NCSX Fabrication Project Cost and Schedule Estimating Form

WBS 172 Machine Base Assembly

Labor

Activity Title	Manhours	FY2003 $$	Labor Type	Start Date Month/Yr	End Date Month/Yr	Comments
Preliminary Design (Title I)						
(50% of design schedule)	202		*EAEM*	Nov-04	Feb-05	PPPL Engineer
	170		*EADM*	Nov-04	Feb-05	PPPL Designer
	20		*ORNL Eng*	Nov-04	Feb-05	Composite of ORNL Engineer / Designer
	0		*ORNL Phys.*	Nov-04	Feb-05	Composite of ORNL Physics / scientific
	0		*PPPL Phys.*	Nov-04	Feb-05	PPPL Physics/scientific
Final Design (Title II)						
(50% of design schedule)	202		*EAEM*	Feb-05	May-05	PPPL Engineer
	170		*EADM*	Feb-05	May-05	PPPL Designer
	20		*ORNL Eng*	Feb-05	May-05	Composite of ORNL Engineer / Designer
	0		*ORNL Phys.*	Feb-05	May-05	Composite of ORNL Physicist
	0		*PPPL Phys.*	Feb-05	May-05	PPPL Physics/scientific
Lab R&D labor						
	0		*EAEM*	Nov-04	Feb-05	PPPL Engineer
	0		*EADM*	Nov-04	Feb-05	PPPL Designer
	0		*ORNL Eng*	Nov-04	Feb-05	Composite of ORNL Engineer / Designer
	0		*EASM*	Nov-04	Feb-05	PPPL monthly support
	0		*EMTB*	Nov-04	Feb-05	PPPL Technician
Lab Fab/Assembly/Installation (Title III)						
	60		*EAEM*	May-05	Dec-05	PPPL Engineer
	0		*EADM*	May-05	Dec-05	PPPL Designer
	252		*ORNL Eng*	May-05	Dec-05	Composite of ORNL Engineer / Designer
	0		*EASM*	May-05	Dec-05	PPPL monthly support
	0		*EMTB*	May-05	Dec-05	PPPL Technician

WBS 172 Machine Base Assembly

Labor

Manhours per fiscal year by labor category

Level of Effort		FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	TOTAL
PPPL Engineer	*EAEM*	0	0	446	17	0	0	*463*
PPPL Designer	*EADM*	0	0	340	0	0	0	*340*
Composite of ORNL Engineer / Designer	*ORNL Eng*	0	0	219	73	0	0	*292*
PPPL monthly support	*EASM*	0	0	0	0	0	0	*0*
PPPL Technician	*EMTB*	0	0	0	0	0	0	*0*
Composite of ORNL Physics / scientific	*ORNL Phy*	0	0	0	0	0	0	*0*
PPPL Physics/scientific	*PPPL Phy*	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
total, manf/dev (R&D)		$0	w/o G&A
Procured Hardware/Material			
Base frame		$137,280	
Rails and interface carriages		$79,450	
0		$0	
Profit		$0	included in hardware estimate
total, procured hdwe/matl.		$216,730	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		$2,000	only one trip is anticipated

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Summary Costs

Activity Title	Manhours	FY2003 $$	Comment
Labor			
PPPL Effort	803	$104,870	*Assumed rates:* *EASM* 100 $/hr
ORNL effort	292	$37,960	*EAEM* 153 $/hr *EMTB* 73 $/hr
subtotal, labor	1,095	$142,830	*EADM* 100 $/hr PPPL Phys 141 $/hr
			ORNL Eng 130 $/hr ORNL Phys 160 $/hr
M&S, Other			
Manufacturing Development (R&D)		$0	
Procured Hardware/Material		$216,730	
Purchased Design Services		$0	
Procured Installation/Assembly Costs		$0	
Travel		$2,000	
subtotal, M&S		$218,730	
G&A		$54,683	25% on all purchased materials, subcontracts, travel
Subtotal without contingency		$416,242	
Contingency		$133,197	32% Overall on this WBS
Total cost		$549,440	

WBS 172 Machine Base Assembly

Materials and Subcontracts (M&S)

Description:
This effort covers manufacturing of the machine base structure, including columns, rails, and interfaces to support structure (WBS 151). The pieces of structure are procured via one or more fixed price contracts.

