

Work Authorization Document

NSTX Upgrade Project

Control Account #:	8200	Title:	CS & Coil Sprt Struc Install
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WBS	1.8.2	Title:	Site Preparation and Torus Assembly
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Period of Performance: 02 November 2009 through 30 September 2014

Authorized Budget:	\$6,474	Control Account Manager: Viola
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Revision #: 0	Revision Date: July-11
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Authorized Work Description:

Torus Assembly and construction includes the assembly and installation of the NSTX torus, coils systems and all associated supports including construction management. This WBS element includes removal of equipment for clearance and accessibility, moving existing coils, cutting off existing supports mounted on the vacuum vessel and installing a new external cage support structure and reinstalling, testing and commissioning the equipment removed.

Attachments:

- 1- A detailed Control Account schedule showing all work packages and planning packages.
- 2- Budgeted Cost by month.
- 3- Original Work Authorization Form (WAF)
- 4- WBS Dictionary sheet that defines the scope of work for this WBS element.

Control Account History

ECP#	Implement Date	Prior Budget	New Budget	Signature

Approvals	Name	Signature	Date
NSTX-U Project Manager	R. Strykowski		
Control Account Manager	Viola		
Functional Manager	L. Dudek		

Activity ID	Activity Description	Work Days	BEGINNING DATE	FORECAST START	BEGINNING FINISH	FORECAST FINISH	Schedule Slip (Days)	Total Float	Budgeted Cost	PPCT	Earned value cost (BCWP)	Planned value cost (BCWS)	FY11	FY12	FY13	FY14	FY15	FY16
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NSTX Upgrade Project

Subtotal		1,222	02NOV09A	02NOV09A	30SEP14	30SEP14	0	1,487	6,472,034.88		67,189.32	67,219.45						
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Job; 8200 - CS & Coil Sprt Struc Install- VIOLA

Subtotal		1,222	02NOV09A	02NOV09A	30SEP14	30SEP14	0	1,487	6,472,034.88		67,189.32	67,219.45						
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Close Vessel and Pumpdown

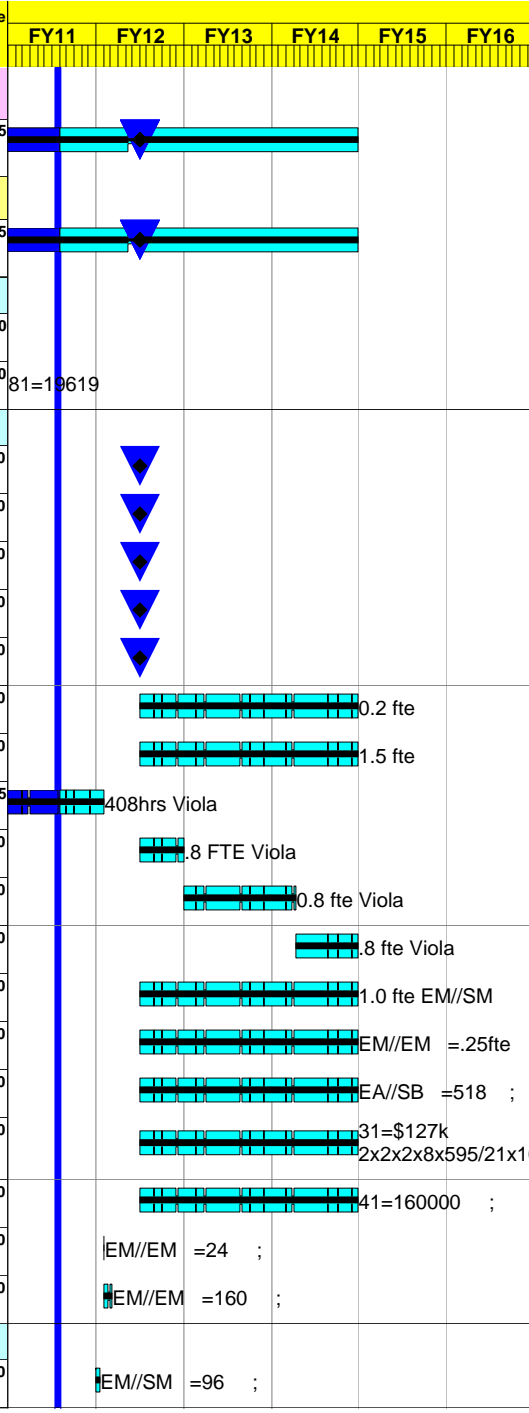
FY108200	FY10 Actual Cost	123	02NOV09A	02NOV09A	30APR10A	30APR10A	0		19,070.00	100	19,070.00	19,070.00						
FY108200A	FY10 Actual Cost	110	03MAY10A	03MAY10A	30SEP10A	30SEP10A	0		6,473.00	100	6,473.00	6,473.00						

