NCSX Work Approval Form (WAF)

WBS Number: 142
WBS Title: Windings and Assembly
Job Number: 1421
Job Title: Design of Modular Coil Interfaces
Job Manager: David Williamson

Description:

Job 1421 consists of the effort to design the modular coil interfaces, including R&D.

Schedule:

Approvals:

David Williamson
2007.07.12 10:52:37 -04'00'

Job Manager — Date

Brad Nelson
Digitally signed by Brad Nelson
DN: cn=Brad Nelson, c=US, o=ORNL, ou=FED, email=nelsonbe@ornl.gov
Date: 2007.07.13 08:33:10 -04'00'

Responsible Line Manager — Date

Hutch Neilson
Digitally signed by Hutch Neilson
DN: CN = Hutch Neilson, C = US, O = PPPL
Date: 2007.07.13 12:14:47 -04'00'

Project Manager — Date

Mike Williams
Digitally signed by Mike Williams
DN: cn=Mike Williams, o=PPPL, ou=Engineering, email=williams@pppl.gov, c=US
Date: 2007.07.13 12:20:07 -04'00'

Engineering Department Head — Date

NCSX June 2007 ETC
TABLE I - DESIGN LABOR

WBS Number: 142
WBS Title: Windings and Assembly
Job Number: 1421
Job Title: Design of Modular Coil Interfaces
Job Manager:David Williamson

Description:
Title I, II and III Engineering for design of the modular coil interfaces.

NOTE: Title III for these components is included in Job 1802

FY07$K

Task ID		41MS	48MS	37STK	35TRVL	31OT	ORNL EM	EMEM	EMSM	EMSB	EMTB	EAEM	EASB	EEEM	EESM	Basis of Estimate
																see Table V - Basis of Estimate
Outboard Interface Design							60									see Table V - Basis of Estimate
IH4-020	Prepare outboard shim dwgs and release						40									see Table V - Basis of Estimate
INTRF-045	FDR outboard shims						60									see Table V - Basis of Estimate
	Resolve CHITs and issue shim drawings															see Table V - Basis of Estimate
																see Table V - Basis of Estimate
Bolted Joint Tests																see Table V - Basis of Estimate
	Tension Tests of Bolted Joint															see Table V - Basis of Estimate
1421-3067	Procure 2 studs f/joint test.Use existing part							8								see Table V - Basis of Estimate
1421-3075	Setup test fixture &perform JHA & pre-job brief							8								
1421-3077	Meas joint deflect vs preload & loss of preload							24								see Table V - Basis of Estimate
1421-3079	Measure joint deflec & preload v. temp @80K							24								see Table V - Basis of Estimate
1421-3084	Measure joint deflection&preload v. cooldown cyc							24								see Table V - Basis of Estimate
1421-3087	Perform pullout tests for tapped holes							24								
1421-3081	Meas joint deflect & preload v. time (days) at R							160								see Table V - Basis of Estimate
1421-3090	Document&conduct review of test results							40								see Table V - Basis of Estimate
																see Table V - Basis of Estimate
	Bolt Shear Test at 77k															see Table V - Basis of Estimate
1421-3112B	Procure/fab parts for test&initial assembly						40									see Table V - Basis of Estimate
1421-3115B	Assemble & test						320									see Table V - Basis of Estimate
1421-3119B	Document test results						80									see Table V - Basis of Estimate
																see Table V - Basis of Estimate
Inboard Interface Design																see Table V - Basis of Estimate
IH1-001	Coil to coil analysis						520									see Table V - Basis of Estimate
1421-3125	Determine geometry&location of high COF shims&pl						80									
1421-3127	Structural analyses to performance rqmts for bol						240									see Table V - Basis of Estimate
1421-3132	PDR to review requirements, design,&development						40									
																see Table V - Basis of Estimate
AB/BC/AA welded joints																see Table V - Basis of Estimate
	Prepare winding form mods for weld clamping bolts						300									see Table V - Basis of Estimate
INTRF-050	Complete Shim fabrication drawings (ORNL)						240									see Table V - Basis of Estimate
	Release information for procurement of shim material						24									
INTRF-055	FDR AB/BC/AA inboard shims						40									see Table V - Basis of Estimate
																see Table V - Basis of Estimate
CC bolted joint																see Table V - Basis of Estimate
IH1-000	ESTABLISH CONCEPT						680									see Table V - Basis of Estimate
IH1-0000	PEER REVIEW OF JOINT CONCEPT						80									see Table V - Basis of Estimate
	Add bolt holes to C winding form for CC interface						140									see Table V - Basis of Estimate
	Bolt Reach and Access study (mockup)						200									see Table V - Basis of Estimate
	Prepare CC shim drawiings and release						360									see Table V - Basis of Estimate
	FDR CC inboard shims						40									see Table V - Basis of Estimate

