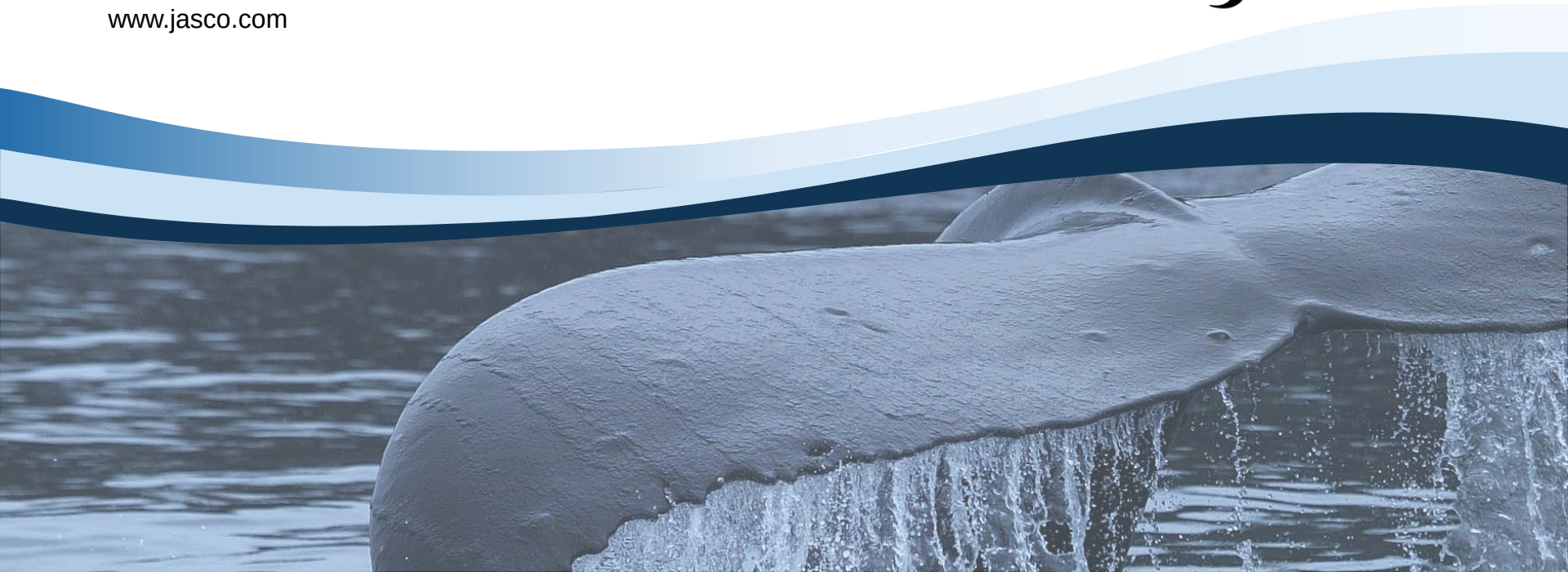
# Combinations of Corrosion and Fatigue Failure of Wire Rope in High-Current Environments