Management/Oversight/supervision

8200-0002	Designs complete	0	03APR12*	03APR12*			0	139	0.00		0.00	0.00						
8200-0003	Sequence complete	0	03APR12*	03APR12*			0	139	0.00		0.00	0.00						
8200-0004	Parts arrived	0	03APR12*	03APR12*			0	139	0.00		0.00	0.00						
8200-0005	Start procedural development	0	03APR12*	03APR12*			0	139	0.00		0.00	0.00						
8200-0006	Mobilize crews	0	03APR12*	03APR12*			0	139	0.00		0.00	0.00						
8200-0010	Shop Fabrication oversight 20% FTE for duration	622	03APR12*	03APR12*	30SEP14	30SEP14	0	1,487	152,188.51		0.00	0.00						
8200-0011	Shop Fabrication support 1.5 FTE for duration	622	03APR12*	03APR12*	30SEP14	30SEP14	0	1,487	719,690.36		0.00	0.00						
8200-0012	Assembly oversight prior to outage (fy10 & fy11)	377*	03MAY10A	03MAY10A	31OCT11	31OCT11	0	218	63,100.49	LOE	41,646.32	41,676.45						
8200-0012A	Assembly oversight 1 FTE Engr	125	05APR12*	05APR12*	01OCT12	01OCT12	0	1,487	121,864.27		0.00	0.00						
8200-0012B	Assembly oversight 0.6 FTE Engr	312	02OCT12*	02OCT12*	13JAN14	13JAN14	0	1,487	307,786.97		0.00	0.00						
8200-0012C	Assembly oversight 1 FTE Engr	183	14JAN14*	14JAN14*	30SEP14	30SEP14	0	1,487	208,719.16		0.00	0.00						
8200-0013	Assembly oversight 1 FTE SM	620	05APR12*	05APR12*	30SEP14	30SEP14	0	1,487	762,210.43		0.00	0.00						
8200-0014	Title 3 Support Engineer	622	03APR12*	03APR12*	30SEP14	30SEP14	0	1,487	186,516.75		0.00	0.00						
8200-0015	Title 3 Support Drafting	622	03APR12*	03APR12*	30SEP14	30SEP14	0	1,487	73,180.71		0.00	0.00						
8200-0016	OT for efficiency (2 crews 1 weekend a month)	622	03APR12*	03APR12*	30SEP14	30SEP14	0	1,487	264,376.43		0.00	0.00						
8200-0017	MISC M&S \$250 per day* 2 crews	622	03APR12*	03APR12*	30SEP14	30SEP14	0	1,487	212,141.48		0.00	0.00						
8200-0020	PREPARE WORK PLANNING FORM	3	01NOV11*	01NOV11*	03NOV11	03NOV11	0	218	4,163.76		0.00	0.00						
8200-0021	Fab/Assy Installation Procedure	20	04NOV11*	04NOV11*	05DEC11	05DEC11	0	218	27,758.40		0.00	0.00						

Bay by Bay Diagnostic Catalogue

8200-0026	Perform bay by bay catalogue and label Elect	12	03OCT11*	03OCT11*	18OCT11	18OCT11	0	193	16,567.68		0.00	0.00						
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Data Date: 30APR11 1105
 Run Date: 20MAY11 11:06

NSTX UPGRADES
 RESOURCE LOADED SCHEDULE
 CD-2 Schedule
 April 2011

Sheet 1 of 5

- Early Bar
- Progress Bar
- Critical Activity

Activity ID	Activity Description	Work Days	BASELINE START	Forecast Start	BASELINE FINISH	Forecast Finish	Schedule Slip (Days)	Total Float	Budgeted Cost	PPCT	Earned value cost (BCWP)	Planned value cost (BCWS)	FY11	FY12	FY13	FY14	FY15	FY16
8200-0027	Perform bay by bay catalogue and label Mech	12	19OCT11*	19OCT11*	03NOV11	03NOV11	0	193	16,567.68		0.00	0.00						
8200-0028	Write removal procedures	60	04NOV11	04NOV11	07FEB12	07FEB12	0	193	82,838.40		0.00	0.00						
8200-0028A	RF Line develop as-built assy drawing	99*	03OCT11*	14FEB11A	28OCT11	01JUL11	83	381	14,989.20	60	0.00	0.00						
8200-0029	Remove RF pipes	20	03APR12*	03APR12*	30APR12	30APR12	0	195	154,331.60		0.00	0.00						
8200-0030	Write Electrical Removal & Installation Procedur	20	03OCT11*	03OCT11*	28OCT11	28OCT11	0	242	13,806.40		0.00	0.00						
8200-0031	Safe, remove and store Elect	15	03APR12*	03APR12*	23APR12	23APR12	0	139	32,637.00		0.00	0.00						
8200-0032	Upper Tray remove and store Elect	20	24APR12	24APR12	21MAY12	21MAY12	0	180	43,516.00		0.00	0.00						
8200-0033	Remove and store Mech	10	22MAY12*	22MAY12*	05JUN12	05JUN12	0	119	43,516.00		0.00	0.00						
8200-0034	Remove and store Upper and lower port eqpt	18	06JUN12*	06JUN12*	29JUN12	29JUN12	0	122	39,164.40		0.00	0.00						
8200-0035	Remove section of platform	10	01AUG12*	01AUG12*	14AUG12	14AUG12	0	101	43,516.00		0.00	0.00						
8200-0036	Fiducialize Coil and Vacuum vessel	20	15AUG12	15AUG12	12SEP12	12SEP12	0	101	45,164.80		0.00	0.00						
Equipment Removals																		
8200-0039	Remove insulation	15	02JUL12*	02JUL12*	23JUL12	23JUL12	0	101	32,637.00		0.00	0.00						
8200-0040	Gas Injection System	15	24JUL12	24JUL12	13AUG12	13AUG12	0	101	32,637.00		0.00	0.00						
8200-0041	Disconnect trim coil and lock mode coil	2	14AUG12	14AUG12	15AUG12	15AUG12	0	101	4,351.60		0.00	0.00						
8200-0042	Remove trim coil and lock mode coil	4	16AUG12	16AUG12	21AUG12	21AUG12	0	101	8,703.20		0.00	0.00						
8200-0043	Clear platform and area to remove bad TF	10	22AUG12	22AUG12	05SEP12	05SEP12	0	101	21,758.00		0.00	0.00						
8200-0044	Remove bad TF	5	06SEP12	06SEP12	12SEP12	12SEP12	0	101	21,758.00		0.00	0.00						
LLD Removal/Original Outer Divertor re-install																		
8200-1001	Remove LLD	20	13SEP12	13SEP12	10OCT12	10OCT12	0	433	43,882.40		0.00	0.00						
8200-1004	Machine original OD tiles for Diag sensors	10	01OCT13*	01OCT13*	14OCT13	14OCT13	0	193	9,187.20		0.00	0.00						
8200-1008	Re-install Diag sensors into original OD tiles	10	15OCT13*	15OCT13*	28OCT13	28OCT13	0	193	22,968.00		0.00	0.00						
8200-1012	Install original OD tiles and supports	20	10APR14*	21APR14*	07MAY14	16MAY14	-7	79	45,936.00		0.00	0.00						
Upper Half																		
8200-0048	Umbrella Lid Remove existing	1	13SEP12	13SEP12	13SEP12	13SEP12	0	101	6,931.60		0.00	0.00						
8200-0048A	Umbrella lid weld new rim	12	27SEP13	27SEP13	14OCT13	14OCT13	0	67	30,101.20		0.00	0.00						
8200-0049	VV Umbrella legs Weld reinforcement plates	24	15OCT13	15OCT13	15NOV13	15NOV13	0	67	55,123.20		0.00	0.00						
8200-0050	VV umbrella legs Remove existing Hardware	5	18NOV13	18NOV13	22NOV13	22NOV13	0	67	11,484.00		0.00	0.00						
8200-0051	Umbrella legs add reinforcement plate	5	25NOV13	25NOV13	03DEC13	03DEC13	0	67	11,484.00		0.00	0.00						
8200-0052	TF Install Datums & Remove turnbuckles	8	25MAR13	25MAR13	03APR13	03APR13	0	62	17,772.80		0.00	0.00						
8200-0052A	TF U&L Remove Existing clevis bolts	12	04APR13	04APR13	19APR13	19APR13	0	62	26,659.20		0.00	0.00						

