

TO: A. vonHalle
FROM: P. Sichta

SUBJECT: Closeout note for Real Time Plasma and Power Supply Control, Job 5501

Date: July 23, 2008

Scope

- *For CD-4/MIE, the control system must provide synchronized control signals for the (approx.) seven NCSX power supplies, and one gas injector.*
- *The control methodology will be open-loop; no feedback will be used to modify the computer's outputs.*
- *WBS4 will specify the detailed requirements for power supply control. WBS2 will provide the detailed requirements for gas injection control.*

Status

- *This job has completed the CDR phase, but awaits a PDR based upon the approved workscope.*

Interfaces

WBS55 will interface with WBS4.

Specifications

An SDD and Data Dictionary have been completed and are on the NCSX website.

Schematics and PIDs

none.

Models

none.

Drawings

none.

Analyses

none.

Testing

none.

Costs

Costs are posted on the NCSX website.

Remaining Work

- *PDR, FDR, Installation and test.*

Lessons Learned:

none.

Conclusion:

Upon job resumption, review current technologies and proceed to PDR.

Central Controls and Computing

WBS53-57

P. Sichta

WBS5 Work Package Manager

Agenda



- Introduction
- Requirements and Interfaces
- Cost and schedule
- Risks and mitigation
- Responses to past review recommendations

