

NCSX Fabrication Project Cost and Schedule Estimating Form

WBS 185 Assembly of Field Periods

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
	4152		<i>EASM</i>	Jul-04	Oct-06	PPPL monthly support
	10752		<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	465	1844	1844	0	0	4152
PPPL Technician	<i>EMTB</i>	0	1203	4774	4774	0	0	10752
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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Summary Costs

Activity Title	Manhours	FY2003 \$\$	Comment
Labor			
PPPL Effort	14,904	\$1,200,096	<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	14,904	\$1,200,096	
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		\$1,200,096	
Contingency		\$480,038	40% Overall on this WBS
Total cost		\$1,680,134	

NCEB Fabrication Project Cost and Schedule

WBS 185 Assembly of Field Periods

In-house Fabrication and Assembly

Description: This sub-element of WBS, when included with actual assembly of the 863 parts, including sub-assembly of the modular coils and TF coils into parent fabrications, representing the WV, welding from WV part assemblies, etc.

Labour resources

Sub-assembly	material	unit	hrs	minutes	rate	cost	rate	cost	rate	cost
TF coil, 3 coil wires, at both	44	per entry	2	4811	1.00	4,811.00	1.00	4,811.00	1.00	4,811.00
TF coil, 3 coil wires, left	500	per entry	2	1623	1.00	1,623.00	1.00	1,623.00	1.00	1,623.00
Mod Coil, 2 coil wires, at both, machine	188	per entry	1	148	1.00	148.00	1.00	148.00	1.00	148.00
Mod Coil, 2 coil wires, left, machine	188	per entry	1	148	1.00	148.00	1.00	148.00	1.00	148.00
Mod Coil, 3 coil wires, at both	144	per entry	2	720	1.00	720.00	1.00	720.00	1.00	720.00
Mod Coil, 3 coil wires, left	144	per entry	2	720	1.00	720.00	1.00	720.00	1.00	720.00
Subtotal				5388		13,882.00		13,882.00		13,882.00

Field period assembly	rate	cost	rate	cost
assembly TF coil to WV, both	240	per entry	2	720
assembly TF coil to WV, left	240	per entry	2	720
assembly TF coil to WV, both, machine	124	per entry	2	248
assembly TF coil to WV, left, machine	124	per entry	2	248
weld WV part assemblies, at both, machine	240	per entry	2	720
weld WV part assemblies, left, machine	240	per entry	2	720
Balance and leak check, at both, machine	128	per entry	2	256
Balance and leak check, left, machine	128	per entry	2	256
Perform vacuum leak check, both	160	per entry	2	320
Perform vacuum leak check, left	160	per entry	2	320
Prepare field period for shipment	200	per entry	2	400
Ship to test coil both	200	per entry	2	400
Subtotal				2672

Schedule assumptions	start	end
Task Complete	04-01-20	04-01-20
Task in Progress	04-01-20	04-01-20
Task in Hold	04-01-20	04-01-20
Task in Hold - no entry	04-01-20	04-01-20
Task in Hold - no entry	04-01-20	04-01-20

Name and worksheet	start	end
Field Period Assembly Area Presentation	04-01-20	04-01-20
Ref J - Crosscheck spreadsheet, April 2020	04-01-20	04-01-20

This proposal includes the coils associated with the fabrication of 185 Modular coils for the NCEB Machine. This includes inspection of the conductor and cable, coil winding, WV and TF coils.

Activity	duration	start	end	WV	TF	Rate	Cost	Rate	Cost	Rate	Cost
185 - Sub-assembly of TF Coils											
185-1000 TF coil and structure, Right side Field Period	18	04-01-20	04-01-20								
185-1000 TF coil and structure, Left side Field Period	18	04-01-20	04-01-20								
185-1000 TF coil and structure, Right side Field Period	18	04-01-20	04-01-20								
185-1000 TF coil and structure, Left side Field Period	18	04-01-20	04-01-20								
185-1000 TF coil and structure, Right side Field Period	18	04-01-20	04-01-20								
185-1000 TF coil and structure, Left side Field Period	18	04-01-20	04-01-20								
185 - Sub-assembly of Modular Coils											
185-1000 Modular coil and structure, Right side Field Period	18	04-01-20	04-01-20								
185-1000 Modular coil and structure, Left side Field Period	18	04-01-20	04-01-20								
185-1000 Modular coil and structure, Right side Field Period	18	04-01-20	04-01-20								
185-1000 Modular coil and structure, Left side Field Period	18	04-01-20	04-01-20								
185-1000 Modular coil and structure, Right side Field Period	18	04-01-20	04-01-20								
185-1000 Modular coil and structure, Left side Field Period	18	04-01-20	04-01-20								
185 - Assemble Field Period #1	27	04-01-20	04-01-20								
185-1000 Assemble and align TF coils to WV #1	15	04-01-20	04-01-20								
185-1000 Assemble and align TF coils to WV #2	12	04-01-20	04-01-20								
185-1000 Perform vacuum leak check of welded assemblies	10	04-01-20	04-01-20								
185-1000 Prepare field period for shipment	8	04-01-20	04-01-20								
185-1000 Ship 1st Field Period	3	04-01-20	04-01-20								
185 - Assemble Field Period #2	27	04-01-20	04-01-20								
185-1000 Assemble and align TF coils to WV #1	15	04-01-20	04-01-20								
185-1000 Assemble and align TF coils to WV #2	12	04-01-20	04-01-20								
185-1000 Perform vacuum leak check of welded assemblies	10	04-01-20	04-01-20								
185-1000 Prepare field period for shipment	8	04-01-20	04-01-20								
185-1000 Ship 2nd Field Period	3	04-01-20	04-01-20								

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Materials and Subcontracts (M&S)

Description:

No additional materials or supplies are required for this WBS. They are included in WBS 12, 13, 14, 15, etc.

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 185 Assembly of Field Periods

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 fract.	EADM fract.	ORNL fract.	Eng fract.	EASM fract.	Vendor 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
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	0.00	0	0.00	0	1.00	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
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
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		0	0

R&D Tasks and Title III (see notes)	total fraction	EAEM fract.	EADM fract.	ORNL fract.	Eng fract.	EASM, EMSM fract.	EMTB fract.	hrs					
0 hrs	1	0	0.00	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 hrs / coil	1	0	0.00	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
subtotal		0	0	0	0	0	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
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 effort 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%