Development of Replacement Cable and Termination for SeaSpy Magnetometer/Gradiometer System
Why?

Poorly designed termination lead to a generally unreliable system. Saltwater short causing damage to towfish increasing repair costs. Unable to hold manufacturer accountable for warranty repairs.

Manufacturer unwilling to admit there was a problem or work towards a solution, saltwater intrusion was a “design feature”.
The Problem
Part 1

- Small cut in jacket usually from shark bite.
Shark Bites
The Problem
Part 2

- Saltwater wicks down Vectran strength member into termination.
The Problem
Part 3

- With no barrier saltwater shorts the electrical component of the termination
1. Began discussions with multiple companies, decided to move forward with PMI Industries.

2. Basic Design developed, quote provided by PMI included one termination and design verification testing.

3. Four vendors were asked to quote replacement cable, South Bay Cable was chosen.

4. Once cable was delivered termination development continued.
Cable Design

**SINGLE CONDUCTORS - 2 UNITS**
- AWG No. 10 (0.0113") T/C
- DC Resistance @ 20°C ≤ 5.4 Ohms/1000 Ft
- HD Polyethylene insulation
- Voltage rating: 600 V
- Color code: Red
- Black

**SHIELD**
- Tinned Copper Braid

**INNER JACKET**
- HD Polyethylene
- Color: Black

**STRENGTH MEMBER**
- Vectran™ Braid

**OUTER JACKET**
- Polyurethane
- Color: Yellow
- Jacket marking:
  - Parallel Black Stripe (1/16" wide)

**ESTIMATED VALUES**
- Nominal O.D. = 0.420"
- Weight in Air = 90 Lb/1000 Ft
- Weight in Seawater = 28 Lb/1000 Ft
- Breaking Strength = 7,000 Pounds
- Maximum Load = 1,000 Pounds
- Min. Bend Diameter = 12 inches

**South Bay Cable**
- E-M Cable
- SB-47107
Termination Design

NOTES: UNLESS OTHERWISE SPECIFIED
1 MATERIALS: MACHINED PARTS; BRONZE, TYPE T3D
SCREWS: CRES

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DO NOT USE FOR FABRICATION

CONDUCTOR COMPLIANCE
AIR GEL OR OIL-FILLED CAVITY
CONDUCTOR SEAL
CONDUCTOR SERVICE LOOPS
AIR CAVITY

TRANSITION BOOt/
D O U T E R HOUSING
SUBASSEMBLY

JACKET SEAL

SEAL ED FILL PORT

14.27

PMI INDUSTRIES, INC.

TOW CABLE TERMINATION
ASSY, MAGNETOMETER

B0G5C2

PMI PART NO.

P7304-01
Design Verification Testing

SCRIPPS MAGNETOMETER TOW CABLE TERMINATION DESIGN VERIFICATION TEST PLAN

- **PRE-DVT Cable Electrical Characteristics**
  - DC Resistance & Insulation Resistance (500VDC)

- **Tension Proof Load**
  - ~50 lbf to 1000 lbf for 10 cycles while monitoring & recording Tension, Elongation, Gauge-Length Elongation & DC Resistance

- **Tension Cycling**
  - ~50 lbf to 1000 lbf for 10,000 cycles while monitoring and recording Tension, Elongation & DC Resistance

- **Hydrostatic Pressure Testing**
  - 0 to 1500 psig for 10 cycles + 4-hour hold at 1500 psig while monitoring and recording Pressure & Low-Voltage Insulation Resistance

- **POST-DVT Cable Electrical Characteristics**
  - DC Resistance & Insulation Resistance (500VDC)

- **Tension to Failure**
  - While monitoring and recording Tension, Elongation & DC Resistance
Conclusions

- Termination exceeded the minimum pass criteria of the test plan
- First Termination installed on Melville Aug 2011.
- Towed from San Diego to Panama without incident.
- Towed from Barbados to Cape Town, South Africa without incident
- Will be installed on Revelle in 2012.