NCSX Work Approval Form (WAF) WBS Number: 185 WBS Title: Assembly of Field Periods Job Numbers: 1802, 1810, and 1815 Job Title: FPA Oversight & support (1802) Job Title: FPA Operations - Stations 1, 2, & 3 (1810) Job Title: FPA Operations - Station 5 (1815) Job Manager: Mike Viola Description: This WBS element consists of those activities associated with the assembly of the three individual field periods in the TFTR Test Cell. 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

WDO N. I. AGE		_	1	1		1		1			
WBS Number: 185											
WBS Title: Assembly of Field Periods											
Job Numbers: 1802, 1810, and 1815											
Job Title: FPA Oversight & support (1802)											
Job Title: FPA Operations - Stations 1, 2, & 3 (1810)											
Job Title: FPA Operations - Station 5 (1815)											
Job Manager: Mike Viola											
Description:				1			1	1			
Description.			ļ	ļ							
TASK DESCRIPTION Work days	41MS	48MS	35TRV L		ORNLE M	ORNLDSN	EMEM	EMSM	EMSB	CREW	
						·					
Design											
This is a Fabrication Job - All labor in Table III											
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NCSX June 2007 ETC TABLE II - Materials and Subcontracts

WBS	Number: 185						
	Title: Assembly of Field Periods						
	Numbers: 1802, 1810, and 1815						
Job '	Title: FPA Oversight & Support (1802)						
Job.	Title: FPA Operations - Stations 1, 2, &	3 (1810)					
	Fitle: FPA Operations - Station 5 (1815)						
		,					
Job	Manager: Mike Viola						
Mate	rials and Supplies						
Metrolo	gy Consumables - Input by Steve Raftopoulos						Basis of Estimate
СС	Item	Quantity	Cost	Annual cost	Years	FY'07-FY'09 Cost Comment	
		-, ,					
5323	Generic replacement or consumables			045		045,000,0	
-	Surface probe kits Replacement Leica Workstation Computer	2	\$7,500 \$3,000	\$15,000 \$3,000	1	\$15,000 Consumable \$3,000	Recent procurements Recent procurements
	Replacement Leica Workstation Computer Replacement Laptops for Romer Arms	3	\$3,000	\$3,000	1	\$9,000	Recent procurements Recent procurements
	Replace Thommen Sensor for Leica Tracker	1	\$1,500	\$1,500	2	\$3,000	Recent procurements
	Replacement tips for Leica and FARO surface probes	4	\$300	\$1,200	3	\$3,600 Consumable	Recent procurements
	1.5" CCRs 2 per year, per tracker	4	\$2,000	\$8,000	3	\$24,000 Consumable	Recent procurements
	0.5" CCRs 2 per year, per tracker	4	\$1,200	\$4,800	3	\$14,400 Consumable	Recent procurements
	Replacement misc. computer parts	1	\$700	\$700	3	\$2,100 Consumable	Recent procurements
	Replacement/additional extension bar kits	2	\$1,000	\$2,000	3	\$6,000 Consumable	Recent procurements
	Replacement and special nests and adapters Replacement/additional 1.5" CCR drift nest pucks	15 30	\$300 \$30	\$4,500 \$900	3	\$13,500 Consumable \$2,700 Consumable	Recent procurements Recent procurements
	Replacement Probe Tips for Romer Arms	6	\$600	\$3,600	3	\$10,800 Consumable	Recent procurements Recent procurements
	Replacement Flobe Tips for Romer Arms	Ů	ΨΟΟΟ	ψ3,000	<u> </u>	\$10,000 Consumable	Necent productions
			Subtotal	\$54,200		\$107,100	
5323	Generic one-time needs		00.000	* 4.000		Od one Ore time word	
	2 - Prortable Brunson Stands Dial indicators for Coil Winding Turning fixture	6	\$2,000 \$200	\$4,000 \$1,200	1 1	\$4,000 One-time need \$1,200 One-time need	Recent procurements Recent procurements
	Brunson Adapter plates	6	\$500	\$3,000	1	\$3,000 for mounting of equipment in various configurations	Recent procurements
	Recondition/maintenance of K&E stands	4	\$500	\$2,000	1	\$2,000 stands are old and need maintenance	Recent procurements
			Subtotal	\$10,200		\$10,200	
Job 181							
9450	NCSX specific needs Monuments/nests for floor grid in NCSX test cell	75	\$75	\$5,625	2	\$11.250 NCSV specific and time peed	Pocent producements
	Reflector holders for wall - NCSX test cell	75 50	\$150	\$5,625	1	\$11,250 NCSX specific one-time need \$7,500 NCSX specific one-time need	Recent procurements Recent procurements
	Leica fixed position reflectors for NCSX test cell walls	50	\$300	\$15,000	1	\$15,000 NCSX specific one-time need	Recent procurements
	Leica 0.5" CCRs	15	\$1,200	\$18,000	1	\$18,000 reflectors required to track FPA assembly in mid-air fli	
						positioning	
			0	640.405		654.750	
			Subtotal	\$46,125		\$51,750	
5323	Annual software and hardware maintenance costs						
3020	Annual Service Contract for Leica Tracker	1	\$17,500	\$17,500	3	\$52,500 Consumable	Recent procurements
	Annual Software maintenance Verisurf	2	\$1,750	\$3,500	3	\$10,500 Annual software renewal to stay current	Recent procurements
	Annual Software maintenance Romer	3	\$1,750	\$5,250	3	\$15,750 Annual software renewal to stay current	Recent procurements
	Romer Arm Maintenance agreements	3	\$4,500	\$13,500	3	\$40,500 We've been spending \$5k/arm (\$15K tot) each year for	
						repairs. Maint. agreement provides for loaner and/or of	uicker
						turnaround.	
		1	Subtotal	\$39,750		\$440.250	
-			Suptotal	\$39,750		\$119,250	
	Total			\$150,275		\$288,300	
				, , , , , , , ,			
	Total Cost to NCSX			\$46,125		\$51,750	

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Number: 185														
Title: Assembly of Field Periods														
umbers: 1802, 1810, and 1815														
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tle: FPA Operations - Station 5 (1815)														
anager: Mike Viola														
tions:														
Assumes 5 day workweek 1 shift no overtime														
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TASK DESCRIPTION	days		41	378	35	ON E	SH	EN	EN		E E	Me		
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Metrology Engineering Supervision Station 1 through station 5 rattopolous 50%							0.50							checked with primavera
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PPPL EM LOE Station 1 through station 5 Viola 100%	_						1.00							checked with primavera
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The III hold period assembly obtained a through station o order support	1 1							1 1						checked with primavera
HP Coverage in the TETR TC LOE. Station 1 through station 3 @ 75 fte							75							checked with primavera
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														checked with primavera
														checked with primavera
	1	4.0												checked with primavera
	1 1	6.0												checked with primavera
Training needs identified & released		6.0												checked with primavera
ACC review completed														checked with primavera
		1.0												checked with primavera
														checked with primavera
3-Modular Coil to VVSA Assembly														checked with primavera
Sequence Plan (Brown) - Covered in Job 1803														checked with primavera
	1 1													checked with primavera
Systems Analysis (Brooks) - covered in Job 8204														checked with primavera
Systems Analysis (Brooks) - covered in Job 8204 Metrology Plan (Elllis) - Covered in Job 8205														
	1	0.0												checked with primavera
Metrology Plan (Elllis) - Covered in Job 8205		6.0												checked with primavera checked with primavera
Metrology Plan (Elliis) - Covered in Job 8205 Procedures approved														
Metrology Plan (Elllis) - Covered in Job 8205 Procedures approved JHA completed		6.0												checked with primavera
Metrology Plan (Elllis) - Covered in Job 8205 Procedures approved JHA completed Training needs identified & released		6.0 6.0												checked with primavera checked with primavera
Metrology Plan (Elllis) - Covered in Job 8205 Procedures approved JHA completed Training needs identified & released ACC review completed		6.0 6.0 6.0												checked with primavera checked with primavera checked with primavera
	umbers: 1802, 1810, and 1815 itle: FPA Oversight & Support (1802) itle: FPA Operations - Stations 1, 2, & 3 (1810) itle: FPA Operations - Stations 5 (1815) lanager: Mike Viola tion and Assembly stions: Assumes 5 day workweek 1 shift no overtime Parallel ops for sta 5 (2 fixtures available) Parallel ops for sta 5 (2 fixtures available) Only 1 fixture for station 3 only Parallel ops for sta 2 TASK DESCRIPTION TASK DESCRIPTION TITLE Ill field period assembly Station 1 through station 5 raftopolous 50% PPPL EM LOE Station 1 through station 5 Viola 100% Title Ill field period assembly Station 1 through station 3 @.75 fte 2-Modular Coil Sub- Assembly Sequence Plan (Brown) - Covered in Job 1803 Systems Analysis (Brooks) - covered in Job 8205 Procedures written & approved JHA completed Training needs identified & released ACC review completed Pre-job brief completed	umbers: 1802, 1810, and 1815 itle: FPA Oversight & Support (1802) itle: FPA Operations - Stations 1, 2, & 3 (1810) itle: FPA Operations - Station 5 (1815) lanager: Mike Viola tion and Assembly tions: Assumes 5 day workweek 1 shift no overtime Parallel ops for sta 5 (2 fixtures available) Parallel ops for sta 5 (2 fixtures available) Only 1 fixture for station 3 only Parallel ops for sta 2 TASK DESCRIPTION Work days TASK DESCRIPTION ### Supervision Metrology Engineering Supervision Station 1 through station 5 raftopolous 50% PPPL EM LOE Station 1 through station 5 Viola 100% Title Ill field period assembly Station 1 through station 5 ORNL support HP Coverage in the TFIR TC LOE Station 1 through station 3 @.75 fte 2-Modular Coil Sub- Assembly Sequence Plan (Brown) - Covered in Job 1803 Systems Analysis (Brooks) - covered in Job 8204 Metrology Plan (Ellis) - Covered in Job 8205 Procedures written & approved JHA completed JHA completed Training needs identified & released ACC review completed Pre-job brief completed Training needs identified & released ACC review completed Pre-job brief completed	umbers: 1802, 1810, and 1815 itle: FPA Oversight & Support (1802) itle: FPA Operations - Stations 1, 2, & 3 (1810) itle: FPA Operations - Stations 5 (1815) lanager: Mike Viola ltion and Assembly tions: Assumes 5 day workweek 1 shift no overtime Parallel ops for sta 5 (2 fixtures available) Parallel ops for sta 5 (2 fixtures available) Only 1 fixture for station 3 only Parallel ops for sta 2 TASK DESCRIPTION Work days TASK DESCRIPTION ### Assumers of the fixed of the	umbers: 1802, 1810, and 1815 itle: FPA Oversight & Support (1802) itle: FPA Operations - Stations 1, 2, & 3 (1810) itle: FPA Operations - Station 5 (1815) lanager: Mike Viola lition and Assembly itions: Assumes 5 day workweek 1 shift no overtime Parallel ops for sta 5 (2 fixtures available) Parallel ops for sta 5 (2 fixtures available) Parallel ops for sta 5 (2 fixtures available) Parallel ops for sta 2 K TASK DESCRIPTION TASK DESCRIPTION TASK DESCRIPTION Tallel Ill field period assembly Station 1 through station 5 raftopolous 50% PPPL EM LOE Station 1 through station 5 Viola 100% Title Ill field period assembly Station 1 through station 3 @.75 fte 2-Modular Coll Sub- Assembly Sequence Plan (Brown) - Covered in Job 1803 Systems Analysis (Brooks) - covered in Job 8204 Metrology Plan (Ellis) - Govered in Job 8205 Procedures writen & approved JHA completed Training needs identified & released ACC review completed Title Ill field period completed Station 1 through station 5 ORNL support Pre-job brief completed	umbers: 1802, 1810, and 1815 itle: FPA Oversight & Support (1802) itle: FPA Operations - Stations 1, 2, & 3 (1810) itle: FPA Operations - Station 5 (1815) lanager: Mike Viola lition and Assembly itions: Assumes 5 day workweek 1 shift no overtime Parallel ops for sta 5 (2 fixtures available) Parallel ops for sta 5 (2 fixtures available) Only 1 fixture for station 3 only Parallel ops for sta 2 TASK DESCRIPTION TASK DESCRIPTION TASK DESCRIPTION TITLE III field period assembly Station 1 through station 5 raftopolous 50% PPPL EM LOE Station 1 through station 5 Viola 100% Title III field period assembly Station 1 through station 3 @ .75 fte 2-Modular Coil Sub- Assembly Sequence Plan (Brown) - Covered in Job 8204 Metrology Plan (Ellis) - Covered in Job 8205 Procedures written & approved Metrology Plan (Ellis) - Covered in Job 8205 Metrology Plan (Ellis) - Covered in J	umbers: 1802, 1810, and 1815 itle: FPA Oversight & Support (1802) itle: FPA Operations - Stations 1, 2, & 3 (1810) itle: FPA Operations - Stations 5, 2, & 3 (1810) itle: FPA Operations - Stations 5 (1815) lanager: Mike Viola ltion and Assembly tions: Assumes 5 day workweek 1 shift no overtime Parallel ops for sta 5 (2 fixtures available) Parallel ops for sta 5 (2 fixtures available) Only 1 fixture for station 3 only Parallel ops for sta 2 TANK DESCRIPTION Assumes 5 day workweek 1 shift no overtime Parallel ops for sta 5 (2 fixtures available) Only 1 fixture for station 3 only Parallel ops for sta 2 K\$ TANK DESCRIPTION Assumes 5 day workweek 1 shift no overtime Parallel ops for sta 5 (2 fixtures available) Take I fixtures available) Take I fixtures available only 1	umbers: 1802, 1810, and 1815 ittle: FPA Oversight & Support (1802) ittle: FPA Operations - Stations 1, 2, & 3 (1810) ittle: FPA Operations - Stations 5 (2, & 3 (1810) ittle: FPA Operations - Stations 5 (1815) lanager: Mike Viola lion and Assembly ition and Assembly ition and Assembly itions: Sasumes 5 day workweek 1 shift no overtime	umbers: 1802, 1810, and 1815 idite: FPA Oversight & Support (1802) ittle: FPA Operations - Stations 1, 2, & 3 (1810) idite: FPA Operations - Stations 5 (1815) lanager: Mike Viola	umbers: 1802, 1810, and 1815 ititle: FPA Oversight & Support (1802) ititle: FPA Operations - Stations 1, 2, & 3 (1810) ititle: FPA Operations - Stations 5, 1, 2, & 3 (1810) ititle: FPA Operations - Stations 5 (1815) lanager: Mike Viola lion and Assembly violons: Assumes 5 day workweek 1 shift no overtime Parallel ops for sta 5 (2 fixtures available) Parallel ops for sta 5 (2 fixtures available) Only 1 fixture for station 3 only Parallel ops for sta 5 (2 fixtures available) TASK DESCRIPTION Work Work Work days TASK DESCRIPTION Work Work days TASK DESCRIPTION Metrology Engineering Supervision Station 1 through station 5 viola 100% Title III field period assembly Station 1 through station 5 Viola 100% Title III field period assembly Station 1 through station 3 @ .75 fie 2-Modular Coll Sub-Assembly Systems Analysis (Briodys) - covered in Job 1803 Systems Analysis (Briodys) - covered in Job 8205 Procedures written & approved JHA completed From the Coverage of the Coll of the Coverage of the Coll of the Coverage of the	umbers: 1802, 1810, and 1815 ittle: FPA Oversight & Support (1802) ittle: FPA Operations - Stations 1, 2, & 3 (1810) ittle: FPA Operations - Stations 5 (1815) lanaager: Mike Viola ition and Assembly ition and Assembly ition and Assembly assembly station 5 (1815) lanaager: Mike Viola ition and Assembly assembly station 5 (1815) lanaager: Mike Viola ition and Assembly Assumes 5 day workweek 1 shift no overtime Parallel ops for sta 5 (2 fixtures available) Parallel ops for sta 5 (2 fixtures available) Parallel ops for sta 5 (2 fixtures available) TASK DESCRIPTION Work Work	umbers: 1902, 1810, and 1815 ittle: FPA Oversight & Support (1802) ittle: FPA Operations - Station 5 1, 2, & 3 (1810) ittle: FPA Operations - Station 5 1, 2, & 3 (1810) ittle: FPA Operations - Station 5 (1815) anager: Mike Viola itilion and Assembly ittle: FPA Operations - Station 5 (1815) Assumes 5 day workweek 1 shift no overtime Parallel ops for sta 5 (2 fixtures available) Parallel ops for sta 5 (2 fixtures available) Out of If fixture for station 3 only Parallel ops for sta 5 (2 fixtures available) TASK DESCRIPTION Work days TASK DESCRIPTION Work Work He Supervision Metrology Engineering Supervision Station 1 through station 5 ratropolous 50% PPPL EM LOE Station 1 through station 5 Viola 100% Title III field period assembly Station 1 through station 5 ORNL support HP Coverage in the TFTR T LOE Station 1 mough station 5 ORNL support HP Coverage in the TFTR T LOE Station 1 mough station 3 @.75 fite Allocating Clinic Supervision Metrology Engineering Supervision Station 1 mough station 3 @.75 fite Allocation Coll Supervision Allocation Coll Supervision Supported HP Coverage in the TFTR T LOE Station 1 mough station 3 @.75 fite Allocation Coll Supervision Supported HP Coverage in the TFTR T LOE Station 1 mough station 3 @.75 fite Allocation Coll Supervision Supported HP Coverage in the FTFR T LOE Station 1 mough station 3 @.75 fite Allocation Coll Supervision Supported HA Completed HA Complete	umbers: 1802, 1810, and 1815 ittle: FPA Oversight & Support (1802) ittle: FPA Oversight & Support (1802) ittle: FPA Operations - Stations 1, 2, & 3 (1810) ittle: FPA Operations - Stations 5 (1815) anager: Mike Viola ition and Assembly ition	umbers: 1802, 1810, and 1815 title: FPA Operations - Stations 1, 2, & 3 (1810) title: FPA Operations - Stations 5 (1815) anager: Mike Viola lion and Assembly lions and Assembly lions and Assembly lions and Assembly lions is 5 day workweek 1 shift no overtine Parallel ops for sts 5 (2 fixtures available) Parallel ops for sts 5 (2 fixtures available) Only 1 fixture for station 3 only Parallel ops for sts 15 (2 fixtures available) Only 1 fixture for station 3 only TANK DESCRIPTION Work Work Work Work Work Holl Station 1 through station 5 Viola 100% Take Ill field period assembly Station 1 through station 5 rathopolous 50% PPPLEM LOE Station 1 through station 5 Viola 100% Title Ill field period assembly Station 1 through station 5 ORNL support HP Coverage in the TTFR TOLDE Station 1 through station 3 @ 7.5 fte Adaption 5 oil 3 between 1 and 1	umbers: 1802, 1810, and 1815 Idle: FPA Operations - Station 5, 12, 8, 3 (1810)