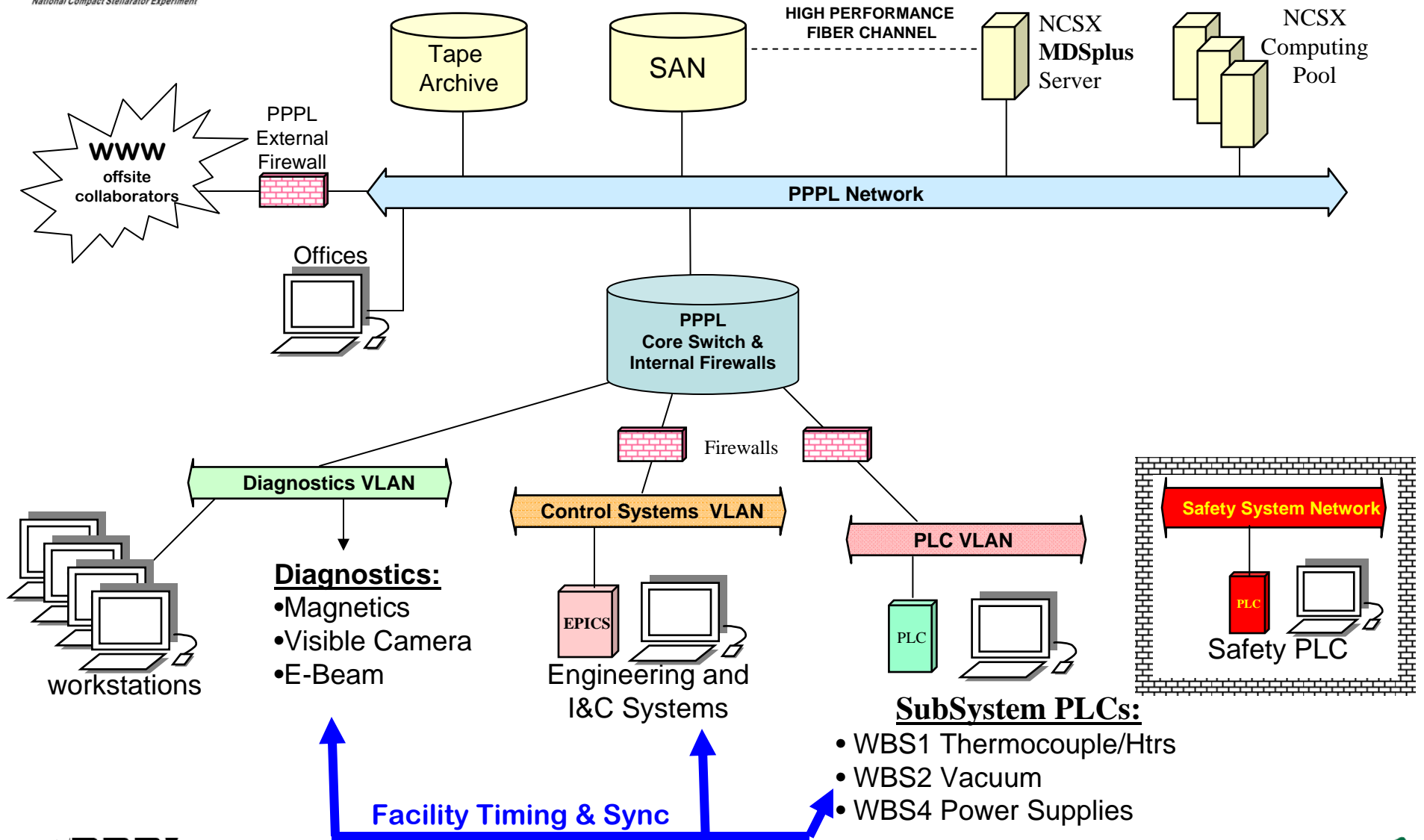
Introduction



Central Controls and Computing will provide the equipment and services to support: 1) integrated and remote control; 2) data acquisition, analysis, and storage; 3) facility timing and synchronization; 4) central safety and interlocks.

- **Network and Fiber Optic Infrastructure (WBS 51)**
- **Central Instrumentation and Control (WBS 52)**
- **Data Acquisition and Facility Computing (WBS 53)**
- **Facility Timing and Synchronization (WBS 54)**
- **Real-Time Plasma and Power Supply Control (WBS 55)**
- **Central Safety and Interlock System (WBS 56)**
- **Management and Integration (WBS 58)**

NCSX Computing Overview



SC Project Review of NCSX, April 8-10, 2008

P. Sichta - page 4



Requirements



- An *NCSX System Design Description* (SDD) was written in 2003, before CD-2. The primary elements of that design remain intact.
- My current estimate is derived from the SDD, ongoing technical discussions and design reviews, and recent experience with similar systems on NSTX.
- A **WBS5 System Requirements Document** (SRD, BSPEC) will be reviewed and approved prior to the *Preliminary Design Review* for each WBS5 element.
- Design Complexity & Maturity
 - Many of the technologies for WBS5/NCSX are currently in use on NSTX, so complexity is low for our experienced staff.
 - The *current workscope* has completed neither **Preliminary** nor **Final design**, so the maturity is medium.

CD-4 Interface List



WBS51 Network & Fiber Optic	WBS1 Thermocouple/Heater Local I&C WBS2 Vacuum/Fueling Systems WBS3 Diagnostics WBS4 Power Systems
WBS52 Central I&C	WBS1 Thermocouple/Heater Local I&C WBS2 Vacuum/Fueling Systems WBS4 Power Systems
WBS53 Data Acquisition and Management	WBS1 Thermocouple Local I&C WBS2 Vacuum/Fueling Systems WBS3 Diagnostics WBS4 Power Systems
WBS54 Timing & Synchronization	WBS3 Diagnostics WBS4 Power Systems
WBS55 Real-Time Control	WBS2 Vacuum/Fueling Systems WBS4 Power Supply Control
WBS56 Central Safety and Interlocks	Access Control: WBS4 Power System Areas, WBS7 Test Cell. SubSystem Interlocks: WBS4 Power Systems. NCSX (Global) E-Stop.

Basis of Estimate



- Labor:
 - referenced actual engineering hours from FY97-99 for the NSTX first plasma.
 - experience with similar activities for NSTX.
 - ‘expert’ estimates (e.g. Erik Perry).

- M&S
 - recent purchase of parts for NSTX and other lab infrastructure projects.
 - catalog prices.
 - includes spares and service contracts.
 - selective use of NSTX equipment.

