UNOLS

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

RVTEC 2017

Rick Trask
UNOLS Wire Pool Manager

NSF

Overview

- Brief Overview of the UNOLS Wire Pool Activities

- Summarize Wire Pool progress to date evaluating various synthetic ropes with emphasis on recent laboratory test results.

What does the Wire Pool do?

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- **Supports the wire rope and cable needs of the UNOLS research vessel fleet**

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- **Evaluates tension members for special applications**

Synthetic Tension Members

A letter to the UNOLS Fleet Improvement Committee from the National Science Foundation (NSF) stated:

“NSF is extremely interested in promoting the use of synthetic ropes through out the Academic Fleet.”

The UNOLS Wire Pool began investigating what manufacturers recommended as a 9/16” diameter trawl wire alternative and evaluating the candidate ropes.

Objectives of Synthetic Evaluation

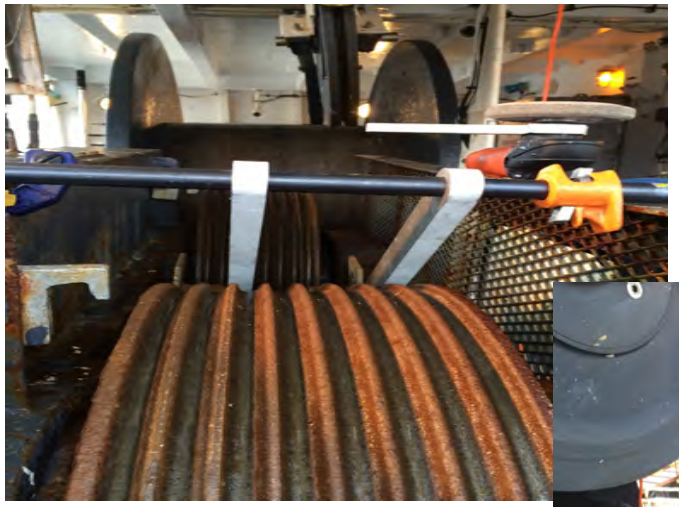
- **Evaluate different rope materials and constructions as alternatives for 9/16” diameter 3x19 wire rope**
- **Evaluate the feasibility of using synthetic rope with existing ship’s equipment**
- **Evaluate the use of synthetic rope for coring operations**

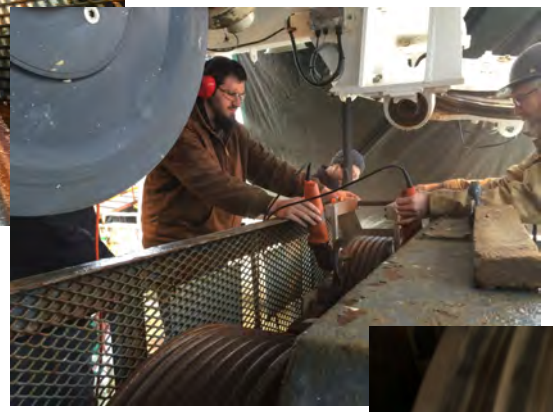
Initial Synthetic Evaluation

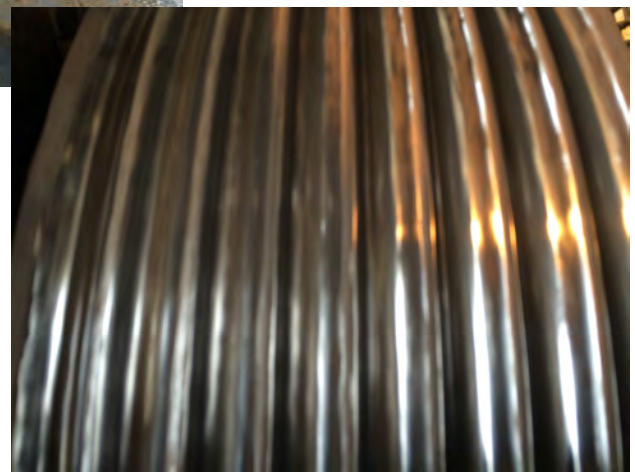
- Select rope products to evaluate
- Select a vessel from which to work
- Conduct several dock-side test to evaluate the compatibility of the synthetics with the winch system on the vessel
- Utilize the synthetics during at sea tests