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WBS Number: 185											
WBS Title: Assembly of Field Periods											
Job Numbers: 1802, 1810, and 1815											
Job Title: FPA Oversight & Support (1802)											
Job Title: FPA Operations - Stations 1, 2, & 3 (1810)											
Job Title: FPA Operations - Station 5 (1815)											
Job Manager: Mike Viola											
Fabrication and Assembly											
Assumptions:											
Assumes 5 day workweek 1 shift no overtime							,				
Parallel ops for sta 5 (2 fixtures available)											
Parallel ops for sta 5 (2 fixtures available)						·					
Only 1 fixture for station 3 only											
Parallel ops for sta 2											
Station 5-Final Field Period Assembly			•								checked with primavera
Sequence Plan (Brown) - Covered in Job 1803											checked with primavera
Systems Analysis (Brooks) - covered in Job 8204											checked with primavera
Metrology Plan (Elllis) - Covered in Job 8205											checked with primavera
Procedures approved	14.0										checked with primavera
JHA completed	6.0										checked with primavera
Training needs identified & released	6.0										checked with primavera
ACC review completed	7.0										checked with primavera
Pre-job brief completed	7.0										checked with primavera
Station 5 operational	1.0										checked with primavera
Job: 1802 - FP Assy Oversight&Support-VIOLA Total	\$ -	\$ -	\$ -	-	0	1 2	0	0	0		checked with primavera
											checked with primavera

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	Title: Assembly of Field Periods													
	lumbers: 1802, 1810, and 1815													
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	itle: FPA Operations - Stations 1, 2, & 3 (1810)													
Job 1	itle: FPA Operations - Station 5 (1815)													
Job N	lanager: Mike Viola													
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	Parallel ops for sta 5 (2 fixtures available)													
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	TASK DESCRIPTION	days	11MS	<u> </u>	SST	HOT JRNL	HTB	W.	SMS	SMS	IM	REW G	Basis of Estimate	
Job:	1810 - Field Period Assembly-VIOLA		4			€ 1 ∪ µ	, o		щ	щ	щ			
OOD.	1010 TICIAT CHOA ASSCRIBIN VIOLA								1				Station 1: Based on actual VV #1	
													costs - almost completed.	checked with primavera
													Station 2: Based on actual VV #1	
													costs - almost completed.	checked with primavera
													Based on experience to accomplish	
													similar tasks (e.g., metrology scans/lock-	
													ins, coil trial fitups, gross checks). Also,	
													it appears that your single shift activity is	
													running parallel resources that are not available. i.e. the trials development	
													crew are the same as the FP crew.	checked with primavera
														checked with primavera
													Nose/Bushing related items based on conceptual designs and rough estimates	abooked with primayers
-													Assumed nose concept based on	checked with primavera
													application of epoxy & set-up times	checked with primavera
													estimates based on conceptual	
1													designs tempered with experieince in	
													alignment of multiple components	checked with primavera
Genera	F.P. Assy support													checked with primavera
													2 men 3 day a week .LOE adjust	
	LOE Crane support, fixture setupfor . Station 1 through station 5 1.2 fte										1.20		consistent with schedule thru Station 5	checked with primavera
											1.20		This is LOE adjust consistent with	and the printer of the
	LOE Field Supervision for station 1 through station 5 edwards 1.0fte								1.00				overall schedule thru Station 5.	checked with primavera
											-		this is LOE adjust consistent with overall	
1	LOE Matrology gupport Clotion 4 through station 5.4.5 the appropriate due: - 4000/							4.50			4.00		schedule. Hours distributed per task based resource profile	aha aka durith primaye
-	LOE Metrology support Station 1 tthrough station 5 1.5 fte engr plus ducco 100%	-						1.50			1.00		based resource profile	checked with primavera
	Misc M&S station 1 through station 5		3K/month										3K/month	checked with primavera
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1810, and 1815																
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6 (2 fixtures available)																
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ical I&C																checked with primavera
s to vac vsl												300	2.5			checked with primavera
															serial tasks alternating between FPA	
S	16.0	\$ 2.0K										320	2.5		constant 2.5 men	checked with primavera
															serial tasks alternating between FPA	
s,headers,manifolds	5.0)										100	2.5			checked with primavera
ance testing (H/C flow test)	5.0	\$ 4.0K										100	2.5			checked with primavera
	2.0)										40	2.5			checked with primavera
wification	40.4											260	2.5			about a divith prima
		1	 	 	1										constant 2.5 men	checked with primavera checked with primavera
nu external monuments and measure	4.0	7	-	1	1 -							ου	2.5		serial tasks alternating between EDA	checked with primavera
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n removeable ports	10.0											200	2.5			checked with primavera
	1 10.	1	1	 	1 1							_00				onconcu with primavera
completed VV to holding are	2.0	o										40	2.5		constant 2.5 men	checked with primavera
o veen	(2 fixtures available) (2 fixtures available) (ion 3 only TASK DESCRIPTION d surface components) plant paths on vessel - Completed vertical ports - Completed atter tapes - Completed atter tapes - Completed atter diagnostic sensors - Completed netic diagnostic sensors	Week 1 shift no overtime (2 fixtures available) (3 fixtures avail	Week 1 shift no overtime (2 fixtures available) (3 fixtures available) (4 fixtures avail	Week 1 shift no overtime (2 fixtures available) (3 fixtures available) (4 fixtures avail	week 1 shift no overtime (2 fixtures available) (2 fixtures available) tion 3 only TASK DESCRIPTION disurface components) laint paths on vessel - Completed vertical ports - Completed 1.0 atter tapes - Completed 3.0 stic sensors - Completed 3.0 stic diagnostic sensors - Completed 1.0 attines - Completed 3.0 attines - Completed 4.0 entic diagnostic sensors - Completed 5.0 compl	Week 1 shift no overtime (2 fixtures available) (2 fixtures available) (2 fixtures available) (2 fixtures available) (3 fixtures available) (4 fixtures available) (5 fixtures available) (6 fixtures available) (7 fixtures avail	Week 1 shift no overtime (2 fixtures available) (2 fixtures available) (2 fixtures available) (2 fixtures available) (3 fixtures available) (4 fixtures available) (5 fixtures available) (7 fixtures avail	Week 1 shift no overtime (2 fixtures available) (2 fixtures available) (2 fixtures available) (2 fixtures available) (3 fixtures available) (4 fixtures available) (5 fixtures available) (6 fixtures available) (7 fixtures avail	Week 1 shift no overtime	week 1 shift no overtime (2 fixtures available) (2 fixtures available) (3 fixtures available) (4 fixtures available) (5 fixtures available) (6 fixtures available) (7 fixtures available) (8 fixtures available) (9 fixtures available) (10 fixtures available) (11 fixtures available) (12 fixtures available) (13 fixtures available) (14 fixtures available) (15 fixtures available) (16 fixtures available) (17 fixtures available) (18 fixtures available) (18 fixtures available) (19 fixtures available) (10 fixtures available) (10 fixtures available) (10 fixtures available) (11 fixtures available) (12 fixtures available) (2 fixtures available) (2 fixtures available) (2 fixtures available) (2 fixtures available) (3 fixtures available) (4 fixtures available) (2 fixtures available) (3 fixtures available) (4 fixtures available) (5 fixtures available) (6 fixtures available) (7 fixtures available) (8 f	week 1 shift no overtime (2 fixtures available) (2 fixtures available) (3 fixtures available) (4 fixtures available) (5 fixtures available) (6 fixtures available) (7 fixtures available) (8 fixtures available) (9 fixtures available) (10 fixtures available) (11 fixtures available) (12 fixtures available) (13 fixtures available) (14 fixtures available) (15 fixtures available) (17 fixtures available) (18 fixtures available) (18 fixtures available) (2 fixtures available) (3 fixtures available) (4 fixtures available) (5 fixtures available) (6 fixtures available) (7 fixtures available) (8 fixtures available) (9 fixtures available) (17 fixtures available) (18 fixtures available) (2 fixtures available) (2 fixtures available) (3 fixtures available) (4 fixtures available) (4 fixtures available) (5 fixtures available) (6 fixtures available) (8 fixtures available) (9 fixtures available) (18 fix	week 1 shift no overtime (2 fixtures available) (2 fixtures available) (3 fixtures available) (4 fixtures available) (5 fixtures available) (6 fixtures available) (7 fixtures available) (8 fixtures available) (9 fixtures available) (10 a fixtures avail	Week 1 shift no overtime	Week 1 shift no overtime	March Marc	Mark 1 shift no overtime

