

NCSX	<u>NATIONAL COMPACT STELLARATOR EXPERIMENT</u>	
PROCEDURE: NCSX-PROC-004 Revision 1		Page 1 of 5
Title NCSX Work Planning Package Process	Initiated by: NCSX Systems Engineering Support Manager	Effective Date: August 4, 2004
Concurrence by: NCSX Quality Assurance Manager	Concurrence by: PPPL Head, Engineering & Technical Infrastructure	Concurrence by: NCSX ES&H Manager
	Approved by: NCSX Engineering Manager	Supersedes: Revision 0 10/31/2003

Applicability

This procedure is applicable to the entire NCSX Project.

Introduction

The NCSX Systems Engineering Management Plan (SEMP) provides the project's approach to work planning. As indicated in Attachment (1) to this procedure, there are two key items that make up the necessary documentation package for work planning for the NCSX Project. These are the:

- **Work Planning (WP) Form** - PPPL Engineering Procedure ENG-032 provides guidance on preparing WP forms. This document can be found on the PPPL web at: <http://workplanning.pppl.gov> . The WP is the key work planning document for all phases of projects designed and constructed at PPPL. It documents the work planning logic in the form of a checklist of activities and deliverables that need to be completed in preparation for the next formal design review (preliminary or final), on-site fabrication activities (including R&D activities), and field assembly and installation activities. If desired, the NCSX WP may also be used for the development of the conceptual design and the preparation for the Conceptual Design Review (CDR). *Generally, there will be a one-to-one correlation with a WP to a Work Authorization Form (WAF, but there are two exceptions to this general rule:*
 - *For design only tasks (e.g., analyses, preparation of design drawings, specifications/SOWs, etc.) which do not include any physical field or R&D activities,. one WP may encompass several WAFs – each WAF number will be specifically defined on the WP (e.g., the final design for the modular coils will have one WP that will encompass several design-only WAFs for the modular coils).*

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- *For field activities, it may be more appropriate for a single WAF to include several WPs since the safety precautions and hazards analyses for each task on a WAF may vary significantly (e.g., the machine assembly WAF contains numerous assembly tasks, many of which have different safety considerations and hazards that must be addressed – in this instance several WPs will be prepared).*
- **Work Authorization Form (WAF)** – At PPPL, the WAF system provides the means by which individual jobs and/or tasks are detailed and authorized. Design Checklists can be used by the job manager of a WAF when defining and scheduling the detailed tasks to be included on a WAF. Each Design Checklist is deliverable oriented with specific requirements and success (completion) criteria detailed. Attachment 2 to this procedure provides a generic Design Checklist for activities leading up to a Preliminary Design Review and Attachment 3 does the same for activities leading up to a Final Design Review. Each WAF provides the resource loading information, detailed task schedule, and deliverable milestones used for job tracking and performance measurement and analysis. The summation of the all the WAFs provide our current year performance measurement baseline for the NCSX PMS. A WAF typically will cover the current fiscal year, but it may cover a shorter or longer span depending on the job duration and logical break points that are based on deliverables.

This procedure basically consists of two sub-procedures. Section A provides the steps needed to identify the configuration items (subsystems and major components) in the design development and to align the specifications, design reviews, and acquisition plans with the configuration items. Section B then establishes the procedure for development, review, and approval of NCSX work planning packages. The attachments to this procedure provide a flow chart and generic guidance for the elements that should be included in the Design Checklist prepared for Preliminary and Final Design.

Referenced Documents

NCSX Systems Engineering Management Plan (NCSX-PLAN-SEMP)
PPPL Policy 010, “Design Reviews”
PPPL Procedure ENG-032, “Work Planning”
PPPL Procedure ENG-033, “Design Verification”
ES&HD 5008, “PPPL ES&H Manual”

Key Terminology

- Configuration Item (CI) – basic element of the NCSX configuration. May be established at the total project level, at the subsystem (WBS) level, or at the major component/procurement level. The definition and scope of a CI will evolve as the design evolves and matures into more detail.
- Cognizant Engineer – engineer responsible for each Configuration Item (CI), May be a WBS Manager (at subsystem level) or at a lower responsible engineer level.
- Design Basis Document (DBS) – typically a design report that outlines a particular point in time (e.g., conceptual design review, preliminary design review, final design review) the design basis of the system and how the system satisfies the requirements contained in

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either the “design to” specification (aka Systems Requirement Document or SRD) or the “build to” specification.

- Responsible Project Engineer – WBS 1 Project Engineer, WBS 2-6 Project Engineer, or WBS 7 Project Engineer.
- Value Engineering/Management – disciplined approach by which alternatives are identified and evaluated to determine whether they are more cost effective.

