

## NCSX Fabrication Project Cost and Schedule Estimating Form

### WBS 181 Field Period Assembly Planning and Oversight

#### Labor

Activity Title	Manhours	FY2003 \$\$	Labor Type	Start Date Month/Yr	End Date Month/Yr	Comments
<b>Preliminary Design (Title I)</b>						
( 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
<b>Final Design (Title II)</b>						
( 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
<b>Lab R&amp;D labor</b>						
	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
<b>Lab Fab/Assembly/Installation (Title III)</b>						
	7414		<i>EAEM</i>	Jul-04	Oct-06	PPPL Engineer
	0		<i>EADM</i>	Jul-04	Oct-06	PPPL Designer
	1909		<i>ORNL Eng</i>	Jul-04	Oct-06	Composite of ORNL Engineer / Designer
	0		<i>EASM</i>	Jul-04	Oct-06	PPPL monthly support
	0		<i>EMTB</i>	Jul-04	Oct-06	PPPL Technician

**WBS 181 Field Period Assembly Planning and Oversight**

**In-house Fabrication and Assembly**

Description:				Labor category									
This effort covers all PPPL effort involved with preparing the facility space for field period assembly.													
multiplier	unit	no.	hours	total fraction	EAEM		EASM, EMSM		EMTB		EADM		
					fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs	
<b>Planning and Oversight summary</b>													
Field Period Assembly Planning/Oversight	3514	LOE	1	3514	1.00	1.00	3514	0.00	0	0.00	0	0.00	0
<i>subtotal</i>				3514	3514		0		0		0		
<b>Auxiliary functions summary</b>													
Health Physics Coverage (Coil wir	3900	LOE	1	3900	1.00	1.00	3900	0.00	0	0.00	0	0.00	0
Construction Safety Manager (sha	0	LOE	1	0	1.00	1.00	0	0.00	0	0.00	0	0.00	0
Industrial Hygiene Coverage (shared between D-site & C-site activities)	0	LOE	1	0	1.00	1.00	0	0.00	0	0.00	0	0.00	0
Quality Control Coverage (shared between D-site & C-site activities)	0	LOE	1	0	1.00	1.00	0	0.00	0	0.00	0	0.00	0
<i>subtotal</i>				3900	3900		0		0		0		
<b>Schedule assumptions</b>				<b>duration (weeks)</b>									
Title I Design, R&D	Sep-02	31	Apr-03										
Title II Design	Apr-03	39	Jan-04										
Procurement	Jan-04	22	Jun-04										
In-house fab / sub-assy	Jun-04	72	Nov-05										
Installation / final assembly	Nov-05	48	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	EMSM	EMTB	M&S	M&S
									Engr	Design	Sr. Lab	machines	Tech	w/G	G&A
ID	Days				hours	hours	hours	hours	hours	hours	hours	hours	hours		
<p><b>Notes:</b> A number of activities can be performed in parallel and are not series activities during the field period assemblies.</p> <p>a) The TF coil sub-assembly</p> <p>b) The sub-assembly of the modular coils</p> <p>c) Preparation of the vacuum vessel for assembly</p>															
#	Field Period Assembly Planning/Oversight														
	LOE FY04								125						
	LOE FY05								800						
	LOE FY06								2589						
	LOE FY07														
	Health Physics Coverage (Coil winding & Field Period Assy)				1300										
	LOE FY04				1300										
	LOE FY05				1300										
	LOE FY06				1300										
	Construction Safety Manager (shared between D-site & C-site activities)					1726									
	LOE FY04					1726									
	LOE FY05					1726									
	LOE FY06					1726									
	LOE FY07					1726									
	Industrial Hygiene Coverage (shared between D-site & C-site activities)						863								
	LOE FY04						863								
	LOE FY05						863								
	LOE FY06						863								
	LOE FY07						863								
	Quality Control Coverage (shared between D-site & C-site activities)								1726						
	LOE FY04								1726						
	LOE FY05								1726						
	LOE FY06								1726						
	LOE FY07								1726						
					3900	6904	3452	6904	3514						

