NCSX

CONFIGURATION MANAGEMENT PLAN

(NCSX-PLAN-CMP-01)

February 3, 2004

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Controlled Document

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Revision	Date	Description of Changes
Revision 0	February 25, 2003	Initial Issue
Revision 1	February 3, 2004	Made Change Classifications consistent with latest DOE guidance. Changes from Revision 0 are underlined.

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1 BACKGROUND AND INTRODUCTION

1.1 Program Description

The National Compact Stellarator Experiment (NCSX) is an experimental research facility that is to be designed and constructed at the Department of Energy's Princeton Plasma Physics Laboratory (PPPL). Its purpose is to develop the physics of compact stellarators, an innovative fusion confinement concept. The facility will include the stellarator device and ancillary support systems. The design and fabrication project will be led by PPPL, in partnership with the Oak Ridge National Laboratory (ORNL). This partnership approach is being used to effectively take advantage of each laboratory's specific expertise to provide the best possible facility for the fusion research community.

1.2 Overview of the NCSX Configuration Management Program

Configuration Management (CM) is an integrated program that ensures that the configuration is identified and properly documented and that changes to the configuration are controlled during this life cycle. However, this Configuration Management Plan (CMP) focuses on the design and fabrication phases of the NCSX Project, including the integrated systems testing and producing the first plasma. The Office of Fusion Energy Sciences (OFES) has identified the NCSX Project as a Major Item of Equipment (MIE).

The physical and functional description of the components, systems, and software/firmware comprise the "configuration" of the NCSX MIE Project. The NCSX project and details of its design configuration is progressively described in greater detail as it proceeds through the design process, fabrication, assembly, and installation. The goal of the NCSX Configuration Management Program is to ensure that the configuration design evolution is controlled and that the documentation of the configuration design shown in electronic drawings and models accurately reflects what is installed in the field to the extent practicable. As-built drawings are encouraged, but not required due to potential adverse resource impacts.

At selected points in the NCSX life cycle, the current design configuration, including fabrication and testing define the *technical* baseline. The cost and schedule estimates to accomplish this technical baseline are developed to form the *cost* baseline and *schedule* baselines. These three baselines are fully integrated since they are derived from the same configuration. The combination of technical, cost, and schedule baselines forms the basis for project work authorization and management. This becomes the basis against which the status of resources and the progress of the NCSX Project are measured. Consequently, there are three baselines: technical, cost, and schedule. Any proposed change to one baseline must be evaluated from the perspective of its impact on the other two baselines.

The CM program described in this NCSX Configuration Management Plan (CMP) is consistent with higher-level DOE orders and procedures. The CMP is intended to provide the following processes:

- Configuration Identification - a process for identifying configuration items and development of the appropriate configuration documentation to define the physical and functional characteristics of each configuration item. A

Configuration Item (CI) may be a complete system, a subsystem, or a component/assembly. The decision on the appropriate level of the CI is left to the WBS Manager.

- Configuration Change Control - a process for identifying and managing proposed changes to a configuration item and its characteristics and the impact of the proposed change on the documentation describing the technical, cost, and schedule baselines. This includes evolution of the design of the configuration item over time and tracking of the status of proposed changes to the configuration item until the change is approved or rejected.
- Configuration Status Accounting - a process for tracking the status of the implementation of approved changes in detail down to each impacted document.
- Configuration Verification - a process for verifying that the latest approved documents are used to fabricate/test configuration items and that the as-built physical and functional configuration is accurately reflected in the supporting documentation. It is anticipated that most of this effort will occur under the existing PPPL QA program.

While the NCSX Configuration Management Program is implemented immediately when the initial technical, cost, and schedule baselines are established, not all design information will be under formal configuration control at the same time. Rather, progressively more and more detailed information and documentation is placed under formal configuration control as the design matures.

1.3 Relationships to Other DOE and NCSX Plans and Procedures

In accordance with DOE Order 413.3, the NCSX Project is classified in the category of Other Projects (Not Major System Projects). Baseline change control (technical, cost, and schedule) approval thresholds for Level 0 (Secretarial Acquisition Executive) and Level 1 (Program Secretarial Officer) are defined in Attachment 5 to this order. Baseline change control for Level 2 (Federal Project Manager) and Level 3 (Project) are outlined in the *NCSX Project Execution Plan* (NCSX-PLAN-PEP). The PEP provides policy guidance for the overall planning and execution approach being used on the project and invokes this *Configuration Management Plan* (NCSX-PLAN-CMP) as the vehicle for maintaining the technical, cost, and schedule baselines for NCSX. Table 1.3-1 depicts the Level 0, Level 1, Level 2, and Level 3 NCSX baseline change control approval thresholds for technical, cost, or schedule baselines. In addition, several other NCSX plans, procedures, and documents support and implement other specific details outlined in this CMP. These include the:

- *Systems Engineering Management Plan* (NCSX-PLAN-SEMP);
- *NCSX Quality Assurance Plan* (NCSX-PLAN-QAP);
- *NCSX Data Management Plan* (NCSX-PLAN-DMP)
- *NCSX Document and Records Plan* (NCSX-PLAN-DOC)
- *Interface Control Management Plan* (NCSX-PLAN-ICMP)
- *Pro/INTRALINK Users Guide*
- *WBS Dictionary (NCSX-WBS)*
- *NCSX Procedure (NCSX-PROC-001), NCSX Glossary of Acronyms and Definitions*
- *NCSX Procedure (NCSX-PROC-002), NCSX Configuration Control*

- PPPL Engineering Procedures and Standards, including, but not limited to the latest version of:
  - *ENG-006 "Review and Approval of Specifications and Statement of Work";*
  - *ENG-010 "Control of Drawings, Software, and Firmware";*
  - *ENG-019 "PPPL Engineering Standards";*
  - *ENG-029 "Technical Definitions and Acronyms";* and
  - *ENG-033 "Design Verification"*

If deemed necessary as this program is implemented, the NCSX Project may develop project-specific configuration management and control procedures to augment the above documents.

Change Level	Approval Level	Technical Scope	Schedule	Cost
1	**Deputy Secretary of Energy**	Any change in scope and/or performance that affects mission need requirements or is not in conformance with the current approved OMB-300.	6 month or greater increase (cumulative) in the orginal project completion date.	Increase in excess of 25% (cumulative) of hte orginal cost baseline.
2	**Associate Director OFES**	Changes to technical requirements and parameters that affect safety basis and operation function, but do not affect mission need objectives.	3-6 month increase (cumulative) in the orginal project completion date.	Increase of the original cost baseline.
3	**NCSX Federal Project Manager**	Changes with ES&H impacts significant enough to affect the approved NEPA/EA documentation.	<3 month increase (cumulative) in the orginal project completion date **OR** Change in DOE level 2 milestone.	Changes requiring the use of contingency funds
4	**NCSX Project Manager or NCSX Engineering Manager**	Changes to the GRD and all other changes not requiring DOE approval.	All other changes to the performance measurement baseline schedules not requiring DOE approval.	All other changes to the performance measurement baseline costs not requiring DOE approval.

Table 1.3-1 NCSX Project Change Classification Matrix

The CMP is the next most senior of the NCSX Project Plans following the Systems Engineering Management Plan (SEMP). All other NCSX project plans are subordinate to the CMP.

2 ORGANIZATION AND RESPONSIBILITY

The NCSX Engineering Manager is responsible for the overall CM Program, including the establishment and monitoring of the technical, cost, and schedule baselines. The

Engineering Manager is also responsible for identifying which configuration items will come under configuration control and when. Within his organization, the Systems Engineering Support Manager is responsible for the implementation and administration of the CM process and update of the technical, cost, and schedule baselines as described in this CMP. The NCSX Project Control Manager provides support to the CM process in the area of cost and schedule assessments of proposed changes and implementation of approved changes to the cost and schedule baselines.

The NCSX WBS Managers are responsible for identifying the physical and functional configuration items that comprise their WBS elements and for developing the designs and the associated costs and schedule in their specific areas of responsibility, including proposing changes to those designs, costs, and schedules. They are also responsible for assessing impacts of other proposed changes on their areas of responsibility.

The NCSX Project Manager is responsible for approving changes to the established technical, cost, and schedule baselines or, for those changes requiring DOE approval, making project recommendations. In some instances where the scope of the change is urgent or a relatively minor nature, the NCSX Project Manager may authorize the NCSX Engineering Manager to disposition and implement the proposed change in an expedited fashion. This process is described later in Section 3.1.4 of the CMP.

3 CONFIGURATION MANAGEMENT

3.1 Configuration Change Control

3.1.1 Placement of Documents Under Configuration Change Control

The formal DOE configuration change control processes described in the applicable DOE guidelines and procedures and this CMP will not be implemented until the Project receives approval of the Critical Decision 2 (CD-2) milestone the establishes the DOE approved Acquisition Performance Baseline (APB). This milestone was completed in February 2004.

Notwithstanding that CD-2 marks the starting point for the formal DOE configuration control, the Project established the initial technical, cost, and schedule baselines in the late summer of 2002. These baselines formed the basis for the performance measurement baseline in the NCSX Project Control System (PCS). This also marked the start of an internal configuration control process on the NCSX Project where documents are progressively placed under configuration control. The project technical baseline started as a high-level specification and will evolve to greater level of detail as the design progresses. This process is controlled by the manner in which documents are progressively placed under configuration control as the design details mature. Details of the design that are not under formal configuration control are controlled in less formal manner by the Engineering Manager and WBS managers.

