

NCSX Work Approval Form (WAF)

WBS Number: 21

WBS Title: Gas Fueling System

Job Number: 2101

Job Title: Fueling System

Job Manager: Bill Blanchard

Description:

NCSX will re-use the existing Gas Fueling System from PBX-M. In its initial configuration, the Gas Fueling System will have 2 to 4 injectors capable of providing a modest level of torr-liter/s of H₂, D₂, or He fueling. This initial configuration will have the flexibility to allow the easy changing of gas plenum volumes, or the adding of additional injectors, at selected vessel locations, as required by the experimental program. This WBS element consists of the effort to provide a gas fueling injectors, the gas delivery line, and associated vacuum system. System control will be partially manual and partially PLC control.

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: 21
WBS Title: Gas Fueling System
Job Number: 2101
Job Title: Fueling System
Job Manager: Bill Blanchard

Description:

The proposed fueling system consists of a gas delivery from a single gas cylinder and a gas injection portion consisting of one piezo electric pulse valve, one manual interface valve located at one of the upper P12 port covers. The pulse valve will be operated by a valve driver controlled by the NCSX computer system (greater than 50 T-/sec fueling rate).

Task ID	K\$											Basis of Estimate
	EMEM	EMSM	EMSB	EMTB	EASB	EEEM	EESM	EESB	EETB	Hours		
Title I and II Design												<p>This is a relatively simple system that utilizes some existing parts/components already at PPPL. Estimate based on prior experience on similar systems (e.g., NSTX), adjusted for the simplicity of this system. Includes some P&ID drawings, weld drawings, fabrication drawings, two reviews (PDR & FDR) and installation and test procedures. Input from experienced engineers/personnel familiar with specific parts of this scope was used for estimates. Includes overall design and oversight, design activities (dwgs, support and bracket design, overall configuration of the system) and purchasing of components.</p> <p><i>M&S included function generator/valve driver (~\$3K) + miscellaneous</i></p> <p>This effort includes fabrication/welding/assembly, installation, oversight, leak checking of the subsystems, procedures, and initial operation and testing.</p>
Pro-E models (avg)												
assy dwgs												
Detail drawings												
installation dwg												
designer oversight												
electrical schematic												
I&C schematic												
stress analysis												
thermal analysis												
special analysis (electromagnetics)												
Procurement Specifications												
preliminary and final design reviews												
Subtotal Title I & II Design	\$5K	120	0	96	64	32	0	96	0	0		
Title III		40										
Subtotal Title III	\$0K	40	0	0	0	0	0	0	0	0		

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TABLE II - Materials and Subcontracts

WBS Number: 211
WBS Title: Gas Fueling Systems
Job Number: 2101
Job Title: Fueling Systems
Job Manager: Bill Blanchard

Materials and Subcontracts (M&S)	Basis of Estimate
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Description:

See Table I

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TABLE III - Fabrication and Installation

WBS Number: 211
WBS Title: Gas Fueling Systems
Job Number: 2101
Job Title: Fueling Systems
Job Manager: Bill Blanchard

In-house Fabrication and Assembly and Installation

Included in Table I

TABLE IV - Uncertainty of Estimate and Residual Risk Assessment

WBS Number: 211
 WBS Title: Gas Fueling Systems
 Job Number: 2101
 Job Title: Fueling Systems
 Job Manager: Bill Blanchard

Uncertainty of the Estimate

	High	Medium	Low	Uncertainty Range (%)	Comments/Other Considerations
Design Maturity		X			Although may be similar to previous designs, some design features (not yet defined)
Design Complexity			X	-10%/+15%	Anticipated to only require standard components
Other Comments:					

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

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=Unlikley (40%>P>10%), VU=Very Unlikley (P<10%), NC=Non-credible (P<1%)