

NCSX Work Approval Form (WAF)

WBS Number: 38

WBS Title: Electron Beam Mapping

Job Number: 3801

Job Title: Electron Beam Mapping Systems

Job Manager: Brent Stratton

Description:

This WBS element consists of all EB mapping equipment required to accomplish the NCSX mission as defined in the General Requirements. This equipment will be required in the field-line mapping phase of operations and thus is included in the NCSX Fabrication Project.

Schedule:

See Attached

Approvals:

Job Manager

Date

Responsible Line Manager

Date

Project Manager

Date

Engineering Department Head

Date

**NCSX June 2007 ETC
TABLE I - DESIGN LABOR**

WBS Number: 38													
WBS Title: Electron Beam Mapping													
Job Number: 3801													
Job Title: Electron Beam Mapping Systems													
Job Manager: Brent Stratton													
Description: E-beam mapping will be done with an electron gun and movable fluorescent wand borrowed from Auburn University. Will use same visible TV camera as in WBS 36. Need two port extensions for 10" diameter ports. Need data acquisition system to record wand position, electron gun bias voltage and emission current. Need control capability for wand, electron gun bias voltage and emission current..													
		\$		Labor Hours							Basis of Estimate		
	Task Description	M&S	Travel	E MEM	E MSM	E MTB	E EEM	E ETB	E ADM	E CEM	R M2		
Design System													
	Design interface components - adapting flange sizes			120									Engineering judgement - however standard design used before
	Physics-based modeling, work with Auburn personnel		\$3,000								480		Engineering judgement - however standard design used before
	Prepare drawings (~6 drawings)										80		Based on conceptual design and PPPL design experience
	Design software for control & data acquisition for H/W										300		Engineering judgement - however standard design used before
Fabricate System (Including welding)													
	Fabricating & Welding Spool Pieces										16		Engineering judgement - however standard design used before
	Fabricating other parts										80		Engineering judgement - however standard design used before
Install System													
											240		Engineering judgement - however standard design used before
Engineering Oversight													
											40		
Materials													
	Port Extensions Material/Parts	\$4,000											Based on estimate provided by PPPL Construction Manager - see Table V
	Data Acquisition Materials/Parts	\$10,000											Based on estimate provided by PPPL Computer Division - see Table V
	Rack	\$28,600											Based on estimate provided by PPPL Electrical Engineer - see Table V
	TOTAL	\$42,600	\$3,000	160	0	336	0	16	80	300	480		

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TABLE II - Materials and Subcontracts

WBS Number: 38									
WBS Title: Electron Beam Mapping									
Job Number: 3801									
Job Title: Electron Beam Mapping Systems									
Job Manager: Brent Stratton									
Materials and Subcontracts (M&S)							Basis of Estimate		
					Material				
					Labor				
Description - included in Table I									

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TABLE III - Fabrication/Assembly Installation

WBS Number: 38																	
WBS Title: Electron Beam Mapping																	
Job Number: 3801																	
Job Title: Electron Beam Mapping Systems																	
Job Manager: Brent Stratton																	
In-house Fabrication and Assembly and Installation																	
Included in Table I																	

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TABLE IV - Uncertainty of Estimate and Residual Risk Assessment

WBS Number: 38
WBS Title: Electron Beam Mapping
Job Number: 3801
Job Title: Electron Beam Mapping Systems
Job Manager: Brent Stratton

Uncertainty of the Estimate

	High	Medium	Low	Uncertainty of Estimate (%)	Comments/Other Considerations
Design Maturity		X		-15%/+25%	Similar designs done elsewhere, but NCSX specific design still conceptual
Design Complexity		X			Standard components, but interfaces could be somewhat complex
Other Comments:					Leak checking not included in this estimate

Note: High/Medium/Low uncertainty assessment from Job Manager. Uncertainty range based on ACEI 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
NONE								

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%)

NCSX June 2007 ETC TABLE V - Basis of Estimate

Backup Information

Hardware requirements for e-beam mapping

Equipment rack	isolating a-c power ethernet link camac crate, system clock, etc Single point grounding	Sichta? Sichta Sichta
Camera	(borrowed from NSTX) Move camera to port on NCSX Modify port to accept camera Move control hardware to NCSX rack timing module/channel for camera MDS tree for camera data Camera filters Cable runs	Stratton Stratton Stratton Sichta Sichta Stratton
Electron gun	(borrowed from Auburn) Modify NCSX port Modify gun probe to fit NCSX port Duplicate/borrow control hardware from NSTX probes Slow ($\approx 1\text{kHz}$) acquisition system to record filament parameters (908?) Bias supply (100V, e.g., Kepco BOP-100-1M $\approx \$3000$) Digital control for bias supply (D-to-A module?) Cable runs	Stratton/Knowlton Stratton Sichta Fredrickson Sichta
Swept fluorescent rod (borrowed from Auburn)	Modify NCSX port and gun Duplicate/borrow control hardware from NSTX probes Control hardware to remotely sweep rod (stepper motor controller?) Cable runs	Stratton Stratton Stratton/Knowlton

Testing system at Auburn

Data Acquisition Hardware

Sichta M&S: \$10K
[computer, LabVIEW, timer card, d/a, a/d, motor controller, network].
hardware & software labor: 300 hours
[requirements/design/select_parts/fdr/code/test].

Additional:
mechanical stuff, installation, post-acquisition software analysis & visualization.

EBEAM mapping tasklist.xls

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