R/V Endeavor with its traction winch selected as the test vessel

Reconditioning of Endeavor's traction heads







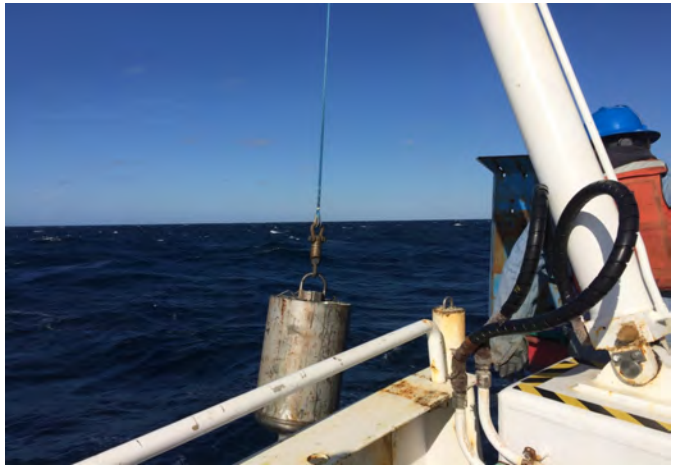
Ready for heavy lifts

Initial Synthetic Rope Products Evaluated

	Phillystran	Samson	Cortland BOB
Name	PST	DM-20	B.O.B.
Diameter	9/16"	9/16"	5/8"
MBS	32,500 lbs.	33,200* lbs.	51,400 lbs.
Construction	7-strand "wire lay" with an overall braided jacket	12-strand single braid	12-strand single braid
Material	Aramid (Technora®)	HMPE (Dyneema® DM-20 Fiber)	Blend of LCP (Vectran®) and HMPE
Specific Gravity	1.39	0.98	1.18
Elongation @ 30% of MBS	1.24%	0.96%	1.12%
Length	1000 m	1000 m	100 m

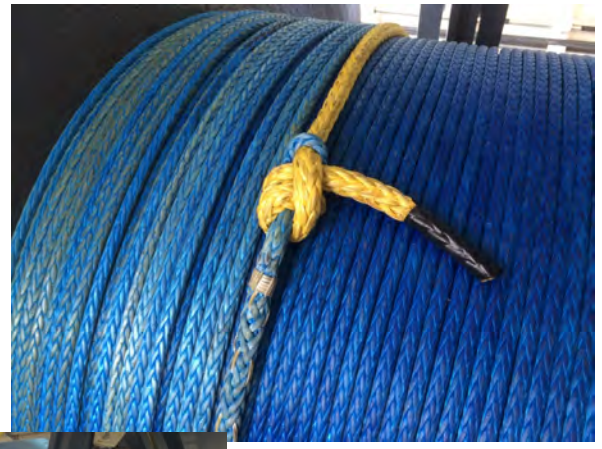
*At the time of testing the MBS was estimated at 32,500 lbs.

Each rope type was wound onto the winch and then used to raise a 15,000 lbs. weight



Gravity Coring (April 2016) using both the Phillystran and Samson products

B.O.B (larger diameter) used to lift 25,000 lbs.



Continuation of Synthetic Testing

2016 & 2017

- **Repeat of lift tests using the traction winch on the R/V Neil Armstrong in preparation for a piston coring application**

- **Laboratory Tension Tests to compare candidate ropes and identify a viable option for piston coring**