**Presented by Eric McCorquodale, BEng, EIT**
**Durability of Cables and Moorings in Tidal Flows**
**31 March 2016**

www.jasco.com



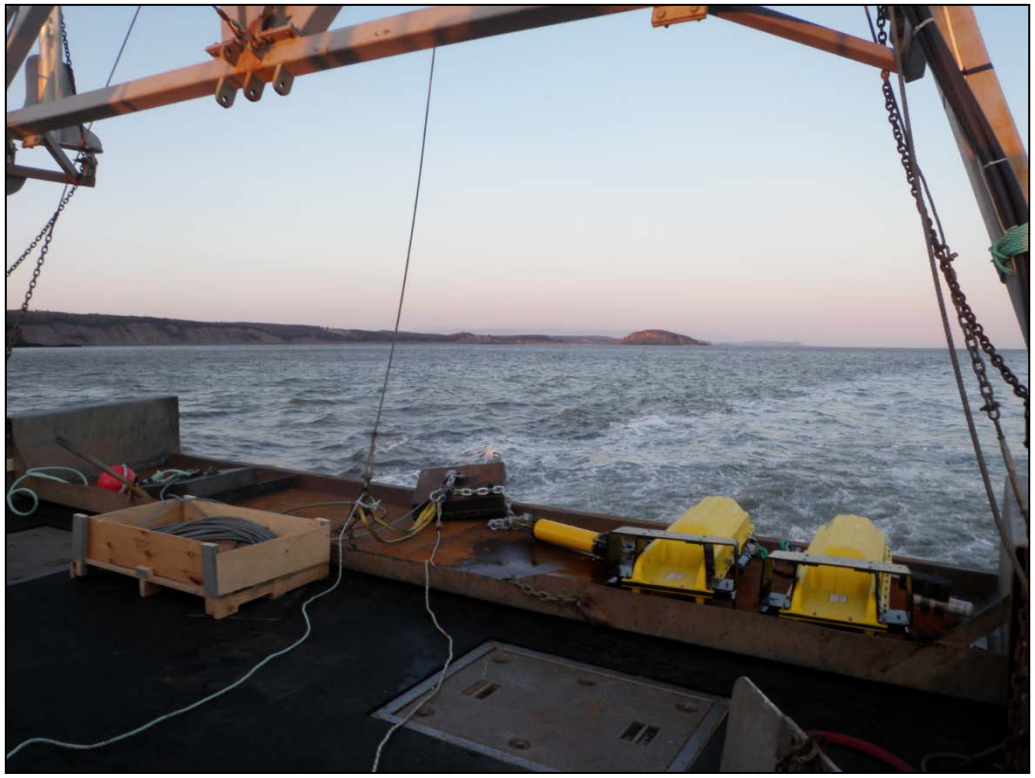
# JASCO Applied Sciences Ltd

- Specialist Acoustic and Bio-acoustic Consultancy
- Acoustic instrumentation R&D and manufacture – 25 years experience
- Global capability
  - Canada - Victoria BC, Halifax NS
  - USA - Washington DC, Anchorage AK, Ithaca
  - Southampton, UK
  - Brisbane, Australia
- Clients
  - Oil & Gas Multi-Nationals
  - Construction
  - Military
  - Government, Academia

- Staff
  - 76 staff, multiple PhDs - Acoustics, Engineering, Electronics, Software, Oceanography, Bioacoustics
- Example projects
  - Sakhalin (Vessel and oil activity noise measurement and monitoring), Chukchi Sea (49,000 km² recording programme), Falkland Islands (Cetacean and noise recording Programme), Alaska (Shell drilling programme vessel, sonar rig noise), Gulf of Mexico (Deep water vessel noise measurement), North Sea (Ambient, power generation, renewable energy noise + particle velocity), Great Barrier Reef (noise and marine life)