A. Procedure for Configuration Item (CI) Identification

This procedure for CI identification is as follows. This procedure is done once, before development of the first NCSX WP package.

<u>Responsibility</u>	<u>Action</u>
WBS Manager	1. Determines how the subsystem design will be accomplished. Configuration items are defined. Specifications, formal design reviews, and acquisition plans are aligned with the CI identification. The Developmental Specifications are the source for specification lists; a CI should be defined by a specification.
Responsible Project Engineer	2. Reviews proposed CI identification and, upon reconciling issues, concurs and forwards to the Engineering Manager.
Engineering Manager	3. Approves proposed CI identification. Establishes responsible official (responsible Project Engineer or Engineering Manager) for approving specifications and coordinating design reviews for each CI. 4. If procurement will be required, works with the Responsible Project Engineer to identify the likely Procurement Technical Representative (PTR).
Systems Engineering Support Manager	5. Updates spec tree to reflect CIs and schedule of design reviews on Engineering Web.
Project Control Manager	6. Updates detailed schedule to include major design reviews and acquisitions consistent with approved CI identification.

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B. Procedure for NCSX WP Package Development, Review, and Approval

The procedure for NCSX WP development, review, and approval is as follows.

<u>Responsibility</u>	<u>Action</u>
Job Manager/WBS Manager	<ol style="list-style-type: none"> 1. Develops a WP appropriate in accordance with the requirements specified in PPPL Engineering Procedure ENG-032 (“Work Planning). The WP form is electronic and can be found at: http://workplanning.pppl.gov (Note that each WP should include a risk classification per ENG-032 Table 1). Ensures that the appropriate job number(s) enveloped by this WP are included in the “Scope” section of the WP. 2. Prepares draft job plan/estimate to detail the specific tasks to be accomplished, the resources required, and the schedule for these tasks. If desired, utilizes the appropriate detailed Design Checklist to amplify the information contained on the WP and to provide a basis for developing a WAF. Attachments (2) and (3) to this procedure provide generic templates for these checklists. 3. Forwards WP(s) and job plan/estimate(s) to the responsible Project Engineer for review, comment, and concurrence.
Responsible Project Engineer	<ol style="list-style-type: none"> 4. Reviews proposed NCSX WP(s) and job plan/estimate(s) and, upon reconciling issues, concurs, and returns the WP(s) and WAF(s) to the WBS Manager.
Job Manager/WBS Manager	<ol style="list-style-type: none"> 5. Utilizes the approved WP(s) and draft job plan/estimate as a basis for generating the necessary WAFs in collaboration with the NCSX Project Control Manager. 6. When WAF prepared, forward complete Work Planning Package (includes WP and WAF) to the Engineering Manager for review and approval.
Engineering Manager	<ol style="list-style-type: none"> 7. Reviews proposed Work Planning Package and, upon reconciling issues, approves the WP electronically via the WP web page and notifies the Project Control Manager that the WAFs are ready for approval.
Project Control Manager	<ol style="list-style-type: none"> 8. Circulates the WAF for signature by the Job Manager, WBS Manager (if not the job manager), and the Engineering Manager.

