WBS Level 1.3
Cryo. Plant & Dist.

RIA SYSTEM FOR 71 MODULES, 31@4.5 K 40 @ 2.1 K(REV 1)

SHEET 1 0F 2 — Summary on Sheet one

Costs:	Per Year			
Engineeer	$	96,600	FINAL DRAFT	Started 8.26.99
Design	$	85,200		Revised 12.02.99
Tech	$			W.C. CHRONIS

RIA SYSTEM, 31 MODULES @4.5 K, 40 MODULES @ 2.1 K

SUMMARY OF COSTS

MATERIAL		
COMPRESSOR SYSTEM	$ 2,560,192	
OIL SYSTEM	$ 260,006	
CONTROLS	$ 1,333,660	
300 TO 80 K BOX	$ 635,428	
80 K TO 4.5 K BOX	$ 2,101,414	
ANCILLARY EQUIPMENT	$ 1,483,242	
2K COLD BOX		
TRANSFER LINE/BARE PIPE		
PROJECT MANAGEMENT	$ 387,044	
LABOR FOR FABRICATION	$ 19,059,924	
TOTAL COST =	$ 33,602,110	
COLD BOXES PORTION ($$)		
CALIBRATION	$ 465,730	Estimate On Sheet #2
START-UP	$ 357,857	Estimate On Sheet #2
TOTAL COST=	$ 34,425,697	

