

Review Board Report

A PDR for the NCSX Cryostat was conducted on April 22, 2005. Geoff Gettelfinger presented the cryostat design. The presentation was clear and on point. The design appeared mature and well founded. Requirements were defined and addressed. Numerous design options were considered. Appropriate attention had been given to minimizing the cost of the cryostat.

The Board was asked to respond to the following charge questions. Responses are shown in blue.

1. **Requirements.** Do the requirements provide an adequate basis for proceeding with final design? **Yes.** The requirements have been documented in an SRD which should be ready for signature soon. More work should be done to define requirements for rapid access to the interior of the cryostat. The need for a 1 psi internal pressure also seems excessive.
2. **Design.** Does the design address and meet the requirements? **Yes.**
3. **Analysis.** Does the analysis indicate the design satisfies the design criteria and is robust in regard to engineering uncertainties? **Yes, but analysis should be done to quantify loads on fasteners.**
4. **R&D.** Is additional R&D warranted to reduce engineering uncertainties? **The additional development activities identified to prove out the sealing concept appear to be adequate.**
5. **Manufacturability.** Can the design be readily manufactured? **Yes.**
6. **Design Integration**
 - a. Is the design compatible with the integrated model of the stellarator core?
 - b. Do adequate clearances exist for final assembly and operation?

To first order, the design is compatible with the integrated model of the stellarator core and provides adequate clearances. However, there were several discussions during the PDR that reflected concerns about interfaces (particularly with the VV penetrations) and areas where real estate was tight (particularly in the vicinity of the large midplane ports) that still need to be addressed.

7. **Interfaces.** Have the physical and functional interfaces been adequately established to proceed with final design?
 - a. A commendable job has been done identifying interfacing elements in scope sheets. Near term efforts should focus on getting “buy-in” from interfacing WBS Managers that the plans in the scope sheets are appropriate.
 - b. Concern was expressed about having enough room for sealing penetrations and the detailed design of the penetration seals, particularly around the large vertical and midplane ports. Resolving these key interface issues should be a near term priority in cryostat final design.

- c. Concern was expressed by the presenter about having enough space inside the cryostat to accommodate cooling tubes and electrical and I&C leads (WBS 16). In the past, Williamson has been receptive to PPPL taking the lead in proposing arrangements for these components inside the cryostat. This would help Gettelfinger address his concerns while taking some of the schedule pressure off Williamson to respond to interface issues at this point in time.
8. **Procurement.** Is the procurement plan (e.g., make versus buy, bundling of procurements) appropriate? The procurement plan presented at the PDR appeared appropriate. The performance measurement baseline (PMB) should be updated to reflect the plan that was presented.
9. **Cost and Schedule.** Are the cost and schedule baselines (and cost basis documentation) consistent with the technical baseline and procurement plan? Do the cost and schedule baselines appear reasonable? The PMB shows preliminary design concluding 30 May 2005 and final design starting on 02 October 2006 – 17 months later. Clearly, the critical issues raised at this review which have the potential to impact the cryostat design concept and interfacing systems should be resolved before this hiatus. The development activities proposed in the review should also be expedited. More detailed plans through final design should be developed and reflected in the PMB. The preliminary design is significantly different from the conceptual design of the cryostat. The cost should be re-estimated consistent with the new design. Upon review, the basis of estimate for WBS 17 should be updated and a new estimate to complete (ETC) developed. This information should be available to Strykowski by 31 May to incorporate for the June Lehman review.
10. **ES&H.** Have potential environmental, health, and safety issues been identified and addressed? Yes. The only outstanding issue raised was to determine the requirements for fire protection.
11. **Risk management.** Have technical, cost, and schedule risks been identified and appropriately mitigated? Yes.
12. **Chits.** Have all chits from previous design reviews been adequately addressed? Yes.

The review was judged successful pending resolution of chits.