Work Authorization Document

NSTX Upgrade Project

Control Account #:	2440	**Title:**	2nd NBI Beamline
WBS	1.2.4	**Title:**	NB Injection
Period of Performance:	23 February 2009 through 16 October 2013		
Authorized Budget:	$2,590	**Control Account Manager:**	Denault
Revision #:	0	**Revision Date:**	July-11

Authorized Work Description:

This WBS element includes refurbishment of a TFTR NBI and its relocation to the NSTX test cell.

Included in this WBS element are the activities necessary to refurbish a TFTR Neutral Beam beamline for use on NSTX. This scope includes replacing copper impinged parts as required and refurbishment of the seals, thermocouple wiring, and bellows (cal and spool) as needed.

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.

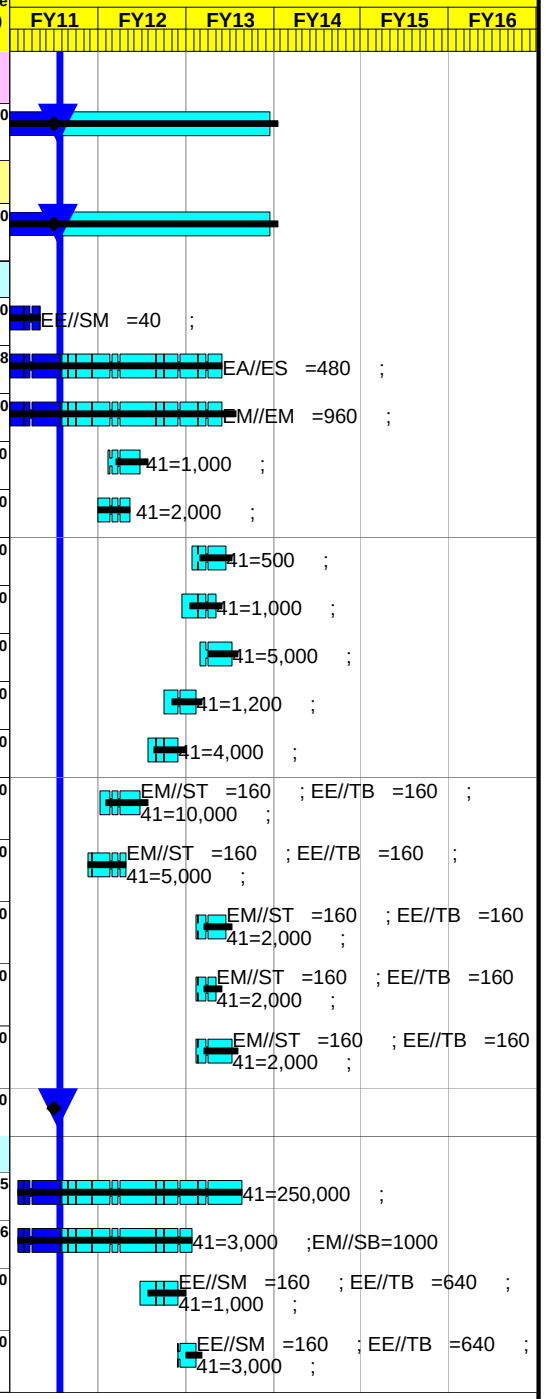
Control Account History

ECP#	Implement Date	Prior Budget	New Budget	Signature

Approvals	Name	Signature	Date
NSTX-U Project Manager	R. Strykowsky		
Control Account Manager	Denault		
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		1,145	23FEB09A	23FEB09A	16OCT13	18SEP13	20	8	2,584,573.79		221,512.64	245,321.30
Job: 2440 - 2nd NBI Beamline-DENAULT												
Subtotal		1,145	23FEB09A	23FEB09A	16OCT13	18SEP13	20	8	2,584,573.79		221,512.64	245,321.30
Procure, Fab & Assembly												
2440-0001	Begin refurbishment job parts list	143*	01OCT10*	01OCT10A	01FEB11	31JAN11A	1		6,212.80	100	6,212.80	6,212.80
2440-0002	Prepare drawings	600*	01OCT10*	01OCT10A	01MAR13	01MAR13	0	147	44,155.30	45	19,869.89	10,523.68
2440-0002A	Engineering Supervision (LOE)	599*	01OCT10*	01OCT10A	26APR13	28FEB13	41	148	161,013.17	LOE	38,620.58	36,105.80
