NCSX WBS 4 REVISED BASELINE ESTIMATE 9/15/03

														M&S					Design/ Procurement		Installation				Commissioning			Line Total	Contingency				Total Cost
						Start date	Finish date	Multi plier	Qnty	Units	Qnty	Units	Qnty	Units	Unit Cost	Cost	Spare Units	Spare Cost	EEEM	Dm	EEEM	EESM	EETB	SC	EEEM	EESM	EETB		Tech	Cost	Schedule	Total	
															(k$/unit)	($K)		($K)	(md)	(md)	(md)	(md)	(md)	($K)	(md)	(md)	(md)	($K)	(%)	(%)	(%)	(%)	($K)
41- AC Power	512.0	604.2																															
	411 - Auxiliary AC Power	468.7	553.1																														
			Test Cell AC Power Distribution			1/1/04	1/1/07	1							0.000	0.000		0.000	20	50	10	10	60		6	10	20	158	8.0	8	2	18.0	186.89
					Iso Transformers			1					3	unit	5.000	15.000		0.000										20	8.0	8	2	18.0	23.54
					Transformers			1					6	unit	3.500	21.000		0.000										28	8.0	8	2	18.0	32.96
					Panels			1					6	unit	2.500	15.000		0.000										20	8.0	8	2	18.0	23.54
					Cable			1					800	feet	0.002	1.200		0.000										2	8.0	8	2	18.0	1.88
					Tray			1					100	feet	0.010	1.000		0.000										1	8.0	8	2	18.0	1.57
					Conduit			1					150	feet	0.001	0.150		0.000										0	8.0	8	2	18.0	0.24
			Ex-Test Cell AC Power Distribution		Reactivate/new installation	1/1/04	1/1/06	1					3	xfmr/ panel	3.000	9.000		0.000	10	15	15	20	30		10	10	20	129	8.0	8	2	18.0	152.00
			Standby Power for Cryo systems		UPS Systems																												
			Grounding		Misc. grounding	6/104	6/30/06	1					1	lot	5.000	5.000		0.000	10	20	10	20	40		5	5	10	111	8.0	8	2	18.0	130.47
	412 - Experimental AC Power	43.3	51.1																														
			D-site Pulsed AC Power Distribution		Lockouts/protection/reactivate	1/1/05	4/1/06	1					1	lot	5.000	5.000		0.000	5	5	2	8	10		3	3	5	43	8.0	8	2	18.0	51.12
42 - AC/DC Converters	27.2	32.1																															
	421 - C-site AC/DC Converters	0.0	0.0																														
			~~Trim Coil Power Supplies~~	~~Robicon PS Maintenance~~	~~Reactivation~~			~~1~~					~~1~~	~~lot~~	~~5.000~~	~~5.000~~		~~0.000~~	~~10~~	~~15~~	~~10~~	~~10~~	~~15~~		~~3~~	~~3~~	~~0~~	~~0~~	~~8.0~~	~~8~~	~~2~~		~~0.00~~
	422 - D-site AC/DC Converters	27.2	32.1					1																									0.00
			Coil Power Supplies	Transrex PS Maintenance	Reactivation	9/30/00	5/31/01	1					10	PSS	0.250	2.500		0.000	0	0	0	0	0		5	5	20	27	8.0	8	2	18.0	32.055
43 - DC Systems	2208.2	2686.9																															
	431 - C-site DC Systems	324.9	383.4																														
			Coil DC Cabling to Disconnect/Link Box (PCTB)	Design & Supervision		3/1/04	6/1/05	1								0.000		0.000	15	60	15	15	15					113	8.0	8	2	18.0	132.96
				Materials & Installation	Reroute & Reconnect			1	12	Cable	48	Hrs/ Cable	576	Hrs	0.075	43.200		0.000										57	8.0	8	2	18.0	67.80
					Cable Tray			1					50	ft	0.010	0.500		0.000	2	4								7	8.0	8	2	18.0	7.81
					Install Tray			1					50	ft	0.010	0.500		0.000										1	8.0	8	2	18.0	0.78
			DC Cabling to Coils in Test Cell	Design & Supervision		6/1/05	12/1/05	1								0.000		0.000	15	40	10	10	10					81	8.0	8	2	18.0	96.10
				Materials & Installation	1000MCM 5kV Cable For Circuit			1	6	Ckt	100	ft/ckt	600	ft	0.012	7.200		0.000										10	8.0	8	2	18.0	11.30
					Install Cable			1	6	Ckt	100	ft/ckt	600	ft	0.055	33.000		0.000										44	8.0	8	2	18.0	51.79
					Cable Tray			1					100	ft	0.010	1.000		0.000	2	4								7	8.0	8	2	18.0	8.59