WBS5 Aggregate Cost

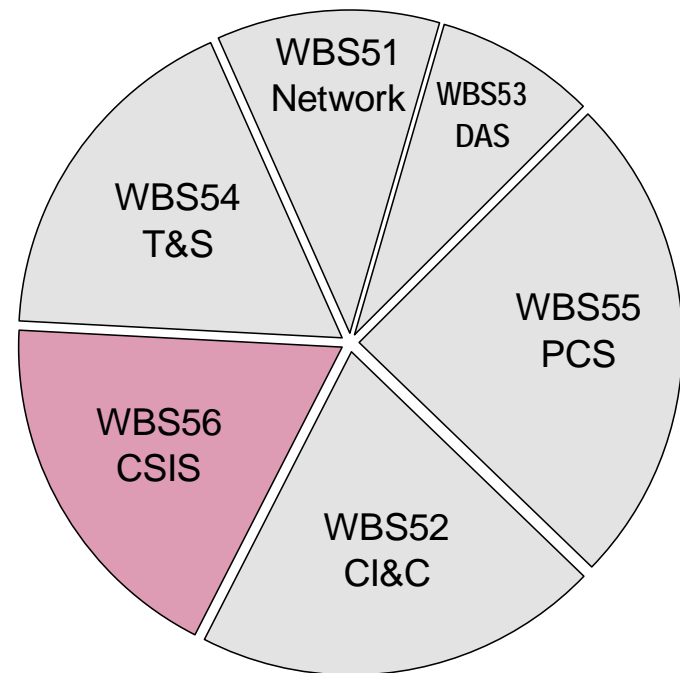


Reference *WAFs* for labor and M&S detail for WBS51-58.

http://ncsx.pppl.gov/Rebaseline/Rebaseline_index.htm

WBS5 ETC = \$ 2.1 M

Softwr/Elec Engineering: **3.6 years**
Elec/Mech/Draft Tech: **3.1 years**
'Materials & Services': **\$ 432 K**



Activity ID	MILE-STONE LEVEL	Activity Description	Duration (work days)	SHIFTS	Forecast Start	Forecast Finish	Total Float	Cost to Complete	Fiscal Year				
									FY08	FY09	FY10	FY11	FY12
55 - Real Time Plasma & Power Supply Control Sys													
Job: 5501 - Real Time Control System-SICHTA													
R55-10		FCPC - Preliminary Design	30		01OCT09*	11NOV09	209	20,611.52					
R55-11		PDR	0			11NOV09	209	0.00					
R55-20		FCPC -Final Design	60		12NOV09	17FEB10	209	38,767.40					
R55-21		FDR	0			17FEB10	209	0.00					
R55-30		FCPC - Procurement	65		19APR10*	20JUL10	167	178,272.60					
R55-40		Host Programming	115		21JUL10	10JAN11	172	17,751.25					
R55-42		ACQ Programming	115		21JUL10	10JAN11	167	11,834.16					
R55-45		PCS programming	115		21JUL10	10JAN11	167	17,751.25					
R55-48		PSRTC Programming	115		21JUL10	10JAN11	167	34,432.57					
R55-50		FCPC PLC Intgration-EPICS Prog	115		21JUL10	10JAN11	167	5,917.08					
R55-51		FCPC Data Acq & Ctl Installation	115		21JUL10	10JAN11	167	34,910.26					
R55-60		FCPC -Test	30		11JAN11	21FEB11	167	34,645.00					
R55-70		GISRTC - Preliminary Design	30		01OCT09*	11NOV09	219	10,696.80					
R55-71		PDR	0			11NOV09	219	0.00					
R55-80		GISRTC -Final Design	60		12NOV09	17FEB10	219	11,103.20					
R55-81		FDR	0			17FEB10	219	0.00					
R55-90		GISRTC - Procurement	60		18MAY10*	11AUG10	156	21,130.30					
R55-100		GISRTC Programming	115		12AUG10	01FEB11	156	11,915.30					
R55-110		GISRTC - Installation	115		12AUG10	01FEB11	156	33,107.79					
R55-120		GISRTC -Test	25		02FEB11	08MAR11	156	19,004.40					
56 - Central Safety and Interlock Systems													
Job: 5601 - Central Safety & Interlock Sys-SICHTA													
R56-10		Requirements, Codes&Standards	30		03AUG09*	14SEP09	191	5,591.20					
R56-20		Preliminary Design	45		15SEP09	16NOV09	191	19,182.49					
R56-21		PDR	0			16NOV09	191	0.00					
R56-30		PLC Training	15		17NOV09	09DEC09	191	19,363.00					
R56-35		Final Design	80		10DEC09	12APR10	191	43,600.00					
R56-36		FDR	0			12APR10	191	0.00					
R56-40		Procurement	60		13MAY10*	06AUG10	169	95,435.50					
R56-50		Safety PLC Programming	100		09AUG10	06JAN11	169	29,677.96					
R56-60		Installation (4 subsystems)	100		09AUG10	06JAN11	169	98,334.54					

