

NCSX Project Review

November 2, 2005

Cost and Schedule

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Overview



- **Project Schedule**
 - FY05 Performance SPI = 0.95
 - Risks, vendor delays and impacts to date being mitigated.
 - Realistic detailed plans in place to complete project.
 - First plasma July 2009 with 5 months float.
- **Project budget**
 - Updated to reflect ETC's plus unrecoverable cost variances.
 - FY05 Performance CPI= 0.96
 - Opportunities identified to offset cost growth.
 - Plan consistent with anticipated BA funding guidance.
- **Project Contingency**
 - Contingency budget supported by bottoms up assessment. Near term risks quantified.
- **Project Controls**
 - Sound system in place. Provides value added forecasts, plans, staffing needs, early warning of cost/schedule issues and basis for “what-if” exercises.
 - Communication to stakeholders key to rapid issue resolution.

Proposed Changes to Performance Measurement Baseline



	Current Baseline	Unrecoverable Cost Variances	ETC Updates & Design Changes	Total Proposed Change	New PMB
12 - Vacuum Vessel Systems	9,400	(68)	107	39	9,439
13 - Conventional Coils	4,790	246	(205)	41	4,831
14 - Modular Coils	29,114	1,044	1,198	2,242	31,356
15 - Structures	1,413	(1)	(26)	(27)	1,386
16 - Coil Services	1,140		(5)	(5)	1,135
17 - Cryostat and Base Support Struct	1,361	178	(6)	172	1,533
18 - Field Period Assembly	5,430	(23)	(126)	(149)	5,281
19 - Stellarator Core Mgt & Integr	2,738	9	20	29	2,767
1 Stellarator Core Systems	55,386	1,385	957	2,342	57,728
2 Heating, Fueling & Vac Sys	783		8	8	791
3 Diagnostics	1,143	18	(12)	6	1,149
4 Electrical Power Sys	3,301	68	(64)	4	3,305
5 Central I&C Sys	2,050	(7)	(169)	(176)	1,874
6 Facility Sys	691		(13)	(13)	678
7 Test Cell Prep & MachAssy	4,373	129	54	183	4,556
8 Project Oversight & Support	12,630	1	3	4	12,634
subtotal	80,357	1,593	764	2,357	82,714
Contingency	11,969	(1,593)	(764)	(2,357)	9,612
TEC =	92,326				92,326
DCMA	75				75
	92,401				92,401

BCWR 44,400
 Contingency balance 9,612
 21.6%

Budget Reconciliation



Unrecoverable Cost Variances

wbs 13	TF Design	\$119	TF Design iterations
wbs 13	TF Fabrication facilities	\$149	Design time plus materials. Electrical sys debugging.
wbs 14	Modular Coil Type C detail design	\$409	Iterative process in conjunction with TRC fabrication.
wbs 14	Coil test facility fabrication and TRC testing	\$150	Cryogenic systems debugging and design. Safety design safeguards.
wbs 14	MCWF 1st production casting	\$137	(part of prototype contract)
wbs 14	MCWF contract oversight	\$110	Working with EIO addressing technical reqmnts and schedule.
wbs 17	Cryostat & base support structure prel dsn	\$178	Designer and engineering time underestimated
wbs 74	Test cell electrical power supply	\$178	House power for test cell.
wbs 4	Electrical pwr sys DC sys & coil protection	\$68	DC systems engineering.
Other		<u>\$95</u>	
		\$1,593	

Budget Reconciliation



Proposed PMB Updates

wbs 12	Vacuum Vessel Design incl Title III	\$204	Redesign of insulation scheme and cooling tubes
wbs 12	VV Hardware	(\$98)	Cheaper tubes and insulation
wbs 131	TF Coil fabrication	\$432	Facility, Material and winding operation
wbs 132	PF Coil design/fab	(\$466)	Use NSTX PF1a coil for central solenoid
wbs 133	Trim Coils	(\$154)	Simplify design of trim coils
wbs 14	Modular Coil Design for Type A & B incl interface hardware	\$520	re-estimated based on Type C experience
wbs 14	Modular Coil Winding -Operations	(\$17)	Increased time for ground wrap, interlacing and shift differential offset by supervision and oversight reduction due to shorten schedule.
wbs 14	Modular coil-to-coil interface hardware	\$655	Underestimated cost of shims and high strength bolts
wbs 14	MCWF Title III	\$69	Req'd oversight of contract
wbs 18	Eliminated 350C bakeout of field period assy	(\$40)	
wbs 18	Field Period Tooling and Fixturing	(\$50)	Only 1 set of fixtures req'd
wbs 31	Magnetic Diagnostics	\$62	Saddle loops and termination box design/fab
wbs 38	E-beam mapping	(\$104)	Simplified application
wbs 81	Project Management	(\$54)	Revised FY09 ETC Reqmnt
wbs 82	Dimensional control	\$84	Coordination of metrology and design integration
wbs 5x	Plasma Control	(\$100)	Simplified Plasma Control
Other	re-scheduling and laboratory rate changes	<u>(\$180)</u>	
		\$764	