In general, project design reviews will determine when specific configuration items come under formal change control. As a guideline, the following configuration items will come under configuration control (from a project perspective) at the following design review points:

- Conceptual Design Review (CDR) – The CDR was successfully completed in May, 2002. Following resolution of the major CDR recommendations and comments, including some changes in schedule logic, and revised DOE funding guidance, the Project established its initial set of baselines. This baseline was the source of the baseline cost and schedule information documented in the NCSX Project Execution Plan (PEP) that was approved as part of the CD-1 milestone achievement. For this initial series of baselines, only the General Requirements Document (GRD), the technical data that constitutes the fundamental agreements between engineering and physics (e.g., the coil geometries, coil currents for the reference scenarios, and the first-wall envelope), and the Pro/Engineer (Pro/E) models and drawings will constituted the technical baseline. The cost estimate and schedules that were consistent with this technical baseline constituted the cost and schedule baselines. These baselines serve as a point of departure for implementing the CM process internally.
- Preliminary Design Reviews (PDRs) – At the completion of preliminary design, subsystems or grouping of subsystems will undergo formal preliminary design reviews or PDRs. At the completion of these PDRs, the subsystem requirements expressed in system "design to" or performance specifications (flowed down from the GRD), interface control documents (ICDs – representing interface agreements between systems), updated models/drawings, and any other supporting technical data (e.g., tables, sketches, computer files, etc.) will be defined and placed under configuration control. These "design-to" specifications and constraints let the each WBS manager know what they have to design to and what are the envelope and boundary conditions for final design. Following the completion of the PDR and other prescribed DOE reviews, the Project expects to receive approval of the CD-2 milestone. It is at this point that the formal DOE configuration control process is implemented.
- Final Design Reviews (FDRs) – At the completion of the final design process, specifications, interfaces, models/drawings, and supporting technical information will have matured to a level of detail sufficient to permit fabrication and assembly. A series of final design reviews or FDRs will be conducted to mark the transition point from design to fabrication. The key "build-to" documents that will now come under configuration control include manufacturing specifications, assembly procedures, fabrication drawings, and any other technical data that is needed to constrain the fabricator or assembler. Near the end of project fabrication, testing procedures will also be developed and placed under configuration control.
- Project Completion –The goal of the NCSX configuration management program is to ensure that the documentation reflected in electronic drawings and models accurately reflect what is installed in the field to the extent practicable. The DMP summarizes how the Project will make every reasonable effort to achieve this goal.

It should be noted that baselines might also be established between the times of major project design reviews as the result of an ECP.

3.1.2 Evolution of the Baselines

As indicated in Section 3.1.1 above, the initial technical, cost and schedule baselines will be established at the start of preliminary design. During preliminary design or final design the level of detail and understanding of the constraints and envelopes of the design will evolve. Between the time that the initial technical, cost, and schedule baselines are established and the periodic cost and schedule reviews outlined in the PEP and/or the technical design reviews outlined in the SEMP and this CMP, the technical baseline and its associated cost and schedule details will evolve. These will be documented in "developmental baselines" that will be controlled at the WBS manager level, but will not be under formal configuration control.

Proposed changes to the internal or DOE controlled technical, cost, or schedule baselines may be identified by several methods:

- Weekly System Integration Team (SIT) meetings may identify technical changes and risk mitigation strategies that need to be accommodated to facilitate successful attainment of mission, physics, or engineering requirements;
- Monthly statusing of the authorized work documented on the Work Authorization Forms (WAFs) or periodic Project and engineering meetings may identify issues that require some changes to the technical, cost, or schedule baseline;
- Suggestions by WBS Managers may identify technical changes that will result in improved performance (technical, cost, or schedule) or are needed to solve technical issues; and
- Preparations for the periodic cost and schedule reviews and/or technical design reviews may identify necessary changes to the project baselines.

Figure 3.1-1 provides a flow chart of managing the development of the project baselines.

