

SUBCO® | soda.®

AusNOG 2024

Behind the curtain of building Australia's most secure subsea systems

Background

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Slattery [family] Office of Digital Assets

Our Pillars

/ Infrastructure

From submarine cable systems to terrestrial fibre routes, we invest in digital assets that are purpose-built to enhance Australia's connectivity and network performance.

/ Sustainability

With a focus on the reef and marine life, we undertake critical research, exploration, education and filming projects to promote an environmentally sustainable future.

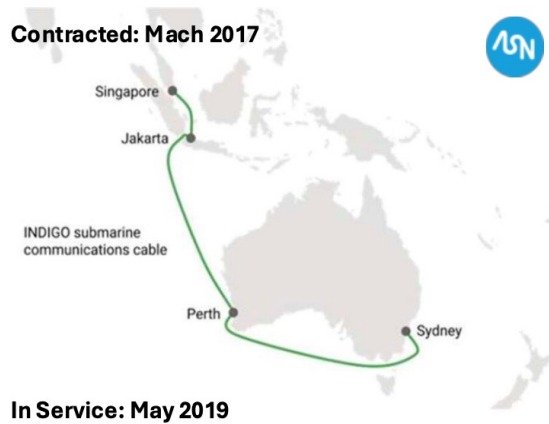
/ Ventures

Beyond supporting our subsidiaries, Soda backs several Australian technology start-ups that have a global ambition. Bevan, our founder, sees these as critical investments in tomorrow's future.

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SODA Infrastructure / SUBCO

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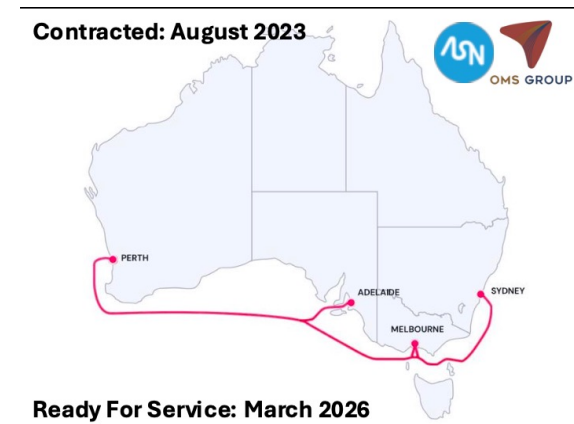
INDIGO West & Central

- INDIGO West
- Configuration: 2 Fibre Pairs
- Repeater Count: 56
- INDIGO Central
- Configuration: 2 Fibre Pairs
- Repeater Count: 55
- Each:
- Segment Length: ~ 4600 km
- Fibre type: Corning EX3000
- Day 1 FP Capacity: 18Tb/s
- Day 1 System Capacity: 36 Tb/s



Oman Australia Cable (OAC)

- Configuration: 3 Fibre Pairs
- System Length: ~ 10,500 km
- Fibre type: OFS-Scuba-125
- Repeater Count: 111
- Day 1 System Capacity: 60 Tb/s



Sydney, Melbourne Adelaide, Perth (SMAP) Cable

- Configuration: 16 Fibre Pairs
- System Length: ~ 5,300 km
- Fibre type: OFS-Scuba-125
- Repeater Count: 61
- Day 1 FP Capacity: 20Tb/s
- Day 1 System Capacity: 400 Tb/s

Excellence in Engineering & Design

SMAP System Landing Overview

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Sydney Maroubra (non-PZ) / CLS - Equinix SY4/5

Melbourne/Torquay x 2 (non-PZ) / CLS – SODA CLS + NEXTDC M3

Adelaide (non-PZ) / CLS – NEXTDC A1

Perth (PZ) / CLS Equinix PE3

Engineering Example

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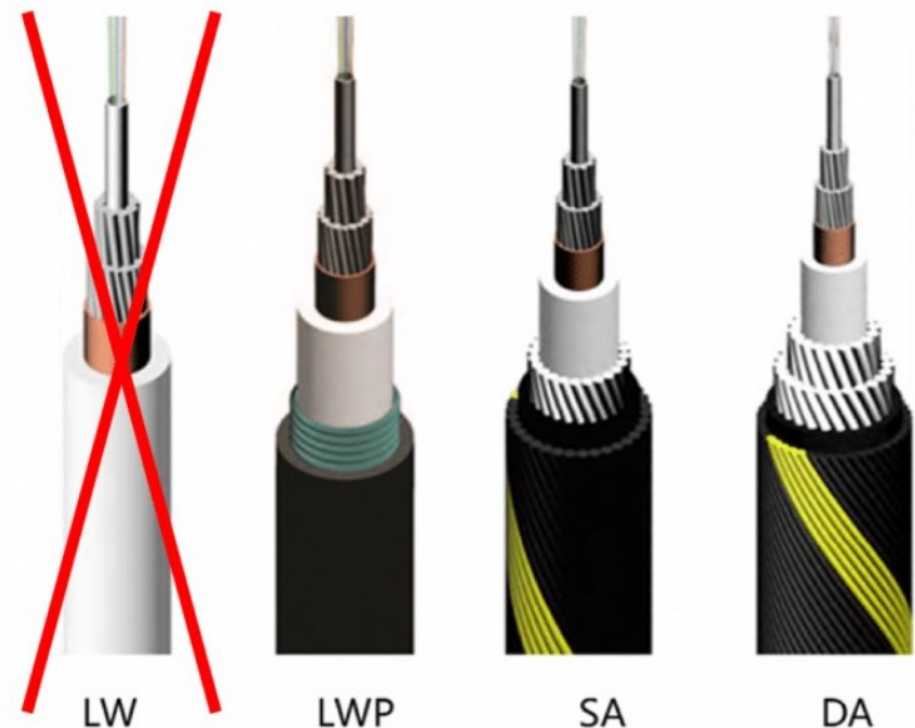
Go Full
Metal Jacket



Engineering Example – Full Metal Jacket

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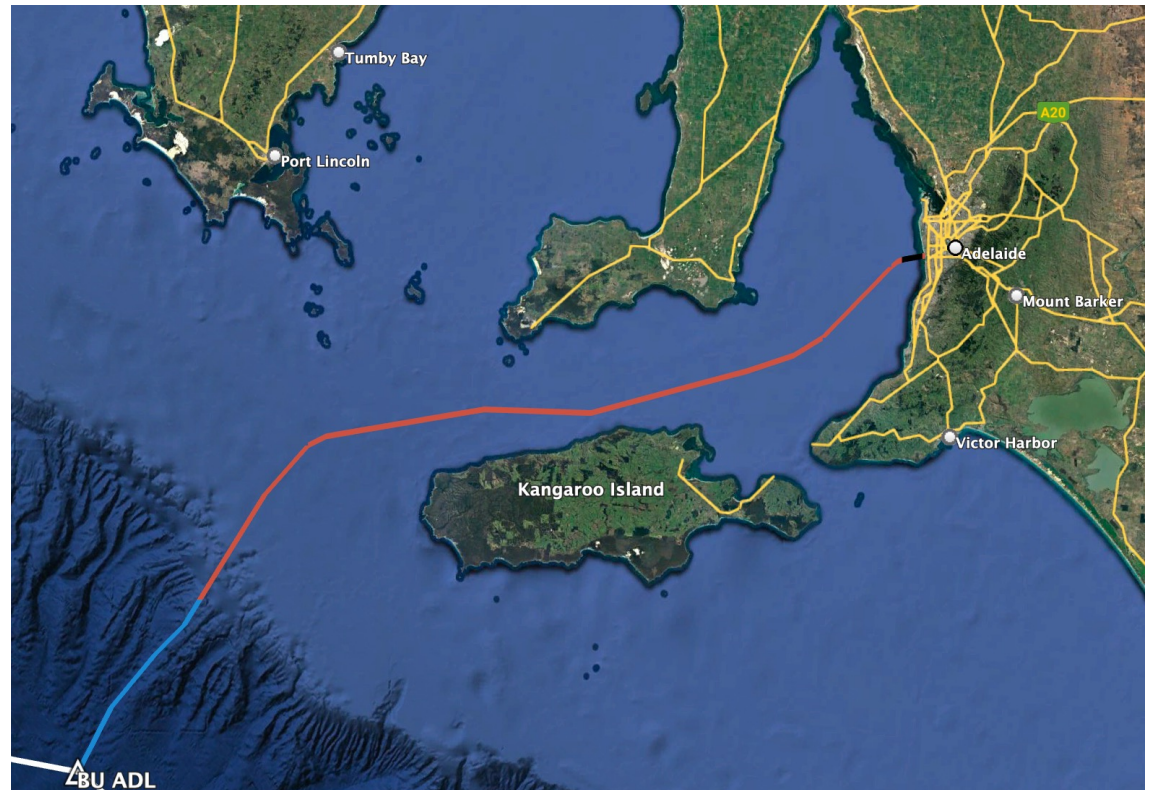
- Desktop survey and ocean survey had a design of approximately 60% of the overall system and 70% of trunk as light-weight (LW)
- Approximately 50% of LW was in the southern ocean which can be affected by high-seas during winter
- Cost to repair if there is a shunt fault AU\$2-3M
- Incremental cost to upgrade ~AU\$10M
- With correct installation likelihood of a shunt fault or break at depth is reduced to almost zero
- Increased reliability and security
- Represents a 2.5% increase in system investment



