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R & D CABLING MACHINE*

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1. Summary

A first experimental cabling machine was built in 1984 to perform R&D work on superconducting cables to be used for the SSC project.

This machine made of a large gap lathe was operated for two years and gave some valuable information on cable manufacturing up to 36 strands.

Due to the lack of versatility of the cablers used in the industry, we were asked to provide most of the cable for long dipole magnets needed in the SSC development program. There was very little time left for real cabling research.

However, some of the weaknesses of this equipment were pointed out and used to specify a more industrial prototype.

There is however a large gap between the existing R&D cabler and the proposed prototype.

2. A New R&D Cabler?

An improvement program for the machine is under way:

- wire braking improvement
- spool spindle strength
- lubrication studies

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- cable dimension recording
- temperature monitoring
- angle of the incoming strand on the mandrel
- twist of the strands during cabling
- removing of residual twist of the cable.

There is unfortunately an important parameter impossible to change: speed and all related problems: (mandrel and roller temperature, mandrel wear -- centrifugal forces on parts and wires.

3. Proposal. Goal

A large number of parts needed for the improvement program were ordered and delivered:

- hysteresis brake magnets
- new spools carbide guides and wire capstans
- spool spindles - bearings
- sprockets

All of these parts can be installed on the actual cabler to complete the alteration scheduled.

A second option, object of this proposal is to build a new machine frame on which we can transfer all those parts and accessories to obtain new R&D caliber with all the improvements proposed plus a back to back spool design, reducing the diameter of the barrel to 54 inches which will allow a 100 RPM speed of the barrel, then a 25 feet/min cable production.

Such a machine will be a valuable tool with characteristics close to those of the prototype, but flexible enough to make special cables: (36 strands max) or preproduction studies listed in #2.

4. Alternate

A second option would be the construction of a barrel with 36 spools back to back but with spools of the prototype size. This solution will be obviously more expensive due to the size of the spools and shafts, the speed will be equal to the prototype speed.

5. Estimates

Two estimates are attached to this note. The smaller one is very attractive and I strongly recommend this solution. See pages 6 and 7.

The machine with the larger spools could allow the same R&D programs that the second one but should be considered only if a gap risk is foreseen for cable production with the prototype which will be ordered from an industrial vendor.

For any of those two solutions a five-month fabrication delay is expected.

6. Gap Lathe

The gap lathe can be returned to the Air Force or more usefully installed in the Bldg. 77 machine shop where it would be more than welcome.

COST ESTIMATE FOR 70" LARGE SPOOL 18 & 18 R & D CABLER

6061-T6 A1 A1	2 circles 3/4" 71" dia.		\$985 each	
	2 circles 5/8" 54" dia.		\$355 each	
Round structural STL tube 1026				
	1 pc 10" OD x 1/2" wall x 5'-0" long		\$390	
	1 pc 3 1/2" OD x 3/4" wall x 10'-0" long		\$316	
	600 lbs. misc. steel @ 40 cents/lbs.		\$240	
Rectangular STL tube				
	4 pcs 6" x 10" x 3/6" wall x 10'-0" long		\$470	
	Misc. Al Al for sliding guard & other		\$350	
Boston, Republic Supply, San Jose 9-408-436-1460				
	1 5 hp. D.C. motor Cat. No. 18500ATF-B			
	Item Code 66791		\$1,375	(2 wks. Kentucky)
	1 230 V single phase controller Cat. No.			
	VEH RG500-CM, Item Code 66919		\$1,304	
19 sprockets	40A26	Item Code 68014	\$ 6.50 ea.	\$ 124.00
19 sprockets	40B26 - 1 1/4	68298	\$ 5.22 ea.	290.00
2 sprockets	40A42	16266	\$ 8.96 ea.	18.00
1 sprocket	40A54	16272	\$ 11.17 ea.	12.00
2 sprockets	40B24 - 1 3/8	36114	\$ 12.81 ea.	26.00
1 sprocket	50A96	16316	\$ 39.10 ea.	40.00
1 sprocket	50B30 - 1 7/16	36684	\$ 21.67 ea.	22.00
100 feet	No. 40 roller chain		\$ 1.40/'	140.00
20 feet	No. 50 roller chain		\$ 1.72/'	35.00
Change gears same as before				234.00
7.2 bearings, Sealmaster SFC-23T			\$ 28.81 ea.	2,075.00
2 bearings, Sealmaster MFC-55			\$232.48 ea.	465.00
4 bearings, Sealmaster MFC-23			\$ 33.17 ea.	134.00
3 bearings, Kaydon JU0400CPO			\$164 ea.	328.00
72 bearings, NDZ99R6			\$ 6.59 ea.	395.00
8 bearings, NDZ99R14			\$ 11.45 ea.	92.00
ENCO coordinate slide table for Turkshead				900.00
72 spools, LBL make			\$ 66.00 ea.	4,752.00
6 pieces Lexan 1/4" x 4' x 8' for guard				<u>855.00</u>
TOTALS THIS PAGE				\$18,062.00

