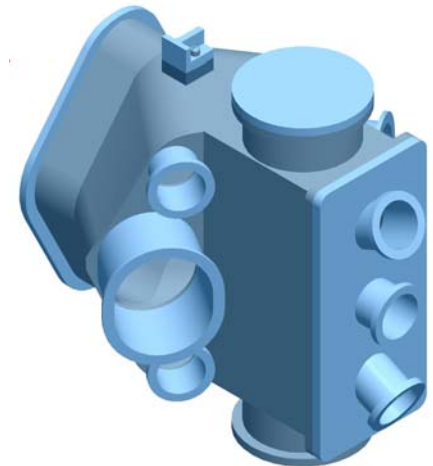


# Job 1260 Neutral Beam Transition Duct (NBTD)

P. L. Goranson

# Functional requirements

- **NBTD provides interface for:**
  - Man access into Vacuum Vessel (opening 13.5" wide x 34" tall)
  - Mounting vacuum pumping system (13.5" id Port)
  - Mounting Neutral Beam units
  - Mounting diagnostics
  - Mounting Lateral Supports and positioning VV toroidally
- In addition, the NBTD must penetrate and seal to the Cryostat.
- NBTD operates at 350C at its mounting flange during bakeout; most of construction must be Inconel.

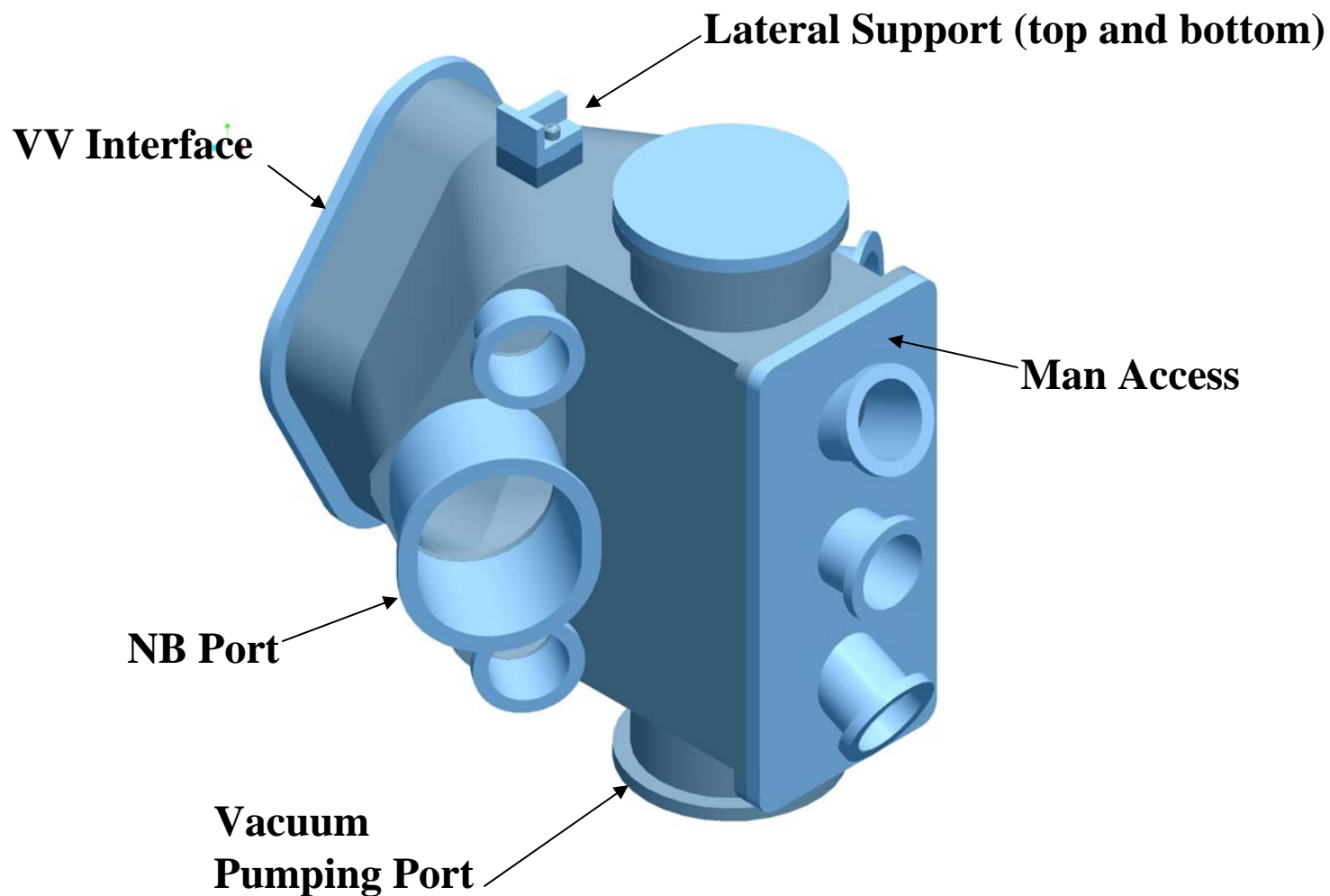


# Design Status

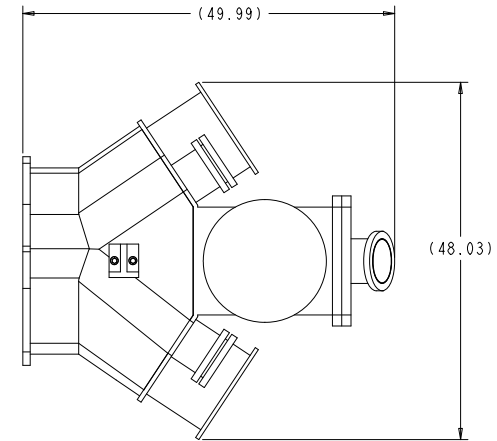
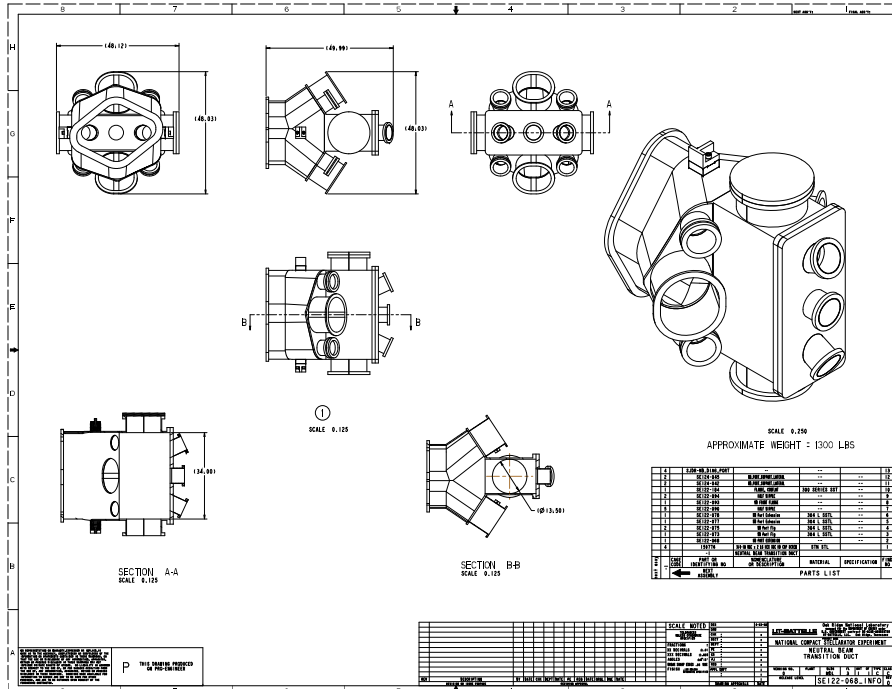


- **Models were completed (2003) and were reviewed several years ago**
  - **Must reaffirm design, hold peer review and work toward SRD**
  - **A PDR is required**
