# NATIONAL COMPACT STELLARATOR PROJECT
# Engineering Change Proposal (ECP)

***COVER PAGE***

***(TO BE COMPLETED BY SYSTEMS ENGINEERING SUPPORT MANAGER)***

**Originator:** R.Strykowsky | **Date:** August 22,2008

**ECP No:** 60 | **ECP Title:** NCSX MIE Project Closeout

**Required Reviewers**

**Required Reviewers for this ECP:** D.Rej, H.Neilson, R.Simmons, P.Heitzenroeder, L.Dudek, J.Harris

**ECP Approval Level**

**Expedited ECP?** ☐ **Yes** ☒ **No**

**Change Level:** 0 - Deputy Secretary of Energy

**Approving Official:** Deputy Secretary of Energy

**Actions**

1. Accept proposed closeout plan as proposed (DOE)
2. Execute closeout plan (PPPL/ORNL)

***APPROVALS***

***(TO BE COMPLETED BY APPROVING OFFICIALS)***

| Change Level | Approving Official | Approval? | Signature |
|---|---|---|---|
| **3** | **NCSX Project Manager** | ☒ **Yes** ☐ **No** | |
| **3a (Expedited ECP)** | **NCSX Engineering Manager** | ☐ **Yes** ☒ **No** | |
| **2** | **NCSX Federal Project Director** | ☒ **Yes** ☐ **No** | |
| **1** | **Associate Director OFES** | ☒ **Yes** ☐ **No** | |
| **0** | **Deputy Secretary of Energy** | ☒ **Yes** ☐ **No** | |

# NATIONAL COMPACT STELLARATOR PROJECT
# Engineering Change Proposal (ECP)

***PART I***
***(TO BE COMPLETED BY ORIGINATOR)***
**ECP-60**

| **Originator: R.Strykowsky** | **Date: August 22,2008** |
|---|---|

**Overview of Change**

**Type of ECP:** ☐ **EXPEDITED** ☒ **STANDARD**

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

**(Check all that Apply)**

**Reason for Change:** Project Cancellation

**Impacted WBS Elements:** All

**Impacts of Change (Briefly Describe):**
NCSX MIE Project cancelled as directed by DOE. Remaining work (as defined in attached) required to bring work efforts to an orderly conclusion, which includes new scope of safeguarding acquired project assets and documentation closeout.

Project TEC reduced from $92.4M to $92.0M
Project OPC increased from $9.6M to $10.0M
Project TPC unchanged at $102.0M
CD-4 date unchanged at July, 2009. Scope changed as described herein.

**Does this Change Impact Material Already Procured or Parts/Assemblies Already Assembled/Manufactured using this Material:** ☒ **Yes** ☐ **No**

**If "Yes", what is the recommended disposition of this material/part/assembly?** Fabricated and procured parts and hardware will be inventoried, collected and stored in a protected defined area.

**Assessment of Other Options:** Parts and fabricated hardware to be stored for future disposition and not sold for scrap value at this time.

# NATIONAL COMPACT STELLARATOR PROJECT
# Engineering Change Proposal (ECP)

***PART I***
***(TO BE COMPLETED BY ORIGINATOR)***

| **Originator: R.Strykowsky** | |
|---|---|

**<u>Detailed Description of the Change</u>:**
(Use Continuation Sheets and/or Attach Information/Sketches, As Needed)

**List Attachments, Impacted Documents, etc.**

1) WBS Element Description & Status at Closeout
2) CD4 Deliverables
3) WBS financial comparison chart between previous baseline (ECP-53) and this Closeout ECP
4) Closeout plan resource loaded schedule
5) Revised list of milestones
6) Decision memo from SC-1 to S-2 announcing project cancellation

**Description of Change:**

1. Scope:
   – Document work performed relative to the ECP-53 baseline
   – Inventory and store all materiel and fabricated components
   – Complete fabrication of 18 modular coils
   – Complete fabrication of 18 toroidal field coils
   – Complete coil structures final design review
   – Complete the LN2 distribution system PDR, trim coil , and base structure FDR
   – Complete subassembly of two half field period assemblies (HFPAs) & one HFPA trial fit-up test over vacuum vessel subassembly
   - Document final status of CAD models, finite-element analyses, and all work packages, including open issues needing to be resolved in order to complete construction.
   – Archive key project documents for long-term storage electronically, and make those documents readily accessible to the research community
   – Prepare journal manuscripts on physics, engineering design, integration, R&D, fabrication, assembly, management, and lessons learned (OPC)
   – Closeout costs, e.g., subcontract claims, indirect changes
   – Organizational restructuring

2. Costs & Budgets:
   – TEC
     - Costs through 5/31/08 ……...…...$82.7M
     - Estimate to Complete…..…………$9.4M
     - Current Baseline ……….…..……...$92.4M
     - Revised Baseline…………………$92.0M
   – OPC
     - Current Baseline: ……….……….$9.6M
     - Revised ………………….…..……$10.0M

3. Schedule: See attached resource-loaded schedule for early finish dates

# WBS ELEMENT DESCRIPTION & STATUS AT CLOSEOUT

## *1 Stellarator Core*

### Vacuum Vessel System (WBS 12)

The vacuum vessel was to have provided the vacuum boundary around the plasma suitable for high vacuum conditions; structural support for all internal hardware and access for auxiliary systems such as neutral beam injection and plasma diagnostics. The vacuum vessel was a highly shaped, three-period Inconel structure which approximately conforms to the plasma. Work included engineering design, R&D in support of design and fabrication, component procurement, and fabrication. Project scope and construction status at the end of the project are listed in Table 1.

**Table 1: Vacuum Vessel System Scope**

| MIE Project Scope | Status at Closeout |
|---|---|
| **Three vacuum vessel sub-assemblies, each consisting of a 120-degree shell sector, spacer, and associated ports** | **Complete** |
| **Heating and cooling hoses, with attachment hardware** | **Complete, except for following exceptions due to replacement of 11 reworked hoses (NCR3758) and connections loosened to correct instrumentation which needed troubleshooting. The following activities would need to be done if the Project were to be restarted.**<br>**VVSA-1: 2 connections (1hose) will need brazing + leak check; 5 lines will need leak check only**<br>**VVSA-2: 14 connections (7 hoses) will need brazing + leak check; 12 lines will need leak check only.**<br>**VVSA-3: 8 connections (4 hoses) will need brazing + leak check; 13 lines will need leak check only** |
| **Heating and cooling manifolds** | **Complete** |
| **Cryostat interface flanges** | **Preliminary design complete. Detail drawings not started. Scope cancelled.** |
| **Heater tapes** | **Complete** |
| **Supports** | **Design: 100% complete**<br>**100% of parts delivered**<br>**Not installed** |
| **Thermocouples and other instrumentation** | **Complete** |
| **Thermal insulation** | **Title-I & II design complete**<br>**100% of materials delivered**<br>**Some further design changes likely needed** |

## Conventional Coils (WBS 13)

The conventional coil systems scope included the fabrication of eighteen toroidal field (TF) coils, six poloidal field (PF) coils, forty-eight trim coils for control of low-order helical field harmonics, local instrumentation, and certain support structures. The TF coils are identical, and were to be installed equally spaced, providing flexibility in the magnetic configuration. TF coils were wound from copper conductor, assembled to steel support wedges, and vacuum impregnated with epoxy. They were designed to operate at the liquid nitrogen (LN2) cryogenic temperatures. The PF magnets produce the poloidal magnetic field within the NCSX device. These coils were to provide inductive current drive and plasma shape and position control. The coils were to be wound from copper conductor and vacuum impregnated with epoxy, and also designed to operate at the LN2 temperatures. Existing PF solenoids from the National Spherical Torus Experiment (NSTX) were to be utilized as the initial central solenoid for NCSX. Project scope and construction status at the end of the project are listed in Table 2.

**Table 2: Conventional Coils Scope**

| MIE Project Scope | Status at Closeout |
|---|---|
| **Design and fabrication of eighteen TF coil assemblies consisting of D-shaped coils assembled to wedge support pieces** | **Complete.** |
| **Design and fabrication of three pairs of PF ring coils. Central Solenoid will utilize existing PF-1a solenoid from NSTX** | **Final design complete; fabrication contract award was pending at time of Project cancellation.** |
| **Design and fabrication or procurement of trim coils required for MIE project.** | **Final design complete.** |
| **Fabrication and installation of local instrumentation for the conventional coils, e.g., thermocouples, strain gauges, RTDs, and voltage taps** | **Scope cancelled. Not started.** |
| **Fabrication and installation of the support structure for existing central solenoid coils, and procurement and installation of I&C for those coils** | **Final design of structure complete. Design of PF 1 interconnecting bus not done.** |

## Modular Coils (WBS 14)

The modular coils consisted of eighteen complex-shaped coils supported on the interior surface of a toroidal shell structure. The coils were fabricated on 2700 kg castings made from a specially developed modified CF8M alloy named Stellalloy. There were three types of coils differing primarily in their shapes. The coils were fabricated from flexible copper cable conductor wound on the inner diameter of a support structure called a modular coil winding form (MCWF), and vacuum impregnated with epoxy. In the finished assembly, the modular coils were arranged in three identical field periods, each containing six coils, two of each type. The winding forms were joined together at their mating flanges to form a stiff toroidal structure when completed. The flange interfaces between the modular coils utilize a combination of electrically insulated custom-fitted friction shims, insulated bolts, and specially designed low distortion welded connections in some regions to provide strong, stable structural connections between the winding forms along with accurate coil positioning and an adequate electrical time constant to facilitate magnetic field penetration. The coils were designed to operate at LN2 cryogenic temperatures. Work included engineering design, R&D in support of design and fabrication, component procurement, tooling and fixtures, fabrication, and sub-assembly. Project scope and construction status at the end of the project are listed in Table 3. There were many challenges that were overcome during the coil winding process, one of the most significant was the metrology. In order to minimize islands in the toroidal flux to less than 10%, a tolerance in the positioning of the modular coil winding pack ± < 0.5 mm was required. Through careful assembly and after-winding shaping techniques the tolerance was achieved on almost all points on the winding path.

**Table 3: Modular Coils Scope**

| MIE Project Scope | Status at Closeout |
|---|---|
| **Delivery of eighteen winding forms to modular coil fabrication operations** | **Complete** |
| **Delivery of eighteen instrumented coils and assembly hardware to assembly operations** | **Coil winding, VPI, and post-VPI activities: Complete.**<br>**Thermocouple installation: 50% Complete**<br>**Strain gage installation: 0% Complete** |
| **Delivery of drawings, specifications, and models to fabrication and assembly operations; and documentation of coil protection limits.** | **All models, drawings, and specifications for the modular coil assemblies (SE104-10X) issued for fabrication/assembly.**<br>**Station-3 models, drawings, and spec issued for comment.**<br>**Station-5 assembly drawings issued for comment.**<br>**Coil protection limits guidance complete** |
| **Delivery and installation (as appropriate) of tooling for the modular coil fabrication facility.** | **Complete** |
| **Delivery of modular coil interface parts to assembly operations** | **Detailed fabrication, assembly, and some as-built drawings issued.** |

## Conventional Coil Structures (WBS 15)

The coil support structures were to have provided the mechanical supports connecting TF, PF ring coils (PF 4, 5, and 6) to the modular coil toroidal shell and the base support structure. Work included engineering design, procurement, and fabrication of structures and associated instruments and controls. The coil supports interfaced with the MCWF shell which provided the load path to react all coil electromagnetic and gravity loads. It also interfaced with mounting hardware for supporting coil buswork, cryogen lines & cryostat. Project scope and construction status at the end of the project are listed in Table 4.

**Table 4: Conventional Coil Structures Scope**

| MIE Project Scope | Status at Closeout |
|---|---|
| **Design, fabrication, and delivery of coil support structure components to machine assembly operations.** | **Final design complete. Final design review judged successful pending resolution of open chits. 2 chits from the FDR and 4 remaining from PDR will be left open, pending re-start of NCSX since their resolution is dependent on work stopped due to NCSX closeout.** |

## Coil Services (WBS 16)

The coil services consisted of the LN2 distribution system and electrical leads inside the cryostat, serving all of the coils. It also included the specification of requirements for the coil protection system. Project scope and construction status at the end of the project are listed in Table 5.

