

NCSX Fabrication Project Cost and Schedule Estimating Form

WBS 184 Receipt, Inspection, and Testing of Vacuum Vessel Field segments

Labor

Activity Title	Manhours	FY2003 \$\$	Labor Type	Start Date Month/Yr	End Date Month/Yr	Comments
Preliminary Design (Title I)						
(44% of design schedule)	0		<i>EAEM</i>	Apr-03	Nov-03	PPPL Engineer
	0		<i>EADM</i>	Apr-03	Nov-03	PPPL Designer
	0		<i>ORNL Eng</i>	Apr-03	Nov-03	Composite of ORNL Engineer / Designer
	0		<i>ORNL Phys.</i>	Apr-03	Nov-03	Composite of ORNL Physics / scientific
	0		<i>PPPL Phys.</i>	Apr-03	Nov-03	PPPL Physics/scientific
Final Design (Title II)						
(56% of design schedule)	0		<i>EAEM</i>	Nov-03	Aug-04	PPPL Engineer
	0		<i>EADM</i>	Nov-03	Aug-04	PPPL Designer
	0		<i>ORNL Eng</i>	Nov-03	Aug-04	Composite of ORNL Engineer / Designer
	0		<i>ORNL Phys.</i>	Nov-03	Aug-04	Composite of ORNL Physicist
	0		<i>PPPL Phys.</i>	Nov-03	Aug-04	PPPL Physics/scientific
Lab R&D labor						
	0		<i>EAEM</i>	Apr-03	Nov-03	PPPL Engineer
	0		<i>EADM</i>	Apr-03	Nov-03	PPPL Designer
	0		<i>ORNL Eng</i>	Apr-03	Nov-03	Composite of ORNL Engineer / Designer
	0		<i>EASM</i>	Apr-03	Nov-03	PPPL monthly support
	0		<i>EMTB</i>	Apr-03	Nov-03	PPPL Technician
Lab Fab/Assembly/Installation (Title III)						
	0		<i>EAEM</i>	Jul-04	Oct-06	PPPL Engineer
	0		<i>EADM</i>	Jul-04	Oct-06	PPPL Designer
	0		<i>ORNL Eng</i>	Jul-04	Oct-06	Composite of ORNL Engineer / Designer
	1248		<i>EASM</i>	Jul-04	Oct-06	PPPL monthly support
	1872		<i>EMTB</i>	Jul-04	Oct-06	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	0	0	0	0
PPPL monthly support	<i>EASM</i>	0	140	554	554	0	0	1248
PPPL Technician	<i>EMTB</i>	0	210	831	831	0	0	1872
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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M&S Costs

Activity Title	FY2003 \$\$	Comment
Manufacturing Development (R&D)		
Purchased Design Services	\$0	
Procured Hardware/Material	\$0	
Profit	\$0	profit already included in these items
<i>total, manf/dev (R&D)</i>	\$0	w/o G&A
Procured Hardware/Material		
0	\$0	
0	\$0	
0	\$0	
0	\$0	
0	\$0	
0	\$0	
0	\$0	
subtotal, purchased parts	\$0	
Profit at 10%	\$0	
<i>total, procured hdwe/matl.</i>	\$0	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	travel related to this task is in WBS 181

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WBS 184 Receipt, Inspection, and Testing of Vacuum Vessel Field segments Summary Costs

Activity Title	Manhours	FY2003 \$\$	Comment
Labor			
PPPL Effort	3,120	\$261,456	<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	0	\$0	
subtotal, labor	3,120	\$261,456	
M&S, Other			
Manufacturing Development (R&D)		\$0	
Procured Hardware/Material		\$0	
Purchased Design Services		\$0	
Procured Installation/Assembly Costs		\$0	
Travel		\$0	
subtotal, M&S		\$0	
G&A		\$0	25% on all purchased materials, subcontracts, travel
Subtotal without contingency		\$261,456	
Contingency		\$52,291	20% Overall on this WBS
Total cost		\$313,747	

NCSX Fabrication Project Cost and Schedule

WBS 184 Receipt, Inspection, and Testing of Vacuum Vessel Field segments

In-house Fabrication and Assembly

Description:
This effort covers all PPPL effort involved with receipt, inspection, cooling tube installation, and thermal insulation installation for the vacuum vessel segments