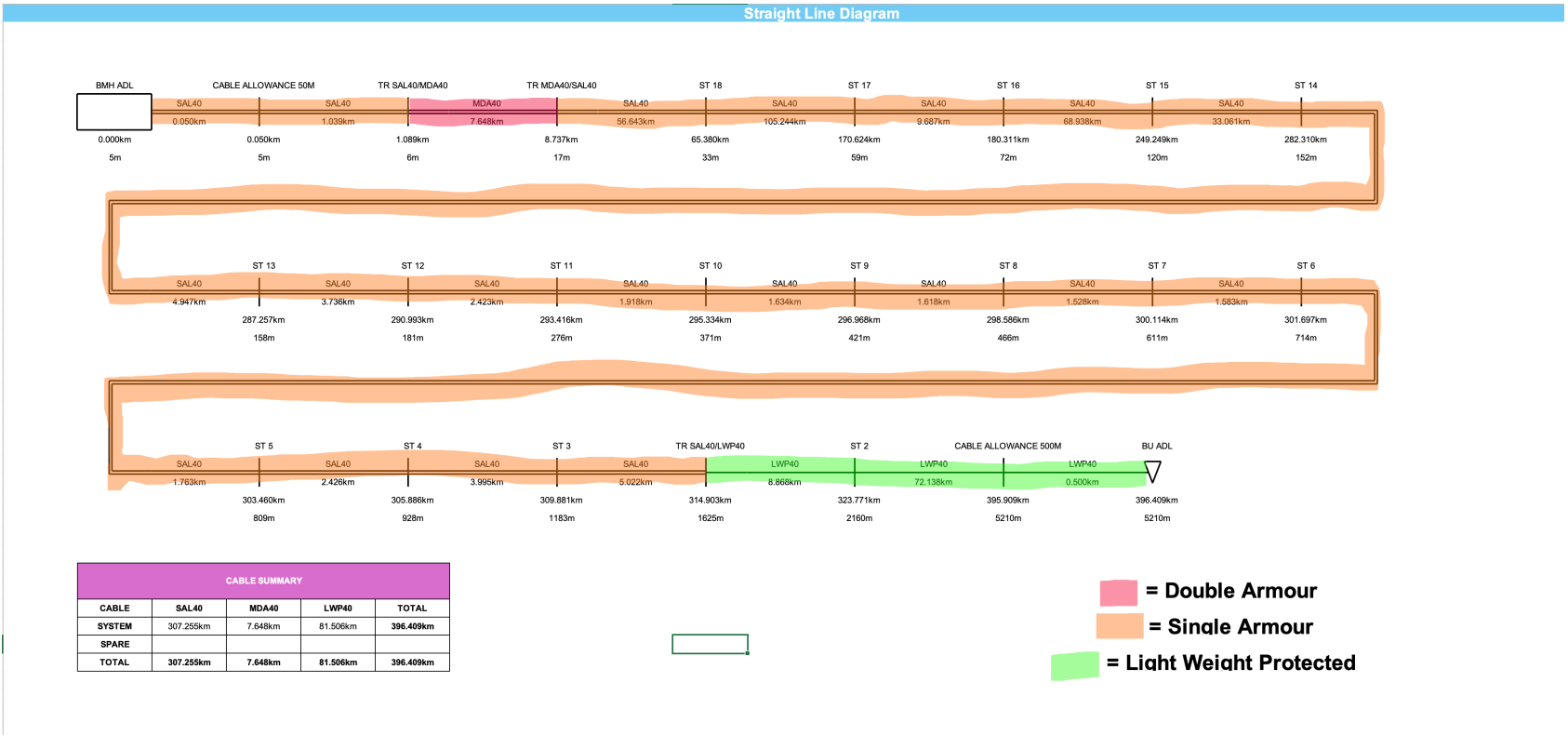
Engineering – Adelaide Branch

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- ~330km branch of from BU in 3,000m water depth to West Beach Adelaide
- Majority of branch in shallow water less than 60m water depth
- 16FP switched branching unit capable of switching up to 8 pairs in:out of main trunk
- First long-haul fibre optic submarine cable to be installed into South Australia



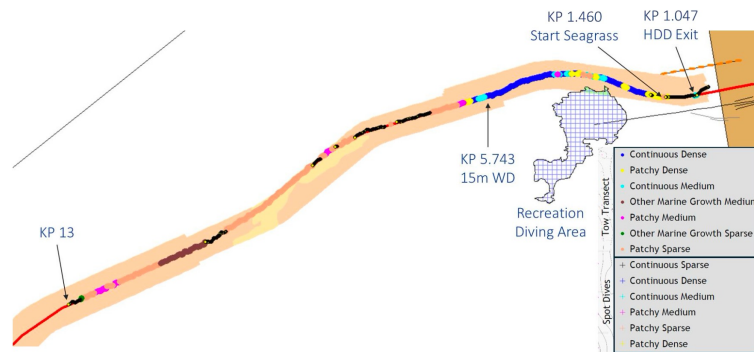
Pre-Survey (Desktop)



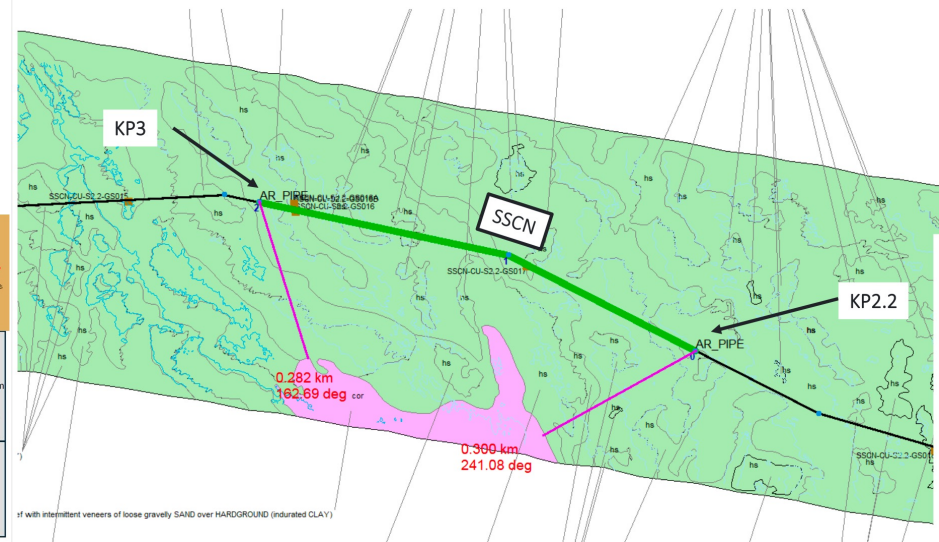
Survey

Adelaide Seagrass Section

1. Industrial practice to surface lay cable in seagrass area.
2. Solution: Surface lay + AP as additional protection.
3. Align with various United Nation effort to protect and conserve marine habitat. (<https://www.un.org/en/observances/seagrass-day>)