**Table 5: Coil Services Scope**

| MIE Project Scope | Status at Closeout |
|---|---|
| **Engineering design, procurement, and fabrication of manifolds, cooling pipes, and associated supports and I&C, and delivery of components to machine assembly operations.** | **Preliminary design for LN2 System (WBS1601) complete.**<br>**R&D, procurement, fabrication & assembly work had not started.** |
| **Engineering design, procurement, and fabrication of leads and associated supports, and delivery of components to machine assembly operations.** | **Preliminary design on lead system (WBS1602) approximately 75% complete.** |
| **Design, fabrication, and delivery of delivery of coil protection requirements to the coil protection system design activity** | **Scope cancelled. Not started.** |

## Cryostat & Base Structure (WBS 17)

A cryostat was to have enclosed the NCSX device to provide a suitable thermal environment for the magnets, and provides thermal insulation and a tight seal to isolate the cold gaseous nitrogen atmosphere surrounding the coils and cold structure from the ambient atmosphere. It would also provide a means for circulating dry nitrogen inside the cold volume to cool down and maintain the temperature of the interior structures. The base support system would have provided the gravity support for the core device (vacuum vessel and coils) and also thermal isolation of the cold structure from the floor. Project scope and construction status at the end of the project are listed in Table 6.Table 6: Cryostat & Base Structure Scope

| MIE Project Scope | Status at Closeout |
|---|---|
| **Engineering design, procurement, and fabrication of the cryostat shell and structure components, insulation, attachments for the structural support of internal components, and penetrations for electrical, cooling, and mechanical support services. Delivery of components to machine assembly operations.** | **A Peer Review of the cryostat involving experts from other laboratories and industry was held on April 23, 2008. A cryostat and cryosystem development plan was formulated based on input from the review. The targeted completion dates for Final Designs were in the 2nd quarter of CY 09. At the time of closeout, a cryostat shell design compatible with the structures, internal components, and penetrations was well underway. A subcontract that was being negotiated for expert support to guide the completion of the shell design, insulation, and integration was terminated.** |
| **Engineering design, procurement, and fabrication of the permanent base support structure for the machine. Delivery of components to machine assembly operations.** | **Final design complete.**<br>**Only the spherical bearings were procured; no fabrication was begun.** |

## Field Period Assembly (WBS 18)

This activity included the assembly of the vacuum vessel, modular coils, and toroidal field coils and trim coils into three identical modules known as field periods. Each field period would contain one vacuum vessel sub-assembly (120-degree shell sector, toroidal spacer, and ports), six modular coils (two each of the three types), six toroidal field coils, sixteen trim coils, and associated coil support structures. Work included engineering design, R&D in support of design and fabrication, component procurement, tooling and fixtures, and assembly. The three different modular coils were aligned, bolted and welded together to form a half period assembly. Alignments were measured to a precision of 0.08 mm and maintained to position requirements of 0.50 mm or less. Project scope and construction status at the end of the project are listed in Table 7.

**Table 7: Field Period Assembly Scope**

| MIE Project Scope | Status at Closeout |
|---|---|
| **Delivery of drawings, specifications, and models to field period assembly and machine operations.** | **Station 2: 100% complete**<br>**Station 3: 100% complete**<br>**Station 5: 50% complete (drawings 90% complete; specifications not started)**<br>**Station 6: 40% complete (drawings 60% complete; specifications not started)** |
| **Delivery and receiving inspections of 3 vacuum vessel assemblies (plus port extensions), to Station 1** | **Complete** |
| **Delivery of three field period modules to machine assembly operations.** | **Two half periods assembled.** |
| **Delivery and installation (as appropriate) of tooling for field period assembly** | **Station 1: 80% complete**<br>**Station 2: 50% complete**<br>**Station 3: Complete**<br>**Station 5: Complete**<br>**Station 6: Complete** |
| **Design, procure and fabricate additional metrology equipment needed for field period assembly.** | **Complete** |

## 2 Auxiliary Systems (WBS 2)

MIE Project scope included gas fueling, vacuum pumping, and an evaluation of an existing PPPL neutral beam system for potential future use after the planned completion of the Project. Work included design, R&D to support the design effort, component fabrication, assembly, installation, system level commissioning and testing. Project scope and construction status at the end of the project are listed in Table 8.

**Table 8: Vacuum Vessel System Scope**

| MIE Project Scope | Status at Closeout |
|---|---|
| **Design, fabrication, refurbishment, installation, and system testing of gas fueling equipment capable of injecting $H_2$, $D_2$, or He gas into the plasma. Components include a gas delivery line, and pulse valve control.** | **Design ~25% complete.**<br>**No parts were procured, fabricated or refurbished.**<br>**Neither installation nor testing of the system had been started.** |
| **Design, fabrication, installation, and system testing of turbomolecular pumps backed by existing mechanical vacuum pump systems.** | **Design ~30% complete.**<br>**No parts were procured, or fabricated.**<br>**Installation of the system had not been started.**<br>**System testing ~30% complete (offline tests of legacy TMPs and mechanical pumps).** |
| **Evaluate, for future use, a neutral beam injection including one beamline, power systems, ac power, & controls system, based on existing C-site NBI system.** | **Complete** |

## 3 Diagnostics (WBS 3)

Diagnostic systems would have provided measurements of first plasma parameters. The NCSX MIE Project included the following diagnostics: (1) magnetic field probes and flux loops; (2) an existing fast visible TV camera to measure edge and divertor plasma; (3) an electron beam mapping apparatus to measure properties of the magnetic surfaces including shape and topology. Project scope and construction status at the end of the project are listed in Table 9.

**Table 9: Diagnostics Scope**

| MIE Project Scope | Status at Closeout |
|---|---|
| **Co-wound magnetic flux loops installed on the modular coils, TF coils, and PF coils. Saddle loops installed on the vacuum vessel. Rogowski loops. Integrator, digitizer, and data acquisition for one Rogowski loop.** | **Design: 95% complete**<br>**95% of parts delivered**<br>**Loops installed on vaccum vessel, modular & TF coils** |
| **Delivery of one Fast visible TV camera system (based on existing equipment).** | **Design: Scope cancelled. Not started.**<br>**No components delivered** |
| **Installation of electron-beam mapping equipment including probe drive with an electron gun at its tip, fluorescent detector which intercepts the electron beam, and a high-resolution CCD camera to detect the light from the detector. Existing components will be used to the extent possible** | **Design: Scope cancelled. Not started.**<br>**No components delivered or installed** |

## 4 Electrical Power Systems (WBS 4)

This system consisted of the supply and delivery of AC and DC electrical power to NCSX equipment, and equipment control and protection systems. The MIE scope dealt with all electrical power system capabilities required for initial operation, including design, component fabrication, assembly, and installation activities, system level commissioning, and testing.

**Table 10: Electric Power System Scope**

| MIE Project & GPP Scope | Status at Closeout |
|---|---|
| **Provide auxiliary AC power systems and experimental AC Power Systems.** | **Design 80% complete**<br>**Fabrication 45% complete (GPP work)**<br>**Installation 45% complete (GPP work)** |
| **Provide refurbished AC/DC Convertors required for initial operation.** | **Design 70% complete**<br>**Procurement 0% complete**<br>**Refurbishment 0% complete** |
| **Provide, refurbishing as needed, cabling and other DC components required to feed the NCSX machine from the existing C-Site rectifiers.** | **Design 35% complete**<br>**Fabrication 0% complete**<br>**Installation 0% complete** |
| Provide control and protection systems including electrical interlocks, Kirk key interlocks; real time Control systems, instrumentation systems | **Design 15% complete**<br>**Fabrication 0% complete**<br>**Installation 0% complete** |

## 5 Central Instrumentation, Controls, & Data Acquisition (WBS 5)

This system consisted of equipment and software that would have provided central computing, control, and synchronization for NCSX. Components interfaced with the subsystem's local instrumentation and controls (I&C) systems and allowed for control and monitoring of NCSX experiments from the control room and includes analysis and display of the data. Subsystems included: network & fiber infrastructure; central I&C; data acquisition and facility computing; facility timing and synchronization; real time control; central safety & interlocks; and control room. Project scope and construction status at the end of the project are listed in Table 11.

**Table 11 Central Instrumentation, Controls, and Data Acquisition Scope**

| MIE Project Scope | Status at Closeout |
|---|---|
| **Provide and install network & fiber infrastructure systems with common backbone for all data acquisition, and I&C communications.** | **Design 10% complete<br>Fabrication 0% complete<br>Installation 0% complete** |
| **Provide and install integrated control of NCSX through supervisory control and a common user interface to selected engineering subsystems and diagnostics instruments. It will provide process control and monitoring functions, inter-process synchronization, operator displays, alarm management, and historical trending. It will be designed using the Experimental Physics and Industrial Control System (EPICS).** | **Design 5% complete<br>Fabrication 0% complete<br>Installation 0% complete** |
| **Provide and install a software structure to collect, catalog, and manage experimental results for analysis and subsequent retrieval. The design will use the MIT-developed MDSplus software for data acquisition, data archiving and display.** | **Design 5% complete<br>Fabrication 0% complete<br>Installation 0% complete** |
| **Provide and install a timing & synchronization system sufficient to synchronize the equipment and computers used for achieving the MIE Project requirements.** | **Design 10% complete<br>Fabrication 0% complete<br>Installation 0% complete** |
| **Provide and install a PC-oriented, LabVIEW-like system to produce synchronized, open-loop power supply commands and gas injection commands. The system will also control a few gas delivery valves.** | **Design 5% complete<br>Fabrication 0% complete<br>Installation 0% complete** |
| **Provide and install a central safety and interlock system Provide a limited CSIS, sufficient to achieve safe operation of the NCSX device.** | **Design 3% complete<br>Fabrication 0% complete<br>Installation 0% complete** |

## *6 Facility Systems (WBS 6)*

Facility Systems consisted of the following subsystems which support operation: water cooling; cryogens; air system utilities; vacuum vessel heating and cooling. Project scope and construction status at the end of the project are listed in Table 12.

**Table 12: Facility Systems Scope**

| MIE Project Scope | Status at Closeout |
|---|---|
| **Provide required cooling water for vacuum pumping system** | **Design 5% complete<br>Fabrication 0% complete** |
| **Provide liquid nitrogen supply for coil and cryostat cooling consistent with CD-4 requirements** | **Design 10% complete<br>Fabrication 0% complete<br><br>Contract with Bagley Assoc for LN2 delivery system (WBS-621) and cooling of structures within cryostat (WBS-623) was underway in May 2008. Contract was terminated prior to completion of any design reviews.** |
| **Establish requirements and system architecture for entire LN2 feed system including in-cryostat LN2 distribution system (WBS 161).** | **Design 70% complete<br>Fabrication 0% complete<br><br>Design of the in-cryostat LN2 distribution (WBS-161) for cooling of coils was well under way (successful PDR on 6/5/08).** |
| **Provide LN2 cooling system based on that constructed for the coil test facility (CTF).** | **Design 5% complete<br>Fabrication 0% complete<br><br>Engineering studies of the LN2 cooling system (WBS 622) was underway by ORNL and Bagley Associates. Contract was terminated prior to completion of any design reviews.** |
| **Provide a vent for the vacuum vessel pumping system.** | **Design 5% complete<br>Fabrication 0% complete** |
| **Provide a system to force 150-deg-C heated air through the vacuum vessel heating and cooling tubes.** | **Design 5% complete<br>Fabrication 0% complete** |

## *7 Test Cell Preparation & Machine Assembly (WBS 7)*

This work consisted of engineering and field labor to prepare the test cell and install the stellarator core systems, including trial machine assembly in which the three field period assemblies would be joined together to form the torus, followed by installation of PF coils, remaining trim coils, coil services, and cryostat. Design and fabrication of special machine assembly tools and equipment were included in this work. Project scope and construction status at the end of the project are listed in Table 13.

**Table 13: Test Cell Preparation and Machine Assembly Scope**

| MIE Project Scope | Status at Closeout |
|---|---|
| **Design and fabricate a platform around the NCSX device, in support of various diagnostics and systems required for operation.** | **Design: 80% complete**<br>**Materials: 50% ordered & received**<br>**Fabrication: 10% complete** |
| **Perform final assembly of the stellarator core, specifically: installation and leveling of machine base plate; installation and leveling of the machine support columns; installation of the machine platform; installation of lighting and fire detection/suppression systems under the platform; installation of the lower cryostat floor; installation of the lower PF-3 & 4 coils in preliminary positions; installation of the three field periods; support pump down and vacuum leak testing; placement of the lower PF-3 & 4 into their final position; installation of the upper PF-3 & 4 coils; installation of the PF-1 & PF-2 solenoid; installation of external cryostat walls and ceiling; and cold power test PTP.** | **Scope cancelled. Not started.** |
| **Design and fabricate tooling and fixtures for machine assembly including the base support structure used during assembly and constructability analyses.** | **Design: Models 75% complete; Drawings not started**<br>**Analyses : Scope cancelled. Not started.**<br>**Fabrication: Scope cancelled. Not started.** |

# *8 Technical Management & Support*

### 81-Project Management & Integration\

This work included of all the activities necessary to manage the NCSX Project and carry out system-level engineering tasks such as project management, project control, systems engineering, design integration, technical assurance, and project physics. It also includes planning and performing Project closeout.

### 84- Project Physics

This work included the definition of the project physics requirements and documenting them in the NCSX Project General Requirements Document (GRD)**.**

## 82-Project Engineering

This work included risk management, project planning, including implementing the PPPL work planning program, safety, including implementing the PPPL Integrated Safety Management (ISM) program. Responsible Line Managers (RLMs) were responsible for managing on-site fabrication and assembly work and the design, fabrication, and assembly of ancillary, facility, and electrical systems.