Risk & Opportunities



	Risk	Opportunity
Modular Coil Winding Operations	\$661 Re-evaluate in 3rd quarter with experience gained winding first 3 coils.	(\$445) Process improvement studies challenge to reduce hours by 10%.
TF Coil Winding Operations	\$448 Winding Operations in FY07 & FY08 to be re-evaluated after first coil is fabricated.	(\$82) Process improvement studies challenge to reduce hours by 10%.
TF,PF Coil and Structure		~(\$1,000) Chinese Fusion Laboratory
Field Period & Machine Assembly		(\$404) Two shift field period assy and final machine assy. Accelerates first plasma by 2 months.
	\$1,109	(\$1,931)

Contingency Analysis



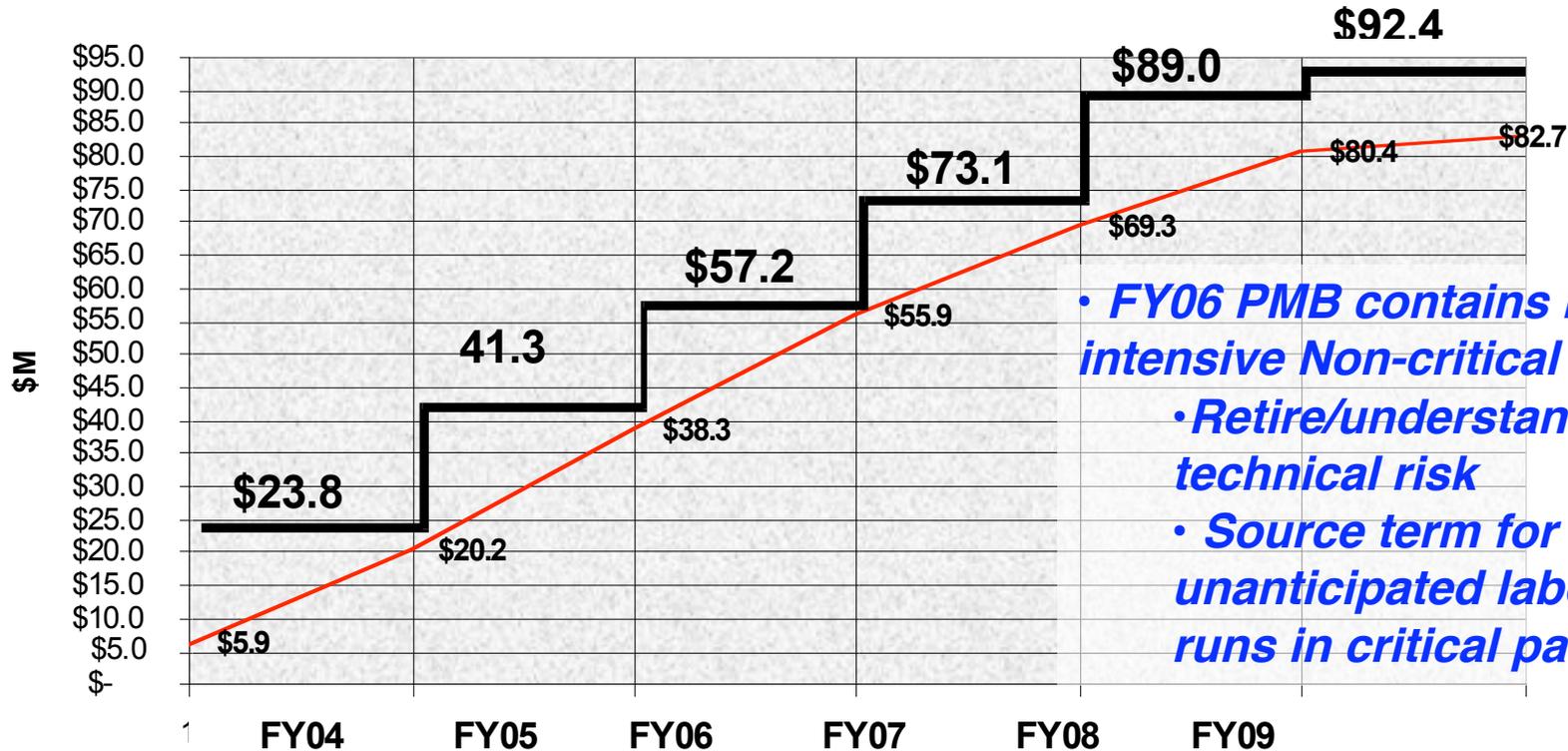
Contingency Supported by Updated Risk Assessment

