

Work Authorization Document

NSTX Upgrade Project

Control Account #:	7710	Title:	Upgrade Allocations
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WBS	1.7.1.5	Title:	Project Support and Integration
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Period of Performance: 23 February 2009 through 30 September 2014

Authorized Budget:	\$2,984	Control Account Manager: Stevenson
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Revision #: 0	Revision Date: July-11
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Authorized Work Description:

Also included in this WBS element are the home office Health Physics efforts necessary to support the collection of radiological analyses of various environmental samples and bioassay samples, and the collection of analyses of data on the gamma radiation spectra of radioactive material at PPPL that are allocated to all Laboratory projects based on their usage of Health Physics staff. This WBS element includes the costs to cover Laboratory Engineering and Scientific Computing and Environmental Services that are allocated to all Laboratory projects based on their funding levels.

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

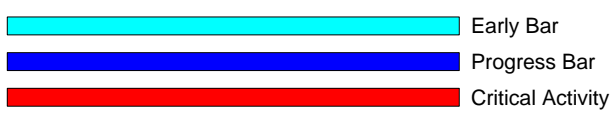
ECP#	Implement Date	Prior Budget	New Budget	Signature
1	5/31/2011	\$381	\$2,984	

Approvals	Name	Signature	Date
NSTX-U Project Manager	R. Strykowski		
Control Account Manager	Stevenson		
Functional Manager	M. Williams		

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					
NSTX Upgrade Project																							
Subtotal		1,401	23FEB09A	23FEB09A	30SEP14	30SEP14	0	1,487	2,984,625.00		381,296.60	1,381,296.60											
Job: 7710 - HP & Other Allocations-STRYKOWSKY																							
Subtotal		1,401	23FEB09A	23FEB09A	30SEP14	30SEP14	0	1,487	2,984,625.00		381,296.60	1,381,296.60											
HP Allocations																							
1180*NUL	FY10 Actual Cost	143	01OCT09A	01OCT09A	30SEP10A	30SEP10A	0		452,420.00	100	452,420.00	452,420.00	54X	=452,420									
CS9500070	NSTX Upgrade HP Allocations FY2010	106*	03MAY10A	03MAY10A	30SEP10A	30SEP10A	0		0.00	100	0.00	0.00	54X	=117682									
CS9500080	NSTX Upgrade HP Allocations FY11	250*	01OCT10*	01OCT10A	30SEP11	30SEP11	0	1,487	353,100.00	LOE	201,973.20	201,973.20	54X	=214000									
CS9500090	NSTX Upgrade HP Allocations FY12	249	03OCT11*	03OCT11*	28SEP12	28SEP12	0	1,487	535,040.00		0.00	0.00		54X	=304000								
CS9500100	NSTX Upgrade HP Allocations FY13	248	01OCT12*	01OCT12*	30SEP13	30SEP13	0	1,487	481,510.00		0.00	0.00			54X	=269000							
CS9500110	NSTX Upgrade HP Allocations FY14	248	01OCT13*	01OCT13*	30SEP14	30SEP14	0	1,487	414,000.00		0.00	0.00				54X	=225000						
FY09NNUL8	FY09 Actual Cost	22*	23FEB09A	23FEB09A	30SEP09A	30SEP09A	0		367,345.00	100	367,345.00	367,345.00											
Other Allocations																							
1170*NUL	FY10 Actual Cost	143	01OCT09A	01OCT09A	30SEP10A	30SEP10A	0		170,667.00	100	170,667.00	170,667.00	54X	=170667									
7710-10	NSTX Upgrade Direct Allocations FY2010	106	03MAY10A	03MAY10A	30SEP10A	30SEP10A	0		0.00	100	0.00	0.00	54X	=96059									
7710-11	NSTX Upgrade Direct Allocations FY11	250*	01OCT10*	01OCT10A	30SEP11	30SEP11	0	1,487	29,700.00	LOE	16,988.40	16,988.40	54X	=18000									
7710-12	NSTX Upgrade Direct Allocations FY12	249	03OCT11*	03OCT11*	28SEP12	28SEP12	0	1,487	3,520.00		0.00	0.00		54X	=2000								
7710-13	NSTX Upgrade Direct Allocations FY13	248	01OCT12*	01OCT12*	30SEP13	30SEP13	0	1,487	3,580.00		0.00	0.00			54X	=2000							
7710-14	NSTX Upgrade Direct Allocations FY14	248	01OCT13*	01OCT13*	30SEP14	30SEP14	0	1,487	1,840.00		0.00	0.00				54X	=1000						
9417*NUL	FY10 Actual Cost	110	01JUN10A	01JUN10A	30SEP10A	30SEP10A	0		12,934.00	100	12,934.00	12,934.00	54X	=12934									
FY09NNUL	FY09 Actual Cost	22*	23FEB09A	23FEB09A	30SEP09A	30SEP09A	0		158,969.00	100	158,969.00	158,969.00											