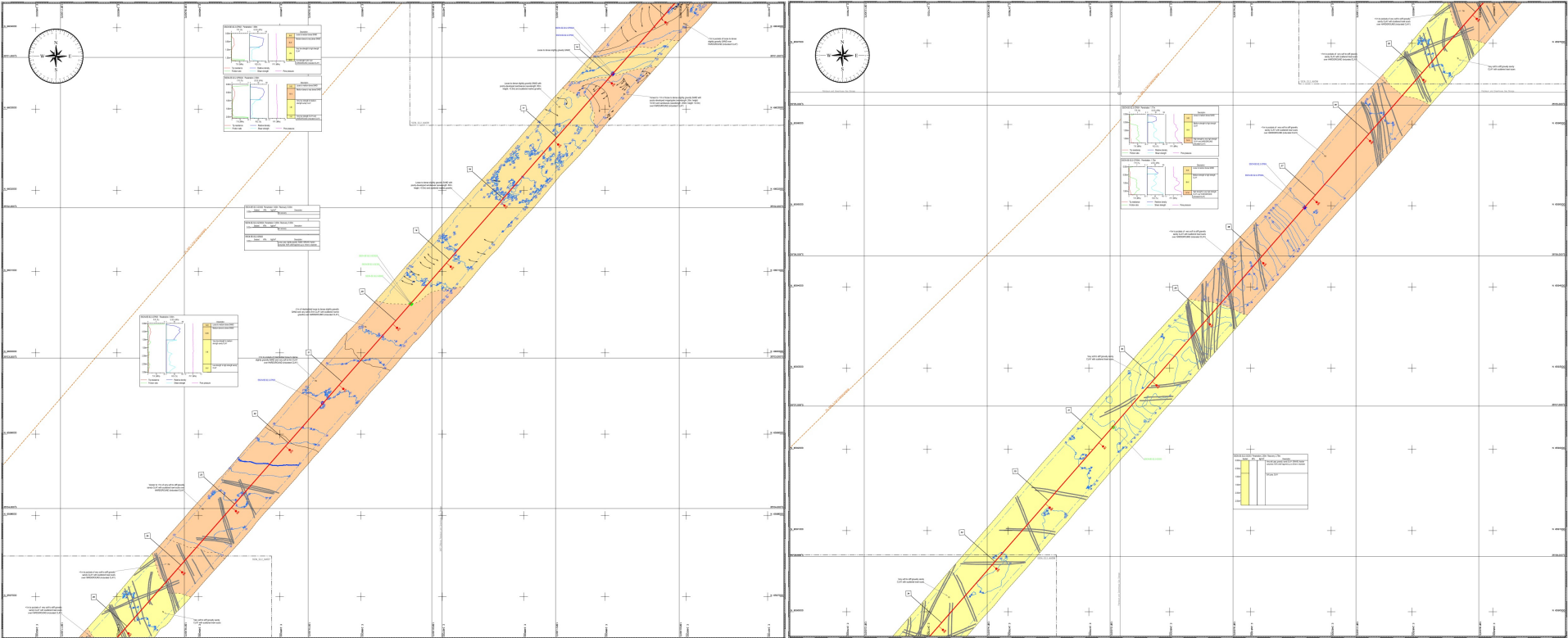
Articulated Pipe Proposal: SEG2.2



Survey

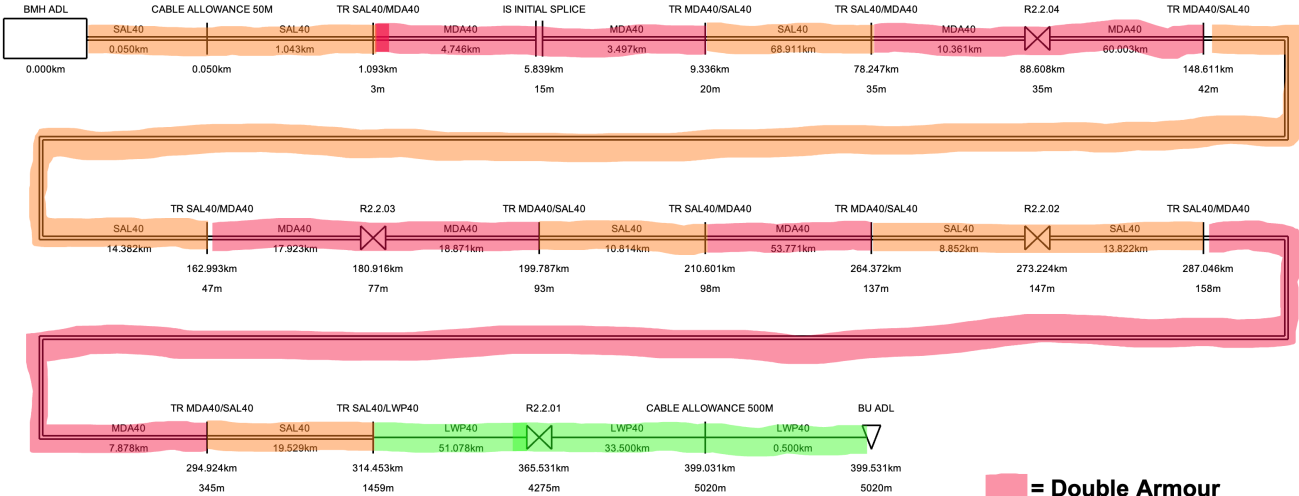
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Post Survey Recommendation

Adelaide Straight Line Diagram



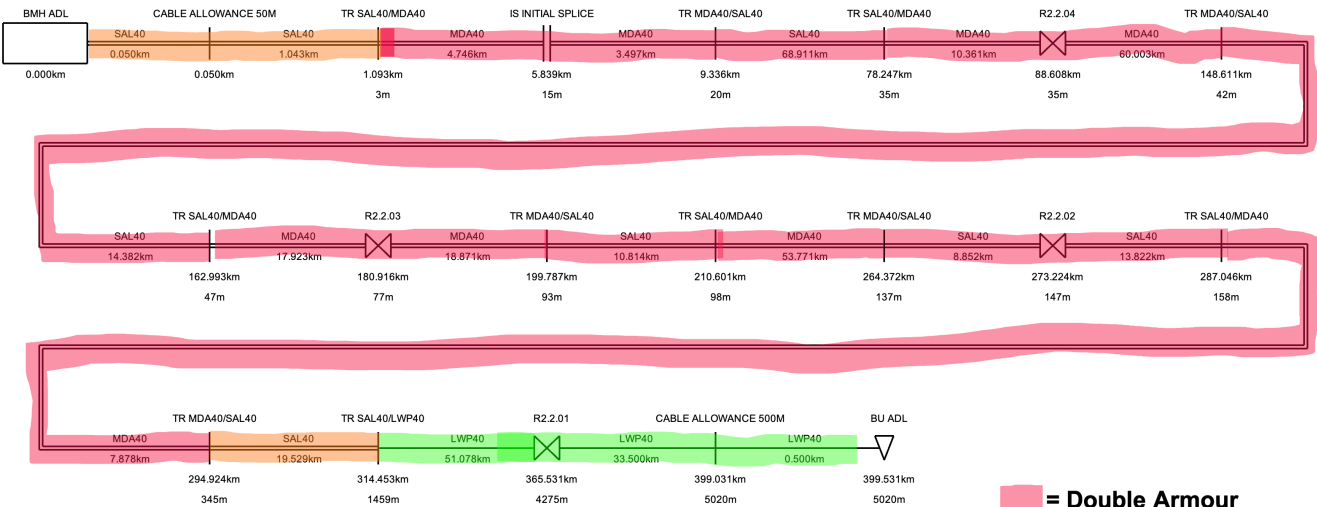
CABLE SUMMARY				
CABLE	SAL40	MDA40	LWP40	TOTAL
SYSTEM	137.403km	177.050km	85.078km	399.531km
SPARE				
TOTAL	137.403km	177.050km	85.078km	399.531km

BODIES SUMMARY	
RPTR-A	3
RPTR-L	1

- = Double Armour
- = Single Armour
- = Light Weight Protected

Post Survey Actual

Adelaide Straight Line Diagram



CABLE SUMMARY				
CABLE	SAL40	MDA40	LWP40	TOTAL
SYSTEM	21.403km	293.050km	85.078km	399.531km
SPARE				
TOTAL	21.403km	293.050km	85.078km	399.531km

BODIES SUMMARY	
RPTR-A	4
RPTR-L	1

- = Double Armour
- = Single Armour
- = Light Weight Protected

Post Survey Actual

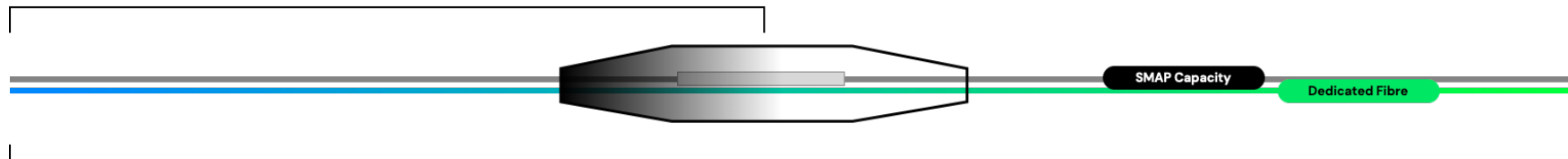
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Inserted two additional fibres strands in the cable

First goes to repeater #1 ~60km

Second bypasses repeater #1 and out to repeater #2 ~150km

Working with SA Gov to get a cable exclusion zone declared





Operational Awareness

**"I need to know of an outage
before the customer calls"**

Core Systems Operations

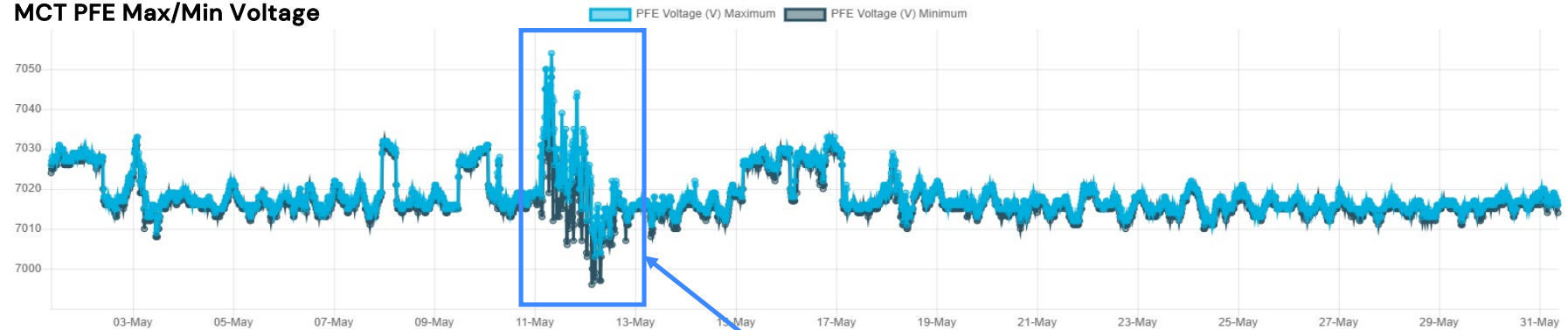
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- Material changes in normal operational levels is an indicator of an anomaly whether it be system failure, degraded performance or external interference.
- Key operational systems include PFE, SLTE, amplifiers, optical platforms with everything from voltages, power, optical power continually monitored and tracked

OAC Trunk PFE Voltages

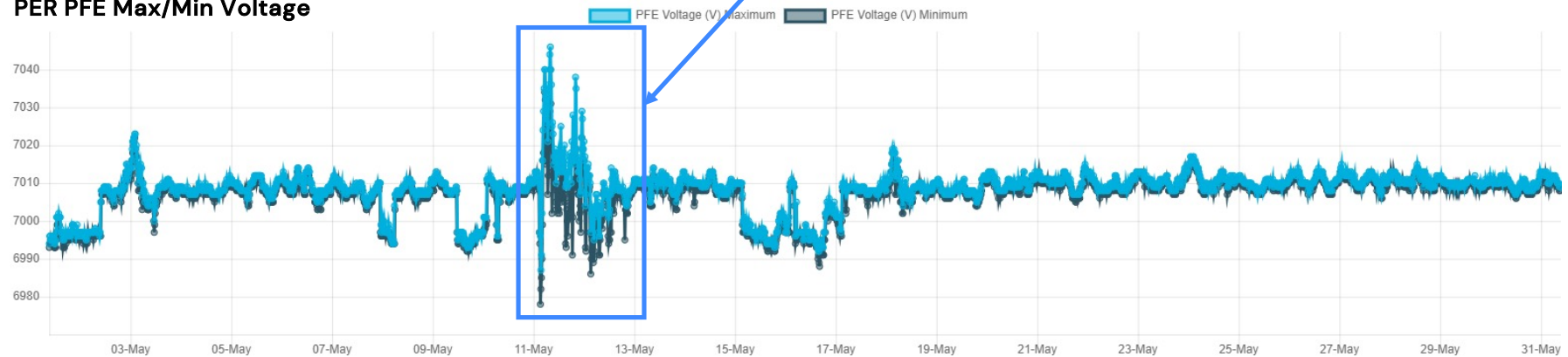
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MCT PFE Max/Min Voltage



Investigation Completed

PER PFE Max/Min Voltage




All the information in this presentation is commercial in confidence

Title

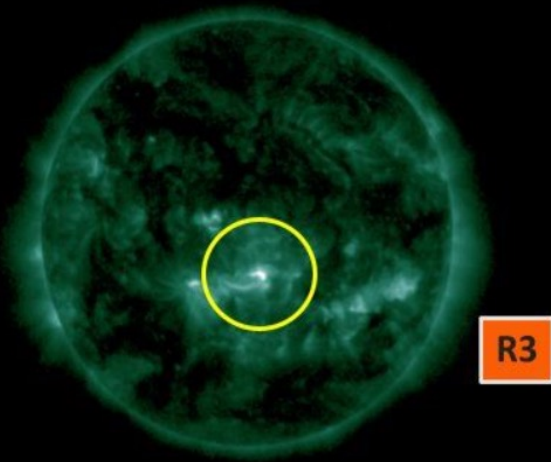
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STRONG Flare Observed - 29 July 2024

WHAT: X1.5 Flare Occurred from NOAA/SWPC Region 3764




EVENT:
A flare is an eruption of energy from the Sun that generally lasts minutes to hours. Flares of this magnitude are not frequent.