# Tidal Environments

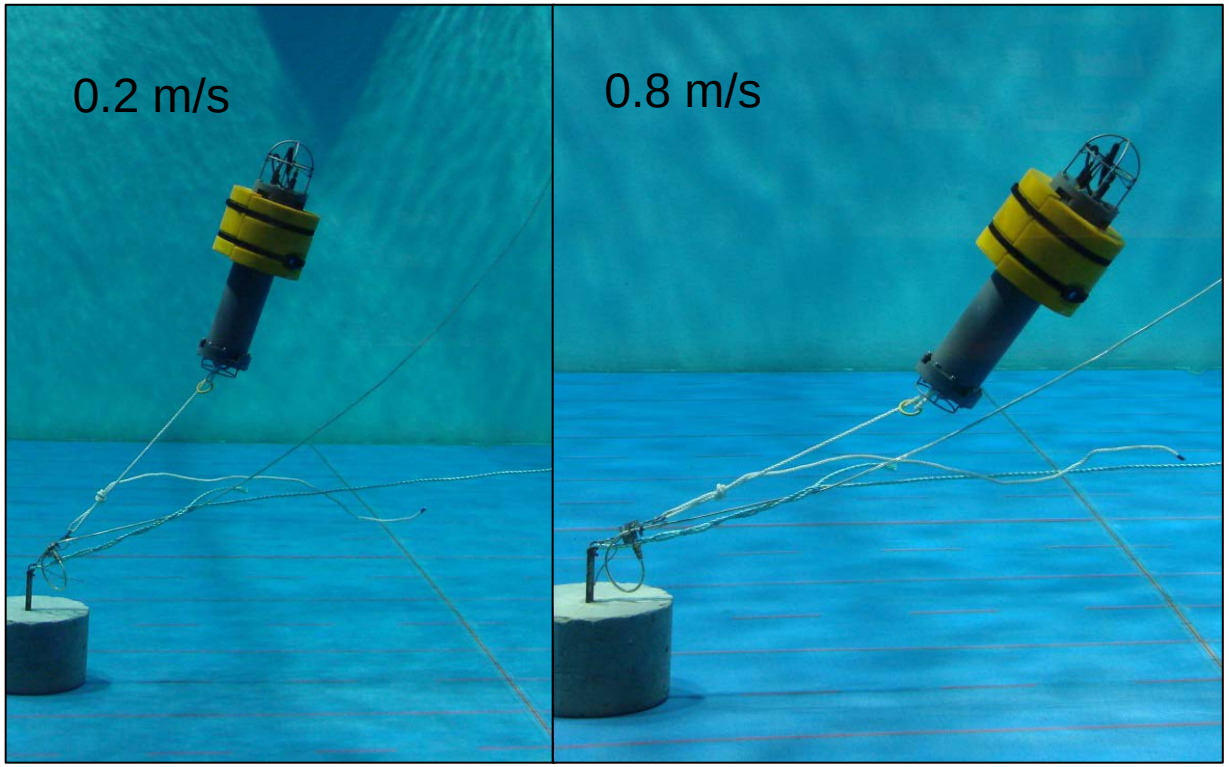
- Bay of Fundy
- Cook Inlet, Alaska
- Bristol Channel, UK
- Tappan Zee, New York
- Uldolmok Straight, South Korea



