CDR Factsheet

The Critical Design Review (CDR) is the midpoint milestone in the Engineering and Manufacturing Development (EMD) phase. The CDR is a multi-disciplined technical review establishing the initial product baseline to ensure that the system under review has a reasonable expectation of satisfying the requirements of the CDD within the currently allocated budget and schedule. Incremental CDRs are held for each Configuration Item (CI) culminating with a system level CDR. This review assesses the final design as captured in product specifications for each CI in the system and ensures that each product specification has been captured in detailed design documentation. CIs may consist of hardware and software elements, and include items such as airframe/hull, avionics, weapons, crew systems, engines, trainers/training, support equipment, etc. Product specifications for hardware enable the fabrication of configuration items, and include production drawings. Product specifications for software enable coding of the Computer Software Configuration Item (CSCI).

The CDR brings to closure technical risk mitigation and alternate design paths in detailed system design. Once the product baseline is established, opportunities to improve performance or reduce life cycle costs are severely limited. Changes to support equipment, training requirements, logistics and supply elements, interoperability, and performance can only be accomplished through a formal Engineering Change Proposal (ECP). All technical risk should be reduced to acceptable levels and remaining program execution risk resulting from resource or schedule shortfalls must be addressed quickly or will jeopardize program success.

Completion of the CDR should provide the following:

(1) An established system initial product baseline,

(2) An updated risk assessment for EMD,

(3) An updated CARD (or CARD-like document) based on the system product baseline,

(4) An updated program development schedule including fabrication, test and evaluation, and software coding, critical path drivers, and

(5) An approved Life Cycle Sustainment Plan updating program sustainment development efforts and schedules based on current budgets, test evaluation results and firm supportability design features.

For complex systems, a CDR may be conducted for each subsystem and logistics element. These incremental reviews lead to an overall system CDR. Incremental design reviews are usually defined at Interface Control Document (ICD) boundaries. System level performance is supported by compliance with ICDs, but not assured. When incremental reviews have been conducted; additional risk is introduced until the overall system CDR establishes the complete system product baseline. Each incremental CDR closes a functional or physical area of design to modification regardless of when it is held. This completed area of design may need to be reopened if open areas cannot achieve desired performance in isolation. If the schedule is being preserved through parallel design and build decisions, any system

deficiencies that lead to reopening design will result in rework and possible material scrap.

At CDR, the EMD process results in a detailed product baseline for the system, hardware, software, support equipment, training systems, system integration laboratory, and technical data. The subsystem detailed designs and logistics elements are evaluated to determine whether they correctly and completely implement all allocated system requirements, and whether the CDD traceability to final system detail design is maintained. Any changes during EMD are incorporated, and the CDD evolves to the Capability Production Document (CPD) required at Milestone C. The overall system level CDR is not only approval of the system product baseline, but also approval of the product baselines for maintainability, supportability, and logistics elements. A successful review is predicated on the review chairperson's determination that the subsystem requirements, subsystem detail design, results of peer reviews, and plans for test and evaluation form a satisfactory basis for proceeding into system fabrication, demonstration and test.

The CDR Chairperson should tailor the review to the technical scope and risk of the system, and address specifics of the CDR in the SEP.

Typical CDR success criteria include affirmative answers to the following exit questions:

(1) Does the status of the technical effort and design indicate operational test and evaluation success (operationally effective and suitable)?

(2) Does the detailed design (hardware and software) including interface descriptions completed, as disclosed, satisfy the Capabilities Development Document or any available draft Capability Production Document?

(3) Has the system product baseline been established and documented to enable hardware fabrication and software coding to proceed with proper configuration management?

(4) Has the detailed design satisfied sustainment, Human Systems Integration (HSI) and Environment, Safety, and Occupational Health (ESOH) design factor requirements?

(5) Are adequate processes and metrics in place for the program to succeed?

(6) Are the risks known and manageable for testing in support of developmental and operational evaluation objectives?

(7) Is the program schedule executable (technical/cost risks)?

(8) Is the program properly staffed?

(9) Is the program executable with the existing budget and the approved product baseline?

(10) Is the detailed design producible within the production budget?

(11) Is the updated CARD consistent with the approved product baseline?

(12) Are all Critical Safety Items and Critical Application Items identified?

(13) Does the updated cost estimate fit within the existing budget?

(14) Is the software functionality in the approved product baseline consistent with the updated software metrics and resource-loaded schedule?

(15) Have key product characteristics having the most impact on system performance, assembly, cost, reliability, and sustainment or safety been identified?

(16) Have the critical manufacturing processes that affect the key characteristics been identified and their capability to meet design tolerances determined?

(17) Have process control plans been developed for critical manufacturing processes?

The CDR should be conducted when the product baseline has been achieved, allowing fabrication of hardware and coding of software deliverables to proceed. A rule of thumb is that 75 percent to 90 percent of (manufacturing quality) product drawings, software design specification(s) and associated instructions should be complete, and that 100 percent of all safety-critical component (Critical Safety Items and Critical Application Items) drawings are complete.

DoD Instruction 5000.02, paragraph 3.6.9.1, directs the reporting of the results from the completion of the Critical Design Review per the following extract:

The PM shall provide a Post-CDR Report to the MDA that provides an overall assessment of design maturity and a summary of the system-level CDR results which shall include, but not be limited to:

- The names, organizations, and areas of expertise of independent subject matter expert participants and CDR chair,
- A description of the product baseline for the system and the percentage of build-to packages completed for this baseline,
- A summary of the issues and actions identified at the review together with their closure plans,
- An assessment of risk by the participants against the exit criteria for the EMD phase, and
- Identification of those issues/risks that could result in a breach to the program baseline or substantively impact cost, schedule or performance.

The CDR risk assessment checklist is designed as a technical review preparation tool, and should be used as the primary guide for assessing risk during the review. This checklist is available via the "Checklist for Technical Reviews" in the Reference Tab in this course