	<u>Proposed PMB</u>	<u>BCWR</u>	<u>Contingency</u>	<u>%</u>
12 - Vacuum Vessel Systems (wo/VVSA)	4,305	863	209	24%
VVSA Contract	5,134	2,392	240	10%
13 - Conventional Coils	4,827	3,316	1,268	38%
14 - Modular Coils (wo/MCWF)	23,159	8,086	2,323	29%
MCWF Contract	8,192	4,499	450	10%
15 - Structures	1,386	1,308	391	30%
16 - Coil Services	1,135	1,135	341	30%
17 - Cryostat and Base Support Struct	1,533	1,162	347	30%
18 - Field Period Assembly	5,280	3,945	1,179	30%
19 - Stellarator Core Mgt & Integr	2,767	1,283	128	10%
1 Stellarator Core Systems	57,719	27,989	6,876	24.6%
2 Heating, Fueling & Vac Sys	791	443	62	14%
3 Diagnostics	1,149	744	176	24%
4 Electrical Power Sys	3,305	2,779	549	20%
5 Central I&C Sys	1,874	1,840	187	10%
6 Facility Sys	679	654	131	20%
7 Test Cell Prep & MachAssy	4,563	3,667	793	22%
8 Project Oversight & Support	12,634	6,285	838	13%
subtotal	82,714	44,401	9,612	21.6%
Contingency	9,612			
TEC =	92,326			
DCMA	75			
	92,401			
<i>VVSA Contract</i>	<i>5,134</i>	<i>2,392</i>	<i>240</i>	<i>10%</i>
<i>MCWF Contract</i>	<i>8,192</i>	<i>4,499</i>	<i>450</i>	<i>10%</i>
<i>WBS 12-18</i>	<i>41,625</i>	<i>19,815</i>	<i>6,058</i>	<i>31%</i>
<i>WBS 2-7 & 85 (BOP)</i>	<i>13,560</i>	<i>11,326</i>	<i>2,209</i>	<i>20%</i>
<i>WBS 19,81 & 82</i>	<i>14,203</i>	<i>6,369</i>	<i>655</i>	<i>10%</i>
	<i>82,714</i>	<i>44,401</i>	<i>9,612</i>	<i>21.6%</i>

Plan supports BA guidance w/adequate contingency



Cost Profile



- *FY06 PMB contains labor intensive Non-critical work*
- *Retire/understand technical risk*
- *Source term for unanticipated labor over-runs in critical path work*

		FY03	FY04	FY05	FY06	FY07	FY08	FY09	Total
BA	\$	7.9	\$ 15.9	\$ 17.5	\$ 15.9	\$ 15.9	\$ 15.9	\$ 3.4	\$ 92.4
PMB	\$	5.9	\$ 14.2	\$ 18.2	\$ 17.5	\$ 13.4	\$ 11.1	\$ 2.3	\$ 82.7
Contingency				\$	\$ 1.3	\$ 2.5	\$ 4.8	\$ 1.0	\$ 9.6
BO (PMB + Cont)	\$	5.9	\$ 14.2	\$ 18.2	\$ 18.8	\$ 15.9	\$ 15.9	\$ 3.4	\$ 92.4