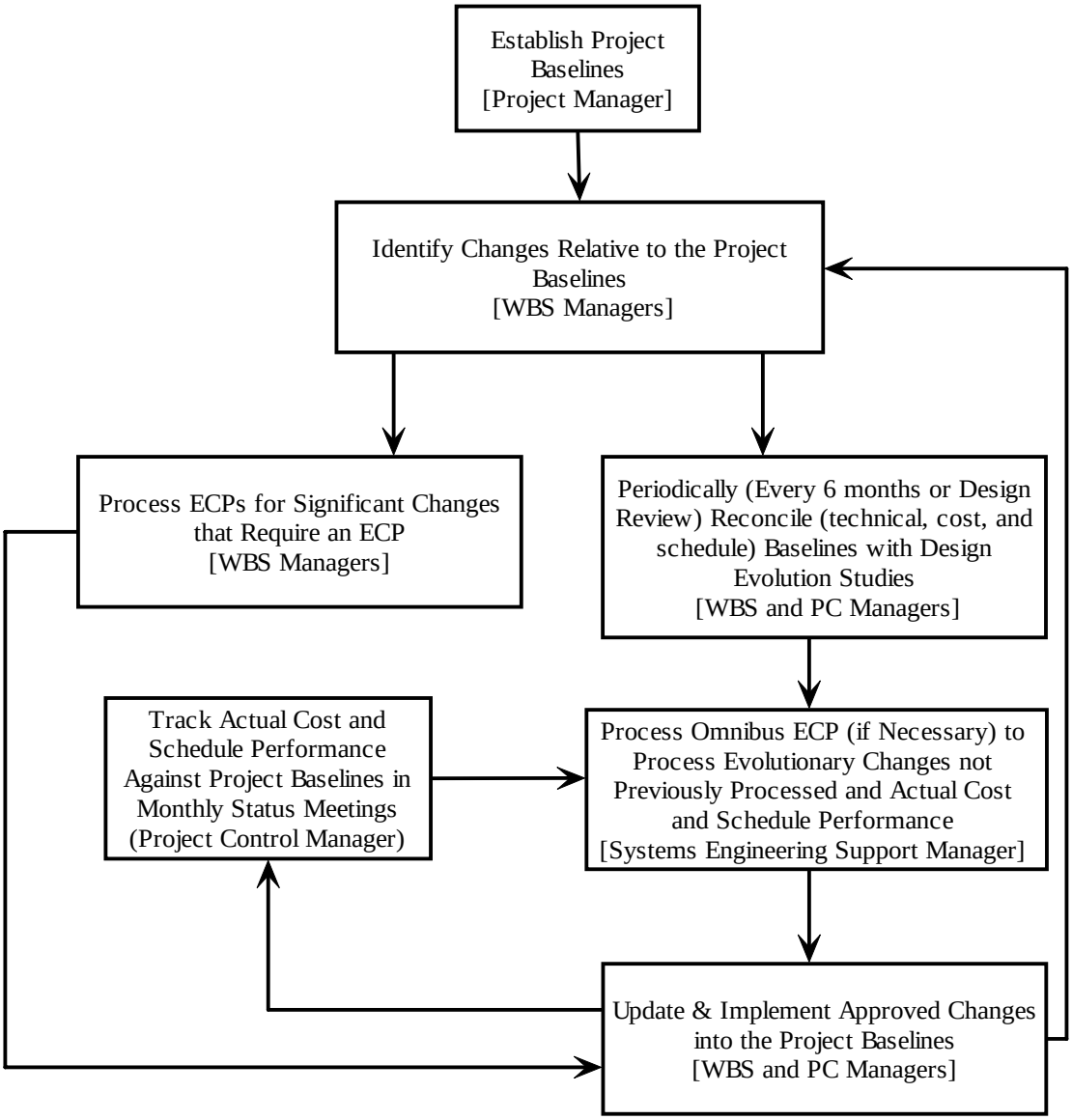

Figure 3.1-1 Managing the Evolution of Project Baselines

3.1.3 Engineering Change Proposal

Once the CD-2 milestone is approved and the DOE APB established, all changes to project baselines will be accomplished by the Engineering Change Proposal (ECP). Evolutionary changes to baselines (technical, cost, and schedule), in which the design (and the associated cost and schedule impacts) advances in a level of detail, moving beyond but not necessarily changing that which is already under formal change control or adjustments due to actual cost and schedule performance against established baselines, will be handled by periodically updating the reference design to incorporate these developments. As indicated on Figure 3.1-1, these "omnibus" ECPs will be processed to capture multiple small changes. Discrete and significant changes, in which a change of thinking or understanding causes the project to change something that is already under formal configuration change control, will be handled by a stand-alone ECP. The decision as to whether a proposed change falls in the "significant" or "omnibus" ECP classification shall be determined by the NCSX Systems Engineering

Support Manager in consultation with the proposer, the impacted WBS Managers, ther responsible Project Engineer(s), and the Engineering Manager. NCSX Procedure NCSX-PROC-002, NCSX Configuration Management, provides the details of the process for completing and processing an ECP. The ECP will be an electronic form that is available and will be processed on an interactive Configuration Management Web Page that will be accessible from the NCSX Engineering Web Page.