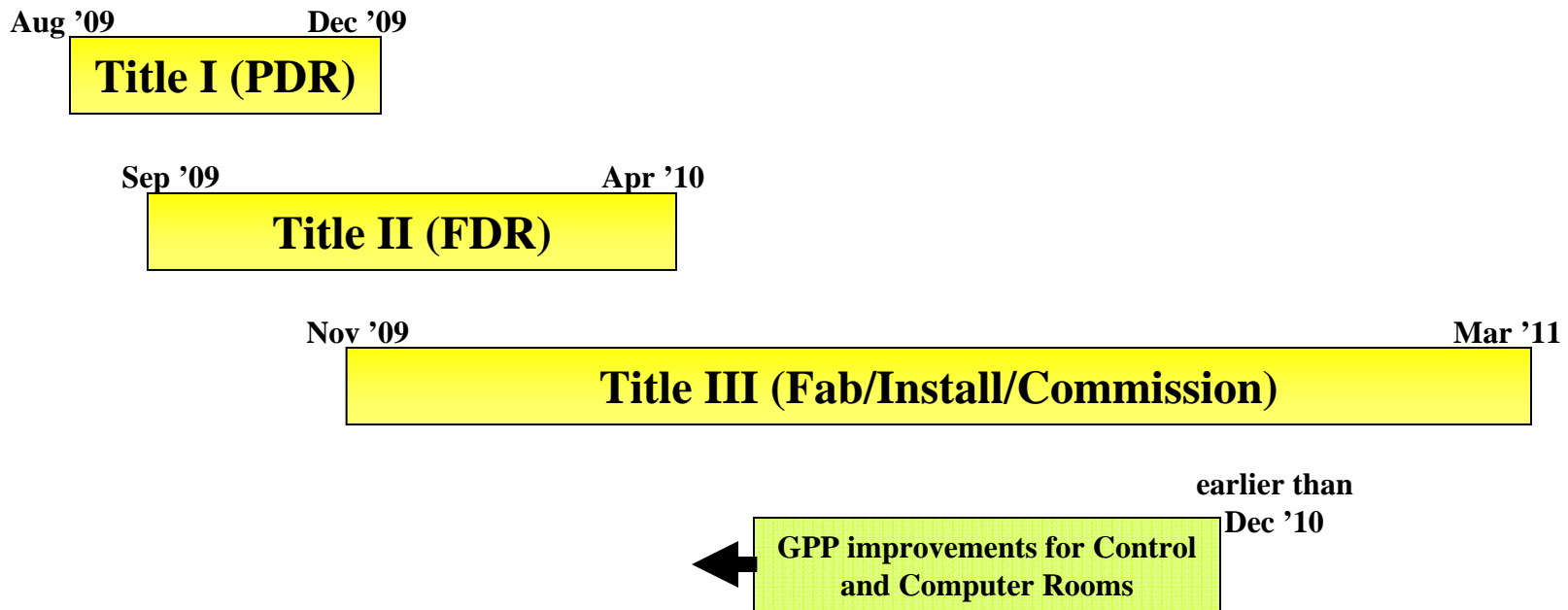


WBS51–WBS56 Aggregate Schedule



Reference *Resource Loaded Schedule* pages 53-56
for schedule detail for WBS51 – WBS58.

http://ncsx.pppl.gov/Reviews/FY08/BCP_2008/Docs/NCSX_RLS0403.pdf



Risks and Mitigation



Reference *NCSX Risk Register* (page 2, item 'e') for WBS5 risks.

http://ncsx.pppl.gov/Reviews/FY08/BCP_2008/Docs/RR_Rev28a.pdf

Risk Description	Mitigation Plan	Likelihood	Consequence	Risk Ranking
Loss of staff with experience in specialized software will delay availability of Central I&C system.	Staff have recently been brought on board in anticipation of growing NCSX I&C needs. The planned shutdown of NSTX after FY10 will increase the availability of similar resources for NCSX.	VU	Marginal	Low

Response to Past Review Findings



1. Work with ES&H on Safety System Requirements and design basis.

- PPPL's *ES&H Directives Manual, section 2-5 "Personnel and Safety Interlock Systems"* is in the process of being updated.

2. Document Basis of Estimate

- A WBS5 notebook has been prepared to compile the design basis.
 - Copies of recent requisitions for similar equipment.
 - Catalog cut-sheets with prices.
 - Actual NSTX engineering-hours (labor) tabulation for first plasma.

Conclusion



The NCSX central controls and computing are **similar in both function and scale to NSTX**. The availability of a technically diverse and **experienced staff** provides confidence that the WBS5 work elements will effectively support the NCSX project's CD-4 objectives.