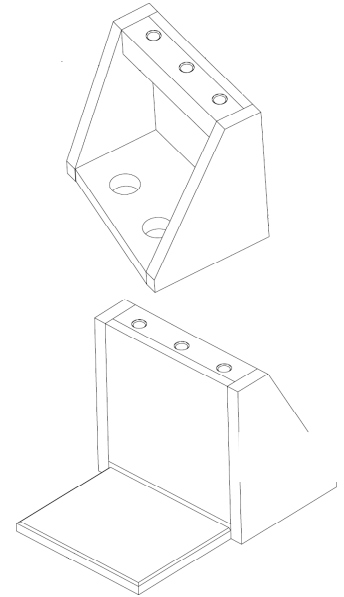


**NCSX Coil Support Structure – 1501/1550 Re-baseline estimate – Rev.F 26 April 2007**

**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.: Inconel 625 plate.....40 lbs. x 28.50 = 1140.00
  
- 1b. G11-CR Mtg. blocks (36 req'd.)
  - Cutting & machining (2 pcs.) .....2.5 hrs x \$92.00 = \$230.00
  - Epoxy adhesive bond to coil .....0.5 hrs x \$75.00 = 37.50
  - Mat'l.: G11-CR plate \$48.00 per pc. ....2 pcs. x \$48.00 = 96.00
  
- 1c. G11-CR Side Wedge Shims (4 pcs. Req'd per set x 36 sets)
  - Cutting & Machining wedges .....3.0 hrs. x \$92.00 = \$276.00
  - Mat'l.: G11-CR plate \$42.00 per pr. ....2 pcs. x 42.00 = 84.00
  - Teflon pads 1/8" thk. ....2 pcs x 27.00 = 54.00
  
- 1d. 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 Series .....4 pcs. x 3.65 = 14.60
  - (4) 1" Lock Washer .....4 pcs. x 2.95 = 11.80
  - (6) 1/2 -13 N.C. Hex Head Bolts .....6 pcs, x 19.80 = 118.80
  - (6) 1/2" Flat Washers – Heavy Series .....6 pcs. x 2.65 = 15.90
  - (6) 1/2" Split Lock Washer .....6 pcs. x 2.10 = 12.50
  
- 1e. T.F. Bridge Clamp (36 Req'd)
  - Cutting & machining .....3.0 hrs x \$92.00 = \$276.00
  - Mat'l.: Inconel 625 plate .....12.0lbs x 28.50 = 342.00
  
- 1f. PFTE coated G11-CR wedge assemblies (72 Req'd.)
  - Cutting & machining .....2 pcs. x 3.0 hrs x 92.00 = 550.00
  - Teflon coating .....2 pcs @ \$40.00/pc. = 80.00



**2. Outer TF support Structure**

- 2a. Supp't brkts. (72 req'd.)
  - Cutting & machining .....7.5 hrs x \$92.00 = \$690.00
  - 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.: Inconel 625 plate.....55 lbs. x 28.50 = 1567.50
  
- 2b. G11-CR Mtg. blocks (36 req'd.)
  - Cutting & machining (2 pcs.) .....2.5 hrs x \$92.00 = \$230.00
  - Epoxy adhesive bond to coil .....0.5 hrs x \$75.00 = 37.50
  - Mat'l.: G11-CR plate \$48.00 per pc. ....2 pcs. x \$48.00 = 96.00

## Outer TF support Structure (con't.)

2c. G11-CR Side Wedge Shims (4 pcs. Req'd per set x 36 sets)  
 Cutting & Machining wedges .....3.0 hrs. x \$92.00 = \$276.00  
 Mat'l.: G11-CR plate \$42.00 per pr. ....2 pcs. x 42.00 = 84.00  
 Teflon pads 1/8" thk. ....2 pcs x 27.00 = 54.00

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 Series .....4 pcs. x 3.65 = 14.60  
 (4) 1" Lock Washer .....4 pcs. x 2.95 = 11.80  
 (6) 1/2 -13 N.C. Hex Head Bolts .....6 pcs, x 19.80 = 118.80  
 (6) 1/2" Flat Washers – Heavy Series .....6 pcs. x 2.65 = 15.90  
 (6) 1/2" Split Lock Washer .....6 pcs. x 2.10 = 12.50