Labor category

	multiplier	unit	no.	hours	total fraction	EAEM		EASM, EMSM		EMTB		EADM	
						fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs
Receipt of VV and setup in fixture													
Sr. Lab tech	168	LOE	1	168	1.00	0.00	0	1.00	168	0.00	0	0.00	0
Tech	552	LOE	1	552	1.00	0.00	0	0.00	0	1.00	552	0.00	0
subtotal				720			0		168		552		0

	multiplier	unit	no.	hours	total fraction	EAEM		EASM, EMSM		EMTB		EADM	
						fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs
Installation of diagnostic, insulation, cooling tubes													
diag loops-sr tech	480	LOE	1	480	1.00	0.00	0	1.00	480	0.00	0	0.00	0
diag. loops-tech	480	LOE	1	480	1.00	0.00	0	0.00	0	1.00	480	0.00	0
cooling tubes and insul-sr tech	600	LOE	1	600	1.00	0.00	0	1.00	600	0.00	0	0.00	0
cooling tubes and insul. -tech	840	LOE	1	840	1.00	0.00	0	0.00	0	1.00	840	0.00	0
subtotal				2400			0		1080		1320		0

Schedule assumptions	start	duration (weeks)		end
Title I Design, R&D	Nov-03	31		Jun-04
Title II Design	Jun-04	39		Mar-05
Procurement	Mar-05	22		Aug-05
In-house fab / sub-assy	Aug-05	20		Dec-05
Installation / final assembly	Jun-05	67		Oct-06

Notes and worksheets

Field Period Assembly Area Preparation

Ref J. Chrzanowski spreadsheet, April 2003

This proposal includes the costs associated with the fabrication of (18) Modular coils for the NCSX Machine. This includes inspection of the conductor and castings, coil winding, VPI and Testing activities.

Activity	Activity Description	Duration	Start	End	HP	Safety	IH	QC	EAEM	EADM	EMSM	EMTB	M&S	M&S
ID	Days	hours	hours	hours	hours	hours	hours	hours	hours	hours	hours	hours	w/o G&A	w/G&A
	Notes: A number of activities can be performed in parallel and are not series activities during the field period assemblies. a) The TF coil sub-assembly b) The sub-assembly of the modular coils c) Preparation of the vacuum vessel for assembly													
184	Receive, Inspect and Prepare VV													
P1-?	Receive and inspect 1st. vacuum vessel segment	5	5-Aug-05	11-Aug-05							40			120
P1-?	Attach diagnostics, cooling tubes & insulation to VV 1st. Period	27	12-Aug-05	20-Sep-05							16			64
	Mount Vacuum vessel to assy. Fixture	2									160			160
	Install magnetic diagnostics (up to 132)	10									160			160
	Install cooling tubes	10									160			160
	Install insulation	5									40			120
P1-?	Receive and inspect 2nd. vacuum vessel segment	5	21-Sep-05	27-Sep-05							40			120
P1-?	Attach diagnostics, cooling tubes & insulation to VV 1st. Period	27	28-Sep-05	3-Nov-05							16			64
	Mount Vacuum vessel to assy. Fixture	2									160			160
	Install magnetic diagnostics (up to 132)	10									160			160
	Install cooling tubes	10									160			160
	Install insulation	5									40			120
P1-?	Receive and inspect 3rd. vacuum vessel segment	5	4-Nov-05	10-Nov-05							40			120
P1-?	Attach diagnostics, cooling tubes & insulation to VV 1st. Period	27	11-Nov-05	21-Dec-05							16			64
	Mount Vacuum vessel to assy. Fixture	2									160			160
	Install magnetic diagnostics (up to 132)	10									160			160
	Install cooling tubes	10									160			160
	Install insulation	5									40			120
					0	0	0	0	0	0	1248	0	1872	

NCSX Fabrication Project Cost and Schedule

WBS 184 Receipt, Inspection, and Testing of Vacuum Vessel Field segments

Materials and Subcontracts (M&S)

Description:

No materials nor subcontracts are anticipated for this WBS. They are in WBS 122, 123, and 124.