MAN-MONTHS	Technician	Engineering
DESIGNER	474.00	170.35
	49.45	

COMPRESSOR SYSTEM

MATERIAL | LABOR

 # = Price checked

DESCRIPTION	QTY	COST PER	TOTAL COST	Eng Man	Eng Mo	Des Man	Des Mo	Mec Tec	MT MM	I&C Tec	I&C MM	Tec Tot	Des Tot	Eng Tot	Tech $$	E/D $$	Des $$
1st stage compressor #	4	$ 64,408	$ 257,632	1.0	0.3	1.00	1.0	2.0	1.5	2.0	0.2	3.40	1.00	0.30	$ 66,209	$ 2,415	$ 7,100
Helium HX's	4	$ 42,000	$ 168,000	1.0	0.5	1.00	0.1	2.0	0.5	0.0	0.0	1.00	0.10	0.50	$ 4,868	$ 4,025	$ 710
Oil HX's	4	$ 48,000	$ 192,000	1.0	0.5	1.00	0.1	2.0	0.5	0.0	0.0	1.00	0.10	0.50	$ 4,868	$ 4,025	$ 710
Oil Pumps	4	$ 16,000	$ 64,000	1.0	0.3	1.00	0.1	1.0	0.3	1.0	0.3	0.60	0.10	0.25	$ 2,921	$ 2,013	$ 710
Oil injection Valve	4	$ 8,000	$ 32,000	1.0	0.3	1.00	0.0	2.0	0.3	1.2	0.0	0.60	0.00	0.25	$ 2,921	$ 2,013	$ -
Shut Off Valves, Oil	16	$ 300	$ 4,800	1.0	0.3	1.00	0.1	1.0	0.3	0.0	0.0	0.30	0.10	0.25	$ 1,461	$ 2,013	$ 710
Flex hoses	28	$ 600	$ 16,800	1.0	0.2	1.00	0.1	1.0	0.1	0.0	0.0	0.10	0.10	0.20	$ 487	$ 1,610	$ 710
Motors, 600 HP,1.15 SF #	4	$ 40,000	$ 160,000	1.0	0.1	1.00	0.1	2.0	0.5	2.0	0.5	2.00	0.10	0.10	$ 9,737	$ 805	$ 710
Couplings	4	$ 1,300	$ 5,200	1.0	0.1	1.00	0.0	2.0	0.1	0.0	0.0	0.20	0.00	0.10	$ 974	$ 805	$ -
Spool valves	4	$ 700	$ 2,800	1.0	0.1	1.00	0.0	1.0	0.5	0.0	0.0	0.50	0.00	0.10	$ 2,434	$ 805	$ -
2nd Stage Compressor #	6	$ 66,560	$ 399,360	1.0	0.3	1.00	1.0	2.0	1.5	2.0	0.2	3.40	1.00	0.30	$ 66,209	$ 2,415	$ 7,100
He HX's	6	$ 45,000	$ 270,000	1.0	0.5	1.00	0.1	2.0	0.5	0.0	0.0	1.00	0.10	0.50	$ 4,868	$ 4,025	$ 710
Oil HX's	6	$ 55,000	$ 330,000	1.0	0.5	1.00	0.1	2.0	0.5	0.0	0.0	1.00	0.10	0.50	$ 4,868	$ 4,025	$ 710
Oil Pumps	6	$ 16,000	$ 96,000	1.0	0.3	1.00	0.1	1.0	0.3	1.0	0.3	0.60	0.10	0.25	$ 2,921	$ 2,013	$ 710
Oil injection Valve	6	$ 6,000	$ 36,000	1.0	0.3	1.00	0.0	2.0	0.3	1.2	0.0	0.60	0.00	0.25	$ 2,921	$ 2,013	$ -
Shut Off Valves, Oil	24	$ 300	$ 7,200	1.0	0.3	1.00	0.1	1.0	0.3	0.0	0.0	0.30	0.10	0.25	$ 1,461	$ 2,013	$ 710
Flex hoses	42	$ 600	$ 25,200	1.0	0.2	1.00	0.1	1.0	0.1	0.0	0.0	0.10	0.10	0.20	$ 487	$ 1,610	$ 710
Motors, 2500 HP, 1.15 SF #	6	$ 65,000	$ 390,000	1.0	0.1	1.00	0.1	2.0	0.5	2.0	0.5	2.00	0.10	0.10	$ 9,737	$ 805	$ 710
Couplings	6	$ 1,500	$ 9,000	2.0	0.1	1.00	0.0	2.0	0.1	0.0	0.0	0.20	0.00	0.20	$ 974	$ 1,610	$ -
Spool valves	6	$ 700	$ 4,200	1.0	0.1	1.00	0.0	1.0	0.5	0.0	0.0	0.50	0.00	0.10	$ 2,434	$ 805	$ -
Skid Design	2	$ -	$ -	1.0	1.0	1.00	1.0	0.0	0.0	0.0	0.0	0.00	1.00	1.00	$ -	$ 8,050	$ 7,100
Skid Fabrication	6	$ 15,000	$ 90,000	1.0	0.5	1.00	0.5	3.0	2.0	2.0	1.5	9.00	0.50	0.50	$ 43,815	$ 4,025	$ 3,550
										MM	=	28.4	4.7	6.7			$ 33,370
	Total Cost Mat'l		$ 2,560,192								Per Skid Subtotal				$ 237,575	$ 53,935	$ 66,740
									OUTSIDE LABOR								
	Labor/ 10 Skids		$ 10,738,052							Loading Overhead					$ 772,118	$ 134,838	$ 166,850
	Total Cost=		$ 13,298,244														