NCSX Milestone Status



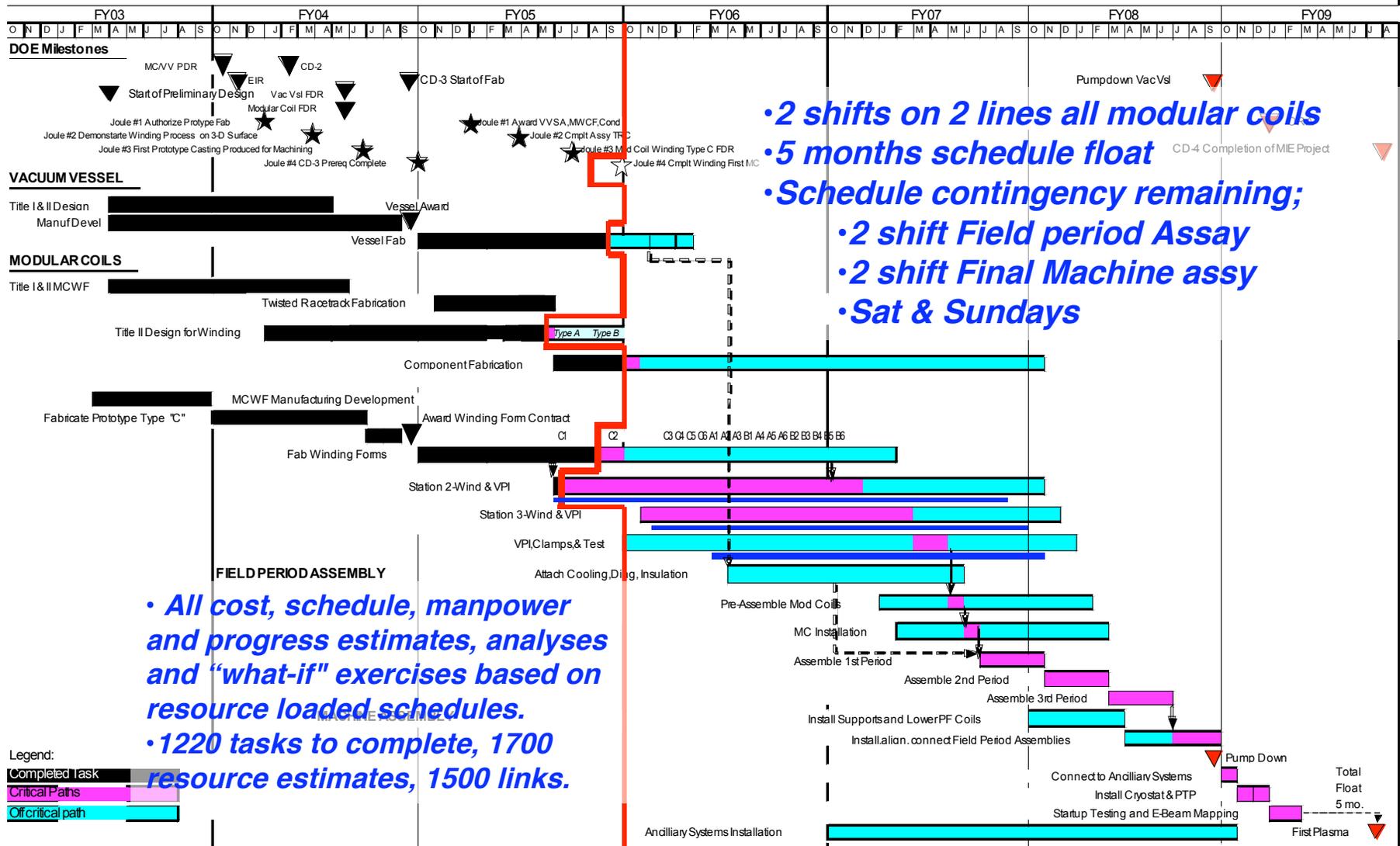
		<u>Baseline</u>	<u>Forecast</u>	<u>Actual</u>
Level I	CD-1	May-2003		<i>May-2003</i>
	CD-2	Feb-2004		<i>Feb-2004</i>
	CD-3	Sep-2004		<i>Sep-2004</i>
	CD-4	Jul-2009	<i>Feb-2009</i>	
Level II	Vacuum Vessel & Modular Coil Prel Dsn Rvw	Oct-2003		<i>Oct-2003</i>
	Performance Baseline Review	Nov-2003		<i>Nov-2003</i>
	Conduct VVSA FDR	Jul-2004		<i>May-2004</i>
	Mod Coil Winding Form Final Design Review	Jul-2004		<i>May-2004</i>
	Award MC Conductor Contract	Dec-2004		<i>Oct-2004</i>
	Award VV Production Vendor	Oct-2004		<i>Sep-2004</i>
	Award MCWF Mfg Contract	Oct-2004		<i>Sep-2004</i>
	First MCWF Delivered	Jul-2005		<i>Sep-2005</i>
	Begin TF Coil fabrication activities	Sep-2005		<i>Jun-2005</i>
	Complete First Mod Coil Fabrication	Mar-2006	<i>Feb-2006</i>	
	Vacuum Vessel Sectors Delivered	Sep-2006	<i>Mar-2006</i>	
	Last MCWF Delivered	Jun-2007	<i>Feb-2007</i>	
	PF Coils Awarded	Mar-2008	<i>Oct-2007</i>	
	Begin Assembly of First Field Period	Jul-2007	<i>Jan-2007</i>	
