NCSX CLOSE OUT NOTE: JOB 1501

TO:	Phil Heitzenroeder
FROM:	Fred Dahlgren

SUBJECT: Coil Support Structure Job-1501

Date:10/02/2008

Scope

This job covers the design and analysis of the structural supports for the TF & PF coils for NCSX, including the short column weldments which interface the core to the base support structure. Completion of this job is required prior to the start of component procurements in job 1553.

<u>Status</u>

This job has completed an FDR and includes a complete set of drawings and bill of materials ready for procurement & fabrication as well as documentation of the analysis in support of the design.

Interfaces

Key interfaces include the PF & TF coils, Trim coils, MCWF shell, C.S. support assembly, and base support structure. Undefined subsystems which will also interface with these supports include the cryogen supply and return manifolds, cryostat, and buswork supporting/mounting hardware for TF, PF, MC, and Trim coils. Other instrumentation leads TBD may also utilize portions of these support brackets.

Specifications

NCSX-BSPEC-15-00

A formal FMECA was not anticipated but a failure mode and mitigation plan was included in the PDR.

Schematics and PIDs

N/A

Models

The model supporting the analyses for the Coil Support Structure is provided in its native format as a backup to the calculation.

Drawings

Top Assembly Drawings: se151-110 –Rev0 se151-109-Rev0 se151-108-Rev0 se151-107-Rev0

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Note: detail drawings, and sub-assemblies can be found on the parts list of the main assemblies cited above or the full listing on the BOM.

Analysis

NCSX-CALC-15-001-01

Testing

The only testing performed was verification of magnetic permeability of commercially procured parts specified on the BOM. Samples of all parts specified meet the project permeability requirements in the locations they are to be used (as specified in the GRD).

Costs

The initial budgetary quotes received for fabrication of this job are now 18 months out of date (as of 10/02/2008) and will need to be escalated based on current market conditions. This was done for the most recent Lehman review but would need to be re-visited were this project to be re-started. Hardware costs in the latest estimates (04/21/2008) are current as of that date as are material costs.

Remaining Work

Four chits from the PDR and 2 chits from the FDR remain unresolved pending input from other subsystems.

A detailed analysis of the local bolting stresses to resolve any issues there is also pending and would be required prior to fabrication.

Lessons Learned:

The initial design for this job was well along (at or near the PDR stage) in the fall of CY'06 when I was first assigned to this task. This initial design, based on stainless steel castings, was tightly integrated into the overall machine core design and assembly plan, and provided a fairly robust solution for supporting the various coil systems. Some detailed drawings were already in progress. Unfortunately budgetary quotes received in Dec. '06 suggested the cost of castings was going to be significantly higher than had been previously estimated and budgeted for this sub-system, with quotes of 1.7-1.9M\$ vs. <1M\$ in the budget. To reduce costs a new design based on either aluminum or stainless weldments, was developed. While budgetary quotes received for the weldment design were significantly less than the castings, the added labor cost in design, drafting, and analysis for the new configuration probably diminished any savings over the casting design and required a significant effort in time and labor to update the CAD and FEA models. In retrospect it might have been more time conserving and cost effective to just re-baseline this job at the 2M\$ level and proceed with the casting option.

Conclusion: A detailed analysis of the most critical bolted connections should be performed which could permit the use of 316 bolting hardware in many locations with Inconel 718 hardware used only where needed. This could reduce costs for bolting materials by 50% or more. Over 6 tons of 304L stainless remains in the PPPL materials yard and was earmarked for use on this job. The majority is $\frac{1}{2}$ " thick although some is

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5/8" Testing performed indicated all this material had a relative magnetic permeability of less than 1.02. Use of this yard material could save as much as 150K\$. Full solution annealing of 304L can lower the permeability of cold worked and welded 304L and should be considered if permeability issues arise.



PF, TF, & Trim Coil Supports (WBS-15) Core Base Support Structure (WBS-17)

F. Dahlgren NCSX Coil & Core base support structures









PF, TF, Trim Coil Supports

The coil support structure provides the means for accurately locating and supporting the TF, PF, & Trim coils.

- It must provide adequate support for the EM loads arising from the coil operational scenarios and fault conditions.
- It must have sufficient compliance to accommodate cooldown from room temperature to 77 deg.K
- It must be sufficiently rigid to limit coil deflections to acceptable values per field error criteria.
- It must have a relative magnetic permeability less than 1.02
- It must limit eddy currents to effectively limit field errors at the plasma boundary.
- It must meet the NCSX seismic & Structural Design Criteria.







Base Support Structure

Functional requirements:

- Provides the gravity load path from the NCSX core to the test cell floor.
- It must not exceed the maximum test cell floor loading of 4,500 lbs/sq.ft.
- It must have a relative magnetic permeability less than 1.05
- It must meet the NCSX Structural Design & Seismic Criteria.
- It must provide support & clearance for the three period assembly tooling.





NCS National Compact Stellarator Experiment

PF,TF, & Trim Coil Supports

The coil supports interface with the MCWF shell which provides the load path to react all coil EM and gravity loads. It will also interface with the mounting hardware for supporting the coil buswork, cryogen lines & cryostat.





PF5 & 6 support brackets are cantileverd off the TF outer brackets









(1)

3

2

(10)

6)

0

P

The interface between the MCWF and Base Support columns

Spherical Bearings provide translational connections and avoid introduction of rotational moments on the MCWF shell.

Low friction PTFE sheets provide a low compliance radial interface to allow for differential thermal contraction from room temperature base supports to 77 K core.

TF Coil bracket & clamp interface



PF4 Coil bracket & clamp interface









Base Support Structure

The base support structure interfaces with the test cell floor, and TF support brackets. It also provides the mounting pads for the three period assembly fixtures.



Mounting pads for 3-period assembly cart rails





Design Status



PF,TF, & Trim Coil Supports

- Peer review held on 01/18/07
- PDR held on 07/20/07
- FDR scheduled for 06/16/08
- Pro-E design integration complete.
- Preliminary drawings issued for review.
- Minor revisions being implemented to accommodate trim coil support mounting hardware.
- Design in final detailing awaiting interface information for buswork, cryogen lines, and cryostat mounting hardware.
- FEA modeling utilizing a single period fully integrated model is complete.
- FEA analysis of various EM and fault loading conditions is underway (~ 30% complete) with the fully integrated FEA model.





Design Status



Base Support Structure

- Peer review held on 01/18/07
- PDR held on 03/06/08
- FDR scheduled for 04/30/08
- Pro-E design integration complete.
- Preliminary drawings issued for review.
- Minor revision to accommodate cryostat interface underway.
- FEA modeling (w/testcell floor & structure) complete.
- FEA analysis complete.





Procurement Plans



PF,TF, & Trim Coil Supports

- Current plan for a fixed price subcontract.
- At least two potential vendors have been identified and budgetary estimates have been received.
- RFQ & CSPEC are being prepared, with a projected procurement cycle of 6 weeks starting mid-July '08 (subsequent to FDR).

Base Support Structure

- Procure main columns & beams from Stainless Structurals, LLC (~ 13 weeks)
- Fabricate parts in-house (welding, drilling, & assembly).





Cost & Schedule - Coil Supports



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161	PF,TF, & Trim Coil Supports - Design							FY(08 	+		F	Y09	П	+	тт	- FY	10	ł			
1	5 - Coil Struc	tures				5									H	-						ŀ
Ϊ,	ob: 1501 - C	oil Stru	uctures Design-DAHLGREN																			
			3																			
		1	1			T			1													
	1501-533		Detail CAD Drawings,BOM	260*		01JUN07A	16JUN08	188	28,638.26			EA	//EN	/ =2	0hr	; EA	//DM	1 =68	; 01			
	1501-533F		Integrated Stress Analysis	176*		010CT07A	16JUN08	188	27,007.75		÷	EA	//EN	/ =6	10h	r:						
	1501-536		Issue dwgs for review	0			01APR08*	215	0.00		\checkmark											
	1501-535		Develop Interfaces with cryostat	0			01MAY08*	213	0.00		∇	7										ĺ
	1501-549		Update C.S.Support Attacgment Design	6		09MAY08	16MAY08	188	8,146.80			EA//	ЕМ :	=201	hr;E	EA//I) M =	=40	;			
	1501-550		Peer review C.S.Design	5		19MAY08	23MAY08	188	1,168.88			EA//	ΕМ	=04	hr;i	EA//	DM :	=04	;			
	1501-554		Resolve CS peer review Chits	5		27MAY08	02JUN08	188	8,146.80			EA/	/EM	=20)hr;	EA/	/DM	=40	;			ĺ
	1501-562		Prepare Specs for Coil Structure & CSS h/w	10		03JUN08	16JUN08	188	3,542.00			EA	//EN	A =2	0hr	;						
	1501-537		FDR Prep	6		09JUN08	16JUN08	188	3,515.48			EA	//EN	/ =1	4hr	; EA	//DM	1 =9	;			
	1501-541	3	Coil Support Structures - FDR	0			16JUN08	188	0.00			\checkmark										ĺ
	1501-545		Resolve Chits	5		17JUN08	23JUN08	188	5,844.40			[EA	v/er	M =2	20hr	; EA	v/DN	A =2	0;			
	1501-558		Prepare requisition for Coil Structure & CSS h/w	10		24JUN08	08JUL08	188	3,542.00	1		E.	A//E	M =	20h	r;						







