

NCSX Fabrication Project Cost and Schedule Estimating Form

WBS 152 Central Solenoid Support Structures

Labor

Activity Title	Manhours	FY2003 \$\$	Labor Type	Start Date Month/Yr	End Date Month/Yr	Comments
Preliminary Design (Title I)						
(50% of design schedule)	212		<i>EAEM</i>	Oct-03	Feb-04	PPPL Engineer
	124		<i>EADM</i>	Oct-03	Feb-04	PPPL Designer
	34		<i>ORNL Eng</i>	Oct-03	Feb-04	Composite of ORNL Engineer / Designer
	0		<i>ORNL Phys.</i>	Oct-03	Feb-04	Composite of ORNL Physics / scientific
	0		<i>PPPL Phys.</i>	Oct-03	Feb-04	PPPL Physics/scientific
Final Design (Title II)						
(50% of design schedule)	212		<i>EAEM</i>	Feb-04	Jul-04	PPPL Engineer
	124		<i>EADM</i>	Feb-04	Jul-04	PPPL Designer
	34		<i>ORNL Eng</i>	Feb-04	Jul-04	Composite of ORNL Engineer / Designer
	0		<i>ORNL Phys.</i>	Feb-04	Jul-04	Composite of ORNL Physicist
	0		<i>PPPL Phys.</i>	Feb-04	Jul-04	PPPL Physics/scientific
Lab R&D labor						
	0		<i>EAEM</i>	Oct-03	Feb-04	PPPL Engineer
	0		<i>EADM</i>	Oct-03	Feb-04	PPPL Designer
	0		<i>ORNL Eng</i>	Oct-03	Feb-04	Composite of ORNL Engineer / Designer
	0		<i>EASM</i>	Oct-03	Feb-04	PPPL monthly support
	0		<i>EMTB</i>	Oct-03	Feb-04	PPPL Technician
Lab Fab/Assembly/Installation (Title III)						
	250		<i>EAEM</i>	Jul-04	Jan-06	PPPL Engineer
	83		<i>EADM</i>	Jul-04	Jan-06	PPPL Designer
	31		<i>ORNL Eng</i>	Jul-04	Jan-06	Composite of ORNL Engineer / Designer
	0		<i>EASM</i>	Jul-04	Jan-06	PPPL monthly support
	0		<i>EMTB</i>	Jul-04	Jan-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	464	167	42	0	0	673
PPPL Designer	<i>EADM</i>	0	262	56	14	0	0	331
Composite of ORNL Engineer / Designer	<i>ORNL Eng</i>	0	73	21	5	0	0	99
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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M&S Costs

Activity Title	FY2003 \$\$	Comment
Manufacturing Development (R&D)		
Purchased Design Services	\$0	
Procured Hardware/Material	\$0	
Profit	\$0	included in hardware estimate
<i>total, manf/dev (R&D)</i>	\$0	w/o G&A
Procured Hardware/Material		
upper and lower interface hub	\$47,584	
brackets to TF structure	\$19,760	
spacers and tie rods	\$23,262	
solenoid integration	\$41,000	
Profit	<u>\$13,161</u>	included in hardware estimate
<i>total, procured hdwe/matl.</i>	\$144,767	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	\$2	only one trip is anticipated

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Summary Costs

Activity Title	Manhours	FY2003 \$\$	Comment
Labor			
PPPL Effort	1,004	\$136,058	<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 <i>PPPL Phys</i> 141 \$/hr <i>ORNL Phys</i> 160 \$/hr
ORNL effort	99	\$12,896	
subtotal, labor	1,103	\$148,954	
M&S, Other			
Manufacturing Development (R&D)		\$0	
Procured Hardware/Material		\$144,767	
Purchased Design Services		\$0	
Procured Installation/Assembly Costs		\$0	
Travel		\$2	
subtotal, M&S		\$144,769	
G&A		\$36,192	25% on all purchased materials, subcontracts, travel
Subtotal without contingency		\$329,915	
Contingency		\$105,573	32% Overall on this WBS
Total cost		\$435,488	

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WBS 152 Central Solenoid Support Structures

Materials and Subcontracts (M&S)

Description:

This effort covers manufacturing of the central solenoid support structure and integration of the PF1, PF2, and PF3 with the structure. The pieces of structure are procured via one or more fixed price contracts.