WBS Number: 185				1						
			1 1	1			1			
WBS Title: Assembly of Field Periods										
Job Numbers: 1802, 1810, and 1815										
Job Title: FPA Oversight & Support (1802)										
Job Title: FPA Operations - Stations 1, 2, & 3 (1810)										
Job Title: FPA Operations - Station 5 (1815)										
Job Manager: Mike Viola										
JOD Manager. Mike viola										
Fabrication and Assembly			1					Г		
Assumptions:										
Assumes 5 day workweek 1 shift no overtime										
Parallel ops for sta 5 (2 fixtures available)										
Parallel ops for sta 5 (2 fixtures available)										
Only 1 fixture for station 3 only										
Parallel ops for sta 2										
Station 1- FP #2 VV Prep (hrd surf cmpnts)										checked with primavera
Misc Hardware - Completed		\$ 2.0K								checked with primavera
Layout diagnostic&coolant paths on vessel - Completed Install heater tape on vertical ports - Completed		2.0		-	1					checked with primavera checked with primavera
Verify installation of heater tapes - Completed		7.0								checked with primavera
Attach studs forcoolant lines - Completed		3.0								checked with primavera
Wind magnetic diagnostic sensors - Completed		1.0								checked with primavera
Install precision magnetic diagnostic sensors - Completed		3.0								checked with primavera
Verity installation magnetic diagnostic sensors - Completed		1.0								checked with primavera
Install local I&C (incl thermocouples) - Completed		5.0								checked with primavera
Verify installation of local I&C - Completed		2.0								checked with primavera
Verify installation of local face Completed		2.0								Serial tasks alternating between FPA
Install cooling/htg lines to vac vsl	1	5.0						300	2.5	constant 2.5 men. checked with primavera
install coolinging lines to vac vsi	- 19	5.0						300	2.0	Serial tasks alternating between FPA
l										constant 2.5 men. Delayed due to coil
Weld cooling/htg risers		3.0 \$ 2.0K						320		tests checked with primavera
Verify Instl of H/C lines,headers,manifolds		5.0						100	2.5	
										constant 2.5 men. Serial tasks are
						1				showing up as parallel on schedule checked with primavera
										Serial tasks alternating between FPA
Perform final acceptance testing (H/C flow test)		5.0 \$ 4.0K					1	100		constant 2.5 men checked with primavera
Trim seal plates		2.0						40	2.5	Serial tasks alternating between FPA
							1			constant 2.5 men. Need to buy high
							1			strength nibbler. checked with primayera
						+	1			Serial tasks alternating between FPA
Loop termination & verification	4.	3.0					1	360	2.5	constant 2.5 men checked with primavera
install Final Internal and External monuments and measure		1.0		-		-		360		checked with primavera
install Final internal and external monuments and measure	- - - '	+.0		-		-		80	2.5	Serial tasks alternating between FPA
Final Occur									0.5	
Final Scan		1.0				1	1	80	2.5	
										Serial tasks alternating between FPA
Install heater tape on removeable ports	11	0.0				1		200	2.5	constant 2.5 men checked with primavera
									l T	Serial tasks alternating between FPA
Prepare and transfer completed VV to holding are		2.0					1	40	2.5	constant 2.5 men checked with primavera
										checked with primavera
· · · · · · · · · · · · · · · · · · ·						 •				

WBS	Number: 185									
	Title: Assembly of Field Periods									
	umbers: 1802, 1810, and 1815								+	
	itle: FPA Oversight & Support (1802)								+	
	itle: FPA Oversight & Support (1802)								1	
	itle: FPA Operations - Stations 1, 2, & 3 (1810)					-				
Job I	anager: Mike Viola				_					
JOD IV	anager: Mike viola									
	tion and Assembly									
Assum	otions:									
	Assumes 5 day workweek 1 shift no overtime									
	Parallel ops for sta 5 (2 fixtures available)									
	Parallel ops for sta 5 (2 fixtures available)									
	Only 1 fixture for station 3 only									
Ctation	Parallel ops for sta 2 1- FP #3 VV Prep (hrd surf cmpnts)									ahaakad with primayara
Station	Misc Hardware		\$ 2.0K			1				checked with primavera checked with primavera
	Layout diagnostic&coolant paths on vessel - Completed	12.0					240	2.5	15% complete	checked with primavera
									Serial tasks alternating between FPA	
	Install heater tape on vertical ports	7.0					140	2.5	constant 2.5 men. Not started yet due to coil alignment tests	checked with primavera
	install heater tape on vertical ports	7.0					140	2.0	Serial tasks alternating between FPA	checked with primavera
									constant 2.5 men. Not started yet due to	
	Verify installation of heater tapes	1.0					20	2.5	coil alignment tests Serial tasks alternating between FPA	checked with primavera
									constant 2.5 men. Not started yet due to	
	Attach studs for coolant lines	3.0					60	2.5	coil alignment tests	checked with primavera
									Serial tasks alternating between FPA	
	Install Templates	3.0					60	2.5	constant 2.5 men. Not started yet due to coil alignment tests	
	motali remplates	0.0						2.0	Serial tasks alternating between FPA	
									constant 2.5 men. Not started yet due to	
-	Wind magnetic diagnostic sensors	14.0					280	2.5	coil alignment tests Serial tasks alternating between FPA	checked with primavera
	Install precision magnetic diagnostic sensors - Completed	3.0					60	2.5	constant 2.5 men.	checked with primavera
									Serial tasks alternating between FPA	
	Verify installation magnetic diagnostic sensors - Completed	4.0					80	2.5	constant 2.5 men.	checked with primavera
	Install local I&C (incl thermocouples)	5.0					100	2.5	Serial tasks alternating between FPA constant 2.5 men.	checked with primavera
									Serial tasks alternating between FPA	onconoa mar primarora
	Verify installation of local I&C	2.0					40	2.5	constant 2.5 men.	checked with primavera
	Install cooling/htq lines to vac vsl	15.0					300	2.5	Serial tasks alternating between FPA constant 2.5 men.	checked with primavera
	Weld cooling/htg risers	16.0					320	2.5	Serial tasks alternating between FPA	onconda with primavera
									constant 2.5 men Experience is 8 tubes	all a street with
-						-			per day 128 tubes per VVSA Serial tasks alternating between FPA	checked with primavera
	Verify Instl of H/C lines,headers,manifolds	5.0					100	2.5	constant 2.5 men.	checked with primavera
									Serial tasks alternating between FPA	
-	Perform final acceptance testing (H/C flow test)	5.0					100	2.5	constant 2.5 men Serial tasks alternating between FPA	checked with primavera
	Trim seal plates	2.0					40	2.5	constant 2.5 men	checked with primavera
	Loop termination & verification	18.0					360	2.5		checked with primavera
	lastall Circl lateral and Citarral annual and Citarral annual and Citarral annual and Citarral annual annua							0.5	Serial tasks alternating between FPA	about a discrete
1	Install Final Internal and External monuments and measure	4.0					80	2.5	constant 2.5 men. Serial tasks alternating between FPA	checked with primavera
	Final Scan	4.0					80	2.5	constant 2.5 men.	checked with primavera
									Serial tasks alternating between FPA	
-	Install heater tape and insulation on removeable ports	10.0					200	2.5	constant 2.5 men Serial tasks alternating between FPA	checked with primavera
	Prepare and transfer completed VV to holding area	2.0					40	2.5	Serial tasks alternating between FPA constant 2.5 men.	checked with primavera
Station	1-Spool pieces (3) (spacers)	2.0		, , , , , , , , , , , , , , , , , , ,	1		 2702	2.0	The state of the s	checked with primavera
	Attach diagnostics, studs and coolant lines	17.0					340	2.5		checked with primavera
	install Final Internal and External monuments and measure	2.0					40	2.5		checked with primavera

WDC	Number: 185							
	Title: Assembly of Field Periods							
Job N	Numbers: 1802, 1810, and 1815							
Job 1	Fitle: FPA Oversight & Support (1802)							
	Title: FPA Operations - Stations 1, 2, & 3 (1810)							
	Title: FPA Operations - Station 5 (1815)							
Job I	Manager: Mike Viola							
Cobries	ation and Assembly							
Assum								
Assum								
	Assumes 5 day workweek 1 shift no overtime							
	Parallel ops for sta 5 (2 fixtures available)							
	Parallel ops for sta 5 (2 fixtures available)							
	Only 1 fixture for station 3 only							
	Parallel ops for sta 2							
								checked with primavera
Station	2 Trials			, , , , , , , , , , , , , , , , , , , ,				checked with primavera
	Trial tensioning test on prototype		\$ 3.0K		40	2.5		checked with primavera
	Trial bushing and shim test on prototype	12.0			240	2.5		checked with primavera
	Perform trial x-y-z alignments on A1-A2. Perform developmental trials on A1-A2.		\$ 2.0K \$ 2.0K		140 600	2.5 2.5	included in job 1421	checked with primavera
	Bushing test A-B	7.0	\$ 2.0K		112	2.0	included in Job 1421	cnecked with primavera
	Bushing test R-D	7.0			112	2.0		
	Alignment mechanisms, metro equipt &positioning		\$ 40.0K		120	2.5		checked with primavera
	Procure alignment mechanisms, fiducials, lifting		\$ 25.0K		400	2.5		checked with primavera
	Develop procedures for torquing bolts	4.0			80	2.5		checked with primavera
							Perform welding trials and procure	
	Develop trails for for NOSE WELDING (RLS addition)		\$ 70.0K		600	2.5	EWI and Bob Parcells support	checked with primavera
	Determine fiducial types&locations	11.0			220	2.5		checked with primavera
	Procure monuments&related metrology equipment Hardware rework (1/2 FTE)	15.0 120.0			300 960	2.5 1.0	MISC LOE SUPPORT	checked with primavera checked with primavera
Station	2 Setup	120.0	φ 10.0K		900	1.0	MISC ECE SOLI OKT	checked with primavera
Station	Misc Hardware	1	\$ 5.0K					checked with primavera
	Test out equipt & procedures	7.0	Ψ 0.01		140	2.5		checked with primavera
	Receive drawings and hardware (shims and bolts)	7.0			140	2.5		checked with primavera
	Shim sizing / preparations							checked with primavera
3.01	Using flange measurement of the coils, define the A/A and A/B shim thickness.						Back Office	checked with primavera
3.02	Surface grind a set of metal shims that will be used on the first MCHP article for assembly process qualifications.							
	qualifications.						Actual experience (LED: actual	
2.00	Compress allowing account of the and act to this leaves the abin act that will be in 1997 at a 1997 at 1997.	12.0			240	2.5	Experience Was 4 days per JOINT)	checked with primavera
3.03	Compress alumina coated shims and sort by thickness the shim set that will be installed on the MCHP.	6.0			120	2.5	800 shims - not critical path	checked with primavera
4.00	Pre-Installation Station 2 set-up							
							Metrology plan covering Station 2:	checked with primavera
4.01	Install MCHP fixtures and metrology equipment.						not critical path - separate crew in	
							parallel	checked with primavera
4.02	Perform metrology set-up and checks						not critical path - separate crew in	
		5.0			100	2.5	parallel	checked with primavera
l	Install FIRST Holding 20 deg fixture		\$ 2.0K		80	2.5		checked with primavera
	Install SECOND Holding 20 deg fixture		\$ 2.0K		60	2.5	Just received - Not done yet	checked with primavera
	Install THIRD Holding 20 deg fixture		\$ 2.0K		120	2.5	Just received - Not done yet Just received - Not done yet	checked with primavera
	Install LAST Holding 20 deg fixture	3.0	\$ 2.0K		60	2.5	Just received - Not done yet	checked with primavera
	Tools&tooling available for FPA operations	2.0			40	2.5		checked with primavera
			1					checked with primavera

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WBS	Number: 185											
WBS	Title: Assembly of Field Periods											
Job N	umbers: 1802, 1810, and 1815											
	itle: FPA Oversight & Support (1802)											
	itle: FPA Operations - Stations 1, 2, & 3 (1810)											
	itle: FPA Operations - Station 5 (1815)											
JOD I	lanager: Mike Viola											
Fabrica	tion and Assembly		-	1	I	1	1					
Assum	otions:											
	Assumes 5 day workweek 1 shift no overtime					ļ.						
	Parallel ops for sta 5 (2 fixtures available)											
	Parallel ops for sta 5 (2 fixtures available)											
	Only 1 fixture for station 3 only											
	Parallel ops for sta 2											
STATIC												checked with primavera
	asauring and fitup checks						1					checked with primavera
	MC fit-up pre-check and surface insulation										Sequence Plan R5	checked with primavera
1.01	Verify that mating MC's of a MCHP will come together without interferences by pre-fitting mating coils. This will include the Type-C coil with its interfacing Period Type-C coil.	4.0						80				checked with primavera
1.02	Epoxy paint all close fitting interfacing surfaces.	3.0						60	2.5			checked with primavera
2.00	Pre-measurement of MCHP Type A, B and C coils flanges plus interfacing Type-A coil flange										2 at a time on the two 20 degree wedges	checked with primavera
2.01	Set the Type-A coil on the pre-measurement fixture, "A" side flange down.	1.0						20	2.5		May be done early	checked with primavera
2.02	Using the laser tracker, align to the conical seats locking into a minimum of 8 of them.	2.0								40	Metrology Staff Budgeted as LOE	checked with primavera
2.03	Establish a global coordinate system based on the modular coil geometry. Measure the monuments on the fixture and on the walls.	7.0								140	Metrology Staff Budgeted as LOE	checked with primavera
2.04	Measure all of the tooling ball monuments on the winding form.	1.0									Metrology Staff Budgeted as LOE	checked with primavera
2.05	Scan the "B" flange of the Type-A coil.	1.0									Metrology Staff Budgeted as LOE	checked with primavera
2.07	Remove Type-A coil from stand and move to holding area.	1.0						20	2.5		monology otal. Daugotou do 101	checked with primavera
2.08	Measure Type B "A" flanges	14.0			· · · · · ·			40			Repeats 2.01-2.07	checked with primavera
2.11	Measure Type C "A"flanges	13.0						40	2.5		Repeats 2.01-2.07	checked with primavera
2.14	Measure Type A-A "A" flange	13.0						40			Repeats 2.01-2.07	checked with primavera
3.00	Shim sizing / preparations										Sequence Plan R5	checked with primavera
3.01	Using flange measurement of the coils, define the A/A and A/B shim thickness.										Back Office	checked with primavera
3.02	Surface grind a set of metal shims that will be used on the first MCHP article for assembly process qualifications.	4.0						80	2.5		Actual experience	checked with primavera
4.00	Pre-Installation Station 2 set-up recalibration										Sequence Plan R5	checked with primavera
4.01	Install MCHP fixtures and metrology equipment.							0	2.5			checked with primavera
	Perform metrology set-up and checks 6	 2.0									Metrology Staff Budgeted as LOE	checked with primavera

