

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														
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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 SISSCO/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		Based on previous experience on Station 1 earlier work on original fixture	
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							

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TABLE II - Materials and Subcontracts

WBS Number: 186									
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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		
	(lbs)	Lb	Cost (\$)	Qty	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			34.97	7	\$245	Internet price (one spare included)		
	Flange bolt access platform					\$0	Shop supplied (included in Viola's estimate)	0	
	Hardware & Misc items					\$1,000			Rough estimate based on previous experience on similar tasks.
	Misc assembly Cost					\$8,100	Assumes 2.5 wk shop hour	100	Based on previous experience on similar task
						\$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			Rough estimate based on previous experience on similar tasks.
6	Misc. assembly Cost					\$8,100	Assumes 2.5 wk shop hour	100.0	Based on previous experience on similar task
						\$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				3	-	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			Rough estimate based on previous experience on similar tasks.
8	Misc. assembly Cost					\$16,200	Assumes 5 wk shop hours	200	Based on previous experience on similar task
						\$99,480		793 19.8 wks	
TOTAL M&S						\$311,091	with add'l wedges		
						\$218,291	without add'l wedge		

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TABLE III - Fabrication and Assembly

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

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TABLE IV - Uncertainty of Estimate and Residual Risk Assessment

WBS Number: 186
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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%)