases within development tools.

TABLE D-1. DOCUMENTATION TECHNICAL REVIEWS

Document Technical Reviews	ITR	ASR	SRR	SFR	SSR	PDR	CDR	HW PDR	SW PDR	HW CDR	SW CDR	SW IR	TRR	FCA / SVR	PCA
Initial Capabilities Document - Mission Needs - Operational Requirements	P	F	U												
STAR / STA		F													
Key Performance Parameters		P	F	U											
Design Reference Mission (DRM)		F	U	U											
Operational Concept Document	O	P	F	U											
Capability Development Document	O	P	F												
Capability Production Document		O	P	P	P	F									
Analysis of Alternatives	P	F													
Technology Development Plan/Technology Readiness Assessment	D	P	F												
System Requirements Document (SRD)		D	P	F	U										
Work Breakdown Structure (WBS)		D	P	F	U	U	U								
Milestone Schedule		D	P	F	U										

Document Technical Reviews	ITR	ASR	SRR	SFR	SSR	PDR	CDR	HW PDR	SW PDR	HW CDR	SW CDR	SW IR	TRR	FCA / SVR	PCA
Integrated Master Schedule / Integrated Master Plan			F	U	U	U	U								
System Engineering Plan	D	P	F	U	U	U	U	U	U	U	U	U	U	U	U
Configuration Management (CM) Plan		P	F	U	U	U	U								
Risk Management Plan (RMP) / Risk Database	D	P	F	U	U							U			
Mission and Requirements Analysis		D	P	F	U										
Functional Flow Analysis			P	F	U				U		U				
Test and Evaluation Master Plan (TEMP)			P	F	U								U		
Trade and Design Studies		D	P	F	U	U	U	U	U	U	U				
Specialty Engineering Studies		D	P	F	U	U	U	U	U	U	U				
System Acquisition And Life Cycle Cost Estimate & Supporting Rationale			P	F	U	U	U	U	U	U	U				
Manpower Estimate Report (ACAT 1 only)		P	F												
Human Systems Integration (HSI) Plan			P	F	U	U	U	U	U	U	U	U			
Logistics Support Analysis			P	P		F	U	U		U					

Document Technical Reviews	ITR	ASR	SRR	SFR	SSR	PDR	CDR	HW PDR	SW PDR	HW CDR	SW CDR	SW IR	TRR	FCA / SVR	PCA
Supportability Analysis Plan			F												
Technical Performance Measurement Planning		D	P	F	U	U	U	U	U	U	U				
System Safety Plan			P	P	U	F	U	U	U	U	U	U			
Manufacturing Plan				P				F		U					
Security/IA/ Program Protection Plan		P	F	U	U	U	U	U	U	U	U	U	U		
Information Support Plan (ISP)			F												
Facilities Management Plan														P	F
Product Support Plan /DMSMS Plan			P	F		U	U	U		U				U	U
Quality Assurance Plan (QAP)			P	P	F	U	U								
System/Subsystem Design Description (SSDD) or System Architecture Description Document (SADD)			P	F	U	U	U	U							
Prime Item Development Specification (PIDS)				P	P			F	U						
Critical Item Development Specification (CIDS)				P	P			F							
Software Requirements Specification (SRS)				P	F							U			

Document Technical Reviews	ITR	ASR	SRR	SFR	SSR	PDR	CDR	HW PDR	SW PDR	HW CDR	SW CDR	SW IR	TRR	FCA / SVR	PCA
External Interface Requirements Specifications (IRS)			P	F	U							U			
Internal Interface Requirements Specifications (IRS)				P	F	U	U					U			
Interface Control Documents				P				F		U					
Support Equipment Specs				P				F		U			U		
Software Development Plan (SDP)				P	F				U		U	U			
Software Design Description (SDD) or Model Equivalent					P				F		U	U			
Metrics Plan (MP)		`			P				F						
Test Strategy /TEMP				D	P	U	U	U				U	F		
Training Planning Process Methodology						F									
System/ Software Test Plan (STP)					P				F		U	U	U	U	
Prototype Hardware								P		F					
Hardware CI Test Plan (HWCITP)								P		F			U		
Top Level Drawings								F		U			U		U
Interface Design Description (IDD)									P		F		U	U	U

