



CRITICAL DESIGN REVIEW FOR UNMANNED MISSIONS

Practice:

Conduct a formal Critical Design Review (CDR) of hardware, software, and firmware at the subsystem and system levels. Schedule the review prior to the start of subsystem fabrication and assembly to assure that the design solutions satisfy the performance requirements established in the development specifications. Establish this review as a standard reliability engineering practice for flight hardware.

Benefits:

The CDR provides increased assurance that the proposed design, and the planned manufacturing and test methods and procedures, will result in an acceptable product, with minimal project risk.

Programs That Certified Usage:

The CDR process has been used on all JPL-managed projects and science instrument tasks, including Ranger, Mariner, Voyager, Galileo, Magellan, Topex/Poseidon, Mars Observer, Microwave Limb Sounder, Wide Field Planetary Camera, and numerous other science instruments.

Center to Contact for Information:

Jet Propulsion Laboratory (JPL)

Implementation Method:

Responsibilities

The responsible project or task manager defines the need to conduct a formal review and initiates action by contacting the convening authority (generally, the next higher management level). The convening authority, in consultation with the responsible manager, appoints the review board and a chair and defines the board charter and schedule.

The CDR ensures that all design considerations have been adequately incorporated and that all engineering analyses have been completed. Results of engineering model tests are presented to demonstrate that the hardware and software can be built to perform as planned. In addition, plans are presented for fabrication and testing, including qualification and acceptance.

The review board, under direction of the chair, conducts the review and prepares a written report to the responsible manager on the findings and recommendations. The responsible manager then prepares a written response to the convening authority addressing the disposition of the review board findings and recommendations. The convening authority reviews and approves these dispositions.

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CDR Agenda

The following items and issues are addressed at the CDR, where applicable:

1. Functional description and block diagram.
2. Functional requirements and compliance of the design, presented in matrix format with traceability references.
3. Disposition of subassembly/subsystem Preliminary Design Review (PDR) action items.
4. Compliance of the design with accuracy requirements.
5. Compliance of the design with interface requirements.
6. Compliance of the design with mass requirements.
7. Compliance of the design with power requirements.
8. Compliance of the design with memory requirements.
9. Compliance of the design with environmental requirements.
10. Compliance of the design with project Single Point Failure (SPF) policy.
11. Compliance of the design with maintainability requirements.
12. Status and plans for electronic piece part acquisition.
13. Make or buy decisions and rationale.
14. Compliance with project requirements for inherited hardware and software. Consideration of inheritance review results.
15. Plans for compliance with spares requirements.
16. Status of plan for meeting quality assurance requirements, procedures, and workmanship standards.
17. Status of plan for meeting software assurance requirements.
18. Status or results of plan for meeting reliability analyses requirements.
19. Status or results of plan for meeting safety analyses requirements.

CRITICAL DESIGN REVIEW FOR UNMANNED MISSIONS

20. Status of plan for meeting documentation requirements.
21. Status of plan for meeting support equipment requirements.
22. Status or results of plan for meeting structural analysis requirements.
23. Status or results of plan for meeting thermal analysis requirements.
24. Fabrication, assembly, and test schedule and constraints.
25. Status or results of plan for meeting calibration requirements.
26. Plans for compliance with testability requirements.
27. Qualification (protoflight) test requirements and implementation plans.
28. Acceptance test requirements and plans.
29. Manufacturing and test facility requirements, availability and acceptability. Certification status and plans.
30. Hazardous operations facility requirements, availability and acceptability. Certification status and plans.
31. Results of detailed peer reviews, conclusions, and implementation plans.

Technical Rational:

The CDR provides for the assessment of the design and fabrication plans by a group of knowledgeable persons not directly involved in the activity being reviewed. A formal review can focus many years of experience on the subject at hand.

The CDR aids the responsible manager in evaluating the quality of the work and in making important decisions, including those concerning completion of critical milestones and resolution of identified issues. The review process should aid in the identification of problems and the evaluation of design approaches and options.

Impact of Non-Practice:

In the absence of a CDR, potential problems with adverse impacts on the subsystem, system, or project may not be identified in a timely manner. This oversight may later result in a condition having a significant effect on quality, reliability, capability, schedule, or cost.

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Related Practices:

1. *Preliminary Design Review*, Practice No. PD-ED-1215.1
2. *Subsystem Inheritance Review*, Practice No. PD-ED-1215.
3. *Common Review Methods* (under development)

References:

1. JPL Standard Practice Instruction (SPI) 4-16-1.
2. Guidelines for Planning and Conducting Formal Reviews, Jet Propulsion Laboratory document JPL D-10401 (Office of Engineering and Mission Assurance).
3. Technical Reviews and Audits for Systems, Equipment and Computer Software, MIL-STD-1521 (USAF).