Work Authorization Document

NSTX Upgrade Project

Control Account #:	2485	**Title:**	Vacuum Pumping System
WBS	1.2.4	**Title:**	NB Injection
Period of Performance:	01 March 2010 through 27 August 2014		
Authorized Budget:	$388	**Control Account Manager:**	Blanchard
Revision #:	0	**Revision Date:**	July-11

Authorized Work Description:

In order to accommodate the installation of the 2nd NBI on NSTX the existing Vacuum Pumping System will be modified. This WBS element includes the design, fabrication, and installation of a new vessel pumping system and includes new pump ducts off of the Neutral Beamline 2 duct, mechanical and electrical isolation of the system, vacuum diagnostic relocation, magnetic shielding and support of TVPS TMPs, and TMP service connections.

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.

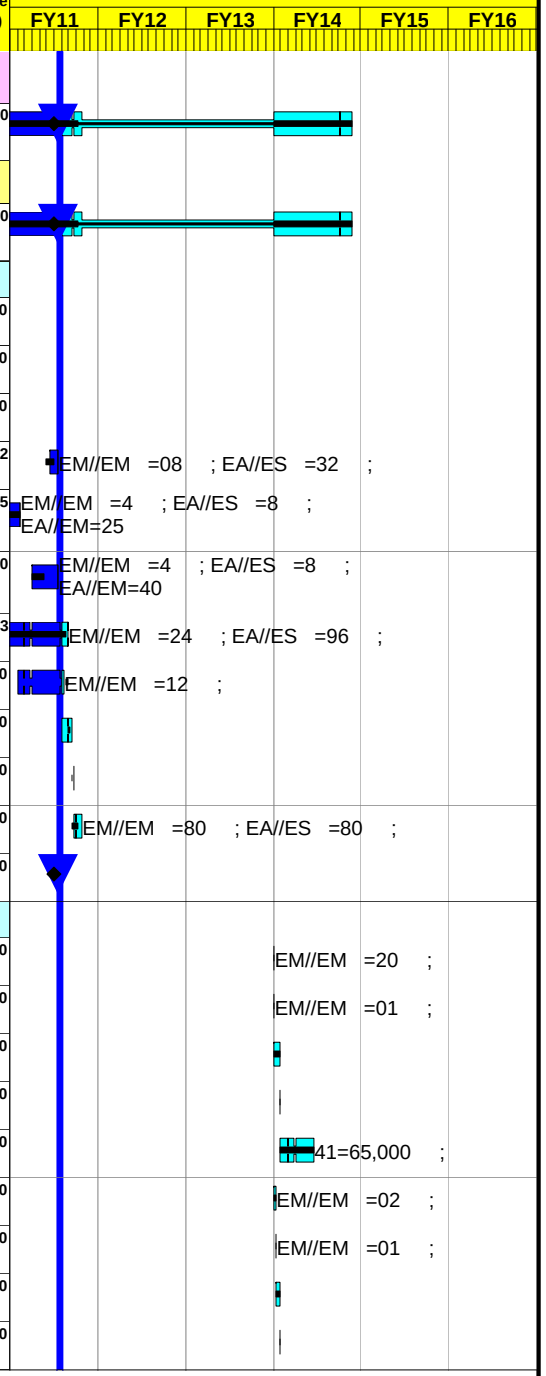
Control Account History

ECP#	Implement Date	Prior Budget	New Budget	Signature

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

NSTX Upgrade Project

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)
Subtotal		1,123	01MAR10A	01MAR10A	27AUG14	27AUG14	0	8	387,729.33		58,810.00	63,579.00
Job: 2485 - Vacuum Pumping System-BLANCHARD												
Subtotal		1,123	01MAR10A	01MAR10A	27AUG14	27AUG14	0	8	387,729.33		58,810.00	63,579.00
Design												
2485-0013	PDR Prep	10	09JUN10A	09JUN10A	22JUN10A	22JUN10A	0		0.00	100	0.00	0.00
2485-0014	CONDUCT PDR	2	23JUN10A	23JUN10A	24JUN10A	24JUN10A	0		0.00	100	0.00	0.00
2485-0015	Disposition PDR Chits	15	25JUN10A	25JUN10A	16JUL10A	16JUL10A	0		0.00	100	0.00	0.00
2485-0016	Vacuum Diagnostic Layout	29*	01MAR11*	14MAR11A	28MAR11	21APR11A	-18		4,050.32	100	4,050.32	4,050.32
2485-0016A	Magnetic Shieding Conceptual Design	143	01SEP10A	01SEP10A	12NOV10A	12NOV10A	0		5,887.05	100	5,887.05	5,887.05