Assumptions:

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

Purchased parts:

subtotal, purchased parts \$0

Purchased materials for in-house fabrication and sub-assembly

subtotal purchased materials \$0

Worksheet:

WBS 184 Receipt, Inspection, and Testing of Vacuum Vessel Field segments

R&D

Description:
No R&D is anticipated for this element

Summary

Purchased Design Services

subtotal \$0 w/o G&A

Procured Hardware/Material

subtotal \$0 w/o G&A

Subcontractor labor rates:

design rate: \$120 per hour
fab rate \$80 per hour
inspection/technician rate \$90 per hour

R&D design	unit	no.	hours	total fraction	Labor category									
					EAEM fract.	EAEM hrs	EADM fract.	EADM hrs	ORNL fract.	Enq hrs	EASM fract.	Vendor fract.	Vendor hrs	
Task														
Pro-E models	12 hrs/model	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0
assy dwgs	20 hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0
Detail drawings	8 hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	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
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	0 hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	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
procurement specifications	40 hrs/spec	0	0	1.00	0.00	0	0.00	0	1.00	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	0% % of tot	0	0	1.00							0	0.00		1.00
preliminary and final design reviews	40 hrs/rev	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0
meetings/reporting/presentations	20% % of tot	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0
subtotal			0			0		0		0		0		0

R&D Tasks and Title III (see notes)	unit	no.	hours	total fraction	Labor category										
					EAEM fract.	EAEM hrs	EADM fract.	EADM hrs	ORNL fract.	Enq hrs	EASM fract.	EMTB fract.	EMTB hrs		
0 hrs	1	0	0.00	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
0 hrs/setup	1	0	0.00	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
0 hrs/setup	1	0	0.00	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
0 hrs / coil	1	0	0.00	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
0 hrs	1	0	0.00	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
subtotal			0			0		0		0		0		0	

Schedule assumptions	start	duration (weeks)	end
R&D planning	Nov-02	4	Dec-02
Bid and award	Dec-02	2	Dec-02
R&D procurement / in-house fab.	Dec-02	4	Jan-03
R&D testing	Jan-03	52	Jan-04

Notes and worksheets

Engineering Design

Pro-E models	0
assy dwgs	0
Detail drawings	0
installation dwg	0
cooling schematic	0
electrical schematic	0
I&C schematic	0
special analysis	0
procurement specifications	0
Epoxy R&D contract	0
Tooling and fixtures	0
Clean room	0
Cable conductor	0
vendor shop drawings	0
vendor part programming	0
vendor misc engineering	0
preliminary and final design reviews	0
meetings/reporting/presentations	10%

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Engineering, Title I, II and III

Description:

Engineering for this task is covered under WBS 181

Labor category

	multiplier	unit	no.	hours	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 (avg)	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	20	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	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0
cooling schematic	20	hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0
electrical schematic	20	hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0
I&C schematic	20	hrs/dwg	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0
stress analysis	40	hrs/calc	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0
thermal analysis	40	hrs/calc	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0
special analysis (electromagnetics)	160	hrs/calc	0	0	1.00	0.00	0	0.00	0	0.00	0	1.00	0	0.00	0
procurement/fab specifications	160	hrs/spec	0	0	1.00	0.75	0	0.00	0	0.25	0	0.00	0	0.00	0
preliminary and final design reviews	80	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	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0
<i>subtotal</i>				0			0		0		0		0		0

	multiplier	unit	no.	hours	total fraction	EAEM		EASM		EADM		ORNL Eng	
						fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs
Title III													
vendor oversight, inspection	0	hrs/wk	22	0	1.00	0.50	0	0.00	0	0.00	0	0.50	0
Disposition of deviation requests and non-conformances	0	hrs/wk	147	0	1.00	0.20	0	0.00	0	0.00	0	0.80	0
As-built drawings	0	hrs/dwg	0	0	1.00	0.00	0	0.00	0	0.00	0	1.00	0
Installation oversight and inspection	0	hrs/wk	53	0	1.00	0.25	0	0.75	0	0.00	0	0.00	0
<i>subtotal</i>				0			0		0		0		0

Schedule assumptions	start	duration (weeks)	end
Title I Design	Apr-03	31	Nov-03

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Engineering, Title I, II and III

Title II Design	Nov-03	39	Aug-04
Procurement	Jul-04	22	Dec-04
In-house fab / sub-assy	Jan-05	72	May-06
Installation / final assembly	Sep-05	53	Oct-06

Notes and worksheets

	total	
Pro-E models		0
assy dwgs		0
Detail drawings		0
installation dwg		0
cooling schematic		0
electrical schematic		0
I&C schematic		0
stress analysis		0
thermal analysis		0
special analysis		0
procurement specifications		0
preliminary and final design reviews		0
meetings/reporting/presentations		15%