## 8202-System Engineering

This work included requirements management, design verification, including a program for systematic design reviews, configuration management and change control, including processing of Requests for Deviations (RFDs), Engineering Change Proposals (ECPs), Risk registry maintenance, Risk management, and Engineering Change Notices (ECNs), and interface control, document control, and training project personnel in project plans, procedures, and practices.

## 8203-Design Integration

This work included configuration development and integration support for all design and construction activities, design reviews, the computer aided design (CAD) database of project models and drawings, reviewing and promoting CAD models and drawings, establishing Intralink procedures and privileges, and providing support to the metrology and dimensional control efforts by analyzing metrology data in conjunction with CAD models of the parts and assemblies.

## 8204-System analysis / Technical Assurance

This work included establishing structural and cryogenic design criteria, establishing dimensional accuracy requirements for coil systems based on field error considerations, analyzing field errors and managing field error budgets for as-designed conditions, out-of-tolerance conditions, eddy currents, and magnetic materials. It also included the disposition of nonconformance reports (NCRs), providing analysis support to the metrology and dimensional control efforts for troubleshooting problems as well as production activities, analyzing options for optimally aligning modular coils based on physical and magnetic measurements, performing global analyses which are outside the scope of individual subsystems, and independently assessing design adequacy and risks for critical systems and design feature. Analyses included electromagnetic analyses to determine coil inductances, fields, forces; global structural modeling to determine overall structural behavior, mechanical interface loads, and operating limits.

## 8205-Dimensional Control Coordination

This work included support of design and construction activities in the realization of dimensional accuracy requirements by developing strategies and procedures for dimensional control and supporting their implementation.

## 8215-Plant Design

This work included allocating space within the NCSX Test Cell and adjacent areas, and developing models and drawings to define the routing and location of equipment in the Test Cell.

## 8501-Integrated System Testing

This work covered the planning, document preparation, and execution of the NCSX integrated system testing and startup activities, through the generation of the first plasma. Program was documented in a draft *NCSX Safe Startup & Control Plan.* Costs for the development and completion of the sub-system preoperational tests procedures were the responsibility of the individual (sub-system) WBS managers and were detailed in the specific WBS work elements.

## 8221-Closeout Documentation

This task includes documentation of all work, both performed and remaining at the time of termination. This information will be of critical value if NCSX construction is restarted, or if another device of this type is undertaken in the future. A Closeout Note will be prepared for each job that was in process at the time of NCSX cancellation or was completed as part of the Project closeout. Closeout Notes for jobs already completed and/or closed prior to cancellation, will be generated on a case-by-case basis to document information that was not captured in other Project documents, *e.g.*, lessons learned and engineering solutions to problems that were encountered. Each closeout note includes the following elements: job scope; status of work completed at the time of closeout; definition of key interfaces and any changes anticipated at time of closeout; specifications, schematics, process & instrumentation diagrams, models, drawings, analyses; testing summaries; costs; narratives of remaining work; lessons learned; and a conclusion. Manuscripts for archival journal publication are also being prepared.

## 8220-Equipment Disposition

This job includes the safe and orderly disassembly of NCSX construction facilities at PPPL and the disposition of equipment. The major components of the NCSX – the vacuum vessel, modular coils, TF coils, diagnostics, and their associated ancillary components, assembly fixtures, rigging, and tooling – will stored in and under the test cell that had been prepared for NCSX. The modular coil autoclave will also be stored at PPPL. The modular coil winding rooms and test cryostat will be salvaged.

## Project Termination

This includes additional costs incurred from cancellation of the Project. These costs include claims resulting from contract termination, and severance associated with workforce restructuring.

# ATTACHMENT 2

## CD-4 Deliverables

### Design

| WBS | Scope | Job Mgr. | CDR | PDR | FDR |
|---|---|---|---|---|---|
| **Inner Core (Stellarator Core out to MC Shell & VV port flanges)** | | | | | |
| 12 | Vacuum Vessel | Goranson | X | X | X |
| 14 | Modular Coil Assemblies | Williamson | X | X | X |
| 14 | MC AA, AB, BC Interface | Williamson / Cole | X | X | X |
| 14 | MC CC Interface | Williamson / Cole | X | X | X |
| 18 | FPA Tooling: Station 2 stands and lift fixtures | Brown | X | X | X |
| 18 | FPA Tooling: Station 3 stands and lift fixtures | Brown | X | X | X |
| 18 | FPA Tooling: Station 3 module alignment system | Brown | X | X | X |
| 82 | Assembly Sequence Plan: Station 2 | Brown | X | X | X |
| 82 | Assembly Sequence Plan : Station 3 | Brown | X | X | X |
| **Outer Core (Stellarator Core Beyond MC Shell & VV port flanges)** | | | | | |
| 12 | NB Transition Ducts | Goranson | X | | |
| 13 | TF Coils | Kalish | X | X | X |
| 13 | PF Coils | Chrzanowski | X | X | X |
| 13 | Trim Coils | Kalish | X | X | X |
| 15 | TF/PF Coil Structures | Dahlgren | X | X | X |
| 15 | Central Solenoid Structure | Dahlgren | X | X | X |
| 16 | LN2 Manifolds | Goranson | X | X | |
| 16 | Electrical Leads | Goranson | X | X | |
| 17 | Base Structure | Dahlgren | X | X | X |
| 17 | Cryostat | Raftopoulos | | | |
| 18 | Assembly Tooling: Station 5 | Brown | X | X | |
| 18 | Assembly Tooling: Station 6 module supports ("sleds") | Brown | X | | |
| 18 | Assembly Tooling: Station 6 spool piece support | Brown | X | | |
| 82 | Assembly Sequence Plan: Station 5 | Brown | X | | |
| 82 | Assembly Sequence Plan: Station 6 | Brown | X | | |
| **Ancillary Systems (Facility Beyond Stellarator Core)** | | | | | |
| 12 | Heater control sys | Gernhardt | X | | |
| 2 | Fueling | Blanchard | X | | |
| 2 | Vacuum Pumping System | Blanchard | X | | |
| 3 | Diagnostics: | | X | | |
| 3 | VV spacer flux loops | Stratton | X | | |
| 3 | Visible camera system | Stratton | X | | |
| 3 | Electron beam mapping sys. | Stratton | X | | |
| 4 | Coil Protection System | Ramakrishnan | X | | |
| 4 | Power Systems | Ramakrishnan | X | | |
| 5 | Central I&C | Sichta | X | | |
| 62 | Cryogenic Systems (LN2) | Raftopoulos | | | |
| 62 | Cryogenic Systems (GN2/Cryostat) | Raftopoulos | | | |
| 63 | Utility Systems | Dudek | X | | |
| 64 | VV heating and cooling system | Kalish | X | | |

### Hardware

| WBS | Component | Job Mgr. |
|---|---|---|
| **Inner Core (Stellarator Core out to MC Shell & VV port flanges)** | | |
| 12 | Three vacuum vessel sub-assemblies, each consisting of a 120-degree shell sector, spacer, associated ports including magnetic diagnostics and cooling tubes installed | Viola |
| 14 | Eighteen modular coils, wound and vacuum-pressure impregnated on eighteen modular coil winding forms | Chrzanowski |
| 14 | Tooling for modular coil fabrication including winding stations and autoclave. | Chrzanowski |
| 18 | Two half field period assemblies, each consisting of three modular coils | Viola |
| 18 | Tooling for field period assembly Statiosn 2 and 3 | Dudek |
| **Outer Core (Stellarator Core Beyond MC Shell & VV port flanges)** | | |
| 13 | Eighteen toroidal field coil assemblies consisting of D-shaped coils assembled to wedge support pieces | Kalish |

# ATTACHMENT 3

## Comparison ECP-53 vs ECP-60

### TEC

| WBS | WBS Element | Previous Baseline (ECP-53) | Actual Costs thru 5/31/08 | Estimate to Complete | New Baseline (ECP-60) | Change |
|---|---|---|---|---|---|---|
| 12 | Vacuum Vessel Systems | 9,909 | 9,838 | 0 | 9,838 | -71 |
| 13 | Conventional Coils | 5,317 | 4,419 | 362 | 4,781 | -536 |
| 14 | Modular Coils | 36,722 | 39,880 | 553 | 40,433 | 3,711 |
| 15 | Coil Support Structures | 1,078 | 656 | 74 | 730 | -348 |
| 16 | Coil Services | 1,153 | 69 | 30 | 99 | -1,054 |
| 17 | Cryostat & Base Support Structure | 1,229 | 670 | 12 | 682 | -547 |
| 18 | Field Period Assembly | 6,400 | 7,362 | 1,287 | 8,649 | 2,249 |
| 19 | Stellarator Core Management & Integration | 2,625 | 2,509 | 127 | 2,636 | 11 |
| **1** | **Stellarator Core** | **64,433** | **65,403** | **2,445** | **67,848** | **3,415** |
| **2** | **Auxiliary Systems** | **484** | **349** | **-** | **349** | **-135** |
| **3** | **Diagnostic Systems** | **935** | **1,262** | **28** | **1,290** | **355** |
| **4** | **Electrical Power Systems** | **2,845** | **646** | **0** | **646** | **-2,199** |
| **5** | **Central Controls and Computing** | **787** | **48** | **0** | **48** | **-739** |
| **6** | **Facility Systems** | **758** | **24** | **0** | **24** | **-734** |
| **7** | **Test Cell Prep & Machine Assembly** | **3,741** | **774** | **0** | **774** | **-2,967** |
| 81 | Project Management | 4,173 | 4,487 | 770 | 5257 | 1,084 |
| 82 | Project Engineering | 5,823 | 7,206 | 453 | 7659 | 1,836 |
| 84 | Project Physics | 470 | 470 | 0 | 470 | 0 |
| 85 | Integrated Systems Testing | 777 | 3 | 0 | 3 | -774 |
| 86 | Closeout Documentation | - | - | 1134 | 1134 | 1,134 |
| 87 | Equipt Disposition & Facility Restoration | - | - | 530 | 530 | 530 |
| 89 | Allocations | 1,067 | 1,939 | 202 | 2141 | 1,074 |
| **8** | **Project Oversight & Support** | **12,310** | **14,105** | **3,089** | **17,194** | **4,884** |
| | **DCMA** | **75** | **75** | **0** | **75** | **0** |
| | **Contingency** | **6,033** | - | **1,112** | **1,112** | **-4,921** |
| | **Project Termination Costs** | **-** | **-** | **2,653** | **2,653** | **2,653** |
| | **Subtotal TEC** | **92,401** | **82,686** | **9,327** | **92,013** | **-388** |

### OPC

| | | Previous Baseline (ECP-53) | Actual Costs thru 5/31/08 | Estimate to Complete | New Baseline (ECP-60) | Change |
|---|---|---|---|---|---|---|
| | **Conceptual Design** | **9,570** | **9,570** | | **9,570** | **0** |
| | **Manuscripts and Journals** | | | **323** | **323** | **323** |
| | **Contingency** | | | **65** | **65** | **65** |
| | **Subtotal OPC** | **9,570** | **9,570** | **388** | **9,958** | **388** |
| | **TOTAL TPC** | **101,971** | **92,256** | **9,715** | **101,971** | **0** |