2485-0016B	Magnetic Shieding Final Design	79*	03JAN11A	03JAN11A	16FEB11	21APR11A	-46		9,036.20	100	9,036.20	9,036.20
2485-0017	Design Drawings	218*	19JUL10A	19JUL10A	19MAY11	01JUN11	-8	135	11,917.22	40	4,763.33	11,114.43
2485-0018	Update Cost & Schedule Estimate	133*	20MAY11	01NOV10A	26MAY11	16MAY11	8	146	6,328.40	25	1,582.10	0.00
2485-0019	FDR Prep	34*	27MAY11	02MAY11	10JUN11	17JUN11	-5	123	0.00		0.00	0.00
2485-0020	CONDUCT FDR	3	13JUN11*	22JUN11*	14JUN11	24JUN11	-8	121	0.00		0.00	0.00
2485-0021	FDR Chit Resolution (All Areas)	20	15JUN11*	27JUN11*	13JUL11	25JUL11	-8	553	19,618.40		0.00	0.00
2485PEER	Peer Review	0			31MAR11	14APR11A	-10		0.00		0.00	0.00
Procure, Fab & Assembly												
2485-0022	Prep Req & proc pckg - 3200i/s TMPx2	4	01OCT13*	01OCT13*	04OCT13	04OCT13	0	8	3,662.80		0.00	0.00
2485-0023	SUBMIT REQ TO PROC - 3200i/s TMPx2	1	07OCT13	07OCT13	07OCT13	07OCT13	0	69	183.14		0.00	0.00
2485-0024	Procurement lead time (1) - 3200i/s TMPx2	15	08OCT13	08OCT13	28OCT13	28OCT13	0	69	0.00		0.00	0.00
2485-0025	AWARD - 3200i/s TMPx2	1	29OCT13	29OCT13	29OCT13	29OCT13	0	69	0.00		0.00	0.00
2485-0026	Fabricate or delivery - 3200i/s TMPx2	90	30OCT13	30OCT13	18MAR14	18MAR14	0	69	87,750.00		0.00	0.00
2485-0028	Prep Req & proc pckg - New VAT Valves	2	07OCT13	07OCT13	08OCT13	08OCT13	0	8	366.28		0.00	0.00
2485-0029	SUBMIT REQ TO PROC- New VAT Valves	1	09OCT13	09OCT13	09OCT13	09OCT13	0	77	183.14		0.00	0.00
2485-0030	Procurement lead time (1)- New VAT Valves	15	10OCT13	10OCT13	30OCT13	30OCT13	0	77	0.00		0.00	0.00
2485-0031	AWARD- New VAT Valves	1	31OCT13	31OCT13	31OCT13	31OCT13	0	77	0.00		0.00	0.00



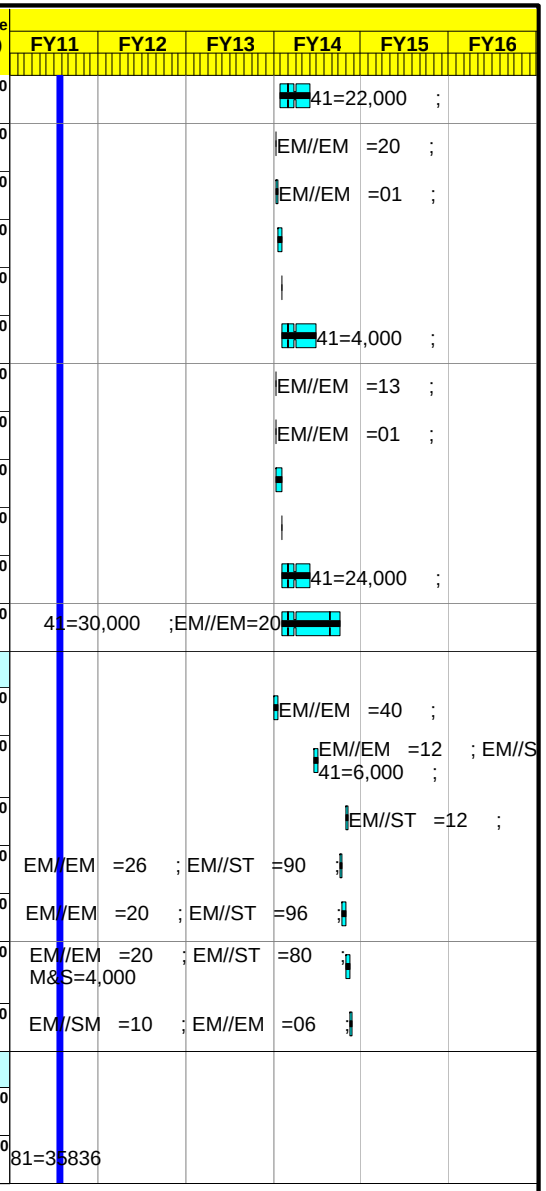
Data Date 30APR11
Run Date 20MAY11 10:57

