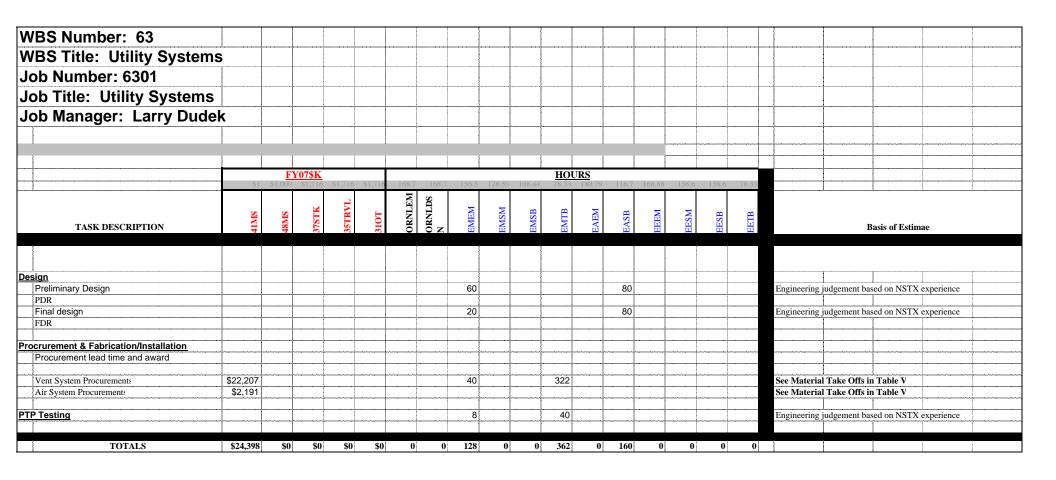
# **NCSX Work Approval Form (WAF)** WBS Number: 63 WBS Title: Utility Systems Job Number: 6301 Job Title: Utility Systems Job Manager: Larry Dudek Description: The Utility Systems (WBS 63) are required to provide service manifolds around the NCSX stellarator for compressed air, vacuum pump venting and gaseous nitrogen. Utility Systems are comprised of three (3) service manifolds around the NCSX vacuum vessel: one for vacuum venting; one for GN2 service; and one for compressed air. The WBS element only consists of the effort to provide the design, fabrication and installation of a manifold system around the NCSX stellarator for compressed air, vacuum pump venting and gaseous nitrogen. Schedule: See Attached Approvals: Job Manager Date Responsible Line Manager Date Project Manager Date

Date

**Engineering Department Head** 

## NCSX June 2007 ETC TABLE I - DESIGN LABOR



# NCSX June 2007 ETC TABLE II - Materials and Subcontracts

WBS Number: 63				
WBS Title: Utility Systems				
Job Number: 6301				
Job Title: Utility Systems				
Job Manager: Larry Dudek				
Materials and Subcontracts (M&S)				Basis of Estimate
M&S in Table I				

# NCSX June 2007 ETC TABLE III - Fabrication/Assembly Installation

In-house Fabrication and	d Assem	ibly and	l Installation			
Fabrication & Installation in Table						

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

WBS Number: 63

**WBS Title: Utility Systems** 

Job Number: 6301

Job Title: Utility Systems
Job Manager: Larry Dudek

## **Uncertainty of the Estimate**

Uncertainty

Range (%) Comments/Other Considerations

Design Maturity X Design not complicated, but still in a conceptual stage.
-10%/+15%

Design Complexity X Standard piping -- off-the-shelf components

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

#### Residual Impacts

Nesiduai iiiipa	<u>uts</u>	Cost Ir	npact	Schedule	mpact					
		Likelihood of								
Job	Risk Description	Occurring	Mitigation Plan	Basis of estimate	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

  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 reponsible 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.

