TO: **A. vonHalle**
FROM: **P. Sichta**

SUBJECT: Closeout note for Data Acquisition and Facility Computing, Job 5301

Date: **July 23, 2008**

Scope

- *Like NSTX, will use the MDSplus software.*
- *A data management infrastructure to catalog and manage experimental results for subsequent retrieval and analysis.*
- *Automated pre-shot device configuration and post-shot data acquisition.*
- *A pool of computers for data analysis.*
- *An Applications Program Interface (API) for common data analysis software, such as C, IDL, Matlab, LabVIEW, and EPICS.*

Status

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

Interfaces

WBS53 will ultimately interface with most NCSX diagnostics. For MIE it will be limited to a few, depending upon the approved workscope.

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
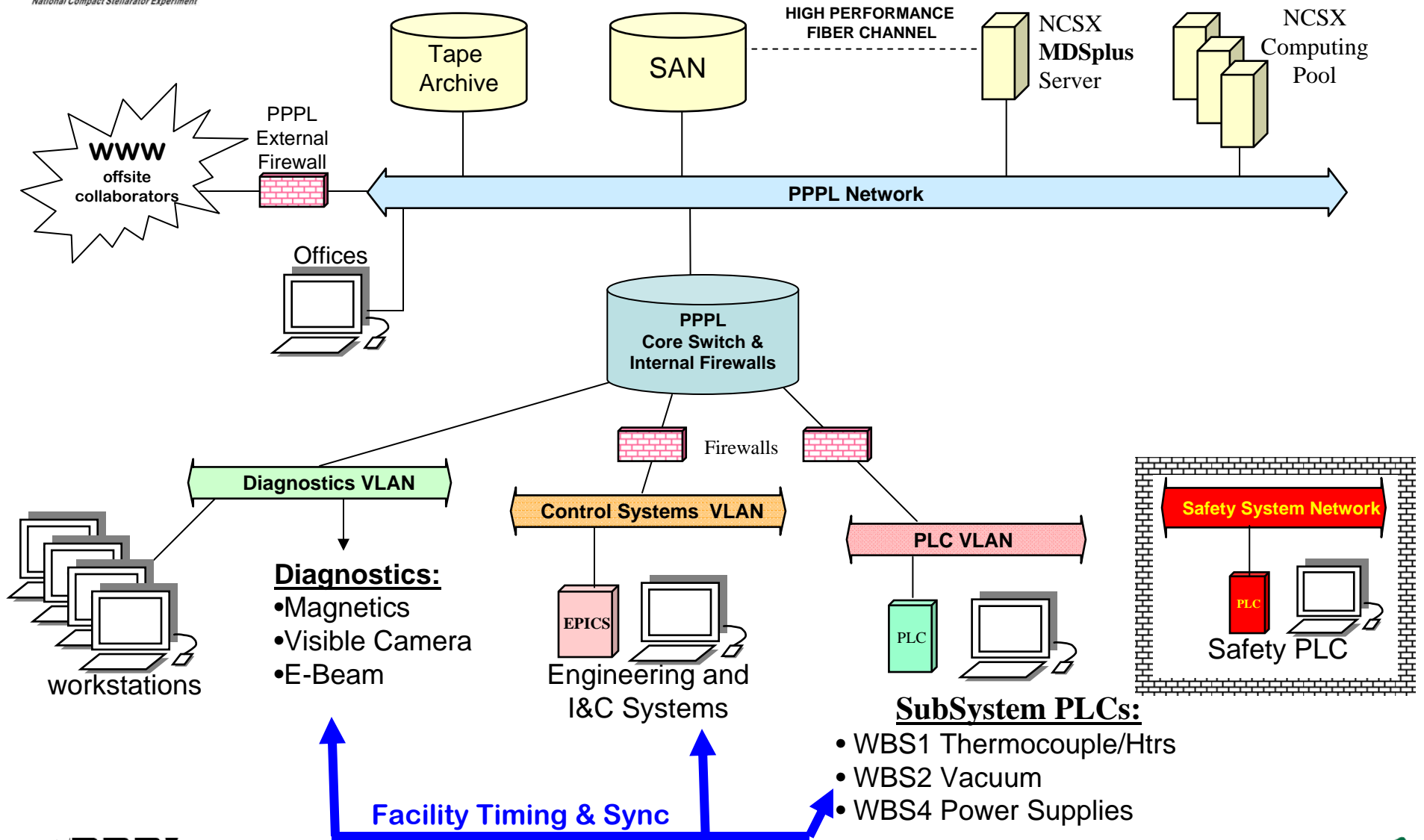
Requirements