1105

NSTX UPGRADES
RESOURCE LOADED SCHEDULE
CD-2 Schedule
April 2011

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)
2485-0032	Fabricate or delivery - New VAT Valves	80	01NOV13	01NOV13	06MAR14	06MAR14	0	77	29,700.00		0.00	0.00
2485-0034	Prep Req & proc pckg - Vacuum Instrumentation	4	10OCT13	10OCT13	15OCT13	15OCT13	0	85	3,662.80		0.00	0.00
2485-0035	SUBMIT REQ TO PROC- Vacuum Instrumentation	1	16OCT13	16OCT13	16OCT13	16OCT13	0	85	183.14		0.00	0.00
2485-0036	Procurement lead time (1)- Vacuum Instrumentatn	15	17OCT13	17OCT13	06NOV13	06NOV13	0	85	0.00		0.00	0.00
2485-0037	AWARD- Vacuum Instrumentation	1	07NOV13	07NOV13	07NOV13	07NOV13	0	85	0.00		0.00	0.00
2485-0038	Fabricate or delivery - Vacuum Instrumentation	90	08NOV13	08NOV13	27MAR14	27MAR14	0	85	5,400.00		0.00	0.00
2485-0040	Prep Req & proc pckg - Misc Mtrl/Comp for Ducts	4	09OCT13	09OCT13	14OCT13	14OCT13	0	8	2,380.82		0.00	0.00
2485-0041	SUBMIT REQ TO PROC - Misc Mtrl/Comp for Ducts	1	15OCT13	15OCT13	15OCT13	15OCT13	0	8	183.14		0.00	0.00
2485-0042	Procurement lead time (1) - Mtrl/Comp for Duct	15	16OCT13	16OCT13	05NOV13	05NOV13	0	8	0.00		0.00	0.00
2485-0043	AWARD - Misc Mtrl/Comp for Ducts	1	06NOV13	06NOV13	06NOV13	06NOV13	0	8	0.00		0.00	0.00
2485-0044	Fabricate or delivery - Misc Mtrl/Comp for Ducts	70	07NOV13	07NOV13	26FEB14	26FEB14	0	83	32,400.00		0.00	0.00
2485-0044A	Fabricate or delivery - All Other Mtrl/Component	160	07NOV13*	07NOV13*	03JUL14	03JUL14	0	8	44,162.80		0.00	0.00
Installation												
2485-0046	Installation Procedure	10	07OCT13*	07OCT13*	18OCT13	18OCT13	0	166	7,325.60		0.00	0.00
2485-0047	Pre-Assemble Duct Legs 1 and 2	15	19MAR14*	19MAR14*	08APR14	08APR14	0	69	27,523.68		0.00	0.00
2485-0048	Leak Checking	3	31JUL14	31JUL14	04AUG14	04AUG14	0	15	1,378.08		0.00	0.00
2485-0049	Install TVPS Supports/	8	07JUL14	07JUL14	16JUL14	16JUL14	0	8	15,097.24		0.00	0.00
2485-0050	Install Ducts/Pumps	10	17JUL14*	17JUL14*	30JUL14	30JUL14	0	8	14,687.44		0.00	0.00
2485-0050A	Install Vacuum Instrumentation	10	31JUL14	31JUL14	13AUG14	13AUG14	0	8	18,250.00		0.00	0.00
2485-0051	PTP Testing	10	14AUG14	14AUG14	27AUG14	27AUG14	0	8	2,920.64		0.00	0.00
FY102485	FY10 Actual Cost	40	01MAR10A	01MAR10A	30APR10A	30APR10A	0		5,206.00	100	5,206.00	5,206.00
FY102485A	FY10 Actual Cost	110	03MAY10A	03MAY10A	30SEP10A	30SEP10A	0		28,285.00	100	28,285.00	28,285.00