2e. T.F. Bridge Clamp (36 Req'd)  
 Cutting & machining .....3.0 hrs x \$92.00 = \$276.00  
 Mat'l.: Inconel 625 plate .....12.0lbs x 28.50 = 342.00

2f. PFTE coated G11-CR wedge assemblies (72 Req'd.)  
 Cutting & machining .....2 pcs. x 3.0 hrs x 92.00 = 550.00  
 Teflon coating .....2 pcs @ \$40.00/pc. = 80.00

### 3. PF5/PF6 Support Brkt. Ass'y. (42 Req'd.)

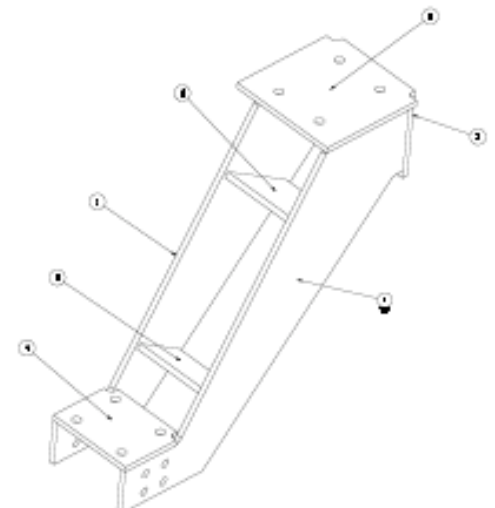
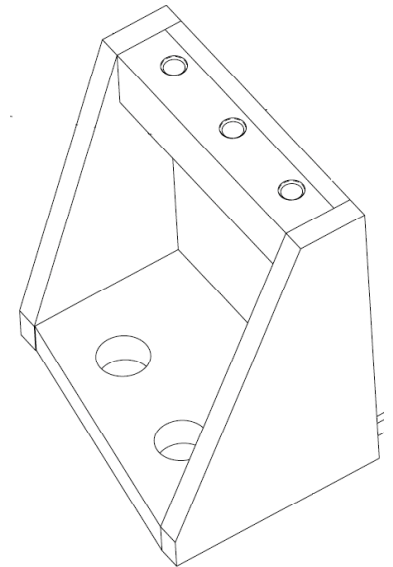
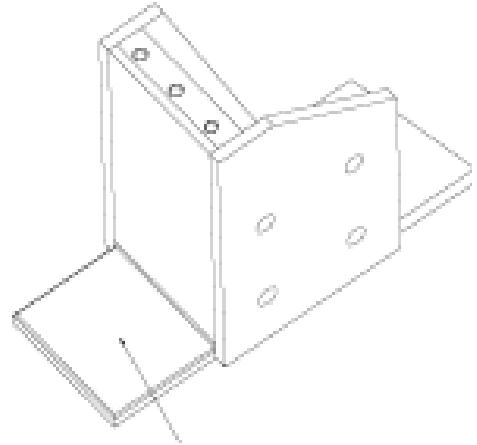
3.a Bracket Ass'y (42 Req'd.)  
 Cutting & Machining .....12.0 hrs x \$92.00 = \$1104.00  
 Weld prep & weld .....6.5 hrs x 76.00 = 494.00  
 Clean-up de-scale de-burr .....1.5 hrs x 76.00 = 114.00  
 Mat'l.: Inconel 625 plate .....120.0lbs x 28.50 = 3420.00

3b. P.F. 5 Bridge Clamps (36 Req'd)  
 Cutting & machining .....3.0 hrs x \$92.00 = \$276.00  
 Mat'l.: Inconel 625 plate .....12.0lbs x 28.50 = 342.00

3c. P.F. 6 Bridge Clamps (36 Req'd)  
 Cutting & machining .....3.0 hrs x \$92.00 = \$276.00  
 Mat'l.: Inconel 625 plate .....12.0lbs x 28.50 = 342.00