NCSX June 2007 ETC
TABLE I - DESIGN LABOR

WBS Number: 142																
WBS Title: Windings and Assembly																
Job Number: 1421																
Job Title: Design of Modular Coil Interfaces																
Job Manager:David Williamson																
Welded Joint Tests																
	Procedure															
INTRF-035	PPPL Determine shim material						40								see Table V - Basis of Estimate	
INTRF-001	PPPL buy SS plate for weld trials						8								see Table V - Basis of Estimate	
INTRF-005	Weld distortion trials at PPPL on SS plate						40								see Table V - Basis of Estimate	
INTRF-025	ORNL build pywood mockup of flange					140									see Table V - Basis of Estimate	
INTRF-030	ORNL verify weld access, develop alternate welding methods					40									see Table V - Basis of Estimate	
INTRF-010	Develop Weld Geometry Procedure					40									see Table V - Basis of Estimate	
	Test															
INTRF-015	Weld trials on two MCWF's at PPPL						80								see Table V - Basis of Estimate	
INTRF-020	Document results and update weld procedure						120								see Table V - Basis of Estimate	
Overall interface																
INTRF-040	Analysis of tensil loads (ORNL)					320									see Table V - Basis of Estimate	
1421-3134	Develop specs & dwgs for station 2 &3 assy					300									see Table V - Basis of Estimate	
1421-3136	Conduct MC interface FDR incl job 1416					40									see Table V - Basis of Estimate	
1421-3138	Resolve issues, release assembly drawings					240									see Table V - Basis of Estimate. **Specs in Job 1806**	
FY07 Rebaseline exercise																
ECP53RBX05	FY07 Rebaseline Exercise					256										
Travel																
	trips for ORNL personnel to PPPL			$9k											6 trips at $1500 avg	
	trips for PPPL personnel to UT MDL			$3k											2 trips at $1500 avg	
	SUBTOTAL			$12k		4960	600									
unlisted, known labor hours																
	scheduled and unscheduled meetings/reporting/presentations (@ 25%)					1240	150								see Table V - Basis of Estimate	
	TOTAL			**$12k**		**6200**	**750**									

NCSX June 2007 ETC
TABLE II - Materials and Subcontracts

WBS Number: 142					
WBS Title: Windings and Assembly					
Job Number: 1421					
Job Title: Design of Modular Coil Interfaces					
Job Manager:David Williamson					
Materials and Supplies					
			M&S-k$		
1421-3067	Procure 2 studs f/joint test.Use existing part		$1k	Based on stud quotation	
1421-3112	Test fixture for fatique testing		$10k	Based on fabrication estimate for hardware, see detail below	
IH1-001	Coil to coil analysis		$36k	Based engineering judgement for subcontract, see details below	
INTRF-001	PPPL buy SS plate for weld trials		$31k	Based on $15/lb SS plate, see detail below	
INTRF-005	Weld distortion trials at PPPL on SS plate		$1k	engr judgement for consumables	
INTRF-025	ORNL build plywood mockup of flange		$30k	Based on est costs for subcontract, see detail below	
INTRF-030	ORNL verify weld access, develop alternate welding methods		$20k	Based engineering judgement for subcontract, see details below	
	ORNL verify CC bolt reach access		$19k	Based engineering judgement for subcontract, see details below	
INTRF-015	Weld trials on two MCWF's at PPPL		$1k	engr judgement for consumables	
	TOTAL		$149k		

