

NCSX Fabrication Project Cost and Schedule Estimating Form

WBS 125 Vacuum Vessel Local I&C

Labor

Activity Title	Manhours	FY2003 \$\$	Labor Type	Start Date Month/Yr	End Date Month/Yr	Comments
Preliminary Design (Title I)						
(50% of design schedule)	0		<i>EAEM</i>	May-06	Jul-06	PPPL Engineer
	0		<i>EADM</i>	May-06	Jul-06	PPPL Designer
	79		<i>ORNL Eng</i>	May-06	Jul-06	Composite of ORNL Engineer / Designer
	0		<i>ORNL Phys.</i>	May-06	Jul-06	Composite of ORNL Physics / scientific
	0		<i>PPPL Phys.</i>	May-06	Jul-06	PPPL Physics/scientific
Final Design (Title II)						
(50% of design schedule)	0		<i>EAEM</i>	Jul-06	Aug-06	PPPL Engineer
	0		<i>EADM</i>	Jul-06	Aug-06	PPPL Designer
	79		<i>ORNL Eng</i>	Jul-06	Aug-06	Composite of ORNL Engineer / Designer
	0		<i>ORNL Phys.</i>	Jul-06	Aug-06	Composite of ORNL Physicist
	0		<i>PPPL Phys.</i>	Jul-06	Aug-06	PPPL Physics/scientific
Lab R&D labor						
	0		<i>EAEM</i>	May-06	Jul-06	PPPL Engineer
	0		<i>EADM</i>	May-06	Jul-06	PPPL Designer
	0		<i>ORNL Eng</i>	May-06	Jul-06	Composite of ORNL Engineer / Designer
	0		<i>EASM</i>	May-06	Jul-06	PPPL monthly support
	0		<i>EMTB</i>	May-06	Jul-06	PPPL Technician
Lab Fab/Assembly/Installation (Title III)						
	0		<i>EAEM</i>	Aug-06	Jan-07	PPPL Engineer
	0		<i>EADM</i>	Aug-06	Jan-07	PPPL Designer
	18		<i>ORNL Eng</i>	Aug-06	Jan-07	Composite of ORNL Engineer / Designer
	0		<i>EASM</i>	Aug-06	Jan-07	PPPL monthly support
	0		<i>EMTB</i>	Aug-06	Jan-07	PPPL Technician

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Labor

Manhours per fiscal year by labor category

Level of Effort		FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	TOTAL
PPPL Engineer	<i>EAEM</i>	0	0	0	0	0	0	0
PPPL Designer	<i>EADM</i>	0	0	0	0	0	0	0
Composite of ORNL Engineer / Designer	<i>ORNL Eng</i>	0	0	0	165	12	0	176
PPPL monthly support	<i>EASM</i>	0	0	0	0	0	0	0
PPPL Technician	<i>EMTB</i>	0	0	0	0	0	0	0
Composite of ORNL Physics / scientific	<i>ORNL Phy</i>	0	0	0	0	0	0	0
PPPL Physics/scientific	<i>PPPL Phy</i>	0	0	0	0	0	0	0

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WBS 125 Vacuum Vessel Local I&C

M&S Costs

Activity Title	FY2003 \$\$	Comment
Manufacturing Development (R&D)		
Purchased Design Services	\$0	
Procured Hardware/Material	\$0	
Profit at 10%	\$0	
<i>total, manf/dev (R&D)</i>	\$0	w/o G&A
Procured Hardware/Material		
Thermocouples	\$1,200	
None required	\$0	
0	\$0	
materials for in-house fab	\$0	
subtotal, purchased parts	\$2,400	
Profit at 10%	\$120	
<i>total, procured hdwe/matl.</i>	\$3,720	w/o G&A
Purchased Design Services	\$0	no purchased services anticipated
Procured Installation/Assembly Costs	\$0	All installation and assembly costs are included in WBS 7

Other Costs

Activity Title	FY2003 \$\$	Comment
Travel	\$0	No travel is anticipated for this WBS

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WBS 125 Vacuum Vessel Local I&C

Summary Costs

Activity Title	Manhours	FY2003 \$\$	Comment
Labor			
PPPL Effort	0	\$0	<i>Assumed rates:</i> <i>EAEM</i> 153 \$/hr <i>EADM</i> 100 \$/hr <i>ORNL Eng</i> 130 \$/hr <i>EASM</i> 100 \$/hr <i>EMTB</i> 73 \$/hr PPPL Phys 141 \$/hr ORNL Phys 160 \$/hr
ORNL effort	176	\$22,932	
subtotal, labor	176	\$22,932	
M&S, Other			
Manufacturing Development (R&D)		\$0	
Procured Hardware/Material		\$3,720	
Purchased Design Services		\$0	
Procured Installation/Assembly Costs		\$0	
Travel		\$0	
subtotal, M&S		\$3,720	
G&A		\$930	25% on all purchased materials, subcontracts, travel
Subtotal without contingency		\$27,582	
Contingency		\$8,275	30% Overall on this WBS
Total cost		\$35,857	