- 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 *WAF*s 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**

WBS51 Network
WBS53 DAS
WBS54 T&S
WBS55 PCS
WBS56 CSIS
WBS52 CI&C

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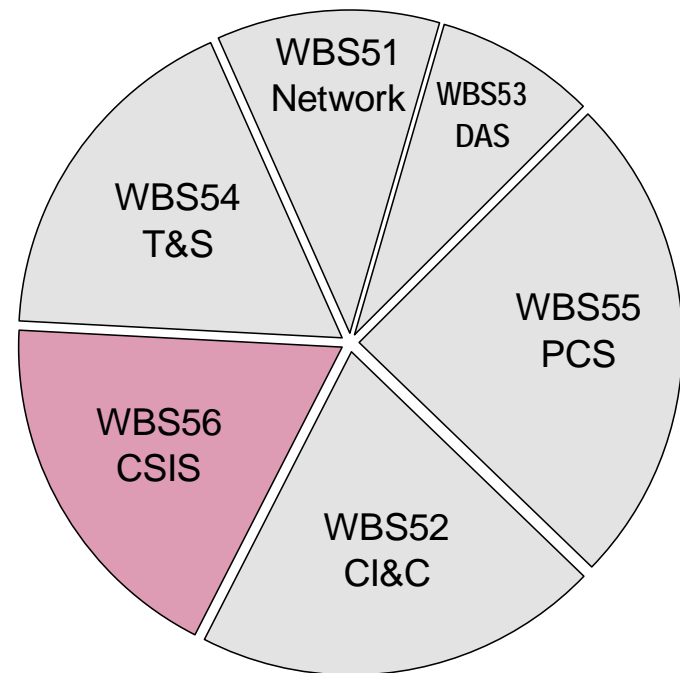
Activity ID	MILE-STONE LEVEL	Activity Description	Duration (work days)	SHIFTS	Forecast Start	Forecast Finish	Total Float	Cost to Complete	FY08	FY09	FY10	FY11	FY12

53 - Data Acquisition & Facility Computing

Job: 5301 - Data Acquisition-SICHTA

Activity ID	Activity Description	Duration	Forecast Start	Forecast Finish	Total Float	Cost to Complete	Chart annotation
R53-10	Preliminary Design	30	03AUG09*	14SEP09	182	5,591.20	EC//EM =40hr ;
R53-11	PDR	0		14SEP09	182	0.00	
R53-20	Final Design	30	15SEP09	26OCT09	182	11,378.72	EC//EM =80hr ;
R53-21	FDR	0		26OCT09	182	0.00	
R53-30	Procurement	30	27OCT09	09DEC09	182	32,291.40	EC//EM =20hr ; 37=02 ; 41=$22k
R53-40	Installation	30	10DEC09	01FEB10	182	3,006.00	EC//TB =40 ;
R53-50	MDSplus Installation	20	02FEB10	01MAR10	182	11,509.60	EC//EM =80hr ;
R53-60	MDSplus Programming - Tree Design	20	02MAR10	29MAR10	182	11,509.60	EC//EM =80hr ;
R53-70	MDSplus Programming - Shot Sync	20	30MAR10	26APR10	182	11,509.60	EC//EM =80hr ;
R53-100	Applications Support (3 Diags)	60	27APR10	21JUL10	182	8,632.20	EC//EM =60hr ;
R53-110	Programming - Misc.	60	27APR10	21JUL10	182	23,019.20	EC//EM =160hr ;
R53-80	MDSplus Programming - Dispatcher	60	23AUG10*	15NOV10	160	23,641.28	EC//EM =160hr ;
R53-90	MDSplus Programming - Acquisition	55	16NOV10	10FEB11	160	12,092.80	EC//EM =80hr ;
R53-120	Test	14	11FEB11	02MAR11	160	12,227.60	EC//EM =60hr ; EC//TB =40 ;