Data Date: 30APR11 1105
Run Date: 20MAY11 11:05

**NSTX UPGRADES
RESOURCE LOADED SCHEDULE
CD-2 Schedule
April 2011**



7710 NSTX-U HP and Other Allocations (Strykowski)	31JAN2011	28FEB2011	31MAR2011	30APR2011	31MAY2011	30JUN2011	31JUL2011	31AUG2011	30SEP2011	31OCT2011	30NOV2011	31DEC2011
BCWS	32	30	35	32	32	33	32	35	33	43	46	46
CUM BCWS	1,282	1,313	1,348	1,380	1,411	1,445	1,477	1,512	1,545	1,589	1,634	1,680
BCWP	32	30	35	32	0	0	0	0	0	0	0	0
CUM BCWP	1,282	1,313	1,348	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380
ACWP	-2	0	947	23	0	0	0	0	0	0	0	0
CUM ACWP	343	343	1,289	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312
CV	940	970	58	67	67	67	67	67	67	67	67	67
SV	.	.	.	.	-32.	-65.	-97.	-132.	-166.	-209.	-255.	-300.
CPI	3.74	3.83	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
SPI	1	1	1	1	0.98	0.95	0.93	0.91	0.89	0.87	0.84	0.82

7710 NSTX-U HP and Other Allocations (Strykowski)	31JAN2012	29FEB2012	31MAR2012	30APR2012	31MAY2012	30JUN2012	31JUL2012	31AUG2012	30SEP2012	31OCT2012	30NOV2012	31DEC2012
BCWS	46	43	46	43	48	43	46	48	41	43	41	39
CUM BCWS	1,725	1,769	1,814	1,858	1,906	1,949	1,995	2,042	2,084	2,126	2,167	2,206
BCWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM BCWP	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380
ACWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM ACWP	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312
CV	67	67	67	67	67	67	67	67	67	67	67	67
SV	-346.	-389.	-435.	-478.	-526.	-569.	-615.	-663.	-704.	-747.	-788.	-827.
CPI	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
SPI	0.8	0.78	0.76	0.74	0.72	0.71	0.69	0.68	0.66	0.65	0.64	0.63

7710 NSTX-U HP and Other Allocations (Strykowski)	31JAN2013	28FEB2013	31MAR2013	30APR2013	31MAY2013	30JUN2013	31JUL2013	31AUG2013	30SEP2013	31OCT2013	30NOV2013	31DEC2013
BCWS	43	37	39	41	43	37	43	41	39	37	33	35
CUM BCWS	2,249	2,286	2,325	2,366	2,409	2,446	2,489	2,530	2,569	2,605	2,639	2,674
BCWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM BCWP	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380
ACWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM ACWP	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312
CV	67	67	67	67	67	67	67	67	67	67	67	67
SV	-870.	-907.	-946.	-987.	-1029.	-1067.	-1109.	-1150.	-1189.	-1226.	-1259.	-1294.
CPI	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
SPI	0.61	0.6	0.59	0.58	0.57	0.56	0.55	0.55	0.54	0.53	0.52	0.52

7710 NSTX-U HP and Other Allocations (Strykowski)	31JAN2014	28FEB2014	31MAR2014	30APR2014	31MAY2014	30JUN2014	31JUL2014	31AUG2014	30SEP2014	31OCT2014	30NOV2014	31DEC2014
BCWS	37	32	33	35	35	33	37	33	35	0	0	0
CUM BCWS	2,711	2,742	2,776	2,811	2,846	2,879	2,916	2,950	2,985	2,985	2,985	2,985
BCWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM BCWP	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380
ACWP	0	0	0	0	0	0	0	0	0	0	0	0
CUM ACWP	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312
CV	67	67	67	67	67	67	67	67	67	67	67	67
SV	-1331.	-1363.	-1396.	-1431.	-1466.	-1500.	-1537.	-1570.	-1605.	-1605.	-1605.	-1605.
CPI	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
SPI	0.51	0.5	0.5	0.49	0.48	0.48	0.47	0.47	0.46	0.46	0.46	0.46

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

cover Neutral Beam engineer's time to prepare for and participate in project cost and schedule reviews.