JLAB LABOR 1.47

OIL REMOVAL SYSTEM

MATERIAL | LABOR

= Price checked

DESCRIPTION	QTY	COST PER	TOTAL COST	Eng Man	Eng MM	Des Man	Des MM	Mec Tech	MT MM	I&C Tech	I&C MM	Tec Tot	Des Tot	Eng Tot	Tech $$	E/D $$	Des $$
Vessels/Charcoal/oil,2sets#	2	$ 53,400	$ 106,800	1.0	0.5	1.0	0.5	0.0	0.0	0.0	0.0	0.00	0.50	0.50	$ -	$ 4,025	$ 3,550
Coalescer Elements #	9	$ 10,000	$ 90,000	1.0	0.3	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.25	$ -	$ 2,013	$ -
Warm Valves	4	$ 4,500	$ 18,000	1.0	0.5	1.0	0.2	0.0	0.0	0.0	0.0	0.00	0.20	0.50	$ -	$ 4,025	$ 1,420
Flow meters #	4	$ 2,860	$ 11,440	1.0	0.3	1.0	0.1	0.0	0.0	0.0	0.0	0.00	0.10	0.25	$ -	$ 2,013	$ 710
Pipe/Flanges etc	1	$ 8,000	$ 8,000	1.0	0.3	1.0	0.4	0.0	0.0	0.0	0.0	0.00	0.40	0.30	$ -	$ 2,415	$ 2,840
Mount Vessels				1.0	0.1	1.0		2.0	0.3	0.0	0.0	0.50	0.00	0.05	$ 2,434	$ 403	$ -
Install Coalescers				1.0	0.2	1.0		2.0	0.4	0.0	0.0	0.80	0.00	0.20	$ 3,895	$ 1,610	$ -
Pipe warm valves				1.0	0.3	1.0		2.0	0.8	0.0	0.0	1.50	0.00	0.30	$ 7,303	$ 2,415	$ -
Install I&C				1.0	0.5	1.0		0.0	0.0	2.0	1.3	2.50	0.00	0.50	$ 12,171	$ 4,025	$ -
Fab Skid				1.0	0.8	1.0		2.0	2.0	0.0	0.0	4.00	0.00	0.75	$ 19,473	$ 6,038	$ -
Design Time				1.0	1.5	1.0		0.0	0.0	0.0	0.0	0.00	0.00	1.50	$ -	$ 12,075	$ -
Engineer Time				1.0	0.5	1.0		0.0	0.0	0.0	0.0	0.00	0.00	0.50	$ -	$ 4,025	$ -
	Total Material=		$ 234,240							Man Mont		9.30	1.20	5.60			
	Shipping all Mat'l=		$ 14,054														
											Labc	Totals=			$ 45,276	$ 45,080	$ 8,520
Add 5% Structual material=			$ 11,712							OUTSIDE LABOR							
										Loading Overhead					$ 147,145	$ 112,700	$ 21,300
	Total mat'l		$ 260,006														
	Total Labor		$ 281,145														
	Total Cost=		$ 541,152														

SYSTEM CONTROLS (BSB)																					
# = Price checked		MATERIAL								LABOR/INSTALL											
				Eng	Eng	Des	Des	Mec	MT	I&C	I&C	Tec	Des	Eng	Tech		E/D		Des	
DESCRIPTION #	QTY	COST PER	TOTAL COST	Man	MM	Man	MM	Tech	MM	Tech	MM	Tot	Tot	Tot	$$		$$		$$	
Pressure instruments	1	$37,000	$ 37,000	1.0	1.5	1.0	0	1.0	1.0	2.0	2.0	5.00	0.00	1.50	$	24,342	$	12,075	$	-
TD's	40	$400	$ 16,000	1.0	1.5	1.0	0	1.0	1.0	2.0	2.0	5.00	0.00	1.50	$	24,342	$	12,075	$	-
TP's	20	$250	$ 5,000	1.0	0.5	1.0	0	1.0	0.5	2.0	2.0	4.50	0.00	0.50	$	21,908	$	4,025	$	-
Flowmeters	1	$2,000	$ 2,000	1.0	0.8	1.0	0	2.0	1.5	2.0	1.5	6.00	0.00	0.75	$	29,210	$	6,038	$	-
Unix Workststion,HPb180L	1	$7,460	$ 7,460	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
C pkg	1	$700	$ 700	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
C++ pkg	1	$750	$ 750	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
VxWorks Development Licen:	1	$5,000	$ 5,000	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
Color Printer (HP 1600CM)	1	$3,000	$ 3,000	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
X- Terminal	3	$ 3,000	$ 9,000	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
VME crate	5	$3,000	$ 15,000	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
ioc (mv167/32MB)	5	$6,900	$ 34,500	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
VxWorks Target License	5	$150	$ 750	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
VME ADC (32ch, 12bit)	11	$1,500	$ 16,500	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
VME DAC (16ch, 12bit)	7	$1,400	$ 9,800	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
VME LVDT Scanner(8 ch)	14	$2,800	$ 39,200	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
VME Digital Input (64ch)	7	$1,700	$ 11,900	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
VME Digital Output (32ch)	5	$1,200	$ 6,000	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
VME Diode Scanner (16ch)	15	$2,600	$ 39,000	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
Procurement Managment			$ -	2.0	6.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	12.0	$	-	$	96,600	$	-
VME crate	18	$3,000	$ 54,000	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
ioc (mv167/32MB)	18	$6,900	$ 124,200	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
VxWorks Target License	18	$150	$ 2,700	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
VME ADC (32ch, 12bit)	18	$1,500	$ 27,000	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
VME Diode Scanner (16ch)	36	$2,600	$ 93,600	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
VME LVDT Scanner (8ch)	52	$2,800	$ 145,600	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
VME Pulse Generator (8ch)	52	$2,000	$ 104,000	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
VME LL Scanner	18	$3,000	$ 54,000	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
EV Actuator	160	$2,000	$ 320,000	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
Cables, connectors, etc.	1	$150,000	$ 150,000	0.0	0.0	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	$	-	$	-	$	-
Cable Installation			$ -	1.0	3.0	1.0	0	0.0	0.0	5.0	4.0	20.0	0.00	3.00	$	97,367	$	24,150	$	-
Programming/ Sys Design			$ -	3.0	6.0	1.0	0	0.0	0.0	0.0	0.0	0.0	0.00	18.0	$	-	$	144,900	$	-
		Total Materia	$ 1,333,660						Man-Months=			40.5	0.0	37.3			$	299,863	$	-
		Total Labor	$ 1,171,432								Labor totals=				$197,168		$599,725	$	-
		Total Cost=	$ 2,505,092								JLAB LABOR									
											Overheads				$	289,836	$	881,596	$	-

