UNOLS Wire Rope Inspection Update

Shipboard Scientific Support Equipment: Oceanographic Cable
NSF Grant No. 0555000

Presented by Rick Trask (WHOI)

Discussion Topics

- **Electromagnetic Non-Destructive Testing System**
- **Research Vessel Wire Testing (Destructive)**

Non-Destructive Testing

NDT TECHNOLOGIES, Inc.

LMA-125 Wire Rope Inspection System

- High resolution electromagnetic wire rope inspection system
- Assists in identifying degradation of mechanical aspects of the wire
- Measures loss of metallic cross sectional area
- Identifies localized faults

Sensor Head

- **Rope is magnetized as it passes through Sensor Head**

- **Discontinuities (broken wire, corrosion pitting) distort the magnetic flux in the rope**

NDT Sensor Head
Opened with Wire in Track

Signal Console

- Gives a quantitative measure of the loss of metallic cross-sectional area caused by corrosion, wear, broken wire, etc.
- A flaw can be localized to determine its actual nature
- Raw data exported to a laptop via USB port for real-time viewing
- Data analysis and charting using Excel
- Strip chart recorder available for real-time hard copy of raw data

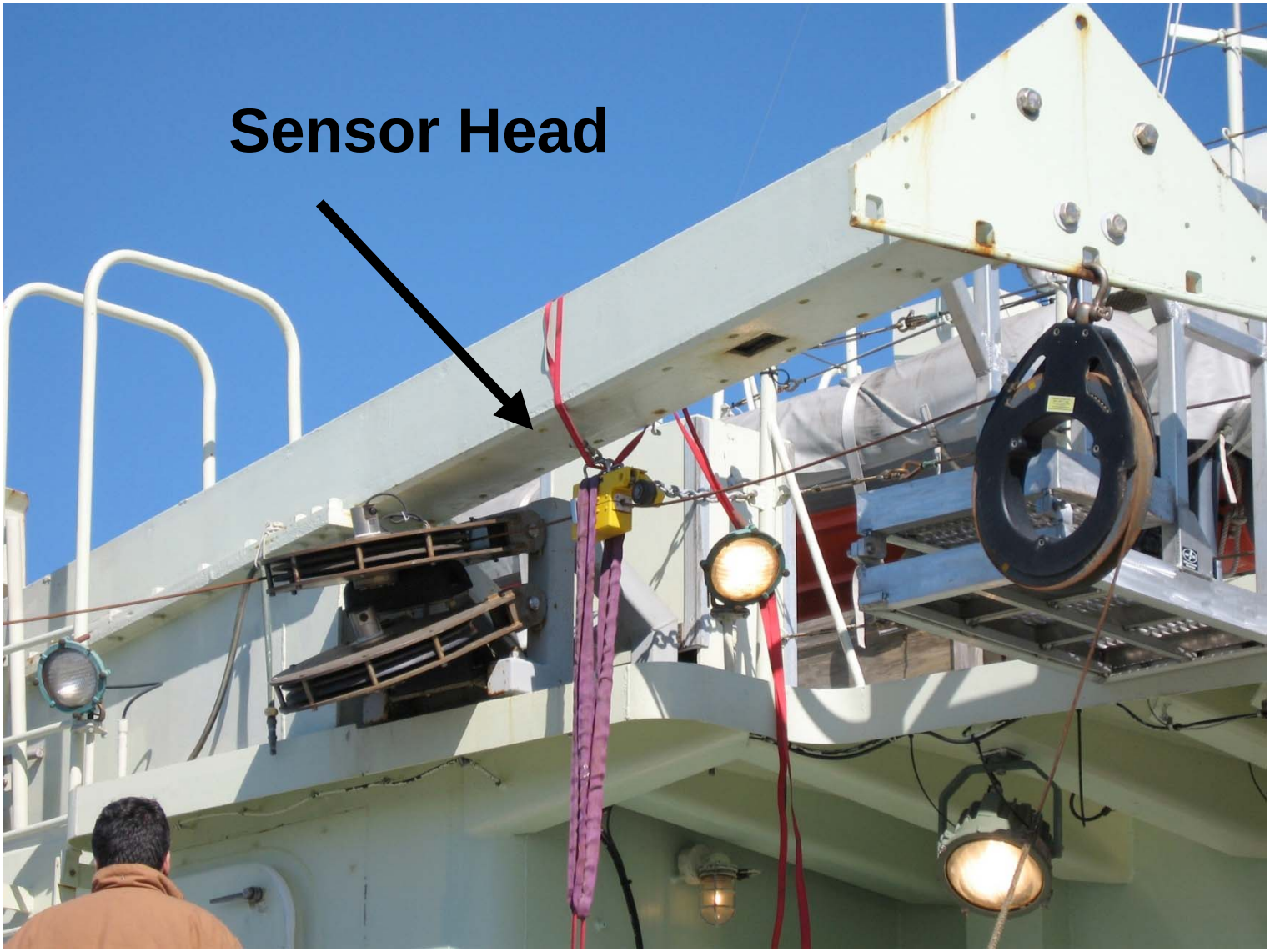
NDT Equipment is relatively easy to transport to vessels for wire testing