Activity ID	Activity Description	Work Days	BASELINE START	Forecast Start	BASELINE FINISH	Forecast Finish	Schedule Slip (Days)	Total Float	Budgeted Cost	PPCT	Earned value cost (BCWP)	Planned value cost (BCWS)	FY11	FY12	FY13	FY14	FY15	FY16			
8200-0052B	TF reinforce clevis	12	22APR13	22APR13	07MAY13	07MAY13	0	62	26,659.20		0.00	0.00							EM//ST =240 ;		
8200-0052C	TF Install new TF wet layup & clamp	9	08MAY13	08MAY13	20MAY13	20MAY13	0	62	19,994.40		0.00	0.00							EM//ST =180 ;		
8200-0053	TF Install new clamps	12	21MAY13	21MAY13	06JUN13	06JUN13	0	62	26,659.20		0.00	0.00							EM//ST =240 ;		
8200-0054	TF Install Vessel Ties & Align	18	07JUN13	07JUN13	02JUL13	02JUL13	0	62	39,988.80		0.00	0.00							EM//ST =360 ;		
8200-0055	TF Install new hoop brace	12	03JUL13	03JUL13	22JUL13	22JUL13	0	62	26,659.20		0.00	0.00							EM//ST =240 ;		
8200-0056	TF Align and match drill new hoop brace	18	23JUL13	23JUL13	15AUG13	15AUG13	0	62	39,988.80		0.00	0.00							EM//ST =360 ;		
8200-0057	TF Install and torque all bolts	8	16AUG13	16AUG13	27AUG13	27AUG13	0	62	17,772.80		0.00	0.00							EM//ST =160 ;		
8200-0058	Design & build lifting method	16	03OCT11*	03OCT11*	24OCT11	24OCT11	0	323	111,948.96		0.00	0.00							EM//ST =384 ; EM//EM =128 ; 41=10,000 ; EA/SB =256 ;		
8200-0059	PF2 Mark Location: lift and support	1	14SEP12	14SEP12	14SEP12	14SEP12	0	101	2,175.80		0.00	0.00							EM//ST =20 ;		
8200-0060	PF2 Replace existing hardware (bolted)	1	26NOV12	26NOV12	26NOV12	26NOV12	0	53	2,221.60		0.00	0.00							EM//ST =20 ;		
8200-0061	PF2 Install New plates (bolted)	4	27NOV12	27NOV12	30NOV12	30NOV12	0	53	8,886.40		0.00	0.00							EM//ST =80 ;		
8200-0062	PF2 weld reinforcement	8	03DEC12	03DEC12	12DEC12	12DEC12	0	53	17,772.80		0.00	0.00							EM//ST =160 ;		
8200-0063	PF2 Reinstall & Realign	2	13DEC12	13DEC12	14DEC12	14DEC12	0	53	4,443.20		0.00	0.00							EM//ST =40 ;		
8200-0064	PF3 lift and support	2	17DEC12	17DEC12	18DEC12	18DEC12	0	53	4,443.20		0.00	0.00							EM//ST =40 ;		
8200-0065	PF3 remove bolted support	1	19DEC12	19DEC12	19DEC12	19DEC12	0	53	2,221.60		0.00	0.00							EM//ST =20 ;		
8200-0066	PF3 Install new bolted support	8	20DEC12	20DEC12	09JAN13	09JAN13	0	53	17,772.80		0.00	0.00							EM//ST =160 ;		
8200-0067	PF3 weld reinforcement	18	10JAN13	10JAN13	04FEB13	04FEB13	0	274	39,988.80		0.00	0.00							EM//ST =360 ;		
8200-0068	PF3 Reinstall & Realign	3	05FEB13	05FEB13	07FEB13	07FEB13	0	274	8,886.40		0.00	0.00							EM//ST =80 ;		
8200-0069	PF5U/L Disconnect existing midplane columns	4	10JAN13	10JAN13	15JAN13	15JAN13	0	53	8,886.40		0.00	0.00							EM//ST =80 ;		
8200-0070	PF4, 5 lift and install 1/4" plate	8	16JAN13	16JAN13	25JAN13	25JAN13	0	53	17,772.80		0.00	0.00							EM//ST =160 ;		
8200-0071	PF4, 5 Install newbolts and torque	6	28JAN13	28JAN13	04FEB13	04FEB13	0	53	13,329.60		0.00	0.00							EM//ST =120 ;		
8200-0072	Prefit &match drill new umbrella lid	10	05FEB13	05FEB13	18FEB13	18FEB13	0	53	44,432.00		0.00	0.00							EM//ST =400 ;		
Lower Half																					
8200-0076	Umbrella Lid Remove existing	1	27NOV12	27NOV12	27NOV12	27NOV12	0	103	4,443.20		0.00	0.00							EM//ST =40 ;		
8200-0076A	Umbrella Lid weld new rim	12	24JUN13	24JUN13	11JUL13	11JUL13	0	57	29,299.20		0.00	0.00							EM//ST =240 ;		
8200-0077	TF Install new clamps	12	01OCT13*	01OCT13*	16OCT13	16OCT13	0	39	27,561.60		0.00	0.00							EM//ST =240 ;		
8200-0078	TF Install Vessel ties & Align	18	17OCT13	17OCT13	11NOV13	11NOV13	0	39	41,342.40		0.00	0.00							EM//ST =360 ;		
8200-0079	TF Install new hoop brace	12	12NOV13	12NOV13	27NOV13	27NOV13	0	39	27,561.60		0.00	0.00							EM//ST =240 ;		
8200-0080	TF Align and match drill new hoop brace	18	02DEC13	02DEC13	06JAN14	06JAN14	0	39	41,342.40		0.00	0.00							EM//ST =360 ;		
8200-0081	TF Install and torque all bolts	8	07JAN14	07JAN14	16JAN14	16JAN14	0	39	18,374.40		0.00	0.00							EM//ST =160 ;		