West Full Care Assembly of Field Periods Obo Thirties: FAR Operating & Support (1922) Obo Thirties: FAR Operations - Station 5 (1815) Obo Thirties: FAR Operations - Station 5 (1815)	WBS	Number: 185											
John Number: 1902, 1910, and 1918													
Job Title: PR A potention s - Stations 1, 2, 3 (1810)													
Job Title: FPA Operations - Stations (1815)				1	+								
About Abou					+								
About Abou		1 , , , ,		1									
Assume				-	-								
Assume Side workeask shift no overtime Parallel spot for als 2 Fiftense worklash) Parallel spot for als 2 Fiftense worklash worklash and parallel spot for als 2 Fiftense worklash and parallel spot for all 2 Fiftense workla	JOD	nanager: wilke viola			1	1	 1						
Assume Side workeask shift no overtime Parallel spot for als 2 Fiftense worklash) Parallel spot for als 2 Fiftense worklash worklash and parallel spot for als 2 Fiftense worklash and parallel spot for all 2 Fiftense workla				1									
Mary Parallel upon to take \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	Fabric	ation and Assembly							1				
Persiding for the data of a first future available	Assun	ptions:											
Persiding for the data of a first future available		Assumes 5 day workweek 1 shift no overtime											
Particular of the fat \$6 C (Internal analyse)													
Part Filtre for state Part Pa		. , , , ,											
Assemble A142													
Second S													
1											_	<u></u>	
Marie Mari													checked with primavera
1	5.01	positions the Type-A modular coil on the fixture, "B" flange down. Obtain a set of "realigned" fiducial positions.	2.0						40				chacked with primayors
Second Second Secon	5.02	Align the laser tracker to the conical seats locking into a minimum of 8 of them.							40		20		ta di
Mary Continue and set the weak 19 19 19 19 19 19 19 1		Establish a global coordinate system based on the modular coil geometry. Measure the monuments on											
A fig page			2.0								40	Metrology Staff Budgeted as LOE	checked with primavera
10.5 20.0	5.04		0.5						10	2.5			checked with primavera
Search the recruments of the bottom coult, also as an excessing of being displaced or excessing of the bottom of the bottom coult, also as an excessing of being displaced or excessing of the bottom of the bottom coult, also as an excessing of the bottom		Install dial indicators on the modular coil in areas where we expect to see deflection.	2.0			L	<u> </u>		40	2.5			
Processing the set waters (Conf. of their corpus) growth of the 14 of 12 of 12 of 12 of 12 of 14 of 12 of 14 of 12 of 14 of			1.0						20	2.5			checked with primavera
decided with primaries and private larger private private plants present private priv	5.07		1.0						20	2.5			checked with primavera
solution for the management product allower solitors and purpose of contract and solitors and purpose of contract and purpose	5.08												
Land a hard "signife rest (protes on today) and affirms formate sure that they are ignif. If a boxes are than 1 and 1 an	5.09												
word bask of this sufficient adjacent tools to allow a replacement allowing to be invented. Tighten hot and such a support of the support of	5.10		2.0	1	1				40	2.5			checked with primavera
Store the Doorg Store and Store Control of Store	00	found back off on sufficient adjacent bolts to allow a replacement shim to be inserted. Tighten bolt and											
Control Cont	5 1 1		1.0						20	2.5			checked with primavera
Legislation of the control of the centred Fig pages. Evaluate shire pressure distribution and make chim adjournment of the pages of the control of the contr			5.0								100	Metrology Staff Budgeted as LOE	checked with primavera
checked with primaveral contents to enter the proper. Evaluate ability pressure distribution and make leave the management of the state of the contents of the state of the state of the contents of the state of	5.12		2 0						60	2.5			chacked with primayers
his impressure is unaccopatable. Re-bis comparison free-bis control primary and studies critical formation of the control withing primary and studies, russ, shims etc. Identify shim locations. 1.0 Remove all studes, russ, shims etc. Identify shim locations. 2.0 Remove all studes, russ, shims etc. Identify shim locations. 3.1 Remove all studes, russ, shims etc. Identify shim locations. 3.2 Remove all studes, russ, shims etc. Identify shim locations. 3.2 Remove all studes, russ, shims etc. Identify shim locations. 3.2 Remove all studes, russ, shims etc. Identify shim locations. 3.3 Remove all studes, russ, shims etc. Identify shim locations. 3.4 Remove all studes, russ, shims etc. Identify shim locations. 3.5 Remove all studes, russ, shims etc. Identify shim locations. 3.6 Remove all studes, russ, shims etc. Identify shim locations. 3.6 Remove all studes, russ, shims etc. Identify shim locations. 3.6 Remove all studes, russ, shims etc. Identify shim locations. 3.6 Remove all studes, russ, shims etc. Identify shims etc. Identify shims etc. 3.6 Remove all studes, russ, shims etc. Identify shims etc. 4.0 Remove the russ, shims etc. Identify shims etc. 4.0 Remove the russ, shims etc. Identify shims etc. 4.0 Remove the russ, shims etc. 4.0 Remo	5.13		3.0	-				-	60	2.5			
8.6.00 A Bemove all stude, rules, shims etc. Identify shim licentous. 9.00 A Person of all stude, rules, shims etc. Identify shim licentous. 9.01 Piece the Type-A coil. A' flange down, on the 20deg feature. Obtain a set of "realigned" fiducial positions of the "A" and "B" coils. 9.02 Using the leave tracker, eligns to the contents assists belong into a minemum of a of them. 9.03 Exemunal ground commands year of metal shims on the coll in the designated locations. 9.04 Studies with the properties of the "Type-A coil. 9.05 Commands of the "Type-A coil. 9.06 Commands of the "Type-A coil. 9.07 Using the treating position of the "Type-A coil. 9.08 Install the remaining metal shims on the "Type-A coil. 9.09 Install the remaining metal shims with Full paper, install stude, supermits, and torque to 50% of final values to 10 of the "Type-A coil. 9.09 Install the remaining metal shims with Full paper, install stude, supermits, and torque to 50% of final values to 50%. 9.00 Install the remaining metal shims with Full paper, install stude, supermits, and torque to 50% of final values to 50%. 9.00 Install the remaining metal shims with Full paper, install stude, supermits, and torque to 50% of final values to 100 or all shims to the part paper grows the principle of the Type-A coil. 9.02 Install the remaining metal shims with Full paper, install stude, supermits, and torque to 50% of final values to 100 or all shims to the principle and to 100 or all shims to the principle and to 100 or all shims to the principle and to 100 or all shims to final values that they are sight. If a loose shin is footed book of or sufficient adjacent botal to allow a replacement shim to be inserted. Tighten bold and the check of with principle and the check of the principle and the check		shim pressure is unacceptable. Re-torque all studs to 50% and recheck alignment.			1								
A Bandular coil assembly of the "A" and "B" coils. A Bandular coil as													
Four the Type-A colt. "A" large down, on the 20deg foture. Obtain a set of "realigned" flucial positions for the "A" and "8" cols. A" and "8			1.0		+				20	2.5		Sequence Plan R5	
Jang the laser tracker, along to the control sease locking into a minimum of 6 of them. 20 Metrology Staff Budgeted as LOE checked with primavera the facture and on the walks. 20 40 Metrology Staff Budgeted as LOE checked with primavera the facture and on the walks. 20 40 ED. Staff Shim Bag with Fibergias, Reseal, Place Shim Bag on Wing 20 52 5 Checked with primavera the check of with primavera the cked wit		Place the Type-A coil, "A" flange down, on the 20deg fixture. Obtain a set of "realigned" fiducial positions										• • • • •	-
Easted the facture and on the weeks. 40 40 40 40 40 40 40 40	6.00								40	2.5	00	Motrology Stoff Budgeted as LOC	
He flature and on the walls. 6.04 Place the an initial set of metal shims on the coil in the designated locations. 5.04 Place the an initial set of metal shims on the coil in the designated locations. 5.05 Stuff Shim Bag with Fibergias, Reseal, Place Shim Bag on Wing 6.05 Lover the Type-B coil onto the Type-A coil. 6.06 Measure the monitoring of the Coil Just A greas of the coil as necessary to bring displaced monuments on the A coil. Just A greas of the coil as necessary to bring displaced monuments on the A coil. Just A greas of the coil as necessary to bring displaced monuments on the A coil. Just A greas of the coil as necessary to bring displaced monuments on the A coil. Just A greas of the coil as necessary to bring displaced monuments on the A coil. Just A greas of the coil as necessary to bring displaced monuments on the A coil. Just A greas of the coil as necessary to bring displaced monuments on the A coil. Just A greas of the coil as necessary to bring displaced monuments on the A coil. Just A greas of the coil as necessary to bring displaced monuments on the A coil. Just A greas of the coil as necessary to bring displaced monuments on the A coil. Just A greas of the coil as necessary to bring displaced monuments on the A coil. Just A greas of the coil as necessary to bring displaced monuments on the A coil as necessary to bring displaced monuments on the A coil. Just A great of the Coil as necessary to bring displaced monuments on the A coil as necessary to bring displaced monuments on the A coil as necessary to bring displaced monuments on the A coil as necessary to bring displaced monuments on the A coil as necessary to bring displaced monuments on the A coil as necessary to bring displaced monuments on the A coil as necessary to bring displaced monuments on the A coil as necessary to bring displaced monuments on the A coil as necessary to bring displaced monuments on the A coil as necessary to bring displaced on the Coil as necessary to bring displaced on the Coil as necessary to bring displ		Establish a global coordinate system based on the modular coil geometry. Measure the monuments on	1.0								20	Metrology Start Budgeted as LOE	checked with primavera
Suff Shim Bag with Fiberglas, Reseal, Place Shim Bag on Wing 6.05 Cover the Type-B coil onto the Type-B coil on											40	Metrology Staff Budgeted as LOE	
6.05 Lower the Type-B coll onto the Type-A coll. 6.06 Measure the monuments on the A coll. Jack areas of the coil as necessary to bring displaced monuments back to within 0.0° of their original position. 6.06 Install Dial indicators for X-Y Positioning 6.07 Using three target points on the B coil, perform the X-Y positioning of the B coil. 6.08 Install Dial indicators for X-Y Positioning 6.09 Wake a hand "wiggle" test (rotate on both) on all shims to make sure that they are tight. If a loose shim is found back off on sufficient adjacent boths to allow a replacement shim to be inserted. Tighten both and 10 or 10			2.0						40	2.5			checked with primavera
6.05 Lower the Type-B coil onto the Type-A coil. 6.06 Measure the monuments on the A coil. Jack areas of the coil as necessary to bring displaced monuments back to within .002 of their original position. 6.06 Install Dial Indicators for X-Y Positioning of the B coil. 6.07 Using three target points on the B coil perform the X-Y positioning of the B coil. 6.08 Install the remaining metal shims with Fuji paper, install studs, supernuts, and torque to 50% of final value. 6.09 Make a hand "wiggle" test (rotate on boil) on all shims to make sure that they are light. If a loose shim is found back off on sufficient adjacent boilts to allow a replacement shim to be inserted. Tighten boil and roll of original studs, adjust shims locally. Re-torque all studs to 50%. 6.10 Wessure the tooling balls on both coils. The maximum deviation from the Trail aloose shim is found back off on sufficient adjacent boilts to allow a replacement shim is coally. Re-torque all study to 50%. 6.10 Wessure the tooling balls on both coils. The maximum deviation from the Trail great points should be torque all study to 50%. 6.11 Make a hand "wiggle" test (rotate on boil to allow a replacement shim is found back off on sufficient adjacent boilts to allow a replacement shim is found back off on sufficient adjacent boilts to allow a replacement shim is found back off on sufficient adjacent boilts to allow a replacement shim to be inserted. Tighten boil and to the realigned points should be sufficient adjacent boilts to allow a replacement shim to be inserted. Tighten boil and the realigned points should be sufficient adjacent boilts to allow a replacement shim to be inserted. Tighten boil and the realigned points should be sufficient adjacent boilts to allow a replacement shim to be inserted. Tighten boil and the realigned points should be sufficient adjacent boilts. The maximum deviation from the "realigned points should be sufficient adjacent boilts to allow a replacement shim to be inserted. Tighten boil and the realigned points should be suffin	6.04.1	Stuff Shim Bag with Fiberglas, Reseal, Place Shim Bag on Wing	0.0							0.5			ab a also dissibly a view asset
Measure the monuments on the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced monuments and the A coil. Jack areas of the coil as necessary to bring displaced and the A coil. Jack areas of the Checked with primavers and a collaboration of the A coil as a collaboration of the A collaborat	6.05	I ower the Type-B coil onto the Type-A coil.										assembly	
back to within, 002" of their original position. 1.0 20 2.5 6.06.1 Install Dial indicators for X-Y Positioning 6.07 Using three target points on the B coil, perform the X-Y positioning of the B coil. 6.08 Install the remaining metal shims with Fuji paper, install study, supernuts, and torque to 50% of final value. 6.09 Make a hand "wiggle" test (rotate on both) on all shims to make surer that they are tight. It a loose shim is found back off on sufficient adjacent botts on allow a replacement shim to be inserted. Tighten bott and substant to 50%. 6.10 Mesure the tooling balls on both coils. The maximum deviation from the "realigned" points should be 0.07" or less substant to 50%. 6.11 Loosen all study, reduce load on flanges and install an equivalent set of alumina coated metal shims. Re- torque all study, reduce load on flanges and install an equivalent set of alumina coated metal shims. Re- torque all study is 50%. 6.13 Make a hand "wiggle" test (rotate on both) on all shims to make sure that they are tight. If a loose shim is found back off on sufficient adjacent botts to allow a replacement shim to be inserted. Tighten bott and checked with primavera		Measure the monuments on the A coil. Jack areas of the coil as necessary to bring displaced monuments		1	+								
6.07 Using three target points on the B coil, perform the X-Y positioning of the B coil. 6.08 Install the remaining metal shims with Fuji paper, install studs, supernus, and torque to 50% of final value. 6.09 Make a hand "wiggle" test (rotate on boil) on all shims to make sure that they are tight. If a loose shim is found back off on sufficient adjacent boils to allow a replacement shim to be inserted. Tighten boil and studies to 50%. 6.10 Measure the tooling balls on both coils. The maximum deviation from the "realigned" points should be study to 50%. 6.11 If the above step does not fall within .007" or less then loosen all studs, adjust shims locally, Re-torque all studs to 50%. 6.12 Loosen all studs, reduce load on flanges and install an equivalent set of alumina coated metal shims. Reformed back off on sufficient adjacent boils to allow a replacement shim to be inserted. Tighten boil and recheck. 6.13 Make a hand "wiggle" test (rotate on boil) on all shims to make sure that they are tight. If a loose shim is found back off on sufficient adjacent boils to allow a replacement shim to be inserted. Tighten boil and recheck. 6.14 Measure the tooling balls on both coils. The maximum deviation from the "realigned" points should be		back to within .002" of their original position.										I ED. Missing from	
6.08 Install the remaining metal shims with Fuji paper, install studs, supernuts, and torque to 50% of final value. 6.09 Make a hand "wiggle" test (rotate on bolt) on all shims to make sure that they are tight. If a loose shim is found back off on sufficient adjacent bolts to allow a replacement shim to be inserted. Tighten bolt and recheck. 6.10 Measure the tooling balls on both coils. The maximum deviation from the "realigned" points should be 3.007 or less. 6.11 If the above step does not fall within .007* or less then loosen all studs, adjust shims locally. Re-torque all studs to 50%. 6.12 Loosen all studs, reduce load on flanges and install an equivalent set of alumina coated metal shims. Re-torque all studs to 50%. 6.12 Loosen all studs, reduce load on flanges and install an equivalent set of alumina coated metal shims. Re-torque all studs to 50%. 6.13 Make a hand "wiggle" test (rotate on bolt) on all shims to make sure that they are tight. If a loose shim is found back off on sufficient adjacent bolts to allow a replacement shim to be inserted. Tighten bolt and recheck. 6.14 Measure the tooling balls on both coils. The maximum deviation from the "realigned" points should be considered. Tighten bolt and recheck. 6.14 Measure the tooling balls on both coils. The maximum deviation from the "realigned" points should be considered. Tighten bolt and recheck. 6.14 Measure the tooling balls on both coils. The maximum deviation from the "realigned" points should be considered. Tighten bolt and recheck.								1				LED: MISSING from sequence	
walue. Additional part of the properties of the				1	1			1					checked with primavera
found back off on sufficient adjacent botts to allow a replacement shim to be inserted. Tighten bott and recheck. 6.10 Measure the tooling balls on both coils. The maximum deviation from the "realigned" points should be 0.007" or less. 6.11 If the above step does not fall within .007" or less then loosen all study, adjust shims locally. Re-torque all studys to 50%. 6.12 Locar all studys, reduce load on flanges and install an equivalent set of alumina coated metal shims. Re-torque all studys to 50%. 6.13 Make a hand "wiggle" test (rotate on bott) on all shims to make sure that they are tight. If a loose shim is found back off on sufficient adjacent botts to allow a replacement shim to be inserted. Tighten both and recheck. 6.14 Measure the tooling balls on both coils. The maximum deviation from the "realigned" points should be		value.	2.0						40	2.5			checked with primavera
recheck. 1.0 1.0 Metrology Staff Budgeted as LOE checked with primavera 1.0 Metrology Staff Budgeted as LOE checked with primavera checked with primavera checked with primavera 1.0 Metrology Staff Budgeted as LOE checked with primavera checked with primaver	6.09		1										
6.11 If be above step does not fall within .007° or less then loosen all stude, adjust shims locally. Re-torque all studes to 50%. 6.12 Loosen all stude, reduce load on flanges and install an equivalent set of alumina coated metal shims. Re-torque all studes to 50%. 6.13 Make a hand "wiggle" test (rotate on bolt) on all shims to make sure that they are tight. If a loose shim is found back off on sufficient adjacent bolts to allow a replacement shim to be inserted. Tighten bolt and recheck. 6.14 Measure the tooling balls on both coils. The maximum deviation from the "realigned" points should be		recheck.	1.0						20	2.5			checked with primavera
6.11 If the above step does not fall within .007" or less then loosen all studs, adjust shims locally. Re-torque all studs to 50%. 6.12 Loosen all studs, reduce load on flanges and install an equivalent set of alumina coated metal shims. Re-torque all studs to 50%. 6.13 Make a hand "wiggle" test (rotate on bolt) on all shims to make sure that they are tight. If a loose shim is found back off on sufficient adjacent bolts to allow a replacement shim to be inserted. Tighten bolt and recheck. 6.14 Measures the tooling balls on both coils. The maximum deviation from the "realigned" points should be	6.10		5.0								100	Metrology Staff Budgeted as LOF	checked with primavera
studs to 50%. 6.12 Loosen all studs, reduce load on flanges and install an equivalent set of alumina coated metal shims. Relative load on flanges and install an equivalent set of alumina coated metal shims. Relative load to flanges and install an equivalent set of alumina coated metal shims. Relative load to 50%. 6.13 Make a hand "wiggle" test (rotate on bolt) on all shims to make sure that they are tight. If a loose shim is found back off on sufficient adjacent bolts to allow a replacement shim to be inserted. Tighten bolt and recheck. 6.14 Measure the tooling balls on both coils. The maximum deviation from the "realigned" points should be	6.11										100	men clogy oftan badgeted de LOE	oncoxed with primavera
torque all studs to 50%. 6.13 Make a hand "wiggle" test (rotate on boit) on all shims to make sure that they are tight. If a loose shim is lound back off on sufficient adjacent boits to allow a replacement shim to be inserted. Tighten boit and recheck. 6.14 Measure the tooling balls on both coils. The maximum deviation from the "realigned" points should be		studs to 50%.	3.0						60	2.5			checked with primavera
6.13 Make a hand "wiggle" test (rotate on bolt) on all shims to make sure that they are tight. If a loose shim is found back off on sufficient adjacent bolts to allow a replacement shim to be inserted. Tighten bolt and recheck. 6.14 Measure the tooling balls on both coils. The maximum deviation from the "realigned" points should be	6.12	Loosen all studs, reduce load on flanges and install an equivalent set of alumina coated metal shims. Re- torque all studs to 50%.	1.0						20	2,5			checked with primavera
recheck. 1.0 1.0 2 20 2.5 Checked with primavera 6.14 Measure the tooling balls on both coils. The maximum deviation from the "realigned" points should be	6.13	Make a hand "wiggle" test (rotate on bolt) on all shims to make sure that they are tight. If a loose shim is	1.0						20	0			zazzatoa mar primavera
6.14 Measure the tooling balls on both coils. The maximum deviation from the "realigned" points should be			1 0						20	25			checked with primavera
6.0 Matralagy Staff Budgeted as LOC should always a	6.14	Measure the tooling balls on both coils. The maximum deviation from the "realigned" points should be	1.0				 1	<u> </u>	20	د.2			<mark>-</mark>
100 metrology Staff Budgeted as LOE Checked with primavera	<u></u>	.007" or less.	5.0								100	Metrology Staff Budgeted as LOE	checked with primavera