NDT Set-up on site

- **Locate Sensor Head – must be parallel to wire**
- **Sensor Head clamps on the wire**
  - **- Angular changes due to level wind create challenges with regard to sensor placement**
- **Connect Sensor Head (25 ft. cable) to Signal Console**
- **Connect Signal Console (via USB) to Laptop**
- **Test set-up is done from Laptop**


LMA Signal Monitor Panel
Chart Recorder Panels
SPEED/BALANCE
POWER
LMA/LF RESET
USB
NDT TECHNOLOGIES, Inc.
mV/mm
DELL

Test of .322” EM Cable
R/V Oceanus March 2008



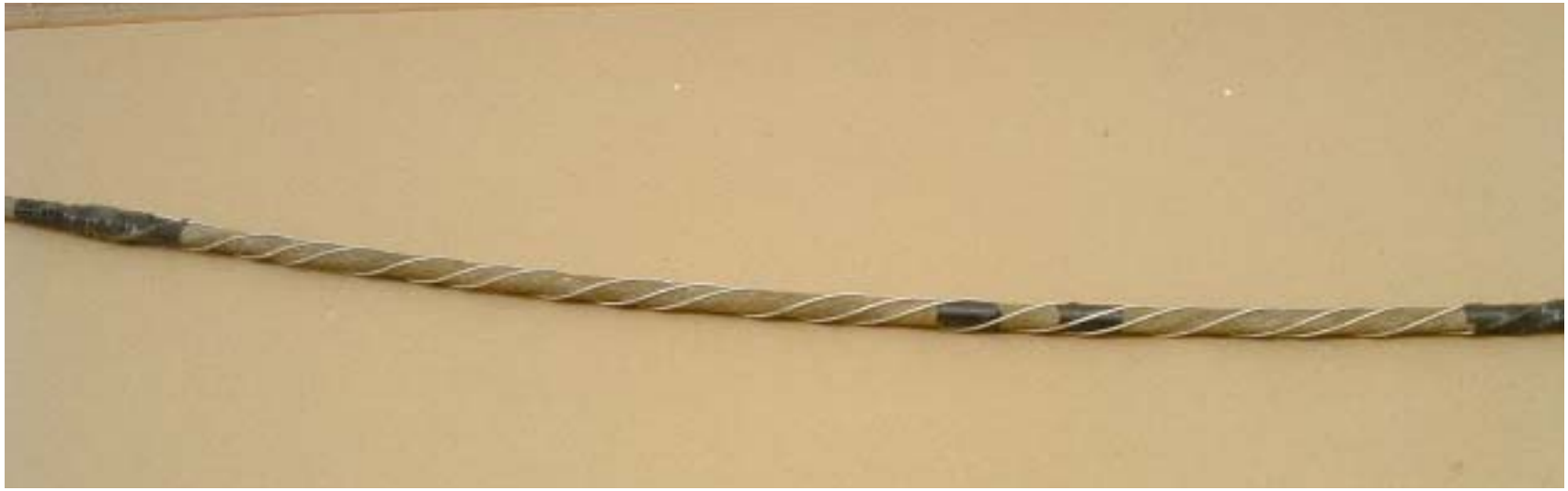
Sensor Head strapped to overhead beam to align with cable feed