Activity ID	Activity Description	Work Days	BASELINE START	Forecast Start	BASELINE FINISH	Forecast Finish	Schedule Slip (Days)	Total Float	Budgeted Cost	PPCT	Earned value cost (BCWP)	Planned value cost (BCWS)	FY11	FY12	FY13	FY14	FY15	FY16
8200-0082	PF2 Mark location; lower and support	2	28NOV12	28NOV12	29NOV12	29NOV12	0	103	4,443.20		0.00	0.00				EM//ST =40 ;		
8200-0083	PF2 Replace existing hardware (bolted)	1	01APR13*	01APR13*	01APR13	01APR13	0	24	2,221.60		0.00	0.00				EM//ST =20 ;		
8200-0084	PF2 Install New plates (bolted)	4	02APR13	02APR13	05APR13	05APR13	0	24	8,886.40		0.00	0.00				EM//ST =80 ;		
8200-0085	PF2 weld reinforcement	8	08APR13	08APR13	17APR13	17APR13	0	24	17,772.80		0.00	0.00				EM//ST =160 ;		
8200-0086	PF2 Reinstall	2	18APR13	18APR13	19APR13	19APR13	0	24	4,443.20		0.00	0.00				EM//ST 40 ;		
8200-0087	PF3 lower and support	2	22APR13	22APR13	23APR13	23APR13	0	24	4,443.20		0.00	0.00				EM//ST =40 ;		
8200-0088	PF3 remove bolted support	1	24APR13	24APR13	24APR13	24APR13	0	24	2,221.60		0.00	0.00				EM//ST =20 ;		
8200-0089	PF3 Install new bolted support	8	25APR13	25APR13	06MAY13	06MAY13	0	24	17,772.80		0.00	0.00				EM//ST =160 ;		
8200-0090	PF3 weld reinforcement	18	07MAY13	07MAY13	31MAY13	31MAY13	0	24	39,988.80		0.00	0.00				EM//ST =360 ;		
8200-0091	PF3 Reinstall & Align	3	03JUN13	03JUN13	05JUN13	05JUN13	0	24	6,664.80		0.00	0.00				EM//ST =60 ;		
8200-0092	PF4, 5 lower and install 1/4" plate	12	06JUN13	06JUN13	21JUN13	21JUN13	0	24	17,772.80		0.00	0.00				EM//ST =20 ;		
8200-0093	PF4, 5 Install new bolts and torque	6	24JUN13	24JUN13	01JUL13	01JUL13	0	24	13,329.60		0.00	0.00				EM//ST =20 ;		
8200-0094	PF4 Install new clamps	12	02JUL13	02JUL13	19JUL13	19JUL13	0	24	26,659.20		0.00	0.00				EM//ST =240 ;		
8200-0095	PF5 U&L Reconnect & Install New Interstitial	6	22JUL13	22JUL13	29JUL13	29JUL13	0	24	13,329.60		0.00	0.00				EM//ST =120 ;		
8200-0095A	TF Reinforce clevis	12	30JUL13	30JUL13	14AUG13	14AUG13	0	24	26,659.20		0.00	0.00				EM//ST =240 ;		
8200-0095B	TF Install new TF wet layup & clamp	9	15AUG13	15AUG13	27AUG13	27AUG13	0	24	19,994.40		0.00	0.00				EM//ST =180 ;		
8200-0096	VV Umbrella legs Weld reinforcement plate	24	28AUG13	28AUG13	01OCT13	01OCT13	0	24	53,393.60		0.00	0.00				EM//ST =480 ;		
8200-0097	Umbrella leg Remove Existing hardware	5	02OCT13	02OCT13	08OCT13	08OCT13	0	24	11,484.00		0.00	0.00				EM//ST =100 ;		
8200-0098	Umbrella legs Add reinforcement plate	8	09OCT13	09OCT13	18OCT13	18OCT13	0	24	18,374.40		0.00	0.00				EM//ST =160 ;		
8200-0099	TF Install New Coil	5	21OCT13	21OCT13	25OCT13	25OCT13	0	24	90,468.00		0.00	0.00				EM//ST =200 ; 41=50,000		
8200-0100	Prefit & Match Drill New Umbrella Lid	10	28OCT13	28OCT13	08NOV13	08NOV13	0	24	45,936.00		0.00	0.00				EM//ST =400 ;		
8200-0101	VV Legs Reinforcements Plate	8	11NOV13	11NOV13	20NOV13	20NOV13	0	24	18,374.40		0.00	0.00				EM//ST =160 ;		
8200-0102	Reinstall platform sections	8	17JAN14	17JAN14	28JAN14	28JAN14	0	39	36,748.80		0.00	0.00				EM//ST =320 ;		
Alignment Verification Coil & VV																		
8200-0105	Map internal targets to external	10	21NOV13*	21NOV13*	06DEC13	06DEC13	0	24	37,619.20		0.00	0.00				EM//EM =80 ; em//st=200		
8200-0106	Verify Vessel Aligmennt targets	10	09DEC13	09DEC13	20DEC13	20DEC13	0	24	37,619.20		0.00	0.00				EM//EM =80 ; em//st=200		
8200-0107	Verify Coil Alignment Targets	20	02JAN14	02JAN14	29JAN14	29JAN14	0	24	75,238.40		0.00	0.00				EM//EM =160 ; em//st=400		
8200-0108	Adjust vessel Internals	30	30JAN14	30JAN14	12MAR14	12MAR14	0	24	112,857.60		0.00	0.00				EM//EM =240 ; em//st=600		
8200-0109	Adjust TF Coils	4	13MAR14	13MAR14	18MAR14	18MAR14	0	24	15,047.68		0.00	0.00				EM//EM =32 ; em//st=80		