# ATTACHMENT 4 page 1/9

| Activity ID | Activity Description | Forecast Start | Forecast Finish | % cmplt | ETC | FY08 J J A S / FY09 O N D J F M A M J J A S / FY10 O N E |
|---|---|---|---|---|---|---|
| **Included Closeout Scope** | | | | | | |
| **Brown** | | | | | | |
| **Job: 1803/1805- FPA Tooling/Constr-BROWN** | | | | | | |
| **Station 3-Modular Coil to VVSA Assembly** | | | | | | |
| 1803S3-4 | Generate laser screen trace drawings (1/2 period | 15AUG08 | 05SEP08 | | 10,688.40 | SMITH etc =40hr ; MORRIS etc =40h |
| 1803S3-6 | Station 3 simulation detail model | 02JUN08* | 30JUN08 | | 22,704.00 | BROWN etc =24hr ; SMITH etc =120 |
| 1803S3-7 | VV/MC clearance study (for VVSA1) | 01APR08A | 30JUN08 | 75 | 1,537.80 | SMITH etc =10hr ; |
| 1803S3-9 | Oversite, cost and schedules, reviews | 31JAN08A | 30SEP08 | LOE | 3,520.75 | BROWN etc =20hr ; |
| 1805S3-2 | Left side base grout plates | 24MAR08A | 30JUN08 | 99* | 2,620.62 | 41etc =02$k ; |
| 1805S3-3 | MCHP lift fixture frame weldment | 24MAR08A | 30JUN08 | 99* | 9,091.44 | 41etc =07$k ; |
| 1805S3-4 | Lift fixture mounting bracket weldments | 24MAR08A | 30JUN08 | 99* | 14,717.70 | 41etc =12$k ; |
| 1805S3-5 | Reworked laser frame structure | 24MAR08A | 30JUN08 | 99* | 1,117.80 | 41etc =01$k ; |
| 1805S3-6 | Right inboard laser frame structure | 24MAR08A | 30JUN08 | 99* | 1,055.70 | 41etc =01$k ; |
| 1805S3-7 | Left inboard laser frame structure | 24MAR08A | 30JUN08 | 99* | 844.56 | 41etc =01$k ; |
| 1805S3-8 | Laser screen lexan sheet (1/8 x 48" x 96") | 24MAR08A | 30JUN08 | 99* | 546.48 | 41etc =00$k ; |
| 1805S3-9 | Estimate for Station 2 type alignment system | 24MAR08A | 30JUN08 | 99* | 4,024.08 | 41etc =03$k ; |
| 1805S3-100 | Hardware & Misc items | 24MAR08A | 30JUN08 | 99* | 1,242.00 | 41etc =01$k ; |
| 1805S3-110 | Misc assembly Cost | 24MAR08A | 30JUN08 | 99* | 10,060.20 | 41etc =08$k ; |
| 1805S3-201 | MC base support system (left / rt side) | 24MAR08A | 30JUN08 | 99* | 15,512.58 | 41etc =12$k ; |
| 1805S3-202 | Hilman roller - 8-0T plus R & U guides | 24MAR08A | 30JUN08 | 99* | 2,943.54 | 41etc =02$k ; |
| 1805S3-203 | AirLoc Wedgmount Precision Levelers | 24MAR08A | 30JUN08 | 99* | 707.94 | 41etc =01$k ; |
| 1805S3-204 | Lift fixture mounting bracket weldments | 24MAR08A | 30JUN08 | 99* | 4,409.10 | 41etc =04$k ; |
| 1805S3-205 | Estimate for Station 2 type alignment system | 24MAR08A | 30JUN08 | 99* | 1,204.74 | 41etc =01$k ; |
| 1805S3-206 | Hardware & Misc items | 24MAR08A | 30JUN08 | 99* | 372.60 | 41etc =00$k ; |
| 1805S3-207 | Misc assembly Cost | 31JAN08A | 30SEP08 | | 5,005.26 | 41etc =04$k ; |
| **Job: 8203 - Design Integration-BROWN** | | | | | | |
| 8203FY08-4 | General integration activities | 01FEB08A | 30SEP08 | LOE | 13,991.20 | BROWN etc =40hr ; EA/IDM etc =60h |
| **Brooks** | | | | | | |
| **Job: 8204 - Systems Analysis-BROOKS** | | | | | | |
| 8204-FY08Z | Syst Analysis, studies & tech assurance FY08 etc | 02JUN08* | 30SEP08 | LOE | 41,999.27 | BROOKS etc =107hr ; FAN etc =51 ZHANG etc =79hr ; |
| **Chrzanowski** | | | | | | |
| **Job: 1302 - PF Design -CHRZANOWSKI** | | | | | | |
| 1302-275 | Resolve FDR Chits | 22FEB08A | | 90 | 0.00 | CHRZANOWSKI etc =00hr ; |
| **Job: 1352 - PF Coil Procurement-CHRZANOWSKI** | | | | | | |
| **PF Coil Fabrication** | | | | | | |
| 141-038.1 | PF Conductor cancellation cost | 21FEB08A | 18JUL08 | C | 93,150.00 | 41etc =75$k ; CHRZANOWSKI etc =00hr ; |
| **Job: 1408 - MC Winding Supplies-CHRZANOWSKI** | | | | | | |
| 1408-3 | Misc and safety supplies ($7k/mo.) | 23MAY07A | 31JUL08 | LOE | 7,452.00 | 41etc =06$k ; |
| 1408-6 | VPI clean manifold contract | 23MAY07A | 31JUL08 | 80 | 2,484.00 | 41etc =02$k ; |
| 1408-8 | Cutting hardware for flange bolts | 23MAY07A | 31JUL08 | LOE | 534.06 | 41etc =.5$k ; |
| 1408-7 | Misc tech shop support | 23MAY07A | 31JUL08 | 80 | 10,108.16 | EMT/TB etc =128hr ; |

Run Date 25JUN08 08:21

FORECAST SCHEDULE
Progress Bar
Critical Activity

0805

NCSX
MIE CLOSEOUT PLAN
June 25,2008

Sheet 1 of 9

# ATTACHMENT 4 page 2/9

| Activity ID | Activity Description | Forecast Start | Forecast Finish | % cmplt | ETC | FY08: J J A S / FY09: O N D J F M A M J J A S / FY10: O N E |
|---|---|---|---|---|---|---|
| **Job: 1451 - Mod Coil Winding-CHRZANOWSKI** | | | | | | |
| **Station 3-Casting Prep & Winding** | | | | | | |
| P1-170 | Instl Chill Plates,Tubing,Bag A6 | 02JUN08 | 01JUL08 | | 57,490.16 | EM/TB etc =728hr ; |
| **Station 5-VPI** | | | | | | |
| P1-171V | VPI (Station 5) A6 | 02JUL08 | 29JUL08 | | 47,514.31 | EM/TB etc =281hr ; EM2/TB etc =27 EMT/TB etc =16hr ; |
| P3-171VM | COMPLETE VPI OF 18th MOD COIL | | 29JUL08 | | 0.00 | |
| **Station 1 Post VPI** | | | | | | |
| P2-171C | Final Clamps & Warm Test (Station1) B6 | 01JUL08* | 23JUL08 | | 24,006.88 | EM/TB etc =272hr ; EMT/TB etc =32 |
| P1-171C | Final Clamps & Warm Test (Station1) A6 | 30JUL08 | 20AUG08 | | 24,006.88 | EM/TB etc =272hr ; EMT/TB etc =32 |
| **LOE Oversight & Supervision** | | | | | | |
| 145XSPRV-3 | Winding Engineering oversight and supervision | 01MAY07A | 30SEP08 | LOE | 42,266.43 | LANGISH etc =275hr ; |
| 145XSPRV-A | Winding Engineering oversight and supervision | 01NOV07A | 29AUG08 | LOE | 84,677.10 | CHRZANOWSKI etc =241hr ; MEIGHAN etc =321 |
| **Job: 1459 - Mod Coil Fabr.Punch List-CHRZANOWSKI** | | | | | | |
| **Punchlist Tech shop/RESA** | | | | | | |
| PLTS-C5 | Grinding & Drill Holes -C5 | 01MAY08A | 29AUG08 | 83 | 3,221.98 | EM/TB etc =41hr ; |
| PLTS-A5 | Grinding -A5 | 01MAY08A | 29AUG08 | 0 | 6,949.36 | EM/TB etc =88hr ; |
| PLTS-B5 | Grinding -B5 | 01MAY08A | 29AUG08 | 0 | 9,476.40 | EM/TB etc =120hr ; |
| PLTS-A6 | Grinding -A6 | 01MAY08A | 29AUG08 | 20 | 3,095.62 | EM/TB etc =39hr ; |
| PLTS-B6 | Grinding -B6 | 01MAY08A | 29AUG08 | 0 | 9,476.40 | EM/TB etc =120hr ; |
| PLTS-C6 | Grinding & Drill Holes -C6 | 01MAY08A | 29AUG08 | 23 | 14,593.66 | EM/TB etc =185hr ; |
| **Punchlist- Coil Technicians** | | | | | | |
| PLCT-A6 | Insul,measure,TC,SG other punch list-A6 | 01OCT07A | 29AUG08 | 36 | 10,411.40 | EM/TB etc =132hr ; |
| PLCT-B6 | Insul,measure,TC,SG other punch list-B6 | 01OCT07A | 29AUG08 | 36 | 10,411.40 | EM/TB etc =132hr ; |
| **Cole** | | | | | | |
| **Job: 1416 - Mod Coil Type AB Fnl Dsn-COLE** | | | | | | |
| **Analysis and closeout documentation** | | | | | | |
| 1416-601 | Prepare EM and structural analysis of leads | 31JAN08A | 30JUN08 | 70 | 9,966.00 | williamson etc =66h |
| 1416-650 | Prepare cooling analysis of lead area | 02JUN08* | 30JUN08 | | 3,020.00 | freudenberg etc =160hr ; |
| 1416-651 | 2D cooling analysis for mod colis | 02JUN08* | 30JUN08 | | 12,080.00 | freudenberg etc =80hr ; |
| **ECN Modifications** | | | | | | |
| 1416-801 | ECN Mods-Resize vertical port boot | 02JUN08 | 30JUN08 | 80 | 3,624.00 | lovett etc =24hr ; |
| 1416-802 | ECN Mods-Revise Type B cooling lines | 01MAY08A | 30JUN08 | 80 | 1,812.00 | lovett etc =12hr ; |
| 1416-803 | ECN Mods-Issue DXF shim files for fab | 02JUN08* | 30JUN08 | 80 | 3,020.00 | lovett etc =20hr ; |
| 1416-805 | ECN Mods-Add TC's at bottom of 101,102,103 dwgs | 01MAY08A | 30JUN08 | 80 | 2,416.00 | lovett etc =16hr ; |
| 1416-806 | ECN Mods-Revise dwg 123-151 | 02JUN08* | 30JUN08 | 80 | 1,510.00 | lovett etc =10hr ; |
| **Job: 1421 - Mod Coil Interface Design-COLE** | | | | | | |
| **Inboard Interface-CC** | | | | | | |
| 1421-3155 | Resolve C-C shim FDR comments | 02JUN08* | 30JUN08 | | 18,120.00 | COLE etc =120hr ; |
| 1421-9000 | Perform shear test | 02JUN08* | 18JUL08 | 60 | 31,710.00 | moon etc =120hr ;freudenberg=40 ornlem=50 |
| **Job: 1901 - Stellarator Core Mngtt&Integr-COLE** | | | | | | |
| **191 - Stellarator Core Management & Oversight** | | | | | | |
| 1901-08 | WBS 191 FY08 | 01OCT07A | 29SEP08 | LOE | 28,889.32 | COLE etc =121hr ; NELSON etc =70 |
| 1901-9000 | Update drawing tree | 01OCT07A | 29SEP08 | LOE | 24,160.00 | lovett= 160 |
| **192 - Stellarator Core Integr & Global Analysis** | | | | | | |
| 1902-08 | WBS 192 FY08 | 01OCT07A | 29SEP08 | LOE | 66,445.34 | COLE etc =121 m&s =20 travel= 10 MCGINNIS etc =182 |
| **193 - Risk Mitigation Tasks** | | | | | | |
| RISK-43 | Bolt preload could relax with time. | 03MAR08A | 26AUG08 | | 7,852.00 | FOGARTY etc =52hr ; |