Bay of Fundy, 2012

# Difficulties

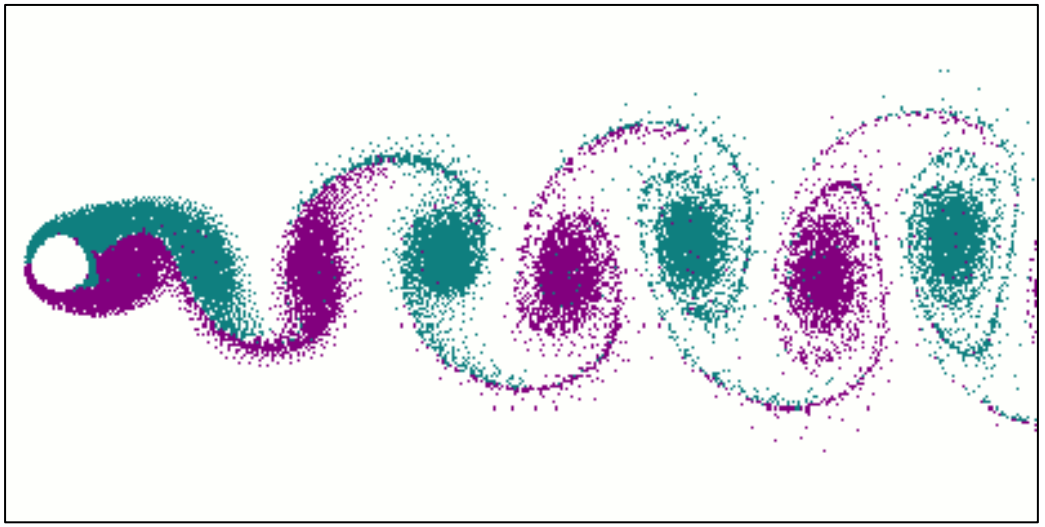
- Knockdown




Memorial University, CSAR Flume Tank, 2009

# Difficulties

- Strumming
- Vortex-Induced Vibrations



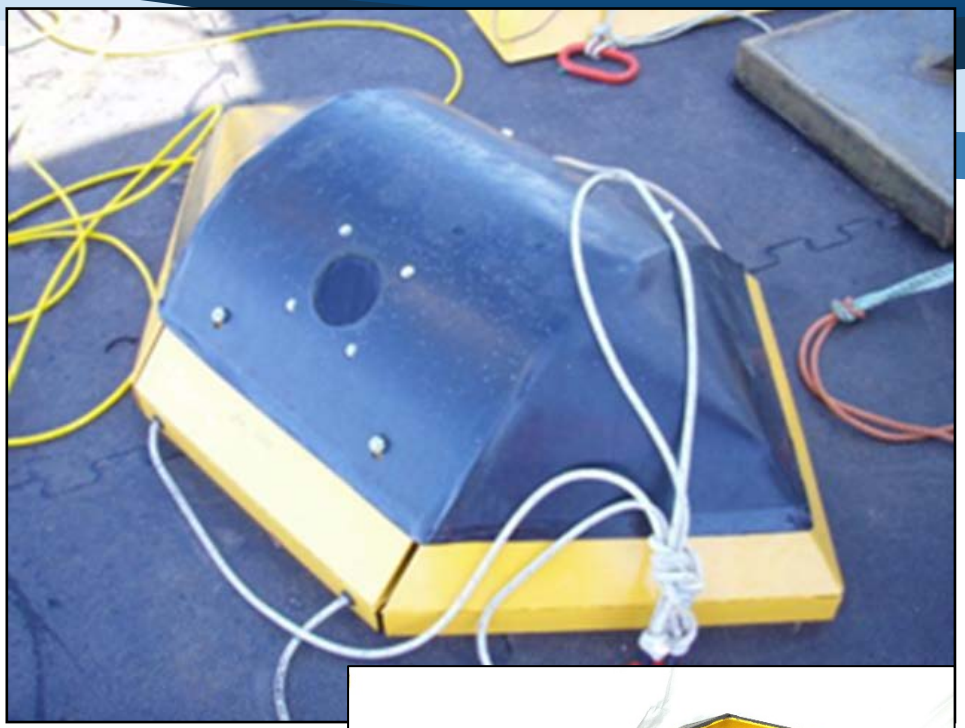
Gif Credit: Cesareo de La Rosa Siqueira, 2005

# Difficulties

- High Forces
- Movement
- Waves

# Acoustic Monitoring

- Flow noise
  - Mooring-created eddies
  - “Pseudo-noise”
- Hydrodynamic moorings
  - SUBS
  - High-Flow shields



High-Flow Mooring

# The Problem

Corrosion of Wire Rope

- Accelerated corrosion
  - Current
  - Abrasion
- Constant movement
  - Strumming
  - Fatigue
  - Torsion
  - Flexing

# Solutions

Material choices

- 316 SS
- Titanium
- Galvanized Steel

Isolation

- Prevent galvanic potential
- Sacrificial anodes

Coatings

- Remove electrolyte


Photo Credit: Mooring Systems Inc.