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8200-0110	Adjust PF Coils	6	19MAR14	19MAR14	26MAR14	26MAR14	0	24	22,571.52		0.00	0.00						EM//EM =48 ; em//st=120
8200-0112	Fit and Install PF 1a, 1b, 1c U&L buswork	15	02OCT13*	02OCT13*	22OCT13	22OCT13	0	33	34,452.00		0.00	0.00						EM//ST =300 ;
8200-0113	Fit and Install OH U&L buswork	15	23OCT13	23OCT13	12NOV13	12NOV13	0	33	34,452.00		0.00	0.00						EM//ST =300 ;
8200-0114	Install CHI & Ring bus	8	13NOV13	13NOV13	22NOV13	22NOV13	0	33	18,374.40		0.00	0.00						EM//ST =160 ;
8200-0115	Install TF coil cooling system (72)	3	25NOV13	25NOV13	27NOV13	27NOV13	0	33	6,890.40		0.00	0.00						EM//ST =60 ;
8200-0116	Install Inboard Divertor heating/cooling system	15	02DEC13	02DEC13	20DEC13	20DEC13	0	33	34,452.00		0.00	0.00						EM//ST =300 ;
8200-0117	New TF air cooled bus and support system	25	02JAN14	02JAN14	05FEB14	05FEB14	0	33	57,420.00		0.00	0.00						EM//ST =500 ;
Reinstall Equipment																		
8200-0120	Gas Injection System	15	10APR14	21APR14	30APR14	09MAY14	-7	-19	68,904.00		0.00	0.00						EM//ST =600 ;
8200-0121	Reinstall insulation	10	01MAY14	12MAY14	14MAY14	23MAY14	-7	-19	22,968.00		0.00	0.00						EM//ST =200 ;
8200-0122	Platform areas reinstall	10	15MAY14	27MAY14	29MAY14	09JUN14	-7	-19	45,936.00		0.00	0.00						EM//ST =400 ;
8200-0123	Heating Manifold Reconfigure	10	06FEB14	06FEB14	19FEB14	19FEB14	0	86	56,718.00		0.00	0.00						EM//ST =200 ; 41=25,000
8200-0124	Re-install RF pipes	30	15MAY14*	27MAY14*	26JUN14	08JUL14	-7	44	243,575.20		0.00	0.00						ea//em ellis=80; ee//st em//sb miller=600
8200-0125	Reinstall electrical Tray	40	30MAY14	10JUN14	25JUL14	05AUG14	-7	-19	91,872.00		0.00	0.00						EM//ST =800 ;
Bay by Bay Diagnostic																		
8200-0130	Perform bay by bay review Elect	2	27MAR14	27MAR14	28MAR14	28MAR14	0	24	7,287.20		0.00	0.00						EM//SM =40 ;
8200-0131	Perform bay by bay review Mech	2	31MAR14	31MAR14	01APR14	01APR14	0	24	7,287.20		0.00	0.00						EM//SM =40 ;
8200-0132	Write reinstallation procedures	5	02APR14	02APR14	08APR14	08APR14	0	24	18,218.00		0.00	0.00						EM//SM =100 ;
8200-0133	Reinstall Mech	10	09APR14	09APR14	22APR14	22APR14	0	24	36,748.80		0.00	0.00						EM//ST =320 ;
8200-0134	Reinstall Upper and lower port Eqpt	18	23APR14	23APR14	16MAY14	16MAY14	0	24	66,147.84		0.00	0.00						EM//ST =576 ;
8200-0135	Reinstall Elect	10	28JUL14	06AUG14	08AUG14	19AUG14	-7	-19	22,968.00		0.00	0.00						EM//ST =200 ;
8200-0136	Testing	10	11AUG14	20AUG14	22AUG14	03SEP14	-7	-19	22,968.00		0.00	0.00						EM//ST =200 ;