80 K COLD BOX (300 K to 80 K Box)

Spare included

DESCRIPTION	QTY	MATERIAL COST PER	TOTAL COST	Eng Man	Eng MM	Des Man	Des MM	Mec Tech	MT MM	I&C Tech	LABOR I&C MM	Tec Tot	Des Tot	E/D Tot	Tech $$	E/D $$	Des $$
COLD BOX																	
Turbines##	1	$ 230,000	$ 230,000	1.0	1.5	1.0	0.2	2.0	0.8	2.0	0.8	3.00	0.20	1.50	$ 14,605	$ 12,075	$ 1,420
Piping	1	$ 15,000	$ 15,000	1.0	0.7	1.0	1.2	2.0	2.5	2.0	1.3	7.50	1.20	0.70	$ 36,513	$ 5,635	$ 8,520
Heat Exchangers, 3 Pass	1	$ 95,000	$ 95,000	1.0	0.7	1.0	1.0	2.0	0.5	1.0	0.3	1.30	1.00	0.70	$ 6,329	$ 5,635	$ 7,100
Heat Exchanger, GN2/GHe	1	$ 20,000	$ 20,000	1.0	0.8	1.0	0.8	2.0	1.0	1.0	0.5	2.50	0.80	0.75	$ 12,171	$ 6,038	$ 5,680
Instruments	1	$ 10,000	$ 10,000	1.0	0.5	1.0	0.2	0.0	0.0	2.0	0.5	1.00	0.20	0.50	$ 4,868	$ 4,025	$ 1,420
Frame	1	$ 20,000	$ 20,000	1.0	1.0	1.0	0.2	3.0	1.3	0.0	0.0	3.75	0.20	1.00	$ 18,256	$ 8,050	$ 1,420
Spares, Required Set	1		$ -	1.0		1.0						0.00	0.00	0.00	$ -	$ -	$ -
Cold Box Vessel #	1	$ 120,000	$ 120,000	1.0	3.0	1.0	0.8	3.0	2.3	2.0	1.0	8.75	0.80	3.00	$ 42,598	$ 24,150	$ 5,680
Valves Manual, Cold #	10	$ 6,200	$ 62,000	1.0	1.5	1.0	0.2	2.0	1.3	2.0	1.5	5.50	0.20	1.50	$ 26,776	$ 12,075	$ 1,420
Valves, Warm	15	$ 3,500	$ 52,500	1.0	1.0	1.0	0.1	2.0	1.0	2.0	1.3	4.50	0.10	1.00	$ 21,908	$ 8,050	$ 710
			$ -									0.00	0.00	0.00	$ -	$ -	$ -
Transistions, Bi-Braze			$ -									0.00	0.00	0.00	$ -	$ -	$ -
8"	2	$ 1,488	$ 2,976									0.00	0.00	0.00	$ -	$ -	$ -
6"	4	$ 852	$ 3,408									0.00	0.00	0.00	$ -	$ -	$ -
2"	2	$ 270	$ 540									0.00	0.00	0.00	$ -	$ -	$ -
10"	2	$ 2,002	$ 4,004									0.00	0.00	0.00	$ -	$ -	$ -
			$ -									0.00	0.00	0.00	$ -	$ -	$ -
									Man-Months=			37.8	4.7	10.7			
		Total Materia	$ 635,428								Labor totals=				$ 184,023	$ 85,733	$ 33,370
											OUTSIDE LABOR						
		Total Labor	$ 895,831								Overheads				$ 598,075	$ 214,331	$ 83,425
		Total Cost=	**$ 1,531,259**														