2440-0003	Calorimeter parts	90	13DEC11	11NOV11	24APR12	27MAR12	20	8	1,290.00		0.00	0.00
2440-0004	Ion Dump parts	90	03OCT11*	03OCT11*	15FEB12	15FEB12	0	37	2,580.00		0.00	0.00
2440-0005	Magnet parts	90	28NOV12	29OCT12	11APR13	14MAR13	20	8	660.00		0.00	0.00
2440-0006	90 inch flange and neutralizer parts	90	15OCT12	17SEP12	28FEB13	31JAN13	20	8	1,316.67		0.00	0.00
2440-0007	Exit spool piece parts	90	04JAN13	28NOV12	09MAY13	11APR13	20	8	6,600.00		0.00	0.00
2440-0008	BL Lid parts	90	03AUG12	06JUL12	11DEC12	09NOV12	20	8	1,560.00		0.00	0.00
2440-0009	BL Box parts	90	23MAY12	25APR12	28SEP12	30AUG12	20	8	5,160.00		0.00	0.00
2440-0011	Calorimeter TC wiring	115	04NOV11	07OCT11	24APR12	27MAR12	20	8	45,034.40		0.00	0.00
2440-0012	Ion Dump TC wiring	103	22AUG11*	22AUG11*	24JAN12	24JAN12	0	53	37,745.26		0.00	0.00
2440-0013	Magnet TC wiring	78	14DEC12	14NOV12	11APR13	14MAR13	20	8	35,451.20		0.00	0.00
2440-0014	90 inch flange and neutralizer TC wiring	48	14DEC12	14NOV12	28FEB13	31JAN13	20	8	35,451.20		0.00	0.00
2440-0015	Exit spool piece TC wiring (refurb & relocate)	98	14DEC12	14NOV12	09MAY13	11APR13	20	8	35,451.20		0.00	0.00
2440PEER	Peer Review	0			31MAR11	14APR11A	-10		0.00		0.00	0.00
Refurbishment												
2440-0017A	Radiation Supplies (M&S) (LOE)	635*	01NOV10*	01NOV10A	20MAY13	20MAY13	0	91	321,649.61	LOE	61,756.73	61,797.25
2440-0017B	Test Cell Maintenance (LOE)	500*	01NOV10*	01NOV10A	30OCT12	30OCT12	0	226	131,251.04	LOE	32,025.26	32,025.26
2440-0018	Refurbish BL Box	110	25APR12*	28MAR12*	28SEP12	30AUG12	20	8	87,454.80		0.00	0.00
2440-0020	Refurbish BL Lid	50	01OCT12	31AUG12	11DEC12	09NOV12	20	8	91,177.44		0.00	0.00



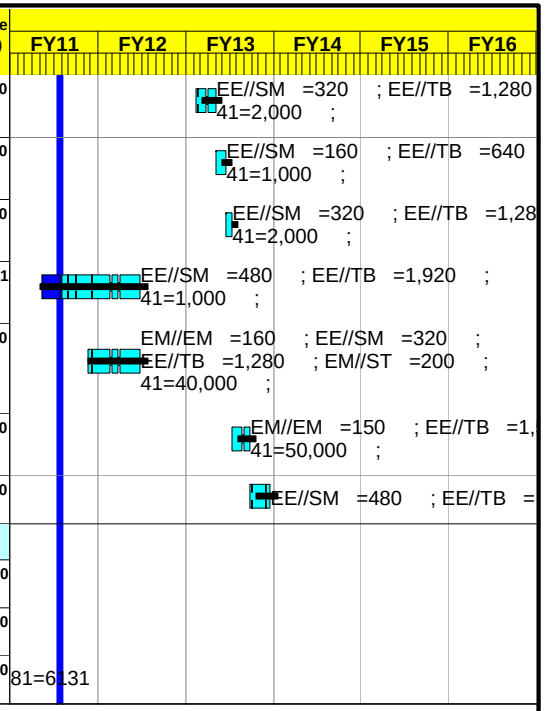
Data Date 30APR11
Run Date 20MAY11 10:54