	All TF Coils Delivered	Aug-2008	<i>Nov-2007</i>	
	Last Field Period Assembled	Nov-2008	<i>Jun-2008</i>	
	Begin Vac Vsl Pumpdown	Feb-2009	<i>Sep-2008</i>	
	Begin Cryostat Installation	Apr-2009	<i>Nov-2008</i>	
Operational Readiness	Jun-2009	<i>Dec-2008</i>		
Begin Start-up Testing	Jun-2009	<i>Jan-2009</i>		
Joule	FY04 JOULE #1-Authorize Prototype Fab	Dec-2003		<i>Oct-2003</i>
	FY04 JOULE #2-Begin winding on 3D surface	Mar-2004		<i>Jan-2004</i>
	FY04 JOULE #3-Prototype Casting Ready for Machining	Jun-2004		<i>May-2004</i>
	FY04 JOULE #4 - CD-3 Readiness	Sep-2004		<i>Sep-2004</i>
	FY05 JOULE #1- VVSA, MCWF and MC Copper Conductor Awarded	Dec-2004		<i>Oct-2004</i>
	FY05 JOULE #2- Cmplt Assy of twisted racetrack	Mar-2005		<i>Mar-2005</i>
	FY05 JOULE #3- Mod Coil Winding Type C FDR	Jun-2005		<i>Jun-2005</i>
	FY05 JOULE #4- Complete Winding First MC	Sep-2005	<i>Dec-2005</i>	
	FY06 JOULE Receive all VVSA and 1/3 of MCWF's	Sep-2006	<i>Mar-2006</i>	
	FY07 JOULE Complete Winding of 1/2 of Modular Coils	Sep-2007	<i>Nov-2006</i>	