TIMING:
The impulsive flare began at 29/0232 UTC, reached a peak of X1.5 at 0233 UTC, and ended at 0236 UTC.

EFFECTS:
Users of high frequency (HF) radio signals may experience temporary degradation or complete loss of signal on much of the sunlit side of Earth.

GOES-16 SUVI Composite 094 Angstroms 2024-07-29 02:33:09



National Oceanic and Atmospheric Administration
U.S. Department of Commerce

Safeguarding Society with Actionable Space Weather Information

Space Weather Prediction Center;
Boulder, CO



Situational Awareness

**"I need to know of an outage
before it's an outage"**

Partnership with Fibersense

The Technology – Distributing Fiber Sensing

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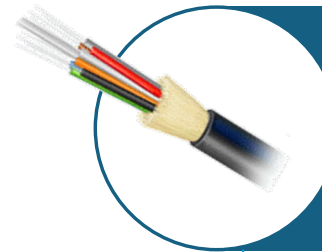
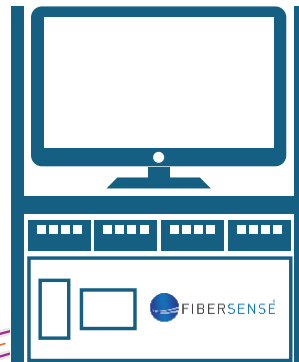
Distributed Fiber Sensing (DFS): A box that converts existing optical fiber cables in Urban centres in to long continuous acoustic sensors

What fiber sensing can detect, classify and locate:

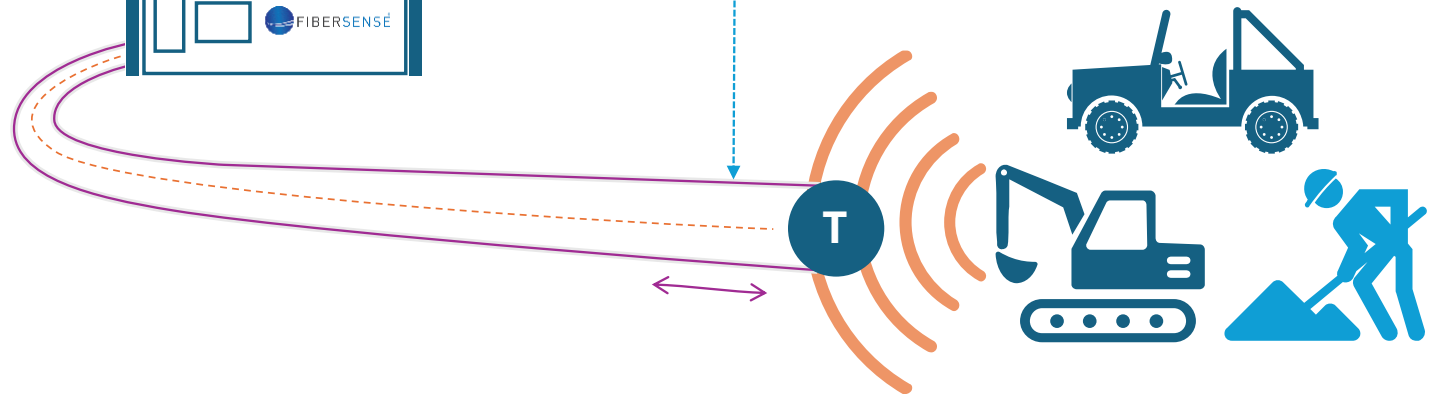
Cars and road vehicles
Pedestrians
Civil Construction
Seismic Events
Utilities – Water, Power
Environmental Monitoring –
ambient noise,
temperature, pressure

Anything that
makes a sound

Interrogator Unit



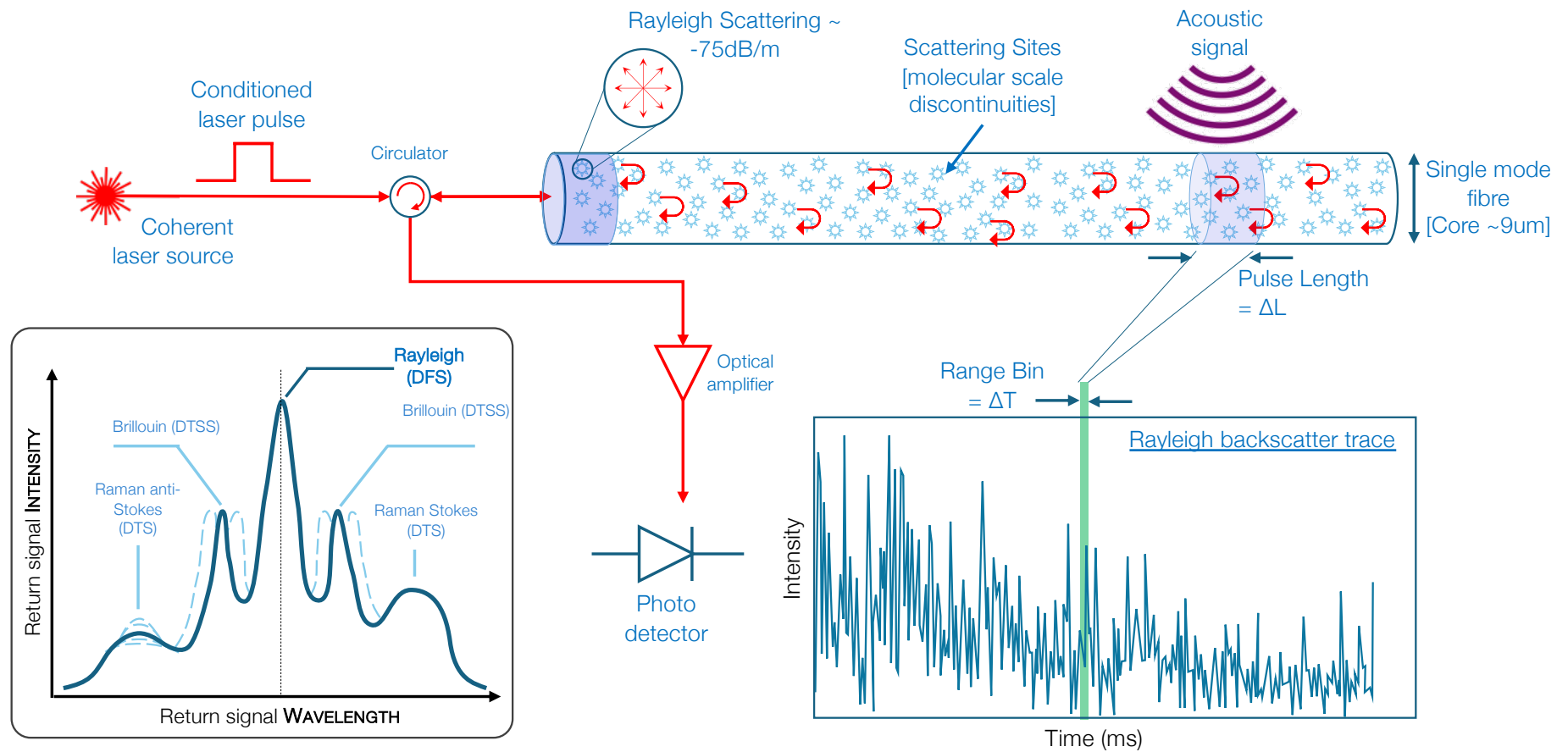
Optical pulses are sent down the fiber cable and the small reflections from the fiber are detected with a highly tuned receiver to pick up sounds around the cable



The Technology behind Fibersense

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Proprietary ultra high performance implementation of Coherent Optical Time Domain Reflectometry (C-OTDR)



Terrestrial - What people think I worry about. subco® | soda®



Terrestrial - What I actually worry about.

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Terrestrial Fibersense Deployment

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- The entirety of Australian fronthaul for both SMAP and OAC protected by FiberSense
- Provides situation awareness of all key threat vectors for external aggression including saw cutting, excavation and horizontal drilling
- Provides awareness of people working in/near our network including handling of network and even opening of pit covers

Terrestrial Network Awareness

Sean W

Hazardous Works Notification - NOC-2850
at 2024-08-08, 11:41 PM UTC.
Approximate Address: 8 Tourist Drive 204,
City Beach WA 6015, Australia

Fibersense has alerted for a "Potential Asset Strike" again as part of the ongoing the OAC fronthaul Network Change activity located in Perth. The activity is known and alarms are part of the on going network change NOC-2615 for SMAP works. Works have moved further down the road following the cable path as expected.