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)
2440-0022	Refurbish 90 inch flange and neutralizer	50	12DEC12	12NOV12	28FEB13	31JAN13	20	8	178,598.40		0.00	0.00
2440-0024	Refurbish Bending Magnet	30	01MAR13	01FEB13	11APR13	14MAR13	20	8	89,299.20		0.00	0.00
2440-0026	Refurbish spool piece	20	12APR13	15MAR13	09MAY13	11APR13	20	8	178,598.40		0.00	0.00
2440-0028	Refurbish Ion Dump	284*	01FEB11*	07FEB11A	23APR12	23MAR12	21	10	279,383.97	8	22,422.38	58,051.51
2440-0030	Refurbish Calorimeter	148	22AUG11*	22AUG11*	24APR12	27MAR12	20	8	269,381.13		0.00	0.00
2440-0031	Modify to New style	50	10MAY13	12APR13	23JUL13	21JUN13	20	8	233,556.00		0.00	0.00
2440-0033	Reassembly & Test & relocate	60	24JUL13	24JUN13	16OCT13	18SEP13	20	8	263,937.60		0.00	0.00
FY092440	FY09 Actual Cost	22*	23FEB09A	23FEB09A	30SEP09A	30SEP09A	0		28,566.00	100	28,566.00	28,566.00
FY102440	FY10 Actual Cost	100	01DEC09A	01DEC09A	30APR10A	30APR10A	0		5,908.00	100	5,908.00	5,908.00
FY102440A	FY10 Actual Cost	1	03MAY10A	03MAY10A	30SEP10A	30SEP10A	0		6,131.00	100	6,131.00	6,131.00



2440 2nd NBI Beamline (Denault)	START	28FEB2009	31MAR2009	30APR2009	31MAY2009	30JUN2009	31JUL2009	31AUG2009	30SEP2009	31OCT2009	30NOV2009	31DEC2009
BCWS	0	1	4	4	4	4	4	4	4	0	0	1
CUM BCWS	0	1	5	9	13	17	21	25	29	29	29	30
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	.	-1.	-5.	-9.	-13.	-17.	-21.	-25.	-29.	-29.	-29.	-30.
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

2440 2nd NBI Beamline (Denault)		31JAN2010	28FEB2010	31MAR2010	30APR2010	31MAY2010	30JUN2010	31JUL2010	31AUG2010	30SEP2010	31OCT2010	30NOV2010	31DEC2010
	BCWS	1	1	1	1	1	1	1	1	1	8	22	19
	CUM BCWS	31	32	33	34	36	37	38	39	41	48	70	89
	BCWP	0	0	0	0	0	0	0	0	0	0	0	92
	CUM BCWP	0	0	0	0	0	0	0	0	0	0	0	92
	ACWP	0	0	0	0	0	0	0	0	0	0	0	61
	CUM ACWP	0	0	0	0	0	0	0	0	0	0	0	61
	CV	0	0	0	0	0	0	0	0	0	0	0	31
	SV	-31.	-32.	-33.	-34.	-36.	-37.	-38.	-39.	-41.	-48.	-70.	3.
	CPI	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.51
	SPI	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.03

2440 2nd NBI Beamline (Denault)		31JAN2011	28FEB2011	31MAR2011	30APR2011	31MAY2011	30JUN2011	31JUL2011	31AUG2011	30SEP2011	31OCT2011	30NOV2011	31DEC2011
	BCWS	23	37	43	39	39	41	39	57	79	82	93	95
	CUM BCWS	112	149	192	231	270	311	350	407	487	569	662	757
	BCWP	25	35	26	30	0	0	0	0	0	0	0	0
	CUM BCWP	117	152	178	208	208	208	208	208	208	208	208	208
	ACWP	2	26	4	21	0	0	0	0	0	0	0	0
	CUM ACWP	63	89	93	114	114	114	114	114	114	114	114	114
	CV	55	63	85	94	94	94	94	94	94	94	94	94
	SV	5.	2.	-14.	-23.	-62.	-103.	-142.	-199.	-278.	-361.	-454.	-548.
	CPI	1.87	1.71	1.91	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82
	SPI	1.05	1.02	0.93	0.9	0.77	0.67	0.59	0.51	0.43	0.37	0.31	0.28