Purchased parts:

Base frame	$137,280	see notes below
Rails and interface carriages	$79,450	
subtotal, purchased parts	$216,730	

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

Worksheet:

Machine base assembly

Base Frame

Fabrication / parts costs

Item / description	Value	Unit	Cost $/unit	No.	Cost $
Frame weldment	2400	lbs	15	3	$108,000
Frame machining	64	hrs	60	3	$11,520
Inspection	16	hrs	80	3	$3,840
misc bolts and assembly hardware	1	lot	2500	1	$2,500
		subtotal machine base frame fab./matl			$119,520

Subassembly costs

Item / description	Value	Unit	Cost $/unit	No.	Cost $
Pre-assembly and fit check, crew of 3, 16 hours/assy	48	hrs	80	3	$11,520
technical oversight	24	hrs	130	2	$6,240
		subtotal machine base frame pre-assembly			$17,760
		total, machine base frame			**$137,280**

Rails and carriages

Fabrication / parts costs

Item / description	Value	Unit	Cost $/unit	No.	Cost $
Linear rail/ball bushing assemblies	1	assy	2500	6	$15,000
Rail supports	100	lbs	25	6	$15,000
Carriages	350	lbs	25	3	$26,250
Inspection	8	hrs	80	3	$1,920
Misc hardware, bolts, shims	1	interface	500	3	$1,500
		subtotal rail/carriage fab./matl			$56,250

Subassembly costs

Item / description	Value	Unit	Cost $/unit	No.	Cost $
Pre-assembly and fit check	80	hrs	80	2	$12,800
technical oversight	40	hrs	130	2	$10,400
		subtotal rail/carriage pre-assembly			$23,200
		total, rail/carriage subassembiles			**$79,450**

WBS 172 Machine Base Assembly

Engineering, Title I, II and III

Description:
This effort covers all Title I, II, and III engineering for the base assembly structure, which includes the base frame, rail structures and interface carriages. The base assembly is the interface between the building and the stellarator core. The subassemblies are procured via one or more fixed price contracts. All installation oversight will be performed as part of WBS 7.

						Labor category									
					total fraction	EAEM		EADM		ORNL Eng		ORNL Physics		PPPL Physics	
	multiplier	unit	no.	hours		fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs
Title I, II design															
Pro-E models (avg)	16	hrs/model	10	160	1.00	0.25	40	0.50	80	0.25	40	0.00	0	0.00	0
assy dwgs	40	hrs/dwg	4	160	1.00	0.50	80	0.50	80	0.00	0	0.00	0	0.00	0
Detail drawings	20	hrs/dwg	10	200	1.00	0.20	40	0.80	160	0.00	0	0.00	0	0.00	0
installation dwg	40	hrs/dwg	1	40	1.00	0.50	20	0.50	20	0.00	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	1.00	0	0.00	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
stress analysis	24	hrs/calc	2	48	1.00	1.00	48	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
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
procurement/fab specifications	32	hrs/spec	2	64	1.00	1.00	64	0.00	0	0.00	0	0.00	0	0.00	0
preliminary and final design reviews	40	hrs/rev	1	40	1.00	1.00	40	0.00	0	0.00	0	0.00	0	0.00	0
meetings/reporting/presentations	10%	% of tot	712	71	1.00	1.00	71	0.00	0	0.00	0	0.00	0	0.00	0
subtotal				*783*			*403*		*340*		*40*		*0*		*0*

					total fraction	EAEM		EASM		EADM		ORNL Eng	
Title III						fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs
vendor oversight, inspection	4	hrs/wk	18	72	1.00	0.50	36	0.00	0	0.00	0	0.50	36
Disposition of deviation requests and non-conformances	4	hrs/wk	30	120	1.00	0.20	24	0.00	0	0.00	0	0.80	96
As-built drawings	8	hrs/dwg	15	120	1.00	0.00	0	0.00	0	0.00	0	1.00	120
subtotal				*312*			*60*		*0*		*0*		*252*

Schedule assumptions	**start**	**duration (weeks)**	**end**
Title I Design	Nov-04	12	Feb-05

WBS 172 Machine Base Assembly

Engineering, Title I, II and III

Title II Design	Feb-05	12	May-05
Procurement	May-05	18	Sep-05
In-house fab / sub-assy	Sep-05	0	Sep-05
Installation / final assembly	Sep-05	12	Dec-05

Notes and worksheets

Coil support structure

	total	base beam system	rails and carriages	
Pro-E models	10	6	4	models of all parts
assy dwgs	4	2	2	typical assemblies of half field period, whole field period, and full structure
Detail drawings	10	6	4	each part is detailed
installation dwg	1	1	0	
cooling schematic	0			
electrical schematic	0			
I&C schematic	0			covered in WBS 163
stress analysis	2	1	1	local analyses of base and rails
thermal analysis	0			
special analysis	0			seismic analysis in WBS 162
procurement specifications	2	1	1	one procurement specification for each major system
preliminary and final design reviews	1			standard reviews
meetings/reporting/presentations	10%			