80 K to 4.5 K Cold Box

## Spare Included		MATERIAL										LABOR						
					Eng	E/D	Des	Des	Mec	MT	I&C	I&C	Tec	Des	E/D	Tech	E/D	Des
DESCRIPTION	QTY	COST PER	TOTAL COST		Man	MM	Man	MM	Tech	MM	Tech	MM	Tot	Tot	Tot	$$	$$	$$
Turbines ##	3	$ 230,000	$ 690,000		1.0	2.0	1.0	0.3	2.0	1.0	2.0	1.0	4.00	0.30	2.00	$ 19,473	$ 16,100	$ 2,130
Turbine Duty, 4.5 %			$ 31,050		1.0		1.0							0.00				$ -
Heat Exchangers	11	$ 65,000	$ 715,000		1.0	2.0	1.0	0.5	2.0	2.0	2.0	1.0	6.00	0.50	2.00	$ 29,210	$ 16,100	$ 3,550
Piping, Internal	1	$ 50,000	$ 50,000		1.0	3.0	1.0	1.5	4.0	2.0	2.0	2.0	12.0	1.50	3.00	$ 58,420	$ 24,150	$ 10,650
Shipping Pipe, 6 %			$ 3,000		1.0		1.0							0.00				$ -
Vessel	1	$ 200,000	$ 200,000		1.0	2.0	1.0	0.8	2.0	1.0	2.0	1.0	4.00	0.80	2.00	$ 19,473	$ 16,100	$ 5,680
Shipping costs, 6 %			$ 12,000		1.0		1.0							0.00				$ -
Warm valves	20	$ 4,250	$ 85,000		1.0	1.0	1.0	0.3	2.0	0.4	2.0	0.4	1.50	0.30	1.00	$ 7,303	$ 8,050	$ 2,130
Diffusion Pump #	1	$ 10,000	$ 10,000		1.0	0.1	1.0	0.1	2.0	0.2	2.0	0.2	0.60	0.10	0.10	$ 2,921	$ 805	$ 710
Mech Pump #	1	$ 6,428	$ 6,428		1.0	0.1	1.0	0.1	1.0	0.1	1.0	0.1	0.20	0.10	0.10	$ 974	$ 805	$ 710
Vac Instruments #	1	$ 1,500	$ 1,500		1.0	0.1	1.0	0.1	1.0	0.1	1.0	0.1	0.15	0.10	0.05	$ 730	$ 403	$ 710
Adsorber Vessels, 80/20K	3	$ 8,000	$ 24,000		1.0	0.2	1.0	0.5	2.0	1.0	0.0	0.0	2.00	0.50	0.20	$ 9,737	$ 1,610	$ 3,550
Cryo-valves #	20	$ 8,073	$ 161,460		1.0	0.4	1.0	0.3	2.0	1.0	2.0	1.0	4.00	0.30	0.35	$ 19,473	$ 2,818	$ 2,130
Piping, External	1	$ 25,000	$ 25,000		1.0	0.4	1.0	0.8	2.0	2.0	2.0	1.0	6.00	0.80	0.35	$ 29,210	$ 2,818	$ 5,680
Shipping 6 %			$ 1,500		1.0		1.0							0.00				$ -
Load Heater	1	$ 11,000	$ 11,000		1.0	0.2	1.0	0.1	2.0	0.1	2.0	0.3	0.80	0.10	0.15	$ 3,895	$ 1,208	$ 710
Super Insulation	1	$ 10,000	$ 10,000		1.0	0.2	1.0		2.0	0.5	0.0	0.0	1.00	0.00	0.20	$ 4,868	$ 1,610	$ -
Design engineer			$ -		1.0	2.5	1.0		0.0	0.0	0.0	0.0	0.00	0.00	2.50	$ -	$ 20,125	$ -
Designer			$ -		1.0	2.5	1.0		0.0	0.0	0.0	0.0	0.00	0.00	2.50	$ -	$ 20,125	$ -
Bi-Braze, Labor			$ -		1.0		1.0	0.8	2.0	1.0	0.0	0.0	2.00	0.75	0.75	$ 9,737	$ 6,038	$ 5,325
8"	16	$ 1,488	$ 23,808															
6 "	8	$ 852	$ 6,816								Man	Mont	44.3	6.2	17.3			
4"	6	$ 462	$ 2,772															
2"	4	$ 270	$ 1,080															
		Material	$ 2,071,414									Labc	Totals=			$ 215,424	$ 138,863	$ 43,665
		Structual	$ 30,000									OUTSIDE LABOR						
		Total Mat'l	$ 2,101,414									Overhead				$ 700,127	$ 347,156	$ 109,163
		Total Labor	$ 1,156,446															
		Total Cost=	$ 3,257,860															