					Install Tray			1					100	ft	0.010	1.000		0.000										1	8.0	8	2	18.0	1.57
					Install Tray			1	6	Ckt	50	ft/ckt	300	ft	0.010	3.000		0.000										4	8.0	8	2	18.0	4.71
			~~DC Cabling to Trim Coils~~	~~Design & Supervision~~				~~1~~								~~0.000~~		~~0.000~~	~~5~~	~~10~~	~~5~~	~~5~~	~~5~~					~~0~~	~~8.0~~	~~8~~	~~2~~		~~0.00~~
				~~Materials & Installation~~	~~250MCM 5kV Cable For Circuit~~			~~1~~	~~4~~	~~Ckt~~	~~150~~	~~ft/ckt~~	~~600~~	~~ft~~	~~0.012~~	~~7.200~~		~~0.000~~										~~0~~	~~8.0~~	~~8~~	~~2~~		~~0.00~~
					~~Install Cable~~			~~1~~	~~4~~	~~Ckt~~	~~150~~	~~ft/ckt~~	~~600~~	~~ft~~	~~0.055~~	~~33.000~~		~~0.000~~										~~0~~	~~8.0~~	~~8~~	~~2~~		~~0.00~~
					~~Cable Tray~~			~~1~~					~~100~~	~~ft~~	~~0.010~~	~~1.000~~		~~0.000~~	~~2~~	~~4~~								~~0~~	~~2.0~~	~~8~~	~~2~~		~~0.00~~
					~~Install Tray~~			~~1~~					~~100~~	~~ft~~	~~0.010~~	~~1.000~~		~~0.000~~										~~0~~	~~2.0~~	~~8~~	~~2~~		~~0.00~~
	432 - D-to-C-Site DC Systems	1358.7	1684.5																														
			DC Cabling	Design & Supervision				1								0.000		0.000	15	25	15	10	15					78	8.0	8	2	18.0	92.23
				Materials & Installation	1000MCM 5kV Cable	10/1/03	10/1/04	1	14	Pole	620	ft/poles	8680	ft	0.012	104.160		0.000	5									145	8.0	8	2	18.0	170.93
					Install Cable			1	14	Pole	620	ft/poles	8680	ft	0.055	477.400		0.000										635	8.0	12	2	22.0	774.63
					Cable Tray			1					1100	ft	0.010	11.000		0.000	2	4								21	8.0	8	2	18.0	24.29
					Install Tray			1					1100	ft	0.010	11.000		0.000										15	8.0	8	2	18.0	17.26
					Structural Supports			1					1	lot				0.000						350				466	8.0	20	2	30.0	605.15
	433 - D-site DC Systems	524.6	619.0																														
			DC Cabling	Design & Supervision		10/1/04	2/1/05	1								0.000		0.000	15	50	15	15	15					104	8.0	8	2	18.0	122.86
				Materials & Installation	1000MCM 5kV Cable For PSS			1	10	PSS	50	ft/PSS	500	ft	0.012	6.000		0.000	5									14	8.0	8	2	18.0	16.87
					Install Cable			1	10	PSS	50	ft/PSS	500	ft	0.055	0.055		0.000										0	8.0	8	2	18.0	0.09
					1000MCM 5kV Cable For Circuit			1	6	Ckt	150	ft/ckt	900	ft	0.012	10.800		0.000										14	8.0	8	2	18.0	16.95
					Install Cable			1	6	Ckt	150	ft/ckt	900	ft	0.055	49.500		0.000										66	8.0	8	2	18.0	77.69
					Cable Tray			1					200	ft	0.010	2.000		0.000	2	4								9	8.0	8	2	18.0	10.16
					Install Tray			1					200	ft	0.010	2.000		0.000										3	8.0	8	2	18.0	3.14
			DC Current Limiting Reactors (CLRs)	Procure CLRs																													
				Write CLR Installation Procedure																													
				Install CLRs																													
			NSTX TF Power Supply changes	TF PS changes		10/1/04	10/1/05	1								0.000		0.000	6	12	2	5		10	1	1	2	42	8.0	8	2	18.0	49.22
			NSTX OH PS changes	Task of NSTX OH PS changes		10/1/05	10/1/06	1								0.000		0.000	6	12	2	5		10	1	1	2	42	8.0	8	2	18.0	49.22
						9/30/99	9/30/00																					0					
																												0					
																												0					
			Isolating Switch	Design & Specification		10/1/03	4/1/04	1								0.000		0.000			5	5						11	8.0	8	2	18.0	12.84

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													M&S						Design/ Procurement		Installation				Commissioning			Line Total	Contingency				Total Cost