Cost & Schedule - Base Support Structure



Base Support Structure - Design

	Activity	MILE	Activity	Duration	SHIFT	Forecast	Forecast	Total	Cost to	D//2 D//2 D//2
	ID	-STONE LEVEL	Description	(work days		Start	Finish	Float	Complete	
	17 - Cryostat a	and Ba	se Support Structure							
ſ	Job: 1702 - B	ase Su	pport Struct Design-DAHLGREN							
	-									
					1	1	1			
	1702-515	3	Base support - PDR	5	R	31JAN08	06FEB08	202	3,506.64	DAHLGREN =04hr ;
	1702-516	3	Disposition PDR chits	5	R	07FEB08	13FEB08	202	2,833.60	DAHLGREN =04hr ;
	1702-520		Final design. Assy dwgs, fab dwgs,	64*		01FEB08A	30APR08	147	127,230.72	DAHLGREN =448hr ; CRUIK\$HANK =224 ;
	1702-521	2	Issue dwgs for comment	0			28MAR08*	170	0.00	
	1702-525M	2	Base Support Structure FDR	0			30APR08	147	0.00	
	1702-530		Resolve chits, issue dwgs for fab,Issue requisit	10		01MAY08	14MAY08	147	8,430.08	DAHLGREN=32;CRUIKSHANK=24

Base Support Structure - Fabrication

,	Job: 1752 - E	ase Si	upport Proc-PERRY	·				·			
	172 - Base Support Structure										
			1				-				
	161-036.8	3	Bid and award base support materials	30		19AUG08*	30SEP08	177	0.00		
	161-036.9	3	Deliver base support materials	130		01OCT08	13APR09	177	192,190.96		41=147.156\$k ;
	161-037		PPPL assemble structure	40		14APR09*	09JUN09	177	30,335.91		EMT/TB =363 ;
	161-038		Title III	306		15MAY08*	05AUG09	1,311	7,037.18		PERRY=44

Total: 229.5 k\$ (FY'09)





Risks & Mitigation



PF,TF, & Trim Coil Supports & Base Support Structure

Both these jobs are comprised of conventional weldments and bolted assemblies. As such they are classified as relatively low risk components with minimal probability of cost escalation or scheduler delay associated with their procurement and fabrication.

Risk:

The main source of cost escalation would be tied to increased commodity prices for Nickel and Molybdenum and the weakening value of US dollar vs. the Euro.



QuickTime[™] and a TIFF (LZW) decompressor are needed to see this picture.

Nickel Price Since January

Mitigation:

Expedite procurement of stainless structurals and Inconel hardware.







Backup slides







QuickTime™ and a TIFF (LZW) decompressor are needed to see this picture.

Strip heaters (4 per column) will be used to maintain R.T. (40 to 60 F) of columns

















TF Inner Supports "B" to "C" Span

Inner TF coil mtg. brkts.



TF Outer Supports "C" to "B" Span

Outer TF Coil mtg. brkts.





PF4 Coil Mtg. off inner TF brkts.









PF Coils are shimmed & clamped to the support brackets









Trim coils mount to PF5 &6 cantilevered bracket assemblies.

Vertical channels provide additional support between the top and bottom brackets.

Inbd.Trim coils mount to TF-bracket assemblies.



Trim Coils are shimmed & clamped to the support brackets





PF-TF Coil Supports -Cost estimate breakdown

Outer TF support Structure (con't.)



NCSX Coil Support Structure - 1501/1550 Re-baseline estimate - Rev.K 2 April 2008

1. Inner TF support Structure

1a. Supp't brkts. (72 req'd.) Cutting & machining .6.0 hrs x \$92.00 = \$552.00 Weld prep & weld .2.2 hrs x 76.00 = 167.20 Clean-up de-scale de-burr .0.5 hrs x 76.00 = 38.00 Mat'l.: 304ss plate .120 lbs. x 6.90 = 828.00							
 *1b. G11-CR Mtg. blocks (36 req'd.) Cutting & machining (2 pcs.)2.5 hrs x \$92.00 = \$230.00 Epoxy adhesive bond to coil2 hrs x \$75.00 = 37.50 Mat'l.: G11-CR plate \$48.00 per pc2 pcs. x \$48.00 = 96.00 *1c. G11-CR Side Wegde Shims (4 pcs. Req'd per set x 36 sets) Cutting & Machining wedges							
Mat 1.: G11-CR plate \$42.00 per pr2 pcs. x 42.00 = 84.00 Teflon pads 1/8" thk2 pcs x 27.00 = 54.00							
 **1d. Inconel Hardware (36 sets Req'd.) (4) 1-8 N.C. x 2.5" Hex Head Bolts4 pcs. x \$50.40 =\$201.60 (4) 1" Flat Washer - Heavy Series4 pcs. x 3.65 = 14.60 (4) 1" Lock Washer4 pcs. x 2.95 = 11.80 (6) ½ -13 N.C. Hex Head Bolts6 pcs. x 2.65 = 15.90 (6) ½" Split Lock Washer							
1e. T.F. Bridge Clamp (36 Req'd) Cutting & machining							
*1f. PFTE coated G11-CR wedge assemblies (72 Req'd.) Cutting & machining							
2. Outer TF support Structure							
2a. Supp't brkts. (72 req'd.) Cutting & machining Weld prep & weld .2.5 hrs x 76.00 = 190.00 Clean-up de-scale de-burr 0.5 hrs x 76.00 = 38.00 Mat'l.: 304 ss plate plate 165 lbs. x 6.90 = 1138.00							
*2b. G11-CR Mtg. blocks (36 req'd.)							

20). GIT-CK Mig. blocks (50 feq d.)				
	Cutting & machining (2 pcs.)2.5 hrs	х	\$92.00	=	\$230.00
	Epoxy adhesive bond to coil0.5 hrs	x	\$75.00	=	37.50
	Mat'l.: G11-CR plate \$48.00 per pc2 pcs.	х	\$48.00	=	96.00



IVSICS LABORATOR

*2c. G11-CR Side Wegde Shims (4 pcs. Req'd per set x 36 sets)
Cutting & Machining wedges
Mat'1.: G11-CR plate \$42.00 per pr2 pcs. x 42.00 = 84.00
Teflon pads $1/8$ " thk
**2d. Inconel Hardware (36 sets Req'd.)
(4) 1-8 N.C. x 2.5" Hex Head Bolts 4 pcs. x \$50.40 = \$201.60
(4) 1" Flat Washer – Heavy Series4 pcs. x 3.65 = 14.60
(4) 1" Lock Washer
(6) ½ -13 N.C. Hex Head Bolts
(6) 1/2" Flat Washers – Heavy Series6 pcs. x 2.65 = 15.90
(6) 1/2" Split Lock Washer
2e. T.F. Bridge Clamp & pre-load ass'y. (36 Req'd)
Cutting & machining
Mat'1.: 304 ss plate plate
Lateral TF preload ass'y (36 req'd.)1,740 per ass'y.= 1,740.00
*2f. PFTE coated G11-CR wedge assemblies (72 Req'd.)
Cutting & machining
Teflon coating
1g Lateral TF pre-load (36 reg'd.)
TF preload ass'y
3. PF5/PF6 Support Brkt. Ass'y. (66 Req'd.)
3.a Bracket Ass'y (66 Req'd.)
Cutting & Machining

Cutting & Machining
Weld prep & weld6.5 hrs x 76.00 = 494.00
Clean-up de-scale de-burr
Mat'1.: 304 ss plate plate120.01bs x 6.90 = 828.20
3b. P.F. 5 Bridge Clamps (66 Req'd)
Cutting & machining
Mat'1.: 304 ss plate plate
3c. P.F. 6 Bridge Clamps (66 Req'd)
Cutting & machining
Mat'1.: 304 ss plate plate
**3d Inconel Hardware (66 sets Req'd.)
(4) ³ / ₄ -10 N.C. x 8.5" Hex Head Bolts4 pcs. x \$ 68.90 = \$275.60
(4) ³ / ₄ -10 N.C. x 9.5" Hex Head Bolts4 pcs. x 73.90 = 295.60
(4) ³ / ₄ -10 N.C. Hex Nuts
(8) 1" Flat Washer – Heavy Series8 pcs. x 3.65 = 29.20
(8) 1" Lock Washer
3e Positioning Brkt. Ass'y. (21 Req'd)
Cutting & Machining
Weld prep & weld2.5 hrs x 76.00 = 190.00
Clean-up de-scale de-burr
Mat'1.: 304 ss plate plate105.01bs x 6.90 = 724.50







PF-TF Coil Supports -Cost estimate breakdown -con't.



