

Disposition Plan for Recommendations from the DOE Performance Baseline Review (PBR) of the NCSX Project

January 13, 2004

The performance baseline review (PBR) of the NCSX project was conducted by the Office of Science on November 18-20, 2003, at PPPL. The final panel report, issued in early January, 2004, contained nineteen recommendations to be addressed prior to approving the performance baseline (CD-2), including a recommendation that the project is ready for CD-2 after appropriate project responses to the recommendations. This report documents the project's responses. There were also numerous comments in the panel report, which the project is treating as recommendations. Similar items were combined as appropriate for purposes of responding. In all, twenty-one items are identified.

This disposition plan is documented in the form of a tracking log, which the project will maintain as a living document as it tracks each sequentially-numbered item to closure. Many of the items are considered closed at this time, for example where a recommended evaluation has been completed or where a recommended change has been incorporated in the baseline. The project will report status of the open items at future Integrated Project Team meetings and semi-annual Office of Science Reviews until all are closed.

PBR Cost and Schedule Impacts

At the PBR, the project presented a plan, denoted the "PDR baseline," with a TEC of \$81.0M and a CD-4 date of September, 2007. Several of the recommendation responses affect the project cost. One response impacts the overall project schedule, extending it four months. Some of the responses are expected to provide management with greater scheduling flexibility in the future and thus reduce schedule risks. The cost and schedule impacts recognized to date are summarized as follows:

**Summary of Cost and Schedule Impacts of the PBR Responses
as of January 13, 2004**

Item	Summary	Cost Impact (\$K)	Schedule Impact (months)
1	Second winding line	475	
2	Cold test all modular coils	550	
4	R&D to evaluate vacuum vessel spool piece	15	
10	Ground fault monitor	150	
13/14	Machine assembly estimates	119	
20	Expanded CD-4 criteria	1,850	4
Total		3,159	4

Other Cost and Schedule Impacts

The PDR baseline was also reviewed by a Preliminary Design Review (PDR) panel which met at PPPL on October 7-9, 2003. That review also produced numerous recommendations as well as an overall finding that the project is ready to proceed to CD-2. The recommendations from the PDR were assessed and the project's planned response was reported to the PBR panel in November. The PBR panel was supportive of the project's directions in response to the PDR. A separate disposition plan documenting the project's responses to the PDR recommendations in detail has been developed by the Integrated Project Team. Here we summarize the cost and schedule impacts of the PDR recommendations.

Summary of Cost and Schedule Impacts of the PDR Responses

Item Summary	Cost Impact (\$K)	Schedule Impact (months)
Additional winding R&D	195	
Coil services estimate	130	
Vacuum vessel bakeable to 350C	300	
Additional time to evaluate winding form prototypes	226	1
Additional time for component fit-up tests	226	1
Winding & potting development	51	
Miscellaneous items	284	
Total	1,412	2

Modifications to the project plans resulting from these two reviews, including these cost and schedule impacts, are incorporated in the revised project baseline that is to be approved at CD-2. More detailed estimates now being developed by the project to support the new baseline, may result in minor changes relative to this report.

A third review, an Office of Engineering and Construction Management Performance Baseline Validation, was conducted concurrently with the PBR. This review, which served as the required External Independent Review (EIR) of the baseline, also generated a list of recommendations as well as a general conclusion that the project is ready for CD-2. A separate disposition plan for the EIR recommendations has been developed and is submitted as part of the documentation to support CD-2, however there are no additional cost or schedule impacts from that plan.

Subsequent to these reviews, the Office of Fusion Energy Sciences provided a revised funding profile for the project. The main change relative to the PDR baseline was a \$4.5M reduction in FY-05 necessitated by anticipated constraints on available funds for that year. Upward adjustments were made in subsequent years to partially offset the schedule impact. Also, the project work scope was re-scheduled within the revised funding envelope to provide more budget contingency earlier in the project, relative to the PDR baseline. This was done in response to the concerns raised by the PBR panel (item 18 of this report). The

net effect of these profile changes is an additional 2-month extension of the project and an associated cost increase due to carrying costs and escalation.