8200 CS & Coil Sprt Structure Install (Viola)	31JAN2011	28FEB2011	31MAR2011	30APR2011	31MAY2011	30JUN2011	31JUL2011	31AUG2011	30SEP2011	31OCT2011	30NOV2011	31DEC2011
BCWS	4	3	4	4	4	4	4	4	4	175	55	31
CUM BCWS	55	59	63	66	70	73	77	81	85	260	315	346
BCWP	4	12	4	5	0	0	0	0	0	0	0	0
CUM BCWP	55	67	71	76	76	76	76	76	76	76	76	76
ACWP	2	1	0	14	0	0	0	0	0	0	0	0
CUM ACWP	48	49	49	63	63	63	63	63	63	63	63	63
CV	8	18	22	13	13	13	13	13	13	13	13	13
SV	.	8.	8.	10.	6.	3.	-1.	-5.	-9.	-184.	-239.	-270.
CPI	1.16	1.37	1.44	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21
SPI	1	1.14	1.13	1.15	1.09	1.03	0.99	0.94	0.9	0.29	0.24	0.22

8200 CS & Coil Sprt Structure Install (Viola)	31JAN2012	29FEB2012	31MAR2012	30APR2012	31MAY2012	30JUN2012	31JUL2012	31AUG2012	30SEP2012	31OCT2012	30NOV2012	31DEC2012
BCWS	27	6	0	283	168	145	144	223	170	122	120	133
CUM BCWS	373	379	379	662	830	975	1,120	1,343	1,513	1,635	1,754	1,888
BCWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM BCWP	76	76	76	76	76	76	76	76	76	76	76	76
ACWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM ACWP	63	63	63	63	63	63	63	63	63	63	63	63
CV	13	13	13	13	13	13	13	13	13	13	13	13
SV	-297.	-303.	-303.	-586.	-754.	-899.	-1043.	-1267.	-1437.	-1559.	-1678.	-1812.
CPI	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21
SPI	0.2	0.2	0.2	0.11	0.09	0.08	0.07	0.06	0.05	0.05	0.04	0.04

Annex I – WBS Dictionary

This Work Breakdown Structure (WBS) organizes and defines the scope of the NSTX Upgrade using the WBS as established by the original NSTX project and modified to accommodate the NSTX Upgrade.

<u>WBS</u>			
<u>L1</u>	<u>L2</u>	<u>L3</u>	<u>Description</u>
1			NSTX UPGRADE PROJECT
	1.1		Torus Systems
		1.1.0	Project Integrated Model
		1.1.1	Plasma Facing Components
		1.1.2	Vacuum Vessel and Support Structure
		1.1.3	Magnet Systems
	1.2		Plasma Heating and Current Drive Systems
		1.2.1	High Harmonic Fast Wave (HHFW)
		1.2.2	Coaxial Helicity Injection (CHI) Current Drive
		1.2.3	Electron Cyclotron Heating (ECH)
		1.2.4	Neutral Beam Injection (NBI)
	1.3		Auxiliary Systems
		1.3.1	Vacuum Pumping System
		1.3.2	Coolant Systems
		1.3.3	Bakeout Heating System
		1.3.4	Gas Delivery System
		1.3.5	Glow Discharge Cleaning System
	1.4		Plasma Diagnostics
		1.4.1	Plasma Diagnostics
	1.5		Power Systems
		1.5.1	AC Power Systems
		1.5.2	AC/DC Converters
		1.5.3	DC Systems
		1.5.4	Control and Protection System
		1.5.5	General Power Systems and Integration
	1.6		Central Instrumentation and Controls (I&C)
		1.6.1	Control System
		1.6.2	Data Acquisition System
	1.7		Project Support & Integration
		1.7.1	Project Management and Integration
		1.7.2	Project Physics
		1.7.3	Integrated Systems Tests
	1.8		Site Preparation and Assembly
		1.8.1	Site Preparation
		1.8.2	Torus Assembly and Construction

Annex I – WBS Dictionary

issuance of appropriate Safety Certificate parameters for operation of NSTX with new enhanced operating capabilities; preparation of documentation (procedures) for safely integrating the upgrades for operations within NSTX safe operating parameters; working with NSTX Operations Group for the successful integration of the upgrades.

{Integrated Systems Test (Job 7900)}

WBS Element: 1.8

WBS Level: 2

WBS Title: Site Preparation and Assembly

Definition: Site preparation and torus assembly includes modifications to the existing NSTX Test Cell components and subsystems and the assembly and installation of all Torus Systems (WBS 1.1). Modifications to other PPPL facilities, components, and subsystems outside the NSTX Test Cell and the assembly and installation of non-torus components and subsystems are included in the individual components and subsystems.

WBS Element: 1.8.1

WBS Level: 3

WBS Title: Site Preparation

Definition: This WBS element includes construction of the NSTX machine platform and the modifications to the NSTX Test Cell. There are no activities in this WBS element as part of the NSTX Upgrade Project. NTC equipment removals, relocations and platform modifications necessary to support installation of the 2nd NBI are included in WBS element 1.2.4.2.