WBS Number: 142					
WBS Title: Windings and Assembly					
Job Number: 1421					
Job Title: Design of Modular Coil Interfaces					
Job Manager:David Williamson					
	Details				
	Test fixture for fatique testing				
	SST plate, G11 bushings and insulators material			$6k	
	LN2 can, bellows, support struts, G10 rods			$4k	see detail bill of matls below
				$10k	
	Analysis subcontract				
	12 weeks x 50% time	240	hours	$36k	
	stainless steel plate				
	1.5"x 4' x 8' plate @ $15/lb	2070	lbs	$31k	
	plywood mockup				
	plywood, paint, etc.	1	lot	$3k	
	labor, technicians	240	hours	$18k	2 techs for 3 weeks
	labor, supervision	60	hours	$9k	half time for 3 weeks
	total est. for contract			$30k	
	ORNL verify weld access				
	weld consumables	1	lot	$2k	weld wire, gas, etc.
	labor, technicians	160	hours	$12k	2 techs for 2 weeks
	labor, supervision	40	hours	$6k	half time for 2 weeks
	total est. for contract			$20k	
	ORNL verify CC bolt access				
	wood, glue, etc	1	lot	$1k	
	labor, technicians	160	hours	$12k	2 techs for 2 weeks
	labor, supervision	40	hours	$6k	half time for 2 weeks
	total est. for contract			$19k	

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Parts List For NSCX Shear testing:

Item	Description	Part number	Supplier	quantity	cost/item	Total Price	phone number
1	Del Seal CF Flanges - 4-1/2 Inch OD	110018 (Ref# 450000)	MDC	1	$48.00	$48.00	800-443-8817
2	4.5 OD half nipple with clearance holes	401004 (Ref# 150-1)	MDC	1	$110.00	$110.00	800-443-8818
3	Bellows (2" ID, 4.5" OD)	400005 (Ref# 250-x)	MDC	1	$330.00	$330.00	800-443-8819
4	Copper Gasket (4.5" flange)	191009 (Ref# GK-250)	MDC	12	$24.00	$288.00	800-443-8820
5	18" X 12" X 18.125" Stainless stell batch can	3763K221	McMaster	1	$524.53	$524.53	404 629-6500
6	Semi-Ridgid PVC insulation (low density 3/8")	9318k74	McMaster	4	$27.42	$109.68	405 629-6500
7	Vibration Damping Clamps	3015T133	McMaster	6	$20.56	$123.36	406 629-6500
8	18-8 Hex Head Cap Screws (4.25" long)	92240A559	McMaster	2	$21.42	$42.84	407 629-6500
9*	3" X 1.5" T-slotted Extrusion (cut to 19" long)	unknown	BertleKamp	4	unk	unk	865 588-7691 Wendel Copper
10*	3" X 1.5" T-slotted Extrusion (cut to 20" long)	unknown	BertleKamp	2	unk	unk	866 588-7691 Wendel Copper
9-10 alternative	This part can be orederd from mcmaster as "Aluminum Fractional T-Slotted Framing Svtems" **We cut it to size ourselves**	47065T138	McMaster	2	$76.60	$153.20	407 629-6500
11	G-10/FR4 Rod (3/16" diameter) sold by the foot	8669K23	McMaster	6	$3.03	$18.18	408 629-6500
10	1.5" diameter (17-4 PH) stainless precision ground rod (6' long) **see if you can get 4 feet long**	9095K25	McMaster	1	$290.81	$290.81	409 629-6500
11	2.0" diameter 4140 steel rod (12" long)	8935K151	McMaster	1	$38.81	$38.81	410 629-6500
12	2.5" diameter 4140 steel rod (12" long)	8935K191	McMaster	1	$56.15	$56.15	411 629-6500
13	4-48 NF Tap (Plug) **ask Joe/Jim if this is ok for them.**	2522A775	McMaster	3	$4.29	$12.87	412 629-6500
14	4-48 Socket Cap screws (3/8" long)	91251A836	McMaster	1	$8.40	$8.40	413 629-6500
15	Schaevitz LVDT's (GCA-121-125)	2350500	Schaevitz	4	$365.00	$1,460.00	800 745-8008
					Total Cost	$3,614.83	