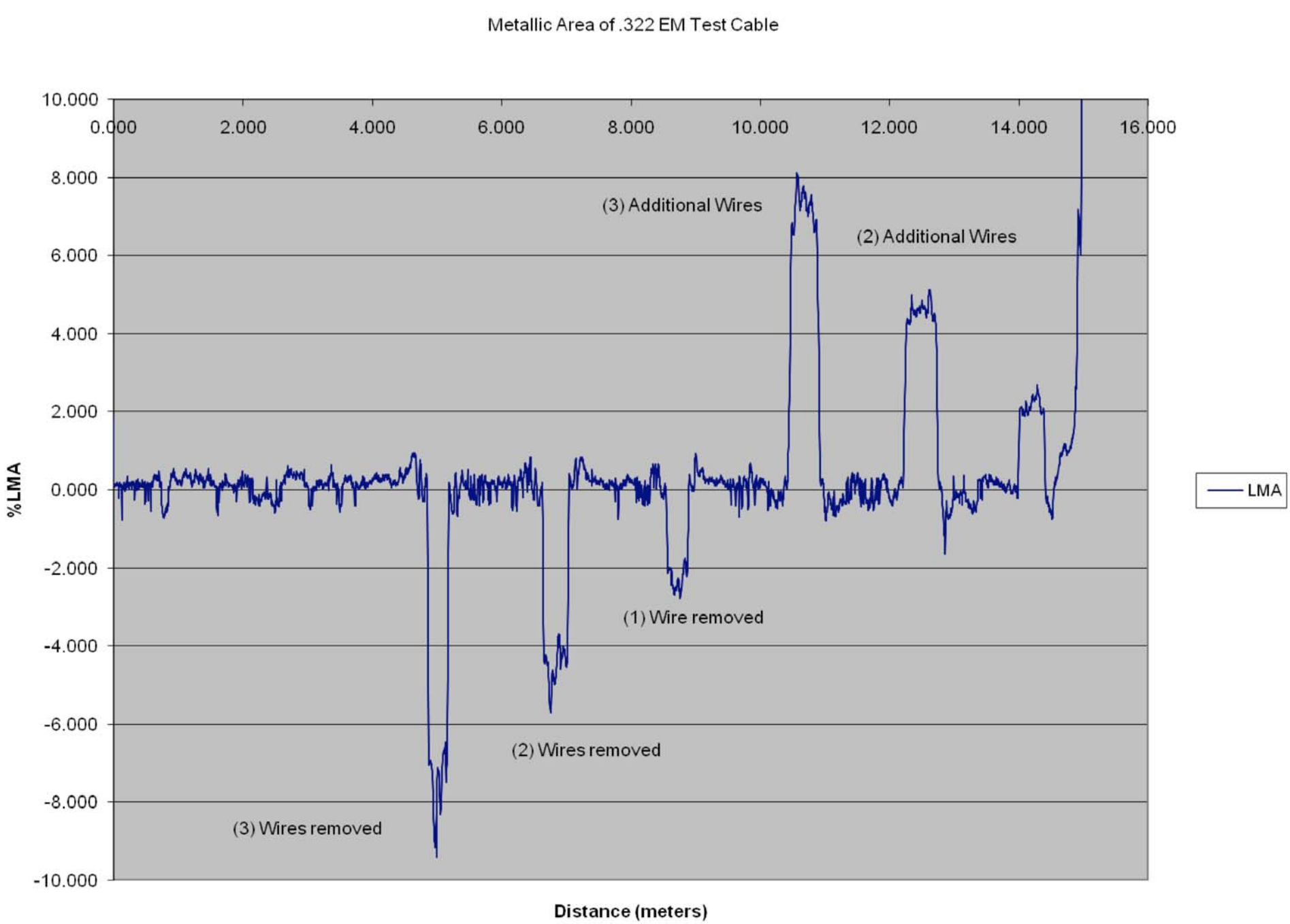

CAROL C-1310 MADE IN USA

Data Interpretation

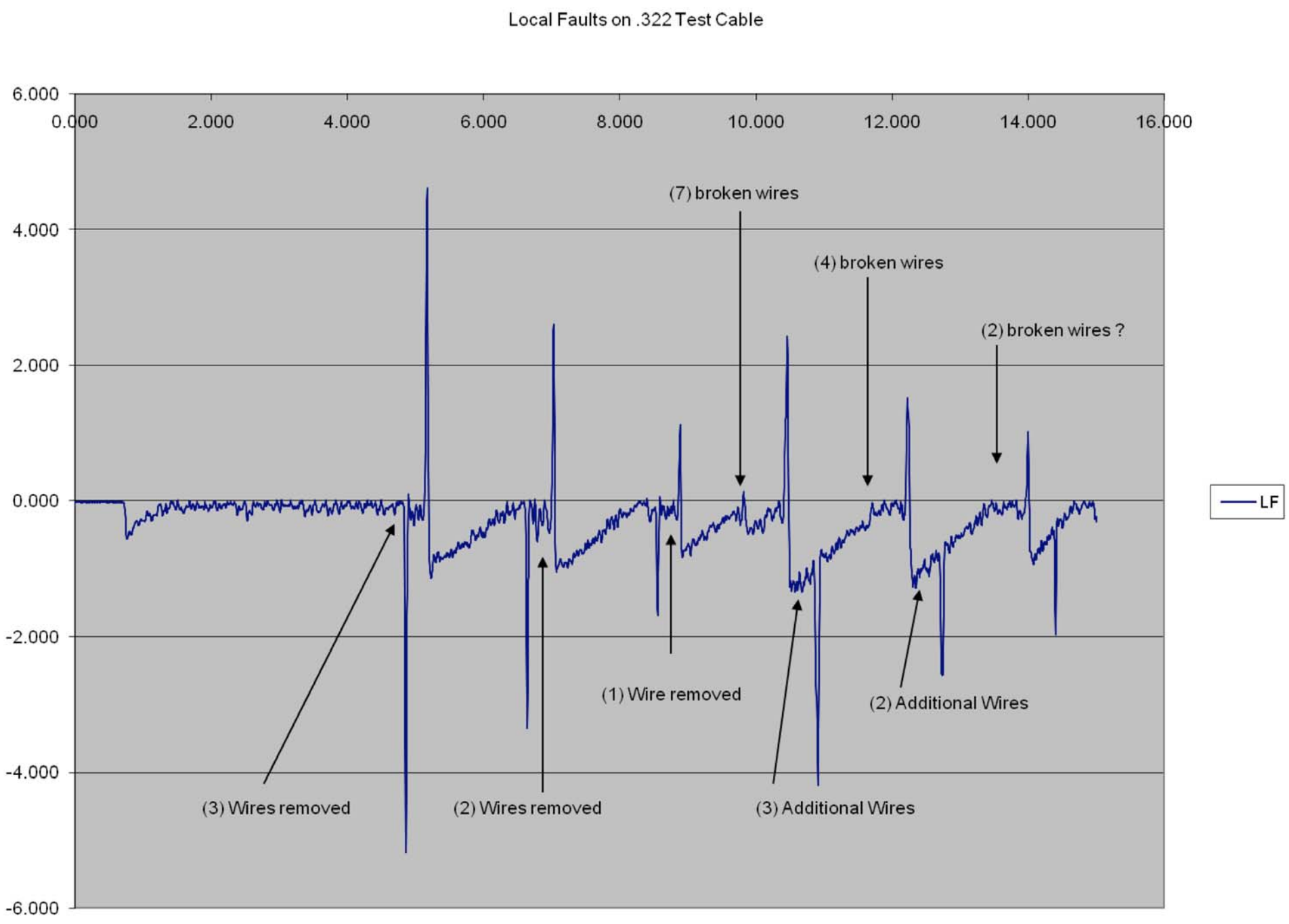
- Labor intensive to monitor in real time
- Post-calibration necessary for data interpretation
- Interpretation following winding precludes real-time visual inspection of questionable areas
- Familiarization with signature of known defects needed

.322” EM with Wires added and removed to simulate changes in Metallic Area




Metallic Area of .322 EM Test Cable
10.000
8.000
6.000
4.000
2.000
0.000
-2.000
-4.000
-6.000
-8.000
-10.000
%LMA
0.000
2.000
4.000
6.000
8.000
10.000
12.000
14.000
16.000
Distance (meters)
(3) Additional Wires
(2) Additional Wires
(1) Wire removed
(2) Wires removed
(3) Wires removed
LMA