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WBS Manager

9. Implements scope of work approved on the WP and approved WAF.

Attachments

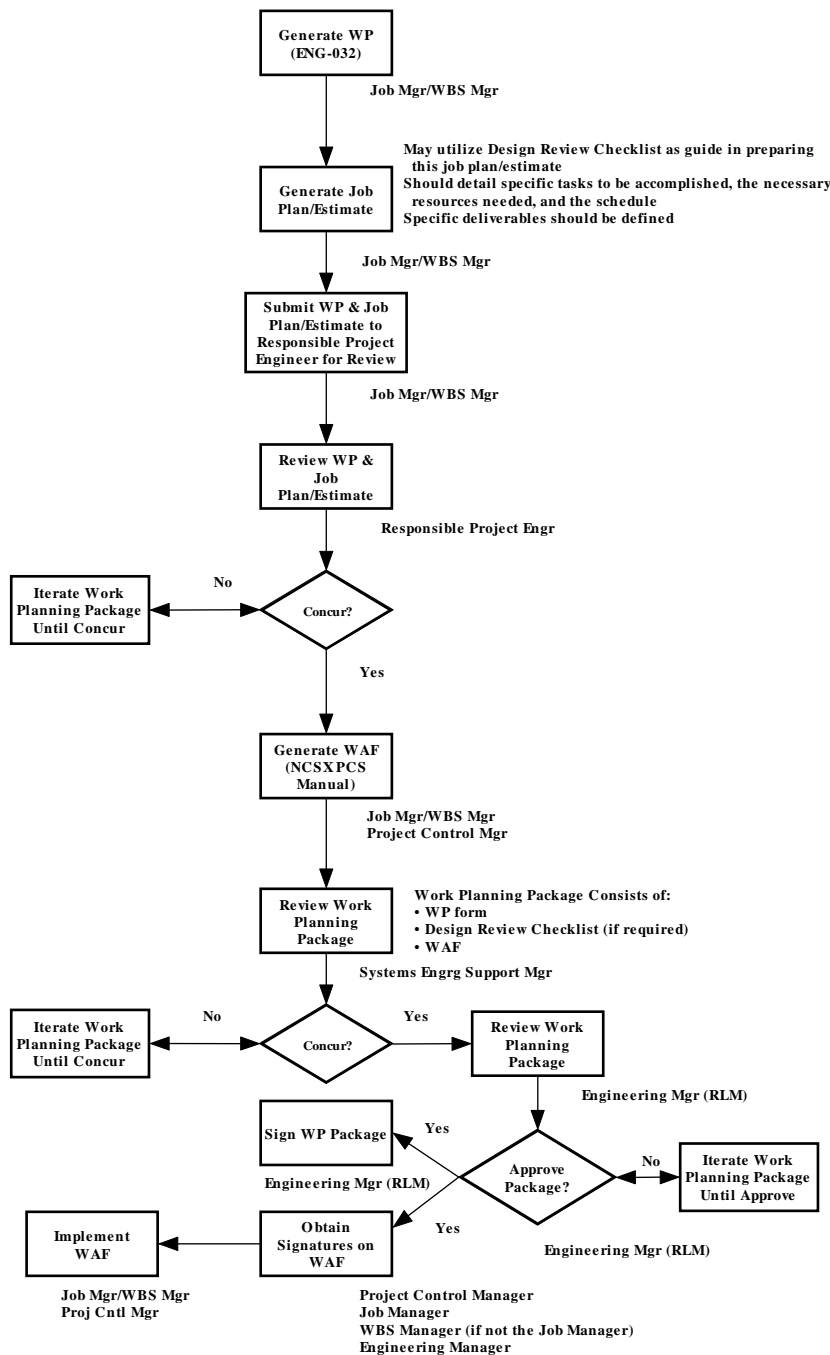
1. NCSX Work Planning Flow Chart
2. Generic Design Checklist for Preliminary Design
3. Generic Design Checklist for Final Design

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Attachment 1

NCSX Work Planning Flow Chart



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Item	Requirement	Success Criteria
Configuration Identification	<p>Identify configuration items (CIs). Include software, support equipment, and tooling. Align specifications, design reviews, and acquisition plans with CI identification. The NCSX Configuration Management Plan (CMP) and NCSX Procedure 002 provide guidance on defining CIs.</p> <p>Acquisition plans should address build v. buy issues.</p>	<p>Spec tree, design review schedule, and acquisition plans updated and posted on Web.</p> <p>Project detailed schedule updated by PC Mgr.</p>
Specifications	<p>Performance requirements are finalized and documented in approved development ("design-to") specifications, which are under change control. No TBDs are allowed. The NCSX Systems Engineering Management Plan (SEMP) and the NCSX Engineering Web page (specifications provides guidance on content and format of these specs.</p>	<p>Approved specification(s).</p>
Design vs. Requirements	<p>Document design approach. Demonstrate how the design concept satisfies requirements and design constraints in the relevant development specifications.</p>	<p>Documented in Design Basis Document prior to PDR. Approved by responsible Project Engineer.</p>
Resolution of Design Recommendations	<p>Document resolution of chits from prior design reviews. PPPL Procedure ENG-033 provides guidance.</p>	<p>Resolution of chits from prior design reviews documented on Web. Action items completed.</p>
Interface Identification	<p>Signed scope sheets for all primary interfaces. No TBDs allowed. The NCSX Interface Control Management Plan (ICMP) and NCSX Procedure 003 provide details of content and format expected.</p>	<p>Approved by Systems Engineering Support Manager</p>
	<p>Signed ICDs for all primary interfaces. TBDs allowed with closure plans. The NCSX Interface Control Management Plan (ICMP) and NCSX Procedure 003 provide details of content and format expected.</p>	<p>Approved by Systems Engineering Support Manager</p>