Medium

Low

[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 Unlikely (P<10%), NC=Non-credible (P<1%)

## NCSX June 2007 ETC TABLE V - Basis of Estimate

WBS Number: 63

**WBS Title: Utility Systems** 

Job Number: 6301

Job Title: Utility Systems
Job Manager: Larry Dudek

## Backup Data

## Vent Systems Material Takeoffs

Vent

Size		Labor	Material Cost	Total Labor	M&S	Size	3	Labor	Material Cost	Total Labor	M&S
		Manhours	(\$)	(Mhours)	(\$)			Manhours	(\$)	(Mhours)	<b>(\$)</b>
Material: 304 SS					(in 1991 \$)	Material: 304 SS					(in 1991 \$)
Sch10 with Clevis han	gers					Ball VALVES 150 #	, Threaded	(Bronze)		0	\$0
	Linear Feet					1/2"		0.364	\$4.45	0	\$0
1*		0.160	\$5	.0	\$0	1"		0.421	\$9.25	3.368	\$74
1-1/4"		0.176	\$6	0	\$0	2"	9	0.727	\$25.00	- 0	\$0
1-1/2"		0.193	\$7	0	\$0						
2"		0.239	\$9	0	\$0						
1-1/2"		0.314	\$11	0	\$0						
3"		0.348	\$13	0	\$0	Pipe					
4"	300	0.381	\$17	114	\$4,983	1"		0.160	\$5	- 0	\$0
O						Install Pump		32.000	\$10,000	0	\$0
Sch 5 and 10	NO. JOINTS					Instil Ht Xchgr		40.000	\$0	0	\$(
1*		1.000	2 (1	0	\$0	Install Instru	0	16,000	\$200	. 0	\$(
ELBOWS	Quantity							To	tals		
3"	G G G TELLY	2.670	\$20	0	\$0					322	\$6.39
4"	12	4.000	\$39	48	\$468					-	
			111			For Small Quantiti	es M&S add	:10%			\$639
45 Deg. ELBOWS	Quantity	*********			9017						
3"		2.670	\$18	.0	\$0	Subtotal (1991\$)		- 11	- '		\$7,030
4"	- 4	4.000		16					4		
5*		5:330	\$215	.0	\$0						
8		1	2			Escalation from 19	91\$ to 2007	\$ for 304SS	3	2	3.16
	Quantity					ALL STREET, ST	11.00000000	La Contraction			
4"	10	8.000		80		Approximate Cost	of M&S in 2	007\$			\$22,207
5*		8.000	\$285	0	\$0	5 2 2 2 2	3		2		
FLANGES, SLIP ON 16	Quantity										
1"		0.296	\$20	0	\$0					7	
VALVES											
4" (Motorized)		8.000	\$2,000	0	\$0						
		12.000		0							
6"											