2485 Vacuum Pumping System (Blanchard)	START	28FEB2009	31MAR2009	30APR2009	31MAY2009	30JUN2009	31JUL2009	31AUG2009	30SEP2009	31OCT2009	30NOV2009	31DEC2009
BCWS	0	0	0	0	0	0	0	0	0	0	0	0
CUM BCWS	0	0	0	0	0	0	0	0	0	0	0	0
BCWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM BCWP	0	0	0	0	0	0	0	0	0	0	0	0
ACWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM ACWP	0	0	0	0	0	0	0	0	0	0	0	0
CV	0	0	0	0	0	0	0	0	0	0	0	0
SV	.	.	.	.	.	.	.	.	.	.	.	.
CPI	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SPI	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

2485 Vacuum Pumping System (Blanchard)	31JAN2010	28FEB2010	31MAR2010	30APR2010	31MAY2010	30JUN2010	31JUL2010	31AUG2010	30SEP2010	31OCT2010	30NOV2010	31DEC2010
BCWS	0	0	3	3	5	6	6	7	9	4	2	1
CUM BCWS	0	0	3	5	11	16	23	30	39	42	45	46
BCWP	0	0	0	0	0	0	0	0	0	0	0	49
CUM BCWP	0	0	0	0	0	0	0	0	0	0	0	49
ACWP	0	0	0	0	0	0	0	0	0	0	0	51
CUM ACWP	0	0	0	0	0	0	0	0	0	0	0	51
CV	0	0	0	0	0	0	0	0	0	0	0	-2
SV	.	.	-3.	-5.	-11.	-16.	-23.	-30.	-39.	-42.	-45.	4.
CPI	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	.96
SPI	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.08

2485 Vacuum Pumping System (Blanchard)	31JAN2011	28FEB2011	31MAR2011	30APR2011	31MAY2011	30JUN2011	31JUL2011	31AUG2011	30SEP2011	31OCT2011	30NOV2011	31DEC2011
BCWS	7	4	5	1	7	11	8	0	0	0	0	0
CUM BCWS	53	57	62	64	71	82	90	90	90	90	90	90
BCWP	3	2	3	2	0	0	0	0	0	0	0	0
CUM BCWP	52	54	57	59	59	59	59	59	59	59	59	59
ACWP	3	1	16	19	0	0	0	0	0	0	0	0
CUM ACWP	54	55	71	91	91	91	91	91	91	91	91	91
CV	-2	-2	-15	-32	-32	-32	-32	-32	-32	-32	-32	-32
SV	-1.	-3.	-6.	-5.	-12.	-23.	-32.	-32.	-32.	-32.	-32.	-32.
CPI	.96	.97	.8	.65	.65	.65	.65	.65	.65	.65	.65	.65
SPI	0.99	0.94	0.91	0.92	0.83	0.72	0.65	0.65	0.65	0.65	0.65	0.65

2485 Vacuum Pumping System (Blanchard)	31JAN2012	29FEB2012	31MAR2012	30APR2012	31MAY2012	30JUN2012	31JUL2012	31AUG2012	30SEP2012	31OCT2012	30NOV2012	31DEC2012
BCWS	0	0	0	0	0	0	0	0	0	0	0	0
CUM BCWS	90	90	90	90	90	90	90	90	90	90	90	90
BCWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM BCWP	59	59	59	59	59	59	59	59	59	59	59	59
ACWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM ACWP	91	91	91	91	91	91	91	91	91	91	91	91
CV	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32
SV	-32.	-32.	-32.	-32.	-32.	-32.	-32.	-32.	-32.	-32.	-32.	-32.
CPI	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65
SPI	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65