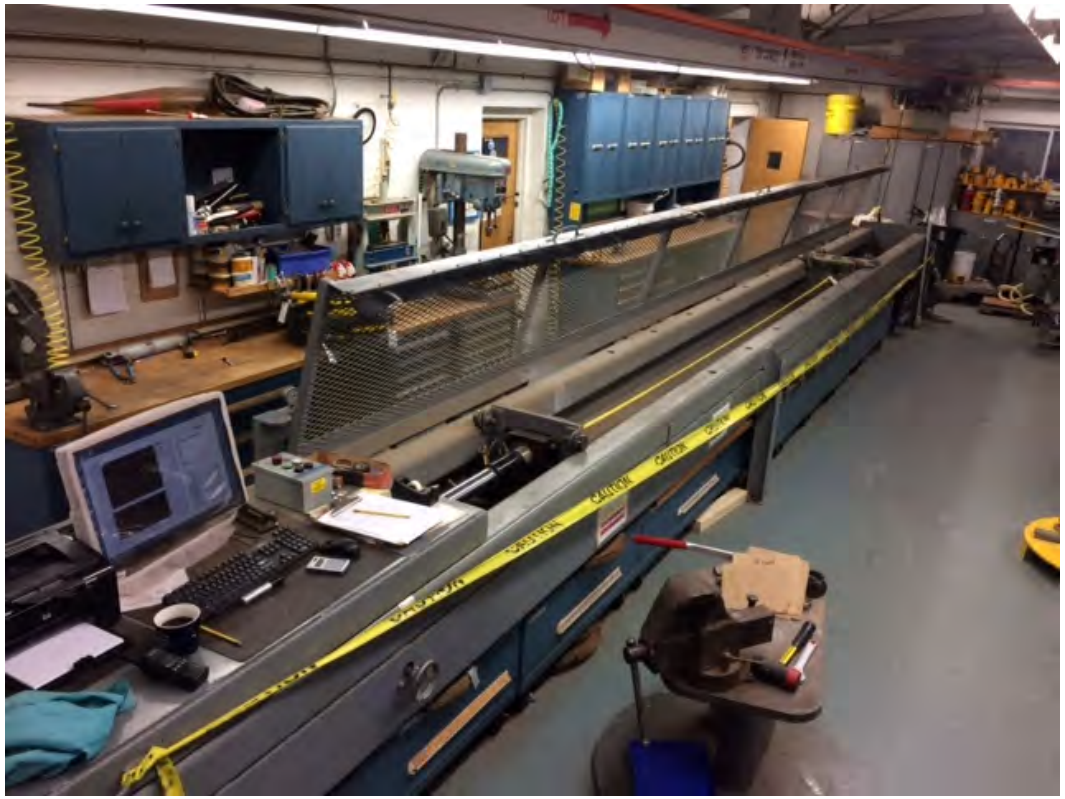
R/V Neil Armstrong

Load Tests using the Armstrong's Traction winch and lifting 20,000 lbs.

In House Laboratory Testing

4 Rope Samples Tested using the **Thousand Cycle Load Level (TCLL) Determination:**

- 5/8” Cortland B-O-B
- 9/16” Samson Product with DM-20 fiber
- 9/16” Phillystran PST with Multiplex jacket
- **9/16” Cortland Plasma® HiCo**



Thousand Cycle Load Level Procedure

(TCLL)

TCLL is the load at which failure would occur in 1,000 cycles
Expressed as a % of the manufacturer's minimum breaking strength

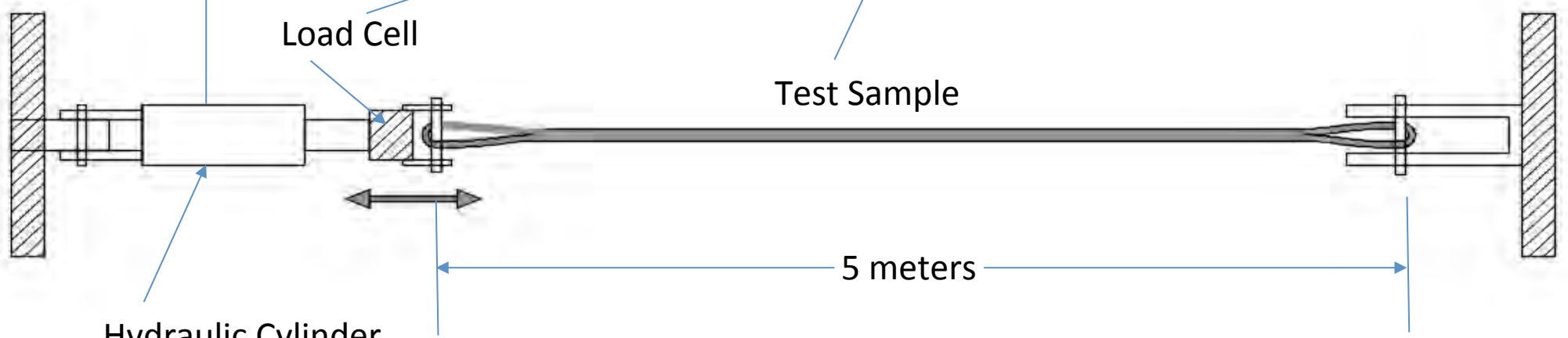
- 1,000 cycles @ 50% of breaking strength, if it survives
- 1,000 cycles @ 60%, if sample survives
- 1,000 cycles @ 70%, if sample survives
- 2,000 cycles @ 80%