Cost and Schedule Impacts of Revised Budget Profiles

Item Summary	Cost Impact (\$K)	Schedule Impact (months)
Funding and contingency profile changes	724	2

Cost and Schedule Summary

The project baseline will be revised as a result of the three reviews and the changes to the budget profiles. The changes relative to the PDR Baseline are summarized as follows:

Summary of Changes to the Baseline Cost and Schedule as of January 13, 2004

	Cost (\$M)	Schedule
PDR Baseline	81.0	Sept., 2007
PDR Recommendations (Oct. 7-9, 2003)	+1.4	+ 2 mos.
PBR Recommendations (Nov. 18-20, 2003)	+3.2	+ 4 mos.
EIR Recommendations (Nov. 18-20, 2003)	0.0	0
Budget profile changes	+0.7	+2 mos.
Total of changes	+5.3	+8 mos.
CD-2 Performance Baseline	86.3	May, 2008

The schedule contingency of 5.5 months remains unchanged from the PDR baseline. The budget contingency as a percentage of the base estimate will be re-evaluated based on the updated estimate details being developed by the WBS managers, but is expected to remain close to PBR baseline value of 28%.

NCSX Performance Baseline Review (Lehman Review) Recommendations Disposition Plan

January 13, 2004

ID	WBS # Responsible Person	Recommendation / Selected Comments	Disposition (Plan and schedule for closing out)	TEC Impact	Schedule Impact	Status (Jan., 2004)
1	WBS 14 Williamson, Chrzanowski	Comment, Section 2.1: The project should consider two winding lines for the modular coils.	Agreed. After consideration, it was decided to add a second winding station. It will provide additional schedule flexibility as well as improve the quality of the oversight coverage.	\$475k, including contingency	Reduced schedule risk	Closed. Included in CD-2 baseline.
2	WBS 14 Williamson, Chrzanowski	Recommendation 1, Section 2.1: Include performing cold testing of all the Modular Coils during the construction project. Determine the cost and schedule impact of these tests before CD-2.	Agreed. Testing each modular coil will verify their integrity and reduce the risk of installing a faulty or lower quality coil in the machine.	\$550k, including contingency	None	Closed. Included in CD-2 baseline.
3	WBS 13 Kalish, Templon	Comment, Section 2.1: Attention should be given early to insure that delivery of these (TF/PF) coils does not affect the machine assembly schedule. Potential for major schedule impact.	Agreed. An effort has begun to solicit interested vendors by providing a preliminary specification for the conventional coils now instead of after the final design is complete. Information will be posted on the NCSX Manufacturing Web Site, vendors will be contacted and a "sources sought" announcement will be posted on the Federal Business Opportunities (FedBizOpps or FBO) web site.	None	Reduced risk	In progress
4	WBS 12 Goranson	Recommendation 2, Section 2.1: Investigate alternative designs for the Vacuum Vessel spool pieces to optimize the final assembly and closeout welding.	Agreed. The baseline spool design was chosen after investigating numerous alternatives during preliminary design. A design review was held to choose the baseline. Nonetheless, the spool configuration and weld prep will be further evaluated during an R&D program, which will simulate the spool and weld. The work is scheduled to be completed before delivery of the VV prototype section(PVVS) in late March.	\$15k	None	Closed. Included in CD-2 baseline.

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5	WBS 1 Cole	<p>Recommendation 3, Section 2.1: Evaluate the use of tolerance stack-up software for performing 3-D assembly in Pro-E.</p>	<p>An evaluation has been performed, showing that this product might reduce risk and would cost \$40k plus 200 engineering hours for training and analysis. We will not implement it at this time, but can do so in the future if its costs are shown to be offset in the form of reduced contingency (due to risk reduction) or some other cost savings.</p>	None	None	<p>Closed. Evaluation complete.</p>
6	WBS 17 Gettelfinger	<p>Recommendation 4, Section 2.1: Evaluate the use of fixators for base adjustments.</p>	<p>Agreed. Full evaluation will occur during Title 1 and Title II design of the Base Structure (FY-06)</p>	None	None	<p>Planned</p>
7	WBS 14 Williamson, Chrzanowski	<p>Comment in Section 2.1: The shape and position of the coil block will be determined by the clamping arrangement at the vacuum impregnation stage. Consideration should be given to resolving coil positioning at that time rather than on a turn-by-turn basis.</p> <p>Recommendation 5: Evaluate the option of determining the position of the Modular Coils winding packs by tooling/fixturing during winding and prior to impregnation.</p>	<p>Agreed. During the prototype winding activities, we will investigate this option by winding a section of the coil without turn-by-turn shims, but instead make adjustments to the whole winding pack. We will evaluate winding accuracy, process efficiency, and potential impact to the design of the winding clamps. Any changes to the final design of the clamps and tooling can be incorporated prior to FDR in Oct, 2004.</p>	None	None	<p>Planned</p>

