

## NCSX Fabrication Project Cost and Schedule Estimating Form

### WBS 151 Coil Support Structure

#### Labor

Activity Title	Manhours	FY2003 \$\$	Labor Type	Start Date Month/Yr	End Date Month/Yr	Comments
<b>Preliminary Design (Title I)</b>						
( 50% of design schedule)	502		<i>EAEM</i>	Oct-03	Feb-04	PPPL Engineer
	333		<i>EADM</i>	Oct-03	Feb-04	PPPL Designer
	169		<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
<b>Final Design (Title II)</b>						
( 50% of design schedule)	502		<i>EAEM</i>	Feb-04	Jul-04	PPPL Engineer
	333		<i>EADM</i>	Feb-04	Jul-04	PPPL Designer
	169		<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
<b>Lab R&amp;D labor</b>						
	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
<b>Lab Fab/Assembly/Installation (Title III)</b>						
	720		<i>EAEM</i>	Jul-04	Jan-06	PPPL Engineer
	218		<i>EADM</i>	Jul-04	Jan-06	PPPL Designer
	62		<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	1121	481	121	0	0	1723
PPPL Designer	<i>EADM</i>	0	701	145	37	0	0	884
Composite of ORNL Engineer / Designer	<i>ORNL Eng</i>	0	347	42	11	0	0	400
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 151 Coil Support Structure

#### M&S Costs

Activity Title	FY2002 \$\$	Comment
<b>Manufacturing Development (R&amp;D)</b>		
Purchased Design Services	\$0	
Procured Hardware/Material	\$0	
Profit	\$0	included in hardware estimate
<i>total, manf/dev (R&amp;D)</i>	\$0	w/o G&A
<b>Procured Hardware/Material</b>		
Integrated TF support structure	\$653,496	
PF Coil interface structure	\$48,340	
TF to modular coil interface structure	\$112,144	
subtotal, purchased parts	\$813,980	
Profit	<u>\$65,350</u>	included in hardware estimate
<i>total, procured hdwe/matl.</i>	\$879,330	w/o G&A
<b>Purchased Design Services</b>	\$0	no purchased services anticipated
<b>Procured Installation/Assembly Costs</b>	\$0	All installation and assembly costs are included in WBS 7

#### Other Costs

Activity Title	FY2003 \$\$	Comment
Travel	\$2	only one trip is anticipated

## NCSX Fabrication Project Cost and Schedule Estimating Form

### WBS 151 Coil Support Structure

#### Summary Costs

Activity Title	Manhours	FY2003 \$\$	Comment
<b>Labor</b>			
PPPL Effort	2,607	\$352,010	<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	400	\$51,948	
subtotal, labor	3,006	\$403,958	
<b>M&amp;S, Other</b>			
Manufacturing Development (R&D)		\$0	
Procured Hardware/Material		\$879,330	
Purchased Design Services		\$0	
Procured Installation/Assembly Costs		\$0	
Travel		\$2	
subtotal, M&S		\$879,332	
<b>G&amp;A</b>		\$181,459	25% on all purchased materials, subcontracts, travel \$38,374 G&A adjustment on large procurement
<b>Subtotal without contingency</b>		\$1,464,748	
<b>Contingency</b>		\$468,719	32% Overall on this WBS
<b>Total cost</b>		\$1,933,467	

**WBS 151 Coil Support Structure**

**Materials and Subcontracts (M&S)**

Description:  
This effort covers manufacturing of 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. The pieces of structure are procured via one or more fixed price contracts.

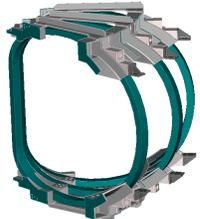
<b>Purchased parts:</b>					
Integrated TF support structure	\$653,496	see notes below			
PF coil interface structure	\$48,340				
TF to modular coil interface structure	\$112,144				
subtotal, purchased parts	\$813,980		vendor 1	438	w/o machining
outside engr rate =	130	\$ per hour	vendor 2	120	lte beams
outside fab rate =	60	\$ per hour		300	outer support castings
outside inspection/technician rate =	80	\$ per hour		110	inboard support castings
			vendor 3	530	
				594	