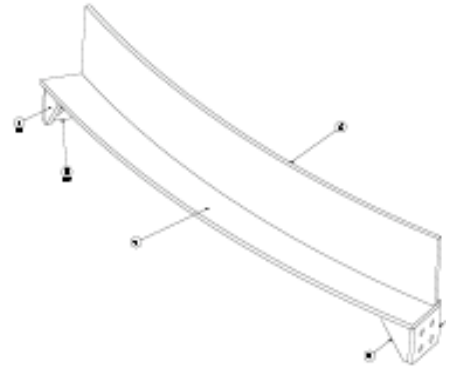
3d. Inconel Hardware (36 sets Req'd.)  
 (4) 3/4-10 N.C. x 8.5" Hex Head Bolts ...4 pcs. x \$ 68.90 = \$275.60  
 (4) 3/4-10 N.C. x 9.5" Hex Head Bolts ...4 pcs. x 73.90 = 295.60  
 (4) 3/4-10 N.C. Hex Nuts .....4 pcs. x 24.80 = 99.20  
 (8) 1" Flat Washer – Heavy Series .....8 pcs. x 3.65 = 29.20  
 (8) 1" Lock Washer .....8 pcs. x 2.95 = 23.80

3e Positioning Brkt. Ass'y. (21 Req'd)  
 Cutting & Machining .....8.0 hrs x \$92.00 = \$ 736.00  
 Weld prep & weld .....2.5 hrs x 76.00 = 190.00  
 Clean-up de-scale de-burr .....1.5 hrs x 76.00 = 114.00  
 Mat'l.: Inconel 625 plate .....35.0lbs x 28.50 = 997.00



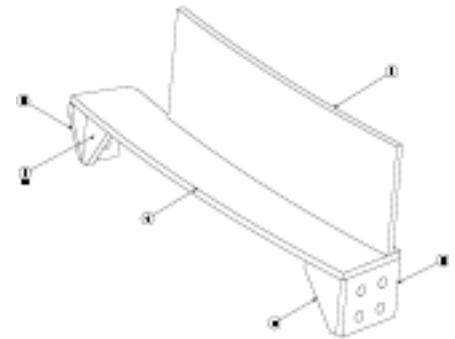
**4. PF5/PF6 Support Frame Ass'y Long Span (6 Ass'y. Req'd)**

- 4a. Curved beam angle (For 2- Req'd. per ass'y)  
 Cutting & Machining .....7.5 hrs x \$92.00 = \$690.00  
 Bend forming .....14.0 hrs x 75.00 = 1050.00  
 Weld prep & weld .....6.0 hrs x 76.00 = 456.00  
 Clean-up de-scale de-burr .....1.5 hrs x 76.00 = 114.00  
 Mat'l.: Inconel 625 plate .....112.0lbs x 28.50 = 3192.00
- 4b. 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'l.: Inconel 625 plate chann .....44.0lbs x 120.00 =5280.00
- 4c. Inconel Mtg. Hardware (6 sets of 4 per ass'y)  
 (4) ½ -13 N.C. Hex Head Bolts .....4 pcs, x 24.50 = 98.00  
 (4) ½ -13 N.C. Hex Nuts .....4 pcs. x 16.80 = 67.20  
 (4) ½” Flat Washers – Heavy Series .....4 pcs. x 2.65 = 10.60  
 (4) ½” Split Lock Washer .....4 pcs. x 2.10 = 8.40



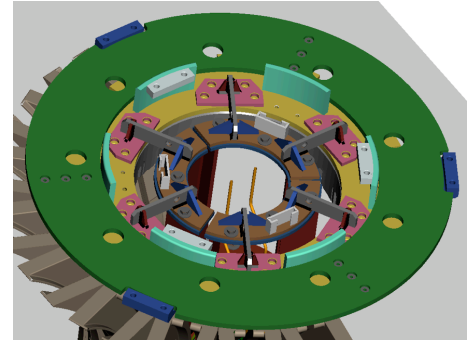
**5. PF5/PF6 Support Frame Ass'y Short Span (3 Ass'y. Req'd)**