- 4. PF5/PF6 Support Frame Ass'y Long Span (6 Ass'y. Req'd)
- 4a. Vertical channels (For 3 -Req'd. per ass'y)

 Cutting & Machining
 2.0 hrs x \$92.00 = \$184.00

 Clean-up de-scale de-burr
 0.8 hrs x
 76.00 = 60.80

 Mat'1.: 304 ss channel
 44.01bs x
 8.50 = 374.00
- 5. PF5/PF6 Support Frame Ass'y Short Span (6 Ass'y. Req'd)
- 5a. Vertical channels (For 3 -Req'd. per ass'y)

 Cutting & Machining

 .2.0 hrs x \$92.00 = \$184.00

 Clean-up de-scale de-burr

 .0.8 hrs x

 .0.8 hrs x

 76.00 =

 60.80

 Mat'1: 304 ss channel.

 .401bs x

 .401bs x





6. TF Pre-load Ring & PF4 Support Brkts (2 rings, 2 sets of brkts.)

- 6b. PF4 Brkts Inco plate weldments (6 Top & 6 Bottom)
 (6) Cutting & Machining

 (6) Cutting & Machining
 2.5 hrs x 6 x \$92.00 = \$1380.00
 (6) Weld prep & weld

 (6) Weld prep & weld
 1.5 hrs x 6 x 76.00 = 684.00
 (6) Clean-up de-scale de-burr
 3.0 hrs x 6 x 76.00 = 228.00

 (6) Mat'1: Inconel 625 plate
 41.0lbs x 28.50 = 1168.50
- 7. C.S. Coil mtg. brkts. (2x =12 brkts total)

8. T.F. Pre-load clamp Assemblies

 8a. Stellalloy casting (36 Required)
 \$350.00 x 36 = 12,600.00

 (36) Inco ¾ -10NC Pivot Bolt. 1.25 grip 41.50 x 36 = 1,494.00
 (36) Inco ¾ -10NC Hex Nut
 24.80 x 36 = 892.80

 (72) Inco ⅓ -13NC Hex Head Bolt
 16.80 x 72 = 1,209.60
 (72) G11-CR Washers
 2.65 x 72 = 190.80

 (72) G11-CR Washer
 1.40 x 72 = 100.80
 (72) G11-CR Sleeve
 2.50 x 72 = 180.00

 (36) Inco ⅓ -10NC" Jack Nut
 28.50 x 36 = 1,026.00
 (36) G11-CR ¾" thk. Insul. Pad
 51.50 x 36 = 666.00







Supplemental parts Inner & Outer TF Lateral Pre-load: \$125,876





PF-TF Coil Supports -Cost estimate breakdown -con't.



9. P.F. 4 Bridge clamps (12 req'd.)

9a. (1) C & M Plates 6" x 6" x ³ / ₄ "4.5 hrs x 1 x \$92.00 = 414.00
9b. Clean-up de-scale de-burr1.5 hrs x 76.00 = 114.00
**9c. Inconel Hardware
(4) 1/2 -13 N.C. Hex Head Bolts
(4) ¹ / ₂ -13 N.C. Hex Nuts
(4) 1/2" Flat Washers - Heavy Series4 pcs. x 2.65 = 10.60
(4) ¹ / ₂ " Split Lock Washer
*9d. (1) G11-CR ¹ / ₄ " thk. Insul. Pad
*9e. (2) Teflon pads
9f. 6 x 6 x ³ / ₄ " thick Inconel601 plate27.0lbs x 22.50 = 607.50



10. Inner & outer spacer blocks MCWF-TF supp't brkts (24 Req'd.)

10a. C & M blocks	
10b. Clean-up, de-scale & de-burr	
**10c. (4) Inco 3/4 -10NC Hex Bolt	4.25 grip 64.90 x 4 = 259.60
**10d. (4) Inco ¾" Flat Washers	
10e. 304 ss 6" x 6" x 3" thick	
10f. Lateral TF preload ass'y	1,740 per ass'y.= 1,740.00

11. Machine/base support Interface (6 Req'd.)

11a. C & M plates	(11 parts) 80 hrs x	92.00 =	= 7,3	60.00
11b. Weld Clevises & side plates	s16 hrs x	75.00 =	= 1,2	200.00
11c. Clean-up, de-scale & de-bu	rr4 hrs x	92.00 :	= 3	368.00
11c. Spherical Bearings	1 x 28	50.00 =	= 28	350.00
*11e. C &M G11 & Teflon shee	ts8 hrs x	92.00	= 7	736.00
11f. Inco 625 plates & rnd. Bar	144 lbs x	28.50 =	= 4,1	04.00
*11g. G11-CR Plate	10" x 10	"x 1" =	= 1	58.00
*11h. Teflon sheet	8" x 8'	x.13":	=	56.00
**11i. Inconel Hardware (2 sets	Req'd.)			
(4) 1-8 N.C. x 2.5" Hex Head	d Bolts4 pcs. :	x \$50.40	0 =\$2	201.60
(4) 1" Flat Washer – Heavy	Series4 pcs.	x 3.6	5 =	14.60
(4) 1" Lock Washer	4 pcs. :	x 2.9:	5 =	11.80

12. Misc. Assembly Hardware

12a. G11 bushings TF clamps	$\dots 360 \times 2.50 =$	900.00
12b. G11 washers TF clamps	360 x 0.80 =	288.00
12c. G11 bushings Frame Assy'	168 x 2.50 =	420.00
12d. G11 washers PF Clamps	168 x 0.80 =	134.40
12e. G11 bushings PF Clamps	168 x 2.50 =	420.00
12f. G11 washers Frame Ass'y	168 x 0.80 =	134.40
12g. G11 bushings M/B interface	24 x 2.50 =	60.00
12h. G11 washers M/B interface	24 x 0.80 =	19.20
***12i. Inconel 718 .75 ID B'ville washers	$720 \ge 12.50 = 9$	9,000.00
***12j Inconel 718 1.03 IDB'viille washers.		9,694.80