**Worksheet:**

**Coil Support Structures**

**Integrated TF support structure**

<b>Fabrication / parts costs</b>					
<b>Item / description</b>	<b>Value</b>	<b>Unit</b>	<b>Cost \$/unit</b>	<b>No.</b>	<b>Cost \$</b>
inboard TF support castings	550	lbs	8	12	\$38,000
Machining of inboard TF support casting, 2 setups	40	hrs	60	18	\$43,200
Pattern for TF shell casting (120 des.1)	1	lot	20000	1	\$20,000
outboard TF support castings	950	lbs	6	36	\$205,200
Machining of outboard TF support castings, 2 setups (120 des.1)	40	hrs	60	18	\$43,200
radial lte beam casting	24	hrs	60	18	\$29,520
Radial lte beam machining	141	lbs	6	36	\$30,456
Pattern for radial lte beam	24	hrs	60	18	\$29,520
Insulation and shims between castings	1	interface	2000	18	\$36,000
misc bolts and assembly hardware	1	lot	20000	1	\$20,000
<b>subtotal integrated TF structure fab./matt</b>					<b>\$562,596</b>
<b>Subassembly costs</b>					
<b>Item / description</b>	<b>Value</b>	<b>Unit</b>	<b>Cost \$/unit</b>	<b>No.</b>	<b>Cost \$</b>
Pre-assembly and fit check, crew of 3, 40 hours/assy	120	hrs	80	2	\$19,200
rework	250	hrs	60	2	\$30,000
technical oversight	160	hrs	30	2	\$41,600
<b>subtotal fabricated TF structure pre-assembly</b>					<b>\$90,800</b>
<b>total, integrated TF structure</b>					<b>\$653,496</b>



weights	aa	no	total
	(lbs)		(lbs)
inboard TF support casting	550	12	6600
outboard TF support casting	950	36	34200
radial lte beam casting	141	36	5076
<b>total</b>			<b>45876</b> lbs

spr130-001-c4.asm  
spr132-001-

**PF Coil interface structure**

<b>Fabrication / parts costs</b>					
<b>Item / description</b>	<b>Value</b>	<b>Unit</b>	<b>Cost \$/unit</b>	<b>No.</b>	<b>Cost \$</b>
PF 4 castings (PF1, PF2, PF3 diamas part of WBS 1411)	5	lbs	50	18	\$4,500
PF 5 castings	5	lbs	50	18	\$4,500
PF 6 brackets	10	hrs	50	18	\$9,000
PF 6 castings	5	interface	50	18	\$4,500
misc bolts and assembly hardware	1	lot	10000	1	\$10,000
<b>subtotal PF Coil interface structure fab./matt</b>					<b>\$4,500</b>
<b>Subassembly costs</b>					
<b>Item / description</b>	<b>Value</b>	<b>Unit</b>	<b>Cost \$/unit</b>	<b>No.</b>	<b>Cost \$</b>
Pre-assembly and fit check, 2 hrs/klamp, crew of 2	144	hrs	80	2	\$23,040
technical oversight (1/2 time)	80	hrs	130	2	\$26,800
<b>subtotal PF Coil interface structure pre-assembly</b>					<b>\$43,840</b>
<b>total, PF Coil interface structure subassembly</b>					<b>\$48,340</b>

**TF to modular coil interface structure**

<b>Fabrication / parts costs</b>					
<b>Item / description</b>	<b>Value</b>	<b>Unit</b>	<b>Cost \$/unit</b>	<b>No.</b>	<b>Cost \$</b>
Upper and lower IB brackets to modular coil 3 shell, weldments	0	lbs	15	0	\$0
Upper and lower OB brackets to modular coil 3 shell, weldments	0	lbs	15	0	\$0
Upper and lower IB brackets to modular coil 3 shell, weldments	101	lbs	15	12	\$15,144
Upper and lower OB brackets to modular coil 3 shell, weldments	216	lbs	15	12	\$38,880
Machining, 4 hours per interface, two interfaces/bracket	8	hrs	60	24	\$11,520
Shims for all joints	1	interface	500	24	\$12,000
misc bolts and assembly hardware	1	lot	10000	1	\$10,000
<b>subtotal TF to modular coil interface structure fab./matt</b>					<b>\$95,544</b>
<b>Subassembly costs</b>					
<b>Item / description</b>	<b>Value</b>	<b>Unit</b>	<b>Cost \$/unit</b>	<b>No.</b>	<b>Cost \$</b>
Pre-assembly and fit check, 1/2 shift / part, crew of 2	96	hrs	80	2	\$15,360
technical oversight (1/2 time)	24	hrs	130	2	\$6,240
<b>subtotal TF to modular coil interface structure pre-assembly</b>					<b>\$21,600</b>
<b>total, TF to modular coil interface structure subassemblies</b>					<b>\$112,144</b>