NCSX Fabrication Project Cost and Schedule

WBS 125 Vacuum Vessel Local I&C

Engineering, Title I, II and III

Description:

This effort covers all Title I, II, and III engineering for the vacuum vessel local I&C for Phases I, II, and III of NCSX operation. The sensors and wires will be procured from a qualified vendor. All installation oversight will be performed as part of WBS 7.

	multiplier	unit	no.	hours	Labor category											
					total fraction		EAEM		EADM		ORNL Eng		ORNL Physics		PPPL Physics	
					fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs		
Title I, II design																
Pro-E models	8	hrs/model	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	
assy dwgs	40	hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	
Detail drawings	16	hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	
installation dwg	40	hrs/dwg	3	120	1.00	0.00	0	0.00	0	1.00	120	0.00	0	0.00	0	
cooling schematic	0	hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	
electrical schematic	0	hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	
I&C schematic	8	hrs/dwg	3	24	1.00	0.00	0	0.00	0	1.00	24	0.00	0	0.00	0	
stress analysis	0	hrs/calc	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	
thermal analysis	0	hrs/calc	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	
special analysis	40	hrs/calc	0	0	1.00	0.00	0	0.00	0	0.00	0	1.00	0	0.00	0	
procurement specifications	16	hrs/spec	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	
preliminary and final design reviews	0	hrs/rev	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	
meetings/reporting/presentations	10%	% of tot	144	14	1.00	0.00	0	0.00	0	1.00	14	0.00	0	0.00	0	
<i>subtotal</i>				158			0		0	158		0		0		
Title III																
vendor oversight, inspection	8	hrs/lot	1	8	1.00	0.00	0	0.00	0	0.00	0	1.00	8			
in-house fab/assy oversight and inspection	0	hrs/wk	4	0	1.00	0.00	0	1.00	0	0.00	0	0.00	0			
Disposition of deviation requests and non-conformances	0.5	hrs/wk	20	10	1.00	0.00	0	0.00	0	0.00	0	1.00	10			
As-built drawings	0	hrs/dwg	3	0	1.00	0.00	0	0.00	0	0.00	0	1.00	0			
Installation oversight and inspection	0	hrs/wk	4	0	1.00	0.25	0	0.75	0	0.00	0	0.00	0			
<i>subtotal</i>				18			0		0	0		18				

NCSX Fabrication Project Cost and Schedule

WBS 125 Vacuum Vessel Local I&C

Engineering, Title I, II and III

Schedule assumptions	start	duration (weeks)	end
Title I Design, R&D	May-06	6	Jul-06
Title II Design	Jul-06	6	Aug-06
Procurement	Aug-06	12	Nov-06
In-house fab / sub-assy	Nov-06	4	Dec-06
Installation / final assembly	Dec-06	4	Jan-07

Notes and worksheets

Vacuum vessel local I&C

	total	vessel torus	vessel port extensions	
Pro-E models	0			
assy dwgs	0			
Detail drawings	0			
installation dwg	3	1	2	typical drawing for RTD and Strain gage installation
cooling schematic	0			PF-1,2,3 share one drawing for RTDs, one for Strain gages
electrical schematic	0			
I&C schematic	3	1	2	
stress analysis	0			
thermal analysis	0			
special analysis	0			
procurement specifications	0			one specification for RTDs, one for Strain gages incl in WBS 133
preliminary and final design reviews	0			one review for temp/strain instr. Included in WBS 133
meetings/reporting/presentations	15%			

NCSX Fabrication Project Cost and Schedule

WBS 125 Vacuum Vessel Local I&C

R&D

Description:
No R&D is anticipated for this WBS

Summary
Purchased Design Services \$0 w/o G&A
design rate \$120 per hour
Procured Hardware/Material \$0 w/o G&A
fab rate \$60 per hour
inspection/technician rate \$80 per hour