Sheet 2 of 9

# ATTACHMENT 4 page 3/9

| Activity ID | Activity Description | Forecast Start | Forecast Finish | % cmplt | ETC | FY08 J J A S · FY09 O N D J F M A M J J A S · FY10 O N E |
|---|---|---|---|---|---|---|
| **Job: 1806 - FP Assembly specs and drawings-COLE** | | | | | | |
| **Station 3-Modular Coil to VVSA Assembly** | | | | | | |
| 1803-301 | Station 3 Assembly Specification | 02JUL07A | 30JUN08 | 80 | 3,624.00 | COLE etc =24hr ; |
| 1803-305 | Station 3 Assembly Drawings | 02JUL07A | 30JUN08 | 80 | 2,416.00 | COLE etc =16hr ; |
| **Dahlgren** | | | | | | |
| **Job: 1702 - Base Support Struct Design-DAHLGREN** | | | | | | |
| 1702-525M | Base Support Structure FDR | | 30MAY08A | 100 | 0.00 | |
| 1702-530 | FDR labor cost (accounting lag) | 02JUN08 | 13JUN08 | | 11,688.80 | DAHLGREN etc =40hr ; CRUIKSHANK etc =40h |
| **Job: 1501 - Coil Structures Design-DAHLGREN** | | | | | | |
| 1501-533 | Detail CAD Drawings,BOM | 01JUN07A | 30JUN08 | 75 | 21,319.30 | DAHLGREN etc =05hr ; RUSHINSKI etc =89h CRUIKSHANK etc =89hr ; |
| 1501-533F | Integrated Stress Analysis | 01OCT07A | 30JUN08 | 75 | 34,286.56 | DAHLGREN etc =154hr ;FAN=etc=40 |
| 1501-536 | Issue dwgs for review | | 30JUN08* | | 0.00 | |
| 1501-549 | Update C.S.Support Attacgment Design | 01MAY08A | 09JUN08 | 75 | 2,036.70 | DAHLGREN etc =05hr ; RUSHINSKI etc =10h |
| 1501-562 | Prepare Specs for Coil Structure & CSS h/w | 24JUN08 | 30JUN08 | | 3,542.00 | DAHLGREN etc =20hr ; |
| 1501-537 | FDR Prep | 24JUN08 | 30JUN08 | | 12,370.68 | DAHLGREN etc =38hr ; RUSHINSKI etc =49h |
| 1501-541 | Coil Support Structures - FDR | | 30JUN08 | | 0.00 | |
| **Dudek** | | | | | | |
| **Job: 1431 - Mod. Coil Interface Hardware-DUDEK** | | | | | | |
| **Shims-Outboard** | | | | | | |
| 1431-100 | Complete PE007965 & 8090 with zenex | 02JUN08 | 27JUN08 | | 84,331.80 | 41etc =68$k ; |
| **Shims-Inboard** | | | | | | |
| 1431-110 | Complete PE007677 with white engr | 02JUN08 | 27JUN08 | | 12,705.66 | 41etc =10$k ; |
| **Ellis** | | | | | | |
| **Job: 8205 - Dimensional Control Coordin-ELLIS** | | | | | | |
| **Station 3-Modular Coil to VVSA Assembly** | | | | | | |
| METFY08R | Support FPA Station 2 | 01FEB08A | 30SEP08 | LOE | 14,889.60 | ELLIS etc =45hr ; SMITH etc =45h |
| METDCP-3 | Dimensional control plans for station 3 | 01FEB08A | 10JUN08 | 67 | 4,675.44 | ELLIS etc =26hr ; |
| STAT3 PREP | Station 3 preparations | 01JUL08* | 02SEP08 | | 14,168.00 | ELLIS etc =80hr ; |
| **Goranson** | | | | | | |
| **Job: 1601 - Coil Services Design-GORANSON** | | | | | | |
| **161 - LN2 Distribution** | | | | | | |
| 191-002 | Coil Serv-LN2 manifolds&piping-PDR prep etc | 03JUN08 | 05JUN08 | | 6,040.00 | GORANSON etc =40hr ; |
| 162-217 | PDR | | 05JUN08 | | 0.00 | |
| 162-900 | Update LN2 models & input to INTRALINK | 02JUN08 | 30JUN08 | | 18,120.00 | homescu etc =40hr mcginnis=80 |
| 162-901 | Update Electrical Leads Models & input to INTRAL | 02JUN08 | 30JUN08 | | 6,040.00 | mcginnis etc =40hr ; |
| **Harris** | | | | | | |
| **Job: 8102 - NCSX MIE Management ORNL-HARRIS** | | | | | | |
| 810.105XX | Project Management Office ORNL FY08 (LOE) | 01FEB08A | 29SEP08 | LOE | 100,619.47 | ORNL35 etc =07$ ; HILLIS etc =70 ; HARRIS etc =282 MMORRIS etc =176 ; |
| 810.105Z | Project Management Office ORNL FY09 (LOE) | 01OCT08* | 31MAR09 | LOE | 35,930.73 | HILLIS etc =45 ; HARRIS etc =110 |
| **Heitzenroeder** | | | | | | |
| **Job: 8202 - Engr Mgmt & Sys Eng Sprt-HEITZENROED** | | | | | | |
| 8205DC | document control & admin support | 01FEB08A | 31MAR09 | LOE | 23,630.52 | SUCH etc =142hr ; TYRELL etc =21 |
| 8205FY08.2 | Engr mgt & systems engr FY08 | 01FEB08A | 30SEP08 | LOE | 181,477.20 | HEITZENROED etc =445hr ; SIMMONS etc =00 REIERSEN etc =89hr ; DUDEK etc =474 VONHALLE etc =89hr ; |

Sheet 3 of 9

# ATTACHMENT 4 page 4/9

| Activity ID | Activity Description | Forecast Start | Forecast Finish | % cmplt | ETC | FY08 (J J A S) / FY09 (O N D J F M A M J J A S) / FY10 (O N E) |
|---|---|---|---|---|---|---|
| 8205FY09 | Engr mgt & systems engr FY09 | 01OCT08* | 31MAR09 | LOE | 157,899.44 | HEITZENROED etc =315hr<br>REIERSEN etc =126hr ;<br>VONHALLE etc =126hr ; |
| **Job: 8221 -Documentation Closeout-HEITZENROEDER** | | | | | | |
| **Closeout Documentation** | | | | | | |
| 8221-100 | Technical data collection | 01JUL08* | 31OCT08 | | 626,239.87 | SIMMONS =160hr BLANCHARD =40<br>BROOKS =100hr BROWN =375<br>CHRZANOWSKI =168hr COLE =80<br>DAHLGREN =40hr DODSON =40h<br>DUDEK =32hr ELLIS =40<br>GORANSON =80hr Fogarty= 80<br>Phil =160; Kalish =56; labik =40;<br>langish =24 freudenberg =120<br>Perry =16; Raftopoulos =220; Raki =16<br>rushinski =335 mike morris=20<br>sichta =80; smith = 14;<br>strykowsky =160; upcavage =215<br>viola = 158 williamson =80 Moon=10<br>Nelson=10; Harris= 20; Fan=100<br>Gentile=20; Lew Morris=335 |
| 8221-251 | Tech presentation/paper collection | 02JUN08 | 29SEP08 | | 9,902.00 | HAMPTON etc =100hr ; TYRELL etc =10 |
| 8221-301 | Guidance to collect data | 02JUN08 | 29SEP08 | | 53,130.00 | SIMMONS etc =300hr ; |
| 8221-305 | Organizing and posting data | 30SEP08 | 27MAR09 | | 56,203.18 | SIMMONS etc =300hr ; |
| 8221-401 | Finalizing and archiving key analyses/reports | 02JUN08 | 29SEP08 | | 137,504.00 | FREUDENBERG etc =160hr ; DAHLGREN etc =16<br>FAN etc =160hr ; AVASARALA etc =16<br>ZHANG etc =160hr ; |
| 8221-501 | dell server, software, setup (non project cost | 02JUN08 | 29SEP08 | | 0.00 | CARROL etc =200hr ; 41etc =18$k ; |
| 8221-555 | Comp. div support of web (non project cost) | 02JUN08 | 29SEP08 | | 0.00 | CARROL etc =160hr ; |
| 8221-575 | Archiving doc & files in ops center | 02JUN08 | 26MAR09 | | 18,009.74 | SUCH etc =200hr ; |
| 8221-700 | As-built Drawing Updates | 01JUL08* | 23DEC08 | | 232,562.06 | EA//SB Designers etc =1995hr ; |
| **Prepare Closeout report** | | | | | | |
| 8221-601 | Lessons learned report | | 31MAR09 | | 0.00 | |
| 8221-605 | Closeout report-Adjustments to obligations/costs | | 31MAR09 | | 0.00 | |
| 8221-609 | Closeout report-Baseline change control log | | 31MAR09 | | 0.00 | |
| 8221-613 | Closeout report-Closeout approvals | | 31MAR09 | | 0.00 | |
| 8221-617 | Closeout report-Contract closeout status | | 31MAR09 | | 0.00 | |
| 8221-621 | Closeout report-D&D planning | | 31MAR09 | | 0.00 | |
| 8221-625 | Closeout report-Final cost report, incl claims | | 31MAR09 | | 0.00 | |
| 8221-629 | Closeout report-Photographic documentation | | 31MAR09 | | 0.00 | |
| 8221-633 | Closeout report-Tech, cope,cost,schedule accompl | | 31MAR09 | | 0.00 | |
| 8221-900 | CLOSEOUT BCP | | 31MAR09* | | 0.00 | |
| **Kalish** | | | | | | |
| **Job: 1361 - TF Fabrication-KALISH** | | | | | | |
| **TF Title III and Fabrication Oversight** | | | | | | |
| 131-033C | Title III engr,inspection, support | 02JAN08A | 18SEP08 | LOE | 37,543.84 | KALISH etc =71hr ; 35etc =02$k ;<br>41etc =00$k ; EM//TB etc =00hr ;<br>MEIGHAN etc =173hr ; |
| **TF Fabrication Contract** | | | | | | |
| 1361C-114 | Fab, Test & Deliver Coil #14 | 27MAY08A | 24JUN08 | 61 | 18,550.00 | 49etc =19 ; |
| 1361C-115 | Fab, Test & Deliver Coil #15 | 17JUL08* | 17JUL08 | | 47,220.00 | 49etc =47 ; |
| 1361C-116 | Fab, Test & Deliver Coil #16 | 08AUG08* | 08AUG08 | | 47,220.00 | 49etc =47 ; |
| 1361C-117 | Fab, Test & Deliver Coil #17 | 02SEP08* | 02SEP08 | | 47,220.00 | 49etc =47 ; |
| 1361C-118 | Fab, Test & Deliver Coil #18 | 24SEP08* | 24SEP08 | | 47,220.00 | 49etc =47 ; |
| 1351-195X | ALL TF COILS DELIVERED | | 24SEP08 | | 0.00 | |
| **Job: 1354 - Trim Coil Design &Procurement-KALISH** | | | | | | |
| **Trim Coil **Updated estimate**** | | | | | | |
| TRIM-170 | Complete Trim Coil Detailed Drawings | 25MAR08A | 30JUN08 | 80 | 12,769.36 | KALISH etc =14hr ; RUSHINSKI etc =10h<br>CRUIKSHANK etc =80hr ; |
| TRIM-200 | Assy drawings & parts list | 01APR08A | 30JUN08 | 90 | 10,998.36 | KALISH etc =04hr ; RUSHINSKI etc =10h<br>CRUIKSHANK etc =80hr ; |

Sheet 4 of 9

# ATTACHMENT 4 page 5//9

| Activity ID | Activity Description | Forecast Start | Forecast Finish | % cmplt | ETC | FY08: J J A S / FY09: O N D J F M A M J J A S / FY10: O N E |
|---|---|---|---|---|---|---|
| **Neilson** | | | | | | |
| **Job: 8222 - Manuscripts and Papers - NEILSON** | | | | | | |
| **Prepare Closeout report** | | | | | | |
| 8222-900 | Manuscripts, journal & papers (40 papers@40hrs) | 02SEP08* | 31MAR09 | | 299,600.15 | ea//em=800,em//em=400;r///rm= travel=15 |
| **Perry** | | | | | | |
| **Job: 8220 - Equipt Save & Facility Restora-PERRY** | | | | | | |
| **Safe and store NCSX hardware assets** | | | | | | |
| 8220-201 | Coordination and oversight | 02JUN08 | 23DEC08 | | 60,133.75 | PERRY etc =382hr ; |
| 8220-205 | NCTC floor penetrations & PLT water htr removal | 01JUL08* | 12AUG08 | | 56,248.54 | 41etc =21$k ; EM//TB etc =382hr ; |
| 8220-209 | Secure platform parts from CAS Bldg to NCTC | 13AUG08 | 26AUG08 | | 4,163.16 | 41etc =00$k ; EM//TB etc =48hr ; |
| 8220-215 | Secure TF Coils from Dsite MG to NCTC | 11SEP08 | 24SEP08 | | 3,000.86 | EM//TB etc =38hr ; |
| 8220-219 | Electr trays & hw from D-site yard to dsite pad | 01JUL08* | 15JUL08 | | 6,194.13 | 41etc =01$k ; EM//TB etc =69hr ; |
| 8220-223 | Items f/TFTR bsmnt (incl spare MC cond) to NCTCB | 01AUG08* | 14AUG08 | | 13,831.24 | 41etc =00$k ; EM//TB etc =172hr ; |
| 8220-227 | Portable AC units to Csite crib | 27AUG08 | 03SEP08 | | 631.76 | EM//TB etc =08hr ; |
| 8220-231 | Drawing closeouts and field follow-up | 01OCT08* | 23DEC08 | | 27,614.00 | LANGELLA etc =200hr ; |
| 8220-235 | Large and Small shield block to Dsite pad | 02SEP08* | 15SEP08 | | 2,527.04 | EM//TB etc =32hr ; |
| 8220-239 | Machine mock-up to NCTC | 13AUG08 | 19AUG08 | | 631.76 | EM//TB etc =08hr ; |
| 8220-243 | Welding machines to RESA | 01OCT08* | 07OCT08 | | 668.56 | EM//TB etc =08hr ; |
| 8220-247 | Tools to Csite crib | 01OCT08* | 14OCT08 | | 2,674.24 | EM//TB etc =32hr ; |
| 8220-251 | Measuring Equipment to MU Shop | 01OCT08* | 07OCT08 | | 1,337.12 | EM//TB etc =16hr ; |
| 8220-255 | Inventory parts,material, tools to new location | 01OCT08* | 28OCT08 | | 6,685.60 | EM//TB etc =80hr ; |
| 8220-409 | Crates,cabinets,parts shelves f/TFTRTC to NCTCB | 01OCT08* | 14OCT08 | | 10,362.68 | EM//TB etc =124hr ; |
| 8220-415 | Coil winding station to NCTC | 13AUG08 | 26AUG08 | | 5,054.08 | EM//TB etc =64hr ; |
| 8220-419 | MC bolts (incl crate) to NCTCB | 09SEP08 | 15SEP08 | | 2,076.20 | 41etc =00$k ; EM//TB etc =20hr ; |
| 8220-427 | Assemble 4 remaining MC 3 packs | 04AUG08 | 08SEP08 | | 25,270.40 | EM//TB etc =320hr ; |
| 8220-431 | Transport MC 3 packs (6) to NCTC | 09SEP08 | 22SEP08 | | 5,302.48 | EM//TB etc =64hr ; 41etc =00$k ; |
| 8220-501 | Autocalve- Safe all AC power | 30JUL08 | 05AUG08 | | 3,762.80 | LANGELLA etc =24hr ; EM//TB etc =08h |
| 8220-505 | Autoclave-Removal and store Dsite pad & NCTCB | 01OCT08* | 23DEC08 | | 154,843.44 | LANGELLA etc =400hr ; EM//TB etc =11 |
| 8220-901 | VV Diagnostic parts incl fab crates to NCTCB | 09SEP08* | 15SEP08 | | 1,669.86 | 41etc =0.2$k ; EM//TB etc =18hr ; |
| 8220-903 | Move tool crib from C-site back to D-Site | 09SEP08* | 15SEP08 | | 9,476.40 | EM//TB etc =120hr ; |
| 8220-605 | VV Spool piece crates to NCTCB | 01JUL08* | 02JUL08 | | 473.82 | EM//TB etc = 6 |
| 8220-423 | VVSA's (incl port extension crates) to NCTC | 13AUG08 | 26AUG08 | | 7,176.24 | 41etc =01$k ; EM//TB etc =72hr ; |
| 8220-609 | Yellow wedge stands to NCTC | 01OCT08* | 02OCT08 | | 334.28 | EM//TB etc = 4 |
| 8220-613 | Wedge cover plates to NCTC | 01OCT08* | 02OCT08 | | 334.28 | EM//TB etc = 4 |
| 8220-617 | 5 ton lift beam to RESA | 01OCT08* | 02OCT08 | | 334.28 | EM//TB etc = 4 |
| 8220-621 | 14 ton lift beam to RESA | 01OCT08* | 02OCT08 | | 167.14 | EM//TB etc = 2 |
| 8220-625 | Remove coil winding rooms & dispose | 27AUG08 | 01OCT08 | | 69,377.38 | EM//TB etc = 480 Langella etc = 241 |
| 8220-633 | Equipment in MU machine shop-Electrical to RESA | 02SEP08* | 29SEP08 | | 11,536.00 | EM//TB etc = 80Langella etc = 40 |
| 8220-641 | Equipment in MU machine shop-Mechanical to RESA | 02SEP08* | 15SEP08 | | 12,635.20 | EM//TB etc = 160 |
| 8220-645 | Cryo pump skid- Electrical to NCTCB | 02JUL08* | 23JUL08 | | 13,815.44 | EM//TB etc = 56Langella etc = 72 |
| 8220-653 | Cryo pump skid- Mechanical to NCTCB | 02JUL08* | 16JUL08 | | 3,790.56 | EM//TB etc = 48 |
| 8220-657 | Cryostat-dispose | 02JUL08* | 16JUL08 | | 3,790.56 | EM//TB etc = 48 |
| 8220-661 | Interlocked cryo room-leave in place | 02JUN08* | 02JUN08 | | 0.00 | |
| 8220-665 | Spherical bearings (Dahlgren) to NCTCB | 02JUL08* | 03JUL08 | | 78.97 | EM//TB etc = 1 |
| 8220-669 | Prototype castings to NCTC | 13AUG08 | 14AUG08 | | 631.76 | EM//TB etc = 8 |
| 8220-673 | Prototype VV cross sections-Scrap | 02JUL08* | 03JUL08 | | 157.94 | EM//TB etc = 2 |
| 8220-677 | TF coil fabrication fixtures to NCTC-VPI fixture | 13AUG08 | 14AUG08 | | 315.88 | EM//TB etc = 4 |
| 8220-681 | TF coil fabrication fixtures to NCTC-Mandrel | 13AUG08 | 14AUG08 | | 315.88 | EM//TB etc = 4 |
| 8220-685 | TF coil fabrication fixtures to NCTC-Misc fixtur | 13AUG08 | 14AUG08 | | 315.88 | EM//TB etc = 4 |