2485 Vacuum Pumping System (Blanchard)	31JAN2013	28FEB2013	31MAR2013	30APR2013	31MAY2013	30JUN2013	31JUL2013	31AUG2013	30SEP2013	31OCT2013	30NOV2013	31DEC2013
BCWS	0	0	0	0	0	0	0	0	0	20	37	42
CUM BCWS	90	90	90	90	90	90	90	90	90	110	148	190
BCWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM BCWP	59	59	59	59	59	59	59	59	59	59	59	59
ACWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM ACWP	91	91	91	91	91	91	91	91	91	91	91	91
CV	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32
SV	-32.	-32.	-32.	-32.	-32.	-32.	-32.	-32.	-32.	-52.	-89.	-131.
CPI	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65
SPI	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.53	0.4	0.31

2485 Vacuum Pumping System (Blanchard)	31JAN2014	28FEB2014	31MAR2014	30APR2014	31MAY2014	30JUN2014	31JUL2014	31AUG2014	30SEP2014	31OCT2014	30NOV2014	31DEC2014
BCWS	44	38	35	17	6	5	33	20	0	0	0	0
CUM BCWS	234	272	307	324	329	335	367	388	388	388	388	388
BCWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM BCWP	59	59	59	59	59	59	59	59	59	59	59	59
ACWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM ACWP	91	91	91	91	91	91	91	91	91	91	91	91
CV	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32	-32
SV	-176.	-213.	-248.	-265.	-271.	-276.	-309.	-329.	-329.	-329.	-329.	-329.
CPI	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65
SPI	0.25	0.22	0.19	0.18	0.18	0.18	0.16	0.15	0.15	0.15	0.15	0.15

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.

WBS L1	L2	L3	Description
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

{NBI Controls & Instrumentation (Job 2475)}

WBS Element: 1.2.4.8 **WBS Level: 4**
WBS Title: NSTX Beamline 2 Duct & vacuum Vessel Modifications
Definition: This WBS element includes the design, and fabrication of all components connecting the Neutral Beam Box to NSTX, and the connecting ductwork and modifications to NSTX Vacuum Vessel to accommodate the second beamline.
{NSTX NB2 Duct & VV Mods (Job 2480)}

WBS Element: 1.2.4.9 **WBS Level: 4**
WBS Title: NSTX Test Cell Equipment Removals/Relocations
Definition: This WBS element covers moving of racks and diagnostics to clear space in the NSTX Test Cell (NTC) for the second Neutral Beamline. Racks to be removed and re-installed in a new location are #419, 431-435, 440-445, 447-449, 488. Racks 456 and 489 will be removed and excess. This scope also includes the fabrication and installation of five sections of platform at elevation 118' on the west side of the NTC to accommodate the racks being re-installed in the NTC. Racks #441-445 will be relocated to the Gallery east of the NTC. Diagnostics to be removed are those from the midplanes of Bay J and Bay K as well as those on the present pump duct. The diagnostics from Bay J will be re-installed ~5" outboard of their present position. IR windows and the Transmission Grating Spectrometer will be relocated to the new NB duct. Ion gages, filaments and the RGA will be relocated to the new pump duct under the NB2 duct. SPRED and LOWEUS will be relocated to Bay L. The Thomson Scattering Beam Dump Window will be relocated to between Bays K and L.
{NTC Equipment Removals/Relocations (Job 2490)}

WBS Element: 1.3 **WBS Level: 2**
WBS Title: Auxiliary Systems
Definition: The auxiliary systems include all the mechanical non-torus support systems for NSTX. This WBS element includes the Vacuum Pumping System, the Coolant Systems, the Bakeout Heating System, Gas Delivery System and the Glow Discharge Cleaning System. The scope of the work contains engineering design, R&D, mockups, procurement activities, component fabrication, and System Testing. Installation of the WBS 3 systems is included in the individual WBS 3, level 3 elements.

WBS Element: 1.3.1 **WBS Level: 3**
WBS Title: Vacuum Pumping System
Definition: The Vacuum Pumping System provides the source and distribution of all vacuum pumping to NSTX. This includes the roughing pumps as well as the turbo pumps and any backing pumps to:

- Provide the initial high vacuum environment with minimum impurities for plasma formation;

- Evacuate the spent plasma constituents at the end of each pulse prior to the next plasma pulse;
- Remove impurities liberated during bakeout and/or discharge cleaning of the vacuum vessel interior; and
- Provide instrumentation and a Residual Gas Analyzer.

This WBS element also includes the controllers for all pumps and any baffles for backstreaming.