A change request can be initiated by anyone associated with the Project. The initiator identifies the affected documentation, outlines the reasons for the change, quantifies the technical, cost, and schedule impacts, and describes the change in detail. The ECP form allows for review of all changes in a consistent manner. The normal adjudicating body for each ECP is the Change Control Board (CCB) and Section 3.1.5 that follows describes the makeup and operation of the CCB. However, in some instances, a process for "expedited" ECPs may be appropriate and Section 3.1.4 that follows addresses when this might be applicable. ECPs will be numbered sequentially as follows: ECP-FY-XXX, where FY is the current fiscal year and XXX the sequential number of the ECP.

The NCSX Project Execution Plan (NCSX-PLAN_PEP) identifies the 4 levels of change control approval. Starting with the Deputy Secretary of Energy for Science and Environment, there are technical, cost, and schedule thresholds defined that identify the appropriate approval level. Level 3 changes are reserved for the NCSX Project team for disposition.

Once the ECP is adjudicated, the Project will be notified as to whether the ECP is approved or not approved. If an ECP is approved, the ECP is then implemented and the affected documentation is revised accordingly in a timely manner The NCSX Systems Engineering Support Manager shall be responsible to the NCSX Project Engineering Manager for developing and implementing the web-based status accounting system. The ECP and an updated list of approved, disapproved, and pending changes will be maintained electronically by the Systems Engineering Support Manager on the NCSX Configuration Management Web Page. Figure 3.1-2 illustrates the change control process.

The WBS Manager is responsible for implementing approved ECPs, including coordinating the revision of impacted documents. During the monthly status review meetings with each WBS Manager, the status of implementing the approved ECP into the impacted documents will be addressed.

To facilitate tracking of the status and implementation of an ECP from inception to close out, two web-based logs have been developed. These are the ECP Tracking Log and the ECP implementation log. NCSX procedure NCSX-PROC-002 provides sample of these logs.

3.1.4 Expedited ECPs

Although any change to established baselines (technical, cost, and schedule) requires an ECP, it may not always be practical to follow the full-blown ECP processing system shown on Figure 3.1-2. Instances where an "expedited" ECP might be appropriate is

when a pending critical procurement needs to reflect the proposed change, if field activities may be delayed by the normal ECP process involving full reviews and the CCB, or if the change is primarily editorial or minor in nature and impact. The NCSX Engineering Manager, in consultation with the NCSX Project Manager, may direct the Systems Engineering Support Manager to implement an "expedited" ECP process in which the NCSX Engineering Manager may review and approve the ECP with only an abbreviated review. This class of ECPs is a subset of the Level 3 ECP classification. However, any "expedited" ECPs will be reviewed "after-the-fact" by the full CCB to ensure that major errors and/or omissions were not made.