{NBI Project Support & Integration (Job 7300)}

WBS Element: 1.7.1.4

WBS Level: 4

WBS Title: Health Physics Support

Definition: This WBS element includes the effort necessary for continuous health physics (HP) support for the Neutral beamline decontamination, refurbishment, and relocation to the NTC as well as the HP support for equipment removal and relocations being accomplished under WBS 1.2.4.

{Health Physics Technical Support (Job 7400)}

Also included in this WBS element are the home office Health Physics efforts necessary to support the collection of radiological analyses of various environmental samples and bioassay samples, and the collection of analyses of data on the gamma radiation spectra of radioactive material at PPPL that are allocated to all Laboratory projects based on their usage of Health Physics staff.

{NSTX Upgrade Health Physics Allocations (Job 7700)}

WBS Element: 1.7.1.5

WBS Level: 4

WBS Title: Direct Allocations (Job 7710)

Definition: This WBS element includes the costs to cover Laboratory Engineering and Scientific Computing and Environmental Services that are allocated to all Laboratory projects based on their funding levels.

{NSTX Upgrade Direct Allocations (Job 7710)}

WBS Element: 1.7.2

WBS Level: 3

WBS Title: Project Physics

Definition: Project Physics includes the definition of requirements necessary to meet the overall NSTX mission and supporting objectives, physics analysis supporting the project's design and construction activities, and definition of R&D needs. In addition it includes the provision of hardware and software required for plasma control.

Project Physics is not included in the scope of the Upgrade Project.

WBS Element: 1.7.3

WBS Level: 3

WBS Title: Integrated Systems Tests

Definition: This element includes all of the activities associated with the support of development of all necessary procedures and documents to support the integrated tests, and to support performance of the pre-operational integrated system tests culminating in first plasma.

The WBS element includes Convening the NSTX Activity Certification Committee (ACC) for comprehensive review the upgrades. Prepare and make presentation to the PPPL ES&H Executive Safety Board for

Work Approval Form (WAF)

Cost Center: 9417
Job Number: 7700
Job Title: NSTX Upgrade HP Allocations
Job Manager: Ron Strykowski
Rev 1 7/16/2020

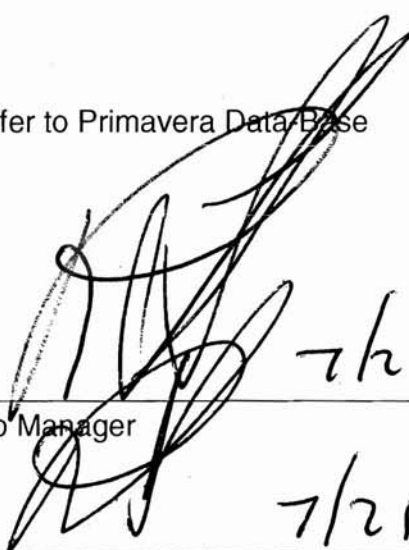
Description:

Health Physics allocated costs are collected in a cost account managed by the PPPL Health Physics Manager. These costs include labor and materials to support the collection of radiological analyses of various environmental samples and bioassay samples, and the collection of analyses of data on the gamma radiation spectra of radioactive material at PPPL. The cost of this activity is "allocated" to the various DOE funded direct programs based on Health Physics field technician support provided.