In order to accommodate the installation of the 2nd NBI on NSTX the existing Vacuum Pumping System will be modified. This WBS element includes the design, fabrication, and installation of a new vessel pumping system and includes new pump ducts off of the Neutral Beamline 2 duct, mechanical and electrical isolation of the system, vacuum diagnostic relocation, magnetic shielding and support of TVPS TMPs, and TMP service connections.
{NSTX NB2 TVPS (Job 2485)}

WBS Element: 1.3.2 **WBS Level: 3**
WBS Title: Coolant Systems
Definition: The Coolant System provides cooling water to remove heat generated from NSTX systems during experimental operations. The systems include the:

- TF/PF bus and coil cooling water system;
- Center stack cooling water system;
- Component cooling water system; and the
- Ohmic heating cooling water system.

These systems will provide cooling water for normal operations and discharge cleaning of the vacuum vessel. This WBS includes engineering design, analysis, procurement activities, component fabrication and installation to the coil, bus and component cooling manifolds at the torus.

The new Center Stack on NSTX will require modifications to the existing coolant system. This WBS element will provide water cooling services to the new Center Stack and ancillary equipment in the NSTX test cell.
{Water System Coolant Modifications for CSU (Job 3200)}

WBS Element: 1.3.3 **WBS Level: 3**
WBS Title: Bakeout Heating System
Definition: The Bakeout Heating System provides a heating system to bake out the vacuum vessel. It includes a heating blanket system for the vacuum vessel and the insulation for that system. It includes a supplementary heating system for the center stack coil subsystems. The controls and interlocks for safe operation of this system is included. This WBS element includes the engineering design, analysis, procurement activities and component fabrication.

Work Approval Form (WAF)

Cost Center: 1180
Job Number: 2485
Job Title: NSTX NB2 TVPS
Job Manager: Craig Priniski
Rev 1 6/10/2010

Description:

This job includes the design, fabrication, and installation of new Vessel Pumping System. The job scope includes new pump ducts off of NB2 duct, mechanical and electrical isolation of system, vacuum diagnostic relocation, magnetic shielding and support of TVPS TMPs, and TMP service connections

Schedule:

Refer to Primavera Data-Base

Approvals:

Craig Priniski 7-20-10
Job Manager

8/3/10
Project Manager

8/3/10
Engineering Department Head

Cost Center: [illegible]80
Job Number: 2485
Job Title: NSTX NB2 TVPS
Job Manager: Craig Priniski