- 5a. Curved beam angle (For 2- Req'd. per ass'y)  
 Cutting & Machining .....7.5 hrs x \$92.00 = \$690.00  
 Bend forming .....14.0 hrs x 75.00 =1050.00  
 Weld prep & weld .....6.0 hrs x 76.00 = 456.00  
 Clean-up de-scale de-burr .....1.5 hrs x 76.00 = 114.00  
 Mat'l.: Inconel 625 plate .....112.0lbs x 28.50 = 3192.00
- 5b. 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'l.: Inconel 625 plate chann .....44.0lbs x 120.00 =5280.00
- 5c. . Inconel Mtg. Hardware (3 sets of 4 per ass'y)  
 (4) ½ -13 N.C. Hex Head Bolts .....4 pcs, x 24.50 = 98.00  
 (4) ½ -13 N.C. Hex Nuts .....4 pcs. x 16.80 = 67.20  
 (4) ½” Flat Washers – Heavy Series .....4 pcs. x 2.65 = 10.60  
 (4) ½” Split Lock Washer .....4 pcs. x 2.10 = 8.40



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

- 6a. Base Ring
  - Castings ..... 355 lbs x \$35.00 = \$12,425.00
  - Machining ..... 120 hrs x 92.00 = 11,040.00
- 6b. PF4 Brkts Inco plate weldments – (6 Top & 6 Bottom)
  - (6) Cutting & Machining .....2.5 hrs x 6 x \$92.00 = \$1380.00
  - (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'l.: Inconel 625 plate ..... .41.0lbs x 28.50 = 1168.50

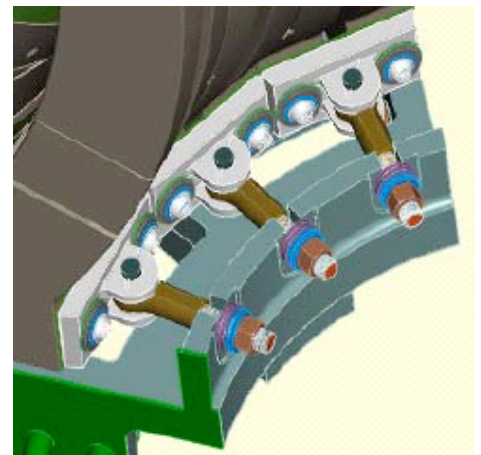


**7. C.S. Coil mtg. brkts. (2x=12 brkts total)**

- 7a. Inconel Suppt't brackets (2 sets Req'd – 6 Top & 6 Bottom)
  - (6) Cutting & Machining .....6.5 hrs x 6 x \$92.00 = \$3588.00
  - (6) Weld prep & weld .....2.5 hrs x 6 x 76.00 = 1140.00
  - (6) Clean-up de-scale de-burr .....3.0 hrs x 6 x 76.00 = 228.00
  - (6) Mat'l.: Inconel 625 plate .....67.0lbs x 6 x 28.50 = 11,336.40
- 7b. . Inconel Mtg. Hardware (6 sets of 4 per ass'y)
  - (4) ½ -13 N.C. Hex Head Bolts .....4 pcs, x 24.50 = 98.00
  - (4) ½ -13 N.C. Hex Nuts .....4 pcs. x 16.80 = 67.20
  - (4) ½” Flat Washers – Heavy Series .....4 pcs. x 2.65 = 10.60
  - (4) ½” Split Lock Washer .....4 pcs. x 2.10 = 8.40

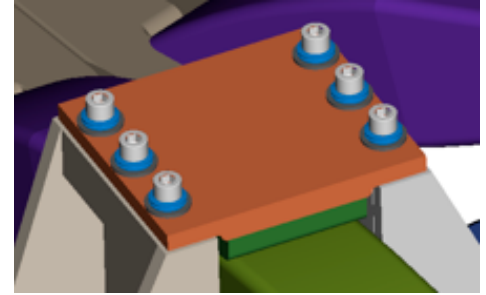
**8. T.F. Pre-load clamp Assemblies**

- 8a. Stلالloy 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 ½ -13NC Hex Head Bolt .....16.80 x 72 = 1,209.60
- (72) Inco ½” Flat 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 ¾-10NC” Jack Nut .....28.50 x 36 = 1,026.00
- (36) Inco ¾” Swivel Eye-Bolt .....51.50 x 36 = 1,854.00
- (36) G11-CR ¼” thk. Insul. Pad .....18.50 x 36 = 666.00