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8	WBS 1 Goranson	<p>Recommendation 6, Section 2.1: Evaluate the effect on the overall project schedule and cost of a Vacuum Vessel delay sufficient to cause it to become the critical path.</p>	<p>Agreed that vacuum vessel schedule delays are a risk to the overall schedule because of its proximity to the critical path. The appropriate response is to focus on ways to improve the vacuum vessel schedule. For example.</p> <ol style="list-style-type: none"> 1. A decision was made to take delivery of each vacuum vessel sector as it is fabricated rather than wait for the complete assembly. This will allow the project to start adding attachments earlier, improving schedule flexibility. 2. A decision was made to change to a mechanical attachment scheme for the tubing, eliminating the need for grouting or welding. This reduces cost and installation time and provides more options for installation. <p>Schedule improvement opportunities will continue to be sought throughout Final Design.</p>	None	Reduced risk.	In progress
9	WBS 84/R.P. Zarnstorff	<p>Recommendation 1, Section 2.3: Consider negotiating an agreement between PPPL and IPP/Greifswald, Germany that would allow sharing of plasma physicists (and possibly plasma diagnostics systems) during the current construction phase and the first 2-3 years of NCSX operations.</p>	<p>Agreed. We have started to explore with IPP-G and OFES management and will pursue it.</p>	None	None	In progress

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10	WBS 8 Neilson	<p>Recommendation 1, Section 2.4: Review the decision to exclude trim winding power supplies and ground monitor circuit in the scope of baseline work prior to CD-2.</p>	<p>These decisions have been reviewed.</p> <p>Ground monitor: Now that the baseline includes a significant period of operation as part of the startup program prior to CD-4, we agree that the ground fault monitor would be useful and should be included in the baseline.</p> <p>Trim coil power supplies: Use of the trim coils to improve flux surfaces is part of the research program that will not start until well after first plasma. The power supplies will use available PPPL legacy equipment which has been recently tested and found to be in good condition. It is straightforward to connect them to the trim coil terminals outside the cryostat when they are needed by the program.</p>	\$150k for the ground fault monitor.	None	Closed
11	WBS 5 Oliaro	<p>Recommendation 1, Section 2.5: Clearly define the role and use of LabView (and any others) versus EPICS in the overall I&C system implementation.</p>	<p>Agreed. EPICS is used at the top-level in the NCSX I&C architecture. The subsystem experts will be given free reign to select their local control hardware and software platforms with the caveat that choosing a technology with a supported EPICS interface will be most cost effective. Therefore, all subsystem local controls will be specified in the NCSX Project Interface Control Documents in collaboration with the Central I&C Control Team.</p>	None	None	Closed

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12	WBS 5 Oliaro	Recommendation 2, Section 2.5: Consider moving preliminary and some detailed design of Central I&C components into the FY05 schedule and establish dialog between the Central I&C team and local control system developers to insure that these systems are compatible.	Agreed, but after re-consideration, we still believe that this work can be accomplished without changing the original I&C schedule. The I&C schedule is based upon the assumption that no significant EPICS or MDS-plus development work will be required for NCSX. Our experience on NSTX is that the EPICS interface has been integrated with all common local control system architectures. The Central I&C team will maintain a close dialog with the local control system developers, throughout FY05, to guide them to cost effective and compatible solutions.	None	None	Closed
13	WBS 7 Perry	Recommendation 1, Section 2.7: Review and consider an increase in the current baseline cost of WBS 75 associated with assembling/ shimming the modular magnets (during Field Period assembly) and the positioning/welding of the Vacuum Vessel sections/spool pieces. This should be done before CD 2.	Agree.	\$89k	None	Closed. Included in CD-2 baseline.
14	WBS 7 Perry	Recommendation 2, Section 2.7: Review and consider an increase in the current contingency for WBS 75 [Machine Assy.] and 76 [Tooling] to accommodate the higher risk associated with these activities. This should be done before CD-2.	Agreed that 28% contingency should be added for the high-risk tasks noted in Item #13	\$30k	None	Closed. Included in CD-2 baseline.