L:			
i.a I-C&M422 S77.651.40 ib S13.66.00 ic S13.557.20 ic I-C&M108 S13.557.20 ic I-C&M108 S15.66.00 ib S52.66.00 S52.66.00 ib S52.66.00 S55.60.00 ib S52.60.00 S55.60.00 ib S52.60.00 S55.60.00 ib S52.60.00 S55.60.00 ib S55.60.00 S55.80.00 ib S55.60.00 S55.80.00 ib<	1. 222Anner TF Support Structure (36)		
1b S12,085,00 1c S12,082,00 1d S12,082,00 2d S2,040,00 3d S12,082,00 3d S2,040,00 3d S2,040,00 3d S2,040,00 3d S2,040,00 3d LC&M108 S12,02,00 3d LC&M108 S12,02,00 3d LC&M108 S12,02,00 3d LC&M108 S12,02,00 3d LC&M108 S12,02,00 </td <td>la</td> <td>I-C&M432</td> <td>\$67,651.40</td>	la	I-C&M432	\$67,651.40
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id S13.597.20 if i if i <	lc		\$14,904.00
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ih S.5,000.00 2. µJCATE TF Support Structure (30) N 2. µJCATE TF Support Structure (30) S.41.15.00 2. µJCATE TF Support Structure (30) S.11.096.00 2. µJCATE TF Support Bracket Assembly (66) S.21.82.800 3. µJCATE TF Support Bracket Assembly (66) S.21.82.800 3. µJCATE TF Support Bracket Assembly (56) S.21.82.800 3. µJCATE TF Support Bracket Assembly S.5.00.00 S.21.82.800 3. µJCATE TF Trane Assembly S.5.00.10 S.21.82.800 3. µJCATE TF Trane Assembly S.5.00.10 S.8.84.200 5. µJCATE TF Trane Assembly S.5.00.10 S.2.12.82.800 5. µJCATE TF Trane Assembly S.5.00.10 S.2.2.10.00 6. µJCATE Trane Assembly S.5.00.10 S.2.2.10.00 7. µJCA Support Frame Assembly S.5.00 S.2.2.10.00 7	1g		\$62,640.00
ii S4,500,00 2 m20her TF Support Structure (5) S4,154,00 2a LC&M540 S14,154,00 2b S14,094,00 S14,094,00 2c S14,094,00 S12,090,00 2c LC&M108 S12,128,00 3c LC&M112 S1,712,80 3c LC&M12 S1,712,80 3c LC&M12 S1,712,80 3c LC&M112 S1,712,80 <t< td=""><td>1h</td><td></td><td>\$3,600.00</td></t<>	1h		\$3,600.00
2. 222000 TP Support Structure (36) 2a (CAM150 State of CAM150 State of CAM15	li		\$4,500.00
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1-C&M108 \$11,00,00,00 2 \$24,00,00 2 \$24,00,00 2 \$24,00,00 2 \$24,00,00 2 \$24,00,00 2 \$24,00,00 3 1-C&M108 \$21,02,00 5 1-C&M108 \$21,00 5 1-C&M108 \$21,00 5 1-C&M108 \$21,00 5 1-C&M108 \$22,00 5 1-C&M128 \$4,00,00 7 1-C <m128< td=""> \$22,00 7 1-C<m128< td=""><td>24</td><td></td><td>512,507,00</td></m128<></m128<>	24		512,507,00
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21 54,50,00 2:22PFSPF6 Support Bracket Assembly (66) 5149,107,00 25 1-C,2M108 521,522,00 26 1-C,2M108 521,522,00 26 1-C,2M108 521,522,00 27 1-C,2M108 521,522,00 26 1-C,2M108 521,522,00 27 1-C,2M108 521,522,00 27 1-C,2M108 521,522,00 27 1-C,2M108 521,522,00 27 1-C,2M102 57,800,00 27 1-C,2M102 57,800,00 4 1-C,2M102 57,870,00 5 25,872,00 58,872,00 5 25,255,00 54,20,00 5 25,255,00 54,20,00 5 25,255,00 54,20,00 7 25,254,00 52,254,00 7 25,254,00 52,254,00 7 25,254,00 52,254,00 7 25,254,00 52,254,00 7 25,254,00 52,254,00 7 25,254,00 52,254,00 7 25,254,00 52,254,00 7 25,254,00 52,254,00 9 25,254,00 52,256,00 9 25,254,00 52,25	2n		\$3,600.00
3. 222FP3 SPF0 Support Bracket Assembly (60) 5149.107.00 36 1-C&X1108 521.828.00 31 1-C&X1108 521.828.00 32 1-C&X1108 521.828.00 31 1-C&X1108 521.828.00 32 1-C&X1108 521.828.00 31 1-C&X1108 522.190.00 32 1-C&X1108 522.190.00 31 1-C&X112 53.712.80 32 22.8757F6 Support Frame Assembly Short (1) 53.842.00 52 1-C&X112 53.712.80 52 1-C&X112 54.40.30 62 1-C&X112 54.40.30 63 1-C&X112 54.40.30 64 1-C&X113 54.20.90 65 1-C&X114 53.70.84.50 73 730 53.21.04 74 1-C&X173 53.22.04.00 75 53.21.04 54.40.30 74 Coll Nounting Enc.(26) 53.70.54.50 74 Coll Nounting Clamp Assemblies (36) 53.70.54.50	2i		\$4,500.00
3a 1-C&N164 \$149,107,00 3b 1-C&N1108 \$21,1828,00 3c 1-C&N1108 \$21,1828,00 3c 1-C&N1108 \$21,749,40 3c 1-C&N1108 \$25,172,40,40 3c 1-C&N1108 \$25,749,40 4. <i>u2PSPT6S</i> Support Frame Assembly 5 Iong (6) 35,712,50 4a 1-C&N112 \$3,712,50 4b . \$3,712,50 5c 1-C&N112 \$3,712,50 4c . \$3,712,50 5c . 1-C&N112 \$3,712,50 5c . . \$4,420,90 6c. . 1-C&N120 \$4,623,00 6c. . 1-C&N120 \$4,623,00 6c. . 1-C&N120 \$4,623,00 7 . . \$22,20,00 \$2,210,40 7 . . \$22,20,00 \$2,22,00 7 . . \$22,20,00 \$2,22,20,00 7 . \$22,22,00	2222PF5/PF6 Support Bracket Assemble	y (66)	
bh I-C&M108 \$21,828.00 5c I-C&M108 \$21,828.00 3d I-C&M108 \$21,828.00 3f I-C&M108 \$25,190.00 3f I-C&M108 \$25,190.00 3f I-C&M108 \$3,702.00 4a I-C&M112 \$3,702.80 5 I-C&M12 \$3,702.80 6 I-C&M18 \$22,84.00 7 I-C&M18 \$22,84.00 7 I-C&M18 \$22,84.00 7 I-C&M18 \$22,84.00 7 I-C&M18 \$22,284.00 7 I-C&M18 \$22,284.00 7 I-C&M18 \$22,284.00 7 I-C&M18 \$22,284.00 8 I	3a	I-C&M504	\$149,107.00
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3d 54 54/17/39-40 3c 1-C&M168 525,190,00 3f 1-C&M140 57,800,00 3f 1-C&M140 57,800,00 4a 1-C&M12 53,702,800,00 5 267,87176 Support Frame Assembly S Iong (b) 58,842,00 5a 1-C&M12 53,712,80 5a 1-C&M12 53,712,80 5a 1-C&M12 53,712,80 5a 1-C&M12 54,202,00 5a 1-C&M120 54,202,00 7, 222,53,001 1-C&M15 56,522,00 7, 222,54,00 1-C&M15 56,220,00 7, 222,54,00 1-C&M15 52,20,40 7, 222,54,00 1-C&M15 52,20,40 7, 222,52,00 1-C&M54 54,40,60 9, 222F4 Coil Mounting Clamp (12) 52,20,40 52,20,40 9, 222F4 Coil Mounting Clamp (12) 52,20,40 52,20,40 9, 222F4 Coil Mounting Clamp (12) 52,20,80,00 52,20,80,00 10, ACWF-TF Mtg. Brit. Spacer block & shim 52,20,80,00 52,20,80,00 <td>3e</td> <td>I-C&M108</td> <td>\$21,828.00</td>	3e	I-C&M108	\$21,828.00
b: I-C&N168 \$\$25,000.00 37 I-C&N400 \$\$7,800.00 4, 222F52F6 Support Frame Assembly S. Iong (6) \$\$8,842.00 4a I-C&N12 \$\$3,712.80 4b S\$8,842.00 \$\$8,842.00 5a I-C&N12 \$\$3,712.80 5b S\$25765 Support Frame Assembly S. Short (3) \$\$4,420.90 6a I-C&N12 \$\$4,420.90 6b I-C&N15 \$\$6,520.00 7a I-C&N15 \$\$52.20.00 7a I-C&N15 \$\$52.20.00 7a I-C&N15 \$\$52.20.00 7a I-C&N15 \$\$52.20.00 8 22.210.00 \$\$52.20.00 9 I-C&N15 \$\$52.20.00 9 \$\$22.20.00<	3d		\$47,749.40
37 L-C&M40 57,800,00 4: 22PF5/Pf6 Support Frame Assembly SLong (6) 53,712,80 5: 22PF5/Pf6 Support Frame Assembly Short (3) 58,842,00 5: 22PF5/Pf6 Support Frame Assembly Short (3) 53,712,80 5: 22PF2 54,420,90 6: L-C&M12 53,712,80 6: L-C&M12 54,420,90 6: L-C&M15 56,220,00 7: 22C.S. Coil Mounting Brackets (12) 52,210,40 7: 22C.S. Coil Mounting Champ Assemblies (36) 8 8: 22TF Coil Pre-Load Champ Assemblies (36) 53,210,40 9: 22PF4 Coil Mounting Champ (12) 54,406,00 9: 22F4 Coil Mounting Champ (12) 54,806,00 9: 22F4 Coil Mounting Champ (12) 54,806,00 9: 22F4 Coil Mounting Champ (12) 53,312,00 9: 22F4 Coil Mounting Champ (12) 54,806,00 9: 22F4 Coil Mounting Champ (12) 53,312,00 9: 22F4 Coil Mounting Champ (12) 53,312,00 9: 53,312,00 53,312,00<	3e	I-C&M168	\$25,190.00
4. 222F3F65 Support Frame Assembly Short (3) 5. 222F57F6 Support Support Interface 11. 22 M340 11. 22 M340 12. 22 M340 13. 24 M340 13. 24 M340 14. 24 M340 15. 25. 240 16. 25. 240 17. 25. 25. 25. 25. 25. 25. 25. 25. 25. 25	3f	I-C&M40	\$7,800.00