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FY07$K

Task ID		Comments	41MS	48MS	37STK	35TRVL	31OT	EMSM	EMTB	EASB	EEEM	EESM	EESB	EETB	ECEM	ECSB	ECTB	RM2	RM3	Basis of Estimate
Outboard Interface Design																				
IH4-020	Prepare outboard shim dwgs and release								0											see Table V - Basis of Estimate
INTRF-045	FDR outboard shims								0											see Table V - Basis of Estimate
	Resolve CHITs and issue shim drawing								0											see Table V - Basis of Estimate
Bolted Joint Tests																				
	Tension Tests of Bolted Joint																			
1421-3067	Procure 2 studs f/joint test.Use existing part								48											see Table V - Basis of Estimate
1421-3075	Setup test fixture &perform JHA & pre-job brief								16											see Table V - Basis of Estimate
1421-3077	Meas joint deflect vs preload & loss of preload								24											see Table V - Basis of Estimate
1421-3079	Measure joint deflec & preload v. temp @80K								24											see Table V - Basis of Estimate
1421-3084	Measure joint deflection&preload v. cooldown cyc								24											see Table V - Basis of Estimate
1421-3087	Perform pullout tests for tapped holes								24											see Table V - Basis of Estimate
1421-3081	Meas joint deflect & preload v. time (days) at R								160											see Table V - Basis of Estimate
1421-3090	Document&conduct review of test results								0											see Table V - Basis of Estimate
	Bolt Shear Test at 77k																			
1421-3112B	Procure/fab parts for test&initial assembly								0											see Table V - Basis of Estimate
1421-3115B	Assemble & test								100											see Table V - Basis of Estimate
1421-3119B	Document test results								0											see Table V - Basis of Estimate
Inboard Interface Design																				
IH1-001	Coil to coil analysis								0											see Table V - Basis of Estimate
1421-3125	Determine geometry&location of high COF shims&pl								0											see Table V - Basis of Estimate
1421-3127	Structural analyses to performance rqmts for bol								0											see Table V - Basis of Estimate
1421-3132	PDR to review requirements, design,&development								0											see Table V - Basis of Estimate
	Conduct MC interface FDR																			see Table V - Basis of Estimate
AB/BC/AA welded joints																				
	Prepare winding form mods for weld clamping bolts								0											see Table V - Basis of Estimate
INTRF-050	Complete Shim fabrication drawings (ORNL)								0											see Table V - Basis of Estimate
	Release information for procurement of shim materia								0											see Table V - Basis of Estimate
INTRF-055	FDR AB/BC/AA inboard shims								0											see Table V - Basis of Estimate
CC bolted joint																				
IH1-000	ESTABLISH CONCEPT								0											see Table V - Basis of Estimate
IH1-0000	PEER REVIEW OF JOINT CONCEPT								0											see Table V - Basis of Estimate
	Add bolt holes to C winding form for CC interface								0											see Table V - Basis of Estimate
	Bolt Reach and Access study (mockup								0											see Table V - Basis of Estimate
	Prepare CC shim drawiings and release								0											see Table V - Basis of Estimate
	FDR CC inboard shims								0											see Table V - Basis of Estimate
Welded Joint Tests																				
	Procedure																			
INTRF-035	PPPL Determine shim material								0											see Table V - Basis of Estimate
INTRF-001	PPPL buy SS plate for weld trials								0											see Table V - Basis of Estimate
INTRF-005	Weld distortion trials at PPPL on SS plate								0											see Table V - Basis of Estimate
INTRF-025	ORNL build pywood mockup of flange								0											see Table V - Basis of Estimate
INTRF-030	ORNL verify weld access, develop alternate welding method								0											see Table V - Basis of Estimate
INTRF-010	Develop Weld Geometry Procedure								0											see Table V - Basis of Estimate
	Test																			
INTRF-015	Weld trials on two MCWF's at PPPL								600											see Table V - Basis of Estimate
INTRF-020	Document results and update weld procedure								0											see Table V - Basis of Estimate
Overall interface																				
INTRF-040	Analysis of tensil loads (ORNL)								0											see Table V - Basis of Estimate
1421-3134	Develop specs & dwgs for station 2 &3 assy								0											see Table V - Basis of Estimate
1421-3136	Conduct MC interface FDR incl job 1416								0											see Table V - Basis of Estimate
1421-3138	Resolve issues, release assembly spec&drawings								0											see Table V - Basis of Estimate
FY07 Rebaseline exercise																				
ECP53RBX05	FY07 Rebaseline Exercise								0											see Table V - Basis of Estimate
Travel																				
	Trips for ORNL personnel to PPPL																			
	Trips for PPPL personnel to UT MDL																			
	TOTAL								1020											