<b>Bracket weight:</b>	width	height_avg	depth	thickness	weight
	(in)	(in)	(in)	(in)	(lbs)
Upper and lower IB brackets to modular coil 3 shell, weldments	12	0	4	0	0
Upper and lower OB brackets to modular coil 3 shell, weldments	20	0	4	0	0
Upper and lower IB brackets to modular coil 3 shell, weldments	12	12	4	1	101
Upper and lower OB brackets to modular coil 3 shell, weldments	20	20	4	1	216

## NCSX Fabrication Project Cost and Schedule

### WBS 151 Coil Support Structure

#### 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
<b>Title I, II design</b>																
Pro-E models (avg) assy dwgs	24	hrs/model	31	744	1.00	0.50	372	0.25	186	0.25	186	0.00	0	0.00	0	
Detail drawings	40	hrs/dwg	11	440	1.00	0.50	220	0.50	220	0.00	0	0.00	0	0.00	0	
installation dwg	20	hrs/dwg	20	400	1.00	0.50	200	0.50	200	0.00	0	0.00	0	0.00	0	
cooling schematic	40	hrs/dwg	3	120	1.00	0.50	60	0.50	60	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	
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/analysis	3	120	1.00	0.50	60	0.00	0	0.50	60	0.00	0	0.00	0	
thermal analysis	40	hrs/analysis	0	0	1.00	0.50	0	0.00	0	0.50	0	0.00	0	0.00	0	
special analysis (electromagnetics)	40	hrs/analysis	0	0	1.00	0.50	0	0.00	0	0.50	0	0.00	0	0.00	0	
procurement/fab specifications	40	hrs/spec	0	0	1.00	0.50	0	0.00	0	0.50	0	0.00	0	0.00	0	
preliminary and final design reviews	80	hrs/rev	0	0	1.00	0.50	0	0.00	0	0.50	0	0.00	0	0.00	0	
meetings/reporting/presentations	10%	% of tot	1824	182	1.00	0.50	91	0.00	0	0.50	91	0.00	0	0.00	0	
<i>subtotal</i>				2006			1003		666		337		0		0	
<b>Title III</b>																
vendor oversight, inspection	8	hrs/wk	52	416	1.00	1.00	416	0.00	0	0.00	0	0.00	0			
Disposition of deviation requests and non-conformances	4	hrs/wk	78	312	1.00	0.80	250	0.00	0	0.00	0	0.20	62			
As-built drawings	8	hrs/dwg	34	272	1.00	0.20	54	0.00	0	0.80	218	0.00	0			
<i>subtotal</i>				1000			720		0		218		62			
<b>Schedule assumptions</b>	<b>start</b>	<b>duration (weeks)</b>	<b>end</b>													
Title I Design	Oct-03	18	Feb-04													

## NCSX Fabrication Project Cost and Schedule

### WBS 151 Coil Support Structure

#### 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 TF assembly	PF coil interface structure	Interface structure to modular coil shell	
Pro-E models	31	9	13	9	models of all parts
assy dwgs	11	3	5	3	typical assemblies of half field period, whole field period, and full stru
Detail drawings	20	6	8	6	each part is detailed
installation dwg	3	1	1	1	
cooling schematic	0				assume passive cooling of base interface structure
electrical schematic	0				
I&C schematic	0				covered in WBS 153
stress analysis	3	1	1	1	local analyses of each subsystem
thermal analysis	0				base interface structure heat leak analysis
special analysis	0				seismic analysis
procurement specifications	0				one procurement specification for each major system
preliminary and final design reviews	0				standard reviews
meetings/reporting/presentations	10%				