WBS Element: 1.8.2

WBS Level: 3

WBS Title: Torus Assembly and Construction

Definition: Torus Assembly and construction includes the assembly and installation of the NSTX torus, coils systems and all associated supports including construction management. This WBS element includes removal of equipment for clearance and accessibility, moving existing coils, cutting off existing supports mounted on the vacuum vessel and installing a new external cage support structure and reinstalling, testing and commissioning the equipment removed.

{Installation of the Coil Support System (Job 8200)}

Also included in this WBS element is the removal of the existing Center Stack and installation of the NSTX Upgraded Center Stack, followed by closing up the vacuum vessel, pumping down, leak checking, bakeout and machine area scrubs to be ready for Integrated System Testing.

{CS Removal & Re-Installation/Pumpdown/Bakeout (Job 8250)}

Work Approval Form (WAF)

Cost Center: 9417
Job Number: 8200
Job Title: Installation of Coil Support System
Job Manager: Mike Viola
Project Start Dat 10/1/2011

Rev 4 7/21/2010

Description:

The scope of this job includes the PF and TF support upgrade. This involves removing some equipment and cable tray for clearance and accessibility, welding stiffeners to PF2 and PF3 supports and installing new PF5 columns, replace bad TF coil.

NSTX is an operating machine complete with a full complement of diagnostics in every bay. In order to reach the existing structure for modification, some equipment relocation is required. After work is compelte, a significant metrology effort will be needed to verify alignements.

Schedule:

See Tab B or attached

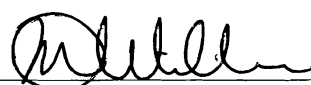
Approvals:

 7/21/10

Job Manager

 8/3/10

Project Manager

 8/3/10

Engineering Department Head

Cost Center: 9417
 Job Number: 8200
 Installation of Coil Support System
 Job Title:
 Job Manager: Mike Viola
 Project Start Date: #####

Task	Task Description	Responsible	DURATION in		User Input Start Date (optional)	Calculated		FINISH DATE	BASIS OF ESTIMATE	ESTIMATE CATEGORY
			WEEKDAYS	CRW SIZE		START DATE	FINISH DATE			
1	Milestones dates		1							
2	Design complete	Mengra			4/1/12		10/1/11	10/2/2011		
3	Assembly Sequence complete	Mengra			4/1/12		10/1/11	10/2/2011		
4	Parts arrived	Mark Smith			1/1/12		1/1/12	1/2/2012		
5	Start procedure development	Mark Smith			4/1/12		4/1/12	4/2/2012		
6	Mobiles crews	Viola								
7										
8										
9	Milestones FY10/FY11 oversight (@ 3 med Inmonth) 5/1/10-9/30/11									
10	Ordering Duration oversight 20% FTE for duration	Viola	300	0.2	4/1/12		4/1/12	5/28/2013		
11	Shop Fabrication oversight 15 FTE for duration	Viola	300	1.5	4/1/12		4/1/12	5/28/2013		
12	Assembly oversight 8 FTE	Viola	300	0.8	4/1/12		4/1/12	5/28/2013		
13	Assembly oversight 1 FTE	Wilson	300	1.0	4/1/12		4/1/12	5/28/2013		
14	Title 3 Support Engineer	Mark Smith	300	0.4	4/1/12		4/1/12	5/28/2013		
15	Title 3 Support Drafting	Designer	300	0.2	4/1/12		4/1/12	5/28/2013		
16	OT for efficiency (2 crews 1 weekend a month)	OT	300	0.2	4/1/12		4/1/12	5/28/2013		
17	MISC M&S \$250 per day 2 crews	Techs	300	2.0	4/1/12		4/1/12	5/28/2013		
18										
19										
20	Documentation PREPARE WORK PLANNING FORM	Viola	3	1.0	1/1/12		1/1/12	1/5/2012		
21	Fab/Installation Procedure	Mark Smith	20	1.0	1/1/12		1/1/12	1/28/2012		
22										
23										
24	UPGRADE BAY BY BAY DIAGNOSTIC CATALOGUE									
25	Assume 8 lower 8 midplane and 4 upper trays		12	1.0	1/1/12		1/1/12	1/17/2012		
26	Perform bay by bay catalogue and label Eject	SM	12	1.0	1/1/12		1/1/12	1/17/2012		
27	Perform bay by bay catalogue and label Mech	SM	12	1.0	1/1/12		1/1/12	1/17/2012		
28	Write removal procedures	SM	6	1.0	4/1/12		4/1/12	4/17/2012		
29	Write removal procedures	SM	20	2.5	1/1/12		1/1/12	1/17/2012		
30	Wide Elongated Removal & Installation Procedure	SM	20	2.0	1/1/12		1/1/12	1/17/2012		
31	Wide Elongated Removal & Installation Procedure	SM	20	2.0	1/1/12		1/1/12	1/17/2012		
32	Upper Tray remove and store Eject	Techs E	20	2.5	3/1		4/2/12	4/22/2012		
33	Remove and store Mech	Techs M1	10	5.0	3/1		4/2/12	5/20/2012		
34	Remove and store Upper and lower port egs	Techs M1	18	2.5	3/3		5/8/12	5/31/2012		
35	Remove section of platform	Techs M2	10	5.0	3/4		6/14/12	7/12/2012		
36	Facialize Coil and Vacuum vessel	Prinika+Tech	20	1.0	3/5		6/14/12	7/12/2012		
37										
38	EQUIPMENT REMOVALS									
39	Remove insulation	Techs M1	15	2.5	3/3		5/8/12	5/27/2012		
40	Gas Injection System	Techs M1	15	2.5	3/9		5/27/12	6/17/2012		
41	Remove trim coil and lock mode coil	Techs M1	2	2.5	4/1		6/17/12	6/18/2012		
42	Remove trim coil and lock mode coil	Techs M1	4	2.5	4/1		6/17/12	6/25/2012		
43	Clear platform and area to remove bed TF	Techs M1	10	2.5	3/5		6/14/12	6/28/2012		
44	Remove bed TF	Techs M2	5	5.0	4/3		6/28/12	7/5/2012		
45	Remove bed TF	Techs M2	5	5.0	4/3		7/5/12	8/2/2012		
46										
47	UPPER HALF									
48	2 week delay contingency for rework		10	3/1			4/25/12	5/5/2012		
49	Unroll L&D Remove sealing	Rigger Techs	1	5.0	4/4		7/5/12	7/6/2012		
50	VY Unroll high Mid reattachment plate	Techs M1	5	2.5	4/6		7/5/12	7/17/2012		
51	Unroll high Mid reattachment plate	Techs M1	5	2.5	4/6		7/5/12	7/17/2012		
52	Unroll high Mid reattachment plate	Techs M1	5	2.5	4/6		7/5/12	7/17/2012		
53	Unroll high Mid reattachment plate	Techs M2	12	2.5	4/2		7/6/12	7/17/2012		
54	TF install new hoop brace	Techs M2	18	2.5	4/2		7/17/12	8/3/2012		
55	TF install new hoop brace	Techs M2	12	2.5	4/4		8/3/12	9/14/2012		
56	TF Align and match drill new hoop brace	Techs M2	18	2.5	4/4		9/14/12	10/9/2012		
57	TF Align and torque all bolts	Techs M2	8	2.5	5/5		10/9/12	10/21/2012		
58	Design & build lifting method	Mark Smith	16	3.0	5/8		10/11/12	10/23/2011		
59	PF2 Mark Location, fit and support	Techs M1	1	2.5	5/9		7/31/12	8/2/2012		
60	PF2 Replace existing hardware (bolts)	Techs M1	4	2.5	6/1		8/2/12	8/7/2012		
61	PF2 install New plates (bolts)	Techs M1	8	2.5	6/1		8/7/12	8/19/2012		
62	PF2 weld reinforcement	Rigger Techs	2	2.5	6/2		8/21/12	8/24/2012		
63	PF2 Reretail	Rigger Techs	2	2.5	6/3		8/24/12	8/28/2012		
64	PF3 lift and support	Rigger Techs	1	2.5	6/4		9/5/12	9/5/2012		
65	PF3 remove bolted support	Techs M1	8	2.5	6/5		9/5/12	10/12/2012		
66	PF3 install new bolted support	Rigger Techs	3	2.5	6/6		9/5/12	10/12/2012		
67	PF3 weld reinforcement	Rigger Techs	4	2.5	6/6		9/5/12	10/12/2012		
68	PF3 Reretail and align	Techs M1	8	2.5	6/6		9/5/12	10/12/2012		
69	PF3 Disconnect existing midplane column	Techs M1	4	2.5	6/9		9/5/12	10/12/2012		
70	PF4, 5 lift and install 1/4" plate	Techs M1	8	2.5	6/9		9/5/12	10/12/2012		
71	PF4, 5 lift and install 1/4" plate and torque	Techs M1	8	2.5	7/0		9/29/12	10/12/2012		

