

NCSX Work Approval Form (WAF)

WBS Number: 186

WBS Title: Tooling Design & Fabrication

Job Numbers: 1803 & 1805

Job Titles: FPA Tooling & Constructibility (1803)

Job Titles: FPA Hardware & Fixture Procurement (1805)

Job Manager: Tom Brown (1803) and Larry Dudek (1805)

Description:

This WBS element includes all of the non-VVSA procurements.

Schedule:

See Attached

Approvals:

Job Manager

Date

Job Manager

Date

Responsible Line Manager

Date

Project Manager

Date

Engineering Department Head

Date

NCSX June 2007 ETC
TABLE I - DESIGN LABOR

WBS Number: 186							
WBS Title: Tooling Design & Fabrication							
Job Numbers: 1803 & 1805							
Job Titles: FPA Tooling & Constructibility (1803)							
Job Titles: FPA Hardware & Fixture Procurement (1805)							
Job Manager: Tom Brown							
Description:							
TASK DESCRIPTION	41MS	48MS	EAEM (Fan)	EAEM (Brown)	EADM (Morris)		Basis of Estimate
Design (Job 1803)							
Stage 3							
Details of remaining Manhour needs							
Complete SISCO/support frame interface						0	Work Completed
Revise drawings as needed per FDR input						48	Based on previous experience on Station 1 earlier work on original fixture
Flange bolt/VV support access platform						120	Based on previous experience on Station 1 earlier work on original fixture
Transportation study (move between test cells)						40	Based on previous experience on Station 1 earlier work on original fixture
VV/MC clearance report (for VVSA1, 2 and 3)					72		Based on previous experience on Station 1 earlier work on original fixture
Generate laser trace drawing for each screen						80	Based on previous experience on Station 1 earlier work on original fixture
Assembly sequence plan and Installation procedure				40			Based on previous experience on Station 1 earlier work on original fixture
Analyze single point lift			40	16			Based on previous experience on Station 1 earlier work on original fixture
Subtotal Stage 3			40	128		288	
Stage 5							
Details of remaining Manhour needs							
Complete FP support and platform models						240	Based on previous experience on Station 1 earlier work on original fixture
Complete platform models						80	Based on previous experience on Station 1 earlier work on original fixture
Complete dwg package & release for fabrication						120	Based on previous experience on Station 1 earlier work on original fixture
Complete models and dwgs for test cell metrology layout						160	Based on previous experience on Station 1 earlier work on original fixture
Design follow-up and preliminary analysis				60			Based on previous experience on Station 1 earlier work on original fixture
Perform structural analysis			60				Based on previous experience on Station 1 earlier work on original fixture
Subtotal Stage 5			60	60		600	
Final Machine Assembly Fixture Design							
Details of remaining Manhour needs							
Complete Stage 6 support						240	Based on previous experience on Station 1 earlier work on original fixture
Complete platform models						80	Based on previous experience on Station 1 earlier work on original fixture
Complete dwg package & release drawings						160	Based on previous experience on Station 1 earlier work on original fixture
Design follow-up and preliminary analysis				120			Based on previous experience on Station 1 earlier work on original fixture
Perform structural analysis			120				Based on previous experience on Station 1 earlier work on original fixture
Subtotal Final Machine Assembly Fixtures Design			120	120		480	Based on previous experience on Station 1 earlier work on original fixture
TOTAL REMAINING HOURS (Job 1803)			220	308		1368	
Design (Job 1805) - NONE							1896
							1896