2K COLD BOX

# = Price Checked		MATERIAL					LABOR											
				Eng	Eng	Des	Des	Mec	MT	I&C	I&C	Tec	Des	Eng	Tech	E/D	Des
DESCRIPTION	QTY	COST PER	TOTAL COST	Man	MM	Man	MM	Tech	MM	Tech	MM	Tot	Tot	Tot	$$	$$	$$
Cold Compressors	4	$ 797,112	$ 3,188,448	1.0	0.8	1.0	1.0	2.0	1.5	2.0	1.5	6.00	1.00	0.80	$ 29,210	$ 6,440	$ 7,100
S2M/Refu included	4	$ -	$ -	1.0	1.0	1.0	0.5	0.0	0.0	2.0	1.2	2.40	0.50	1.00	$ 11,684	$ 8,050	$ 3,550
Duty/Shipping, 4.5 %			$ 143,480	1.0	0.0	0.0	0.5	0.0	0.0	2.0	1.2	2.40	0.00	0.00	$ 11,684	$ -	$ -
Piping	1	$ 25,000	$ 25,000	1.0	0.7	1.0	1.0	3.0	3.0	2.0	2.0	13.0	1.00	0.70	$ 63,288	$ 5,635	$ 7,100
Vessel #	1	$ 120,000	$ 120,000	1.0	0.5	1.0	0.4	0.0	0.0	0.0	0.0	0.00	0.40	0.50	$ -	$ 4,025	$ 2,840
Headers/supply/return	1	$ 50,000	$ 50,000	1.0	1.2	1.0	1.5	3.0	3.0	2.0	1.0	11.0	1.50	1.20	$ 53,552	$ 9,660	$ 10,650
Structural/Internal	1	$ 30,000	$ 30,000	1.0	0.6	1.0	0.5	2.0	1.0	0.0	0.0	2.00	0.50	0.60	$ 9,737	$ 4,830	$ 3,550
Structural/External	1	$ 20,000	$ 20,000	1.0	0.6	1.0	0.8	2.0	1.5	0.0	0.0	3.00	0.80	0.60	$ 14,605	$ 4,830	$ 5,680
Design Engineer			$ -	1.0	1.5	1.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	1.50	$ -	$ 12,075	$ -
Designer			$ -	1.0	0.0	1.0	3.0	0.0	0.0	0.0	0.0	0.00	3.00	0.00	$ -	$ -	$ 21,300
Bi-Braze Labor				1.3	1.0	1.0	0.2	2.0	0.8	0.0	0.0	1.50	0.20	1.25	$ 7,303	$ 10,063	$ 1,420
4" #	7	$ 462	$ 3,234									0.00	0.00	0.00	$ -	$ -	$ -
10" #	2	$ 2,002	$ 4,004									0.00	0.00	0.00	$ -	$ -	$ -
Various Sizes	10	$ 414	$ 4,140									0.00	0.00	0.00	$ -	$ -	$ -
10" #	2	$ 2,002	$ 4,004														
										Man Mont		41.3	8.9	8.2			
		Material	$ 3,592,310								Labo	Totals=			$ 201,062	$ 65,608	$ 63,190
												OUTSIDE LABOR					
		Total Labor	$ 975,446									Overhead			$ 653,452	$ 164,019	$ 157,975
		Total Cost=	$ 4,567,756														