Our network remains up and operational.

10:56 am

Sean W

Hazardous Works Notification - NOC-2852
at 2024-08-09, 03:02 AM UTC.
Approximate Address: 44 Mooro Dr, Mount
Claremont WA 6010, Australia

Fibersense has alerted for a "Potential Asset Strike" again as part of the ongoing the OAC fronthaul Network Change activity located in Perth. The activity is known and alarms are part of the on going network change NOC-2615 for SMAP works. Works are following the cable path as expected.

Our network remains up and operational.

1:27 pm

Sean W

Hazardous Works Notification - NOC-2886
at 2024-08-12, 03:20 AM UTC.
Approximate Address: 9 John Xxiii Ave,
Mount Claremont WA 6010, Australia

Fibersense has alerted for a "Potential Asset Strike" again as part of the ongoing the OAC fronthaul Network Change activity located in Perth. The activity is known and alarms are part of the on going network change NOC-2615 for SMAP works. Works are following the cable path as expected.

Our network remains up and operational.

3:43 pm

Rogue digging stopped on a 12kV subsea cable

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Interdiction Report



Mechanical Digging

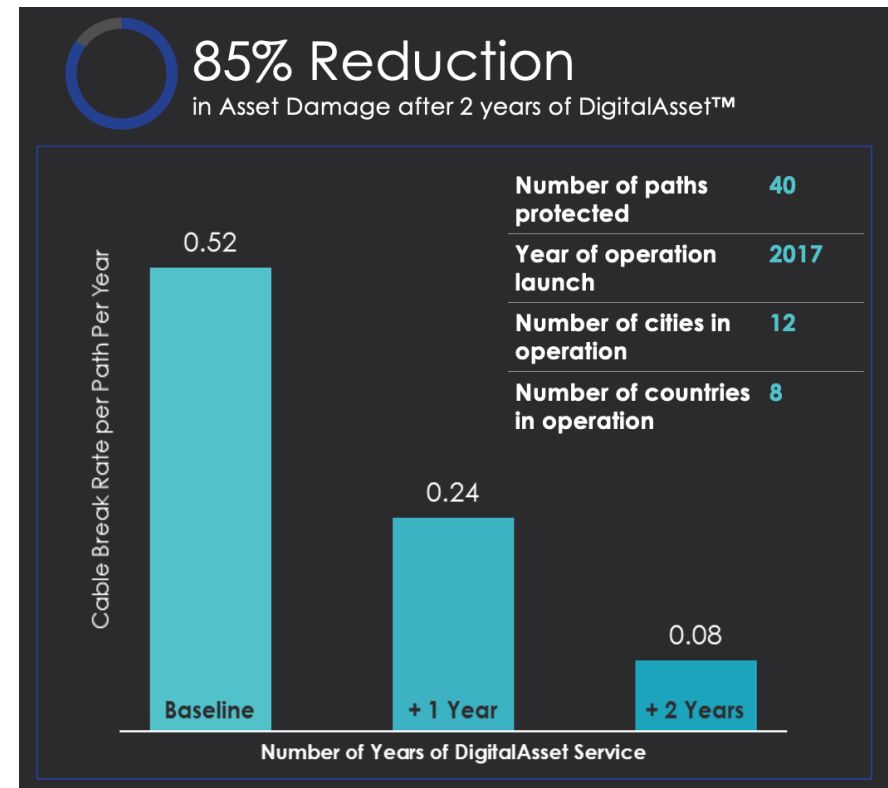
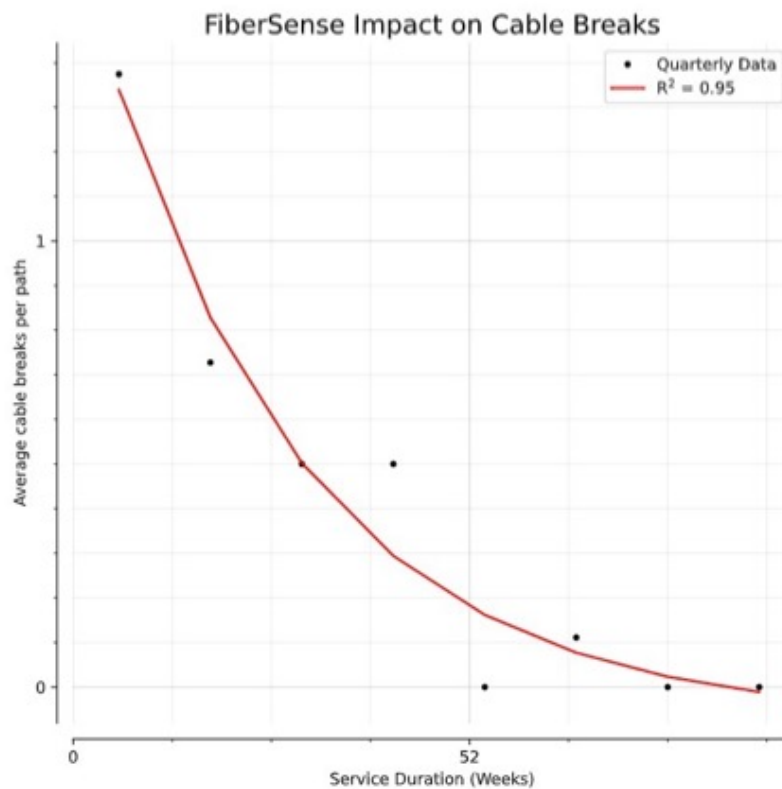
Thursday, 28 Jan 2021

NEAR ASSET (<10M) N/A	INTERDICTION COMPLETE YES	
NEAREST ADDRESS 6 Wolseley Rd Coogee NSW 2034 Australia	PATH AUSY OSP	EVENT 74abf4ba
	OPTICAL DISTANCE 9287 m	LOCATION -33.927157, 151.258815
REQUESTED AT 22:59 UTC	ARRIVED AT 23:58 UTC	ELAPSED 59 mins
WITHIN SLA YES	CONFIRMED ROGUE YES	FALSE POSITIVE NO
DISTANCE FROM ASSET N/A	ESCALATED TO ASSET OWNER YES	CONSTRUCTION CREW KNOWS ASSET LOCATION YES

Interdiction Puts Rogue Operators on Notice

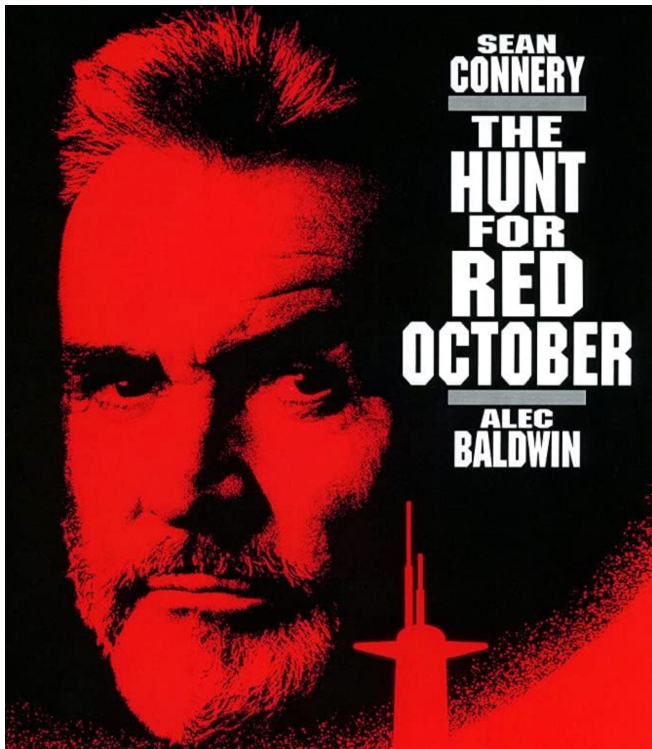
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Subsea – What People think I worry about subco® | soda.®

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Subsea – What I actually worry about