Sheet 5 of 9

# ATTACHMENT 4 page 6/9

| Activity ID | Activity Description | Forecast Start | Forecast Finish | % cmplt | ETC | FY08 J J A S / FY09 O N D J F M A M J J A S / FY10 O N E |
|---|---|---|---|---|---|---|
| **Rej** | | | | | | |
| **Job: 8101 - Project Management &Control-REJ** | | | | | | |
| 810.900 | Project Management Office PPPL FY08 (LOE) | 01OCT07A | 30SEP08 | LOE | 216,292.20 | NEILSON etc =414hr ; STRYKOWSKY etc =540<br>B///CB etc =680hr ; 35etc =12$k ;<br>41etc =03$k ; DEPUTYPC etc =95hr ; |
| 810.9005A | Project Management Office PPPL fy08 etc | 02JUN08 | 30SEP08 | LOE | 125,600.00 | DON REJ1 etc =126$k ; |
| 810.901 | Project Management Office PPPL FY09 (SA LOE) | 01OCT08* | 31MAR09 | LOE | 290,785.02 | NEILSON etc =335hr ;<br>Hampton etc =484hr ;<br>41etc =05$k ;<br>DON REJ1 etc =100$k ;<br>SIMMONS etc =61<br>STRYKOWSKY etc =417 |
| **Stratton** | | | | | | |
| **Job: 3101 - Magnetic Diagnostics-STRATTON** | | | | | | |
| **Rogowski Coils** | | | | | | |
| 3101-359 | Install Rogowski coils support (in job 1815) | 02APR08A | 20JUN08 | 30 | 28,185.66 | LABIK etc =40hr ; GUTTADORA etc =302<br>EM//TB etc =15hr ; |
| **Strykowsky** | | | | | | |
| **Job: 8998 - Allocations-STRYKOWSKY** | | | | | | |
| 99.08 | PPPL Allocations FY08 LOE | 01OCT07A | 29SEP08 | LOE | 142,323.48 | 54etc =88 ; |
| 99.09C | PPPL Allocations FY09 LOE | 01OCT08* | 31MAR09 | LOE | 59,465.00 | 54 etc =35 |
| **Viola** | | | | | | |
| **Job: 1802 - FP Assy Oversight&Support-VIOLA** | | | | | | |
| **Oversight and Supervision** | | | | | | |
| 1802ORNL02 | ORNL Title III field period assy station 2/3 | 02JUN08 | 30SEP08 | LOE | 13,860.00 | mcginnis=140 |
| R1802-003 | Metrology Engr Super FY08 | 01OCT07A | 30SEP08 | LOE | 45,122.13 | PRINISKI etc =293hr ; |
| R1802-007 | FPA Management FY08 | 01OCT07A | 30SEP08 | LOE | 85,747.73 | VIOLA etc =558hr ; |
| R1802-009 | PU Title III support | 02JUN08 | 30SEP08 | LOE | 62,742.24 | SANDS etc =408hr ; |
| R1802-010 | Drexel co-op student support | 02JUN08 | 30JUN08 | LOE | 2,520.00 | DREXEL etc =168 ; |
| R1802-015 | HP Coverage in the TFTR TC LOE FY08 | 01OCT07A | 30SEP08 | LOE | 53,157.42 | SH//TB etc =440hr ; |
| R1802-016 | HP Coverage in the TFTR TC LOE FY09 | 01OCT08* | 23DEC08 | LOE | 36,276.45 | SH//TB etc =629hr ; |
| 1802MISC | Misc materials,tools, GSA vehicle,rigging | 01FEB08A | 30SEP08 | LOE | 55,890.00 | 41etc =45$k ; |
| **Station 3 procedures,JHA,ACC,Training,Prep** | | | | | | |
| R1802-307 | Procedures written & approved | 14APR08A | | | 0.00 | |
| R1802-309 | JHA completed | 02JUN08 | 09JUN08 | | 0.00 | |
| R1802-311 | Training needs identified & released | 10JUN08 | 17JUN08 | | 0.00 | |
| R1802-313 | ACC review completed | 18JUN08 | 25JUN08 | | 0.00 | |
| R1802-315 | Pre-job brief completed | 26JUN08 | 03JUL08 | | 0.00 | |
| R1802-320 | Update FPA cost estimate for FPA station 2&3 | 14OCT08 | 20OCT08 | | 0.00 | |
| **Job: 1810 - Field Period AssyStation 1,2,3 VIOLA** | | | | | | |
| **General Assy Support** | | | | | | |
| R1810-003 | LOE Crane support, fixture setupfor FY08 | 01OCT07A | 30SEP08 | LOE | 55,605.94 | EM//TB etc =704hr ; |
| R1810-025 | Crane & Rigging inspections | 01FEB08A | 30SEP08 | LOE | 3,948.50 | EM//TB etc =50hr ; |
| R1810-007 | LOE Field Supervision for FY08 | 01OCT07A | 30SEP08 | LOE | 79,035.61 | EDWARDS etc =587hr ; |
| R1810-2001 | Misc Hardware and hardware rework (1/2 fte loe) | 01FEB08A | 30SEP08 | LOE | 23,691.00 | EM//TB etc =300hr ; |
| S21-4.02 | Perform routine metrology set-up and checks (loe | 01FEB08A | 30SEP08 | LOE | 61,094.25 | ZMET etc =525 ; |
| **Setup** | | | | | | |
| R1810-2034 | Misc Tool and Hardware | 02JUN08 | 30SEP08 | LOE | 18,630.00 | 41etc =15$k ; |
| **Pre-Measuring and fitup checks** | | | | | | |
| **Pre measurement of MCHP A2,B2,C2 flanges** | | | | | | |
| 2-2-2.99 | Drill Stycast fill holes C2 | 01JUL08* | 03JUL08 | | 9,476.40 | EM//TB etc =120hr ; |
| S22-3.02 | Compress shims sort by thickness | 01MAY08A | 11AUG08 | 50 | 3,158.80 | EM//TB etc =40hr ; |