54 - Facility Timing & Synchronization

Job: 5401 - Facility Timing & Synchron.-SICHTA

Activity ID	Activity Description	Duration	Forecast Start	Forecast Finish	Total Float	Cost to Complete	Chart annotation
R54-10	Preliminary System Design	30	02NOV09*	15DEC09	202	11,403.80	EC//EM =60hr ;ec//tb=4;ea//sb=20
R54-11	PDR	0		15DEC09	202	0.00	
R54-20	Final SystemDesign	40	16DEC09	19FEB10	202	17,052.80	EC//EM =80hr ;ec//.tb=8;ea//sb=40
R54-21	FDR	0		19FEB10	302	0.00	
R54-30	Preliminary Design - Clock Dist.	20	22FEB10	19MAR10	302	15,311.10	EC//EM =20hr ; EE//EM =70hr ;ec//tb=4
R54-40	Final Design - Clock Dist.	30	22MAR10	30APR10	302	25,664.84	EC//EM =20hr ; EE//EM =128hr ;ec//tb=8
R54-50	Test - Clock Dist.	40	29JUN10	24AUG10	262	42,142.08	EC//EM =24hr ; EE//EM =120hr ; EE//TB =200hr ;ec//tb=24
R54-60	Procurement	90	22FEB10*	28JUN10	212	101,257.28	EC//EM =44hr ; 41=$71k
R54-70	UNT - Timing & Seq Emulation (FPGA Pgm)	90	16DEC09*	30APR10	342	14,901.40	EC//EM =20hr ; EC//TB =160 ;
R54-80	UNT - Device Driver Prog (EPICS/MDSplus)	120	19APR10	06OCT10	202	23,058.08	EC//EM =160hr ;
R54-90	Central Clock (EPICS) Programming	30	07OCT10	17NOV10	202	12,092.80	EC//EM =80hr ;
R54-100	Installation	90	30AUG10*	13JAN11	169	50,074.31	EC//EM =56hr ; EA//SB =40hr ; EC//TB =80 ; EM//TB =340hr ;
R54-110	Test	25	14JAN11	17FEB11	169	45,340.80	EC//EM =80hr ; EC//TB =100 ;ee//tb=300
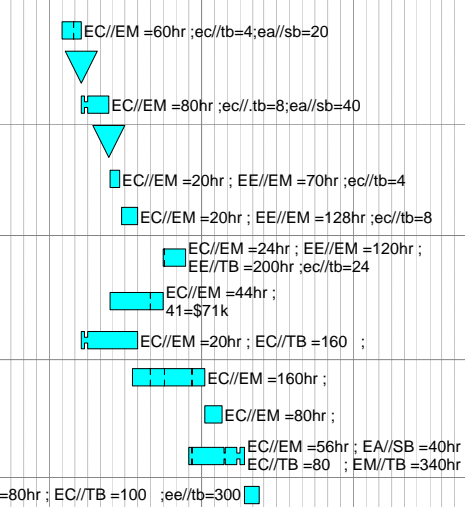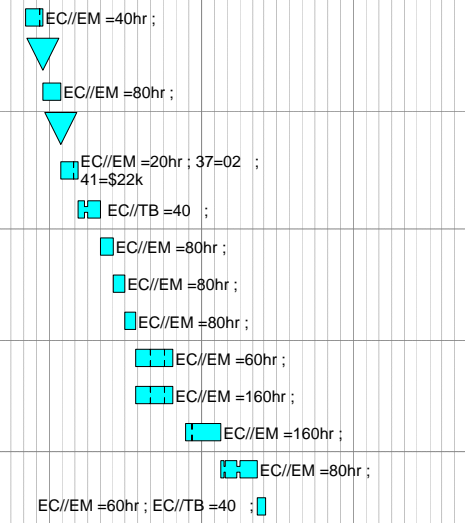
WBS51–WBS56 Aggregate Schedule