MISCELLANEOUS EQUIPMENT

# = Price Checked		MATERIAL		LABOR														
DESCRIPTION	QTY	COST PER	TOTAL COST	Eng Man	Eng MM	Des Man	Des MM	Mec Tech	MT MM	I&C Tech	I&C MM	Tec Tot	Des Tot	E/D Tot	Tech $$	E/D $$	Des $$
LN2 Dewar,60000 Gallons #	1	$ 426,819	$ 426,819	1.0	0.5	1.0	0.5	2.0	0.5	2.0	0.2	1.30	0.50	0.50	$ 6,329	$ 4,025	$ 3,550
LHe Dewar, 20000 Gallons	1	$ 397,923	$ 397,923	1.0	0.5	1.0	0.5	2.0	0.5	2.0	0.2	1.30	0.50	0.50	$ 6,329	$ 4,025	$ 3,550
80K Purifiers, External	2	$ 70,000	$ 140,000	1.0	0.5	1.0	1	2.0	2.0	2.0	1.0	6.00	1.00	0.50	$ 29,210	$ 4,025	$ 7,100
Purifier Compressors #	2	$ 18,000	$ 36,000	1.0	0.2	1.0		2.0	0.8	2.0	0.5	2.50	0.00	0.20	$ 12,171	$ 1,610	$ -
Skid Fabrication	2	$ 15,000	$ 30,000	1.0	0.5	1.0		2.0	2.0	2.0	0.5	5.00	0.00	0.50	$ 24,342	$ 4,025	$ -
Controls	1	$ 2,500	$ 2,500	1.0	0.2	1.0		0.0	0.0	2.0	0.8	1.50	0.00	0.20	$ 7,303	$ 1,610	$ -
Storage Tanks, 30k gallon	8	$ 40,000	$ 320,000	1.0	0.3	1.0	0.5	2.0	1.0	2.0	0.2	2.30	0.50	0.30	$ 11,197	$ 2,415	$ 3,550
External Piping	1	$ 15,000	$ 15,000	1.0	0.5	1.0	0.5	2.0	0.8	2.0	0.2	1.90	0.50	0.50	$ 9,250	$ 4,025	$ 3,550
Design Engineer				1.0	0.6	1.0	0	0.0	0.0	0.0	0.0	0.00	0.00	0.60	$ -	$ 4,830	$ -
Designer				1.0	2.3	1.0	1	0.0	0.0	0.0	0.0	0.00	1.00	2.25	$ -	$ 18,113	$ 7,100
Arc Cell #	1	$ 15,000	$ 15,000	1.0	8.0	1.0	0	0.5	0.1	1.0	0.3	0.35	0.00	8.00	$ 1,704	$ 64,400	$ -
Hydrometer #	1	$ 10,000	$ 10,000	1.0	0.1	1.0	0	0.0	0.0	1.0	0.1	0.10	0.00	0.10	$ 487	$ 805	$ -
	0		$ -			0.0						0.00	0.00	0.00	$ -	$ -	$ -
	0		$ -			0.0						0.00	0.00	0.00	$ -	$ -	$ -
Inst Air Compressor #	2	$ 5,000	$ 10,000	1.0	0.2	1.0	0.2	2.0	0.2	2.0	0.2	0.80	0.20	0.20	$ 3,895	$ 1,610	$ 1,420
Local Control Room (1)	1		$ -	1.0	0.9	1.0	0.8					0.00	0.80	0.90	$ -	$ 7,245	$ 5,680
Adsorber Regen Skid	1	80000	$ 80,000	1.0	1.0	1.0	1	2.0	2.5	2.0	1.5	8.00	1.00	1.00	$ 38,947	$ 8,050	$ 7,100
										Man Mont		31.1	6.0	16.3			
		Material	$ 1,483,242								Labc Totals=				$ 151,162	$ 130,813	$ 42,600
											OUTSIDE LABOR						
		Total Labor	$ 924,807								Overhead				$ 491,276	$ 327,031	$ 106,500
		Total Cost=	$ 2,408,049														

