



71-971205-CLN-01

TO: DISTRIBUTION
FROM: C NEUMEYER
SUBJECT: CLARIFICATION OF NSTX DESIGN REVIEW OBJECTIVES & PROCEDURES

This memo provides clarification of the objectives of, and procedures for, NSTX design reviews.

The governing procedure is NSTX-PROC-004-01, "NSTX Design Verification". While the procedure establishes general guidelines, this memo provides more specific information. It is the intention of the writer to revise the procedure to include the more specific information contained herein. This memo provides interim guidance.

Project Elements Subject To Review

The WBS structure provides the high level division of the project scope into elements at various levels. The depth of the WBS definition varies within each WBS element. On NSTX, WBS 1 is divided up down to Level 5 in the WBS parlance (e.g. the OH coil is WBS 1332). Further subdivision of the project scope beyond the formal WBS definition is possible and in many cases appropriate in terms of deciding which elements of the project scope require formal individual review. For example, WBS 21 HHFW is not further subdivided by the WBS definition. However, it makes sense to review the antenna scope separately from the transmitter/transmission line scope.

The grouping of WBS elements into individual reviews, and/or the partitioning of WBS elements into pieces subject to individual review, is negotiable and subject to agreement between the WBS Manager and the NSTX Project Engineering Manager (C Neumeyer).

All NSTX Level 3 WBS elements were reviewed together at the conceptual level (Conceptual Design Review - CDR) at the Engineering Cost & Schedule Review in July 1996. After the move of NSTX to D-site, those WBS elements which are significantly site dependent (WBS 3 - Auxiliary Systems, WBS 5 - Power Systems, WBS 6 - Central I&C) were subject to a second CDR in February 1997.

Typically the higher level elements of the project scope are subject to three reviews, namely the CDR, Preliminary Design Review (PDR), and Final Design Review (FDR). However, the PDR is optional, subject to agreement between the WBS manager and the NSTX Project Engineering Manager (in retrospect skipping the PDR step has caused some difficulties in the past and will generally be avoided in the future).

History of subsystem reviews and future plans are as indicated in the following table.

				CDR	PDR	FDR
1X-Torus Sys				7/96		
	11-PFCs				5/97	7/97
	12-VV					7/97
	13-Magnets					
		131-PF Outer				
		132-TF Outer				7/97
		133-Center Stk				
			1331-TF Inner		10/96	2/97
			1332- OH		10/96	2/97
			1333-PF1a/1b		10/96	2/97
			1334-CS Casing		10/96	2/97
2X-Htg & CD				7/96		
	21- HHFW					
		Antenna			12/97	2/98
		Xmitter/Lines			TBD	6/98
	22- CHI					
	23- ECH				TBD	TBD
	24- NBI				TBD	TBD
3X-Aux Sys				2/97		
	31- Vacuum				9/97	11/97
	32- Cooling				1/98	3/98
	33- Bakeout				10/97	1/98
	34- Gas				12/97	2/98
	35- GDC				TBD	3/98
4X- Diagnostics				7/96		
	Magnetic Diag.				9/97	1/98
	CHERS				2/98	4/98
	Installations					1/98
5X- Power Sys				2/97		1/98
	Power Cable					8/97
	PS Control				TBD	TBD
6X- I&C				2/97		
	61- Process Cntl				2/98	6/98
	62- Data Acq				2/98	6/98
8X- Facilities						
	Platform				7/97	8/97
	Test Cell GA					10/97

As the project moves forward there will arise the need for additional lower level reviews, typically for individual components rather than integrated subsystems. The procedure NSTX-PROC-004-01 allows for such reviews and sets forth general guidelines for Peer, CDR, PDR, and FDR reviews.

Design Review Objectives and Deliverables

The following table outlines the objectives and deliverables for the high level reviews.

In recognition of the fact that the nature of the subsystems vary considerably, it is allowed that each review can have a specific set of deliverables which may differ somewhat from what is listed. For each review the specific deliverables are subject to negotiation between the Cognizant Engineer, WBS manager, Design Review Chair, and the NSTX Project Engineering Manager.