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

WBS Number: 142
WBS Title: Windings and Assembly
Job Number: 1421
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Job Manager:David Williamson

Uncertainty of the Estimate

	High	Medium	Low	Uncertainty Range (%)	Comments/Other Considerations
Design Maturity			x	-10 to +50	Major issue is continuous iteration of design
Design Complexity		x			Major uncertainty is C-C access for bolting at machine assembly

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

Residual Impacts

	Risk	Likelihood of Occurring (%)	Mitigation Strategies	Consequence if Occurs: Cost	Consequence if Occurs: Schedule
1	weld distortion found in R&D exceeds allowable assume double welding time	20%	add distortion control methods to welding procedure development, such as clamping bolts, peening, and alternate weld methods	$70k+sched hit	6 wks
2	C-C access insufficient for bolts redesign and re-analyze alternate solution at CC	20%	Prepare mockups and check access directly	$250k	

NCSX June 2007 ETC
TABLE V - Basis of Estimate

WBS Number: 142
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Job Number: 1421
Job Title: Design of Modular Coil Interfaces
Job Manager:David Williamson

Assumptions
Bladder design remaining and testing are in Larry Dudek's job 1431. Still need method to retain bladder and to provide bladder at B-A interface where bladder is much thicker

Engineering and Technician Hours

Color Key					Pro-E models (avg)	Pro-E models (complex)	assy dwgs	Detail drawings	installation dwg	cooling schematic	electrical schematic	I&C schematic	stress analysis	thermal analysis	special analysis (electromagnetic)	assy/install specs and procedures	procurement/fab and associated specifications	R&D reports	peer, preliminary and final design reviews	Planning	misc engr tasks	Comments for Engineering labor	crew size	shifts	time from detail	Comments for Technicisan labor
	ORNL			multiplier	40	80	100	60	40	0	0	20	240	40	160	40	40	80	40	16	1			8		
	PPPL			unit	hrs/model	hrs/model	hrs/dwg	hrs/dwg	hrs/dwg	hrs/dwg	hrs/dwg	hrs/dwg	hrs/calc	hrs/calc	hrs/calc	hrs/proc	hrs/spec	hrs/report	hrs/rev	hrs/wk	hrs			hrs/shift		
			Total Engr hours	Total Tech hours																						
Outboard Interface Design																										
IH4-020	Prepare outboard shim dwgs and release		60	0				1																		
INTRF-045	FDR outboard shims		40	0															1							
	resolve and issue shim drawings		60	0				1																		
Bolted Joint Tests																										
	Tension Tests of Bolted Joint																									
1421-3067	Procure 2 studs f/joint test.Use existing part		8	48																	8	engineering judgement	2	3		
1421-3075	Setup test fixture &perform JHA & pre-job brief		8	16																	8	engineering judgement	2	1		
1421-3077	Meas joint deflect vs preload & loss of preload		24	24																	24	engineering judgement	1	3		
1421-3079	Measure joint deflec & preload v. temp @80K		24	24																	24	engineering judgement	1	3		
1421-3084	Measure joint deflection&preload v. cooldown cyc		24	24																	24	engineering judgement	1	3		
1421-3087	Perform pullout tests for tapped holes		24	24																	24	engineering judgement	1	3		
1421-3081	Meas joint deflect & preload v. time (days) at R		160	160																	160	engineering judgement	1	20		
1421-3090	Document&conduct review of test results		40	0															1							
	Bolt Shear Test at 77k																									
1421-3112B	Procure/fab parts for test&initial assembly		40	0													1									
1421-3115B	Assemble & test		320	100																	320	full time for 2 engr following test	2.5	5		
1421-3119B	Document test results		80	0														1								
Inboard Interface Design																										
IH1-001	Coil to coil analysis		520	0									2						1							
1421-3125	Determine geometry&location of high COF shims&pl		80	0			1																			
1421-3127	Structural analyses to performance rqmts for bol		240	0									1													
1421-3132	PDR to review requirements, design,&development		40	0															1							
AB/BC/AA welded joints																										
	prepare winding form mods for weld clamping bolts		300			3		3																		
INTRF-050	Complete Shim fabrication drawings (ORNL)		240	0				4																		
	Release information for procurement of shim material		24																			No hours included - RTS added 24 hours				
INTRF-055	FDR AB/BC/AA inboard shims		40	0															1							
CC bolted joint																										
IH1-000	ESTABLISH CONCEPT		680	0		5	3	2											3							
IH1-0000	PEER REVIEW OF JOINT CONCEPT		80	0															2							
	Add bolt holes to C winding form for CC interface		140	0			1	1																		
	Bolt Reach and Access study (mockup)		200	0		2		2																		
	Prepare CC shim drawiings and release		360	0			1	1	3																	
	FDR CC inboard shims		40	0															1							
Welded Joint Tests																										
	Procedure																									
INTRF-035	PPPL Determine shim material		40	0																	40					
INTRF-001	PPPL buy SS plate for weld trials		8	0																	8					
INTRF-005	Weld distortion trials at PPPL on SS plate		40	0																	40					
INTRF-025	ORNL build pywood mockup of flange		140	0		1		1																		
INTRF-030	ORNL verify weld access, develop alternate welding metho		40	0																	40					
INTRF-010	Develop Weld Geometry Procedure		40	0												1										
	Test																									
INTRF-015	Weld trials on two MCWF's at PPPL		80	600																	80				665	see detail below
INTRF-020	Document results and update weld procedure		120	0													1	1								
Overall interface design																										
INTRF-040	Analysis of tensil loads (ORNL)		320	0			1						1													
1421-3134	Issue interface drawings for comment		300	0			3									0						AA, AB, BC only				
1421-3136	Conduct MC interface FDR incl job 1416		40	0															1							
1421-3138	Resolve issues, release assembly spec&drawings		240	0												1					200					
FY07 Rebaseline exercise																										
ECP53RBX05	FY07 Rebaseline Exercise		256	0																16						
	Subtotal		**5560**	**1020**																						
	scheduled and unscheduled																									
	meetings/reporting/presentations (25%)		1390																							
	TOTAL		6950																							