Job Numbe	: Assembly of Field Periods			1									
Job Numbe													
				-									
JOD LITTE: F	ers: 1802, 1810, and 1815			-									
	FPA Oversight & Support (1802)	_											
	FPA Operations - Stations 1, 2, & 3 (1810)												
	FPA Operations - Station 5 (1815)	_											
Job Manag	ger: Mike Viola												
Fabrication an	nd Assembly			1	1	1	1		-				
Assumptions:													
Accur	mes 5 day workweek 1 shift no overtime			1		1							
	el ops for sta 5 (2 fixtures available)				1								
	el ops for sta 5 (2 fixtures available)												
	el ops for sta 5 (2 fixtures available) 1 fixture for station 3 only	-									-		
Paralle	el ops for sta 2	_				1							
6.15 If the ab	bove step does not fall within .007" or less then loosen all studs, adjust shims locally. Re-torque all	3.0							60	2.5			checked with primavera
studs to 6.16 One hole	le at a time, remove the supernut. Using the eccentric gage slid onto the stud define the hole	0.0			1				200			LED: Technical Issue space in some	checked with primavera
eccentric	icity. Select bushing and machine to match required eccentricity. Install bushing. Replace nut and								200			areas is insufficient to remove nuts	
other ta	back to 50% and recheck alignment. Total 10 days 7 days to pre fit & fab bushings (in parallel with isks) and 3 days to install											with flanges in position. If there is	
												space duration should be 1.5 days	ale a ale and codule and as a
6.17 Comple	ete tightening of flange bolts to 100%.	1.0							20	25			checked with primavera checked with primavera
6.18 Measure	re the tooling balls on both coils. The maximum deviation from the "realigned" points should be								20	2.0			
.007" or	r less. le "B" flange of Type-B coil	2.0								0.5	40	Metrology Staff Budgeted as LOE	checked with primavera
	the "B" flange of Type-B coil he "B" flange measurement of the Type-B coil and the earlier "A" flange measurement of the Type-I	1.0			-				20	2.5			checked with primavera
C coil, d	define all B/C flange shim thickness.				<u> </u>		<u></u>					Back office	checked with primavera
	o C modular coil assembly (MCHP)											Sequence Plan R5	checked with primavera
7.01 Place the	ne "A/B" assembly, "A" coil down, on the 40deg fixture. Obtain a set of "realigned" fiducial positions. "A", "B", and "C" coils.	3.0							60	2.5			checked with primavera
7.02 Using th	he laser tracker, align to the conical seats locking into a minimum of 8 of them.	1.0		<u> </u>		1					20	Metrology Staff Budgeted as LOE	checked with primavera
7.03 Establish	sh a global coordinate system based on the modular coil geometry. Measure the monuments on ure and on the walls.	2.0									40	Metrology Staff Budgeted as LOE	obooked with primayers
	the an initial set of metal shims on the coil in the designated locations.	2.0							40	2.5	40	metrology clair budgeted as LOE	checked with primavera checked with primavera
	the Type-C coil onto the Type-B coil.	1.0			1				20	2.5 2.5			checked with primavera
7.06 Measure	re the monuments on the A coil to evaluate monument displacements. If movement greater than						·						
	observed discuss with back office on how to proceed in bringing displaced monuments back to 002" of their original position.	1.0									20	Metrology Staff Budgeted as LOE	checked with primavera
	002* of their original position. Dial indicators for X-Y Positioning	1.0							20	0		LED: Missing from sequence	checked with primavera
	hree target points on the Type-C coil, perform the X-Y positioning of the coil.	1.0							20	2.5			checked with primavera
7.08 Install th	he remaining metal shims with Fuji paper, install studs, supernuts, and torque to 50% of final	2.0							40	2.5			checked with primavera
7.09 Make a	hand "wiggle" test (rotate on bolt) on all shims to make sure that they are tight. If a loose shim is												
found ba recheck.	eack off on sufficient adjacent bolts to allow a replacement shim to be inserted. Tighten bolt and	1.0							20	2.5			checked with primavera
	re the tooling balls on all coils. The maximum deviation from the "realigned" points should be .010"			<u> </u>		1			23			Matralami Staff Budgets I as I 65	
or less. 7.11 If the ab	bove step does not fall within .010" or less then loosen all studs, adjust shims locally. Re-torque all	5.0									100	Metrology Staff Budgeted as LOE	checked with primavera
studs to	50%.	3.0		<u></u>	<u> </u>				60	2.5			checked with primavera
7.12 Loosen	all studs, reduce load on flanges and install an equivalent set of alumina coated metal shims. Reall studs to 50%.	1.0							20	2.5			checked with primavera
7.13 Make a l	hand "wiggle" test (rotate on bolt) on all shims to make sure that they are tight. If a loose shim is	1.0			1				20	2.0			oncoked with primavera
	ack off on sufficient adjacent bolts to allow a replacement shim to be inserted. Tighten bolt and	1.0							20	2.5			checked with primavera
	ce the tooling balls on all coils. The maximum deviation from the "realigned" points should be .010"				+								
or less.		5.0			1				100	2.5			checked with primavera
7.15 If the ab	bove step does not fall within .010" or less then loosen all studs, adjust shims locally. Re-torque all b 50%.	3.0							60	2.5			checked with primavera
	le at a time, remove the supernut. Using the eccentric gage slid onto the stud define the hole icity. Select bushing and machine to match required eccentricity. Install bushing. Replace nut and				•	_	·	1					
eccentric tighten f	icity. Select bushing and machine to match required eccentricity. Install bushing. Replace nut and back to 50% and recheck alignment. Total 10 days 7 days to pre fit & fab bushings (in parallel with												
other tas	isks)and 3 days to install	0.0								2.5		LED: Increase duraction to 1.5	checked with primavera
	ete tightening of flange bolts to 100%.	1.0							20				checked with primavera
	or identify three primary fiducials that will be used in positioning the Period in Station 3. The the tooling balls on both coils. The maximum deviation from the "realigned" points should be	1.0		<u> </u>					20	2.5			checked with primavera
.010" or	r less. Make final metrology measurement of all fiducials. Scan the "B" flange of Type-C coil.	5.0									400	Matrology Staff Products I as I CF	all and and address
	the results. reld inboard welded shims	5.0									100	Metrology Staff Budgeted as LOE Sequence Plan R5	checked with primavera checked with primavera
and rubit me	y tack weld all inboard shims to one flange to keep them in place. The final welding of all welded											•	checked with primavera
shims to	o take place in Station 3.	2.0							40	2.5		Perform at A-B also	checked with primavera
9.00 Install to	trim coil				1							Sequence Plan R5	checked with primavera

										-	
VBS Number: 185											
VBS Title: Assembly of Field Periods											
Job Numbers: 1802, 1810, and 1815											
Job Title: FPA Oversight & Support (1802)											
Job Title: FPA Operations - Stations 1, 2, & 3 (1810)											
Job Title: FPA Operations - Station 5 (1815)											
Job Manager: Mike Viola											
abrication and Assembly											
Assumptions:											
Assumes 5 day workweek 1 shift no overtime											
Parallel ops for sta 5 (2 fixtures available)											
Parallel ops for sta 5 (2 fixtures available)											
Only 1 fixture for station 3 only											
Parallel ops for sta 2											
9.01 Install trim coil on the top surface of the Type-C on Period 1 and 2 only on the MCHP - Right Side (See Figure 3 below).		6.0						120	2.5		checked with primavera
10.00 Complete local service and interface details	+ +	0.0						120	2.0	Sequence Plan R5	checked with primavera
10.01 Install all wing support bladders between wing surfaces (A/B, B/C) and on the C wing (MCHP - Right Side			1								
only).		2.0						40	2.5	LED: Bags were placed earlier	checked with primavera
10.02 Make local service runs/connections on the shell of each MC.										4 days for coolant lines 4 days for	
										mod coils thermocouples and strain	
		8.0						160	2.5	gages terminations	checked with primavera
10.03 Inject stycast or some compound to fill in all shim spaces in order to prevent VV/MC insulation from falling		1.0						20	2.5		checked with primavera
11.00 Final measurements / transfer completed MCHP to holding area				1	1					Sequence Plan R5	checked with primavera
11.02 Make final metrology measurement of all fiducials. Scan the "B" flange of Type-C coil. Record the results	i.							0	2.5	Done at 7.18	checked with primavera
11.03 Using tension tester measure bolt length on all tension fasteners and record the results.		0.5		 1				10	2.5	Done at 7.10	checked with primavera
11.04 Mark part for identification		0.0						0	2.5		checked with primavera
11.05 Install lift support beams		2.0						40	2.5		checked with primavera
11.06 Remove from stand and measure weight of completed assembly		1.0		1				20	2.5		checked with primavera
11.07 Move to holding area.		0.0		1	1			0	2.5	246 shifts	checked with primavera
•		01		 	1	1 1	 l	٦,			maroid mar primaroid