• Request change of Vac Vsl delivery milestone from May to September (Non-critical path task would have 12 mo. free float remaining)

Sound Plan to Complete Project on Schedule



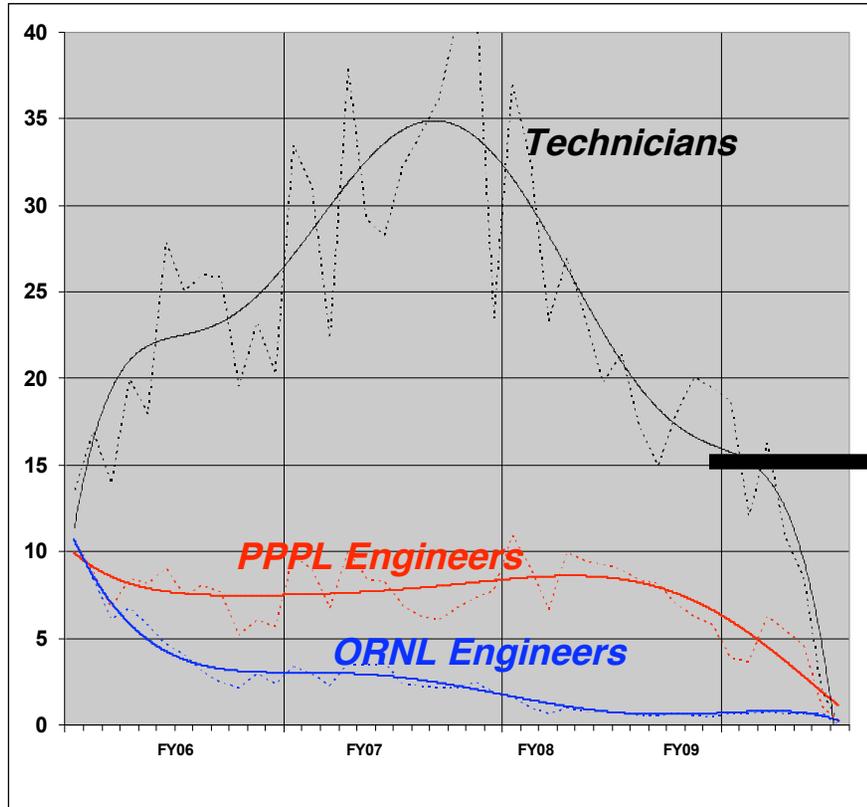
NCSX Critical Path Summary Schedule



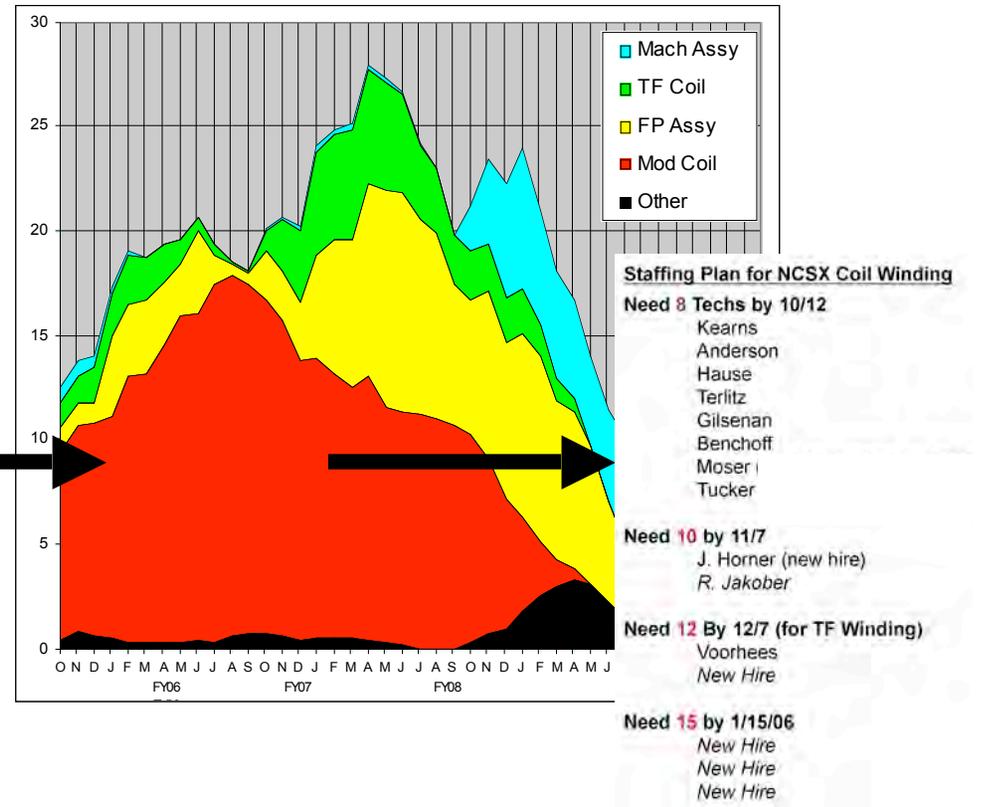
Staffing needs being met



Project Staffing
(incl contingency for risk)



Mechanical Technicians
(inc contingency for risk)



Project Controls Operating per DOE 413



- **Organization**
 - WBS managers identified and held accountable for technical, cost schedule & safety
 - WBS used as basis for organizing and defining scope, used as basis for all estimates
 - Project organization responsive to current mission; Dudek assigned as RLM for Fabrication

- **Planning**
 - Resource loaded schedule basis for all budgets, manpower projections, plans, and progress
 - Manpower; Names of individuals provide assurance of schedule realism. Term staff hiring in progress
 - Responsive to re-baselining exercises, ETC requests, “what-if” exercises

Project Controls Operating per DOE 413



- **Reporting/Communications**
 - Monthly progress status
 - Earned value reports, schedule performance detail, variance & critical path analyses
 - Vendor; Weekly reports, visits, weekly phone calls
 - Internal; Deputy director weekly, SIT weekly, QA weekly, Engineering weekly
 - External; IPT, Lehman reviews, DOE quarterly, PARS , WEB site posting of data reports.

- **Control**
 - ECP's document scope, schedule and/or cost changes. Required to change official performance measurement baseline.
 - Change control board dispositions all changes. DOE notified prior to change being processed.

Conclusion



- Project Plans updated to reflect a realistic plan forward
 - ETC's, unrecoverable cost variances and risks recognized.
 - Detailed plans updated to show current understanding incl vendor forecasts.
 - Adequate schedule and budget contingency
 - Manpower needs being met
- Project management functioning effectively
 - Organization reactive to near term focus
 - Cost, schedule, technical and safety issues being controlled and communicated to stakeholders