**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-burr .....1.5 hrs x 76.00 = 114.00
- 9c. Inconel Hardware
  - (4) 1/2 -13 N.C. Hex Head Bolts .....4 pcs, x 24.50 = 98.00
  - (4) 1/2 -13 N.C. Hex Nuts .....4 pcs. x 16.80 = 67.20
  - (4) 1/2" Flat Washers – Heavy Series ....4 pcs. x 2.65 = 10.60
  - (4) 1/2" Split Lock Washer .....4 pcs. x 2.10 = 8.40
- 9d. (1) G11-CR 1/4" thk. Insul. Pad .....18.50 = 18.50
- 9e. (2) Teflon pads .....2 pcs. x 27.00 = 54.00
- 9f. 6 x 6 x 3/4" thick Inconel625 plate ..... 7.83lbs x 28.50 = 223.15

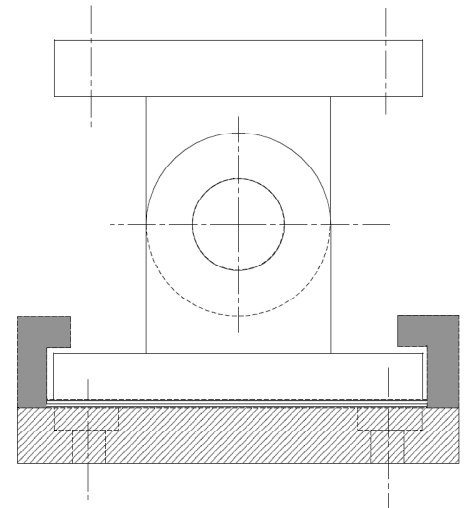


**10. Inner & outer spacer blocks MCWF-TF supp't brkts (24 Req'd.)**

- 10a. C & M blocks.....10hrs x 92.00 = 920.00
- 10b. Clean-up, de-scale & de-burr.....1.5 hrs x 92.00 = 138.00
- 10c. (4) Inco 3/4 -10NC Hex Bolt .....4.25 grip 64.90 x 4 = 259.60
- 10d. (4) Inco 3/4" Flat Washers .....3.40 x 4 = 13.60
- 10e. Inco 625 6" x 6" x 3" thick plate ....32lbs ea. X \$28.50 = 912.00

**11. Machine/base support Interface (3 Req'd.)**

- 11a. C & M plates .....(11 parts) 80 hrs x 92.00 = 7,360.00
- 11b. Weld Clevises & side plates .....16 hrs x 75.00 = 1,200.00
- 11c. Clean-up, de-scale & de-burr.....4 hrs x 92.00 = 368.00
- 11c. C & M Clevis pins .....4 hrs x 92.00 = 368.00
- 11e. C & M G11 & Teflon sheets .....8 hrs x 92.00 = 736.00
- 11f. Inco 625 plates & rnd. Bar.....144 lbs x 28.50 = 4,104.00
- 11g. G11-CR Plate .....10" x 10" x 1" = 158.00
- 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 Bolts ....4 pcs. x \$50.40 = \$201.60
  - (4) 1" Flat Washer – Heavy Series ....4 pcs. x 3.65 = 14.60
  - (4) 1" Lock Washer .....4 pcs. x 2.95 = 11.80



**12. Misc. Assembly Hardware**

- 12a. G11 bushings TF clamps .....360 x 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 x 12.50 = 9,000.00
- 12j Inconel 718 1.03 ID B'ville washers.....360 x 26.93 = 9,694.80

