

NATIONAL COMPACT STELLARATOR PROJECT

Engineering Change Proposal (ECP)

COVER PAGE

(TO BE COMPLETED BY SYSTEMS ENGINEERING SUPPORT MANAGER)

Originator: Bob Simmons

Date: April 26, 2004

ECP No: 04-006

ECP Title: Updated Cost and Schedule Estimate for Design and R&D

Required Reviewers

Required Reviewers for this ECP: WBS Managers 12, 13, and 14; Stellarator Core Project Engineer; Project Control Manager; NCSX Engineering Manager; NCSX Project Manager; and the Federal Project Director

ECP Approval Level

Expedited ECP? ☐ Yes ☒ No

Change Level: 2 Federal Project Director

Approving Official: 2 Federal Project Director

Actions

- (1) Update cost and schedule baselines
- (2) Update WAFs to reflect the new detailed costs and schedules
- (3) Report status against these revised baselines, starting with the April statusing
- (4) Update DOE PARS as necessary to reflect this information

APPROVALS

(TO BE COMPLETED BY APPROVING OFFICIALS)

Change Level	Approving Official	Approval?	Signature
3	NCSX Project Manager	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<i>G. H. Nelson</i> 4/28/04
3a (Expedited ECP)	NCSX Engineering Manager	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2	NCSX Federal Project Director	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<i>C. H. Nelson</i> 4/28/04
1	Associate Director OFES	<input type="checkbox"/> Yes <input type="checkbox"/> No	
0	Under Secretary of Energy	<input type="checkbox"/> Yes <input type="checkbox"/> No	

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PART I *(TO BE COMPLETED BY ORIGINATOR)*

Originator: Bob Simmons

Date: April 26, 2004

Overview of Change

Type of ECP: ☐ EXPEDITED ☒ STANDARD

Type of Change: ☐ TECHNICAL ☒ COST ☒ SCHEDULE ☐ EDITORIAL

(Check all that Apply)

Reason for Change: Since the Technical, Cost, and Schedule Baseline established by ECP-04-005, the design evolution has resulted in a better understanding of the cost to complete ongoing activities, mainly in the design and R&D for the modular coil winding forms and vacuum vessel. In addition, the scope of the modular coil test facility had to be augmented to satisfy the test program requirements as well as requirements for safety and equipment protection. Minor schedule adjustments have been made in non-critical tasks.

Impacted WBS Elements: WBS 12, 13, and 14.

Impacts of Change (Briefly Describe): This ECP proposes a updated cost and schedule baseline due to the following impacts:

- **WBS 121 - Vacuum Vessel Assembly**
 - Additional studies were necessary to finalize port locations and configuration, including some RF ports not included in the original scope, and some preparation of additional drawings. The incomplete status of port configuration at the time of the PDR was noted in the PDR report. The fabrication costs associated with the additional ports are still being estimated and will be captured in a future ECP that will update the technical baseline. The approximate cost impact of the additional design activities is \$75K.
 - Additional effort will be needed to complete the Weld Joint R&D effort, the purpose of which is to reduce the risk associated with assembling the vacuum vessel field joint during final assembly. The primary causes of this cost increase was the need to fabricate full size test specimens prototypical of the field joint. It was originally planned to use the prototype vacuum vessel sector for the full-scale test, but this proved infeasible since the prototype section is not prototypical of the field weld joint region. The approximate cost increase is \$44K.
 - Additional effort will be required to complete the Vacuum Vessel prototype contracts, primarily due to vendor technical issues and problems arising during the prototype fabrication process. The approximate cost of this additional effort is \$213K.
- **WBS 130 - Conventional Coils.** Additional analysis and testing of insulated conductor bundles is needed to ensure that the insulation between conductors will not fail during cooldown. The approximate cost of these activities is \$53K.

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- WBS 141 - Modular Coil Winding Forms. The port configuration development activity described under WBS 121 also required some re-design of the MCWF because of the penetrations that must be added to accommodate the additional ports and additional stress analyses to quantify the allowable hole sizes. The fabrication costs for the additional ports will be captured in a future ECP. The approximate cost of the additional design and analysis work is \$27K.
- WBS 144 – Modular Coil Winding Facility & Fixtures - As the design of the coil test facility has advanced in maturity, improvements that are necessary for the design to meet the testing program requirements as well as provide acceptable levels of safety and equipment protection have been identified. The improvements increase the cost. The safety and engineering design and review processes have added: 1) Nitrogen gas safety ventilator; 2) Thermal protection circuitry for test and production coils; 3) Improved power supply fault response circuitry; and 4) Closed loop liquid nitrogen cooling to provide a relevant test of the actual coil cooling conditions.
 - Additional work was needed to design and procure a N₂ safety ventilator for personnel safety and increased thermal protection circuitry for the test and production coils. The cost of these additional activities is \$80K.
 - A N₂ cooling system was determined to be necessary in order to produce a closed loop coil cooling system. This is necessary to provide a relevant test of the actual coil cooling conditions (vs. the two-phase once-through scheme that was originally envisioned). In addition an upgraded controls system was added to ensure that electrical faults in the coil test facility would not adversely impact NSTX operations. The cost of this added scope is \$138K.
- Schedule impact: Critical path activities have been accommodated and re-planned by delaying non-critical path activities. No impact on the critical path, although some sequencing has been changed within FY2004. Therefore there are no escalation impacts.

As a result of the above changes, it is proposed to draw down contingency by approximately \$630K from \$15,350K to \$14,720K.

Assessment of Other Options: None. These have been determined to be necessary tasks and the resultant increase in costs have been kept to a minimum.

The following list of attachments provide the supporting details of these proposed changes

- Attachment 1 – Detailed Analyses by WBS Level 2 and 3
- Attachment 2 – Updated NCSX Project Baseline