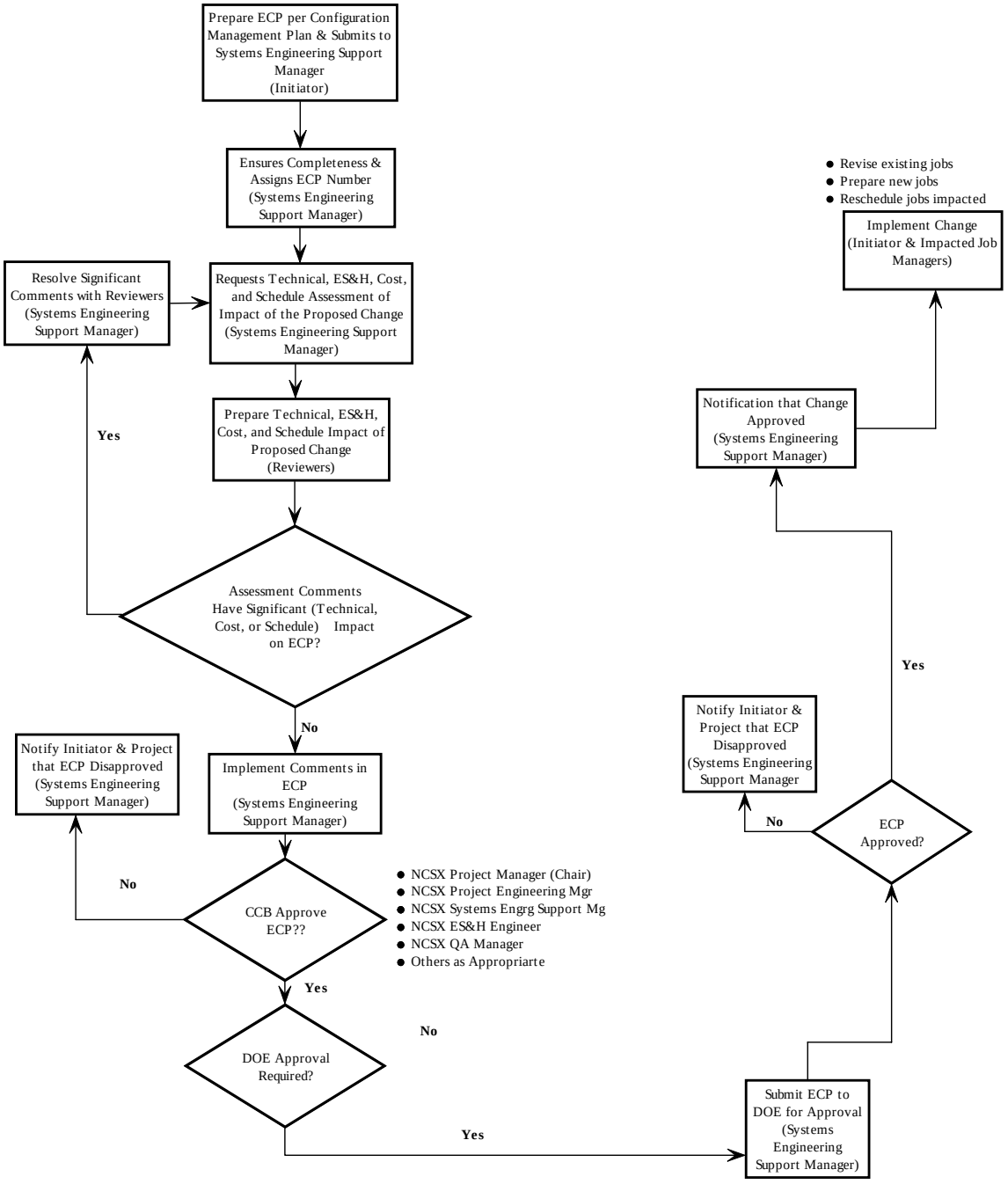

Figure 3.1-2 The Change Control Process

3.1.5 Change Control Board

Once an ECP has been prepared, the determination made that this ECP does not qualify for "expedited" ECP processing, and the impacts fully documented, the ECP will come before a Project Change Control Board (CCB) that is comprised of senior members of the NCSX management team. The NCSX Project Manager or his designee will chair the CCB. Other members of the CCB will be assigned as appropriate, but typically include the following:

- Systems Engineering Support Manager (Secretary of the CCB);
- Project Control Manager;
- Engineering Manager;
- Physics Head;
- Project Engineers impacted by the proposed change
- WBS Managers impacted by the proposed change;
- ES&H Manager;
- QA Manager;
- Other impacted managers; and
- NCSX Project Manager.

The chairperson shall have the ultimate authority to recommend/approve changes for the final approval; other CCB members act solely as advisors. In instances where the ultimate approval authority is DOE, the NCSX Project Manager shall indicate his approval and forward it for DOE disposition with his recommendation to approve.

3.2 Baseline Documentation

3.2.1. Technical Baseline

The technical baseline at any stage of the project is defined by any or the entire following configuration defining documents:

- Requirement documents (specifications) that clearly define the performance requirements and constraints that need to be satisfied;
- Interfaces Control Documents (ICDs) that define the interfaces between WBS elements; and
- Drawings , models, and technical data that physically define the configuration.

Documentation (specifications, drawings/models, supporting technical information, etc.) will come under configuration control progressively as the design evolves. A series of "frozen" baselines (from a technical, cost, and schedule perspective) will be established as the documentation package for each design review is finalized. Changes resulting from design review CHITs or other design evolution changes will be addressed as part of the design review closeout and design evolution process. Before the next design review, all CHITs from the previous review must be closed out.

3.2.1.1 Requirements/Specification Documents

Requirements/specifications for the NCSX Project are captured in a hierarchy of requirements, which begin with the system/project (top-level) requirements in the General Requirements Document (GRD). The GRD provides performance requirements and constraints at the overall system (project) level and the allocation of each

requirement to affected subsystems. These initial subsystem requirement allocations in the GRD are expanded and developed in subsystem and lower level specifications as described in the following paragraphs. As described in the Systems Engineering Plan (NCSX-PLAN-SEMP), the requirement/specifications may be classified in two basic categories:

- Developmental or "Design to" Specifications – these documents encompass the GRD and SRDs. These documents provide the design requirements by system, envelopes, and boundary conditions that constrain the development of the final design. As indicated earlier, the bulk of these documents will be placed under formal configuration control by the completion of preliminary design.
- "Build to" Specifications – these documents provide the details to enable a manufacturer to build or assembler to assemble the component, system, or subsystem. Included in this category would be procurement specifications, detailed assembly and fabrication procedures, and detailed testing procedures.
- Installation and assembly procedures – these documents provide the step-by-step processes and material requirements for installation and assembly.