WRS	Number: 185								
	Title: Assembly of Field Periods								
	Numbers: 1802, 1810, and 1815								
	, ,								
	Title: FPA Oversight & Support (1802)								
Job	Title: FPA Operations - Stations 1, 2, & 3 (1810)								
Job 1	itle: FPA Operations - Station 5 (1815)								
Job I	Manager: Mike Viola								
L									
	ation and Assembly ptions:								
ASSUII									
	Assumes 5 day workweek 1 shift no overtime								
	Parallel ops for sta 5 (2 fixtures available)								
	Parallel ops for sta 5 (2 fixtures available)								
	Only 1 fixture for station 3 only								
	Parallel ops for sta 2								
	A1,B1,C1 subtotal task 5-11 (total elasp time	126			2125		740		checked with primavera
	2 - Production Articles (HPA) and second half of FP #1 A2,B2,C2							Sequence Plan R5	checked with primavera
1.00	MC fit-up pre-check and surface insulation		-					Sequence Plan R5	checked with primavera
1.01	Verify that mating MC's of a MCHP will come together without interferences by pre-fitting mating coils. This will include the Type-C coil with its interfacing Period Type-C coil.	4.0			80	2.5			checked with primavera
1.02	Epoxy paint all close fitting interfacing surfaces.	3.0			60	2.5			checked with primavera
2.00	Pre-measurement of MCHP Type A, B and C coils flanges plus interfacing Type-A coil flange							Sequence Plan R5	checked with primavera
2.08	Measure Type B "A" flanges	14.0			40	2.5	220	Repeats 2.01-2.07	checked with primavera
2.11	Measure Type C "A"flanges	13.0			40	2.5	220	Repeats 2.01-2.07	checked with primavera
2.14	Measure Type A-A "A" flange	13.0			40	2.5	220	Repeats 2.01-2.07	checked with primavera
3.00	Shim sizing / preparations							Sequence Plan R5	checked with primavera
3.01	Using flange measurement of the coils, define the A/A and A/B shim thickness.								checked with primavera
3.02	Compress alumina coated shims and sort by thickness the shim set that will be installed on the MCHP.	4.0			90	2.5		May need more shims	checked with primavera
4.00	Pre-Installation Station 2 set-up recalibration	4.0			60	2.5		Sequence Plan R5	checked with primavera
4.01	Install MCHP fixtures and metrology equipment.	-				2.5		ooquonoo i ian ito	checked with primavera
4.02	Perform metrology set-up and checks 53.0	2.0			o o	2.0	40	Metrology Staff Budgeted as LOE	the state of the s
		2.0				2.5	40	Metrology Staff Budgeted as LOE	checked with primavera checked with primavera checked with primavera
4.02	Perform metrology set-up and checks 53.0 Pre-assemble A-A (Needs to be done total of 3 timee A1-A2, A3-A4, A5-A6) Position the Type-A modular coil on the fixture, "B" flange down. Obtain a set of "realigned" fiducial	2.0				2.5	40	Metrology Staff Budgeted as LOE	checked with primavera checked with primavera
5.00 5.01	Perform metrology set-up and checks 53.0 Pre-assemble A-A (Needs to be done total of 3 timee A1-A2, A3-A4, A5-A6) Position the Type-A modular coil on the fixture, "B" flange down. Obtain a set of "realigned" fiducial positions.	2.0				2.0	40	Metrology Staff Budgeted as LOE	checked with primavera checked with primavera checked with primavera
5.00 5.01 5.02	Perform metrology set-up and checks Pre-assemble A-A (Needs to be done total of 3 timee A1-A2, A3-A4, A5-A6) Prosition the Type-A modular coil on the fixture, "B" flange down. Obtain a set of "realigned" fiducial positions. Align the laser tracker to the conical seats locking into a minimum of 8 of them. Establish a global coordinate system based on the modular coil geometry. Mea	2.0				2.0	40	Metrology Staff Budgeted as LOE	checked with primavera checked with primavera
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4.02 5.00 5.01 5.02 5.03 5.04 5.05 5.06 5.07 5.08 5.09 5.10 5.11 5.12 5.13 5.14 6.00 6.01	Perform metrology set-up and checks Pre-assemble A-A (Needs to be done total of 3 timee A1-A2, A3-A4, A5-A6) Pre-assemble A-B (Needs to be done total of 3 timee A1-A2, A3-A4, A5-A6) Position the Type-A modular coil on the fixture, "B" flange down. Obtain a set of "realigned" fiducial positions. Align the laser tracker to the conical seats locking into a minimum of 8 of them. Establish a global coordinate system based on the modular coil geometry. Mea the fixture and on the walls. Place all alumina and grind inboard weld shims on the coil. Install dial indicators on the modular coil in areas where we expect to see defletower the mating type A modular coil into position. Measure the monuments on the bottom coil. Jack areas of the coil as necession monuments back to within. 002" of their original position. Using three target points, perform the positioning as was done in the A1-A2 I lated to the position of	1.0		16 2	bove		20		checked with primavera
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6.16 Using the "B" flange measurement of the Type-B coil and the earlier "A" flange measurement of the Type-C coil, define all B/C flange shim thickness. 7.00 (A-B) to C modular coil assembly (MCHP) 7.01 Place the "A/B" assembly, "A" coil down, on the 40deg tixture. Obtain a set of "realigned" tiducial positions.	The state of the s
C coil, define all B/C flange shim thickness. 7:00 (A-B) to C modular coil assembly (MCH)	checked with primavera
7.00 (A-B) to C modular coil assembly (MCHP) 7.01 Place the "A/B" assembly, "A" coil down, on the 40deg fixture. Obtain a set of "realigned" fiducial positions.	checked with primavera
	checked with primavera
For the "A", "B", and "C" coils. $\Delta \Omega = \Delta \Omega = \Delta \Omega$	
	checked with primavera
7.02 Using the laser tracker, align to the conical seats locking into a minimum of 8 of them. 7.03 Establish a global coordinate system based on the modular coil geometry. Measure the monuments on	checked with primavera
he fixture and on the walls. 2.0 Metrology Staff Budgeted as LC	checked with primavera
7.04 Place all alumina and grind inboard weld shims on the coil. 2.0 40 2.5	checked with primavera
7.05 Lower the Type-C coil onto the Type-B coil. 1.0 20 2.5	checked with primavera
7.06 Measure the monuments on the A coil to evaluate monument displacements. If movement greater than 0.02° is observed discuss with back office on how to proceed in bringing displaced monuments back to	
within, 002° of their original position.	checked with primavera
7.07 Using three target points on the Type-C coil, perform the X-Y positioning of the coil. 1.0 20 2.5	checked with primavera
7.08 Install studs, supernuts, and torque to 50% of final value. 2.0 40 2.5	checked with primavera
7.09 Make a hand "wiggle" test (rotate on bolt) on all shims to make sure that they are tight. If a loose shim is found back off on sufficient adjacent bolts to allow a replacement shim to be inserted. Tighten bolt and	
recheck. 1.0 20 2.5	checked with primavera
7.10 releasure the tooling balls on all coils. The maximum deviation from the "realigned" points should be .010" 5.0 Metrology Staff Budgeted as LC	to the second
or less. 5.0 100 ehole at a time, remove the supernut. Using the eccentric gage slid onto the stud define the hole	checked with primavera
eccentricity. Select bushing and machine to match required eccentricity. Install bushing. Replace nut and	
tighten back to 50% and recheck alignment. Total 10 days 7 days to pre fit & fab bushings (in parallel with	checked with primavera
other tasks and 3 days to install 10.0 200 2.5 LED: See above 7.12 Complete tightening of flange bolts to 100%. 1.0 20 2.5 2.5	checked with primavera
7.13 Measure the troiling halls on both coils. The maximum deviation from the "realigner" noints should be	· · · · · · · · · · · · · · · · · · ·
80 Metrology Staff Budgeted as LC	
8.00 Tack weld inboard welded shims Sequence Plan R5	checked with primavera
8.01 Partially tack weld all inboard shims to one flange to keep them in place. The final welding of all welded shims to take place in Station 3.	checked with primavera
simils to late place in cliquion 5.	
9.01 Install trim coil on the too surface of the Type-C on Period 1 and 2 only on the MCHP - Right Side (See	checked with primavera
Figure 3 below). 6.0 120 2.5	checked with primavera
10.00 Complete local service and interface details 10.01 Inflate all wing support bladders between wing surfaces (A/B, B/C) and on the C wing (MCHP - Right Side	checked with primavera
10.01 Inflate all wing support bladders between wing surfaces (A/B, B/C) and on the C wing (MCHP - Right Side only). See above	
10.02 Make local service runs/connections on the shell of each MC.	checked with primavera
mod coils thermocouples and s	checked with primavera checked with primavera checked with primavera
8.0 160 2.5 gages terminations	checked with primavera checked with primavera checked with primavera

	_		 	 								
WBS	Number: 185											
WBS	Title: Assembly of Field Periods											
Job N	Numbers: 1802, 1810, and 1815											
	Fitle: FPA Oversight & Support (1802)											
Job 1	Γitle: FPA Operations - Stations 1, 2, & 3 (1810)											
Job 1	Fitle: FPA Operations - Station 5 (1815)											
Job N	Manager: Mike Viola											
Fabrica	ation and Assembly											
Assum	nptions:											
	Assumes 5 day workweek 1 shift no overtime					,						
	Parallel ops for sta 5 (2 fixtures available)											
	Parallel ops for sta 5 (2 fixtures available)											
	Only 1 fixture for station 3 only											
	Parallel ops for sta 2											
10.03	Inject stycast or some compound to fill in all shim spaces in order to prevent VV/MC insulation from falling	1.0						20	2.5			checked with primavera
11.00	Final measurements / transfer completed MCHP to holding area									Sequer	nce Plan R5	checked with primavera
11.01	Install or identify three primary fiducials that will be used in positioning the Period in Station 3.	1.0						20	2.5			checked with primavera
11.02	Make final metrology measurement of all fiducials. Scan the "B" flange of Type-C coil. Record the results.	5.0			,				100	Metrolo	ogy Staff Budgeted as LOE	checked with primavera
11.03	Using tension tester measure bolt length on all tension fasteners and record the results.	0.5						10	2.5			checked with primavera
11.04	Mark part for identification	0.0						0	2.5			checked with primavera
11.05	Install lift support beams	2.0						40	2.5			checked with primavera
11.06	Remove from stand and measure weight of completed assembly and Move to holding area.	2.0						40	2.5			checked with primavera

WBS	Number: 185											
	Title: Assembly of Field Periods											
	umbers: 1802, 1810, and 1815											
	itle: FPA Oversight & Support (1802)											
	itle: FPA Oversight & Support (1802)											
	1											
	itle: FPA Operations - Station 5 (1815)											
Job N	anager: Mike Viola											
Fabrica	tion and Assembly			-1			1 1					
Assum	otions:											
	Assumes 5 day workweek 1 shift no overtime											
	Parallel ops for sta 5 (2 fixtures available)											
	Parallel ops for sta 5 (2 fixtures available)											
	Only 1 fixture for station 3 only			1	1							
	Parallel ops for sta 2											
	A2,B2,C2 Subtotal task 5-11 (total elasp time)	83						1335		620		checked with primavera
Station	2-Modular Coil Subassembly-FP#2											checked with primavera
	Assemble/Align Mod-Coils A3/B3/C3	126						2125		740	Sequence Plan R5	checked with primavera
	Assemble/Align Mod-Coils A4/B4/C4	83	3					1335		620	Sequence Plan R5	checked with primavera
Station	2-Modular Coil Subassembly-FP#3											checked with primavera
	Assemble/Align Mod-Coils A5/B5/C5	126				<u> </u>		2125		740	Sequence Plan R5	checked with primavera
	Assemble/Align Mod-Coils A6/B6/C6	83						1335		620	Sequence Plan R5	checked with primavera
	A COUNTRY IN THE COUNTRY IN COUNT	00						1000		020	ooquonoo : ian ito	checked with primavera
Station	3-Assemble Mod Coils and VVSA-FP#1											checked with primavera
	Misc Hardware		\$ 5.0K									checked with primavera
	Procure and load test 3 legged actuator System	4.0						96				checked with primavera
	Procure, Fabricate and load test 3 legged actuator Lift Fixture	8.0						128				checked with primavera
	Begin Assembly of First Field Period Assy Fab new platform legs	2.0						40 64				checked with primavera checked with primavera
	Install station 3 platforms (8 required)	4.0						112				checked with primavera
	Test out station 3 equipment and procedures		\$ 10.0K					0				checked with primavera
												checked with primavera
1.00	Assembly Step											checked with primavera
1.00	Pre-Installation set-up Install Station 3 site monuments as needed to perform metrology measurements.	3.0) \$ 2.0K					60	2.5			checked with primavera checked with primavera
1.02	Install floor mounted tracks and VV base support		\$ 1.0K					100				checked with primavera
1.03	Use rigging operations to establish the MCHP CG location.	2.0						40	2.5			checked with primavera
2.00	Pre-assemble left MCHP							0				checked with primavera
	Install MCHP support cart assemblies Verify cart motion. Move left cart to final assembly position to accept left MCHP and secure to the floor	4.0)					80	2.5			checked with primavera
2.02	supports. Move right cart far to the right.	2.0						40	2.5			checked with primavera
	Install adjustor bar support weldment on Left Side	0.0						0				checked with primavera
2.04	Using the SISSCO crane, position left MCHP on the cart assembly Secure left MCHP at three location to vertical support posts on support cart base.	1.0			1			20 40				checked with primavera
2.05	Secure left MCHP at three location to vertical support posts on support cart base. Measure the monuments on the positioned left MCHP and on the walls to establish the machine				1			40	∠.5			checked with primavera
	coordinate for further assembly operations.	5.0								100	Metrology Staff Budgeted as LOE	checked with primavera
2.07	Set the positioning stop on the cart so it returns to the machine coordinate defined position in further assembly steps.	1.0						20	2.5			checked with primavera
3.00	Pre-assemble right MCHP	- 1.0						0	2.5			checked with primavera
3.01	Move the right base support cart to its final position ready to accept the right MCHP. Position the AirLoc	0.5						10	2.5			
3.02	Wedgemount in a lowered position. Lift the right side MCHP using the SISSCO crane and position it to be ready to engage the preinstalled				1							checked with primavera
	Type-A flange guide bushings.	1.0						20	2.5			checked with primavera
3.03	Temporary fasteners located adjacent to the alignment bushings can be used to help bring the parts together.	0.0						0	2.5			checked with primavera
3.04	While held by the crane bring the AirLoc Wedgemount leveler up to take the load.	0.0		1				0	2.5			checked with primavera
3.05	Install temporary scaffolding to install flange hardware	1.0						20				checked with primavera
3.06	Install bolts and shims as needed for assembly tolerances.	1.0					$\perp \perp \downarrow$	20				checked with primavera
3.07	Tighten flange fasteners to 50% Perform metrology measurements of all alignment fiducials on both MCHP's. The maximum deviation	1.0			1			20	2.5			checked with primavera
3.00	Perform metrology measurements of all alignment fiducials on both MCHP's. The maximum deviation from the reference points should be .020" or less.	5.0								100	Metrology Staff Budgeted as LOE	checked with primavera
3.09	Perform position adjustments on the right side MCHP if needed. Loosen all studs, adjust AirLock											
	Wedgemounts as needed and install alternate sized shims. Re-torque all studs to 50% and recheck.	2.0						40	2.5			checked with primavera
3.10	Verify position of the VV support hanger locations (top and bottom) on the left and right MCHP. May be	3.0								60	Metrology Staff Budgeted as LOE	checked with primavera
3.11	done as part of 3.08 if 3.09 not needed Remove flange hardware and temporary platforms	1.0						20	2.5	60	metrology Start Budgeted as LOE	checked with primavera
0.11		1.0	1	1	1	<u> </u>		20	د.2			onecked with primavera