# NCSX June 2007 ETC TABLE V - Basis of Estimate

WBS Number: 63

**WBS Title: Utility Systems** 

Job Number: 6301

Job Title: Utility Systems
Job Manager: Larry Dudek

Size		Labor	Material Cost	Total Labor	M&S	Size	Labor	Material Cost	Total Labor	MAS
		Manhours	(8)	(Mhours)	(\$)		Manhours	(\$)	(Mhours)	(\$)
		-	1000		(in 1991 S)					(in 1991 S)
Cu Type K						Cu Type K				
Type L., couplings with		's @ 10' inte	rvals			Ball VALVES 160				
	Linear Feet		V			1/2"	0.364	\$4.45		\$0
1/2		0.103		0	\$0	1" 8	0.421	\$9.25	3.368	\$74
3/4*		0.108	\$1.77	0	\$0	2"	0.727	\$25.00	0	- 80
1	200	0.121		24.2	\$490	2.10	10000			-
1-1/4"		0.143	\$3.35	. 0	\$0	Pipe				
						Install Pump	16	\$500	. 0	
	NO. JOINTS					2" (3hp	6 96	\$1,320	45 0 25 3.368 .00 0 000 0 \$0 0 \$0 0 000 0 000 0	\$
-1"		0		.0	\$0	100000000000000000000000000000000000000				
						Instil Ht Xchgr	40	\$0	(Mhours) (	\$
ELBOWS, Cu Wrought	Quantity		F 100 P 100	. 5		Install Instru	16	\$200	(Amours)  0 0 0 3 359 0 0 0 0 0 0 48	\$1
1/2		0.4	\$0.29	.0	\$0	Install Pwr	24	\$1,000	(Mhours)  0 0 0 3 358 0 0 0 0 0 48	\$1
3/4"		0.421		.0	\$0	Install Tank	96	\$5,000	0	
1"	20	0.5	\$0.99	10	\$20			Totals		
1-1/4		0.533		0	\$0				48	\$63
31,04					- 40					400
45 Deg. ELBOWS (Cu)	Quantity					For Small Quantiti	es M&S add	10%		\$6
1/2	-	0.4	\$0.53	0	\$0		1			
3/4"		0.421		0		Subtotal (1991\$)				\$69
	- 1	0.5		- 4						-
1-1/4		0.533		0		Escalation from 1	9915 14 20075	for BOJES		3.1
1-1/2		0.615		0		Lacestron nom 1	3314 (0.200)	101 504 55	-	2.1
2	_	0.727		0		Approximate Cost	of MES in 20	076		\$2,19
2-1/2		1.23		0		Approximate Cost	or map in 20	010		92,13
2-1/2		1.23		0	\$0		_			
		.0	\$0.00	- 0	. \$0		_			
	Quartity	_					_			
TEES, Cu Wrought		0.615	\$0.49	0	\$0		-			_
3/4*		0.667		0	\$0		_			_
1"		0.007		6.4	\$28					
	. 8	0.8	\$3.55	0.4	\$0		-			_
				- 0	\$0					
	_	_					_			_
						_				
							_			
							-			
							_			_
		_					_			_
	_	-					_		-	_
		_					-			
			The state of the s							
			For Small Quantities M&S add:10%	5	\$0					
			TOTAL	44.6	\$557					
			ManWeeks	1.115						
			M&S in FY 2007 \$	1 1 1 1 1 1 1	\$1,758.45					
				MAS	\$1,800					

Air Systems Material Takeoffs

WBS 6.3 Utility Sys Estimate 2a.xls Air page 1 of 1 5/21/2007 11:31 AM

Activity ID	MILE- stones	Activity Description	Duration (work	Baseline Start	Baseline Finish		Total Float	% cmplt	Proposed Budgeted	FY07 FY08		ne	FY09		<b>/10</b>	FY11	FY
	(level 2 & 3)		days								ШШ			тті			THE PERSON NAMED IN COLUMN
3 - Utility	v Svstei	ms															
		ems-DUDEK															
6301-001	Var	c Vent and Air sys- Prelim Dsn	20	06OCT08*	31OCT08		285		18,479.60			-	] EM//EM =5	:2hr : EA/	/SB _80	hr ·	
6301-005		c Vent and Air sys- PDR	1	03NOV08*	03NOV08		285		1,324.00				IEM//EM =0		/SD =00	· · · · · · · · · · · · · · · · · · ·	
6301-009		c Vent and Air sys- Final dsn	10	04NOV08*	17NOV08		285		11,859.60				BEM//EM =		//SB _80	hr:	
6301-010		c Vent and Air sys- FDR	10	18NOV08*	18NOV08		285		1,324.00				EM//EM =		// SB =00	)iii ,	
6301-013		c Vent and Air sys- Procure hardware and compo	60	19NOV08	23FEB09		285		37,396.80				EDEM//E		. 41_24	200¢k -	
6301-017		c Vent and Air sys- Fabricate and Install	40	01MAY09*	26JUN09		237		29,862.12							л//ТВ =322h	
6301-017		c Vent and Air sys- rabilicate and install	10	29JUN09*	13JUL09		237		4,622.40								
	Val	t vent and Air Sys-rest							•					=MI//EIVI =	:U8NF ; E	M//TB =40hr	,
Subtotal			190	06OCT08	13JUL09		237		104,868.52								