



National Science Foundation Wire Pool In Search of a Synthetic CTD Cable

Rick Trask
NSF Wire Pool Manager

Topics for discussion

- **Overview of the NSF Wire Pool**
- **Synthetic Cable**



NSF Wire Pool

- * Supports the tension member needs of the UNOLS research vessel fleet



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- * Maintains a database of the tension members on each vessel in the fleet
- * Evaluates the condition of UNOLS vessels' tension members
- * Evaluates tension members for special applications



Topics for discussion

- Overview of the NSF Wire Pool
- **Synthetic CTD Cable**

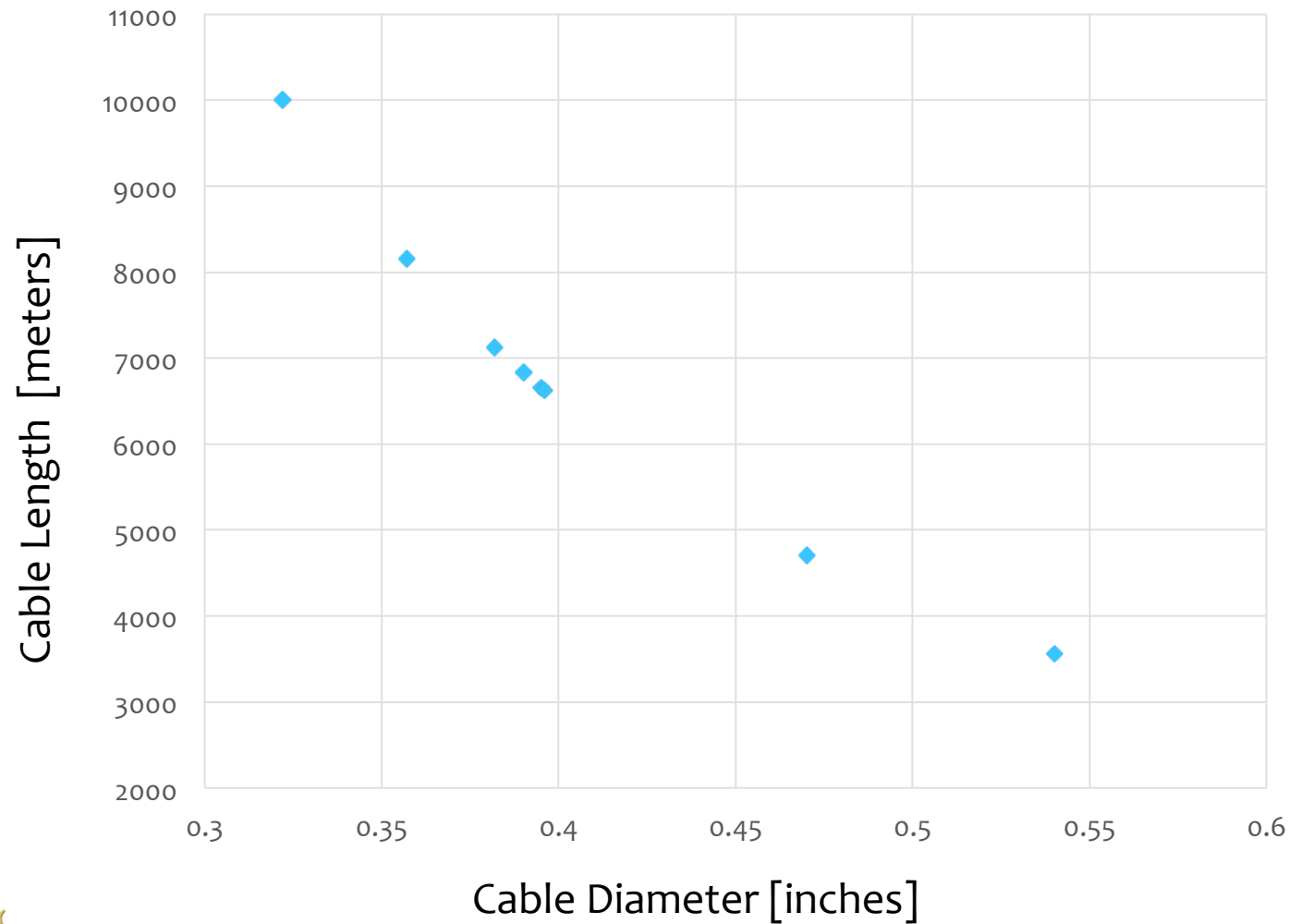


Synthetic Alternatives for CTD Cable

- * Seeking a synthetic cable that could be an alternative to .322" diameter steel armored EM cable
- * 4 conductor cable option preferred for comparable redundancy to existing .322
- * One conductor needed as a substitute for the .322 armor
- * Conductor electrical properties similar to existing .322
- * Short term preference to use existing ship fitted winches in the fleet
 - * Existing drum size limits drum capacity with increasing cable diameters