Design Maturity		Design Complexity			Design Maturity Definition		
		Low	Medium	High			
Low	-15%	+25%	-20%	+40%	-30%	+60%	Final design available. All design features/requirements well known. No further design development or evolution expected that will impact estimate.
Medium	-10%	+15%	-15%	+25%	-20%	+40%	
High	-5%	+10%	-10%	+15%	-15%	+25%	
Preliminary design available. Some additional design evolution likely. Further developments can be somewhat expected or anticipated and reflected in estimate.					No better than conceptual design basis currently available. Design details, procedures, etc. still need much development and evolution of requirements beyond estimate basis is likely and expected.		
No better than conceptual design basis currently available. Design details, procedures, etc. still need much development and evolution of requirements beyond estimate basis is likely and expected.							
Design Complexity Definition		Design Complexity Definition			Design Maturity Definition		
		Low	Medium	High			
Low	Work is fairly well understood -- either standard construction or repetition of activities performed in past. Little likelihood of estimate not being well understood and requirements not being well defined.			More complex work requirements that have potential to impact cost and schedule estimates. Limited experience performing similar tasks, so ability to estimate accurately is somewhat suspect			
Medium							
High	Extremely challenging tasks and/or requirements. Unique or first-of-a-kind assembly or work tasks. No good basis for estimating work exists so there is a high degree of estimate uncertainty. Based on standard industry and DOE estimate classifications (Per AACEI Recommendation)						

Cost Center:
Job Number:
Job Title:
Job Manager:

9417
8200
Installation of Coil Support System
Mike Viola

Materials and Subcontracts (M&S)

Basis of Estimate

Description:

CATEGORIZATION CODES:	
1 - National Standards	
2 - Engineering Judgement/Experience	
3 - Estimates/Data from External Sources (e.g., W7X, ATF, etc.)	
4 - Previous PPP/ORNL Experience (e.g., TFR, NSTX, PLT, etc.)	
5 - Prototype Data/Test Results	
6 - Catalogue Price/Vendor Quote	
7 - Placed Contracts	
8 - Actual experience for NCSX Work	
9 - Other	

TOTALS