4a 1-CAM12 33.712.80 5 32.62/57F6 Support Frame Assembly Short (3) 33.712.80 5 1-CAM12 33.712.80 5 1-CAM12 33.712.80 5 1-CAM12 33.712.80 5 1-CAM120 54.420.90 6 1-CAM240 54.420.90 6. 1-CAM15 56.920.00 7.22C.S. Coll Mounting Brackets (12) 32.258.400 7. 22.25.81.00 32.20.40 8. 22.71 Coil Pre-Load Clamp Assemblies (36) 8 8. 22.71 Coil Pre-Load Clamp Assemblies (36) \$2.210.40 9. 22.72 Pre-CM Mounting Clamp (12) \$3.406.00 9. 22.72 Pre-CM Mounting Clamp (12) \$3.406.00 9. 22.22.00 \$3.312.00 10a CAM124 \$3.312.00 10b \$3.312.00 \$3.312.00 10c \$3.32.00 \$3.32.00 10a \$3.32.00 \$3.32.00 10b \$3.32.00 \$3.33.200 10c \$3.33.200	4. 2222PF5/PF6 Support Frame Assembly	Š Long (6)	. ,
	4a	I-C&M12	\$3,712.80
			50,712.00
2. 2021 Consepond FFame Assembly Sound (3) \$3,712.30 Sh I-C&M12 \$3,712.30 Sh 2011 Support Frame Assembly \$4,420.20 Sh 2011 Support (2) \$4,420.20 Sh 2011 Support (2) \$4,420.20 Sh 2011 Support (2) \$5,220.00 7. 222.52. Coil Mounting Brackets (12) \$5,220.00 \$2,220.00 7. 222.20.00 \$2,220.00 8. 2217 Coil Pre-Load Clamp Assemblies (36) \$2,220.00 9. 2244 \$4,966.00 9. 222.00 \$2,220.00 9. 22.20 \$2,220.00 9. 22.00 \$2,22.00 9. 22.00 \$2,22.00 9. 22.20.00 \$2,22.00 9. 22.20.00 \$2,22.00 9. 22.20.00 \$2,22.00 9. 22.20.00 \$2,22.00 10. 22.20.00 \$2,22.00 10. 22.20.00 \$2,22.00.00 10.	5 444 ØE5/ØE6 Suprest Farmer 4	Š Short (3)	30,042.00
sa i-L-CAN12 S3,712.80 6. zz2F Pre-Load Ring & PF4 Support (2) 6. zz2F Pre-Load Ring & PF4 Support (2) 6 L-CAN145 S4,623.00 6 L-CAN145 S5,230.00 7. zzCS. Coil Mounting Brackets (1) 7. zzCS. Coil Mounting Brackets (36) 8. zz2FC Coil Pre-Load Clamp Assemblies (36) 8. zz2FC Coil Pre-Load Clamp Assemblies (36) 8. zz2FC Coil Pre-Load Clamp Assemblies (36) 9. zzPF4 Coil Mounting Champ (12) 9. zzPF4 Coil Mounting (12)	5. 2224 F 5/PF6 Support Frame Assembly	5 SHOTE (3)	63 F/2 00
50 54,220,90 6a. L-C&N1240 \$46,930,00 6a. L-C&N1240 \$66,200,00 7. L-C&N15 \$6,220,00 7. 222,584,00 \$5,221,040 7. L-C&N178 \$22,108,40 7. S22,108,40 \$3,221,040 8. 22717 Coil Pre-Load Clamp Assemblies (56) \$3,221,040 8. 22717 Coil Pre-Load Clamp Assemblies (56) \$3,221,040 9. L-C&M54 \$4,966,00 9. 222,010,40 \$222,00 9. S22,20,00 \$222,00 9. S22,20,00 \$222,00 9. S22,20,00 \$222,00,00 9. S22,00,00 \$222,00,00 10. S22,00,00 \$22,00,00 10. S22,00,00 \$22,00,00 10. S22,00,00 \$33,312,00 10. S22,00,00 \$32,20,00 11. JACM240 \$22,00,00 11. S22,00,00 \$32,20,00 11. JACM	58	1-C&M12	\$3,712.80
6. izzlF Pre-Load Ring & FF4 Support [2] \$46,930.00 6a. L-C&M120 \$46,930.00 6b. L-C&M15 \$65,920.00 7a L-C&M15 \$56,920.00 7a L-C&M15 \$52,210.40 7a L-C&M78 \$22,210.40 8. izzlF Coil Pre-Load Champ Assemblies (56) \$30 \$37,054.50 8. izzlF Coil Pre-Load Champ Assemblies (56) \$32,210.40 \$34,068.00 96 \$32,210.40 \$32,210.40 \$32,210.40 97 \$32,210.40 \$32,210.40 \$32,210.40 96 \$32,210.40 \$32,210.40 \$32,220.00 96 \$32,220.00 \$32,220.00 \$32,220.00 96 \$32,220.00 \$32,220.00 \$32,220.00 97 \$32,220.00 \$32,220.00 \$33,220.00 98 \$32,220.00 \$32,220.00 \$33,220.00 98 \$32,220.00 \$33,220.00 \$33,220.00 98 \$33,220.00 \$33,220.00 \$33,220.00 99 \$33,220.00 \$35,26.40 \$33,20	50		\$4,420.90
6a. 1-C&M240 \$\$4,90.00 7. 1-C&M15 \$\$6,20.00 7. 222.55. Coil Mounting Brackets (12) \$\$2,218.40 7a 1-C&M78 \$\$2,218.40 7b \$\$2,218.40 \$\$2,218.40 7b \$\$2,220.40 \$\$2,220.40 7b \$\$2,22.08 \$\$2,22.08 7c \$\$5,00 \$\$2,20.80.00 10a \$\$2,20.80.00 \$\$3,32.40 10b \$\$2,20.80.00 \$\$2,20.80.00 11a \$\$2,20.80.00 \$\$4,41.60.00 11b \$\$2,20.80.00 \$\$4,41.60.00 11b \$\$2,20.80.00 \$\$2,20.80.00	6. 2222TF Pre-Load Ring & PF4 Support	(2)	
66 I-C&M15 S692.000 7. zzZCS. Coil Mounting Brackets (12) 7. zzZCS. Coil Mounting Brackets (24) 7. zzZCF Coil Pre-Load Clamp Assemblies (36) 8. zz2FF Coil Pre-Load Clamp Assemblies (36) 8. zzZFF Coil Pre-Load Clamp Assemblies (36) 9. zzZFF Coil Pre-Load Clamp Assemblies (36) 10. z ZZFF Assemblies (36) 10. z ZZFF Assemblies (36) 11. z Machine/Base Support Interface 11. z Machine/Base Support Interface 12. Machine/Base Support Interface 1	6a.	I-C&M240	\$46,930.00
7. 2025.Coll Mounting Brackets (12) S32_584.00 7a LC&M78 S32_584.00 7b S2_2104.00 S22_104.00 8. 2027 Coll Pre-Load Clamp Assemblies (36) S S 8. 257,054.50 S 9. 2674 Coll Mounting Clamp (12) S 9. LC&M54 \$4,968.00 9. S221.04.01 S22.10.40 9. S22.10.40 S2.21.04 9. S2.21.04 S2.21.04 9. S2.21.04 S2.21.04 10. S2.22.00 S2.21.04 10. S3.312.00 S3.312.00 11. Machino Base Su	6b	I-C&M15	\$6,920.00
7a L-C&M78 \$25,210.40 7b \$2,210.40 8. ±2/JF Coil Pre-Load Clamp Assemblies (36) \$37,054.50 8a \$37,054.50 9. ±2/JF4 Coil Mounting Champ (12) \$31,268.00 9a L-C&M54 \$4,968.00 9b \$1,268.00 9c \$2,210.40 9c \$2,210.40 9c \$2,210.40 9c \$2,210.40 9c \$2,210.40 9c \$2,20.00 9c \$2,20.00 <t< td=""><td>7. 2222C.S. Coil Mounting Brackets (12)</td><td></td><td></td></t<>	7. 2222C.S. Coil Mounting Brackets (12)		
7h \$2,210.40 8. <i>2221</i> Coll Pre-Load Clamp Assemblies (36) 5 9. 22247 4 Coll Mounting Clamp (12) \$37,054,50 9a L-C&M54 \$4,968,00 9b \$1,684,00 \$52,210,40 9c \$22,200 \$52,210,40 9d \$52,210,40 \$52,210,40 9d \$52,210,40 \$52,210,40 9d \$52,210,40 \$53,81,200 9c \$54,80,00 \$53,81,200 10a LC&M1240 \$52,200,40 10a \$53,31,2,00 \$53,31,2,00 10b \$53,31,2,00 \$53,31,2,00 10c \$53,31,2,00 \$53,31,2,00 10d \$53,31,2,00 \$53,31,2,00 10d \$53,31,2,00 \$53,31,2,00 10d \$53,31,2,00 \$53,31,2,00 10a \$53,31,2,00 \$53,31,2,00 10b \$53,31,2,00 \$53,31,2,00 11a \$14,544,540 \$14,44,60,00 11a \$14,544,540 \$14,544,540 11g \$14,	7a	I-C&M78	\$32,584.00
8. zzdF C coil Prc-Load Clamp Assemblies (36) \$37,051.50 Sn \$37,051.50 9. zzdF4 Coil Mounting Clamp (12) \$4,968.00 9e \$3,1,68.00 9e \$3,2,08.00 9c \$2,2,00 9d \$2,2,00 9d \$2,2,00 9d \$2,2,00 9d \$2,2,00 10, zMCWF-TF Mtg, Brkt, Spacer block & shim \$7,25,00 10a L C& M240 \$22,080.00 10b L C& M240 \$3,312,00 10c \$3,312,00 10d \$3,326,40 10d \$3,22,00,00 11a L C& M240 \$3,24,00 11b L C& M240 \$3,24,00 11c \$3,44,60,00 11b L C& M240 \$3,44,60,00 11c \$3,44,60,00 11f \$3,44,60,00 11d \$3,54,60 11d \$3,54,60 11d \$3,54,60 11d \$3,54,60 11d \$3,54,60 11d \$3,54,60 <	7b		\$2,210.40
8. 2021 F coil Pre-Load Clamp Asemblies (36) Sa ST,054.50 9. 2024 F4 coil Mounting Clamp (12) 9a LC&M54 54,968.00 9b S22,204.40 9d S22,204.40 9d S22,204.40 9d S22,204.40 9d S22,204.40 9d S22,204.40 9d S3,212.40 10a LC&M240 55,88.00 10a LC&M240 52,208.00 10b S3,312.00 10c S3,326.00 10c S3,326.00 10c S3,326.00 10c S3,312.00 10c S3,326.00 10c S3,32			
Sa 357,055.69 5:20PP4 Coll Mounting Champ (12) 5 9a L-C&M54 54,068.00 9c 35,210.40 55,126.80.00 9c 35,2210.40 55,22.00 9c 35,22.00 55,22.00 9c 35,22.00 55,22.00 9c 35,22.00 55,22.00 10. 57,255.00 57,255.00 10. S1,26.00 53,21.20 10. S22,080.00 55,22.04.01 10b 55,22.04.01 55,22.04.01 10b S3,26.40 55,22.04.01 10c S3,26.40 55,22.04.01 10d S3,26.40 55,22.04.01 10d S3,26.40 55,22.04.01 10d S3,26.40 55,22.04.01 11a L-C&M24 55,22.04.01 11b S3,24.00 55,22.04.01 11c S3,24.00 S3,24.00 11a S3,24.00 S3,24.00 11a S3,24.00 S3,24.00	8. 2222TF Coil Pre-Load Clamp Assembli	es (36)	