USER INPUT TASKS AND DESCRIPTIONS

SCHEDULE — USER INPUT | Estimate (user input): FY10$K / HOURS

task numb	P3 cross ref	TASK DESCRIPTION	Resp	Duration in WORK DAYS	OPTIONAL Logical Pre-requisites (one task numbers in each column ,any order)	User Input Start Date (optional)	[redacted]	actual= A	M&S (41)	CREDIT CARD (43)	OTHER (39)	TRAVEL (35)	OVERTIME (31)	EA** EM (analysis engr)	EA** DM (Designer)	EC** EM (computing Engr)	EC** SM/TB (Computing Tech)	EE** EM (Elctr Engr)	EE** SM/TB (Electr Tech)	EM** EM (FO&M Engr)	EM** SM/TB (FO&M Tech)	Basis of Estimate and Names of req'd skills if known	Category	Uncertainty % positive	negative
		Physics Requirements																							
		Conceptual Design																							
1		CD of System Layout	PRINISKI	20		7/7/2009									96					16		COMPLETED	8	NA	
2		CD of Pump Duct(s)	PRINISKI	5		8/4/2009									24					8		COMPLETED	8	NA	
3		CD of Magnetic Shield	PRINISKI	5		8/11/2009														8		COMPLETED	8	NA	
4		C&S Review	PRINISKI	1		8/18/2009														2		COMPLETED	8	NA	
5		Prep for PPPL/Ext CDR	PRINISKI	5		8/19/2009														12		COMPLETED	8	NA	
6		PPPL CDR	PRINISKI	2		10/28/2009																		NA	
																								NA	
		Preliminary Design																						NA	
7		CDR Chit Resolution (all areas)	PRINISKI	20		10/30/2009									32					96		COMPLETED	8	NA	
8		FMEA Analysis	PRINISKI	1		11/27/2009														8		COMPLETED	8	NA	
9		Preliminary CAD Designs	PRINISKI	10		11/27/2009									80					8		COMPLETED	8	NA	
10		Identify COTS Vendors	PRINISKI	25		4/13/2010														100		COMPLETED	8	NA	
11		Update Cost & Schedule Estimate	PRINISKI	3		4/19/2010														7		COMPLETED	8	NA	
12		Update CAD Models	PRINISKI	10		5/18/2010									32					12		COMPLETED	8	NA	
13		PDR Prep	PRINISKI	10		6/1/2010								0	0					0		COMPLETED	8	NA	
14		CONDUCT PDR	PRINISKI	2		6/23/2010																Prev. Reviews	8	NA	
		Final Design																							
15		Disposition PDR Chits	PRINISKI	15		6/25/2010									18					18		Prev. Reviews	8	25	-20
16		Vacuum Diagnostic Layout	PRINISKI	10		7/16/2010									32					8		Prev. Experince	8	20	-10
17		Design Drawings	PRINISKI	30		7/16/2010									24					96		Work to date	8	10	-5
18		Update Cost & Schedule Estimate	PRINISKI	3		7/30/2010									12							Prev. Updates	8	15	-5
19		FDR Prep	PRINISKI	10		8/27/2010									0					0		Prev. Reviews	8	NA	
20		CONDUCT FDR	PRINISKI	2		3/28/2011																Prev. Reviews	8	NA	
21		FDR Chit Resolution (all areas)	PRINISKI	20											80					80					
		Procurement																							
21		**Item 1: 2600 l/s TMPs x 2**	PRINISKI			3/30/2011			$65													Vendor Quotes	6	15	-20
22		Prep Requisition and procurement package	PRINISKI	4		3/30/2011														19		Prev. Experince	4	20	-10
23		SUBMIT REQ TO PROCUREMENT	PRINISKI	1		4/5/2011														1				10	
24		Procurement lead time	PRINISKI	15		4/6/2011																			
25		AWARD	PRINISKI	1		4/27/2011																Prev. Experince	8		
26		Fabricate and deliveryFabricate or delivery	PRINISKI	90		4/28/2011																Vendor Quotes	6	10	
27		**Item 2: New Gate Valves**	PRINISKI	99		4/5/2011			$22													Catalog Price	6	15	
28		Prep Requisition and procurement package	PRINISKI	2		4/5/2011														2		Prev. Experince	4	20	
29		SUBMIT REQ TO PROCUREMENT	PRINISKI	1		4/7/2011														1		Prev. Experince	4	10	
30		Procurement lead time (1)	PRINISKI	15		4/8/2011																			
31		AWARD	PRINISKI	1		4/29/2011																			
32		Fabricate or deliveryFabricate or delivery	PRINISKI	80		5/2/2011																Catalog lead	6	10	
33		**Item 3: Vacuum Instrumentation**	PRINISKI			4/7/2011			$4													Catalog Price	6	15	
34		Prep Requisition and procurement package	PRINISKI	4		4/7/2011														19		Prev. Experince	4	20	
35		SUBMIT REQ TO PROCUREMENT	PRINISKI	1		4/13/2011														1		Prev. Experince	4	10	
36		Procurement lead time (1)	PRINISKI	15		4/14/2011																			
37		AWARD	PRINISKI	1		5/5/2011																			
38		Fabricate and delivery	PRINISKI	90		5/6/2011																Catalog lead	4	20	Depends on
39		**Item 4: Ceramic Breaks x 2 (one per TMP)**				4/7/2011			$24													Vendor Quote	6	15	-5
40		Prep Requisition and procurement package	PRINISKI	4		4/7/2011														13		Prev. Experince	4	15	-5
41		SUBMIT REQ TO PROCUREMENT	PRINISKI	1		4/11/2011														1		Prev. Experince	4		
42		Procurement lead time (1)	PRINISKI	15		4/12/2011																			
43		AWARD	PRINISKI	1		5/3/2011																			
44		Fabricate and delivery	PRINISKI	70		5/4/2011																Prev. Experince	4	20	
		All other Materials/Components	PRINISKI	90		4/15/2011			$25											20		Prev. Experince	4	20	
45		**Installation**																							
46		Installation Procedure	PRINISKI	10		11/1/2011														40		Prev. Experince	4	10	

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Estimate (user input)