NCSX
National Compact Stellarator Experiment
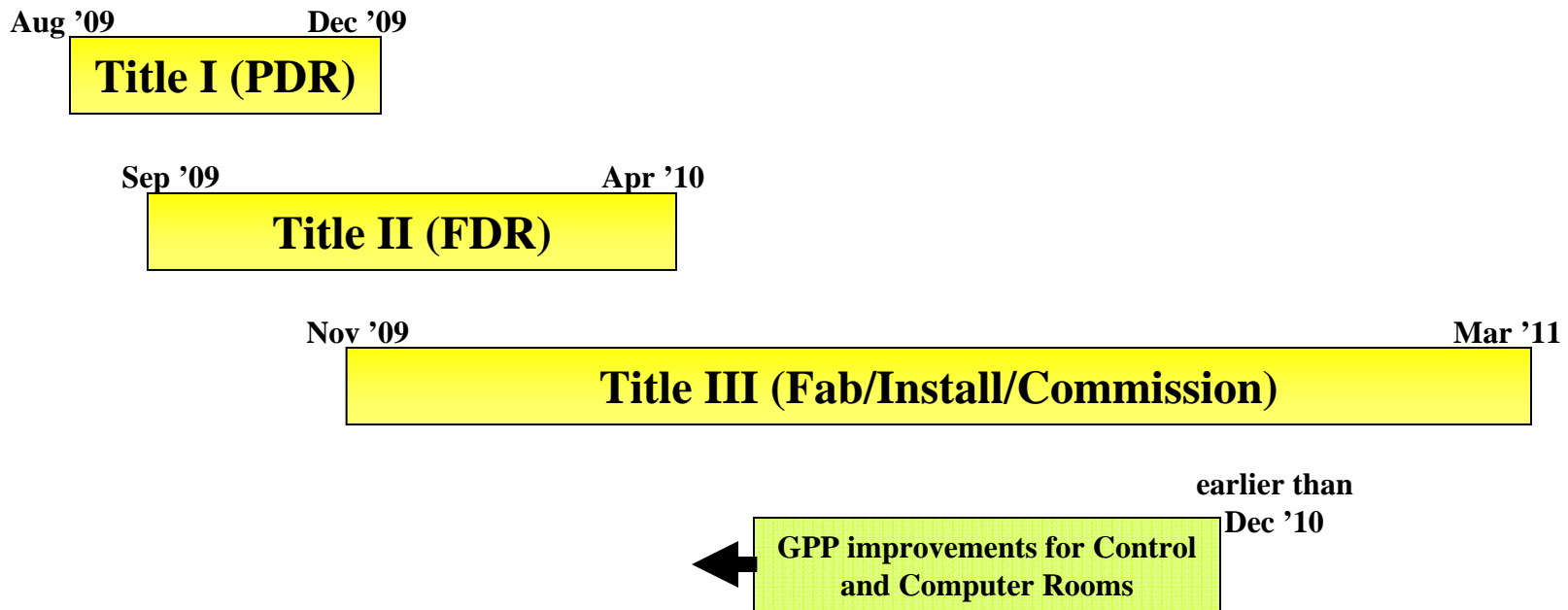
Reference *Resource Loaded Schedule* pages 53-56
for schedule detail for WBS51 – WBS58.
http://ncsx.pppl.gov//Reviews/FY08/BCP_2008/Docs/NCSX_RLS0403.pdf

Aug '09   **Dec '09**

Title I (PDR)

Sep '09   **Apr '10**

Title II (FDR)

Nov '09   **Mar '11**

Title III (Fab/Install/Commission)

earlier than Dec '10

GPP improvements for Control and Computer Rooms

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Risks and Mitigation

NCSX
National Compact Stellarator Experiment

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

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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.