**WBS 181 Field Period Assembly Planning and Oversight**

**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 \$80 per hour

R&D design	unit	no.	hours	Labor category													
				total fraction		EAEM		EADM		ORNL Enq		EASM		Vendor			
				fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs	fract.	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	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	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	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	40	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	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	0.00	0
vendor part programming	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
vendor misc engineering	0%	% of tot	0	0	1.00	0.00	0	0.00	0	1.00	0	0.00	0	0.00	0	0.00	0
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	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	0.00	0
subtotal			0	0			0		0			0		0			0

R&D Tasks and Title III (see notes)	unit	no.	hours	Labor category													
				total fraction	EAEM	EADM	ORNL Enq	EASM	EMTB								
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			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%

## NCSX Fabrication Project Cost and Schedule

### WBS 181 Field Period Assembly Planning and Oversight

#### Engineering, Title I, II and III

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**Description:**

The PPPL engineering for this WBS is covered under Fabrication and Assembly. The ORNL portion is assumed to be one manlevel.

**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
<b>Title I, II design</b>															
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
<b>Title III</b>													
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		hrs/wk	142	0	1.00	0.20	0	0.00	0	0.00	0	0.80	0
As-built drawings		hrs/dwg	0	0	1.00	0.00	0	0.00	0	0.00	0	1.00	0
Installation oversight and inspection	40	hrs/wk	48	1909	1.00	0.00	0	0.00	0	0.00	0	1.00	1909
<i>subtotal</i>				1909			0		0		0		1909

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

## NCSX Fabrication Project Cost and Schedule

### WBS 181 Field Period Assembly Planning and Oversight

#### Engineering, Title I, II and III

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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	Nov-05	48	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%	

## NCSX Fabrication Project Cost and Schedule Estimating Form

### WBS 181 Field Period Assembly Planning and Oversight

#### Labor

*Manhours per fiscal year by labor category*

Level of Effort		FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	TOTAL
PPPL Engineer	<i>EAEM</i>	0	830	3292	3292	0	0	7414
PPPL Designer	<i>EADM</i>	0	0	0	0	0	0	0
Composite of ORNL Engineer / Designer	<i>ORNL Eng</i>	0	214	847	847	0	0	1909
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

## NCSX Fabrication Project Cost and Schedule Estimating Form

### WBS 181 Field Period Assembly Planning and Oversight

#### M&S Costs

Activity Title	FY2003\$\$	Comment
<b>Manufacturing Development (R&amp;D)</b>		
Purchased Design Services	\$0	
Procured Hardware/Material	\$0	
Profit	\$0	profit already included in these items
<i>total, manf/dev (R&amp;D)</i>	\$0	w/o G&A
<b>Procured Hardware/Material</b>		
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
<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	\$24,000	at least two trips per month are expected for one year

## NCSX Fabrication Project Cost and Schedule Estimating Form

### WBS 181 Field Period Assembly Planning and Oversight

#### Summary Costs

Activity Title	Manhours	FY2003 \$\$	Comment	
<b>Labor</b>				
PPPL Effort	7,414	\$1,134,342	<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	1,909	\$248,114		
subtotal, labor	9,323	\$1,382,456		
<b>M&amp;S, Other</b>				
Manufacturing Development (R&D)		\$0		
Procured Hardware/Material		\$0		
Purchased Design Services		\$0		
Procured Installation/Assembly Costs		\$0		
Travel		\$24,000		
subtotal, M&S		\$24,000		
<b>G&amp;A</b>		\$6,000	25% on all purchased materials, subcontracts, travel	
<b>Subtotal without contingency</b>		\$1,412,456		
<b>Contingency</b>		\$338,990	24% Overall on this WBS	
<b>Total cost</b>		\$1,751,446		