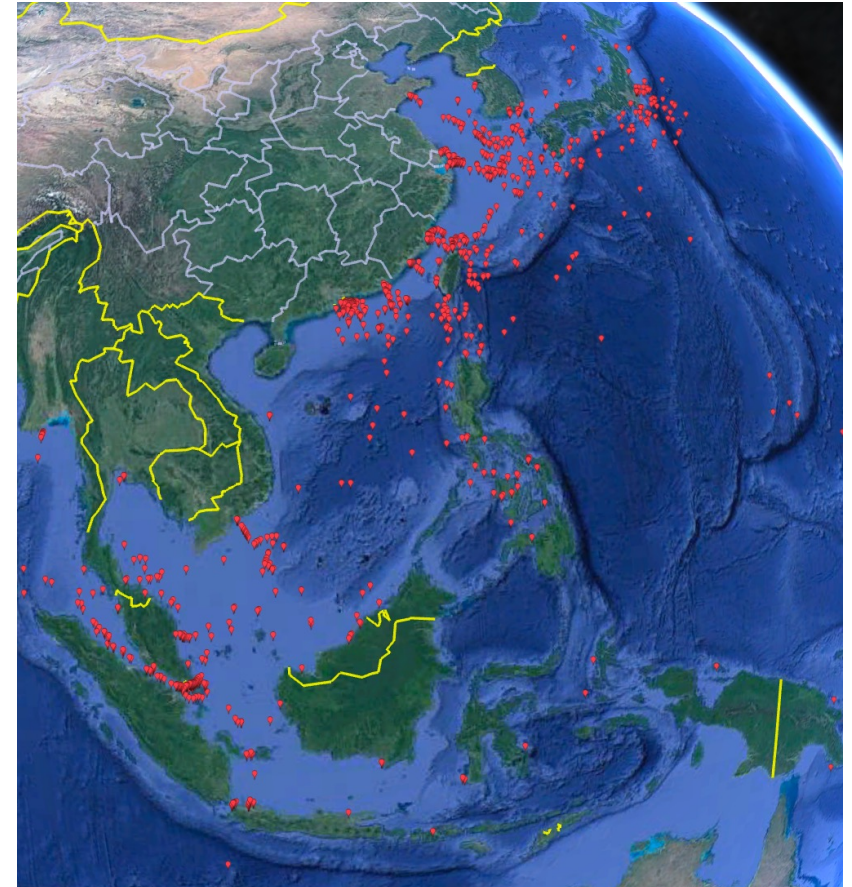
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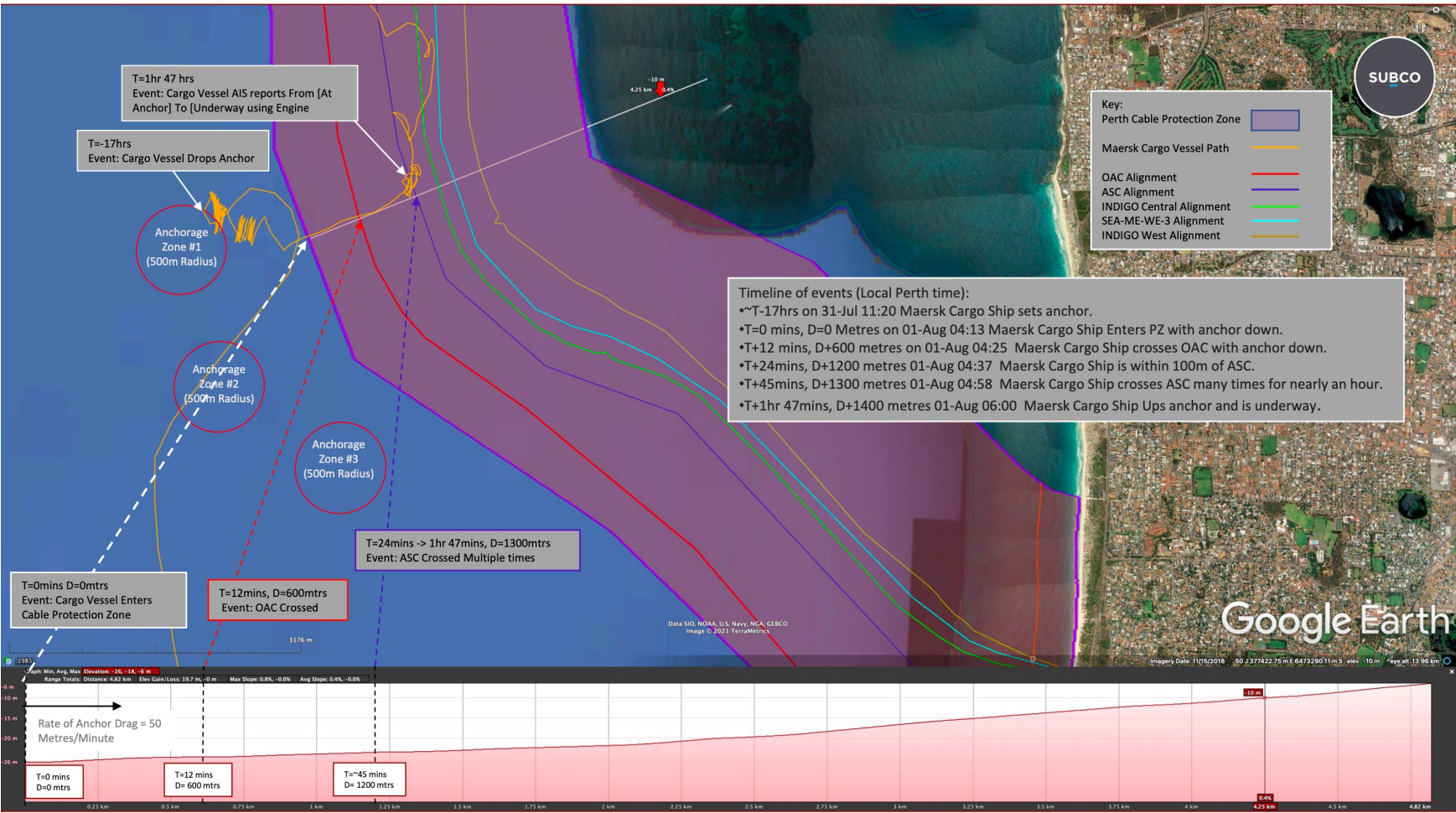
Cable Outages

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- Majority of outages of submarine cables is caused by rogue fishing and anchoring activity or activity caused by bad weather
- Until now systems are "dumb" and not situation aware. Often vessels conducting illegal fishing activity have AIS beacons switched off
- Cost recovery is very rare and burden is with cable operator



Perth Incident



Maersk Surabaya

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IMO: **9330068**

Name: **MAERSK SURABAYA**

Vessel Type - Generic: **Cargo - Hazard A (Major)**

Vessel Type - Detailed: **Container Ship**

Status: **Active**

MMSI: **636017722**

Call Sign: **D5MK8**

Flag: **Liberia [LR]**

Gross Tonnage: **94322**

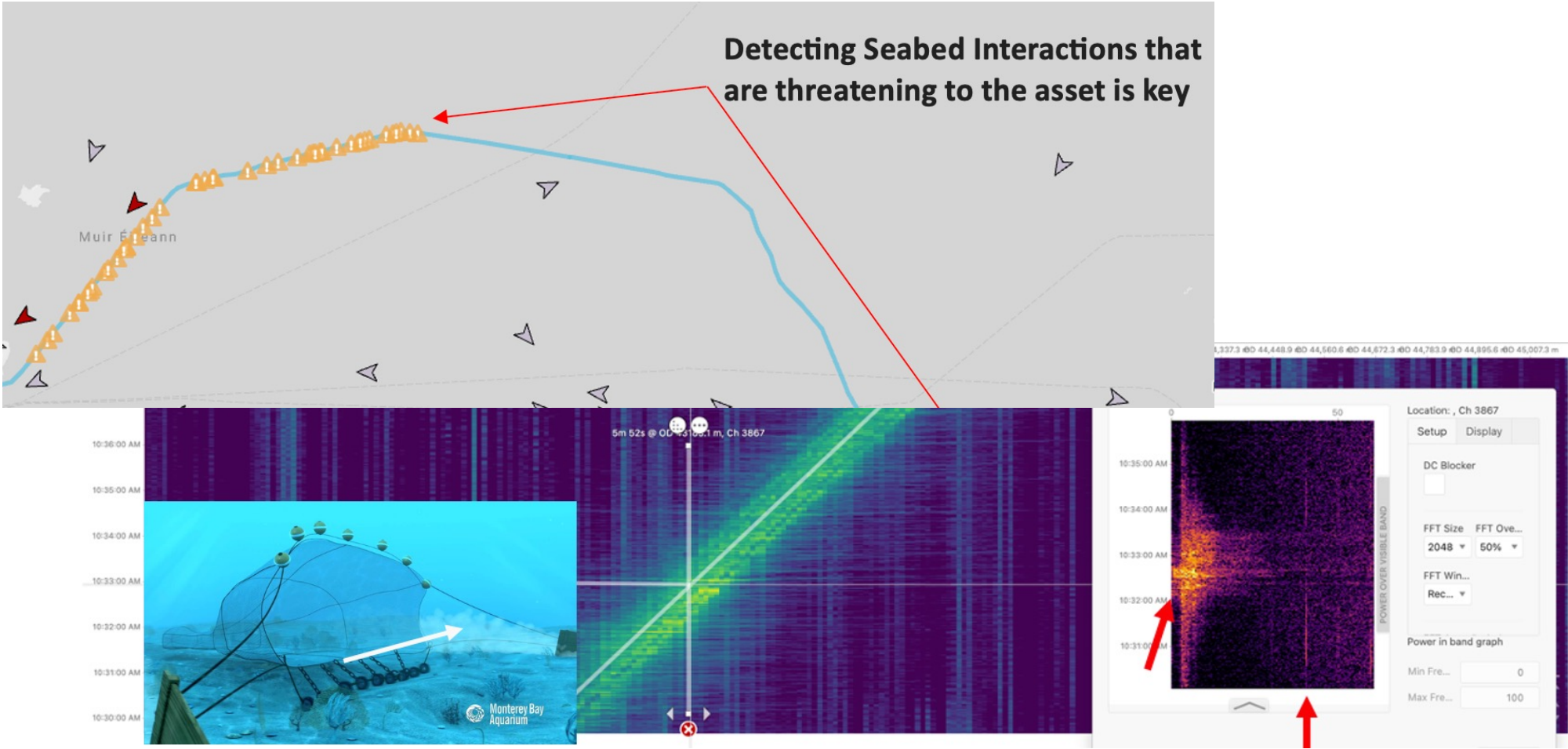
Summer DWT: **108351 t**

Length Overall x Breadth Extreme: **332.58 x 43.32 m**

Fishing Awareness

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Subsea Cable Strike Alerting

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Interdiction Report

FIBERSENSE

Strike by Vessel

Monday, 26 Jun 2023

EXPOSURE ZONE

NO

INTERDICTION COMPLETE

YES

VESSEL INFORMATION

Name

SEATRUCK PRECISION

Type

RO-RO CARGO

MMSI

235092453

IMO

9506239

LAT

53.47788

LON

-5.139527

Speed

12.3 kn

Status

under way using engine

Heading

65°


Course

67°

Time

Tue Jun 27 2023 08:27:25

VESSEL PHOTO



EVENT

55726ff6

LOCATION

-33.813723, 18.551962

PATH

HOL-CLS-CC1

OPTICAL DISTANCE

35573 m

FALSE POSITIVE

NO

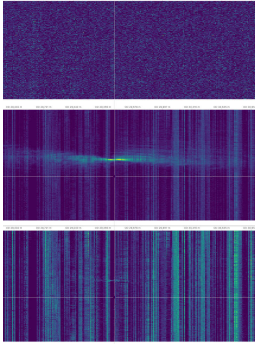
REQUESTED AT

14:14 UTC

ESCALATED TO ASSET OWNER

NO

RAW DATA



AKS DETECTION

YES

DAS DETECTION

YES

https://dac.fiber-sense.com/alert_histories/700002/alert_interdiction

Strike Detector

Strain of cable caused by seabed interaction near cable.