- **Baseline was changed for a time to incorporate simplified ducts (Man Access Ports) which did not mount NB's.**
- **Lateral support drawings were completed.**

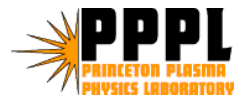
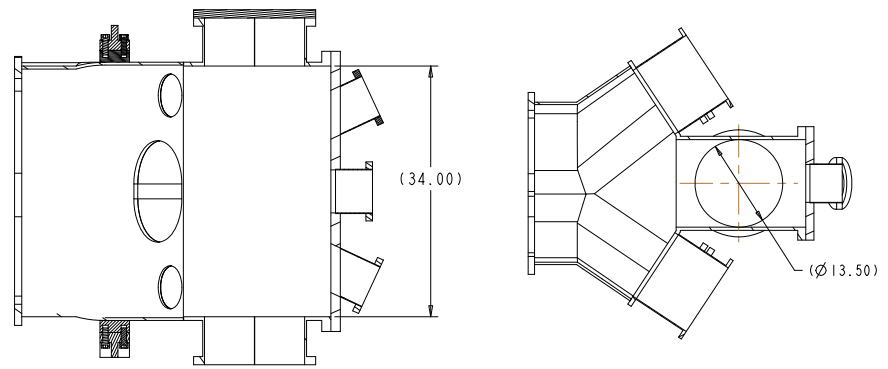
# NBTD showing Lateral Supports



# NBTD Preliminary Drawings



**TOP VIEW**



# Labor Cost



## Title I and II Design

Peer Review to Establish Requirements	80
Review and Update Assbly Dwgs	80
Prepare for PDR Neutral Beam Transition Duct	40
PDR for NBTD	0
Resolve PDR Chits	40
Review and Update Port Mod Dwg	40
Review and Update Large Rect Port Dwg	40
Review and Small Large Rect Port Dwg	40
Review and Update Weldment Dwgs	120
Review and Update Misc Det & Cuts Dwgs	40
Review of Drawings	40
Stress analysis	160
Prepare for FDR Neutral Beam Transition Duct	40
Final Design Review	0
Resolve PDR Chits	40