The SEMP has identified five types of specifications with different functions for NCSX and these will naturally have different formats as appropriate. A specification tree shall be used to identify and plan for each specification required by the NCSX Project. For each specification, the specification tree will identify the scope, specification type, and the organization responsible for its development.

The NCSX Project shall develop and implement a project-specific approach for developing specifications that meets the requirements set forth in most recent revision to PPPL Engineering Procedure ENG-006, "Review and Approval of Specifications and Work."

3.2.1.2 Interface Control Documents

Interface requirements are functional, performance, and physical characteristics required to exist at a common boundary. This boundary consists of performance/physical design constraints between systems and subsystems. The interface may define either the physical boundary conditions or the functional or performance boundary conditions.

The ICMP defines the process and format for defining interfaces. Two types of interfaces exist; primary and secondary interfaces. Primary interfaces exist between two separately deliverable items (referred to as Configuration Items/CIs in systems engineering terms) when the mutual boundary area is not controlled by a single developmental or "design to" specification, when the interface is with systems outside the project (external interfaces identified in the General Requirements Document/GRD), or when, at the discretion of the cognizant Project Engineer, the interface is determined to be critical to the performance of the NCSX program. Configuration Items (CIs) represent the lowest level of control under configuration management and may be a single physical or functional item or collection of items that will satisfy a final end product or deliverable. Physical interfaces are documented in Interface Control documents and functional interfaces will be documented in "design to" performance specifications. Secondary interfaces exist when the interface can be defined by a single developmental or "design to" specification. Secondary interfaces will remain under local control by the

WBS Manager until such time that the design is completed and the CI ready for delivery or the CI interface is elevated to a primary interface status.

As described in the Interface Control Management Plan (NCSX-PLAN-ICMP), the process for defining and documenting primary interfaces involves two steps. The first step is the development of scope sheet interface agreement. These scope sheets, normally in the form of e-mail agreements, will be developed early in the preliminary design phase and document the agreements as to what primary interfaces exist, who will be responsible and a plan for developing either the ICD or "design to" performance specifications. Primary interfaces documented in ICDs or "design to" specifications will be brought under configuration control by completion of preliminary design and an ECP will be required to change an ICD.

Changes to drawings or models that reflect interfaces must be considered when processing ECPs. While the process of revising ICDs properly reflects updates to drawings or models, the opposite must also be considered – where changes to drawings or models may impact existing ICDs. As part of the impact statement on the ECP, the impact of the change to existing interfaces must be considered as part of the impact identification process.

3.2.1.3 Drawings and Models and Supporting Technical Data

3.2.1.3.1 Drawings and Models

Project drawings and models will be prepared in accordance with the PPPL Engineering Design/Drafting Standard ES-DRFT-001, which implements the latest version of the PPPL Drafting Standards Manual. As indicated in the NCSX Data Management Plan (NCSX-PLAN-DMP), the majority of the drawings and models will be developed using Computer Aided Design (CAD) software; e.g., Pro/Engineer for mechanical 2D and 3D drawings and models and AutoCAD for electrical drawings. All drawings and models that interface with the stellarator core will be prepared in 3D using Pro/Engineer.

The Pro/Engineer model and drawings that described the CDR technical baseline came under configuration control in the summer of 2002. These models and drawings will be updated for the PDR. Once CD-2 approval is received, ECP is required to effect changes to the drawing/model that impact the established technical, cost, and schedule baselines. Each "frozen" baseline is easily identified in the PRO/INTRALINK database via a unique baseline tab within the appropriate PRO/INTRALINK WBS folder. Baselines will be identified not only by a date identifier but also by a unique name; e.g., "0512_CDR_Baseline."

If a model or drawing has been released for fabrication, the official version of that model or drawing will be maintained by the PPPL Drafting Supervisor in a separate Released Drawing folder in the Pro/INTRALINK database. The Engineering Web page will contain a list of those drawings released for fabrication so that casual users might know to go into the Released Drawing folder to obtain the latest version. Changes to drawings released for fabrication will also require that an Engineering Change Notice (ECN) be prepared as an attachment to the ECP. The ECN will be processed in accordance with the latest revision to PPPL Engineering Procedure ENG-010, "Control of Drawings, Software, and Firmware" with one alteration. When an ECN is pending on a particular

drawing the Drafting Supervisor will extract the affected drawing from the NCSX Pro/INTRALINK drawing released folder and add an Acrobat stamp that states "ECN Pending" along with the ECN number and any summary description added to the drop-down note. Once the Acrobat stamp is added, the Drafting supervisor will place the drawing back into the released drawing folder. This process allows all viewers of drawings in the Released Drawing folder to be made aware that an ECN is pending on a particular drawing. After the ECN changes have been completed a PDF file will be made of the revised drawing and placed in the Release Drawing folder and the drawing with the ECN Acrobat stamp removed.