.322” EM with Broken Wires


Local Faults on .322 Test Cable
6.000
4.000
2.000
0.000
-2.000
-4.000
-6.000
0.000
2.000
4.000
6.000
8.000
10.000
12.000
14.000
16.000
(7) broken wires
(4) broken wires
(2) broken wires ?
(1) Wire removed
(2) Additional Wires
(3) Wires removed
(2) Wires removed
(3) Additional Wires
LF

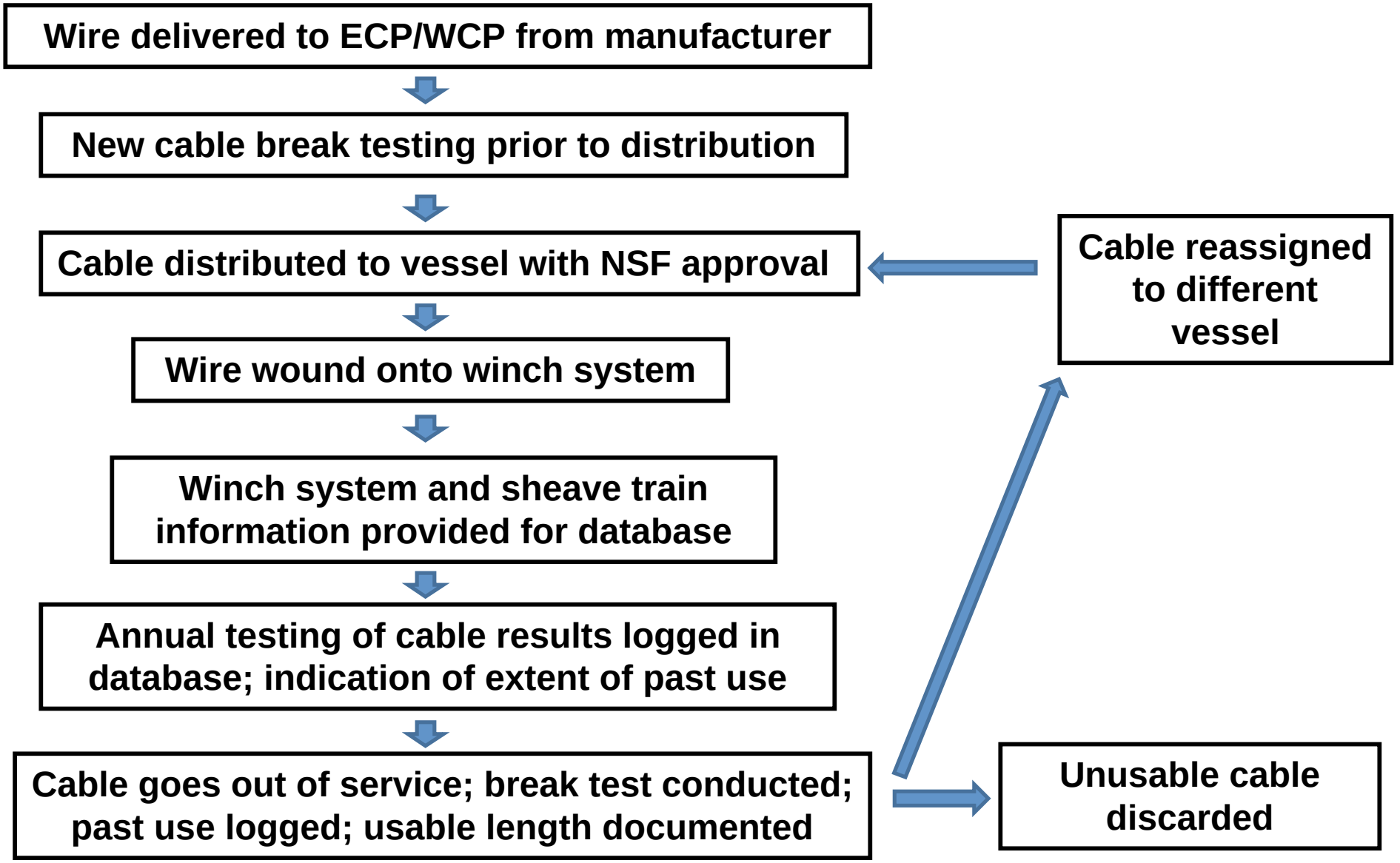
Challenges Ahead

- **Focusing on evaluation of .322” EM cable**
  - **Frequent use**
  - **Greater opportunity to evaluate**
- **How to overcome limited support from manufacturer?**
- **How best to handle and interpret large data files from 10,000m long cables?**
- **Is it feasible to collect data periodically at sea during routine operations?**
- **How to use collected information to assist in decisions with wire and cable retirement?**