NCSX June 2007 ETC
TABLE II - Materials and Subcontracts

WBS Number: 186									
WBS Title: Tooling Design & Fabrication									
Job Numbers: 1803 & 1805									
Job Titles: FPA Tooling & Constructibility (1803)									
Job Titles: FPA Hardware & Fixture Procurement (1805)									
Job Manager: Tom Brown									
Materials and Subcontracts (M&S)									
Job 1803 - NONE									
Job 1805									
PPPL Shop Rate for EMTB (\$/hr) = 81									
NEED TO HAVE BAIS OF ESTIMATE FOR BELOW ITEMS									
Unit									
Weight \$ per Unit Total Equiv Shop									
Description (lbs) Lb Cost (\$) Qnty Cost (\$) Comments hrs Basis of Estimate									
Stage 2 - Assy Fixture Cost (Existing Design)									
Estimate is for two Stage 2 units									
20 Degree Wedge Fixture 11,600 4 46,400 2 \$92,800 Weldment plus some machinings 1,146 29 wks Based on actual weight of existing fixtures and previous experience on similar tasks									
Stage 3 - MC Assembly Fixture Cost									
Estimate is for one Stage 3 unit									
Rt side laser screen weldment (new parts) 300 4 1,200 2 \$2,400 30 Based on current status of CADD Models - previous input from vendors on similar tasks - dwgs completed.									
Reworked left side laser screen weldment 2 \$1,944 Assumes 3 days of shop time 24 Based on previous experience on similar tasks									
Test cell hook adaptor plate 300 7 2,100 1 \$2,100 26 Based on previous experience on similar tasks - HOWEVER, interface has changes => need new estimate.									
SISSCO 3 Actuator Lift System \$0 Cost included in Mike Viola's WBS									
MC I-beam upper support at Type-A 579 4 2,316 1 \$2,316 weldment plus some machined structure Based on CADD model data and previous experience on similar tasks									
MC upper support at Type-C - inboard 160 4 640 1 \$640 weldment plus some machined structure Based on CADD model data and previous experience on similar tasks									
MC upper support at Type-C - outbd 60 7 420 3 \$1,260 weldment plus some machining Based on CADD model data and previous experience on similar tasks									
MC base support system (left / rt side) 2,938 4 11,752 1 \$11,752 weldment plus some machined structure 145 Based on CADD model data and previous experience on similar tasks									
VV support system 1,411 4 5,644 1 \$5,644 weldment plus some machined structure 70 Based on CADD model data and previous experience on similar tasks									
Hilman roller - 8-OT plus R & U guides 960 8 \$7,600 Based on Hilman phone quote Phone quote from Vendor - in 2006									
AirLoc Wedgmount Precision Levelers 315 6 \$1,890 Based on phone quote Phone quote from Vendor - start of 2007									
Bushnell Laser Boresighter \$245 Internet price (one spare included)									
Flange bolt access platform \$0 Shop supplied (included in Viola's estimate) 0									
Hardware & Misc items \$1,000									
Misc assembly Cost \$8,100 Assumes 2.5 wk shop hour: 100									
\$46,891 394 9.9 wks									
Stage 5 - Final FP Assembly Fixture Cost									
Estimate is for one Stage 5 units									
1 FPA base support system 1,500 4 6,000 1 \$6,000 This will be similar to Stage 3, without rollers 74 Based on CADD model data and previous experience on similar tasks									
2 AirLoc Wedgmount Precision Levelers 315 4 \$1,260 Based on phone quote Phone vendor prices off Internet - March 2007									
3 TF support structure 2,200 4 8,800 2 \$17,600 Structure weldment (estimated weight) 217 Based on CADD model data and previous experience on similar tasks									
4 Port 4 handling structure 500 4 2,000 1 \$2,000 Structure weldment (estimated weight) 25 Based on CADD model data and previous experience on similar tasks									
5 Hardware & Masc. items \$1,000									
6 Misc. assembly Cost \$8,100 Assumes 2.5 wk shop hour: 100.0									
\$35,960 each 416 10.4 wks									
\$71,920 need two									
Final Machine Assembly Fixture Costs									
Estimate for 3 FP's and 3 Spool Fixtures									
1 FPA base support system 4,000 4 16,000 3 \$48,000 Structure weldment (estimated weight) 593 Based on CADD model data and previous experience on similar tasks									
2 AirLoc Wedgmount Precision Levelers 315 12 \$3,780 Based on phone quote (assume 4 pt supt) Phone quote from Vendor - start of 2007									
3 Spool piece support system 1,000 4 4,000 3 \$12,000 Structure weldment (estimated weight) Based on CADD model data and previous experience on similar tasks									
4 Thomson linear motion components 1000 12 \$12,000 Estimate Rough estimate based on conceptual design									
5 FPA base motor driven linear screw system Existing system already available									
6 Spool piece support linear screw system 1500 3 \$4,500 Nook screw system (no motor needed) Rough estimate based on previous experience - 2006									
7 Hardware & Masc. items \$3,000									
8 Misc. assembly Cost \$16,200 Assumes 5 wk shop hours: 200									
\$99,480 793 19.8 wks									
TOTAL M&S									
\$311,091 with add'l wedges									
\$218,291 without add'l wedge									