WDC	Number: 185								
	Title: Assembly of Field Periods								
Job N	lumbers: 1802, 1810, and 1815								
Job T	itle: FPA Oversight & Support (1802)								
Job T	itle: FPA Operations - Stations 1, 2, & 3 (1810)								
	itle: FPA Operations - Station 5 (1815)								
	Manager: Mike Viola								
JOD I	nanager: wirke viola								
Fabrica	tion and Assembly								
Assum									
	Assumes 5 day workweek 1 shift no overtime								
									+
	Parallel ops for sta 5 (2 fixtures available)								
	Parallel ops for sta 5 (2 fixtures available)								
	Only 1 fixture for station 3 only								
4.00	Parallel ops for sta 2 Install laser screens		\$ 2.0K						checked with primavera
4.00	Establish a global coordinate system based on the full period geometry. Measure the monuments on the		ψ 2.01						checked with phinavera
	MCHP's and on the walls.	2.0					40	Metrology Staff Budgeted as LOE	checked with primavera
4.02	Using metrology and the established global coordinate system place all of the laser screens as called out	2.0			40	2.5			all a street with a street
4.03	in the Stage 3 drawings. Turn each lasers on and with metrology determine their alignment. Record the laser position.	1.0			20	2.5			checked with primavera
4.03	Based on metrology measurements of the screens and lasers the screens path can be defined by the	1.0			20	2.5			checked with primavera
	back office. Print the path on milar paper and using metrology mount the milar on the screens.				0	2.5			checked with primavera
4.05	Disengage the MCHP's by using the left support and adjustor bar to move the left MCHP.	1.0			20	2.5			checked with primavera
4.06	Remove both MCHP's.							Can these stay on the carts and be	
		2.0			40	2.5		rolled all the way back?	checked with primavera
5.00	Install vacuum vessel				0	2.5			checked with primavera
5.01	Remove the adjustor bar support from left side.	0.0			0	2.5			checked with primavera
5.02	Install VV NBI port support stand. Install VVSA to base support and make the connection to the NBI port attachment.	2.0			40	2.5			checked with primavera checked with primavera
5.04	Using metrology take tooling ball readings off the VV shell to properly position the VVSA to the global	1.0			20	2.5			checked with primavera
0.01	coordinate system. Secure the VVSA to the base and at the NBI port support stand.	2.0			40	2.5			checked with primavera
6.00	Install left MCHP over VV				0	2.5			checked with primavera
6.01	Install any bumper protection components on the VV (left and right side) before manipulating left MCHP over the VV.	0.5			10	2.5			checked with primavera
6.02	Move the left base support cart to the far left so it will not interfere with the MCHP installation. Position the	0.5			10				checked with primavera
	AirLoc Wedgemount in a lowered position.	0.0			0	2.5			checked with primavera
6.03	Using the SISSCO actuators with laser guidance move the left MCHP over the VV.	2.0			40	2.5			checked with primavera
6.04	Re-install the left adjustor bar.	0.0			0	2.5			checked with primavera
6.05	Once the MCHP has been moved over the VV bring up Wedgemount levelers to stabilize the unit and take metrology measurements. Make position adjustments to properly align the MCHP.	2.0			40	2.5			checked with primavera
6.06	Transfer the full load to the AirLoc Wedgemount leveler.	0.0			0	2.5			checked with primavera
6.07	Using the adjustor bar on the left side move the MCHP to the left 1/2".	0.0			0	2.5			checked with primavera
7.00	Install right MCHP over VV				0	2.5			checked with primavera
7.01	Move the right base support cart to the far right so it will not interfere with the MCHP installation. Position	0.0				2.5			checked with primavera
7.02	the AirLoc Wedgemount in a lowered position. Using the SISSCO actuators with laser guidance move the right MCHP over the VV TO WITHIN 1/2" OF								checked with primavera
	ITS FINAL POSITION and pause. Go to the next step.	2.0			40	2.5			checked with primavera
7.03	Using the adjustor bar on the left side move the left MCHP to its final position.	0.5			10	2.5			checked with primavera
7.04	With the left MCHP in place, move the right side MCHP using the CISSCO crane and position it to be ready to engage the preinstalled Type-A flange guide bushings.	0.5			10	2.5			checked with primavera
7.05	Temporary fasteners located adjacent to the alignment bushings can be used to help bring the parts	0.5			10				ondoked with primavera
	together.	0.0			0	2.5			checked with primavera
7.06	While held by the crane bring the AirLoc Wedgemount leveler up to take the load.	0.5			10	2.5			checked with primavera
7.07	Remove the laser screens to provide more floor space for scaffolding.	0.0			0	2.5			checked with primavera
7.08	Install temporary scaffolding to install flange hardware Install bolts and all alumina and inboard weld shims.	4.0			80	2.5			checked with primavera checked with primavera
7.09	Install bots and all alumina and inboard weld snims. Tighten flange fasteners to 50%	1.0			20	2.5			checked with primavera
7.10	Make a hand "wiggle" test (rotate on bolt) on all shims to make sure that they are tight. If a loose shim is	1.0			20	ن.2			oncoked with primavera
	found back off on sufficient adjacent bolts to allow a replacement shim to be inserted. Tighten bolt and								
7.10	recheck.	1.0			20	2.5			checked with primavera
7.12	Perform metrology measurements of all alignment fiducials on both MCHP's. The maximum deviation from the reference points should be .020" or less.	5.0					100	Metrology Staff Budgeted as LOE	checked with primavera
7.13	Perform position adjustments on the right side MCHP if tolerance is not met. Loosen all studs, adjust	0.0							
	AirLock Wedgemounts as needed; install alternate sized shims. Re-torque all studs to 50% and recheck.					0.5			all and a standard the standard as
7.14	Remove SISSCO actuator from right MCHP.	3.0			60	2.5			checked with primavera
	One hole at a time, remove the supernut. Using the eccentric gage slid onto the stud define the hole	0.0				2.5			checked with primavera
1	eccentricity. Select bushing and machine to match required eccentricity. Install bushing. Replace nut and								
	tighten back to 50% and recheck alignment. Total 10 days 7 days to pre fit & fab bushings (in parallel with other tasks) and 3 days to install	10.0			200	2.5			checked with primavera
	outer tasks janu 5 uays to Ilistali	10.0			200	2.0			onconce with primavera

VBS Number: 185							
VBS Title: Assembly of Field Periods							
ob Numbers: 1802, 1810, and 1815							
ob Title: FPA Oversight & Support (1802)							
ob Title: FPA Operations - Stations 1, 2, & 3 (1810)							
ob Title: FPA Operations - Station 5 (1815)							
bb Manager: Mike Viola							
ob Manager. Mike viola							
brication and Assembly				 			
ssumptions:							
Assumes 5 day workweek 1 shift no overtime							
Parallel ops for sta 5 (2 fixtures available)							
Parallel ops for sta 5 (2 fixtures available)							
Only 1 fixture for station 3 only							
Parallel ops for sta 2							
7.16 Tighten nuts 100%. Measure before welding adequate coil alignment and fit-up of shims	1.0			20	2.5		checked with primavera
3.00 Weld all inboard shims				0			checked with primavera
8.01 Follow a predefined weld sequence at all MC's and partially weld the inboard shim. Perform weld peening	45.0			300	2.5		electrical control of
operation. Perform a metrology measurement to re-verify coil alignment. 3.02 Final complete MC scan to verify period alignment.	15.0			300		Metrology Staff Budgeted as LOE	checked with primavera
2.00 VVSA attachment to MC.	5.0				100	Metrology Starr Budgeted as LOE	checked with primavera
				0	2.5		checked with primavera
bottom of the Type-A MC.	2.0			40	2.5		checked with primavera
2.02 Attach temporary VV vertical supports to the MC at the two connection points at the top and bottom of the Type-B MC.	1.0			20	2.5		checked with primavera
1 Type-B MC. Disconnect base support and transfer load to VV vertical supports.	1.0			20			checked with primavera
9.04 Install VV lateral supports and align VVSA to modular coils	4.0			80			checked with primavera
Prepare VVSA for transport. Install blocking as required to prevent any motion relative to the modular							
coils.	2.0			40	2.5		checked with primavera
0.00 Transfer Period to NCSX test cell.				0	2.5		checked with primavera
0.01 Install crane rigging to MCWF and transfer the unit to the transfer support frame. Secure Period /support frame to the transporter.	2.0			80	5.0		checked with primavera
0.02 Transfer completed Period to Station 5 located in NCSX test cell.	1.0			40			checked with primavera
Subtotal FP#1	115	5		1990	500	2495	checked with primavera
Station 3-Assemble Mod Coils and VVSA-FP#2							checked with primavera
Perform above sequence	115	\$ 5.0K		1990	2.6 500.0		checked with primavera
Station 3-Assemble Mod Coils and VVSA-FP#3	10	Ţ 0.0.t			0 000.0		checked with primavera
Perform above sequence	115	\$ 5.0K		1990	2.6 500.0		
remonii above sequence	113	λυ.c ¢		1990	2.0 500.0		checked with primavera

WRS	Number: 185					1										
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	Title: Assembly of Field Periods															
	umbers: 1802, 1810, and 1815															
Job T	itle: FPA Oversight & Support (1802)					J										
Job T	itle: FPA Operations - Stations 1, 2, & 3 (1810)															
	itle: FPA Operations - Station 5 (1815)															
														-		
JOD I	lanager: Mike Viola															
Fabrica	tion and Assembly															
Assum					1	1										
						Į.										
	Assumes 5 day workweek 1 shift no overtime							1								
	Parallel ops for sta 5 (2 fixtures available)															
	Parallel ops for sta 5 (2 fixtures available)															
	Only 1 fixture for station 3 only															
	Parallel ops for sta 2															
																checked with primavera
		Work	SWI	STK	TRVL	OT	ORNL EM/DSN	HTB	1EM	MSM	MSB		EMTB	t Crew		
	TASK DESCRIPTION	days	4	37	35	310	유	당						ğ	Basis of Estimate	checked with primavera
															Shop based on similar tasks,	
															tempered (adjusted) for complexity of	
											الصل				having to do all welds from inside of	
1.1	IOAE E'-LI D-e'- I AI I- O(-t' E (' NOOV TO) V(O) A															checked with primavera
Job:	815 - Field Period Assembly Station 5 (in NCSX TC)-VIOLA															checked with primavera
	Station 5- Final FP Assy -FP#1 (in NCSX TC)															checked with primavera
	metrology network		\$ 7.0K										60			checked with primavera
	Bolt on 2 Port Extensions needed for first Plasma diagnostics	1.0											16 2.	0	10" ports provided by WBS 38	checked with primavera
	MTM NCR Hardware repurchase (bolt kits & cover plates)		\$ 42.0K													checked with primavera
	Weld Wire & weld supples		\$ 15.0K								 					checked with primavera
	Testout Sta 5 equipt & procedures	5.0											60 4.			checked with primavera
	Check 3 sled interfaces adjust holes Fixtures installed - final metrology	12.0 6.0							-				84 4. 92 4.			checked with primavera checked with primavera
	Miscellaneous for tooling	6.0	1									I	92 4.	U	\$ 1.027.8K	checked with primavera
-	Station 5 preinstallation in parallel												_		Ψ 1,027.010	checked with primavera
1.00	Component preparations					1		ı			1 1					checked with primavera
1.01	The short dome port (the one on the top of the dome) needs to cut off near the dome. The longest port		1													checked with primavera
	can remain.	2.0											40 2.	5		checked with primavera
1.02	Install heat tape and theomocouples on all ports.														Covered in Station 2 LED: Reversed	
		0.0											0 2.		order of 1.02 & 1.03	checked with primavera
1.03	Install insulation system around all ports.	0.0						ı					0 2.		Covered in Station 2	checked with primavera
	Install insulation system around all ports.	0.0											0 2.			checked with primavera
2.00	Install heat tape and theomocouples on all ports. Pre-Installation set-up	0.0	1										0 2.	5		checked with primavera
2.00	Install period support fixture	2.0	1						1				40 2.	5		checked with primavera checked with primavera
2.02																oncokeu with primavera
	Install FPA on support stand. Use leveler pad to engage base of MC. Add bolts to secure in place.	2.0											40 2.			checked with primavera
2.03	Install external working platforms	4.0											80 2.		·	checked with primavera
2.04	Install internal VV working platforms	3.0	1										60 2.	5		checked with primavera
	VV port installation													1		checked with primavera
3.01	Install the domes (left and right side), inserting the long dome port through the MC opening, and weld the dome shell to the VV.	2.0											40 2.	5		checked with primavera
3.02	install small dome ports and remaining circular ports. Use a guide tool located at the MC hole opening to help support and center the port. Ports should already have insulation, heater tape and thermocouples on	30.0														
3.03	them. Leak check each port immediately after it is welded.	30.0											00 2. 00 2.			checked with primavera checked with primavera
	Install port boot seal assembly	30.0			- 1						1	ь	00 2.	3		checked with primavera
4.00	Install boots on all ports except for the two port 4's.	16.0						_			1	3	20 2.	5		checked with primavera
	MC lead and coolant connections	10.0			1											checked with primavera
5.01	Install MC lead connections on each of the MC's and temporally position the leads so they will not															
	interfere with the TF coil installation and for routing through the PF structure.	6.0											72 1.	<mark>5</mark>	in parallel with 5.02	checked with primavera
5.02	Install MC coolant lines on each MC and position them for the TF installation and routing through PF structure.	12.0										2	40 2.	5		checked with primavera
5.03	Platforms may need to be altered or moved for the installation of the TF coils.	3.0											40 2. 60 2.			checked with primavera
	TF installation - right side	3.0			1								2.			checked with primavera
6.01	Rotate two individual TF coils over the MC on the right side and temporarily support them off the Type-B	1	1													
	and C MC's.	2.0											40 2.	5		checked with primavera
								_		_			_		-	