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Item	Requirement	Success Criteria
Models and Drawings	Sufficient drawings to support developmental design and analytical evaluation of the inherent ability of the design to attain the required performance. The drawings shall be sufficient to develop manufacturing approaches and cost estimates. All models and drawings promoted to Preliminary Design Release. Drawings shall be provided which define where the equipment will be located in the facility. Preliminary Design Release models and drawings should form a self-consistent package and provide the basis for cost and schedule estimates. The NCSX Pro/INTALINK Users Guide provides information on handling models and drawings.	Models and drawings approved for promotion by the responsible Project Engineer
	Develop a drawing tree with at least enough detail to identify all components necessary to support final design and production planning.	Approved by the cognizant Project Engineer
Analysis	Design criteria to establish limits for acceptability are in place. Sufficient analysis shall be provided to establish that the proposed design is feasible and meets established design criteria. Analyses must be documented in an auditable way – in analysis reports, not viewgraph presentations. The following analyses shall be accomplished as appropriate: structural, thermal, seismic, eddy current, radiation, and circuit analyses. Other analyses shall be included as appropriate.	Design criteria documented. Material properties characterized and documented. Analysis reports reviewed by responsible Project Engineer, summarized in Design Basis Document.
Manufacturability	Provide evidence (if necessary) from R&D activities that the design is manufacturable and has been optimized for manufacturability.	Manufacturing studies conducted as appropriate and results documented in Design Basis Document.
Qualification and Acceptance Testing	Qualification and acceptance test plans consistent with verification requirements in the development specifications. Identify when these tests would be performed. These plans provide the basis for subsequently developing test procedures. PPPL Procedure ENG-030 provides guidance.	Qualification and acceptance test plans documented and approved.
Constructability	Document plans for assembly, installation, and test. Provide evidence that risk-related issues have been satisfactorily addressed. These plans provide the basis for subsequently developing assembly, installation, and test procedures. PPPL Procedure ENG-030 provides guidance.	Assembly, installation, and test plans documented and approved.

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Item	Requirement	Success Criteria
Value Engineering	Determine what design areas would likely benefit from additional value engineering/management assessments at the beginning of Preliminary Design. Conduct and document results of value engineering studies (if any). NCSX Project Execution Plan (PEP) provides approach and the Value Engineering Report provides examples.	Results of value engineering studies (if any) documented in Design Basis Document.
RAM	Provide FMECA per PPPL Procedure ENG-008 identifying potential failure modes and recovery provisions. Explain how design has been optimized for reliability, maintainability, and safety through systematic evaluation of design options and application of proven design approaches.	FMECA documented. Summary of findings and design recommendations provided in Design Basis Document.
ES&H	<p>Provide a hazard analysis per PPPL Procedure ESH-004 that address the following:</p> <ol style="list-style-type: none"> 1. Descriptions of the environment, safety and health (ES&H) features of structures, systems and components, as applicable. 2. Identification of hazards associated with anticipated operation of the structure, system or component and methods employed for their mitigation. 3. Some description of the ES&H aspects of operations, e.g., access controls, setting of hardwired interlocks, operator actions, etc. <p>The depth of the discussions of these topics should be commensurate with the potential severity of the specific hazards, and with the maturity of the designs. The hazard analysis report should address ES&H issues identified in the FMECA. Review existing NEPA documentation per PPPL Procedure ESH-014. Submit new NEPA Planning Form if new hazards are identified.</p>	Report documenting hazard analysis. Approved by NCSX ES&H Manager.
COTS and Legacy Equipment	Identify use of commercial, off-the-shelf (COTS) as appropriate or legacy equipment. Describe plan for testing the performance of legacy equipment.	Documented in Design Basis Document.
Human Engineering	Demonstrate that sound human engineering principles have been followed in the design.	Documented in Design Basis Document.
Standardization Considerations	Identify how design has been optimized for standardization, including a list of standardized components	Documented in Design Basis Document.
Software and Firmware	Identify and describe all planned software and firmware, including the functional requirements allocated to them, how they will be validated and verified. This may be part of a Manufacturing, Inspection, and Test Plan (MITP).	Documented in Design Basis Document.

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Item	Requirement	Success Criteria
Preliminary Weight and Size Data	Demonstrate that weight and sizes are compatible with structural supports and size constraints	Documented in Design Basis Document.
Risk Management	Identify areas of significant risk and mitigation plans. The NCSX Project Execution Plan (PEP) describes the approach and the NCSX Risk Management Plan (RMP) provides specific risk mitigation strategies.	Documented in Design Basis Document.
Baseline Maintenance	Update cost and schedule estimates in Primavera Project Planner (P3) database consistent with proposed technical baseline as defined by Preliminary Design Release Level models and drawings and other documentation. Cost and schedule updates should generally be of a higher quality than the prior estimate with increased input from industry.	Approved by the cognizant Project Engineer. Coordinated with Engineering Manager. Incorporated in P3 database by Project Control Manager.
	Provide input to ECP to reflect proposed changes to the technical, cost, and schedule baselines. ECP will be processed after chits that have significant design, cost, or schedule impacts have been addressed. New baselines will be established upon approval of ECP and implementation of approved changes. The NCSX Configuration Management Plan (CMP) and NCSX Procedure 002 provide guidance on developing and processing an ECP.	Approved by the responsible Project Engineer. Coordinated with the Engineering Manager.