Winch Capacity vs Cable Diameter



Synthetic Cables

Manufacturer	Dia.	Rated Breaking Strength	Working Load	Conductors	Internal Material	Wet Weight (lbs/m)	Dry Weight (lbs/m)	Winch Capacity (m)	External Material
Cortland	0.322	4270	562	-	-	0.041	0.161	10000	-
South Bay	0.322	5000	1000	(3) “#19 AWG” .763 mm ²	Kevlar	0.056	0.174	10000	Dacron Reinforced Polyurethane
Cortland	0.357	6294	899	-	-	0.044	0.190	8134	-
Cortland	0.382	5950	850	-	-	0.048	0.215	7104	-
Falmat	0.39	7100	1420	(4) “#16 AWG”	Vectran	0.092	0.266	6819	-
South Bay	0.395	10000	2000	(3) “#22 AWG” .382 mm ²	Kevlar	0.043	0.220	6600	Dacron Reinforced Polyurethane
Yale	0.395	10000	2000	(4) “#20 AWG” .616 mm ²	Kevlar	0.082	0.213	6600	Braided Polyester Sleeve
Cortland	0.396	7700	1100	-	-	0.049	0.229	6600	-
Cortland	0.47	11690	1686	(3) .62 mm ²	Vectran	0.051	0.299	4693	Extruded Polyester Jacket
Cortland	0.54	16500	2200	(4) #18 AWG	Vectran	0.098	0.433	3555	Extruded Polyester Jacket
Rochester	0.322	10000	2500	(3) “#19AWG” .616 mm ²	Steel	0.473	0.574	10000	Steel Armor



The Grim Reaper of Cables

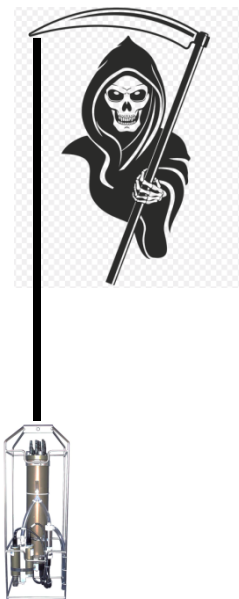


Photo by Jacob Strock, University of Rhode Island



CTD Scenario

- * 5000 m CTD Cast
- * 1000 lb CTD (dry), 600 lb (wet)
- * Rosette with (24) 10 liter bottles
- * Appendix A, section A.9.2 “Finding a Factor of Safety for all Operations”
- * Dynamic Load calculation modified ($\text{Mass Total} \times .39$) instead of ($\text{Mass Total} \times .75$).



Manufacturer	Dia.	Rated Breaking Strength	Working Load	Winch Capacity (m)	Allowable Depth Using Manuf. WLL (m)	CTD Scenario Factor of Safety
Cortland	0.322	4270	562	10000	0	2.11
South Bay	0.322	5000	1000	10000	0	2.36
Cortland	0.357	6294	899	8134	0	3
Cortland	0.382	5950	850	7104	0	2.75
Falmat	0.39	7100	1420	6819	0	2.86
South Bay	0.395	10000	2000	6600	3900	4.66
Yale	0.395	10000	2000	6600	3000	4.28
Cortland	0.396	7700	1100	6600	0	3.51
Cortland	0.47	11690	1686	4693	1000	5
Cortland	0.54	16500	2200	3555	2600	5.82
Rochester	0.322	10000	2500	10000	1450	2.01



Issues

Synthetic Cable

There is much to learn about the suitability of Synthetic Cables for over the side CTD work.

Steel Armored cable is used with a factor of safety that is half that recommended by the manufacturer.

Is the synthetic manufacturer's stated WLL a never exceed limit?
If it is exceeded by 10%, 20% ... what is the impact on the cable life?

Can a synthetic cable on existing ship's equipment work reliably for today's CTD work?

Points to the need to conduct laboratory tests on candidate cables to see how they perform under typical at-sea operating conditions.

What kind of experience have others had with synthetic cables?