Reporting

Reports generated for all Subsea Cable Strike events containing vessel and exposure details.

SUBSEA CABLE STRIKE

ALARM

Start

End

07:34 (+0100)

07:39 (+0100)

12 Jul 2023

12 Jul 2023

8301m

8301m

[CC1-HLHD]

7837+GP Holyhead, UK

Ref: 983fc07e

SUBSEA CABLE STRIKE

07:22 - 07:27 (+01:00)

14988m [CC1-HLHD]

66WC+X3 Holyhead, UK

LiveMaps

Acknowledge

Approve

Dismiss

Interdict

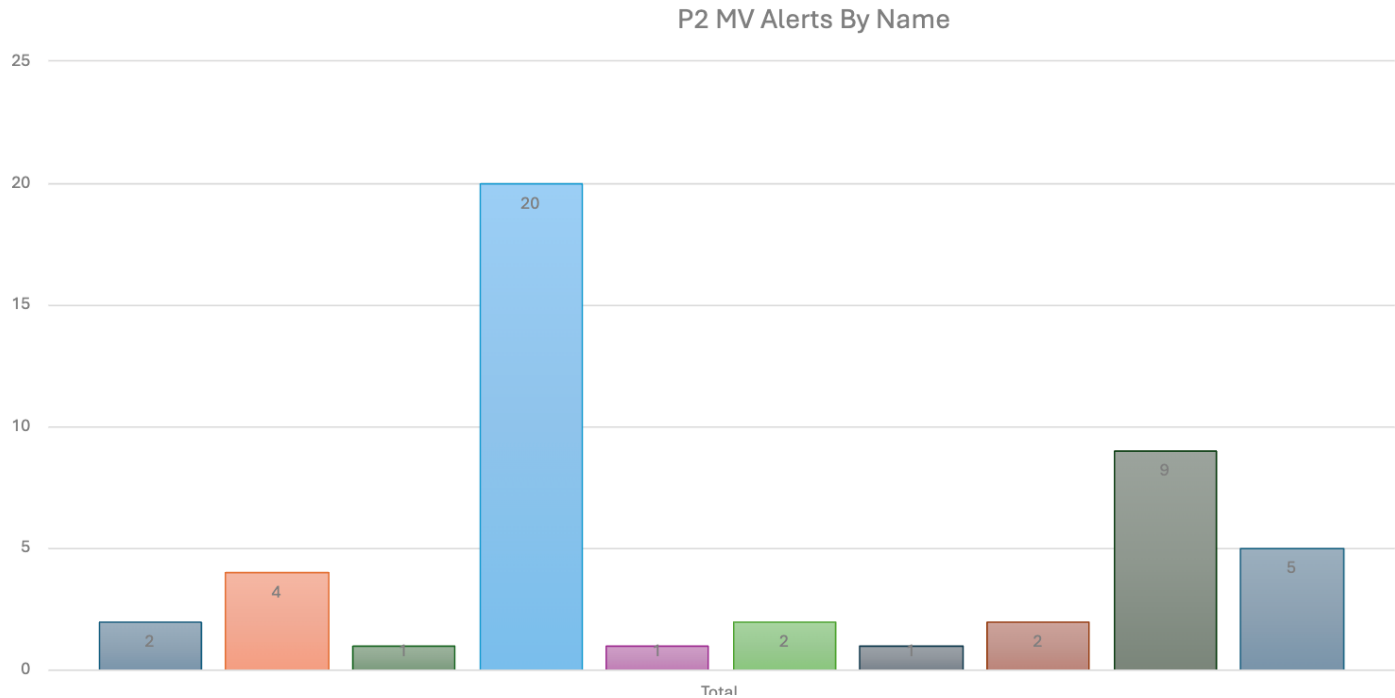
Update End Time

Edit

It's the few that ruin it for the rest...

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Repeat Rogue Fishing Vessels



Free Spanning Awareness

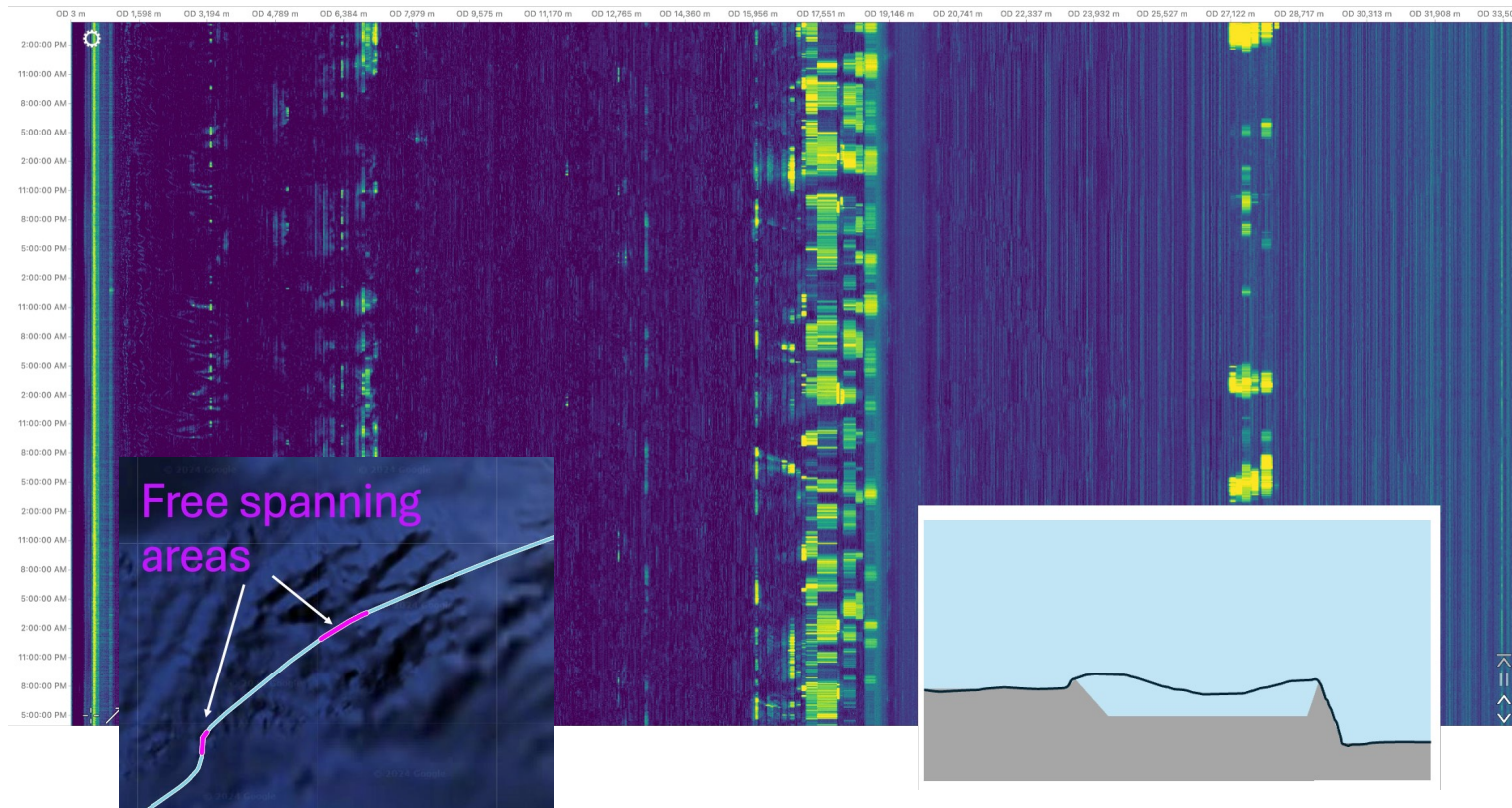
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Free spanning on submarine cables refers to sections of the cable that are suspended or "spanned" over the sea floor without being supported by it. This occurs when the cable is not resting on the seabed but is instead held up by the natural features of the underwater terrain, such as rocks or underwater ridges.