9, 222474 Coll Mounting Clamp (12) 9a LC&M54 54,968,00 9b S. State Coll Sta	8a		\$37,054.50
9a L-C&M54 54,968,00 9b 51,368,00 9c 52,210,40 9c 52,220,00 9c 52,220,00 9c 554,800 9c 57,255,00 10. 2KUVF-TF Mtg, Brkt, Spacer block & shim 10a LC&M240 10b 52,20,80,00 10b 53,22,08,00 10d 53,22,08,00 10d 53,22,08,00 10d 53,22,08,00 11. JAAchino/Base Support Interface 11. JAAchino/Base Support Interface 11. JAAchino/Base Support Interface 12. JMice, Assembly Hardware 12. JMice, Assembly Hardware 12. JMice, Assembly Hardware 12. JMice, Assembly Hardware 12. S11,06,064.60 S14,00 S14,00 12. S14,00 12. S14,00 12. S14,00 13.1 S14,00 14.1 S14,00 <td>9. 2222PF4 Coil Mounting Clamp (12)</td> <td></td> <td></td>	9. 2222PF4 Coil Mounting Clamp (12)		
9h \$1,204,00 9c \$2,210,40 9d \$2,210,40 9d \$2,210,40 9d \$2,210,40 9d \$5,81,80,00 9f \$5,81,80,00 9f \$5,81,80,00 10a, L/C.KD240 \$22,208,00 10b \$2,33,12,00 10c \$5,33,12,00 10d \$3,33,20,00 10d \$3,33,20,00 10d \$3,33,20,00 10d \$3,33,20,00 10d \$3,32,00 10d \$3,32,00 10d \$3,32,00 10d \$3,32,00 10d \$3,32,00 10d \$3,32,00 10d \$3,33,200 10d \$3,33,200 10d \$3,33,200 10d \$3,33,200 10d \$3,33,200 10d \$3,33,200 11d \$3,44,60 11d \$1,4,60,00 11d \$1,4,54,60	9a	I-C&M54	\$4,968.00
9 52,210.40 94 522.20 95 522.20 96 522.20 96 522.20 96 57.255.00 97 57.255.00 100 252.080.00 1016 53.312.00 102 56.230.40 104 53.23.40 104 53.23.40 104 53.23.40 105 52.208.00 111 JAckhine/Base Support Interface 111 14 C&M240 53.208.00 111 14 C&M240 53.208.00 112 114 C <m240< td=""> 53.208.00 114 53.50.00 11 115 53.50.60 11 116 53.50.60 11 117 53.208.00 53.50.60 118 53.50.60 11 119 53.50.60 11 112 21.00 53.20 113 53.50.60 11.20 114 53.50.60</m240<>	9h		\$1,368.00
94	96		\$2,210,40
	94		\$222.00
97 18. // WF-TF Mtg, Brkt. Spacer block & shim 18. / C&M240 18. / C&M240 18. / C&M240 18. / Machine/Base Support Interface 11. / Mise Machine/Base Machine/B	90		\$648.00
1 JUCWF-TF Mtg. Brkt. Spacer block & shim S22,080.00 10a VACWF-TF Mtg. Brkt. Spacer block & shim S22,080.00 10a LCM240 S22,080.00 10b S3,312,00 S3,312,00 10c S2,208,00 S3,312,00 11a LCAN240 S44,160,00 11c S1,4544,00 S1,4544,00 11c S1,4544,00 S1,4544,00 11c S1,4544,00 S1,4544,00 11f S1,4544,00 S1,4544,00 11g S1,4544,00 S1,4544,00 11g S1,4544,00 S1,4544,00 11g S1,4544,00 S1,4544,00 11d S1,4544,00 S1,454,40 11d S1,4544,00 S1,400 12a S1,400 S1,440 12a S1,400 S1,420	0F		\$7 295.00
10. CARMAGE Fragment \$22,000,00 10. CARMAGE \$3,312,00 10. Sa,232,40 \$3,322,00 11. JACAMAGE FRANK Support Interface \$3,322,00 11. JACAMAGE FRANK Support Interface \$3,322,00 11. Sa,232,00,00 \$1,4544,60 11. Sa,333,600 \$11,4544,66 11. Sa,336,00 \$33,36,00 11. Sa,366,00 \$32,80,00 12. JNic, Assembly Hardware \$31,40,00 12. JNic, Assembly Hardware \$31,40,00 12. Sa,31,40,00 \$31,40,00 12. Sa,31,40,00 \$31,34,00 12. Sa,31,40,00 \$31,34,00 12. Sa,31,40,00	10 + MCWE TE Min Dubi Susan blas	I. 8	37,275.00
100 122,000,00 100 123,312,00 100 33,312,00 100 33,312,00 100 33,312,00 100 33,312,00 100 33,312,00 100 33,312,00 100 33,312,00 100 33,312,00 101 33,312,00 101 33,312,00 11a 14,254,00 11c 31,454,00 11c 31,454,00 11f 31,454,00 11f 31,454,60 11g 31,40,00 12g 35,420,00 12g 31,40,00 12g 31,44,00 12g	 ZNC WF-IF Mig. Brkt. Spacer bloc 10- L C & M240 	k & sinni	\$22,080,00
109 \$3.312.00 100 \$3.52.40 101 \$5.23.40 102 \$5.23.40 103 \$32.40 104 \$52.40 105 \$21,88.00 11 \$52.40 11 \$52.40 11 \$52.40 11 \$52.40 11 \$52.40 11 \$52.40 11 \$52.20.00 11 \$52.200.00 116 \$53.50.00 117 \$53.50.00 118 \$53.50.00 119 \$53.50.00 110 \$53.50.00 111 \$53.50.00 112 \$10.308.40 112 \$10.308.40 112 \$10.308.40 112 \$10.308.40 112 \$13.400 112 \$13.400 112 \$13.400 112 \$13.400 113 \$13.400 114 \$13.400	10a I-C&M240		\$22,080.00
IIIC S6,204,40 IOE S23,64,0 IOE S23,64,0 IOE S23,64,0 IOE S23,64,0 IOE S23,64,0 ITA LC&M240 S44,160,00 ITA LC&M240 S44,160,00 ITA LC&M240 S1,4544,00 ITC S2,208,00 ITG S1,4544,00 ITG S1,4544,00 ITG S1,4544,00 ITG S1,4544,00 ITG S1,4544,00 ITG S3,66,00 ITG S3,66,00 ITG S3,86,00 ITG S2,88,00 ITG S2,88,00 ITG S2,88,00 ITG S2,88,00 ITG S2,88,00 ITG S1,44,00 ITG S2,88,00 ITG S1,40,00 ITG S1,40,00 ITG S1,40,00 ITG S1,40,00 ITG S1,40,00	105		\$3,312.00
104 \$32.6.40 106 \$21.888.00 11. / Archino/Base Support Interface \$44.160.00 11. / C.M.124 \$54.40 11. / C.M.124 \$52.208.00 11. / C.M.124 \$54.46 11. / C.M.124 \$54.46 11. / C.M.124 \$54.46 11. / C.M.124 \$55.60 11. / C.M.124 \$55.60 11. / C.M.124 \$55.60 11. / C.M.124 \$55.60 11. / C.M.124 \$50.60 11. / C.M.124 \$50.60 11. / C.M.124 \$51.40 11. / C.M.124 \$51.40 12. / Misc Assembly Hardware \$51.40 12. / Misc Assembly Hardware \$13.40 12. / Misc Assembly Hardware \$11.06.064.60 12. / Misc Assembly Hardware \$11.06.064.60 557.658.00 \$58.600.00 12. / Misc Assend Halowance \$56.600.00	10c		\$6,230.40
10e \$21,88,80,0 1. A'Machine/Base Support Interface 344,160,00 11a L-C&N240 \$44,160,00 11a L-C&N240 \$7,200,00 11c \$14,544,00 11c \$14,544,00 11d \$14,544,00 11e \$14,544,00 11e \$14,544,00 11e \$14,544,00 11f \$14,544,60 11g \$14,544,60 11g \$14,544,60 11g \$14,544,60 11g \$13,454,60 11g \$14,544,60 11g \$13,454,60 11g \$13,454,60 11g \$13,454,60 11g \$13,454,60 11g \$13,454,60 11d \$13,454,60 11d \$13,454,60 11d \$13,454,60 11d \$14,284,00 12d \$13,400 12d \$13,400 12d \$13,400 12d \$13,400 12d	100		\$326.40
11. yAkchine/Base Support Interface 11. jac/KM240 \$44,160,00 11b LCKM240 \$5,208,00 11d \$5,208,00 11d \$14,244,00 11d \$14,444,00 11f \$14,444,00 11f \$14,444,00 11f \$14,444,00 11f \$14,444,00 11f \$14,444,00 11g \$5,566,00 11h \$3,536,00 11a \$3,540,00 11a \$3,540,00 11a \$3,540,00 11a \$3,540,00 11a \$3,540,00 11a \$3,540,00<	10e		\$21,888.00
11a LC&M240 \$44,16,000 11a LC&M240 \$57,200,000 11c \$57,200,000 11c \$52,208,000 11d \$14,544,000 11e \$14,544,000 11e \$14,544,000 11f \$14,544,000 11g \$14,544,000 11g \$14,544,000 11g \$53,66,000 11i \$53,66,000 11i \$53,66,000 11i \$53,86,000 11i \$51,106,064,600 \$50,964,800 \$54,800,000 12i \$59,694,800 12i \$50,690,800 12i \$51,106,064,600 12i \$51,106,064,600 12i	11. z Machine/Base Support Interface		
11b \$7,200,00 11c \$2,208,00 11d \$14,454,00 11d \$14,454,00 11f \$14,454,00 11f \$14,454,00 11g \$14,454,00 11g \$15,068,00 11a \$10,368,40 12 \$10,368,40 12 \$10,368,40 12 \$10,368,40 12 \$10,308,40 12 \$10,308,40 12 \$10,308,40 12 \$10,308,40 12 \$10,308,40 12 \$10,308,40 12 \$10,308,40 12 \$10,00 12 \$10,00 12 \$11,00 12 \$13,400 12 \$13,400 12 \$13,400 12 \$13,400 12 \$13,400 12 \$13,400 12 \$13,400 12 \$13,400 12 \$13,400 12 \$3,000,00 121 \$3,000,00 \$10,100,100,480 \$1,128,120,00 Insp.,Pkging,Shipping \$25,000,00 70tal FOB Plainsboro,NJ \$1,153,122,60	11a I-C&M240		\$44,160.00