						Start date	Finish date	Multi plier	Qnty	Units	Qnty	Units	Qnty	Units	Unit Cost (k$/unit)	Cost ($K)	Spare Units	Spare Cost ($K)	EEEM (md)	Dm (md)	EEEM (md)	EESM (md)	EETB (md)	SC ($K)	EEEM (md)	EESM (md)	EETB (md)	($K)	Tech (%)	Cost (%)	Schedule (%)	Total (%)	($K)
				Procurement				*1*					*7*	*switch*	*13.000*	*91.000*		*0.000*			*5*	*5*						*132*	*8.0*	*8*	*2*	*18.0*	*155.65*
				Installation				1								0.000		0.000			5	10	10	50				88	8.0	8	2	18.0	104.34
44 - Control & Protection Systems	1424.5	1693.6																															
	441 - Electrical Interlocks	576.3	683.7																														
			C-site	Design Interlock System		10/1/04	10/1/06	1								0.000		0.000	15	25	8	15	40					90	12.0	8	2	22.0	109.89
				Procure PLC	1 + 1 spare			1					1	units	10.000	10.000	1.000	10.000	10	20	5	5	10					60	8.0	8	2	18.0	71.30
				Procure I/O				1					80	channels	0.012	0.960		0.000	10	10	10	5	5					43	8.0	8	2	18.0	50.64
				Program PLC				1								0.000		0.000	10	5	5	5	10					34	8.0	8	2	18.0	40.45
				Crate & PS				1					1	units	1.000	1.000		0.000	10		5	5	10					31	8.0	8	2	18.0	36.97
				Install I/O & Cabling				1					1	units	8.000	8.000		0.000				5	50					48	8.0	8	2	18.0	56.17
			D-to-C-site	Design Interconnection		10/1/03	10/1/04	1					1	lot	5.000	5.000		0.000	10	15	5	5	20		5	5	10	73	8.0	8	2	18.0	86.53
			D-site	Design Interlock System		10/1/04	10/1/05	1								0.000		0.000	10	15	5	10	30					60	8.0	8	2	18.0	71.22
				Procure PLC				1					1	units	10.000	10.000		0.000	3	8	0	0	0					24	8.0	8	2	18.0	28.25
				Procure I/O				1					80	channels	0.012	0.960		0.000	0	0	0	0	0					1	8.0	8	2	18.0	1.51
				Program PLC				1								0.000		0.000	10	5	5	5	5					31	8.0	8	2	18.0	36.63
				Crate & PS				1					1	units	1.000	1.000		0.000	10		5	5	5					28	8.0	8	2	18.0	33.15
				Install I/O & Cabling				1					1	units	2.000	2.000		0.000				5	15					17	8.0	8	2	18.0	19.99
				Test Modified NSTX HCS				1								0.000		0.000							10	10	20	35	8.0	8	2	18.0	40.97
	442 - Kirk Key Interlocks	96.7	114.1																														
				Kirk Keys		10/1/03	10/1/06	1					1	lot	10.000	10.000		0.000	15	15	3	5	35		5	5	15	97	8.0	8	2	18.0	114.14
	443 - Real Time Control	37.9	44.7																														
				Develop Control Algorithms		10/1/05	3/1/06	1								0.000		0.000	30									38	8.0	8	2	18.0	44.75
	444 - Instrumentation	432.5	510.3																														
			DC Current Transducers (DCCTs)			10/1/05	10/1/06	1					2	units	18.000	36.000	1.000	18.000	5	10	4	8	35		3	3	15	114	8.0	8	2	18.0	134.57
			DC Shunts					1					4	units	8.000	32.000	1.000	8.000	5	10	4	8	35		3	3	15	109	8.0	8	2	18.0	128.29
			Signal Conditioning & Associated Cabling			1/1/04	1/1/06	1					1	lot	9.000	9.000	0.000	0.000	35	10	5	0	35		10	5	5	114	8.0	8	2	18.0	134.77
			DC Potential Transducers (DCPTs)			*10/1/03*	*10/1/04*	*1*					*12*	*units*	*1.000*	*12.000*	*2.000*	*2.000*	*10*	*20*	*5*	*5*	*35*		*3*	*3*	*15*	*96*	*8.0*	*8*	*2*	*18.0*	*112.72*
	445 - Coil Protection	281.1	340.7																														
			Overload Protection & Associated Cabling			*10/1/05*	*10/1/06*	*1*					*7*	*units*	*4.000*	*28.000*	*1.000*	*4.000*	*50*	*50*	*8*	*30*	*35*		*10*	*4*	*10*	*226*	*12.0*	*8*	*2*	*22.0*	*275.92*
			Ground Fault Protection			10/1/03	10/1/04	1					1	units	3.000	3.000	1.000	3.000	10	10	4	4	15		4	4	4	55	8.0	8	2	18.0	64.79
	446 - Ground Fault Monitor	0.0	0.0																														