WRS	Number: 185								
	Title: Assembly of Field Periods								
	Numbers: 1802, 1810, and 1815								
	Fittle: FPA Oversight & Support (1802)								
	Title: FPA Operations - Stations 1, 2, & 3 (1810)								
	Fitle: FPA Operations - Station 5 (1815)								
Job I	Manager: Mike Viola								
Fabric	ation and Assembly								
	ptions:								
	Assumes 5 day workweek 1 shift no overtime				· · · · · · · · · · · · · · · · · · ·				
	Parallel ops for sta 5 (2 fixtures available)								
	Parallel ops for sta 5 (2 fixtures available)								
	Only 1 fixture for station 3 only				<u> </u>				
	Parallel ops for sta 2								
6.02	Attach the temporary support at the end of the Type-C MC used to unload the a pair of center supports.	1.	0			20	2.5		checked with primavera
6.03	Lower leveler pad to disengage base of MC on the right side. Remove right side leveler pad and intermediate support.	0.	0			0	2.5		checked with primavera
6.04	Install TF support brackets (top & bottom) to the port 12 side on the Type-A MC (platforms will be needed).	2.	o			40	2.5		checked with primavera
6.05	Slide the first TF assembly against the TF support bracket and secure in place with the mating support								
6.06	bracket. Install TF support brackets (top & bottom) to the port 12 side on the Type-B MC.	1. 2.		+		20 40	2.5		checked with primavera checked with primavera
6.05	Slide the second TF assembly against the support bracket and secure in place with the mating support			+	+ + + + + + + + + + + + + + + + + + + +				checked with primavera
	bracket.	1.	0			20	2.5		checked with primavera
6.08	Install machine support plates (inboard and outboard) on the bottom, spanning two TF coil support brackets.	3.	n			60	2.5		checked with primavera
6.09	Reinstall leveler pad to engage base of MC on the right side.	0.				0	2.5		checked with primavera
6.10	Installed one side of the TF support brackets on the Type-C coil (top and bottom) for the TF installation to	4				20	2.5		
7.00	occur at Station 6. TF installation - left side	1.	U			20	2.5		checked with primavera checked with primavera
7.01	The TF installation on the left side will follow the same ten (10) steps that were followed on the right side.	13.	0			260	2.5		checked with primavera
8.00	TF fit-up check								checked with primavera
8.01	Perform a fit-up check of the four TF coils to determine if they can be positioned within tolerances.	5.	0			100	2.5		checked with primavera
9.00	Install Ports 4 Tack weld the left and right port 4's. Use a local laser attached to the port cover to define the port								checked with primavera
9.01	trajectory and to aid positioning in port during welding.	2.	0			40	2.5		checked with primavera
9.02		4.	0			80	2.5		checked with primavera
	Installation of PF structural members and routing of MC coolant and leads.								checked with primavera
10.01	Install the PF coil support structure that surround the TF coils. In doing this the MC leads and coolant lines need to be routed to the outside of the PF structure. PF structure is only partially installed at the Type-C MC's.	8.	0			160	2.5		checked with primavera
11.00	MC header installation and coolant connections	-	_						checked with primavera
11.01	Install the MC coolant manifold outside of the PF structure in the area of PF6.	3.	0			60	2.5		checked with primavera
11.02	Connect all MC coolant lines to the manifold (40 lines top and bottom)	20.	0			400	2.5	Flex lines but need field supports installed	checked with primavera
	Diagnostic								checked with primavera
12.01	Install Rogowski coils on the end of the VV, left side. Route leads through space between port 8 and	5.	0			100	2.5		checked with primavera
13.00	spool port opening and coil onto shell of MC for future routing Final measurements	5.	U			100	2.0		checked with primavera
13.01	Obtain a set of Period 1 alignment fiducial positions to use in locating the VV within the MC.	5.	0				100	Metrology Staff Budgeted as LOE	checked with primavera
13.02	Using the laser tracker, align to tooling balls on each MCHP, locking into a minimum of 8 of them.	1.					20	Metrology Staff Budgeted as LOE	checked with primavera
13.03	Using monuments on the VV for alignment, bring the VV into proper alignment. Make final adjust in the VV supports to secure VV in place.	4.				80	2.5		checked with primavera
13.04	Install or identify three primary fiducials that will be used in positioning the Period in Station 6.	2.	0			40	2.5		checked with primavera
13.05	Make a final measurement of all fiducials, the VV end flanges and the Type-C MC end flanges. Record the results.	5.	0				100	Metrology Staff Budgeted as LOE	checked with primavera
	Final Acceptance tests								checked with primavera
	Check Assembly (bolts, etc)	5.				100	2.5		checked with primavera
13.12	Check Diagnostics (Loops, thermocouples)	5.				100	2.5		checked with primavera
13.13	Check manifolds (pressure, flow, etc.) Check 6 modcoils (voltage etc)	5. 6.		-		100	2.5		checked with primavera checked with primavera
13.14		3.		+		120	2.5		checked with primavera
13.16	Check TF coils (voltage etc)	6.				120	2.5		checked with primavera
	Transfer Period to final assembly (Station 6).								checked with primavera
14.01	Install crane rigging to completed Period assembly	2.				40	2.5		checked with primavera
14.02	Remove platforms Transfer completed Period to Station 6 located in NCSX test cell.	1.		+		20	2.5		checked with primavera checked with primavera
. 7.03	Transfer sempleted I ende to station vilocated in 1400A test cell.	2.	~ <u>I</u>		1 1 1	40	۷.5		oneoked with primavera

WBS Number: 185								
WBS Title: Assembly of Field Periods								
Job Numbers: 1802, 1810, and 1815								
Job Title: FPA Oversight & Support (1802)								
Job Title: FPA Operations - Stations 1, 2, & 3 (1810)								
Job Title: FPA Operations - Station 5 (1815)								
Job Manager: Mike Viola								
Fabrication and Assembly								
Assumptions:								
Assumes 5 day workweek 1 shift no overtime								
Parallel ops for sta 5 (2 fixtures available)								
Parallel ops for sta 5 (2 fixtures available)								
Only 1 fixture for station 3 only								
Parallel ops for sta 2								
Install on support platform (incl in job 7503)								checked with primavera
subtotal	196	0			4472	220	\$ 4,692.0K	checked with primavera
Station 5- Final FP Assy -FP#2 (in NCSX TC)								checked with primavera
Repeat steps for FP #1	196	\$ -			4472	220		checked with primavera
Station 5- Final FP Assy -FP#3 (in NCSX TC)	i i							checked with primavera
Repeat steps for FP #1	196	\$ -			4472	220		checked with primavera

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Job Title: FPA Oversight & Support (1802)

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Job Title: FPA Operations - Station 5 (1815)

Job Manager: Mike Viola

Uncertainty of the Esti	mate				
Job 1802	<u>High</u>	<u>Medium</u>	Low	Uncertainty Range (%) -10%/+15%	Comments/Other Considerations
Design Maturity Design Complexity	X	x			LOE work based on recent NCSX experience LOE work based on recent NCSX experience, but complex processes
Job 1810 Station 1 Maturity Complexity	x	x		-10%/+15%	VV #1 actual experience - very near completion Requires field adjustments & tight metrology requirements which necessitates "back office" support
Station 2 Maturity Complexity	x		x	-30%/+60%	Still at conceptual design for all aspects of joint Challenging all aspects of engineering - W&-X experience also indicates FPA is the most challenging task
Station 3 Maturity Complexity	x		x	-30%/+60%	Still at conceptual design for all aspects of joint Challenging all aspects of engineering - W7-X experience also indicates FPA is the most challenging task
Job 1815 Design Maturity Design Complexity		X	x	-20%/+40%	Standard welding techniques adjust for welding in tight confines inside vessel Welding vessel while using metrology for measuring distortion

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

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Job Manager: Mike Viola

		Likelihood of			Cost In	npact	Schedule Im	pact
Job	Risk Description	Occurring	Mitigation Plan	Basis of estimate	Low	High	Low	High
perso	s or prolonged unavailability of certain key onnel (Viola or Perry) from the project could stantially impact the schedule.	VU	Viola and Perry will be cross- trained such that each could od the other's job	Estimated impact is <1 months on the critical path. Cost estimates cover 0-1 months of near term FPA assembly (in addition to the standing army costs addressed under schedule impact).	+ \$0	+ \$150	+ 0.00	+ 0.50
beco	ck office" support for FPA and final assembly omes a chronic bottleneck, stretching out the required to complete assembly operations	VU	Additional support budgeted for Brown, Brooks, and Ellis providing "2 deep" back office support. Should be available to mitigate peak demands once training in key skills is completed.	of FPA/final assembly.	+ \$0	+ \$600	+ 0.00	+ 2.00
	ular coil damaged during assembly requiring ificant rework to coil	VU	Equipment will be handled during FPA using carefully constructed procedures to minimize likelihood of damage.	Nominally repaired with a 2- man crew within 2 weeks	+ \$10	+ \$20	+ 0.00	+ 0.50
	surface component (coolant tube, flux loop, or damaged during FPA requiring significant ork	VU	Equipment will be handled during FPA using carefully constructed procedures to minimize likelihood of damage.	Nominally repaired with a 2- man crew within 2 weeks	+ \$10	+ \$20	+ 0.00	+ 0.50

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Unacceptable distortion in a field period when welding modular coil shims requiring	VU	Likelihood of occurrence is very unlikely as a result of extensive welding R&D and careful monitoring during welding.	Cut apart and re-weld two coils back together. Nominally a 2.5-man crew in 12 weeks.	+ \$25	+ \$35	+ 0.75	+ 1.25
Field period damaged during loading, transport, or unloading from TFTR TC to NCSX TC	NC	Extreme care will be taken when transporting a field period renering this event extremely unlikely.	Crisis event not covered by contingency				
Metrology equipment and general purpose tooling/ lifting equipment (e.g.cranes) not available to support the schedule	U	Maintenance contract mitigates impact of metrology equipment. Additional \$200K budgeted for a 3rd laser tracker and/or spare metrology equipment. Should result in improved efficiency.	and critical path. FPA cost impact assumed to be \$300k/mo.	+ \$0	+ \$150	+ 0.00	+ 0.50
1815 Metrology equipment and general purpose tooling/ lifting equipment (e.g.cranes) not available to support the schedule	U	Maintenance contract mitigates impact of metrology equipment. Additional \$200K budgeted for a 3rd laser tracker and/or spare metrology equipment. Should result in improved efficiency.	and critical path. FPA cost impact assumed to be \$300k/mo.	+ \$0	+ \$150	+ 0.00	+ 0.50

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		nwobamua

NC

Welds will be leak checked Impacts of having a few leaks during FPA when leaks can be is covered in estimate addressed without significantly uncertainty with present impacting the critical path. mitigation plan

Likelihood of many leaks appearing during initial pumpdown is considered extremely unlikely with this

mitigation plan.

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 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.
- [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%)

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Job Title: FPA Operations - Station 5 (1815)

Job Manager: Mike Viola

EWI Budgetary Proposal No. 50782GTH Date: June 5, 2007

Submitted to: Princeton Plasma Physics Lab

Title: On-Site Design Review and Sample Evaluation

Objectives: Discuss design for welding with minimal distortion meeting minimum fatigue requirements Perform evaluation of welds on test specimen.

Approach:

- 1. Design review with Bill Mohr from EWI in Princeton, New Jersey, followed up with a written report. Dr. Mohr has extensive experience in fitness-for-service assessment, design, and fatigue of welded structures. This will be an opportunity to validate your considerations regarding distortion, allowable stresses, and other design concerns.
- 2. A sample weld to be evaluated at EWI using ultrasonic and radiographic testing. Macros will be
- generated and evaluated and a report will be sent.

 3. Recommendation for additional work will be made after the design review and test weld

A report will be written summarizing the results of the design review. Lab results, macros and a summary of explanation will be delivered with recommenda

Program Budget and Duration:

The above work can be completed with a price of \$18,075. The work is planned for a period of 20 days after receipt of purchase order and any required materials. This quotation is firm fixed price for the work scope outlined in the proposal and, once accepted, will not be changed without the concurrence of both parties. It is understood that if the Client requests an expanded work scope, EWI will quote the cost and timing to complete the additional work.



Notes
1 - Labor rates are fully burdened
2 - EWI indirect rates are ACO approved provisional rates



Edison Welding Institute Support of Test Welding Program

ORNL Updated Title III Engineering (6/8/2007)

Station tation 2	No. start date Oct-07	end date Mar-09	days 517.00	weeks	2954	st peric 21 591	nd peri 3t 394	hd period	1182	ENGR I	Designe T 591	otal hrs		
ation 3	Feb-08	Jul-09	516.00	74	2949	491	295	98	885	442	442	885	_	
ation 5	Apr-08	Sep-09	518.00	74	2960	493	296	99	888	444	444	888	Station 2 to 5 (FPA -	otal Ho
ation 6	Jun-09	Oct-10	487.00	70	2783	742	557	371	1670	1670	835	2505	Station 6 (Fnl Mach A	25
	Assume each period is 1/	/3 of the number of week	701 (S	100	4006 1s 2r 3t	tation 2 st period and period hd period	60% 60° 40% 40° 20% 20°	werage % Engr/Dsn % Engr/Dsn % Engr/Dsn		T Job 1802 J \$4,500 \$9,000 \$4,500	F)	/2007 /2008 /2009 /2010		
						NGR esigner	50% Ave							
					St	tation 3		verage % Engr/Dsn						
						0	30% 30%	% Engr/Dsn						
						0	10% 109	% Engr/Dsn						
						NGR esigner	50% Ave							
					St	tation 5		verage % Engr/Dsn						
						0		% Engr/Dsn						
						0	10% 109	% Engr/Dsn						
						NGR esigner	50% Ave							
					Si	tation 6		verage % Engr/Dsn						
						0		% Engr/Dsn						
						0	40% 409	% Engr/Dsn						
						NGR esigner	100% Ave							