2440 2nd NBI Beamline (Denault)	31JAN2012	29FEB2012	31MAR2012	30APR2012	31MAY2012	30JUN2012	31JUL2012	31AUG2012	30SEP2012	31OCT2012	30NOV2012	31DEC2012
BCWS	93	83	86	73	43	40	42	44	39	66	58	91
CUM BCWS	850	932	1,019	1,092	1,135	1,175	1,217	1,262	1,300	1,367	1,425	1,516
BCWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM BCWP	208	208	208	208	208	208	208	208	208	208	208	208
ACWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM ACWP	114	114	114	114	114	114	114	114	114	114	114	114
CV	94	94	94	94	94	94	94	94	94	94	94	94
SV	-641.	-724.	-811.	-884.	-927.	-967.	-1009.	-1053.	-1092.	-1158.	-1216.	-1307.
CPI	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82
SPI	0.25	0.22	0.2	0.19	0.18	0.18	0.17	0.17	0.16	0.15	0.15	0.14

2440 2nd NBI Beamline (Denault)		31JAN2013	28FEB2013	31MAR2013	30APR2013	31MAY2013	30JUN2013	31JUL2013	31AUG2013	30SEP2013	31OCT2013	30NOV2013	31DEC2013
	BCWS	125	109	96	172	143	88	101	95	91	54	0	0
	CUM BCWS	1,641	1,750	1,846	2,018	2,161	2,249	2,350	2,445	2,536	2,590	2,590	2,590
	BCWP	0	0	0	0	0	0	0	0	0	0	0	0
	CUM BCWP	208	208	208	208	208	208	208	208	208	208	208	208
	ACWP	0	0	0	0	0	0	0	0	0	0	0	0
	CUM ACWP	114	114	114	114	114	114	114	114	114	114	114	114
	CV	94	94	94	94	94	94	94	94	94	94	94	94
	SV	-1433.	-1542.	-1638.	-1810.	-1953.	-2041.	-2142.	-2237.	-2328.	-2382.	-2382.	-2382.
	CPI	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82
	SPI	0.13	0.12	0.11	0.1	0.1	0.09	0.09	0.09	0.08	0.08	0.08	0.08

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

thermal loading. Disruption loads on the ECH waveguide will be evaluated for the Center Stack Upgrade Fields and field transients. Discussions with heating system experts regarding the performance of the ECH system for the higher Center Stack Upgrade fields indicate that no modification to the resonant frequency or other operational characteristic for the system will require upgrade. Only disruption qualification is planned. No previous qualification has been identified, so the resources include creation of a new calculation – not a review of an existing calculation as is the case for ICRH.
{Electron Cyclotron Heating (Job 2300)}

WBS Element: 1.2.4 **WBS Level: 3**
WBS Title: Neutral Beam Injection (NBI)
Definition: The Neutral Beam Injection System Upgrade provides a second Neutral Beam as part of the NSTX Upgrade Project. The second NBI is identical to the one already installed on NSTX. An existing TFTR beam will be decontaminated, refurbished, and installed on NSTX. This WBS element includes the NBI source refurbishment; the TFTR beamline decontamination, refurbishment and relocation to the NSTX Test Cell; the 2nd NBI Services; the NBI armor modifications; the 2nd NBI Power, Controls and Instrumentation; the 2nd NBI Duct and vacuum vessel modifications; and the NSTX Test Cell equipment removals and relocations necessary to accommodate the 2nd NBI. Vacuum Pumping System Modifications necessary to accommodate the 2nd NBI are included in WBS element 1.3. NBI Management and Health Physics support are included in element WBS 1.7.

WBS Element: 1.2.4.2 **WBS Level: 4**
WBS Title: NBI Source Refurbishment
Definition: This WBS element includes the activities to refurbish three neutral beam ion sources for the 2nd Neutral beamline, as currently being performed for the installed Neutral beamline 1.
{Source Refurbishment (Job 2420)}

WBS Element: 1.2.4.3 **WBS Level: 4**
WBS Title: NSTX Beamline 2 Decontamination
Definition: This WBS element includes the disassembly and decontamination activities of a TFTR Neutral Beam beamline in preparation for beamline refurbishment and reuse as an NSTX upgrade.
{NSTX Beamline 2 Decontamination (Job 2430)}

WBS Element: 1.2.4.4 **WBS Level: 4**
WBS Title: NBI Beamline Refurbishment and Relocation
Definition: This WBS element includes refurbishment of a TFTR NBI and its relocation to the NSTX test cell.