Synthetic Cables in the Field

Organization	Country	Strength Member Material	Jacket	Diameter	Breaking Strength	WLL	Conductors	Optical Fiber	Manufacturer
NIOZ	Netherlands	Aramid	Polyester	20 mm	200 kN	40kN	6	4	Cousin Trestec
			Elastomer	.787 in	44,961 lbs	8992 lbs			
NERC	UK	Vectran		15.25 mm	97.8 kN	12.9 kN			Cortland
				.600 in	21,978 lbs	2904 lbs			
IMR	Norway	Aramid Armored	Polyester	18.5 mm	240 kN	20 kN	2 (1mm ²)	3	Nexans Norway
				.728 in	53954 lbs	4496 lbs			
Marine Institute	Ireland	Vectran	Polyurethane	18.0 mm	50 kN		3 (4mm ²)	2	Cortland Fibron BX
				.709 in	11,240 lbs				
Geotraces	Multiple	Vectran	Polyester	14.0 mm	73.5 kN	9.8 kN	4		Cortland
				.55 in	16,534 lbs	2205 lbs			



THANK YOU FOR LISTENING

I would appreciate hearing about any experiences others have had with synthetic cables used for similar applications.



Synthetic Cables

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Cortland	0.357	6294	899	-	-	0.044	0.190	8134	3	0
Cortland	0.382	5950	850	-	-	0.048	0.215	7104	2.75	0
Falmat	0.39	7100	1420	(4) #16 AWG	Vectran	0.092	0.266	6819	2.86	0
South Bay	0.395	10000	2000	(3) #22 AWG	Kevlar	0.043	0.220	6600	4.66	3900
Yale	0.395	10000	2000	(4) #20 AWG	Kevlar	0.082	0.213	6600	4.28	3000
Cortland	0.396	7700	1100	-	-	0.049	0.229	6600	3.51	0
Cortland	0.47	11690	1686	(3) #19 AWG	Vectran	0.051	0.299	4693	5	1000
Cortland	0.54	16500	2200	(4) #18 AWG	Vectran	0.098	0.433	3555	5.82	2600
Rochester	0.322	10000	2500	(3) #19 AWG	Steel	0.473	0.574	10000	2.01	1450



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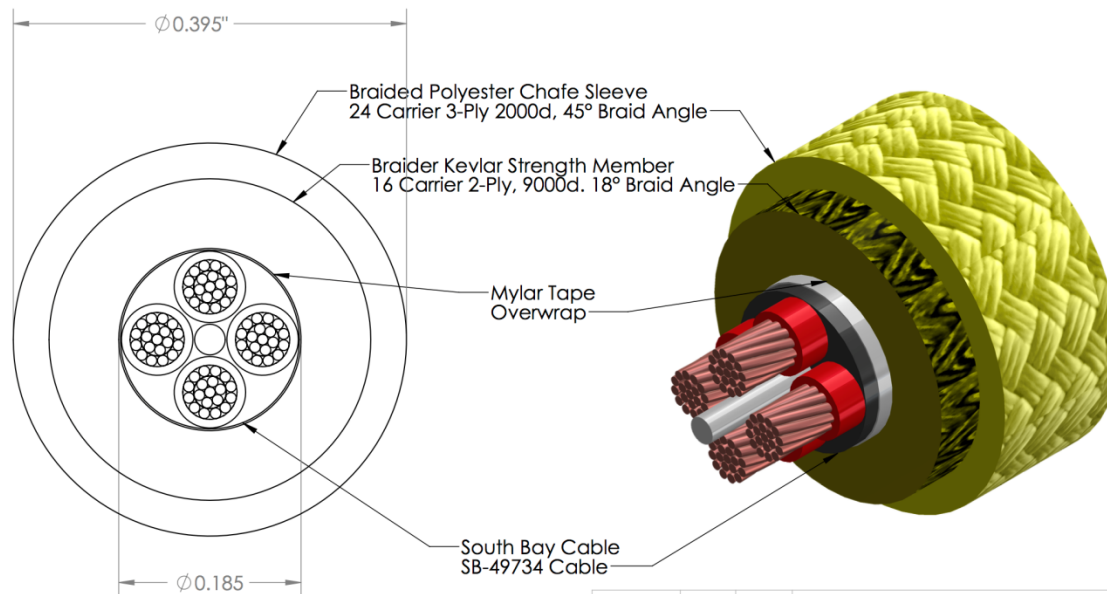


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