**NCSX June 2007 ETC
TABLE III - Fabrication and Assembly**

WBS Number: 186																	
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Job Manager: Tom Brown																	
Fabrication and Assembly																	
M&S/Fab in Job 1805																	

NCSX June 2007 ETC
TABLE IV - Uncertainty of Estimate and Residual Risk Assessment

WBS Number: 186
WBS Title: Tooling Design & Fabrication
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Job Titles: FPA Hardware & Fixture Procurement (1805)
Job Manager: Tom Brown

Uncertainty of the Estimate

	High	Medium	Low	Uncertainty Range (%)	Comments/Other Considerations
Job 1803 - Tom Brown					
Station 3					
Design Maturity		X		-10%/+15%	Simulation run identified several additional issues to be resolved (expect resolution by July) Standardized components.
Design Complexity			X		
Station 5					
Design Maturity		X		-10%/+15%	Only preliminary design completed, but relatively straightforward steps Standardized components.
Design Complexity			X		
Station 6					
Design Maturity			X	-20%/+40%	Only at conceptual stage - incomplete simulations More complex systems
Design Complexity		X			
Job 1805 - Larry Dudek					
Station 3					
Design Maturity		X		-10%/+15%	Simulation run identified several additional issues to be resolved (expect resolution by July) Standardized components, but some complexity.
Design Complexity			X		
Comment:					Design still evolving so amount of material/components could change - expect to resolve by July (SISSCO Interface_)
Station 5					
Design Maturity		X		-10%/+15%	Only preliminary design completed, but relatively straightforward steps Standardized components.
Design Complexity			X		
Comment:					Design still evolving - expect design to be finalized in July.
Station 6					
Design Maturity			X	-20%/+40%	Only at conceptual stage - incomplete simulations More complex systems
Design Complexity		X			
Comment:					Design still evolving - expect design to be finalized in July.

Note: High/Medium/Low uncertainty assessment from Job Manager. Uncertainty range based on AACEI recommended practice 18R-97 as amended for NCSX.

Residual Impacts

Job	Risk Description	Likelihood of Occurring	Mitigation Plan	Basis of estimate	Cost Impact		Schedule Impact	
					Low	High	Low	High
1803	Assembly sled for final assembly is not adequately stiff or does not provide repeatable motion	U	Functionality of sled will be determined first with concrete blocks and later with first FP. Ample time to make design modifications between arrival of the first and third FPs.	Nominal cost impact is 1 man-month of engineering design and up to half the fabrication cost of the sled	+\$25	+\$75	+ 0.00	+ 0.00

Notes:

- [1] Low cost and schedule impacts are considered the minimum (0-percentile) impacts should the event occur.
High cost and schedule impacts are considered the maximum (100-percentile) impacts should the event occur
- [2] Cost impacts should be entered as man-hours (by demographic) and M&S direct cost under basis of estimate.
Cost impacts should NOT include standing army costs which are separately calculated from the schedule impact
Project control is responsible for quantifying the low and high cost impacts based on the labor hours and M&S identified
- [3] The schedule impacts should be entered as the min and max impacts on the critical path.
If there is no critical path impact then the schedule entries should be zero.
- [4] Likelihood of occurrence should be entered consistent with our risk classification methodology, i.e.
VL= Very Likely (P>80%), L=Likely (80%>P>40%), U=Unlikely (40%>P>10%), VU=Very Unlikely (P<10%), NC=Non-credible (P<1%)