Included in this WBS element are the activities necessary to refurbish a TFTR Neutral Beam beamline for use on NSTX. This scope includes

replacing copper impinged parts as required and refurbishment of the seals, thermocouple wiring, and bellows (cal and spool) as needed.
{NSTX Beamline 2 Refurbishment (Job 2440)}

Also included in this WBS element are the efforts necessary to relocate a TFTR neutral beam line and ancillary equipment into the NSTX test cell. This includes High Voltage Enclosures (HVEs) and the complete beam box.
{NSTX Beamline 2 Relocation (Job 2425)}

WBS Element: 1.2.4.5 **WBS Level: 4**
WBS Title: NSTX Beamline 2 Services
Definition: This WBS element includes the efforts to provide services to the new neutral beam beamline and ancillary equipment in NSTX test cell. These services include water, cryogenic systems, gas supplies, and vacuum lines.
{NSTX Beamline 2 Services (Job 2450)}

WBS Element: 1.2.4.6 **WBS Level: 4**
WBS Title: NBI Armor
Definition: This WBS element includes the design, fabrication, and installation of upgraded and relocated neutral beam armor including cooling and instrumentation work.
{NBI Armor (Job 2460)}

WBS Element: 1.2.4.7 **WBS Level: 4**
WBS Title: NBI Beamline 2 Power and Controls
Definition: This WBS element includes providing power, controls and instrumentation for the 2nd Neutral beamline.

Included in this WBS element is providing power for the NBI beamline 2. NB2 is planned to be powered from the TFTR NB4 A, B, & C line ups. The electrical equipment in these line ups will be reactivated. The TFTR NB4 HVEs will be relocated to the NSTX Test Cell as part of WBS element 1.2.4.4. New triax cables will be installed with terminations from the Modregs to the HVEs. New Decel coaxial cables will be installed from the Decel supplies to the Sources. The Arc, Filament, Magnet, and the 208 feeds, to HVEs cables, will be spliced in the TFTR Test Cell basement to new cabling designed and installed from the TFTR Basement to the NSTX Test Cell. The fiber cables also will be spliced with additional lengths recovered from other TFTR line ups. The AC auxiliaries and Grounding for the NB2 will be designed and installed.
{NBI Power System (Job 2470)}

Also included in this WBS element are the controls and instrumentation for the NB2. The work covers PLC, programming, control racks, new thermocouples, TC scanner, miscellaneous controls, and control cabling. The work also includes the gradient grid upgrade. System integration and testing will also be performed as part of this effort.

Work Approval Form (WAF)

Cost Center: 9418
Job Number: 2440
Job Title: NSTX Beamline 2 Refurbishment
Job Manager: Martin Denault

Description:

This job includes the activities necessary to refurbish a TFTR Neutral Beam beamline for use on NSTX. This scope includes replacing copper impinged parts as required and refurbishment of the seals, thermocouple wiring, and bellows (cal and spool) as needed.

Schedule:

Refer to Primavera Data-Base

Approvals:

7-20-10
Job Manager

8/3/10
Project Manager

8/3/10
Engineering Department Head

Cost Center:	9418
Job Number:	2440
Job Title:	NSTX Beamline 2 Refurbishment
Job Manager:	Martin Denault

Martin Denault

USER INPUT TASKS AND DESCRIPTIONS

SCHEDULE — ***USER INPUT***

Estimate (user input)