# The Facebook Post

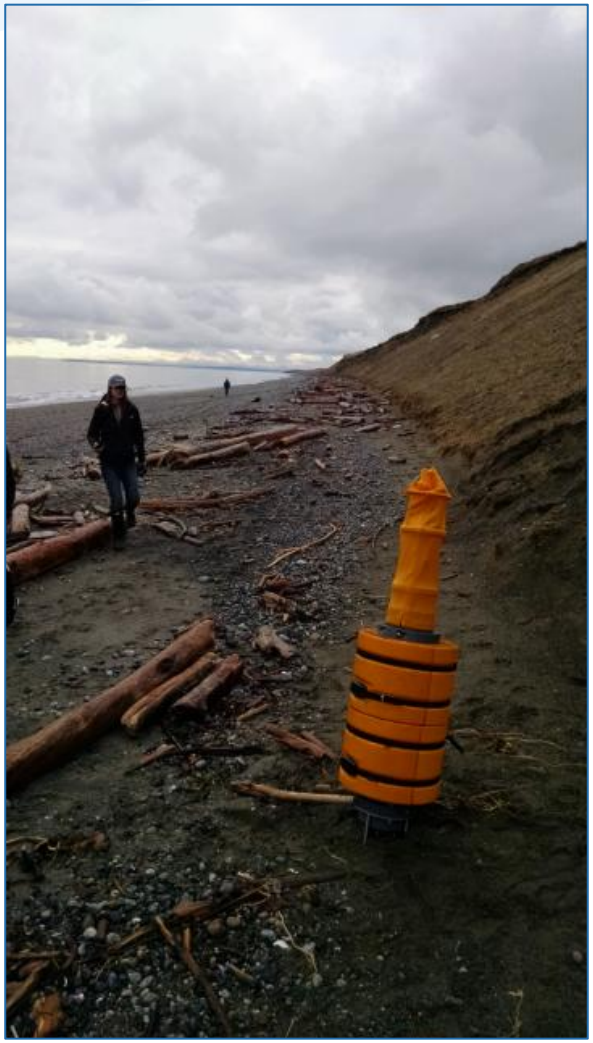
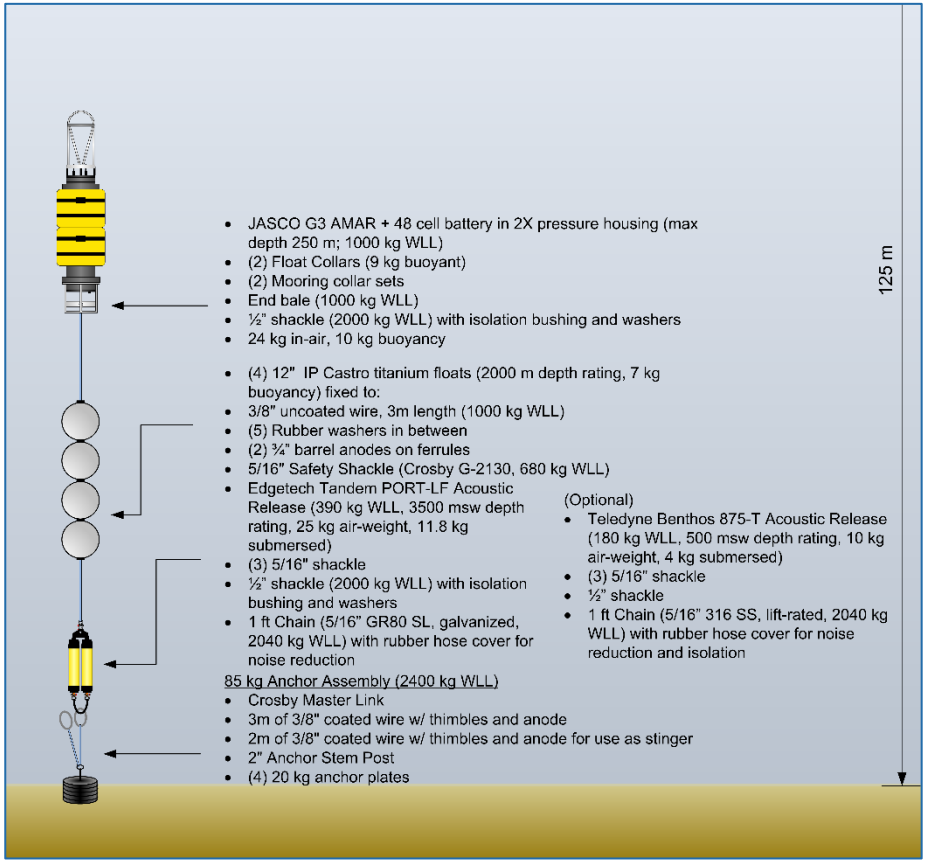