**Job 1501/1550 M& S Summary & Totals:**

<b>1. Inner TF Support Structure (36)</b>	
1a I-C&M432	136,598.20
1b	13,086.00
1c	16,848.00
1d	13,507.20
1e I-C&M108	22,248.00
1f	45,360.00
<b>2. Outer TF Support Structure (36)</b>	
2a I-C&M540	178,956.00
2b	13,086.00
2c	16,848.00
2d	13,500.00
2e I-C&M108	22,248.00
2f	45,360.00
<b>3. PF5/PF6 Support Bracket Assembly (42)</b>	
3a I-C&M504	215,544.00
3b I-C&M108	22,248.00
3c I-C&M108	22,248.00
3d	26,042.40
3e I-C&M168	42,777.00
<b>4. PF5/PF6 Support Frame Assembly – Long (6)</b>	
4a I-C&M45	33,012.00
4b I-C&M12	33,148.80
4c	6,624.00
<b>5. PF5/PF6 Support Frame Assembly – Short (3)</b>	
5a I-C&M45	16,506.00
5b I-C&M12	16,572.00
5c	2,210.40
<b>6. TF Pre-Load Ring &amp; PF4 Support (2)</b>	
6a. I-C&M240	46,930.00
6b I-C&M15	8,234.00
<b>7. C.S. Coil Mounting Brackets (12)</b>	
7a I-C&M78	32,584.00
7b	2,210.40
<b>8. TF Coil Pre-Load Clamp Assemblies (36)</b>	
8a	20,214.00
<b>9. PF4 Coil Mounting Clamp (12)</b>	
9a I-C&M54	4,968.00
9b	1,368.00
9c	2,210.40
9d	222.00
9e	648.00
9f	6,677.8
<b>10. MCWF-TF Mtg. Brkt. Spacer block &amp; shim</b>	
10a I-C&M240	22,080.00
10b	3,312.00
10c	6,230.40
10d	326.40
10e	21,888.00

## 11. Machine/Base Support Interface

11a I-C&M240	22,080.00
11b	3,600.00
11c	1,104.00
11d	1,104.00
11e	2,208.00
11f	12,312.00
11g	484.00
11h	168.00
11i	682.20

## 12. Misc. Assembly Hardware

12a	900.00
12b	288.00
12c	420.00
12d	134.00
12e	420.00
12f	134.00
12g	60.00
12h	19.20
12i	9,000.00
12j	4,896.00

	<b>SUB_TOTAL:</b>	<b>\$ 1,216,490.80</b>
+ 50% material allowance on 18,489 lbs, Inconel 625,	$18,489 \times 28.50 \times 0.5 =$	$\$263,468.50$
Less scrap value \$ 10.50/lb	$18,498 \times 10.50 \times 0.5 =$	$- \mathbf{97,067.25}$
	<b>TOTAL COST</b>	<b>\$ 1,382,892.05</b>

<b>TOTAL M&amp;S PF/TF COIL STRUCTURE*</b>	<b>\$ 1,382,892.05</b>
<b>ADD INSPECTION, PACKAGING &amp; SHIPPING</b>	<b>55,000.00</b>
<b>TOTAL COST FOB PLAINSBORO NJ</b>	<b>\$ 1,437,892.05</b>

**\*THIS DOES NOT INCLUDE THE CS SUPPORTS OR TRIM COIL SUPPORT, OR ENGINEERING, DESIGN AND ASSEMBLY LABOR.**

### NOTES:

1. LABOR RATES BASED ON WEB SURVEY AND SLAC IN-HOUSE RATES
2. 316L @ \$7.50/LB. RANGE OF THREE QUOTES ON .5" - .75" PLATE
3. SOLUTION ANNEAL MAY ADD 15 – 20% . NO VENDOR WILL CERTIFY THE MAGNETIC PERMEABILITY AS LESS THAN 1.02 (1.2 – 1.5 TYPICAL)
4. HARDWARE COSTS BASED ON 1 QUOTE B&G MFG. & MCMASTER-CARR CATALOG PRICING WHERE AVAILABLE. (INCONEL 718 ~ 4X MORE).
5. INCONEL 625 PLATE WITH CURRENT COMMODITY SURCHARGES COST ~ \$28.50/LB. BASED ON FERGUSON METALS QUOTE (WEB SURVEY YIELDED \$29-32.00/LB. AND METALSUPPLIER QUOTED \$48.50 FOR SAME).
6. \$10.50 APPROX. SCRAP INCONEL PRICE PER LB.:

<http://www.recycle.net/specs/gr060152.html>

<http://grn.com/a/0455.html>

## ADDENDUM

### MACHINING COST DIFFERENTIAL 316L VS. INCONEL 625

Total hours machining for 316L = 2832 hrs. x 3 = 8496 hrs

(Per E.Perry estimate Inconel requires 3x machine time).

For \$92.00 shop rate, increase total cost by \$521,088.00

This has not been included in the above estimates.