	USER INPUT TASKS AND DESCRIPTIONS		**SCHEDULE** ***USER INPUT***				**FY10$K**					**HOURS**													
task	TASK DESCRIPTION	Resp	Duration in WORK DAYS	*OPTIONAL Logical Pre-requisites (one task numbers in each column ,any order)*			User Input Start Date (optional)	actual= A	M&S (41)	CREDIT CARD (43)	OTHER (39)	TRAVEL (35)	OVERTIME (31)	EA** EM (analysis engr)	EA** DM (Designer)	EC** EM (computing Engr)	EC** SM/TB (Computing Tech)	EE** EM (Elctr Engr)	EE** SM/TB (Electr Tech)	EM** EM (FO&M Engr)	EM** SM/TB (FO&M Tech)	Basis of Estimate and Names of req'd skills if known	Category	Uncertainty % positive	negative
47	Pre-Assemble Duct Legs 1 and 2	PRINISKI	15				9/20/2012		$6											12	150	Exper./Judgent	4,2	15	
48	Leak Checking	PRINISKI	3				10/11/2012														12	Exper./Judgent	4,2	25	
49	Install TVPS Supports/	PRINISKI	8				4/1/2014													26	90	Exper./Judgent	4,2	20	
50	Install Ducts/Pumps	PRINISKI	10				4/11/2014													20	96	Exper./Judgent	4,2	20	
51	PTP Testing	PRINISKI	3				4/25/2014													6	10	Prev. Experince	4	10	
52																									
	TOTALS								$146	$0	$0	$0	$0	0	430	0	0	0	0	659	357				
									$172	$0	$0	$0	$0	$0	$51	$0	$0	$0	$0	$98	$53				
	TOTAL Preliminary Cost Estimate ($k)=		$375																						

Notes:

(1) Procurement lead time:

	Weeks
Purchase orders-Commercial, off-the-shelf items	3
Purchase orders-Noncommercial items	5
Subcontracts (non construction)	8
Construction subcontracts	9

CATEGORIZATION CODES:

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

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Uncertainty of the Estimate

	High	Medium	Low	Uncertainty Range (%)	Comments/Other Considerations
Design Maturity		X		10	
Design Complexity			X	10	

Residual Impacts

	Risk Description	Likelihood of Occurring	Mitigation Plan	Basis of estimate	Cost Impact		Schedule Impact	
					Low ($K)	High ($K)	Low (weeks)	High (Weeks)
1	Leaks discovered durring intallation/testing	L	Depending on location, field fix or replace with spares	Past NSTX Experience	0	20	0	2
2								
3								
4								
5								

Notes:

(1) Cost impacts should NOT include standing army costs which are separately calculated from the schedule impact

(2) The schedule impacts should be entered as the min and max impacts on the critical path.
If there is no critical path impact then the schedule entries should be zero.

(3) Likelihood of occurrence should be entered consistent with our risk classification methodology, i.e.
VL= Very Likely (P>80%), L=Likely (80%>P>40%), U=Unlikley (40%>P>10%), VU=Very Unlikely (P<10%), NC=Non-credible (P<1%)

Design Complexity

Design Maturity	Low		Medium		High	
Low	-15%	+25%	-20%	+40%	-30%	+60%
Medium	-10%	+15%	-15%	+25%	-20%	+40%
High	-5%	+10%	-10%	+15%	-15%	+25%

Design Maturity Definition

High

Final design available. All design features/requirements well known. No further design development or evolution expected that will impact estimate.

Medium

Preliminary design available. Some additional design evolution likely. Further developments can be somewhat expected or anticipated and reflected in estimate.

Low

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

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.

Medium

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

High

Extremely challenging tasks and/or requirements. Unique or firstof-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 Recommended

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Materials and Subcontracts (M&S)			Basis of Estimate
Description:			
Item 1: 3200 l/s TMPs x 2	$64K	Vednor Quote, summer 2009	6- Vendor Quote

CATEGORIZATION CODES:

1 - National Standards
2 - Engineering Judgement/Experience
3 - Estimates/Data from External Sources (e.g., W7X, ATF, etc.)
4 - Previous PPPL/ORNL Experieince (e.g., TFTR, NSTX, PLT, etc.)
5 - Prototype Data/Test Results
6 - Catelogue Price/Vendor Quote
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9 - Other

TOTALS