Sheet 6 of 9

# ATTACHMENT 4 page 7/9

| Activity ID | Activity Description | Forecast Start | Forecast Finish | % cmplt | ETC | FY08 J J A S / FY09 O N D J F M A M J J A S / FY10 O N E |
|---|---|---|---|---|---|---|
| **Station 2 MC subassy A1B1C1** | | | | | | |
| **AB-C MC Assembly** | | | | | | |
| 2-1-7.16 | "Lightly" tack weld nose flex shims | 02JUN08* | 02JUN08 | | 947.64 | EM//TB etc =12hr ; |
| 2-1-7.17 | remove "C" coil & place it on a separate fixtur | 03JUN08 | 03JUN08 | | 3,790.56 | EM//TB etc =48hr ; |
| 2-1-7.18 | Recheck part alignment & weld all Type-B flex s | 04JUN08 | 06JUN08 | | 6,702.91 | EM//TB etc =00hr ; ZMET etc =58 |
| 2-1-7.19 | After welding "B" coil nose shims recheck align | 09JUN08 | 09JUN08 | | 2,234.30 | EM//TB etc =00hr ; ZMET etc =19 |
| 2-1-7.20 | Back office assessment of part after weld | 10JUN08 | 11JUN08 | | 4,468.61 | EM//TB etc =00hr ; ZMET etc =38 |
| 2-1-7.21 | Measure "C" fiducials | 10JUN08 | 10JUN08 | | 2,234.30 | EM//TB etc =00hr ; ZMET etc =19 |
| 2-1-7.22 | Weld all Type-C (A-flange) flex shims plasma sid | 12JUN08 | 13JUN08 | | 3,790.56 | EM//TB etc =48hr ; |
| 2-1-7.23 | After welding determine metrology acceptance | 16JUN08 | 16JUN08 | | 2,234.30 | EM//TB etc =00hr ; ZMET etc =19 |
| 2-1-7.24 | Back office assessment | 17JUN08 | 18JUN08 | | 4,468.61 | EM//TB etc =00hr ; ZMET etc =38 |
| 2-1-7.25 | Remove shims for alignment mating coil | 17JUN08 | 16JUN08 | | 0.00 | EM//TB etc =00hr ; |
| 2-1-7.07 | Place unfilled shim bags in wing areas | 17JUN08 | 17JUN08 | | 1,895.28 | EM//TB etc =24hr ; |
| 2-1-7.26 | Lower mating "C" coil into position. | 19JUN08 | 19JUN08 | | 3,790.56 | EM//TB etc =48hr ; |
| 2-1-7.261 | alignment "C" coil tooling balls | 20JUN08 | 20JUN08 | | 2,234.30 | EM//TB etc =00hr ; ZMET etc =19 |
| 2-1-7.27 | position coil accurately in x, y, & z directio | 23JUN08 | 23JUN08 | | 1,895.28 | EM//TB etc =24hr ; |
| 2-1-7.28 | Install shims;studs,, & "wiggle" | 24JUN08 | 24JUN08 | | 2,842.92 | EM//TB etc =36hr ; |
| 2-1-7.29 | Torque50% of final value. | 25JUN08 | 25JUN08 | | 947.64 | EM//TB etc =12hr ; |
| 2-1-7.30 | Measure position of all monuments | 26JUN08 | 26JUN08 | | 3,351.46 | EM//TB etc =00hr ; ZMET etc =29 |
| 2-1-7.301 | Fuji paper, & examine load sharing. back office | 27JUN08 | 30JUN08 | | 8,259.17 | EM//TB etc =48hr ; ZMET etc =38 |
| 2-1-7.302 | Install new shims & Fuji paper. Lower & reposit | 01JUL08 | 03JUL08 | | 5,685.84 | EM//TB etc =72hr ; |
| 2-1-7.303 | Install shims without Fuji paper, studs & torqu | 07JUL08 | 08JUL08 | | 3,790.56 | EM//TB etc =48hr ; |
| 2-1-7.31 | Adjust shims locally. Re-torque all studs50%. | 09JUL08 | 10JUL08 | | 3,790.56 | EM//TB etc =48hr ; |
| 2-1-7.32 | Install bushing. Replace nut & tighten back50% | 11JUL08 | 15JUL08 | | 5,685.84 | EM//TB etc =72hr ; |
| 2-1-7.33 | After super bolt tightening, measure position | 16JUL08 | 17JUL08 | | 3,351.46 | ZMET etc =29 ; EM//TB etc =00h |
| 2-1-7.34 | Tighten all boltsir final torque. | 17JUL08 | 17JUL08 | | 1,895.28 | EM//TB etc =24hr ; |
| 2-1-7.35 | After tightening hardware, meas position of monu | 18JUL08 | 18JUL08 | | 3,351.46 | ZMET etc =29 ; EM//TB etc =00h |
| 2-1-7.36 | Weld B / C nose region solenoid side | 21JUL08 | 23JUL08 | | 5,685.84 | EM//TB etc =72hr ; |
| 2-1-7.37 | Measure positions of all monuments | 24JUL08 | 24JUL08 | | 2,234.30 | EM//TB etc =00hr ; ZMET etc =19 |
| 2-1-7.38 | Back office of above results & INSTALL wing supp | 25JUL08 | 28JUL08 | | 4,468.61 | EM//TB etc =00hr ; ZMET etc =38 |
| 2-1-7.39 | Fill all lose bushings with Stycast 2850FT | 29JUL08 | 30JUL08 | | 3,790.56 | EM//TB etc =48hr ; |
| **Stycast shim bags & final measurements** | | | | | | |
| 2-1-8.01 | Fill all wing bladders & cure | 31JUL08 | 01AUG08 | | 3,790.56 | EM//TB etc =48hr ; |
| 2-1-11.01 | Measure tooling balls on all coils. | 04AUG08 | 05AUG08 | | 4,468.61 | EM//TB etc =00hr ; ZMET etc =38 |
| 2-1-11.02 | Install or identify three primary fiducials | 06AUG08 | 07AUG08 | | 4,468.61 | EM//TB etc =00hr ; ZMET etc =38 |
| 2-1-11.03 | Scan "B" flange Type-C coil & interfacing base | 08AUG08 | 12AUG08 | | 6,702.91 | EM//TB etc =00hr ; ZMET etc =58 |
| 2-1-11.04 | Measure bolt length on all tension fasteners | 13AUG08 | 13AUG08 | | 1,895.28 | EM//TB etc =24hr ; |
| 2-1-11.05 | Perform Electrical Megger test on each coil | 14AUG08 | 15AUG08 | | 3,790.56 | EM//TB etc =48hr ; |
| 2-1-11.06 | Mark part for identification | 18AUG08 | 15AUG08 | | 0.00 | EM//TB etc =00hr ; |
| 2-1-11.07 | Install lift support beams | 18AUG08 | 19AUG08 | | 7,581.12 | EM//TB etc =96hr ; |
| 2-1-11.08 | Remove from stand & measure weight of completed | 20AUG08 | 20AUG08 | | 3,790.56 | EM//TB etc =48hr ; |
| 2-1-11.09 | Move to holding area. | 21AUG08 | 22AUG08 | | 7,581.12 | EM//TB etc =96hr ; |
| S21-11.07M | Complete 1st MCHP Assy (Sta 2) | | 22AUG08 | | 0.00 | EM//TB etc =00hr ; |
| 2-1-11.10 | Lift upper wedge & reinstall & grout at Assembly | 25AUG08 | 08SEP08 | | 18,952.80 | EM//TB etc =240hr ; |
| **Station 2 MC subassy A2B2C2** | | | | | | |
| **A-B MC Assembly** | | | | | | |
| 2-2-6.26 | Torque50% of final value. | 02JUN08 | 02JUN08 | | 789.70 | EM//TB etc =10hr ; |
| 2-2-6.27 | Measure position of all monuments | 03JUN08 | 03JUN08 | | 2,792.88 | ZMET etc =24 ; EM//TB etc =00h |
| 2-2-6.28 | Adjust shims locally. Re-torque all studs50%. | 04JUN08 | 04JUN08 | | 10,323.96 | EM//TB etc =60hr ; ZMET etc =48 |
| 2-2-6.29 | Install bushing. Replace nut & tighten back 50% | 05JUN08 | 05JUN08 | | 4,738.20 | EM//TB etc =60hr ; |
| 2-2-6.30 | After super bolt tightening, measure position | 06JUN08 | 06JUN08 | | 2,792.88 | ZMET etc =24 ; EM//TB etc =00h |
| 2-2-6.31 | Tighten all boltsir final torque. | 09JUN08 | 09JUN08 | | 1,579.40 | EM//TB etc =20hr ; |
| 2-2-6.32 | After tightening hardware, measure position | 10JUN08 | 10JUN08 | | 2,792.88 | ZMET etc =24 ; EM//TB etc =00h |
| 2-2-6.33 | Weld A / B nose region solenoid side | 11JUN08 | 11JUN08 | | 10,323.96 | EM//TB etc =60hr ; ZMET etc =48 |
| 2-2-6.34 | Measure positions of all monuments | 12JUN08 | 12JUN08 | | 1,861.92 | EM//TB etc =00hr ; ZMET etc =16 |

Sheet 7 of 9

# **ATTACHMENT 4** page 8/9

| Activity ID | Activity Description | Forecast Start | Forecast Finish | % cmplt | ETC | FY08 J J A S O N D J F M A M J J A S O N E FY09 FY10 |
|---|---|---|---|---|---|---|
| 2-2-6.35 | Review with Back Office. INSTALL wing supports | 13JUN08 | 13JUN08 | | 6,882.64 | EM//TB etc =40hr ; ZMET etc =32 |
| 2-2-6.36 | Identify, a set of monuments moved | 16JUN08 | 13JUN08 | | 0.00 | EM//TB etc =00hr ; |
| 2-2-6.37 | Fill all loose bushings with Stycast 2850FT | 16JUN08 | 16JUN08 | | 3,158.80 | EM//TB etc =40hr ; |
| 2-2-6.38 | Scan "B" flange (datum "E") of "B" coil, | 17JUN08 | 17JUN08 | | 1,861.92 | EM//TB etc =00hr ; ZMET etc =16 |
| 2-2-6.39 | define all B/C flange shim thickness. | 18JUN08 | 18JUN08 | | 2,369.10 | EM//TB etc =30hr ; |
| **AB-C MC Assembly** | | | | | | |
| 2-2-7.01 | lift (A-B) coil, along with fixture, onto anot | 19JUN08 | 19JUN08 | | 9,476.40 | EM//TB etc =120hr ; |
| 2-2-7.02 | Select a subset of monuments for initial alignm | 20JUN08 | 20JUN08 | | 1,861.92 | EM//TB etc =00hr ; ZMET etc =16 |
| 2-2-7.03 | Align set of monuments selected in 7.02. | 23JUN08 | 23JUN08 | | 1,861.92 | EM//TB etc =00hr ; ZMET etc =16 |
| 2-2-7.04 | Establish a set of global monuments | 24JUN08 | 24JUN08 | | 1,861.92 | EM//TB etc =00hr ; ZMET etc =16 |
| 2-2-7.05 | Mark nose shim locations & puck locations. | 25JUN08 | 25JUN08 | | 1,579.40 | EM//TB etc =20hr ; |
| 2-2-7.06 | Place initial set shims (4-8) on Type-B | 26JUN08 | 25JUN08 | | 0.00 | EM//TB etc =00hr ; |
| 2-2-7.08 | Lower mating "C" coil into position. | 01JUL08 | 01JUL08 | | 3,158.80 | EM//TB etc =40hr ; |
| 2-2-7.081 | Perform alignment "C" coil tooling balls | 02JUL08 | 02JUL08 | | 1,861.92 | EM//TB etc =00hr ; ZMET etc =16 |
| 2-2-7.09 | Install jack screws & dial indicators | 03JUL08 | 03JUL08 | | 1,579.40 | EM//TB etc =20hr ; |
| 2-2-7.10 | Position coil within ±.002" | 07JUL08 | 07JUL08 | | 1,579.40 | EM//TB etc =20hr ; |
| 2-2-7.11 | Install shims studs, & "wiggle" | 08JUL08 | 08JUL08 | | 2,369.10 | EM//TB etc =30hr ; |
| 2-2-7.12 | Torque50% of final value. | 09JUL08 | 09JUL08 | | 789.70 | EM//TB etc =10hr ; |
| 2-2-7.13 | Measure position of all monuments | 10JUL08 | 10JUL08 | | 2,792.88 | EM//TB etc =00hr ; ZMET etc =24 |
| 2-2-7.14 | Measure shim puck height | 11JUL08 | 11JUL08 | | 1,579.40 | EM//TB etc =20hr ; |
| 2-2-7.15 | remove puck locating rings & install all nose s | 14JUL08 | 14JUL08 | | 4,738.20 | EM//TB etc =60hr ; |
| 2-2-7.16 | "Lightly" tack weld nose flex shims | 15JUL08 | 15JUL08 | | 789.70 | EM//TB etc =10hr ; |
| 2-2-7.17 | remove "C" coil & place it on a separate fixtur | 16JUL08 | 16JUL08 | | 3,158.80 | EM//TB etc =40hr ; |
| 2-2-7.18 | Recheck part alignment & weld all Type-B flex s | 17JUL08 | 17JUL08 | | 5,585.76 | EM//TB etc =00hr ; ZMET etc =48 |
| 2-2-7.19 | After welding "B" coil nose shims recheck align | 18JUL08 | 18JUL08 | | 1,861.92 | EM//TB etc =00hr ; ZMET etc =16 |
| 2-2-7.20 | Back office assessment of part after weld | 21JUL08 | 21JUL08 | | 3,723.84 | EM//TB etc =00hr ; ZMET etc =32 |
| 2-2-7.21 | Measure "C" fiducials | 21JUL08 | 21JUL08 | | 1,861.92 | EM//TB etc =00hr ; ZMET etc =16 |
| 2-2-7.22 | Weld all Type-C (A-flange) flex shims plasma sid | 22JUL08 | 22JUL08 | | 3,158.80 | EM//TB etc =40hr ; |
| 2-2-7.23 | After welding determine metrology acceptance | 23JUL08 | 23JUL08 | | 1,861.92 | EM//TB etc =00hr ; ZMET etc =16 |
| 2-2-7.24 | Back office assessment | 24JUL08 | 24JUL08 | | 3,723.84 | EM//TB etc =00hr ; ZMET etc =32 |
| 2-2-7.25 | Remove shims for alignment mating coil | 25JUL08 | 24JUL08 | | 0.00 | EM//TB etc =00hr ; |
| 2-2-7.07 | Place unfilled shim bags in wing areas | 25JUL08 | 25JUL08 | | 1,579.40 | EM//TB etc =20hr ; |
| 2-2-7.26 | Lower mating "C" coil into position. | 28JUL08 | 28JUL08 | | 3,158.80 | EM//TB etc =40hr ; |
| 2-2-7.261 | alignment "C" coil tooling balls | 29JUL08 | 29JUL08 | | 1,861.92 | EM//TB etc =00hr ; ZMET etc =16 |
| 2-2-7.27 | position coil accurately in x, y, & z directio | 30JUL08 | 30JUL08 | | 1,579.40 | EM//TB etc =20hr ; |
| 2-2-7.28 | Install shims;studs,, & "wiggle" | 31JUL08 | 31JUL08 | | 2,369.10 | EM//TB etc =30hr ; |
| 2-2-7.29 | Torque50% of final value. | 01AUG08 | 01AUG08 | | 789.70 | EM//TB etc =10hr ; |
| 2-2-7.30 | Measure position of all monuments | 04AUG08 | 04AUG08 | | 2,792.88 | ZMET etc =24 ; |
| 2-2-7.31 | Adjust shims locally. Re-torque all studs50%. | 05AUG08 | 05AUG08 | | 3,158.80 | EM//TB etc =40hr ; |
| 2-2-7.32 | Install bushing. Replace nut & tighten back50% | 06AUG08 | 06AUG08 | | 4,738.20 | EM//TB etc =60hr ; |
| 2-2-7.33 | After super bolt tightening, measure position | 07AUG08 | 07AUG08 | | 2,792.88 | EM//TB etc =00hr ; ZMET etc =24 |
| 2-2-7.34 | Tighten all bolts to final torque. | 08AUG08 | 08AUG08 | | 1,579.40 | EM//TB etc =20hr ; |
| 2-2-7.35 | After tightening hardware, meas position of monu | 11AUG08 | 11AUG08 | | 2,792.88 | ZMET etc =24 ; EM//TB etc =00h |
| 2-2-7.36 | Weld B / C nose region solenoid side | 12AUG08 | 12AUG08 | | 4,738.20 | EM//TB etc =60hr ; |
| 2-2-7.37 | Measure positions of all monuments | 13AUG08 | 13AUG08 | | 1,861.92 | EM//TB etc =00hr ; ZMET etc =16 |
| 2-2-7.38 | Back office of above results & INSTALL wing supp | 14AUG08 | 14AUG08 | | 3,723.84 | EM//TB etc =00hr ; ZMET etc =32 |
| 2-2-7.39 | Fill all lose bushings with Stycast 2850FT | 15AUG08 | 15AUG08 | | 3,158.80 | EM//TB etc =40hr ; |
| **Stycast shim bags & final measurements** | | | | | | |
| 2-2-8.01 | Fill all wing bladders & cure | 18AUG08 | 19AUG08 | | 3,158.80 | EM//TB etc =40hr ; |
| 2-2-8.02 | Inject stycast in all shim spaces | 20AUG08 | 21AUG08 | | 3,158.80 | EM//TB etc =40hr ; |
| 2-2-10.0 | Complete local service & interface details | 22AUG08 | 21AUG08 | | 0.00 | EM//TB etc =00hr ; |
| 2-2-11.01 | Measure tooling balls on all coils. | 22AUG08 | 25AUG08 | | 3,723.84 | EM//TB etc =00hr ; ZMET etc =32 |
| 2-2-11.02 | Install or identify three primary fiducials | 26AUG08 | 27AUG08 | | 3,723.84 | EM//TB etc =00hr ; ZMET etc =32 |
| 2-2-11.03 | Scan "B" flange Type-C coil & interfacing base | 28AUG08 | 02SEP08 | | 5,585.76 | EM//TB etc =00hr ; ZMET etc =48 |
| 2-2-11.04 | Measure bolt length on all tension fasteners | 03SEP08 | 03SEP08 | | 1,579.40 | EM//TB etc =20hr ; |