WBS Number: 142
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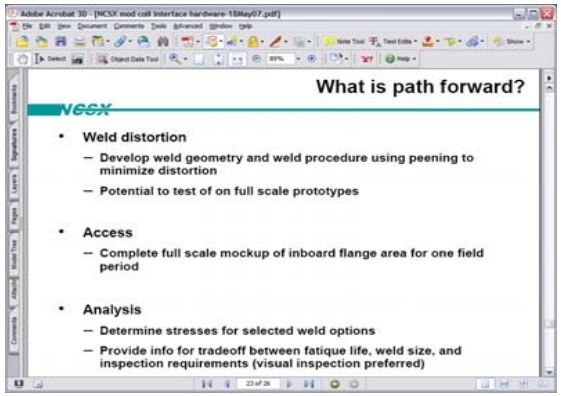

NCSX June 2007 ETC
TABLE VI - Job 1421 Schedule Detail

Sum of BQ									$K			hours					
WBS	JJJJ	sort code	ACT	TITLE	ES	EF	status comment	days	41	actual may cost	ORNL35 ORNL41	EA//EM	EM//EM	EM//TB	EMT/TB	ORNLDA	ORNLEM
	1421		INTRF-100	Misc travel, meetings,reporting,presentations	5/1/2007	9/28/2007	25%	106			*$12*		150				1,210
			REBASE1421	Re-baseline exercise	5/1/2007	6/15/2007		33									256
		142A	IH4-020	Prepare outboard shim dwgs and release **for comment**	5/1/2007	6/15/2007	complete-A	33									60
			INTRF-045	FDR prep outboard shims	6/18/2007	6/29/2007		10									40
			INTRF-046	FDR outboard shims		6/29/2007		0									
			INTRF-047	Resolve chit's and issue shim drawings	7/2/2007	7/10/2007		6									60
		142B	1421-3067	Procure 2 studs f/joint test.Use existing part	5/1/2007	7/25/2007		60	*$1*				8	48			
			1421-3075	Setup test fixture &perform JHA & pre-job brief	5/29/2007	5/30/2007		2					8	16			
			1421-3077	Meas joint deflect vs preload & loss of preload	5/31/2007	6/4/2007	adjust blue cells to g27,	3					24	24			
			1421-3079	Measure joint deflec & preload v. temp @80K	6/5/2007	6/7/2007	which used to be may	3					24	24			
			1421-3081	Meas joint deflect & preload v. time (days) at R	6/18/2007	7/16/2007	28	20					160	160			
			1421-3084	Measure joint deflection&preload v. cooldown cyc	6/8/2007	6/12/2007		3					24	24			
			1421-3087	Perform pullout tests for tapped holes	6/13/2007	9/16/2007		3					24	24			
			1421-3090	Document&conduct review of test results	7/17/2007	7/23/2007		5					40				
		142C	1421-3112B	Procure/fab parts for test&initial assembly	5/1/2007	7/25/2007		60	*$10*				40				
			1421-3115B	Assemble & test	7/26/2007	9/7/2007		31						100			320
			1421-3119B	Document test results	9/10/2007	10/1/2007		16									80
		142D	1429-3026	COF cyclic testing	5/1/2007	5/18/2007	complete-A	14		*$30*							
		142E	1421-3125	Determine geometry&location of high COF shims&pl	5/1/2007	6/13/2007	complete-A	31									80
			1421-3127	Structural analyses to performance rqmts for bol	6/14/2007	6/20/2007	complete-A	5									240
			1421-3131	PDR prep for requirements, design,&development	6/14/2007	6/22/2007		5									40