Activity ID	MILE-stones (level 2 & 3)	Activity Description	Duration (work days)	Baseline Start	Baseline Finish	Shifts	Total Float	% cmlpt	Proposed Budgeted	Budgeted						
										FY07	FY08	FY09	FY10	FY11	FY12	
18 - Field Period Assembly																
Job: 1803/1805- FPA Tooling/Constr-BROWN/DUDEK																
Station 2-Modular Coil Sub- Assembly																
1803-2.1		Assembly sequence plan drafted	28	01MAY07	08JUN07		65	LOE	0.00							
1803-2.2		Procure 2 20degree wedge fixt (for total of 6)	90	04SEP07*	18JAN08		80		0.00							
Station 3-Modular Coil to VVSA Assembly																
1803-3.2		Finalize drawings for internal review and outsid	3	25JUN07	27JUN07		111		0.00							
1803-3.3		Analyze single point lift	10	28JUN07	12JUL07		111		9,756.88							
1803-3.4	3	Stage 3 support FDR	1	13JUL07*	13JUL07		111		0.00							
1803-3.5		Flange bolt/VV support access platform	8	02JUL07*	12JUL07		112		13,495.20							
1803-3.6		Revise drawings per FDR input and release for Fa	2	16JUL07	17JUL07		111		5,398.08							
1803-3.7		Transportation study (move between test cells)	2	18JUL07	19JUL07		173		4,498.40							
1803-3.8		Generate laser trace drawing for each screen	20	16JUL07	10AUG07		157		8,996.80							
1803-3.9		Assembly sequence plan and Installation procedur	18	01JUN07*	26JUN07		168		6,969.20							
R1802-305		Metrology plan	20	01JUN07*	28JUN07		187		0.00							
1803-3.10		VV/MC clearance report (for VVSA1, 2 and 3)	21	27JUN07	26JUL07		168		12,544.56							
1803-3.11		Procure materials and fixture	88	18JUL07*	19NOV07		111		60,445.47							
Station 5-Final Field Period Assembly																
1803-5.1		Complete FP support models	50	01AUG07*	10OCT07		127		27,276.48							
1803-5.5		Design followup & prelim analysis	20	01AUG07*	28AUG07		187		10,453.80							
1803-5.2		Complete platform models	15	11OCT07	31OCT07		127		9,592.80							
1803-5.3		PDR	0		07NOV07		127		0.00							
R1802-503		Sequence plan	20	02MAY07*	30MAY07		240		0.00							
1803-5.4		Structural Analysis	10	08NOV07*	21NOV07		127		11,145.60							
1803-5.6	3	Station 5 FDR	0		21NOV07		127		0.00							
1803-5.7		Complete dwg package and release for Fa	20	22NOV07	21DEC07		127		14,389.20							
1803-5.8		Complete models and dwgs for test cell metrology	9	02JAN08	14JAN08		163		19,185.60							
1803-5.9		Procure materials and fixture (2 stations)	65	02JAN08	01APR08		127		94,071.36							
6.00-Final Machine Assembly																
1803-6.1		Complete Stage 6 support models	50	03DEC07*	19FEB08		69		28,778.40							
1803-6.2		Complete platform models	30	20FEB08	01APR08		69		9,592.80							
1803-6.3		Structural Analysis	30	03DEC07*	22JAN08		119		22,291.20							
1803-6.4		PDR	0		01APR08		69		0.00							
1803-6.5		Complete drawing package	40	02APR08	28MAY08		69		19,185.60							
1803-6.6	3	Station 6 FDR	0		04JUN08		69		0.00							
1803-6.7		Revise drawings per FDR input and release for Fa	5	05JUN08	11JUN08		69		0.00							
Run Date			18JUL07 07:31			ETCZ			NCSX Project			Sheet 30 of 99				
© Primavera Systems, Inc.						Resource Loaded Schedule			EAC							

41=92.8k**ON HOLD** NOT BUDGETED**

ea/em=16; ea/em=40

EA/SB =120hr ;

EA/SB =48hr ;

EA/SB =40hr ;

EA/SB =80hr ;

EA/EM =40hr ;

Ellis

EA/EM =72hr ;

41=46.891\$K ;

ea/sb=240

ea/em=60

EA/SB =80hr ;

Brown

EA/EM =60hr ;

EA/SB =120hr ;

EA/SB =160hr ;

41=71.92\$K ;

EA/SB =240

EA/SB =80

fan =120hr ;

EA/SB =160

Activity ID	MILE-stones (level 2 & 3)	Activity Description	Duration (work days)	Baseline Start	Baseline Finish	Shifts	Total Float	% cmlpt	Proposed Budgeted						
										FY07	FY08	FY09	FY10	FY11	FY12
1803-6.9		Design followup and prelim analysis	82	03DEC07*	03APR08		112		22,291.20	■ Brown=120hr ;					
1803-6.8		Procure materials and fixture	65	02SEP08*	03DEC08		13		111,484.70	■ 41=81.48\$K ;					
Subtotal			400	01MAY07	03DEC08		13		521,843.33						