If we include this delta:

**TOTAL COST: \$ 1,958,980.00**

### COST DIFFERENTIAL USING INCONEL 600

Note, to reduce machining & Material cost Inconel 600 is a more economical candidate material for low relative permeability. (A286 is also being considered). Material removal rates for 600 are comparable to machining 316/316L

If Inconel 600 is used, the original estimate of \$1,437,892 will be reduced by the cost differential between 625 and 600 which averages

~10% less or ~ 52K\$. The 50% material allowance is reduced by

~26K\$ and scrap value is assumed comparably less (~ 10K\$)

If we include these deltas: -78K\$ +10K\$ = -68K\$ net savings

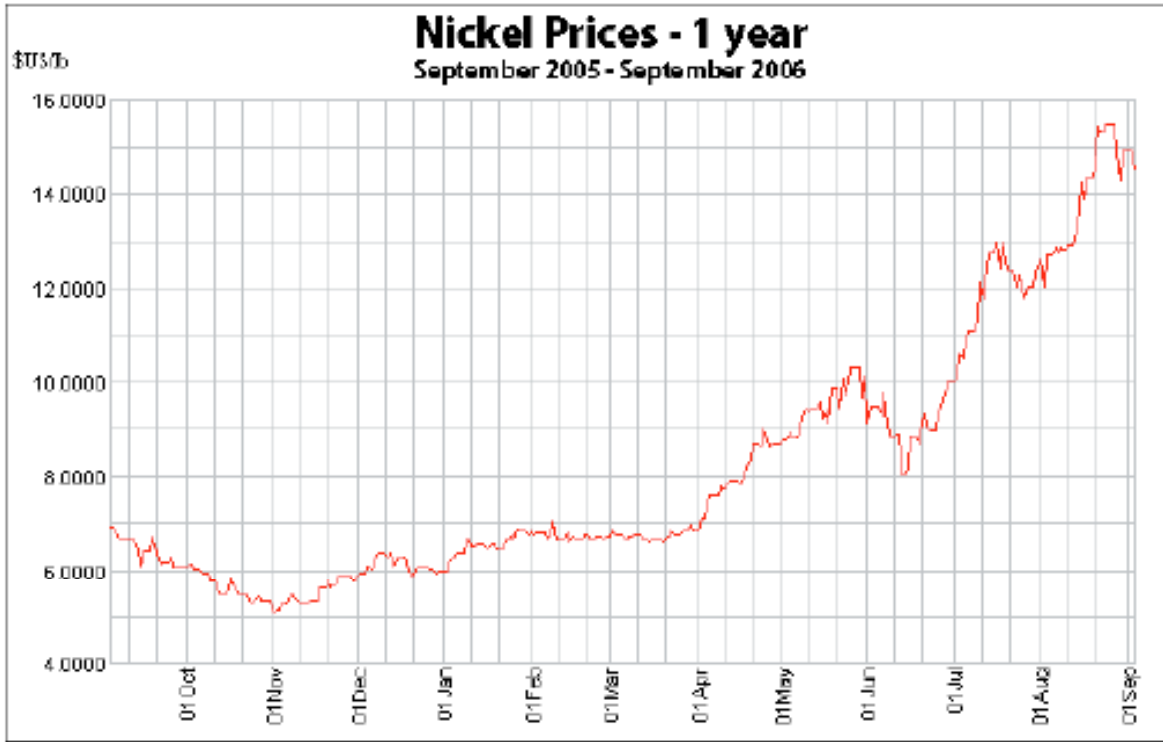
**TOTAL COST: \$ 1,369,892.00**

### COST DIFFERENTIAL - MARKET CONSIDERATIONS

Do to the volatility in the metals market for Ni, Cr, Mo, it is difficult to estimate the cost of materials for next fiscal year. Vendors are only quoting prices with ARO surcharges, but a conservative extrapolation of current material cost inflation would suggest an additional 5% will be likely by FY'08. In anticipation of these increases an additional 40K\$ will be used for this estimate.

**TOTAL COST: \$ 1,409,892.00**





**Current Nickel price is ~ \$23.00/lb.  
(Closing bid Friday 27 April was 48,700 per ton - Bloomberg)**