Photo Credit: Jason Wood, 2015

# The Project

October 2015

- 5 recorders
- Range of currents
- Range of depths
- Tidal zone
- Fishing zone

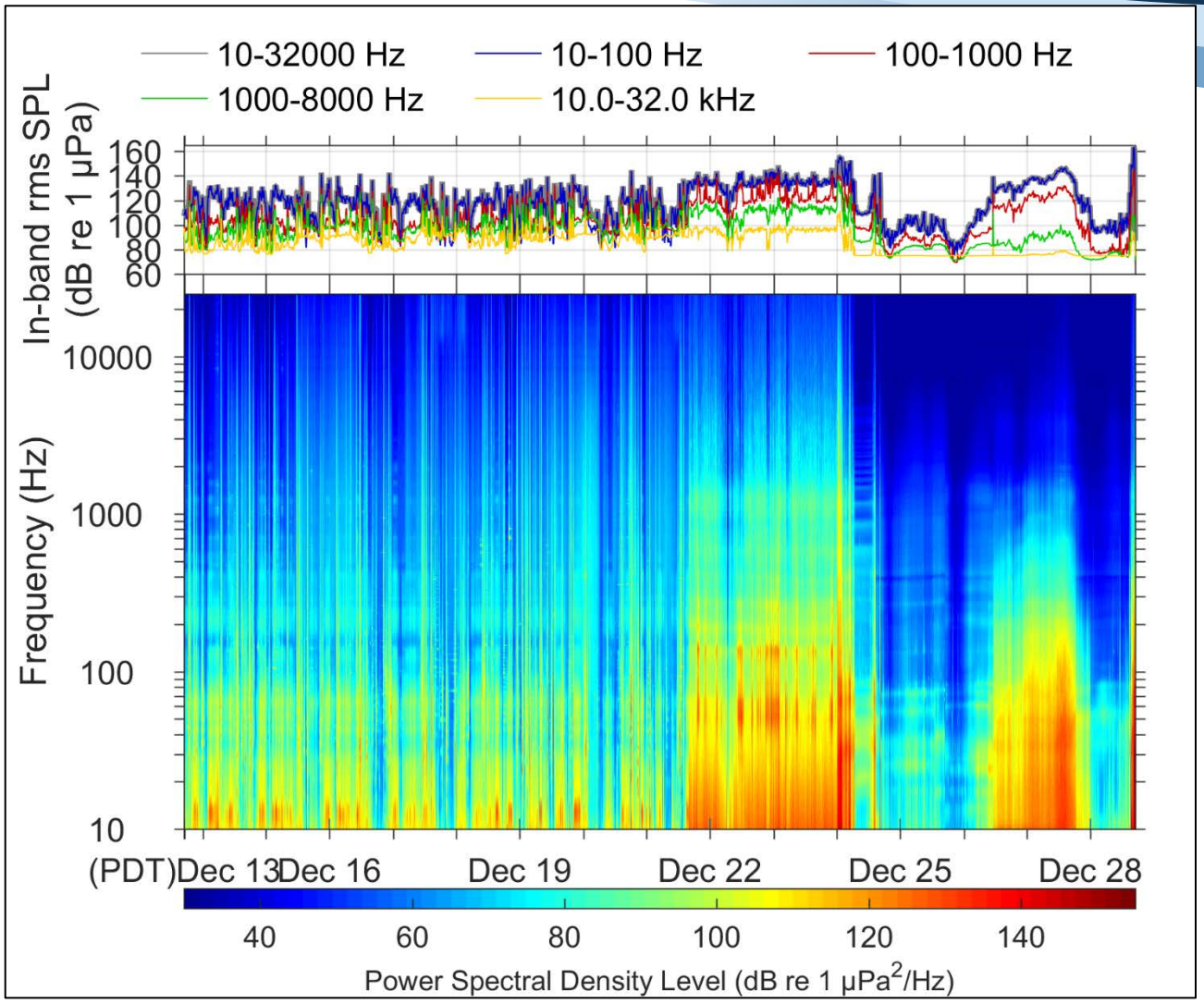


# The Rest of the Mooring

- Washed ashore

- Both ends severed

# The Acoustic Data



# The Investigation

- No isolation
- Partial coating
- No sacrificial anodes

# The Bucket

- High temperature
- High Salinity
- High Oxygen Content

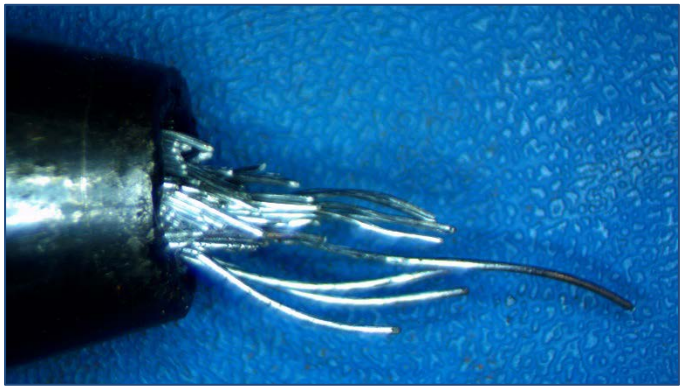
# The Mechanism

## Our Break

- 40 lb load