	-	-	~~Ground Fault Monitor~~					~~1~~					~~1~~	~~unit~~	~~5.000~~	~~5.000~~		~~0.000~~	~~10~~	~~10~~	~~4~~	~~5~~	~~15~~		~~2~~	~~2~~	~~5~~	~~0~~	~~8.0~~	~~8~~	~~2~~		~~0.00~~
45 - System Design and Integration	858.3	1028.6																															
	451 - System Design	475.4	561.0																														
			Design Drawings & Drawings changes , as-builts	New drawings & Misc. updates		10/1/04	10/1/07	1								0.000		0.000	160.00	160.00								339	8.0	8	2	18.0	400.26
			CDR Power system	All power systems				1								0.000		0.000	5.00	5.00								11	8.0	8	2	18.0	12.51
			PDR Power system	All power systems				1								0.000		0.000	5.00	5.00								11	8.0	8	2	18.0	12.51
			FDR D-Site	Transrex D-Site				1								0.000		0.000	5.00	5.00								11	8.0	8	2	18.0	12.51
			FDR C-Site	C-Site				1								0.000		0.000	5.00	5.00								11	8.0	8	2	18.0	12.51
			FDR Cabling	D site				1								0.000		0.000	5.00	5.00								11	8.0	8	2	18.0	12.51
			FDR Cabling	C site				1								0.000		0.000	5.00	5.00								11	8.0	8	2	18.0	12.51
			FDR DC transmission	D-site to C-site				1								0.000		0.000	5.00	5.00								11	8.0	8	2	18.0	12.51
			FDR AC auxiliaries & grounding	AC Auxiliaries power panels etc., grounding etc.				1								0.000		0.000	5.00	5.00								11	8.0	8	2	18.0	12.51
			Calculations	documentation				1								0.000		0.000	40.00	1.00								51	8.0	8	2	18.0	60.67
	452 - Electrical Systems Support	142.3	179.3																														
			Diagnostics AC Power Distribution	Based on Input from Diagnostics WBS		9/30/04	9/30/06	1					1	racks	1.000	1.000		0.000	10	80	10	10	80		5	10	20	92	16.0	8	2	26.0	116.20
			Diagnostics sensor cabling	Based on Input from Diagnostics WBS		9/30/05	9/30/06	0.2					10	cables	0.200	2.000		0.000	25	100	15	20	100		5	10	20	50	16.0	8	2	26.0	63.07
	46- FCPCBuilding Modifications	54.6	68.8																														
		460-01	Clear area in West wing from SPS cabinets to HVAC equipment (Elect)	Based on Input from Mech./construction		4/1/03	10/1/03	0					1	lot	1.000	1.000		0.000	8	8	2	2	12					0	16.0	8	2		0.00
		460-02	Clear the small Vacuum prep lab	Based on Input from Mech./construction		4/1/03	10/1/03	1					1	lot	0.500	0.500		0.000					20					14	16.0	8	2	26.0	17.17
		460-03	Mechanical Clearing	Based on Input from Mech./construction				1					1	lot	2.000	2.000		0.000	2	2	1	2	6					14	16.0	8	2	26.0	17.48

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						Start date	Finish date	Multi plier	Qnty	Units	Qnty	Units	M&S Qnty	M&S Units	M&S Unit Cost (k$/unit)	M&S Cost ($K)	M&S Spare Units	M&S Spare Cost ($K)	Design/ Procurement EEEM (md)	Design/ Procurement Dm (md)	Installation EEEM (md)	Installation EESM (md)	Installation EETB (md)	Installation SC ($K)	Commissioning EEEM (md)	Commissioning EESM (md)	Commissioning EETB (md)	Line Total ($K)	Contingency Tech (%)	Contingency Cost (%)	Contingency Schedule (%)	Contingency Total (%)	Total Cost ($K)
		460-04	Floor & Wall Penetrations	Input from Mech. (WBS-610)	1 Wall penetration & 20 floor penetrations	2/1/04	10/1/04	1					1	lot	5.000	5.000		0.000	1	2	1	2	14	4				27	16.0	8	2	26.0	34.15
	453 - System Testing	186.0	219.5																														
			Preop Testing					1								0.000		0.000										0					0.00
				Test Equipment				1					1	lot	25.000	25.000		0.000										33	8.0	8	2	18.0	39.24
			Procedures PTPs, ISTPs	New Procedures				1								0.000		0.000	20.00	20.00								42	8.0	8	2	18.0	50.03