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15	WBS 7 & 1 Perry, Nelson	<p>Recommendation 3, Section 2.7: Develop a plan to efficiently compare metrology data, taken during fabrication and assembly, with the Pro-E models. This should be done before the completion of the final design.</p>	<p>Agreed. We have decided to advance the procurement of metrology equipment. It is now planned for the first half of FY-04, so that the project team can use it and gain experience during the 3D winding development activities, and to make measurements on the prototype winding forms and vacuum vessel during FY-04.</p>	None	Reduced risk	In progress
16	WBS 8 Neilson, Strykowski	<p>Comment, Section 3: Develop summary analyses of project cost information such as EDIA, to serve as reasonableness tests.</p> <p>Comment, Section 5: Track performance metrics such as EDIA, %-complete for design, fab. installation, etc., distribution of cost information source (vendor info., eng. estimates, firm bids and/or actual costs.)</p>	<p>Agreed. The project will evaluate and establish additional metrics to supplement current project performance reports. Results will be routinely reported to project management as well as DOE, starting with the next semi-annual Lehman review (about May, 2004)</p>	None	None	Planned
17	WBS 8 Templon, Reiersen	<p>Comment, Section 5: Compile a procurement plan identifying planned procurements, type, start date of process, etc.</p>	<p>Agreed. Planning started with a meeting between project management and procurement on 12/1/03. As a first step, WBS managers have been requested to document their planned procurements, with dollar amounts, key dates, issues, type of procurement, and issues. The PPPL Procurement Director will visit ORNL in January, 2004, to meet with his ORNL counterpart to discuss experience with procurement approaches (e.g. incentives) that have been used on SNS and other ORNL projects. The project will compile the plan in conjunction with Procurement and issue it prior to the vacuum vessel and modular coil final design reviews in FY-04.</p>	None	None	In progress

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18	WBS 8 Neilson	<p>Recommendation 1, Section 3: Re-evaluate the planned contingency profile and coordinate any revisions to the profile with the DOE Princeton Area Office before CD-2.</p> <p>Comment, Section 5: Confidence in the overall project schedule would be significantly enhanced if the funding profile provided higher BA in FY05, on the order of \$2 to 4M, with corresponding reduction in FY06 and/or FY07. DOE and PPPL management should consider this matter.</p> <p>Recommendation 1, Section 4: Re-evaluate adequacy of contingency amount and funding level for FY 2005 prior to CD-2.</p> <p>Recommendation 2, Section 4: Reexamine the proposed total project funding profile in concert with Office of Fusion Energy Sciences prior to CD-2.</p>	<p>Although the FY05 project funding was <i>reduced</i> following the review because of limits on available funds in that year, the project has responded positively to this recommendation by <i>increasing</i> the FY-05 contingency budget. In the revised baseline, the contingency profile is more evenly distributed throughout the project period, in contrast to that presented at the review, which was strongly peaked in the last year.</p> <p>The decision to adopt the recommendation for a second winding line (#2.1-1), is also responsive to the spirit of this recommendation because it improves schedule flexibility.</p>	The new BA profile guidance increases cost and extends the schedule. Those impacts are accounted for separately.	Schedule risk is reduced by moving contingency earlier relative to the funding profile.	Closed
19	WBS 8 Neilson	<p>Recommendation 2, Section 3: Evaluate the Committee's comments and recommendations and consider any proposed changes to project base costs or contingency before CD-2.</p>	Agreed. All recommendations impacting cost and schedule have been acted upon and are reflected in the CD-2 baseline.			Closed

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20	WBS 8 Zarnstorff	<p>Recommendation 1, Section 5: Assure that senior DOE management and fusion physics community clearly understand the limitations on the physics productivity of early NCSX operations that derive from the existing definition of CD-4.</p>	<p>The project provided material in support of follow-up discussions within the Office of Science (SC) concerning NCSX CD-4 criteria. As a conclusion of these discussions, SC management determined that the CD-4 criteria should be modified to add a flux surface mapping campaign to the in-scope startup plan and require cryogenic operation of the coils at first plasma. This change, which is incorporated in the CD-2 baseline, improves the facility's expected physics productivity immediately following CD-4. The changes have been discussed with Prof. David Anderson, chair of the NCSX Program Advisory Committee and a member of the PBR panel, who expressed strong approval. The wider physics community will be updated on the NCSX project plans and program implications via presentations at the OFES Budget Planning Meeting and future meetings of the NCSX Program Advisory Committee.</p>	\$1.85M	4 months	<p>Closed (for senior DOE mgt.)</p> <p>Planned (for physics community)</p>
21	WBS 8 Neilson	<p>Recommendation 2, Section 5: Based on the overall assessment of status against requirements for this stage of the project, NCSX is ready to proceed with CD-2, after appropriate response to this committee's recommendations</p>	<p>The project thanks the review panel and believes this disposition plan is the appropriate response. The project will follow up with subject matter experts on the panel to discuss its responses to their concerns.</p>			<p>Follow-ups planned</p>