

Criteria for Successful Completion of a PDR

1 - Design Description (including Requirements, Evolution and Heritage)

- A complete and comprehensive definition of the entire design exists to the component level.
- Results of trade studies and rationale for selected alternatives are defined. Remaining trade studies are identified and potential impacts are understood.
- Requirements flowdown and traceability to the appropriate subsystem of each system element, and essentially to the component, has been completed. A preliminary verification matrix has been defined that includes the selected verification method for each requirement.
- Requirements and design changes since SCR and SRR and their rationale are documented.
- Appropriate descopes have been identified.
 - o Plans and trigger points have been identified.
 - o Impact to science objectives and deliverables has been defined.
 - o Potential impacts to mass, power, software and other resources have been quantified.
 - o Budget and schedule impacts have been estimated.
- Long lead items and their acquisition plans have been identified. Any fabrication needed prior to CDR has been identified.
- Proof of heritage applicability has been assessed. Required analyses and/or tests of heritage designs to address all design modifications, changes in the expected environment and operational differences has been identified.
- EEE Parts Considerations:
 - o Radiation tolerance requirements have been defined.
 - o Selection, de-rating criteria, screening and qualification test criteria are defined.
 - o Preliminary parts lists are complete.
 - o Long lead acquisitions are planned. Risk mitigations are defined.
- Software Considerations:
 - o Preliminary requirements are identified, including language, structure, logic flow, CPU and memory loading.
 - o Design, build, and test approach is defined.
 - o Preliminary system performance estimates exist.
 - o IV&V plans are identified.

2 - Total System Performance (budgets/projections/margins for combined optical, thermal, mechanical, control, etc.)

- Budgets and margins for system level performance are defined.
- Preliminary system performance estimates are complete.
- Estimates of critical resource margins (i.e., mass, power, delta V, memory, CPU throughput, etc.) have been delineated based on design maturity.
 - o sufficient margin exists based on ANSI/AIAA standards or equivalent. Risk mitigation strategies are defined for margins below guidelines.
- Preliminary analyses are completed for:
 - o Mechanical loads, stress, and torque margins,
 - o Thermal environment, including predicted performance and margins,
 - o Radiation protection requirements and design margins,
 - o Expected lifetime and margins for limited life items.

3 - Design Analyses:

- Preliminary analyses critical to proof of design are complete.
- Analyses required to enable detailed design should be substantially complete.
- Rationale and risk assessment exists for outstanding analyses which may, at completion,

- substantially impact the design baseline, i.e. mass, power, volume, interfaces.
- Status and schedule of final analyses are defined.

4 - Development Test Activities

- Breadboard and engineering model development activities have been defined. Test objectives and criteria have been identified.
- Completed breadboard and engineering model test results have been iterated into the flight design.

5 - Risk Management

- A risk management process that meets GPG requirements is defined and utilized.
- All significant risks, problems, and open items are identified and tracked (including programmatic, development and flight performance related items)
- Risk mitigation plans are appropriate and credible.
- Lessons learned have been appropriately researched and adapted.

6 – Safety

- Preliminary identification of hazards and control methods has been completed.
- Any open safety issues are identified with plans for resolution.
- Plans and schedules for all required safety documentation are defined.

7– Assurance Activities

- Initial reliability analyses are completed, including:
 - Failure Mode and Effects (FMEA), Fault Tree (FTA), Probabilistic Risk Assessment (PRA) when applicable, Worst Case Analysis (WCA), and fracture control,
 - Single Point Failure (SPF) assessment and retention rationale,
 - Reliability driver (weak design links) assessment and resultant design improvements.
- Quality Assurance plans are complete including the problem reporting system.
- Preliminary production planning and process controls (including strategy for control/verification of units) has been identified. Applicable workmanship standards have been defined.
- Special materials considerations have been identified.

8 - Implementation Plans

- Equipment and facilities for the development and test of hardware and software have been identified.
- Preliminary planning for Systems Integration and Test activities, including science validation and calibration, as well as operations compatibility testing, has been defined. Facilities are available and, if needed, utilization agreements are in work.
- Risks associated with I&T have been characterized and preliminary mitigations have been defined.
- Contamination requirements and preliminary control plans are defined.

9 - Interface Control Documents:

- ICDs are essentially complete.
- “TBD”s are identified and plans/schedules exist for definition.

10 - Qualification/Environmental Test Plans and Test Flow

- Approach to Qualification/Proto-flight/Acceptance testing has been defined.
- Environmental verification flow is traceable from component to system level.
- Interleaving of environmental and functional test flow has been defined.
- Preliminary identification of all mechanical and electrical GSE has been completed.
- Special test requirements have been defined.
- Test facilities have been defined. Facilities are available and, if needed, utilization agreements are in work.

11 - Logistics

- Transportation methods are identified including environmental control and monitoring considerations.
- Preliminary identification of all GSE has been completed.
- Transportation container requirements have been identified.

12 - Launch Vehicle Interfaces

- Preliminary ICD is complete.
- Payload-driven first flight/mission unique items have been identified and mission implications are understood.
- Potential launch vehicle related risk items are identified.
- Preliminary vehicle Orbital Debris Assessment has been completed.
- Preliminary integrated payload/launch vehicle activity flow has been defined.
- Preliminary schedule of all vehicle/payload inter-related activities has been defined.
- Preliminary coupled loads analysis has been initiated.

13 - Ground Operations, Mission Operations, End-of-Life

- Science and mission operations concepts are defined.
- Launch site and mission operations unique ground systems have been defined.
- Preliminary plans are defined for launch site activities, launch & early orbit operations.
- Preliminary planning for involvement and training of launch site and of mission operations teams are defined.
- Preliminary Orbital Debris Assessment is complete. Potential trades have been determined. End-of-life requirements and design accommodations are understood.

14 - Programmatic

- Organization and staffing plans delineate clear responsibilities and adequate assignment of current and future staff.
- Appropriate processes and metrics are in place to track and control cost, schedule, and technical activities throughout the remaining life-cycle.
- Appropriately detailed schedules show realistic event times as well as appropriate funded slack and are compatible with approved launch dates.
- Cost to complete shows adequate spending profiles and financial reserves, and is compatible with allocations.

15 - Project and Independent Review Activity

- Timely response to RFAs from previous reviews has occurred. Resultant actions have been implemented effectively. Schedule for completion of any outstanding RFAs is defined.
- An appropriate set of engineering peer reviews has been conducted and documented in compliance with GPG requirements. Resultant actions have been effectively dispositioned and executed. Appropriate additional reviews are planned.

- Recommendations from other project or external review activity that is applicable to the subject matter of the PDR have been adequately implemented.

Results of Review -

It is recognized that projects may not fully satisfy all of the above criteria at the time of the PDR. Subsequent to the review, therefore, the review chairman (in consultation with the review team) will assess the degree to which the above criteria have been met, the criticality of the areas where there are shortfalls, how straightforward and likely to succeed are the project's recovery plans, and other relevant factors in making a judgment as to whether the PDR has been successfully completed. Successful completion may be contingent on the responses to some or all of the RFAs generated at the review. In some cases a delta PDR may be required for the project to successfully pass this milestone.

Successful completion of the PDR constitutes readiness for detailed design to proceed.