				DC Circuit Hipots and Impedance Measurements				1								0.000		0.000							3		8	9	8.0	8	2	18.0	10.59
				Electrical Interlock Testing				1								0.000		0.000							3		8	9	8.0	8	2	18.0	10.59
				Kirk Key Interlock Testing				1								0.000		0.000							2		3	4	8.0	8	2	18.0	5.28
				Instrumentation Test & Calibration				1								0.000		0.000							2		2	4	8.0	8	2	18.0	4.51
				Real Time Control System Testing				1								0.000		0.000							3		3	6	8.0	8	2	18.0	6.77
				Coil Protection System Testing				1								0.000		0.000	20						3		3	31	8.0	8	2	18.0	36.60
				~~Ground Fault Monitor Testing~~				~~1~~								~~0.000~~		~~0.000~~							~~2~~		~~2~~	~~0~~	~~8.0~~	~~8~~	~~2~~		~~0.00~~
				Coil Power Supply Dummy Load Testing				1					10	PS		0.000		0.000	0						20	10	20	47	8.0	8	2	18.0	55.88
				~~Trim Coil Power Supply Dummy Load Testing~~				~~1~~								~~0.000~~		~~0.000~~							~~10~~		~~10~~	~~0~~	~~8.0~~	~~8~~	~~2~~		~~0.00~~
			TOTALS													1134.585		45.000	719	946	226	304	862	424	130	107	275	**5030**	760.0	720	176	1594.0	6,045.35
IN MAN HOURS																			5752	7568	1808	2432	6896		1040	856	2200						
RATES															M&S -->	1135	Spares--	45.000					SC -->	424									
			ron	raki																								∑MD	Rate	$K	∑FTE	Years	FTE/yr
EEEM	1.2640	1.0	1.2640	**1.243**									EEEM	980											cross	check	EEEM	1075	1.264	1359	4.9	4	1.22
EESM	0.9120	0.6	0.9120	**0.857**									EESM	1060													EESM	411	0.912	375	1.9	2	0.93
EETB	0.6480	0.6	0.6480	**0.625**									EEDM	420													EETB	1137	0.648	737	5.2	2	2.58
G&A (MHX)	1.3300	1.3	1.3300	**1.250**									EETB	1060													EADM	946	0.856	810	4.3	3	1.43
EADM	0.8560		0.8560	**0.880**																								$K					
																											SC	424	1.330	564			
																											M&S	1135	1.330	1509			
																												5353					
																												323					

		CDR Base				Revised Estimate				Delta's
		Estimate $	Cont %	Cont $	TOTAL $	Estimate	Cont %	Cont $	TOTAL $	
41- AC Power										
	411 - Auxiliary AC Power	499	17.0%	85	584	469	18.0%	84	553	(31)
	412 - Experimental AC Power	43	18.0%	8	51	43	18.0%	8	51	0
42 - AC/DC Converters										
	421 - C-site AC/DC Converters	-	0.0%	-	-	-	#DIV/0!	-	-	-
	422 - D-site AC/DC Converters	15	18.0%	3	17	27	18.0%	5	32	15
43 - DC Systems										
	431 - C-site DC Systems	365	18.0%	66	431	325	18.0%	58	383	(48)
	432 - D-to-C-Site DC Systems	1,311	21.3%	279	1,590	1,359	24.0%	326	1,684	94
	433 - D-site DC Systems	719	18.0%	129	848	525	18.0%	94	619	(229)
44 - Control & Protection Systems										
	441 - Electrical Interlocks	585	18.6%	109	694	576	18.6%	107	684	(10)
	442 - Kirk Key Interlocks	96	18.0%	17	114	97	18.0%	17	114	0
	443 - Real Time Control	40	18.0%	7	47	38	18.0%	7	45	(2)
	444 - Instrumentation	608	12.0%	73	681	432	18.0%	78	510	(170)
	445 - Coil Protection	237	21.3%	50	287	281	21.2%	60	341	53
	446 - Ground Fault Monitor	59	18.0%	11	69	-		-	-	(69)
45 - System Design and Integration										
	451 - System Design	378	18.0%	68	447	475	18.0%	86	561	114
	452 - Electrical Systems Support	467	26.0%	121	588	142	26.0%	37	179	(409)
	453 - System Testing	166	18.0%	30	196	186	18.0%	33	219	24
46 - FCPC Building Modifications		0			0	55	26.0%	14	69	69
		5,587		1,056	6,643	5,030		1,015	6,045	(598)
									6045	-598