**COST ESTIMATE, CONT, FAB HOURS LARGE SPOOL
18 & 18 CABLER**

2 main wheels	160
Ring and auxilliary wheel	90
Ring standoffs	30
Hub and associated parts	80
36 spacers	24
Forks	320
Sprocket machining	24
Wire guard tubes	20
Main shaft	56
Head frame barrel ends	40
Back gear misc. parts	64
Welding, flame butting & coping	100
Paint, preparation, grind, prime	56
Fitting & Assembly	160
Turkshead mounting gear	48
Aluminum sliding guard mechanism	88
Brake mechanism	<u>120</u>
	1,480

@ 33.20 = \$49,136.00, 18.5 weeks if 2 man average
2 week transition time

Total remaining design & drafting 400 hrs @ 36.00/hr for 7000 Acct.
\$14,400

10 week total, 3 week lag before shop can start

Subtotal for 18 & 18 Large Spool R & D

Cabler head for 120 RPM max	\$81,598.00
20% contingency for shop & design time	12,707.00

TOTAL	<u>\$94,305.00</u>
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If Right-Left spindle rotation, add	\$ 4,100.00
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COST ESTIMATE FOR SMALL POOL 18 & 18 R & D CABLER

6061-T6 A1 A1	2 circles 5/8" 54" dia.	\$355 each (Hayward)
" "	1 plate 1/2" x 48 x 96 = 230 lbs.	\$575 each
Round structural steel tube 1026		
	1 pc 10" OD x 1/2" wall x 5'-0" long	\$ 390
	1 pc 3 1/2" OD x 3/4" wall x 10'-0" long	\$ 316
	600 lbs. misc. steel @ 40 cents/lbs.	\$ 240
Rectangular STL tube		
	1400 lbs. @ same lb. price as before	\$ 428
Bearings; 72 Sealmaster SFT-15T 20.02 ea.		
	2 Sealmaster MFC-47 105 ea.	\$1,507
	4 Sealmaster MFC-23	\$ 210
	2 Kaydon JU040CPO	\$ 134
	72 3/8 bore sealed ND's 6.29 ea.	\$ 328
		\$ 475
Boston, Republic Supply, San Jose 9-408-436-1460 Eileen		
	One 3 hp. PM motor Cat. No. 18300ATF-1 Item Code 19135	\$ 804.00
	One controller VEHRG300-CM, Dynamic Brake Without Options	1,494.00
20 sprockets No. 35, 28t plate		
	Cat. No. 35A28, Item Code 67763	\$ 3.94 ea. 79.00
20 sprockets No. 35, 28t hub type, 3/4" bore/key		
	Cat. No. 35 B28-3/4, Item Code 68264	\$7.96 ea. 160.00
Drive system sprockets and chage gears		
	Same as on previous estimate	454.00
Enco coordinate slide table for Turkshead		
	4 pcs, Lexan 1/4" x 4' x 8' for guard	900.00
	Misc. fasteners, gaskets, sealant, lube	570.00
	Misc. Al Al for sliding guard & other	350.00
	Conduit, wiring, switches, no instruments	250.00
	400 lbs. misc. steel @ 40 cents/lb.	600.00
		<u>160.00</u>
TOTAL THIS PAGE		\$10,894.00

**COST ESTIMATE, CONT, FAB HOURS SMALL SPOOL
R & D CABLER**

2 main wheels	120
Ring and auxilliary wheel	80
Ring standoffs	24
Hub and associated parts	48
36 spacers	18
Forks	250
Sprocket machining	24
Wire guard tubes	20
Main shaft	48
Head frame barrel ends	32
Back gear misc. parts	56
Welding, flame butting & coping	80
Paint, preparation, grind, prime	48
Fitting & Assembly	120
Turkshead mounting gear	36
Aluminum sliding guard mechanism	70
Brake mechanism	<u>80</u>
	1,154

<p>@ 33.20 = \$38,313.00 14 1/2 shop weeks if 2 man average 2 week transition time</p>	
<p>Total remaining design & drafting 320 hrs @ 36.00/hr for 7000 Acct</p>	\$11,520.00
<p>8 week total, 3 week lag before shop can start Subtotal for 18 & 18 Large Spool R & D Cabler head for 100 RPM max 20% contingency for shop & design time</p>	\$60,727.00 9,966.00
TOTAL	\$70,693.00
If Right-Left spindle rotation, add	\$ 3,400.00