PREFERRED
RELIABILITY
PRACTICES

HARDWARE REVIEW / CERTIFICATION REQUIREMENT

Practice:

A Hardware Review/Certification Requirement (HR/CR) Review is conducted prior to the delivery of flight hardware and associated software to evaluate and certify that the hardware is ready for delivery and that it is acceptable for integration with the spacecraft.

Benefit:

The HR/CR provides a structured review process for assessing the status of flight hardware and screening for unresolved defects prior to delivery for integration.

Programs That Certified Usage:

Voyager, Galileo, and all other JPL developed Class A, B, and C spaceflight hardware.

Center to Contact for Information:

Jet Propulsion Laboratory (JPL)

Implementation Method:

After flight hardware has been designed, undergone unit level reviews, fabricated, integrated, and tested, a review board is convened to review the status of the hardware and to certify that the hardware is ready for delivery and is acceptable for mating with the spacecraft. The Project System Engineer/Instrument Manager is selected to chair the review. Other members of the review board include the Hardware Division Representative, the Quality Assurance Engineer, the Software Assurance Engineer, The Environmental/Reliability Engineer, and the Product Assurance Manager.

The agenda and the scope of the review board is generally defined by the HR/CR form shown as Figure 1.

Using the HR/CR form as a checklist, the design engineer responsible for the hardware being reviewed addresses the following:

1. The hardware performance and requirements compliance status

2. That all requirements have been met, or that any requirements that have not been met are covered by approved waivers

3. That all documentation is current and complete, and includes all approved waivers and Engineering Change Requests (ECRs).

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4. That all analyses required to validate environmental requirements have been completed, documented, and approved.

5. That all tests required to qualify the hardware have been successfully completed.

6. That the hardware is acceptable for integration with the spacecraft.

If the members of the review board or other participants have any concerns about the flight readiness of the hardware, anyone may write a Request for Action (RFA) against the hardware. These RFAs are reviewed by the Project and a response is prepared. After all RFAs are closed, the board certifies that the hardware is ready for delivery and flight by signing the HR/CR form.

Technical Rationale:

A structured review following a predetermined checklist such as the HR/CR form provides a mechanism for the responsible design engineer to review the status of the hardware and verify that the hardware is in compliance and ready for delivery and spacecraft integration. This process is enhanced by having a review board whose members have not been responsible for the design, fabrication, and testing of the hardware. Board members from the reliability engineering area and the product assurance area can focus this expertise on the completed product. Additionally, the board is able to take a fresh look at the hardware production cycle and to ask questions until they are satisfied that all necessary steps have been completed and that the hardware is acceptable for integration.

Impact of Non-Compliance:

HR/CR reviews are potentially capable of discovering hardware defects, deficiencies, or deviations prior to delivery of the hardware. Consequently, if the HR/CR review is not conducted, any defects, deficiencies, or deviations that may have been uncovered by the Review Board will either go undetected or will have to be detected by some other means at a time subsequent to delivery. If the hardware problems go undetected, then a mission failure may occur. If the hardware problems are detected late, then serious schedule impacts could result and the cost of correcting the hardware defect could be affected.

Related Practices:

1. *Common Review Methods* (under development)

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JPL

CASSINI HARDWARE REVIEW / CERTIFICATION REQUIREMENT (HRCR) 0123

Subsystem	Unit Type: ☐ EM ☐ Non-Flight ☐ Flight ☐ Other	Cognizant Engineer	Extension	Section	Date

Reference Designator	Part Number	Dwg. Rev. Letter	Serial Number	Nomenclature	Final Inspection Report Number	Operating Time and Cycles	Mass (Grams / Kilograms)

Check applicable answers and give necessary explanations on attachments	YES	NO	N/A	*
1. Are all drawings and specifications complete, approved, released and frozen?				
2. Do the released drawings and specifications reflect all approved changes?				
3. Is hardware identical to other hardware delivered? If no, provide difference list (Flight vs EM, Flight vs Flight).				
4. Does the hardware meet the requirements of its level 3 & 4 FRs and ICDs? If no, list waivers.				
5. Have all discrepancies and MRBs been dispositioned and agreed to by Engineering and Quality Assurance?				
6. Has complete as-built list information been submitted to EDMS?				
7. Are all design analyses complete, up-to-date, approved and archived?				
8. Have all required PD 699-260 tests been successfully completed?				
9. Has all assembly and/or subsystem functional testing been successfully completed?				
10. Has applicable analog telemetry calibration data been submitted to the Deputy ATLO Manager?				
11. Have all required single point failure related actions been taken?				
12. Have all required mass and center of mass data been submitted (per PD 699-205-3-2001 to the Division 35 Mass Properties Engineer?				
13. Does the H/W conform to PD 699-211 and are all class 3 & 4 materials documented on approved Materials Usage Agreements (MUA) or waivers?				
14. Does hardware meet all contamination control provisions of PD 699-0187				
15. Have all pre-delivery requirements in PD 699-252 been verified?				
16. Has an archive plan been submitted and accepted by the Project Office? (Attach a copy of the plan.)				
17. Is this hardware acceptable for flight?				

Data Attachments (Check as applicable)	Certification/Approval	
18. ☐ Attached ☐ None List of ECRs against the hardware that have not been released & incorporated	Cognizant/Instrument Engineer Certification	Date
19. ☐ Attached ☐ None Waivers that apply to this hardware	SRE Certification	Date
20. ☐ Attached ☐ None MRBs that required Section Manager decision	Technical Manager/PI Certification	Date
21. ☐ Attached ☐ None Open P/FRs affecting this hardware	Subsystem/Instrument QA Certification	Date
22. ☐ Attached ☐ None Open P/FRs on other hardware of this type that may affect this hardware	S/C System Office Approval	Date
23. ☐ Attached ☐ None Approved environmental test documentation (ETAF, ETSS, & TRSF)	S/C I&T Manager Approval	Date
24. ☐ Attached ☐ None Complete Assembly Subsystem Power Data Sheets	ATLO Manager Approval	Date
25. ☐ Attached ☐ None Instruction/constraints for safety, handling, test, packaging, storage and shipping	Science Instruments Manager Approval	Date
26. ☐ Attached ☐ None List of open action items from past reviews	SAF QA Approval	Date
27. ☐ Attached ☐ None Certification memos for all required PD 699-260 analyses	Other	Date
28. ☐ Attached ☐ None Shortage list	Other	Date

* Indicates that there are attachments that provide explanations or qualifications of previous responses.

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Figure 1: Hardware Review / Certification Requirement Form