

To: L. Dudek  
From: W. Blanchard

Subject: Closeout Summary for NSCX Fueling (WBS21)

### **Scope**

The project scope encompassed the installation and testing of a remotely controlled and monitored fueling system consisting of three gas injection assemblies, three gas delivery systems, a pumpout system and associated gauging. Each gas injection assembly (GIA) would consist of a fill valve, interface valve and a piezoelectric pulse valve that would be operated by a valve driver controlled by the NCSX computer system. Each GIA would have a maximum fueling rate greater than 50 T-l/s. This WBS ends with the installation and testing of the three gas injection systems. Possible future upgrades included additional injectors for gas, pellets and supersonic gas injection.

### **Status**

This project was in the early design phase and there had not been a PDR.

### **Interfaces**

The only interfaces for this system were the three P12 port covers on the vacuum vessel.

### **Specification**

This work was in the early phase of development and the general requirements were in the GRD.

### **Schematics**

No formal approved schematics or PIDs had been generated for this project at the time of closeout.

### **Models**

No formal approved models had been generated for this project.

### **Drawings**

No formal approved drawings had been generated for this project.

### **Analysis**

The anticipated design was to be similar to previously installed systems (NSTX) which exceeded the design requirement of the GRD.

### **Testing**

No testing of system components was done.

**Costs**

There are no pending cost updates for this WBS.

**Remaining Work**

There is no remaining work required to close this project out.

**Lessons Learned**

None

**Conclusion**

This fueling system was in its early phase of development, but it was expected that the gas delivery and injection systems would have been largely patterned after the NSTX fueling system.

# NCSX Fueling Systems

W. Blanchard  
*WBS 21 Manager*

# FUELING SYSTEM

## Requirements

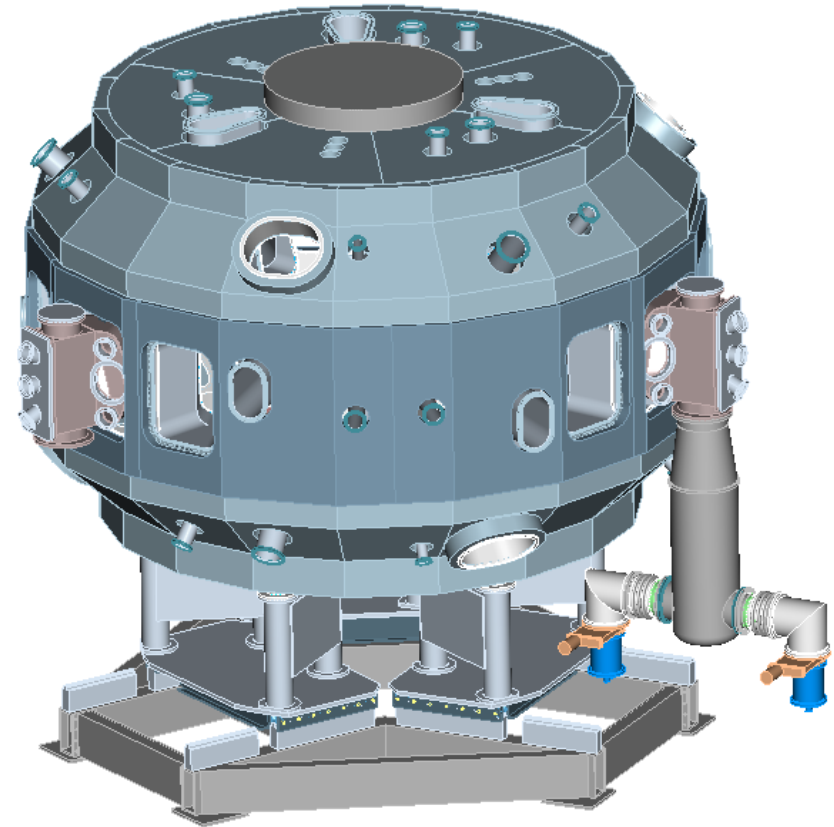
- Three gas injection systems with each injector having a maximum flow rate  $>50$  T-l/s

## Interfaces

- Injectors located at the three upper P12 port covers

## Design Features

- Includes gas delivery manifold, pumpout system and gauging
- System monitored, controlled and interlocked using a PLC
- Pulse valve controlled from central computing



# FUELING SYSTEM



Task ID	M\$	Hours									
		EVEM	EVBM	EVBB	EMTB	EASB	EEEM	EEBM	EEBB	ETTB	
<b>Title I and II Design</b>											
Preliminary Design / Management / Admin											
Engr Work Planning & Design		48									
Design Gas handling Hardware				96							
Design PLC Controls							112				
Drafting Support						24					
Final Design / Management / Admin											
Engr Work Planning & Design		88									
Design Gas handling Hardware				48							
Design PLC Controls							448				
Drafting Support (Electrical)						144					
Drafting Support (Mechanical)						68					
<b>Subtotal Title I &amp; II Design</b>		<b>136</b>	<b>0</b>	<b>144</b>	<b>0</b>	<b>236</b>	<b>560</b>		<b>0</b>	<b>0</b>	
<b>Title III</b>											
Engr Work Planning & Design		40									
Fabricate & Install Hardware				120	240						
Fabricate & Install Hardware (Electrical)					288						
Install PLC Controls							192				
Integrated System Testing		40					80				
Materials and Supplies	\$	38,000									
<b>Subtotal Title III</b>	\$	<b>38,000</b>	<b>80</b>	<b>0</b>	<b>120</b>	<b>528</b>	<b>0</b>	<b>272</b>	<b>0</b>	<b>0</b>	

## Cost Estimate

- \* Based on NSTX costs for system which is similar to the proposed NCSX design
- \* Input from engineers and personnel familiar with various parts of the project



# FUELING SYSTEM



21 - Fueling Systems						
Job: 2101 - Fueling Systems-BLANCHARD						
211-101	Preliminary Design	42	03MAR09*	29APR09	318	40,631.36
211-105	PDR Fueling Systems	0		29APR09	318	0.00
211-109	Final Design	42	30APR09	29JUN09	318	120,756.40
211-113	FDR Fueling Systems	0		29JUN09	318	0.00
211-117	Title III	431	30JUN09	25MAR11	906	6,764.55
211-121	Procure Material and Supplies	65	01OCT09*	13JAN10	253	50,806.00
211-125	Fabricate and Assemble	115	01OCT10*	22MAR11	70	97,654.80
211-126	Test	5	23MAR11	29MAR11	70	21,609.20

em/em=48;em/sb=96  
ea/sb=24; ee/em=112

em/em=88; ea/sb=212  
ee/em=448; em/sb=48

EM/EM =40hr;

41=38\$K;

em/sb=120; em/tb=528  
em/em=40; ee/em=192

em/em=40; ee/em=80

## Project Schedule

**Design in FY09, procurements in FY10 and fabrication/installation in FY11**



# FUELING SYSTEM



<u>Uncertainty of the Estimate</u>																		
			<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Uncertainty Range (%)</u>	<u>Comments/Other Considerations</u>											
Design Maturity					X	-15%/+25%	There have been no design reviews therefore the design is not fixed.											
Design Complexity					X		Anticipated to only require standard components											
Other Comments:																		

## Risk Assessment: Low

### Risk:

- \* Equipment or component failure

### Mitigation:

- \* All components outside of coils and cryostat and easily replaceable
- \* Standard equipment and hardware