Document Technical Reviews	ITR	ASR	SRR	SFR	SSR	PDR	CDR	HW PDR	SW PDR	HW CDR	SW CDR	SW IR	TRR	FCA / SVR	PCA
Detailed Drawings										F			U		U
Software Test Description (STD)									P		F	U	U	U	
AV-1 Overview and Summary Information	D	P	U	U	U	U	F								
AV-2 Integrated Dictionary	O	P	U	U	U	U	F								
OV-1 High-Level Operational Concept Graphic	P	F													
OV-2 Operational Node Connectivity Description	O	F													
OV-3 Operational Information Exchange Matrix		O													
OV-4 Organizational Relationships Chart		O													
OV-5 Operational Activity Model		P	F												
OV-6a Operational Rules Model		O													
OV-6b Operational State Transition Description		O													
OV-6c Operational Event-Trace Description		P	F												

Document Technical Reviews	ITR	ASR	SRR	SFR	SSR	PDR	CDR	HW PDR	SW PDR	HW CDR	SW CDR	SW IR	TRR	FCA / SVR	PCA
OV-7 Logical Data Model		O	O	P	F										
SV-1 Systems Interface Description				P	F	U	U								
SV-2 Systems Communicatio ns Description					P	F	U								
SV-3 Systems-Systems Matrix					P	F	U								
SV-4 Systems Functionality Description			P	F											
SV-5 Operational Activity to Systems Function Traceability Matrix			P	F											
SV-6 Systems Data Exchange Matrix					P	F	U								
SV-7 Systems Performance Parameters Matrix				P	F	U	U								
SV-8 Systems Evolution Description					P	F	U								
SV-9 Systems Technology Forecast					P	F	U								
SV-10a Systems Rules Model				P	F	U	U								
SV-10b Systems State Transition Description				P	F	U	U								
SV-10c Systems Event-Trace Description				P	F	U	U								
SV-11 Physical Schema					P	F	U								

Document Technical Reviews	ITR	ASR	SRR	SFR	SSR	PDR	CDR	HW PDR	SW PDR	HW CDR	SW CDR	SW IR	TRR	FCA / SVR	PCA
TV-1 Technical Standards Profile					P	F	U	U	U	U	U				
TV-2 Technical Standards Forecast					P	F	U	U	U	U	U				

Legend: D = Draft; P = Preliminary; F = Final; U = Update (if required) ; O = Optional; where:

"Draft" is defined as an initial product that was generated and reviewed to support the assessment of other products, but that is expected to undergo further refinement before being assessed for sufficiency or baselined

"Preliminary" is defined as being reviewed and assessed sufficient to proceed to the next phase

"Final" is defined as being reviewed and assessed sufficient to proceed to the next phase, and to be established as a baseline under CM

"Update" is defined as being updated in accordance with established CM processes, with the last "update" being considered the final

"Optional" is defined as being provided, if available (ITR), or if applicable

APPENDIX E: TECHNICAL REVIEW MANUAL COMMENT FORM

The following form is for use in providing comments to the TRM throughout the year. The TRM will be updated at the end of FY10 and users are encouraged to submit comments for consideration in that update.

COMMENT FORM

Title: PEO IWS / NAVSEA 05 Technical Review Manual (TRM) September 2009

Critical (C) comments will cause nonconcurrence with a document if comments are not satisfactorily resolved.

Substantive (S) comments are provided because sections in the document appear to be or are potentially unnecessary, incorrect, incomplete, misleading, confusing, or inconsistent with other sections.

Administrative (A) comments correct what appear to be typographical or grammatical errors.

No.	Page	Para	Date	Org/POC	C / S / A	Comment	Action Taken: A = accepted; R = rejected; P = partial
1							
2							
3							
4							