## Tension break

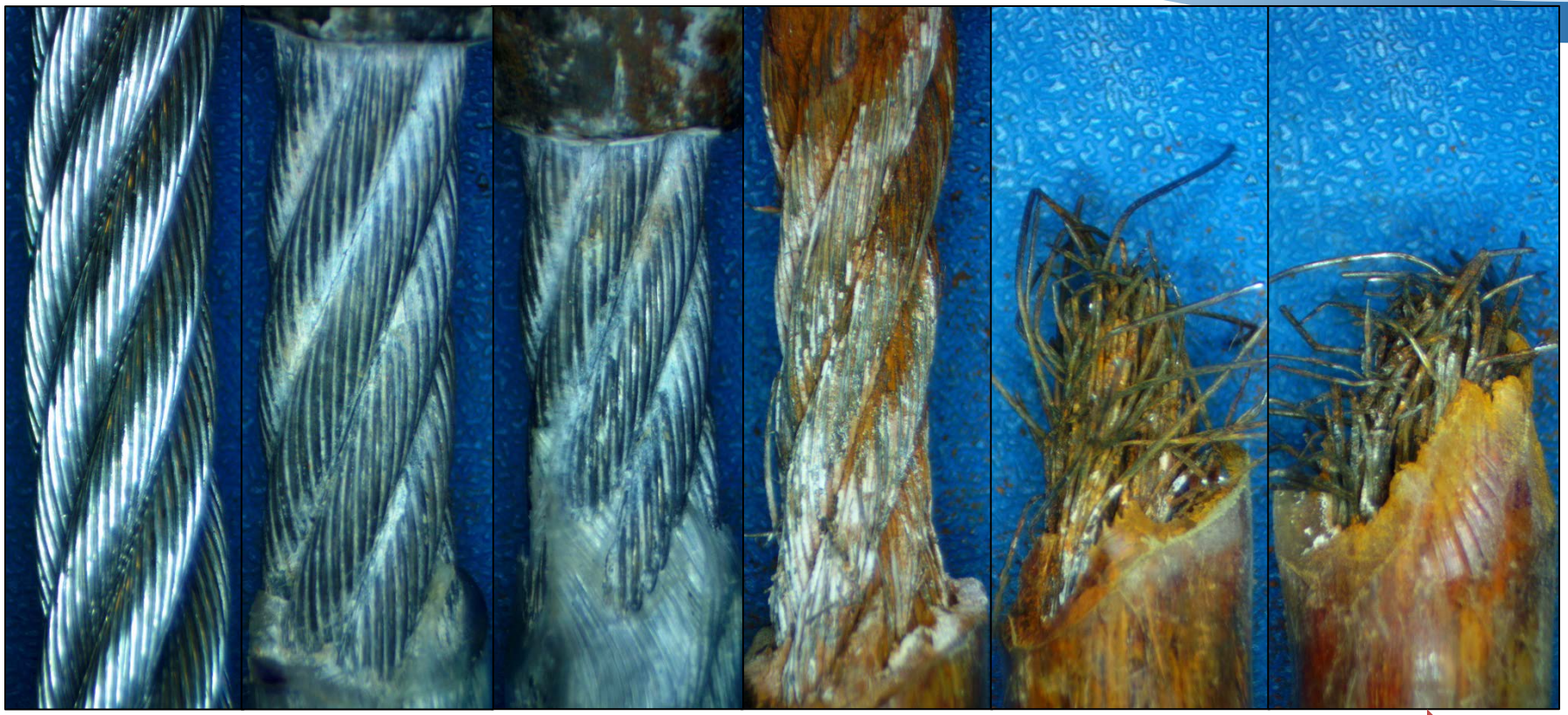
- 18 000 lb breaking load



# The Remaining Moorings

- 3 moorings successfully retrieved
- Floats retrieved from remaining mooring
- Recorder found on beach
- All had same problems
- Same characteristic failure mechanism

# Current vs Corrosion



Increasing Current

# Moving forward

- Anodes
- Isolation
- Thicker strand wire
- Complete coating or no coating
- 316 SS wire
- Inhibit movement

# Questions?