Another special case of models and drawings will be the general arrangement models and drawings of the NCSX facility that show equipment envelops and locations. The current facility model will also be posted on the Engineering Web page in pdf format to facilitate ease in accessing NCSX space allocations information.

The CAD models and drawings are an extension of the systems requirements allocation process. When developed as three-dimensional models and managed within an integrated product data management tool (Pro/INTRALINK) they provide, at the top level, a physical and functional hardware implementation of the design requirements as defined in the GRD. In the Conceptual Design stage, models of the stellarator core and facility were developed and exist in varying degrees of detail, representing the overall design configuration. Some models will have a high level of development while others will provide the allocation of volumetric space of a subsystem.

As described in the DMP and Section 3.1.2 of this CMP, models and drawings will progress though various interim design stages (Conceptual Design, Preliminary Design, Prototype, Final Design) to the fabrication release stage. Each interim stage will be promoted, managed, and stored in accordance with the controlled processes described in the DMP. These processes will support the periodic cost and schedule reviews, technical design reviews, and changes to the technical, cost, and schedule baselines whenever the design evolves to a point that a technical, cost, or schedule baseline change is deemed necessary.

Upon completion of the fabrication and assembly, a set of as-built drawings and models will be developed to the extent practicable to ensure consistency between the design documentation and the physical configuration in the field. Storage of all release points of the design process will allow models to be checked to assure compliance to earlier space allocations.

3.2.1.3.2 Supporting Technical Data

Technical data (e.g., coil geometries, coil currents for the reference scenarios, first-wall envelopes, tables, computer files, etc.) that support and substantiate the design will placed under formal configuration control on a case-by-case basis and at appropriate stages of the design when needed. Either the responsible Project Engineer or the Engineering Manager makes the decision when supporting technical data will come under configuration control. As the design evolves, it is anticipated that technical data will be controlled, checked, and approved in accordance with the processes set forth in the latest version of PPPL Engineering Procedure ENG-033, "Design Verification." WBS

Managers will maintain copies of approved and checked calculations and design confirmatory information.

3.2.1.4 Procurement Support Documents

Procurement support documents include statements of work (SOWs), specifications, and associated drawings and models. Although procurement and management documents, SOWs will come under configuration control as well as the specifications and associated drawings and models that provide the reference for the basis for the design desired. While changes to these documents will be processed via an ECP, the revised documents will not become applicable to the vendor's work scope until such time that the contract is changed.

3.2.2. Design Basis Documents

Another critical set of documentation that supports design reviews will be the Design Basis Documents (DBDs). DBDs are historical documents **NOT** subject to configuration control. Nonetheless, DBDs are important documents in the design evolution process. DBDs are the comprehensive design basis that describes (but not defines) the design of each subsystem and how the design satisfies the requirements specified in the requirements documents. DBDs will be prepared and updated by WBS Managers according to a format appropriate for each major design review (e.g., conceptual design review, preliminary design review, and final design review. The DBDs describe the technical baseline upon which the cost and schedule baselines are predicated at each major design review point. At each major review point, the cost and schedule baselines are updated and the DBDs are also updated to provide a description of the companion technical baseline at that point in time.

3.2.3 Cost and Schedule Baselines

The cost and schedule baselines are derived from the Project's technical baseline; the scheduled tasks and their estimated costs provide a time scale and cost for completing activities that make up the technical baseline. The cost and schedule detailed baselines reside in a Primavera Project Planner (P3) database that is controlled and maintained by the NCSX Project Control Manager. The Level 2 resource-loaded schedules and associated milestones contained in this database, including year-by-year contingency utilization estimates, constitutes the controlled cost and schedule baseline for completing the NCSX Project.

Level 3 resource-loaded schedules and milestones, expanded in detail from the Level 2 baseline, are incorporated in Work Authorization Forms (WAFs). The WAFs are used to authorized work and measure performance at the task level and those constitute the controlled performance measurement baseline for authorized work.

Adopting changes to the controlled cost and schedule baselines will be done in accordance with approved change control procedures outlined in this CMP. When the project changes the project baselines, the data files that underpin the new cost and schedule baselines will be uniquely identified and locked, preventing further changes under that identifier. Viewable files will be generated for project use in PDF format. The

viewable files will include the identifier for the data files from which they were generated.

3.3 Other Management Documents

Project management plans and procedures will not come under the configuration control processes described in this CMP. However, these documents are controlled documents that will be reviewed and approved via a disciplined process. Revisions to these documents will also be carefully controlled by a disciplined change and signature approval process. The DMP indicates the required approval level for each management document.