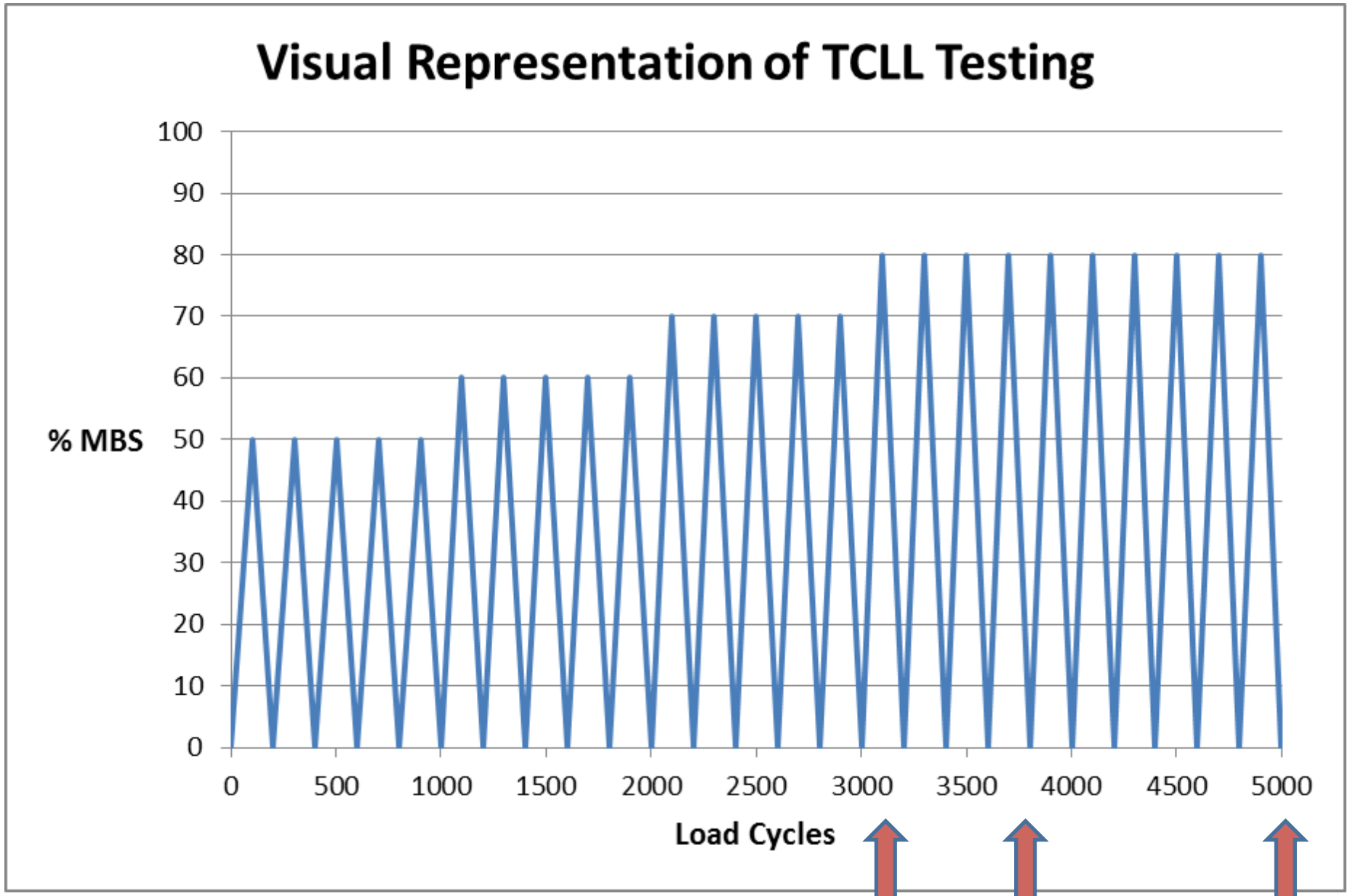
Using Predetermined Equivalents:

- 1,000 cycles @ 50% = 251 cycles @ 60%
- 1,000 cycles @ 50% + 1,000 cycles @ 60% = 215 cycles @ 70%
- 1,000 cycles @ 50% + 1,000 cycles @ 60% + 1,000 cycles @ 70% = 113 cycles @ 80%

CTF= Number of Cycles to Failure
TLL = Test Load Level at which CTF occurred

TCLL can be calculated: $TCLL = 100\% - ((6.91 (100\% - TLL))/Ln\ CTF)$


Load Cell
Test Sample
5 meters
Hydraulic Cylinder


Visual Representation of TCLL Testing
% MBS
100
90
80
70
60
50
40
30
20
10
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Load Cycles
Cortland B.O.B.
Phillystran PST
Cortland Plasma HiCo
Samson DM-20

TCLL Test Results

Manufacturer	Product	TCLL [% MBS]	MBS [Lbs.]
Cortland	B-O-B	71.4	51,400
Phillystran	PST	79.4	32,500
Samson	DM-20	81.9*	32,500
Cortland	Plasma® HiCo	81.9	37,900

* Used an estimated minimum breaking strength

Looking Forward

What's next for the Wire Pool?

Questions?