FY10$K — **HOURS (priced at FY10 rates)**

task numb	P3 cross ref (optinal)	TASK DESCRIPTION	Resp.	DURATION in WORK DAYS	*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** EM (Designer)	EC** TB (Computing Tech)	EE** EM (Electr Engr)	EE** SM (Senior Electr Tech)	EE** SB (Electr Tech)	EE** TB (Electr Tech)	EM** EM (FO&M Engr)	EM** SM Senior Tech)	EM** SB (FO&M Tech)	EM** TB (FO&M Tech)	DP** SB/TB (HP Tech)	Contingency	Names of req'd skills if known	Basis of Estimate Category
1		Begin refurbishment job parts list		60		10/1/09											40								10%		4
2		Prepare drawings		600		1/4/10								480											10%		4
		Engineering Supervision		600		1/5/10														960					10%		4
		Fabrication																									
3		Calorimeter parts		20		3/1/10		1.0																	15%		4
4		Ion Dump parts		40	3			2.0																	15%		4
5		Magnet parts		20	4			0.5																	15%		4
6		90 inch flange and neutralizer parts		40	5			1.0																	15%		4
7		Exit spool piece parts		20	6			5.0																	15%		4
8		BL Lid parts		20	7			1.2																	15%		4
9		BL Box parts		20	8			4.0																	15%		4
10																											
11		Calorimeter TC wiring		20	9			10.0											160				160		15%		4
12		Ion Dump TC wiring		20	11			5.0											160				160		15%		4
13		Magnet TC wiring		20	12			2.0											160				160		15%		4
14		90 inch flange and neutralizer TC wiring		20	13			2.0											160				160		15%		4
15		Exit spool piece TC wiring		20	14			2.0											160				160		15%		4
17																											
		Refurbishment						250.0																	15%	Rad Supplies	Decon Actuals
18		Refurbish BL Box		50		10/1/10		1.0									160		640						15%		2
19																											
20		Refurbish BL Lid		50	18			3.0									160		640						15%		2
21																											
22		Refurbish 90 inch flange and neutralizer		50	20			2.0									320		1,280						15%		2
23																											
24		Refurbish Bending Magnet		30	22			1.0									160		640						15%		2
25																											
26		Refurbish spool piece		20	24			2.0									320		1,280						15%		2
27																											
28		Refurbish Ion Dump		50	26			1.0									480		1,920				320		15%		2
29																											
30		Refurbish Calorimeter		50	28			40.0									320		1,280	160			200		15%		2
31																									15%		5
32																											
33		Reassembly & Test		60		1/2/12											480		1,920						15%		2

Cost Center:	9418
Job Number:	2440
Job Title:	NSTX Beamline 2 Refurbishment
Job Manager:	Martin Denault

Martin Denault

USER INPUT TASKS AND DESCRIPTIONS

SCHEDULE

USER INPUT

Estimate (user input)

FY10$K

HOURS (priced at FY10 rates)

task	TASK DESCRIPTION	Resp.	DURATION in WORK DAYS	*Logical Pre-requisites (one task numbers in each column ,any order)*	User Input Start Date (optional)	actuals= A	M&S (41)	CREDIT CARD (43)	OTHER (39)	TRAVEL (35)	OVERTIME (31)	EA** EM (analysis engr)	EA** (Designer	EC** TB (Computing Tech)	EE** EM (Elctr Engr)	EE** SM (Senior Electr Tech)	EE** SB (Electr Tech)	EE** TB (Electr Tech)	EM** EM (FO&M Engr)	EM** SM Senior Tech)	EM** SB (FO&M Tech)	EM** TB (FO&M Tech)	OP** SB/TB (HP Tech)	Contingency	Names of req'd skills if known	Basis of Estimate Category
	TOTALS						**385.7**	**$0**	**$0**	**$0**	**$0**	**0**	**480**	**0**	**0**	**2440**	**0**	**11900**	**1270**	**0**	**0**	**1320**	**0**			
							454.4	$0	$0	$0	$0	$0	$57	$0	$0	$367	$0	$994	$189	$0	$0	$118	$0			

TOTAL Preliminary Cost Estimate ($k)= $2,180

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

Cost Center:	9418																
Job Number:	2440																
Job Title:	NSTX Beamline 2 Refurbishment																
Job Manager:	Martin Denault																
	Martin Denault																
Uncertainty of the Estimate																	
			High	Medium	Low	Uncertainty Range (%)	Comments/Other Considerations										
	Design Maturity		X				Remaking existing parts.										
	Design Complexity			X			Calorimeter double bellows.										
	Refer to Primavera Data-Base																
Residual Impacts																	
														Cost Impact		Schedule Impact	
	Risk Description					Likelihood of Occurring	Mitigation Plan				Basis of estimate			Low ($K)	High ($K)	Low (weeks)	High (Weeks)
1																	
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 Maturity	Design Complexity					
	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 AACE! Recommende

Cost Center:	**9418**						
Job Number:	**2440**						
Job Title:	**NSTX Beamline 2 Refurbishment**						
Job Manager:	**Martin Denault**						
	Martin Denault						
Materials and Subcontracts (M&S)				**Basis of Estimate**			
Description:							
Copper				Weight of Cu needed at $4.00 per pound.			
RAD Supplies				Decon actuals scaled to job.			
Wire				Spools of wire needed.			
O rings, tools, general supplies				experience.			
Sheet metal				experience.			
Hardware				experience.			

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TOTALS