Level of Review	Objectives	Deliverables
Concept (CDR)	<p>Conceptual review ...</p> <ul style="list-style-type: none"> • Establish technical feasibility of one or more implementation options • Establish interface definitions and requirements • Establish cost & schedule <p>NOTE: Following resolution of CDR chits the SRD shall be signed and placed under configuration control.</p>	<p>Documentation Package to Design Review Board & NSTX File \geq 3 full working days prior to review...</p> <ul style="list-style-type: none"> • Draft SRD (unsigned pending outcome of CDR and chit resolution) • Draft SDD • Results of preliminary calculations to demonstrate performance vs. requirements • Sketch level drawings, P&IDs, schematics • Cost & Schedule Estimate
Prelim (PDR)	<p>Preliminary review...</p> <ul style="list-style-type: none"> • Assessment of design progress • Establish firm definition of configuration • Confirm global/integrated performance vs. requirements via preliminary analysis of all aspects (electrical, thermal, mechanical, structural, seismic, etc. as applicable) • Refine interface definitions and Requirements • Refine Cost & Schedule estimate <p>NOTE: Selection of implementation scheme from multiple options shall be made prior to PDR; multiple options shall <u>not</u> be presented. This includes material selection.</p>	<p>Documentation Package to Design Review Board & NSTX File \geq 3 full working days prior to review...</p> <ul style="list-style-type: none"> • Resolution of CDR chits • SRD Revisions, if any • Updated Draft SDD • Results of preliminary calculations to demonstrate performance vs. requirements • Assembly/system level drawings, P&IDs, schematics • Updated Cost & Schedule Estimate
Final (FDR)	<p>Final review of subsystems...</p> <ul style="list-style-type: none"> • Confirmation of successful completion of detailed design prior to release for procurement, fabrication, assembly, installation as applicable • Establish final definition of 	<p>Documentation Package to Design Review Board & NSTX File \geq 3 full working days prior to review...</p> <ul style="list-style-type: none"> • Resolution of PDR chits • SRD Revisions, if any

	<p>configuration</p> <ul style="list-style-type: none"> • Confirm with complete assurance the global/integrated performance, as well as performance of detailed elements, vs. requirements via completed analysis of all aspects (electrical, thermal, mechanical, structural, seismic, etc. as applicable) • Confirm the constructability, safety and operability of the design • Finalize interface definitions and requirements • Refine cost & schedule estimate <p>NOTE: Following resolution of FDR chits, the SDD and drawings shall be signed off.</p>	<ul style="list-style-type: none"> • Final Draft SDD (unsigned pending outcome of review and chit resolution) • Documented and Checked Calculations to demonstrate performance vs. requirements • Supporting design basis documentation such as memos, reports, etc. referenced by SDD, as appropriate • Formal drawings, to level required to proceed with procurement/fabrication/assembly as applicable, P&IDs, schematics (checked but unsigned pending outcome of review and chit resolution) • Updated Cost & Schedule Estimate
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For reviews which cover only a part of the scope contained within the governing SRD/SDD (e.g. Vacuum Pumping Systems, WBS 31, is part of the SRD which covers all of WBS 3), only the effected sections are considered to be part of the deliverables in the above table.

For lower level reviews (e.g. components instead of subsystems) where the SRD/SDD do not apply, appropriate documentation of requirements and design description should be included in their place.

Criteria for Successful Review

At present, any and all shortcomings (e.g. calculations not documented and checked) can be covered by submittal of a chit at a review, while not rendering the review "unsuccessful". This loophole has led to problems. Therefore in the future the practice of allowing chits to be written to cover the absence of deliverables shall not be permitted, unless approved by the NSTX Project Director (M Ono). If any of the agreed to deliverables are missing then the review shall be declared unsuccessful.

Design Review Follow Up

Design Review Chairperson shall submit a report to NSTX File, signed by WBS manager following review, containing...

- summary
- list of attendees
- recommendations
- chits and dispositions

Procedural Steps

The governing procedure, NSTX-PROC-004-01, outlines in detail the steps to be taken in arranging for and conducting a review. In addition to the steps outlined therein two new steps shall be added (and incorporated into the governing procedure) as follows:

1) At least twenty working days prior to the review date a meeting shall be convened between the Cognizant Engineer, WBS manager, Design Review Chair, and the NSTX Project Engineering Manager, at which time the specific set of deliverables for the review shall be agreed to.

2) At least five working days prior to the review date a meeting shall be convened between the Cognizant Engineer, WBS manager, Design Review Chair, and the NSTX Project Engineering Manager, at which time the Cognizant Engineer shall report on his readiness for the review. If it is judged that he is not ready, then the review shall be postponed. In addition, the review board membership and invitees shall be agreed to.

Essential Features of the Process

The following features are essential to the success of the process:

- Clear definition of deliverables for review well in advance of review date
- Check of status of work one week prior to review to ensure readiness
- Option to postpone review if not ready, rather than proceeding on an incomplete basis
- Advance distribution of documentation package (at least three full working days) to review board to ensure adequate time and detail of their preparations in advance of the meeting
- Elimination of loophole allowing chits to be written against absence of deliverables

Relationship to OP-AD-104

Per previous agreement (71-970728-CLN-01, "NSTX & D-SITE Configuration Control"):

- Global DCAs shall be submitted for each of the NSTX Level 3 WBS elements to introduce the NSTX work to the D-Site system;
- Supplemental DCAs, issued under the global DCA numbers, can be used to cover pieces of the work covered under the global DCAs, and these will use the global DCA numbers with an additional three digit code attached (e.g. DCA-174-001);

- NSTX procedures for requirements and design documentation, and for design reviews, satisfy the spirit of the recommendations given in OP-AD-104 and can therefore be followed during the conduct of the NSTX design process;
- When the time comes to make physical changes at D-Site the Design Change Release Package called out by OP-AD-104 will be prepared in addition to the NSTX Installation Procedure, and will be subject to approval by the D-Site Engineering Manager prior to implementation.

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NSTX File