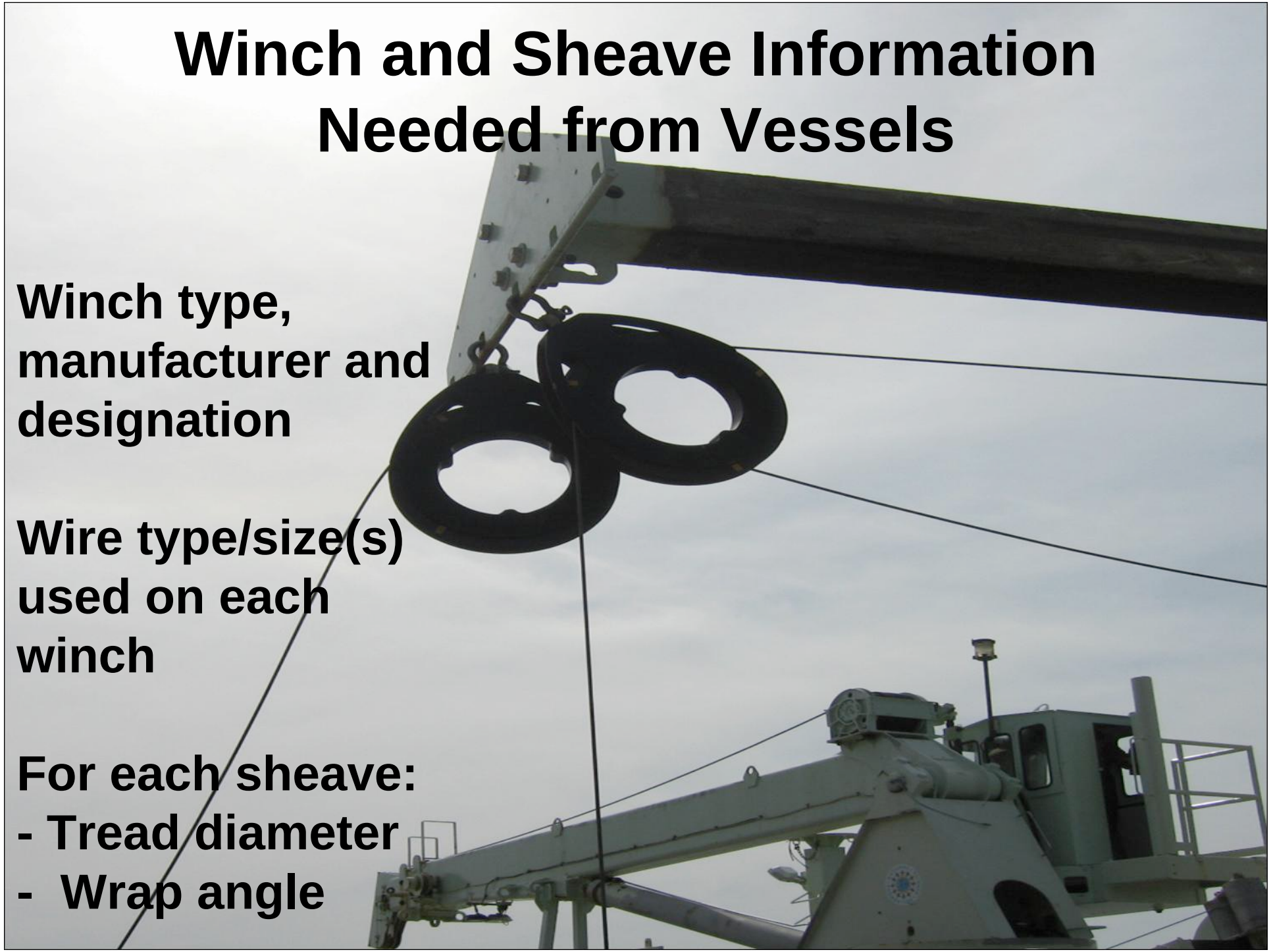
UNOLS Vessel Wire Break Testing Update

Wire Tracking - follow specific wire/cable from cradle to grave

Relies on Vessel Operators' cooperation for info gathering



Winch and Sheave Information Needed from Vessels



Winch type, manufacturer and designation

Wire type/size(s) used on each winch

For each sheave:
- Tread diameter
- Wrap angle

UNOLS Wire Data Record

Reel No.:

Date Distributed:

Original Length:

Distributed to:

Vessel Name:

	Test 1	Test 2	Test 3	Test 4	Test 5
Winch Description:					
Test Date:					
Cable Remaining (m):					
Manufacturer's Breaking Strength:					
Test Breaking Strength:					
Test Notes:					
No. of Deployments since New:					
Maximum Tension since Last Test:					
Typical Deployment Length:					
Maximum Deployment Length:					
Marker Length:					

Reel Status:

UNOLS Vessels

BIOS: Atlantic Explorer
Duke: Cape Hatteras
Skidaway: Savannah
HBOI: Seward Johnson
LDEO: Marcus Langseth
LUMCO: Pelican
Moss Landing: Point Sur
OSU: Wecoma
Smithsonian: Urraca
SIO: Melville
New Horizon
Robert Gordon Sproul
Roger Revelle

UDelaware: Hugh R. Sharp
UHawaii: Kilo Moana
UMiami: Walton Smith
UMinnesota Duluth: Blue Heron
URI: Endeavor
UWashington: Clifford A. Barnes
Thomas G. Thompson
WHOI: Atlantis
Knorr
Oceanus

NOAA: Ronald H. Brown
USCG: Healy
Polar Sea
Polar Star

* Wire samples provided

Wire Break Test Results

Certificate of Testing

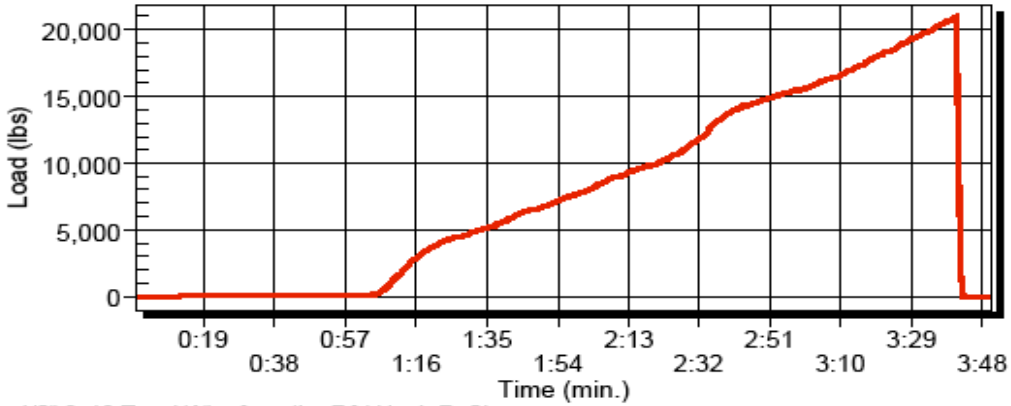
Woods Hole Oceanographic Institution
Mooring Operations, Engineering and Field Support
Rigging Shop
Woods Hole, MA 02543
Tel: (508) 289-2395, Fax: (508) 457-2130

Project Name: UNOLS R/V Wire Break Tests

Test Number: 3268
Test Date: 09/19/07
Description: Trawl Wire
Test Method: BREAK

Work Order No.: 7176
Serial No.:
Size: 1/2" 3x19 TB Wire
Length: 5 meter

Peak Load: 20,950 lbs.



1/2" 3x19 Trawl Wire from the R/V Hugh R. Sharp
Terminated both ends with heavy wire thimble and
single nico press.
WRCA wire from BB01007-01
Maximum number of cast since new (2005) approx 500
Maximum tension since last test = 3000 lbs
Typical Deployment length < 50 m
Maximum deployment length since last test = 1000 m
Sheave train = six (6) 28" diameter synthetic sheaves

Test Results
☐ Acceptable
☐ Not Acceptable

Conducted by:

Rick Trask

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