11c \$\$2,208,00 11d \$\$1,454,00 11e \$\$4,454,00 11e \$\$1,454,60 11g \$\$1,454,60 11g \$\$3,56,00 11i \$\$33,56,00 11i \$\$10,368,40 12a \$\$10,368,40 12b \$\$288,00 12b \$\$288,00 12c \$\$288,00 12c \$\$33,40,00 12d \$\$13,40,00 12d \$\$13,40,00 12f \$\$13,40,00 12g \$\$1,06,064,60 >\$02g,04,480 \$\$1,12g,192,60 <t< td=""><td>11b</td><td></td><td>\$7,200.00</td></t<>	11b		\$7,200.00
11d \$14,44,00 11e \$4,416,00 11f \$14,44,00 11f \$14,444,00 11g \$5,968,00 11h \$5,968,00 11h \$10,368,40 12, 2 Misc, Asembly Hardware \$10,368,40 12 \$10,368,40 12 \$10,368,40 12 \$10,368,40 12 \$28,00 12d \$52,800 12c \$51,400 12c \$51,400 12g \$50,800 12g \$3,040,40 12d \$3,040,40 12d \$3,040,40 12d \$3,044,30 \$50,680 \$3,044,30 \$50,680 \$3,646,80 \$50,741 \$1,128,128,00 1msp.Pkging.Shipping \$25,000,00 70tal FOB Plainsboro,NJ \$1,153,129,260	11c		\$2,208.00
11e \$\$4,544,60 11f \$\$1,454,60 11g \$\$3,56,60 11g \$\$33,56,00 11i \$\$33,56,00 11i \$\$10,368,40 12a \$\$10,368,40 12a \$\$288,00 12b \$\$288,00 12c \$\$33,56,00 12c \$\$33,56,00 12b \$\$288,00 12c \$\$34,400 12c \$\$34,400 12d \$\$13,400 12f \$\$13,400 12g \$\$13,400 12g \$\$13,400 12g \$\$13,400 12g \$\$13,400 12g \$\$13,400 12g \$\$19,200 12i \$\$9,604,80 \$\$19,200 \$\$13,200 12j \$\$9,604,80 \$\$05,850,800 \$\$28,800,00 \$\$05,850,800 \$\$28,800,00 \$\$1,128,192,680 \$\$1,128,192,680 1ssp_2,650,250,200 \$\$25,260,00,00 151,252,560	11d		\$14,544.00
11f \$14,44,60 11g \$5,966,00 11h \$5,966,00 11h \$10,068,40 12 \$10,068,40 12 \$10,068,40 12 \$10,068,40 12 \$10,068,40 12 \$10,068,40 12 \$10,000,00 12b \$20,000,00 12c \$12,000 12c \$12,000 12c \$13,400 12c \$13,400 12c \$13,400 12g \$30,000,00 12l \$30,000,00 12l \$30,000,00 12l \$22,000,000 50% as mat'i allowance \$56,680,000 M&S Total \$1,128,129,200 Insp.,Pking.,Shipping \$225,000,000 Total FOB Plainsboro,NJ \$1,153,192,60	11e		\$4,416.00
11g	11f		\$14,544.60
116 S33.600 11 \$10,56.40 12. J Misc. Assembly Hardware \$10,06.40 12. J Misc. Assembly Hardware \$900,00 12. Status \$38,00 12. Status \$38,00 12. Status \$328,00 12. Status \$34,00 12. Status \$134,00 13.1 Status \$131,20 12. Status \$3000,00 12. Status \$1,106,064,60 50% statilowance \$28,000 50% statilowance \$28,000 Status \$1,128,128,00 Insp.,Pkging.,Shipping \$25,000,00 Total FOB Plainsboro,NJ \$1,153,129,260	11g		\$5,968.00
111 S10,368.40 12a Nisc. Assembly Hardware \$100,00 12a \$300,00 \$258,800 12b \$258,800 \$258,800 12c \$314,400 \$314,400 12d \$314,400 \$14,400 12e \$314,400 \$11,400 12g \$56,000 \$11,92,00 12i \$59,694,800 \$19,200 12j \$59,694,800 \$56,800,000 50% ss mat'i allowance \$28,800,000 \$56,680,000 Stato = \$56,680,000 \$51,126,000,000 \$11,28,192,600 Insp_Pkging_Shipping \$25,000,000 \$25,000,000 Total FOB Plainsboro,NJ \$1,153,192,600 \$15,153,192,600	11ĥ		\$336.00
12 J Misc. Assembly Hardware SH00000 12a SS00.00 12a SS00.00 12b SS28.00 12c SS28.00 12c SS28.00 12c SS28.00 12d SS28.00 12d SS28.00 12d SS28.00 12d SS28.00 12d SS28.00 12g SS000.00 12l SS000.00 12l SS000.00 Strap value -\$66.680.00 MAS Total \$1,128,192.60 InspPkgingShipping \$25,000.00 Total FOB Plainsboro,NJ \$1,153,192.60	116		\$10,368.40
13 \$990.00 13b \$388.00 13c \$358.00 13c \$358.00 13c \$358.00 13c \$354.00 13c \$354.00 13c \$354.00 13c \$354.00 13c \$354.00 13c \$354.00 12c \$359.00 12g \$39.00 12d \$39.00 12d \$39.00 12d \$39.00 12i \$39.00 12j \$39.00 12j \$39.00 12j \$39.00 12j \$39.00 50% ss mat'i allowance \$56.60 0mspPkgingShipping \$25.000 15da FOB Plainsboro,NJ \$1,153,192.60	12. / Misc. Assembly Hardware		910,000,40
	12a		\$000.00
	126		\$200.00
12c \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	120		5288.00
12a \$134.00 12e \$134.00 12f \$134.00 12f \$134.00 12f \$154.00 12g \$66.00 12h \$19.20 12i \$9,000.00 12j \$9,000.00 50% ss matl allowance \$28,808.00 scrap value -\$6,680.00 Insp.,Pkging,Shipping \$25,000.00 Total FOB Plainsboro,NJ \$1,153,192.60	120		\$420.00
12e \$\$22,000 12f \$\$13,400 12g \$\$60,00 12g \$\$60,00 12h \$\$19,002,00 12h \$\$9,004,80 subtotal \$\$1,106,064,60 50% ss mat'l allowance \$\$28,800,00 scrap value -\$\$6,680,00 M&S Total \$\$1,128,192,60 inspPkgingShipping \$\$2,000,00 Total FOB Plainsboro,NJ \$\$1,153,192,60	120		\$134.00
12f \$134.00 12g \$66.00 12b \$19.20 12b \$9,000.00 12j \$9,004.00 12j \$9,004.00 50% ss mat'allowance \$28,808.00 scrap value -\$6,680.00 Insp.,Pkging,Shipping \$25,000.00 Total FOB Plainsboro,NJ \$1,153,192.60	120		\$420.00
12g \$660.00 12h \$19.20 12h \$19.00 12i \$9.000.00 subtotal \$1,106,064.60 50% ss mat'i allowance \$28,808.00 scrap value -\$6,680.00 M&S Total \$1,128,192.60 inspPkgingShipping \$25,000.00 Total FOB Plainsboro,NJ \$1,153,192.60	12f		\$134.00
12h \$19.20 12i \$9,000,00 12j \$9,000,00 subtotal \$1,166,064.60 50% ss mat allowance \$28,808,000 scrap value -\$6,680,00 MAS Total \$1,128,926.00 Insp.,Pkging,Shipping \$25,900,00 Total FOB Plainsboro,NJ \$1,153,192.60	12g		\$60.00
12i \$9,900,00 12j \$9,64,80 subtotal \$1,106,064,60 50% as mat'i allowance \$28,808,00 scrap value -\$6,680,00 M&S Total \$1,128,192,60 InspPkging.,Shipping \$28,000,00 Total FOB Plainsboro,NJ \$1,153,192,60	12h		\$19.20
12j \$9,694.80 subtotal \$1,106,064.60 50% ss mati allowance \$28,808.00 scrap value -\$6,680.00 M&S Total \$1,128,192.60 Insp.,Pkging,Shipping \$25,000.00 Total FOB Plainsboro,NJ \$1,153,192.60	12i		\$9,000.00
subtotal \$1,106,064.60 50% ss mat'l allowance \$28,806.00 scrap value -\$6,680.00 MAS Total \$1,128,192.60 InspPkging\$25,000.00 \$25,000.00 Total FOB Plainsboro_NJ \$1,13,192.60	12j		\$9,694.80
subtotal \$1,106,064.60 50% ss mat'allowance \$28,808.00 scrap value -\$6,680.00 M&S Total \$1,128,192.60 Insp.,Pkging,Shipping \$25,000.00 Total FOB Plainsboro,NJ \$1,13,192.60	•		
50% ss mat'l allowance \$28,808.00 scrap value -\$6,680.00 MAS Total \$1,28,192.60 Insp.,Pkging,Shipping \$25,000.00 Total FOB Plainsboro,NJ \$1,153,192.60	subtotal		\$1,106,064.60
328,000,00 Scrap value -56,680.00 M&S Total \$1,128,192.60 Insp.,Pkging,Shipping \$25,000.00 Total FOB Plainsboro,NJ \$1,153,192.60	50% ss mat'l allowance		\$28 808 00
scrap vaue -56,680.00 M&S Total \$1,128,192.60 InspRyding			\$20,000.00
M&S Total \$1,128,192.60 InspPkging_Shipping \$25,000.00 Total FOB Plainsboro,NJ \$1,153,192.60	scrap value		-\$6,680.00
Insp.,Pkging.,Shipping \$25,000.00 Total FOB Plainsboro,NJ \$1,153,192.60	M&S Total		\$1,128,192.60
Total FOB Plainsboro,NJ \$1,153,192.60	Insp.,Pkging.,Shipping		\$25,000,00
I otal FUB Plainsboro,NJ \$1,153,192.60	T . I FOD DI		÷20,000,000
	I otal FOB Plainsboro,NJ		\$1,153,192.60