R&D design	unit	no.	hours	Labor category												
				total fraction	EAEM		EADM		ORNL Eng		EASM		Vendor			
Task				frac.	hrs	frac.	hrs	frac.	hrs	frac.	hrs	frac.	hrs	frac.	hrs	
Pro-E models	0 hrs/model	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	0.00	0
assy dwgs	0 hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	0.00	0
Detail drawings	0 hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	0.00	0
installation dwg	0 hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	0.00	0
cooling schematic	0 hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	0.00	0
electrical schematic	0 hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	0.00	0
I&C schematic	0 hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	0.00	0
special analysis	0 hrs/calc	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	0.00	0
procurement specifications	8 hrs/spec	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	0.00	0
vendor shop drawings	0 hrs/dwg	0	0	1.00										1.00	0	
vendor part programming	0 hrs/model	0	0	1.00										1.00	0	
vendor misc engineering	20% % of tot	0	0	1.00										1.00	0	
preliminary and final design reviews	0 hrs/rev	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	0.00	0
meetings/reporting/presentations	10% % of tot	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	0.00	0
<i>subtotal</i>			0			0		0		0		0		0		0

R&D Title III	unit	no.	hours	Labor category												
				total fraction	EAEM		EADM		ORNL Eng		EASM		EMTB			
				frac.	hrs	frac.	hrs	frac.	hrs	frac.	hrs	frac.	hrs	frac.	hrs	
vendor oversight, inspection	0 hrs/wk	4	0	1.00	0.00	0	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0
in-house fab/assy, oversight, and inspection	0 hrs/wk	4	0	1.00	0.00	0	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0
Testing and experiments	0 hrs/wk	1	0	1.00	0.00	0	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0
<i>subtotal</i>			0			0		0		0		0		0		0

Schedule assumptions	start	duration (weeks)	end
R&D planning	May-06	4	Jun-06
Bid and award	Jun-06	2	Jun-06
R&D procurement / in-house fab.	Jun-06	4	Jun-06
R&D testing	Jun-06	1	Jul-06

Notes and worksheets

NCSX Fabrication Project Cost and Schedule

WBS 125 Vacuum Vessel Local I&C

Materials and Subcontracts (M&S)

Description:

This effort covers sensors and connectors for the vacuum vessel local I&C for Phases I, II, and III of NCSX operation. The sensors and connectors will be procured from a qualified vendor. All installation will be performed as part of WBS 7. All signal conditioning and data acquisition is part of WBS 5.

Assumptions:

outside engr rate = 120 \$ per hour
outside fab rate = 60 \$ per hour
outside inspection/technician rate = 80 \$ per hour

Purchased parts:

Thermocouples \$1,200
strain gages \$1,200

subtotal, purchased parts \$2,400

Purchased materials for in-house fabrication and sub-assembly

None required \$0

subtotal purchased materials 0

Worksheet:**Thermocouples**

Torus, (6*2) 12 ea two per half field period
Ports and extensions, 13*3 39 one per port

Thermocouple cost each, with connector 50 \$ each
total for thermocouples \$2,550

Strain gages

Number (6*2) 12 ea
strain gage cost each 50 \$ each MTS gage with back to back elements that cancel EM field
total for thermocouples \$600

NCSX Fabrication Project Cost and Schedule

WBS 125 Vacuum Vessel Local I&C

In-house Fabrication and Assembly

Description:

No local fab or assembly is anticipated for the vessel local I&C. Installation is part of WBS 7.

Labor category

	multiplier	unit	no.	hours	total fraction	EAEM		EASM		EMTB		ORNL Eng	
						fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs
Fab operations													
none anticipated	0	hrs/tile	0	0	0.00	0.00	0	0.00	0	0.00	0	0.00	0
				0	1.00	0.00	0	0.00	0	1.00	0	0.00	0
				0	0.00	0.00	0	0.00	0	0.00	0	0.00	0
				0	0.00	0.00	0	0.00	0	0.00	0	0.00	0
				0	0.00	0.00	0	0.00	0	0.00	0	0.00	0
<i>subtotal</i>				0			0		0		0		0

	multiplier	unit	no.	hours	total fraction	EAEM		EASM		EMTB		ORNL Eng	
						fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs
Assembly operations													
none anticipated		man/shift		0	1.00	0.00	0	1.00	0	0.00	0	0.00	0
		man/shift		0	1.00	0.00	0	0.00	0	1.00	0	0.00	0
		man/shift		0	0.00	0.00	0	0.00	0	0.00	0	0.00	0
		man/shift		0	0.00	0.00	0	0.00	0	0.00	0	0.00	0
				0	0.00	0.00	0	0.00	0	0.00	0	0.00	0
<i>subtotal</i>				0			0		0		0		0

Schedule assumptions	start	duration (weeks)	end
Title I Design, R&D	May-06	6	Jul-06
Title II Design	Jul-06	6	Aug-06
Procurement	Aug-06	12	Nov-06
In-house fab / sub-assy	Nov-06	4	Dec-06
Installation / final assembly	Dec-06	4	Jan-07

Notes and worksheets