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Item	Requirement	Success Criteria
Specifications and drawings	<p>Documentation (specifications and drawings) required for product acquisition (to build or buy) is complete.</p> <p>Product ("build-to") specifications are approved and under change control. No TBDs allowed. The NCSX Systems Engineering Management Plan (SEMP) and the NCSX Engineering Web page (specifications provides guidance on content and format of these specs.</p> <p>All models and drawings should be checked (reviewed for consistency, completeness, and adherence to drawing standards) and promoted to Final Design Release level. Drawings need not be signed (promoted to Fabrication Release Level) pending outcome of the review and chit resolution. The NCSX Pro/INTALINK Users Guide provides information on handling models and drawings.</p>	Documentation package for product acquisition is complete.
Design vs. Requirements	<p>Document significant design changes since the PDR. Demonstrate how the final design concept satisfies requirements and design constraints in the relevant development specifications.</p> <p>Update Design Basis Document with regard to considerations previously addressed at the PDR, including: manufacturability; COTS and legacy equipment; human engineering; standardization; software and firmware; weight and size data; and risk management.</p>	Update Design Basis Document for FDR. Design Basis Document approved by responsible Project Engineer.
Resolution of Design Recommendations	Document resolution of chits from prior design reviews. PPPL Procedure ENG-033 provides guidance.	Resolution of chits from prior design reviews documented on Web. Action items completed.

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Item	Requirement	Success Criteria
Interface Identification	Signed ICDs for all primary interfaces. No TBDs allowed. The NCSX Interface Control Management Plan (ICMP) and NCSX Procedure 003 provide details of content and format expected.	Approved by Systems Engineering Support Manager
Analysis	All required analysis shall be performed and checked to establish that the proposed design is feasible and meets established design criteria. Analyses must be documented in an auditable way – in analysis reports, not viewgraph presentations.	Design criteria documented. Material properties characterized and documented. Analysis reports and calculation checks reviewed by responsible Project Engineer, summarized in updated Design Basis Document.
Qualification and Acceptance Testing	Document plans and procedures for product qualification and acceptance. PPPL Procedure ENG-030 provides guidance.	Qualification and acceptance test plans documented and approved. Required procedures in place.
Constructability	Document plans and procedures for assembly, installation, and test. PPPL Procedure ENG-030 provides guidance.	Assembly, installation, and test plans documented and approved. Required procedures in place.
RAM	Update the FMECA prepared per PPPL Procedure ENG-008 during Preliminary Design based on the additional design information available.	FMECA documented. Summary of findings and design recommendations provided in updated Design Basis Document.
ES&H	<p>Update hazard analysis performed per PPPL Procedure ESH-004 during Preliminary Design, including the following:</p> <ol style="list-style-type: none"> 1. Descriptions of the environment, safety, and health (ES&H) features of structures, systems and components, as applicable. 2. Identification of hazards associated with anticipated operation of the structure, system or component and methods employed for their mitigation. 3. Some description of the ES&H aspects of operations, e.g., access controls, setting of hardwired interlocks, operator actions, etc. <p>The depth of the discussions of these topics should be commensurate with the potential severity of the specific hazards, and with the maturity of the designs. Submit new NEPA Planning Form if new hazards are identified.</p>	Updated hazard analysis documentation. Approved by NCSX ES&H Manager.

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Item	Requirement	Success Criteria
Baseline Maintenance	Update cost and schedule estimates in Primavera Project Planner (P3) database consistent with proposed technical baseline as defined by Final Design Release Level models and drawings and other documentation. Cost and schedule updates should generally be of a higher quality than the prior estimate with increased input from industry.	Approved by the responsible Project Engineer. Coordinated with Engineering Manager. Incorporated in P3 database by Project Control Manager.
	Provide input to ECP to reflect proposed changes to the technical, cost, and schedule baselines. ECP will be processed after chits that have significant design, cost, or schedule impacts have been addressed. New baselines will be established upon approval of ECP and implementation of approved changes. The NCSX Configuration Management Plan (CMP) and NCSX Procedure 002 provide guidance on developing and processing an ECP.	Approved by the responsible Project Engineer. Coordinated with the Engineering Manager.

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