(1) Designed by Cryo, Facilities to Bulid

TRANSFER LINE/BARE PIPE

# = Price Checked		MATERIAL								LABOR								
	QTY			Eng	Eng	Des	Des	ME	MT	I&C	I&C	Tec	Des	Eng	Tech	E/D	Des	
DESCRIPTION #	Ft(1)	$S per ft	TOTAL COST	Man	MM	Man	MM	Tech	MM	Tech	MM	Tot	Tot	Tot	$S	$S	$S	
2K Branch(40 meters)	160	$118	$ 18,880	1.0	0.5	1.0	1.2	5.0	6.0	1.0	0.3	30.3	1.20	4.50	$146,735	$39,494	$	8,520
2K Linac(280m)	920	$113	$ 103,960	1.0	0.5	1.0	1.2	5.0	6.0	1.0	0.3	30.3	1.20	4.50	$146,735	$39,494	$	8,520
4.5K branch(170m)	560	$306	$ 171,360	1.0	0.5	1.0	1.2	5.0	7.0	1.0	0.3	35.3	1.20	4.50	$170,949	$39,494	$	8,520
4.5 K Linac (193 m)	640	$184	$ 117,760	1.0	0.5	1.0	1.2	5.0	7.0	1.0	0.3	35.3	1.20	4.50	$170,949	$39,494	$	8,520
H P GHe,2"513 m	1680	$3	$ 5,040	1.0	0.5	1.0	1.0	5.0	1.5			7.50	1.00	4.00	$36,321	$35,106	$	7,100
Cooldown Line, 4"(513 m)	1680	$6	$ 10,080	1.0	0.5	1.0	1.0	5.0	1.5			7.50	1.00	4.00	$36,321	$35,106	$	7,100
Grd Vacuum Line,6"(320m)	1080	$11	$ 11,880	1.0	0.5	1.0	1.0	5.0	1.5			7.50	1.00	4.00	$36,321	$35,106	$	7,100
GN2 Vent, 4"(213m)	720	$6	$ 4,320	1.0	0.5	1.0	1.0	5.0	1.5			7.50	1.00	4.00	$36,321	$35,106	$	7,100
Supply line Anchor,	36	$6,250	$ 225,000	1.0	0.5	1.0	1.6	5.0	3.3			16.3	1.60	6.50	$78,695	$57,047	$	11,360
Supply line Expansion	36	$9,540	$ 343,440	1.0	0.5	1.0	1.6	5.0	3.3			16.3	1.60	6.50	$78,695	$57,047	$	11,360
Return Line Anchor,	36	$12,560	$ 452,160	1.0	0.5	1.0	1.6	5.0	3.3			16.3	1.60	6.50	$78,695	$57,047	$	11,360
Return Line Expansion	36	$16,250	$ 585,000	1.0	0.5	1.0	1.6	5.0	3.3			16.3	1.60	6.50	$78,695	$57,047	$	11,360
Linac expansion/in line Ac	2	$21,450	$ 42,900	1.0	0.5	1.0	1.6	4.0	3.3			13.0	1.60	6.50	$62,956	$57,047	$	11,360
Jigs/ Fixtures, one lot	1	$25,000	$ 25,000	1.0	0.5	1.0	1.0	2.0	1.0			2.00	1.00	2.00	$9,686	$17,553	$	7,100
									Man-Months=			241	17.8	68.5				

(1) ROUNDED LENGTHS	Material	$2,116,780	Labor Totals =	$1,168,074	$601,188	$ 126,380
Assume 40 ' sections	6% Shipping	$72,110	JLAB LABOR			
	Total Materia	$2,188,890	Overhead	$1,717,069	$ 883,746	$ 315,950
	Total Labor	$2,916,765				
	Total Cost=	$5,105,655				

Project Managent		
Base Pay	$105,318	
1.47 fring	$154,817	
W/overhd	$387,044	150% OH

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