Keep the slides below for reference

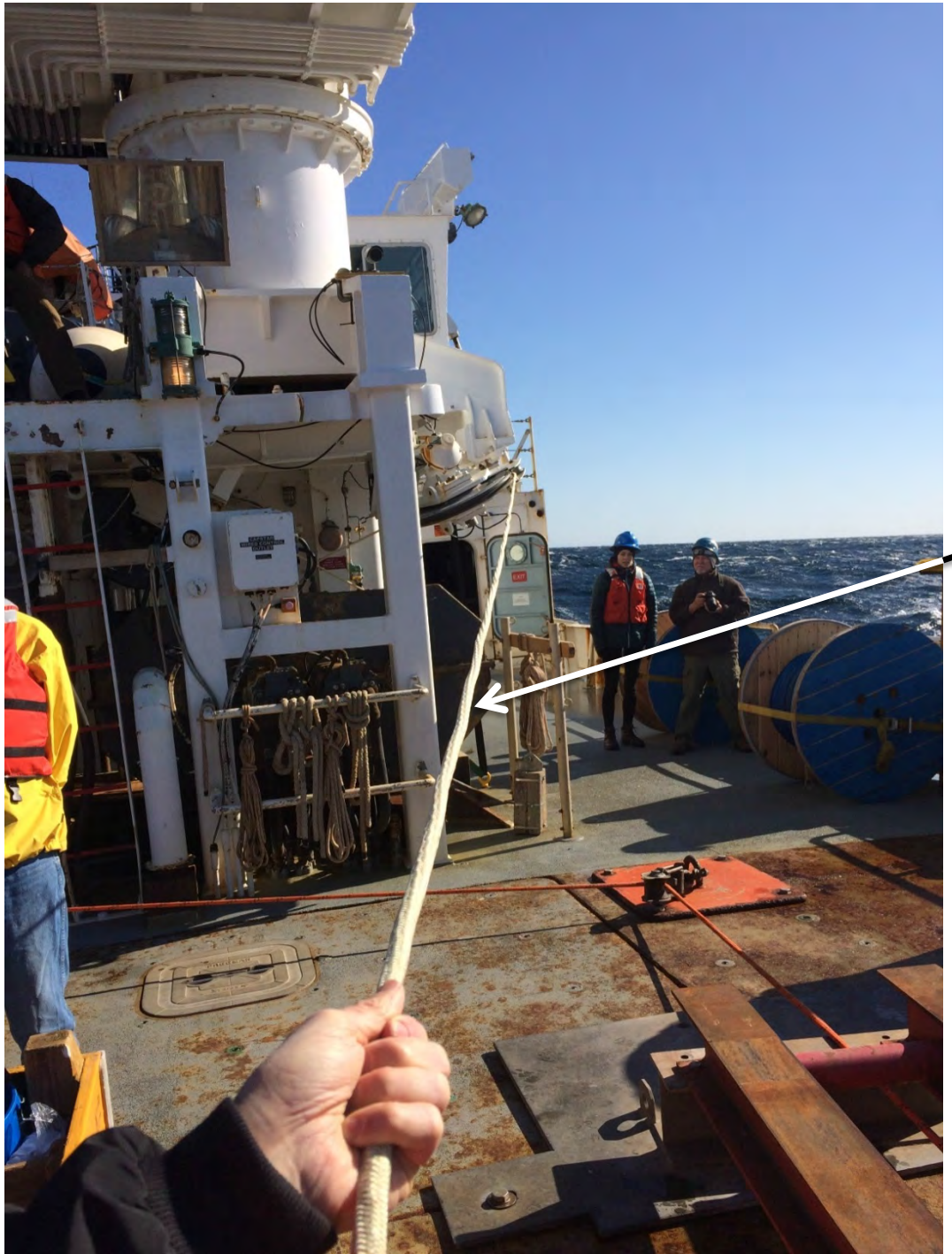
Breaking Strength Results

- PST
- DM-20 38,025 lbs, 29,600 lbs.
- HiCo   42,125 lbs.

6,804 kg
(15,000 lbs.)
Load Test

Gravity Coring using the Phillystran PST from the R/V Endeavor

Rope configuration following the first coring operation after being disconnected from the core head.



Spiral pattern evident in jacket of the Phillystran product after taking the first core.

Additional Testing of a Third Synthetic Sample

- 250 ft sample of a Cortland product called BOB for Braid Optimized for Bending.
- Used the Samson product as a winch leader to which the BOB was attached.
- BOB sample diameter = 5/8”
- MBS = 23314 kg (51,400 lbs.)
- Specific Gravity = 1.18
- Elongation at 30% of MBS = 1.12%
- Blend of fibers that improve the bend over sheave CTF
- Conducted dock side load tests using the BOB