Sheet 8 of 9

# ATTACHMENT 4 page 9/9

| | Activity ID | Activity Description | Forecast Start | Forecast Finish | % cmplt | ETC | FY08 J J A S / FY09 O N D J F M A M J J A S / FY10 O N E |
|---|---|---|---|---|---|---|---|
| | 2-2-11.05 | Perform Electrical Megger test on each coil | 04SEP08 | 05SEP08 | | 3,158.80 | EM//TB etc =40hr ; |
| | 2-2-11.06 | Mark part for identification | 08SEP08 | 05SEP08 | | 0.00 | EM//TB etc =00hr ; |
| | 2-2-11.07 | Install lift support beams | 08SEP08 | 09SEP08 | | 6,317.60 | EM//TB etc =80hr ; |
| | 2-2-11.08 | Remove from stand & measure weight of completed | 10SEP08 | 10SEP08 | | 3,158.80 | EM//TB etc =40hr ; |
| | 2-2-11.09 | Move to holding area. | 11SEP08 | 12SEP08 | | 6,317.60 | EM//TB etc =80hr ; |
| **Station 3 Setup/Preparations/General** | | | | | | | |
| **Misc Prep activities** | | | | | | | |
| | R1810-3112 | Load Test 3 legged actuator lift fixtur | 03JUN08* | 12JUN08 | | 10,108.16 | EM//TB etc =128hr ; |
| | R1810-3113 | Procure wire rope slings & 6 17ton shackles | 03JUN08* | 12JUN08 | | 18,845.20 | 41etc =05$k ; EM//TB etc =160hr ; |
| **Station 3-Assemble Mod Coils and VVSA-FP#1** | | | | | | | |
| **Set-up and Prep** | | | | | | | |
| | 3-1-1.01 | transfer CAD models | 02JUN08* | 10JUN08 | | 13,033.44 | ZMET etc =112 ; |
| | 3-1-1.02 | Install Station 3 site monuments | 03SEP08 | 05SEP08 | | 12,807.96 | 41etc =02$k ; EM//TB etc =60hr ; ZMET etc =48 ; |
| | 3-1-1.03 | Install floor mounted tracks and the VV base sup | 01JUL08 | 08JUL08 | | 18,448.60 | 41etc =01$k ; EM//TB etc =100hr ; ZMET etc =80 ; |
| | 3-1-1.021 | Design, fabricate and calibrate photogrammetry | 02JUN08 | 28JUL08 | | 50,607.60 | 41etc =03$k ; EM//TB etc =240hr ; ZMET etc =240 ; |
| | 3-1-1.05 | Install the MCHP right support stand; | 28AUG08 | 02SEP08 | | 4,738.20 | EM//TB etc =60hr ; |
| | 3-1-1.07 | Reconfirm Leica position | 03SEP08 | 05SEP08 | | 5,585.76 | ZMET etc =48 ; |
| **Install Laser Screen** | | | | | | | |
| | R1810-2109 | Begin Station 3 | 08SEP08 | | | 0.00 | |
| | 3-1-6.02 | Place all laser screens | 08SEP08 | 09SEP08 | | 6,882.64 | EM//TB etc =40hr ; ZMET etc =32 |
| | 3-1-6.03 | Turn each lasers on & measure each laser source | 10SEP08 | 10SEP08 | | 4,129.58 | EM//TB etc =24hr ; ZMET etc =19 |
| | 3-1-6.04 | Print path on milar paper | 11SEP08 | 10SEP08 | | 0.00 | EM//TB etc =00hr ; |
| | 3-1-6NEW | Dry-run MCHP thru laser screen path without VVSA | 11SEP08 | 16SEP08 | | 10,108.16 | EM//TB etc =128hr ; |
| **Install Vacuum Vessel** | | | | | | | |
| | 3-1-7.02 | Install VV NBI port support stand. | 17SEP08 | 18SEP08 | | 3,790.56 | EM//TB etc =48hr ; |
| | 3-1-7.03 | Install VVSA to base support and make connection | 19SEP08 | 19SEP08 | | 1,895.28 | EM//TB etc =24hr ; |
| | 3-1-7.04 | take tooling ball readings and secure VVSA | 22SEP08 | 23SEP08 | | 3,790.56 | EM//TB etc =48hr ; |
| | 3-1-7.05 | Scan VV surface and compare data | 24SEP08 | 26SEP08 | | 6,702.91 | ZMET etc =58 ; EM//TB etc =00h |
| **Trial fit MCHP over VV** | | | | | | | |
| | 3-1-8.01 | Install any bumper protection components on the | 29SEP08 | 29SEP08 | | 947.64 | EM//TB etc =12hr ; |
| | 3-1-8.03 | Install MCHP lift fixture, disengage leveler | 30SEP08 | 01OCT08 | | 3,900.96 | EM//TB etc =48hr ; |
| | 3-1-8.05 | Move right MCHP over the VV | 02OCT08 | 06OCT08 | | 19,130.40 | EM//TB etc =144hr ; ZMET etc =58 |
| | 3-1-8.05M | MCHP test fit over VVSA Complete | | 06OCT08 | | 0.00 | |
| | 3-1-6.05 | Disengage the right MCHP & position on floor | 07OCT08 | 07OCT08 | | 2,005.68 | EM//TB etc =24hr ; |
| **Contingency-Project** | | | | | | | |
| | CC | Closeout contingency @ 20% | 02JUN08* | 31MAR09 | | 1,172,000.00 | |
| **Subtotal** | | | 01MAY07A | 31MAR09 | | 7,031,867.09 | |

Sheet 9 of 9

# ATTACHMENT 5

## Milestones

| | Baseline ECP-53 | Actual | | New Baseline ECP-60 | |
|---|---|---|---|---|---|
| **Level I** | | | | | |
| CD-1 | May-2003 | ***May-2003*** | | | |
| CD-2 | Feb-2004 | ***Feb-2004*** | | | |
| CD-3 | Sep-2004 | ***Sep-2004*** | | | |
| CD-4 | Jul-2009 | | | ***Jul-2009*** | |
| **Level II** | | | | | |
| Vacuum Vessel & Modular Coil Prel Dsn Rvw | Oct-2003 | ***Oct-2003*** | | | |
| Performance Baseline Review | Nov-2003 | ***Nov-2003*** | | | |
| Conduct VVSA FDR | Jul-2004 | ***May-2004*** | | | |
| Mod Coil Winding Form Final Design Review | Jul-2004 | ***May-2004*** | | | |
| Award MC Conductor Contract | Dec-2004 | ***Oct-2004*** | | | |
| Award VV Production Vendor | Oct-2004 | ***Sep-2004*** | | | |
| Award MCWF Mfg Contract | Oct-2004 | ***Sep-2004*** | | | |
| First MCWF Delivered | Jul-2005 | ***Sep-2005*** | | | |
| Begin TF Coil fabrication activities | Sep-2005 | ***Jun-2005*** | | | |
| Complete First Mod Coil Fabrication | Mar-2006 | ***Mar-2006*** | | | |
| Vacuum Vessel Sectors Delivered | Sep-2006 | ***Sep-2006*** | | | |
| Last MCWF Delivered | Sep-2007 | ***Sep-2007*** | | | |
| PF Coils Awarded | Mar-2008 | ***May-2008*** | *** | | ***Contract negotiated and ready to award.*** |
| Begin Assembly of First Field Period | Jul-2007 | ***Jul-2007*** | | | |
| All TF Coils Delivered | Aug-2008 | | | ***Oct-2008*** | |
| Last Field Period Assembled | Nov-2008 | | | ***n/a*** | ***Project terminated*** |
| Begin Vac Vsl Pumpdown | Feb-2009 | | | ***n/a*** | ***Project terminated*** |
| Begin Cryostat Installation | Apr-2009 | | | ***n/a*** | ***Project terminated*** |
| Operational Readiness | Jun-2009 | | | ***n/a*** | ***Project terminated*** |
| Begin Start-up Testing | Jun-2009 | | | ***n/a*** | ***Project terminated*** |
| Modular Coil Fabrication Complete (last VPI) | | | | ***Aug-2008*** | |
| 3 modular coils assembled | | | | ***Oct-2008*** | |
| Modular Coil Half Period test fit over VVSA | | | | ***Nov-2008*** | |
| Modular coils and TF coils in safe storage | | | | ***Mar-2009*** | |
| Techincal Data Collection complete | | | | ***May-2009*** | |

# **ATTACHMENT 6** page 1/2

**Department of Energy**
Washington, DC 20585

JUL 0 9 2008

MEMORANDUM FOR JEFFREY F. KUPFER
ACTING DEPUTY SECRETARY

THROUGH: INGRID KOLB
DIRECTOR, OFFICE OF MANAGEMENT

FROM: RAYMOND L. ORBACH
UNDER SECRETARY FOR SCIENCE

SUBJECT: Attached is the memorandum canceling the National Compact Stellarator Experiment (NCSX) Major Item of Equipment (MIE) project at Princeton Plasma Physics Laboratory (PPPL).

BACKGROUND: The Office of Engineering and Construction Management (OECM) supported and concurs with the Office of Science decision to cancel the NCSX MIE.

cc: Patricia Dehmer, SC-2
Steve Isakowitz, CF-1

# ATTACHMENT 6 page 2/2

**Department of Energy**
Washington, DC 20585

MEMORANDUM FOR UNDER SECRETARY FOR SCIENCE

FROM: for Stephen Eckstrand
RAYMOND J. FONCK, ASSOCIATE DIRECTOR
OFFICE OF FUSION ENERGY SCIENCES

SUBJECT: ACTION: Rebaseline or cancel the National Compact Stellarator Experiment (NCSX) Major Item of Equipment (MIE) project at Princeton Plasma Physics Laboratory (PPPL)

ISSUE: The NCSX project Performance Baseline was initially approved at Critical Decision (CD)-2 with a Total Project Cost (TPC), including conceptual design, of $96 Million (M) and completion in May 2008. The current NCSX project has an established baseline with a TPC of $102M with a CD-4 completion date of July 2009. After PPPL, with support from Oak Ridge National Laboratory (ORNL), evaluated the project performance to date and performed a "bottoms up" estimate to complete, a new baseline was proposed with a TPC of **$170.2M** and a completion date of **August 2013**.

RECOMMENDATION: After extensive evaluation of the past performance and future expectations of the NCSX MIE fabrication, which is documented in the attached Appendix, I recommend that the Under Secretary cancel the NCSX MIE for the following reasons:

1) the NCSX initial pre-CD-0 costs have increased from the $50-60M range first considered by the Fusion Energy Sciences Advisory Committee (FESAC) to the current estimated cost of $170.2M and the date for finishing the project has been delayed from 2007 to 2013;
2) the NCSX will need an additional $30-40M and 1-2 years after 2013 to achieve useful physics operation;
3) there is a significant possibility that the NCSX TPC could increase further due to the inadequate, preliminary stage of some of the design work, and the lack of machine assembly experience;
4) cancellation will clarify PPPL's future, allow significant upgrades to the National Spherical Torus Experiment (NSTX), if NCSX funds are redirected, and eliminate the "standing army" problem; and

5) there is a need to avoid further damage as we move the program into the era of support of burning plasma physics.

APPROVE: Raymond L. Orbach

DISAPPROVE: ______________________

DATE: July 9, 2008