F. Dahlgren -SC Project Review of NCSX, April 8-10,

2008



PF-TF Coil Supports -Cost estimate breakdown -con't.



Cost estimates are based primarily on budgetary quotes from prospective vendors:

PASSAIC C	OUNTY WELDERS, INC QUOTE RECEIVED: 2 MAY 2007							
QTY		U	NIT COST		TOTAL		NET UNIT WEIGHT	TOTAL WEIGHT
6	REQDPF-6 VERTICAL STIFFENER DWG. SE151-152 REV O.	\$	1,645.00	\$	9,870.00		41.1	246.0
12	REQDPF-6 VERTICAL STIFFENER DWG. SE151-153 REV O.	\$	1,310.00	\$	15,720.00		44.0	528.0
6	REQDPF-6 SUPPORT ARC DWG. SE151-156 REV O.	\$	2,471.00	\$	14,826.00		54.4	326.4
12	REQDPF-6 SUPPORT ARC DWG. SE151-160 REV O.	\$	3,253.00	\$	39,036.00		107.5	1,290.
42	REQDPF-5 & PF-6 SUPPORT BRACKET DWG.SE151-175 REV O.	\$	3,204.00	\$	134,568.00		113.7	4,775.
72	REQDCOIL REAR LEFT SUPPORT DWG. SE151-177 REV O.	\$	1,552.00	\$	111,744.00		46.3	3,333.
72	REQDTF COIL FRONT LEFT BRK. DWG. SE151-179 REV O.	\$	1,424.00	\$	102,528.00		33.2	2,390.
	FOB WAYNE,NJ.		SUB-TOTAL		428,292.00	ADJUST WT. 72-RH BRKTS.	12,890.4 (792.0	
	THIS ESTIMATE WAS FOR 316L SOLUTION ANNEALED PLATE							12,098.4
	ESTIMATE FOR COST DELTA FOR INCONEL 601: @22.50/LB SHIPPING, PACKAGING & INSPECTION TOTAL ADJUSTED COST FOR ITEMS 1 THRU 7			\$	217,771.20 15,000.00 661,063.20			
	MY ESTIMATE FOR 7 ITEMS 1A,2A,3A,4A,4B,5A,5B +S,P&I			\$	628,765.00 -	-5% LOWER		
	NOTE: QUOTE FOR 7 ITEMS ONLY TF & PF5&6 BRACKETRY NO HARDWARE, INSULATORS, PF4 SUPP'TS, TF-PRE-LOAD, BASE SUPPORT INTERFACE, ETC.							

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.