Purchased parts:

upper and lower interface hub	\$47,584	see notes below
brackets to TF structure	\$19,760	
spacers and tie rods	\$23,262	
solenoid integration	\$41,000	

subtotal, purchased parts \$131,606

outside engr rate =	130	\$ per hour
outside fab rate =	60	\$ per hour
outside inspection/technician rate =	80	\$ per hour

Worksheet:

Center solenoid upper/lower interface hub

Fabrication / parts costs

Item / description	Value	Unit	Cost \$/unit	No.	Cost \$
Upper and lower solenoid hub casting	52	lbs	12	6	\$3,744
Machining of upper and lower hub casting, 2 setups (120 deg.)	64	hrs	60	6	\$23,040
Inspection	1	lot	10000	1	\$10,000
Insulation and shims between castings	8	hrs	80	6	\$3,840
misc bolts and assembly hardware	1	interface	1500	12	\$18,000
	1	lot	10000	1	\$10,000
			<i>subtotal Integrated TF structure fab./matl</i>		\$36,784

Subassembly costs

Item / description	Value	Unit	Cost \$/unit	No.	Cost \$
Pre-assembly and fit check, crew of 2, 16 hours/assy	48	hrs	80	2	\$7,680
technical oversight	12	hrs	130	2	\$3,120
			<i>subtotal Integrated TF structure pre-assembly</i>		\$10,800

total, Integrated TF structure **\$47,584**

Brackets to TF structure

Fabrication / parts costs

Item / description	Value	Unit	Cost \$/unit	No.	Cost \$
Upper tie plate to TF coil structure	500	lbs	8	1	\$4,000
Machining of upper and lower crown segment casting	40	hrs	60	2	\$4,800
lower brackets to TF coil structure	30	lbs	8	6	\$1,440
machining of lower brackets	16	hrs	60	6	\$5,760
			<i>subtotal brackets to TF coil fab./matl</i>		\$10,240

Subassembly costs

Item / description	Value	Unit	Cost \$/unit	No.	Cost \$
Pre-assembly and fit check	40	hrs	80	2	\$6,400
technical oversight	12	hrs	130	2	\$3,120
			<i>subtotal bracket fit check and pre-assembly</i>		\$9,520

total, brackets to TF coil struct. **\$19,760**

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WBS 152 Central Solenoid Support Structures

Engineering, Title I, II and III

Description:

This effort covers all Title I, II, and III engineering for the coil support structure, which includes the TF and PF structure, the interface structure between the TF coil structure and the modular coil shell assembly, and the interface structure to the base assembly. The pieces of structure are procured via one or more fixed price contracts. All installation oversight will be performed as part of WBS 7.

	multiplier	unit	no.	hours	Labor category												
					total		EAEM		EADM		ORNL Eng		ORNL Physics		PPPL Physics		
					fraction	hrs	fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs	
Title I, II design																	
Pro-E models (avg) assy dwgs	24	hrs/model	8	192	1.00	0.50	96	0.25	48	0.25	48	0.00	0	0.00	0	0.00	0
Detail drawings	40	hrs/dwg	6	240	1.00	0.50	120	0.50	120	0.00	0	0.00	0	0.00	0	0.00	0
installation dwg	20	hrs/dwg	6	120	1.00	0.50	60	0.50	60	0.00	0	0.00	0	0.00	0	0.00	0
cooling schematic	40	hrs/dwg	1	40	1.00	0.00	0	0.50	20	0.50	20	0.00	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	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	0.00	0
stress analysis	40	hrs/calc	1	40	1.00	1.00	40	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
thermal analysis	40	hrs/calc	0	0	1.00	1.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
special analysis (electromagnetics)	40	hrs/calc	0	0	1.00	0.50	0	0.00	0	0.50	0	0.00	0	0.00	0	0.00	0
procurement/fab specifications	40	hrs/spec	1	40	1.00	1.00	40	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
preliminary and final design reviews	80	hrs/rev	0	0	1.00	1.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
meetings/reporting/presentations	10%	% of tot	672	67	1.00	1.00	67	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
<i>subtotal</i>				739			423		248		68		0		0		0
Title III																	
vendor oversight, inspection	2	hrs/wk	52	104	1.00	1.00	104	0.00	0	0.00	0	0.00	0				
Disposition of deviation requests and non-conformances	2	hrs/wk	78	156	1.00	0.80	125	0.00	0	0.00	0	0.20	31				
As-built drawings	8	hrs/dwg	13	104	1.00	0.20	21	0.00	0	0.80	83	0.00	0				
<i>subtotal</i>				364			250		0		83		31				
Schedule assumptions	start	duration (weeks)	end														
Title I Design	Oct-03	18	Feb-04														

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Engineering, Title I, II and III

Title II Design	Feb-04	18	Jul-04
Procurement	Jul-04	52	Jul-05
In-house fab / sub-assy	Jul-05	0	Jul-05
Installation / final assembly	Jul-05	26	Jan-06

Notes and worksheets

Coil support structure

	total	integrated PF1,PF2,PF3 assembly	brackets to TF	spacers and tie rods	
Pro-E models	8	2	2	4	models of all parts
assy dwgs	6	3	1	2	typical assemblies of half field period, whole field period, and full stru
Detail drawings	6	0	2	4	each part is detailed
installation dwg	1	1	0	0	
cooling schematic	0				assume passive cooling of base interface structure
electrical schematic	0				
I&C schematic	0				covered in WBS 153
stress analysis	1	1			local analyses of each subsystem
thermal analysis	0				
special analysis	0				seismic analysis
procurement specifications	1	1	0	0	one procurement specification for each major system
preliminary and final design reviews	0				standard reviews
meetings/reporting/presentations	10%				