			1421-3132	PDR to review requirements, design,&development		6/22/2007		0									
			IH1-001	Coil to coil scoping analysis	5/1/2007	6/15/2007		33			*$36*						520
		142F	INTRF-049	prepare winding form mods for weld clamp bolts	6/13/2007	6/27/2007		11									300
			INTRF-050	Complete Shim fabrication drawings (ORNL)	6/14/2007	7/2/2007		13									240
			INTRF-051	Release info for procurement of shim material	5/1/2007	6/22/2007		38									24
			INTRF-054	FDR prep AB/BC/AA inboard shims	8/2/2007	8/8/2007		5					40				
			INTRF-055	FDR AB/BC/AA inboard shims		8/8/2007		0									
		142G	1421-3140	Prep C-C shim drawings and release	8/20/2007	9/7/2007		14									360
			1421-3142	FDR Prep for C-C shims	9/10/2007	11/6/2007		42									40
			1421-3143	Add bolt holes to C winding form for CC interfac	7/19/2007	8/2/2007	need before INTRF 015	11									140
			1421-3144	FDR C-C Shims		11/6/2007	was 11/30	0									
			1421-3145	Bolt reach & access study (mockup)	8/3/2007	8/10/2007		6									200
			IH1-000	ESTABLISH CONCEPT	6/1/2007	7/23/2007		36									680
			IH1-0000	PEER REVIEW OF JOINT CONCEPT	7/24/2007	8/2/2007		8									80
		142H	INTRF-001	PPPL buy SS plate for weld trials	6/4/2007	6/15/2007		10	*$31*				8				
			INTRF-005	Weld distortion trials at PPPL on SS plate	6/18/2007	7/6/2007		14	*$0*				40	20			
			INTRF-010	Develop Weld Geometry Procedure	7/3/2007	7/10/2007		5				40					
			INTRF-025	ORNL build pywood mockup of flange	5/1/2007	6/20/2007		36			*$30*						140
			INTRF-030	ORNL verify weld access	6/21/2007	6/25/2007		3			*$20*						40
			INTRF-035	PPPL Determine shim material	5/1/2007	6/1/2007	complete-A	23				40					
		142I	INTRF-015	Weld trials on two MCWF's at PPPL	7/11/2007	7/30/2007		14	*$1*				80	600			
			INTRF-020	Document results and update weld procedure	7/31/2007	8/7/2007		6				120					
		142J	1421-3134	Issue interface dwgs for comment	5/1/2007	7/20/2007		57									300
			1421-3135	FDR Prep	7/23/2007	8/8/2007		13									40
			1421-3136	Conduct BC, AB, AA, MC interface FDR incl JOB 1416		8/8/2007		0									
			1421-3138	Resolve issues, release assembly spec&drawings	8/9/2007	8/15/2007		5									240 4,840
			INTRF-040	ANalysis of tensile loads (ORNL)	5/1/2007	8/8/2007		70									320 6,050