Schedule:

Refer to Primavera Data Base


Approvals:



Job Manager

7/21/2010


Project Manager

8/3/10


Engineering Department Head



Cost Center:	9417																				
Job Number:	7700																				
Job Title:	NSTX Upgrade HP Allocations																				
Job Manager:	Ron Strykowski																				
Uncertainty of the Estimate																					
	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Uncertainty Range (%)</u>																	
	X																				
	X																				
Residual Impacts																					
	Risk Description			Likelihood of Occurring		Mitigation Plan		Basis of estimate		Low (\$K)	High (\$K)	Schedule Impact Low (weeks)	High (Weeks)								
1	Volatility of over head rates			L				-2% +2%		-65	65										
2	Volatility of base estimates for the allocated cost centers			L				-2% +2%		-65	65										
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=Unlikely (40%<P>10%), VU=Very Unlikely (P<10%), NC=Non-credible (P<1%)																					

Design Maturity		Design Complexity			Design Maturity Definition		
Low	Medium	High	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%	Preliminary design available. Some additional design evolution likely. Further developments can be somewhat expected or anticipated and reflected in estimate.
High	-5%	+10%	-10%	+15%	-15%	+25%	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		Design Maturity			Design Complexity Definition		
Low	Medium	High	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.
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 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 Recommended

Work Approval Form (WAF)

Cost Center: 9417
Job Number: 7710
Job Title: NSTX Upgrade Direct Allocations
Job Manager: Ron Strykowski
Rev 1 7/16/2010

Description:

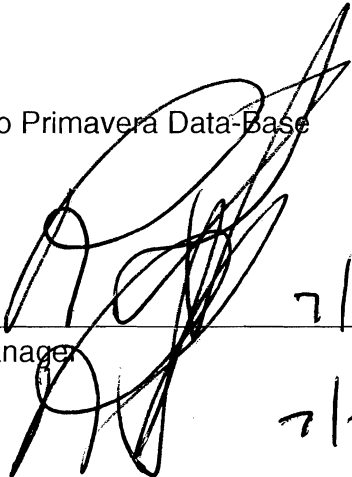
The NSTX Upgrade Direct Allocations covers:
Laboratory Engineering and Scientific Computer Maintenance and Operations that are "allocated" to various laboratory DOE funded programs based on their Research Staff, Computational Scientist and Mechanical Engineering Division Analysis Engineers FTEs that charge each project. Since the NSTX Upgrades will use Mechanical Engineering Analysis Engineers; a portion of the Direct Allocations are assumed to be "allocated" to the NSTX Upgrades based on the ME Analysis Engineer FTEs charging the NSTX Upgrades as a ratio to the total Lab Scientific FTEs.
Laboratory Environmental Services Costs that are "allocated" to all DOE OFES laboratory funded projects *based on total operating costs*. Since a portion of the NSTX Upgrade scope will be funded with operating funds in FY2010 a portion of the Environmental Services Costs are assumed to be allocated to the NSTX Upgrades.

Schedule:

Refer to Primavera Data-Base

Approvals:

Job Manager



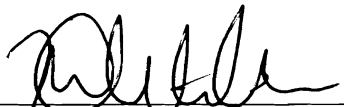
7/20/2010

Project Manager



7/21/2010

Engineering Department Head



8/3/10

Cost Center: 9417		High	Medium	Low	Uncertainty Range (%)	<u>Comments/Other Considerations</u>					
Job Number: 7710		NSTX Upgrade Direct Allocations									
Job Title: NSTX Upgrade Direct Allocations											
Job Manager: Ron Strykowski											
<u>Uncertainty of the Estimate</u>											
Design Maturity		X									
Design Complexity		X									
<u>Residual Impacts</u>											
Risk	Description	Likelihood of Occurring	Mitigation Plan	Basis of estimate	Low (\$K)	High (\$K)	Schedule Impact Low (weeks)	Schedule Impact High (Weeks)			
1	Volatility of over head rates	L		-2% +2%	-65	65					
2	Volatility of base estimates for the allocated cost centers	L		-2% +2%	-65	65					
3											
4											
5											
<u>Notes:</u>											
(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=Unlikely (40%>P>10%), VU=Very Unlikely (P<10%), NC=Non-credible (P<1%)											

Design Complexity		Design Maturity		Design Maturity Definition				
Low	Medium	High						
Low	-15%	+25%	-20%	+40%	-30%	+60%	High	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%	Medium	Preliminary design available. Some additional design evolution likely. Further developments can be somewhat expected or anticipated and reflected in estimate.
High	-5%	+10%	-10%	+15%	-15%	+25%	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		Design Maturity Definition						
Low								
Medium								
High								