*Subtotal Title I & II Design*

800

## Title III

Disposition of deviation requests and non-conformances	40
Update of drawings as Needed	80
Procurement coordination	20
<i>Subtotal Title III Design</i>	140

Based in recent MDL & NCSX experience  
 Assume 2 drawings @ 40 hr each - based on MDL & NCSX experience  
 Based in recent MDL & NCSX experience  
 Milestone - no resources  
 Based in recent MDL & NCSX experience  
 Assume 1 drawing @ 40 hr each - based on MDL & NCSX experience  
 Assume 1 drawing @ 40 hr each - based on MDL & NCSX experience  
 Assume 1 drawing @ 40 hr each - based on MDL & NCSX experience  
 Assume 3 drawings @ 40 hr each - based on MDL & NCSX experience  
 Assume 2 drawings @ 20 hr each - based on MDL & NCSX experience  
 Assume 2 people for ~1/2 Weeks - based on MDL & NCSX experience  
 Based in recent MDL & NCSX experience  
 Based in recent MDL & NCSX experience  
 Based in recent MDL & NCSX experience  
 Based in recent MDL & NCSX experience

Based in recent MDL & NCSX experience  
 Based in recent MDL & NCSX experience  
 Based in recent MDL & NCSX experience



# M&S Cost



Costs reflect recent significant increase in Inconel price.  
Lateral supports added.

This element consists of the port duct, seals, and all cover flanges  
weight of shell assembly, with ports  
\$/lb for fabrication  
subtotal, fab cost shell

**Ports**

8" o.d. flange, 6" tube  
8" o.d. rotatable cover flange  
no. of 8" ports

cost for 8" ports

14.5" x 16.5" flange with tube(ss)

blank 14.5" x 16.5" flanges(ss)

no. of 14.5" x 16.5" ports

cost for 14.5" x 16.5" ports

16.5" o.d. flange, 14" tube

16.5" o.d. rotatable cover flange

no. of 16.5" ports

cost for 16.5" ports

large square flange cover, ss

o-ring seals for diamond flange and square flange

subtotal, ports

Fabricate and install lateral support

number of supports

subtotal for support

Total, each nbi port duct extension

no. of nbi duct extensions

**total, 3 extensions**

None of the above includes an interface to the cryostat.

	1400 lbs	
	51 \$/lb	Includes recent vendor Inconel quotes
	<b>\$71,400</b>	
	225\$/ea	
	125\$/ea	MDC catalog 10
	7ea	MDC catalog 10
	\$2,450	
	1500 \$/ea	<b>NCSX/MDL experience</b>
	1000 \$/ea	<b>NCSX/MDL experience</b>
	2ea	
	\$5,000	
	1000 \$/ea	MDC catalog 10
	710 \$/ea	
	2ea	
	\$3,420	
	\$4,000	
	\$2,530	
	<b>\$17,400</b>	
	\$8,000\$/ea	
	2 ea	
	<b>\$16,000</b>	
	<b>\$104,800</b>	
	3	
	<b>\$314,400</b>	



# Schedule & Staffing



## Schedule

Activity ID	MILE-STONE LEVEL	Activity Description	Duration (work days)	SHIFTS	Forecast Start	Forecast Finish	Total Float	Cost to Complete	FY		
									FY08	FY09	FY10
1260-90		Prep for PDR	65		30JUN08	30SEP08	318	30,200.00			
1260-95		PDR	0			30SEP08	318	0.00			
1260-100		Design Update and review	65		01OCT08*	12JAN09	318	99,486.80			
1260-110		FDR	0			12JAN09	318	0.00			
1260-120		Requisition, Bid and Award Duct contract	40		13JAN09	09MAR09	318	0.00			
1260-130		Fabr & deliver 3 port duct extensions incl suprts	260		01OCT09*	18OCT10	174	420,831.66			
1260-140		Title III	402		13JAN09	18AUG10	1,054	16,188.70			

## Staffing

**P. L. Goranson – 80% during Title I & II design.**

**Gary Lovett – 100% during Title I & II.**





# Schedule and Cost Risk



## Uncertainty of the Estimate

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Uncertainty Range (%)</u>
Design Maturity		X		-10%/+15%
Design Complexity			X	
Other Comments:				

## Mitigation

Job	Risk Description	Likelihood of Occurring	Mitigation Plan	Basis of estimate	Cost Impact		Schedule Impact	
					Low	High	Low	High
1260	Design is vintage and revisit could result in criteria changes, i.e. diagnostic requirements, number of ports, NB alignment, further design review, etc.	U	Schedule was made more aggressive with early start to assure ageement with design.	Engineering hours to redo models and hold design review.	200 hrs ORNL EM	400 hrs ORNL EM	0	0