Free Spanning

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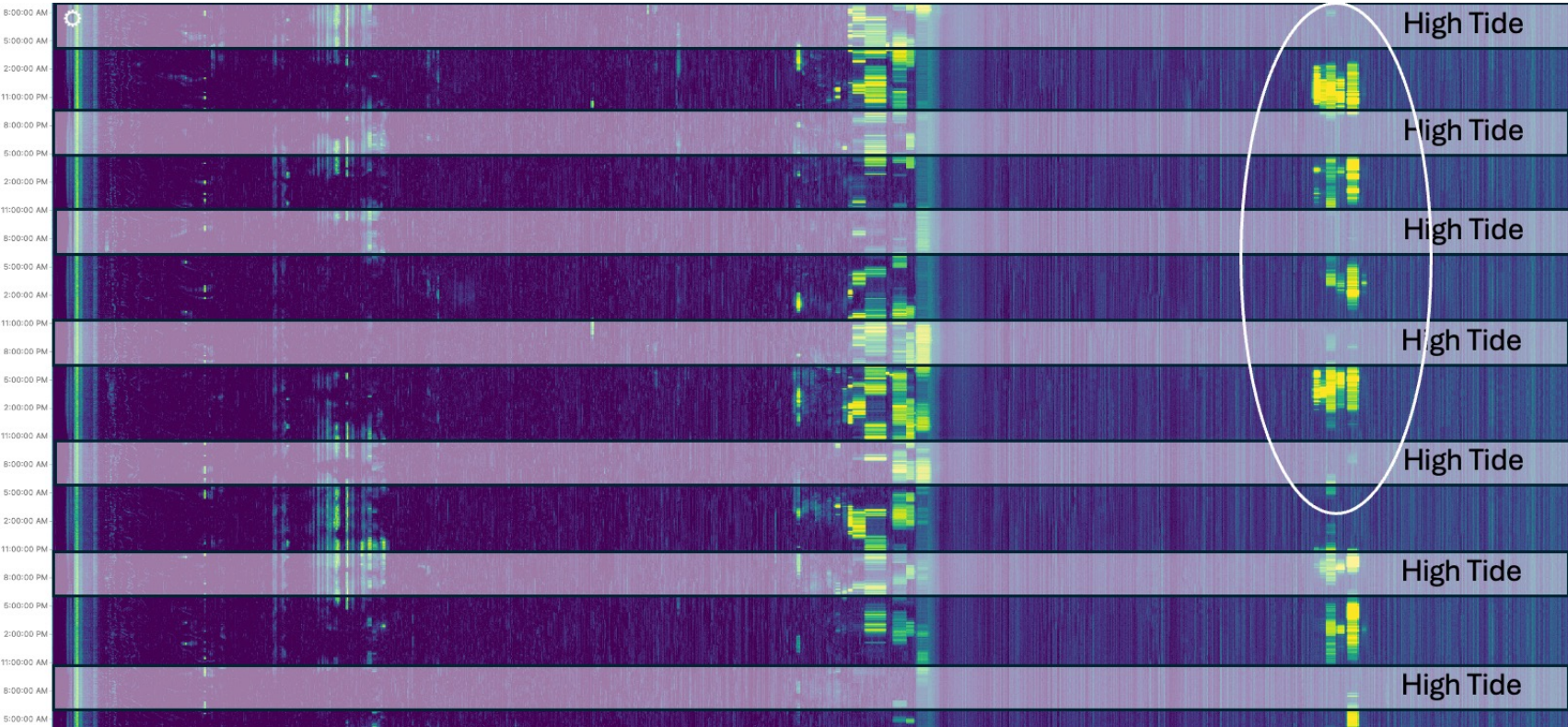
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Free Spanning

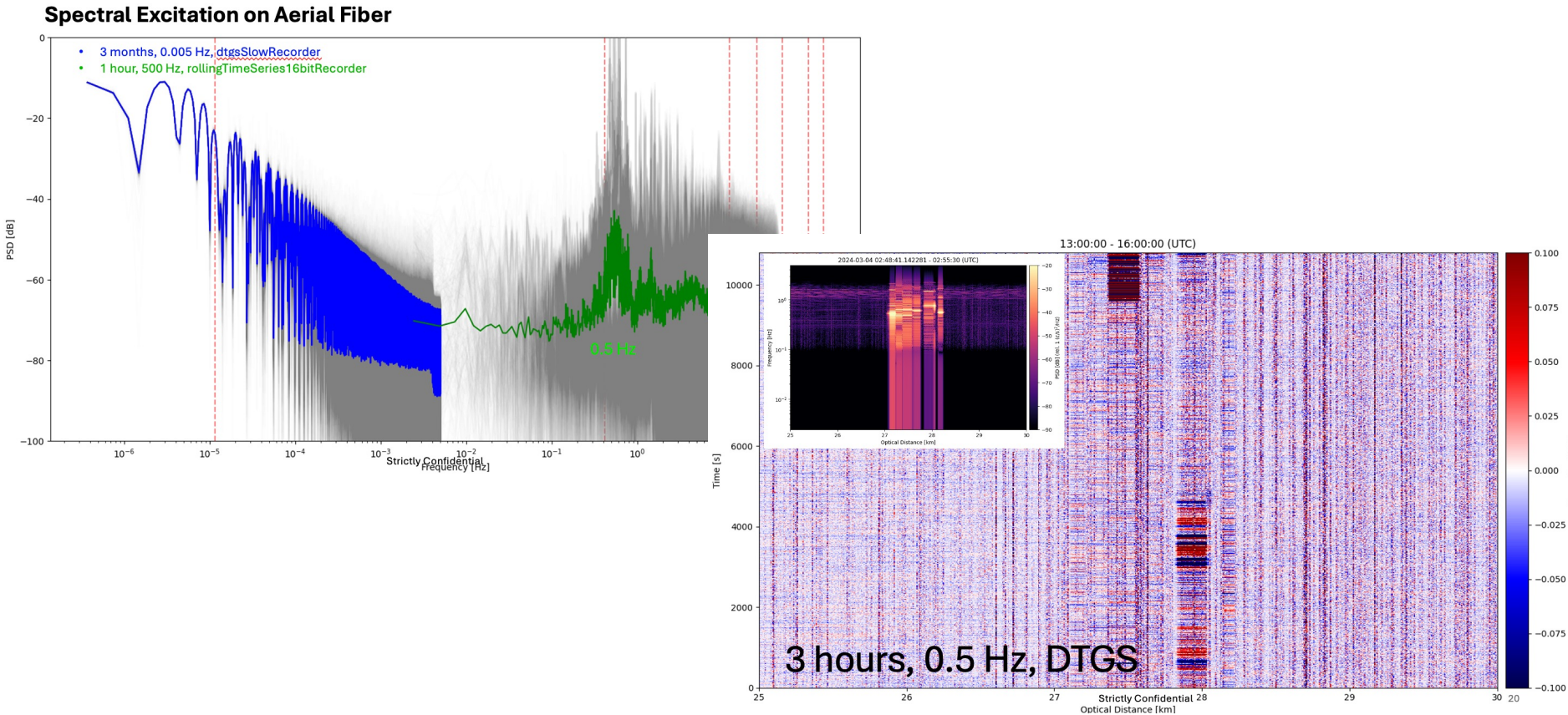
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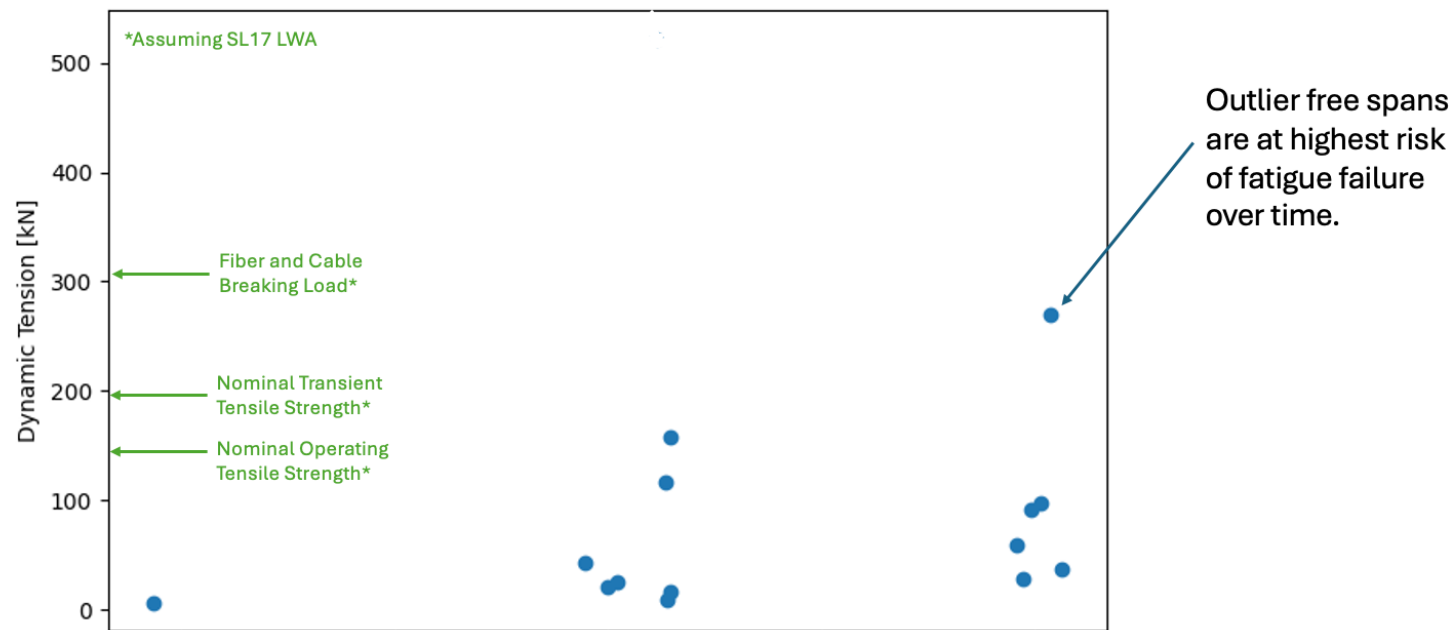
Free Spanning

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Free Spanning

Tension plotted vs length



Free Spanning

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Today – No sensing

- Alarm goes off due to a cable break
- System down event
- Contact maintenance operator to see when the next available vessel for repair will be (could be stood up with days or months if performing repairs on other systems)
- Apply for permits if necessary to effect repairs (days to months depending on location)
- Ship steams out to effect repair (from 3-10 days depending on location and if it needs to go via spares depot)
- Repair conducted 2-3 days
- Total time to repair between 2-30 weeks

Soon – where sensing available

- Ability to check for free spans on systems and conduct tests to assess risk of repair
- If the determination that the risk of failure is high then a planned or outage for repair can be scheduled with months warning to customers and with a ship ready and stationed at the site with all the right spares and crew ready to take action and all permits in hand.
- Time to repair would be between 2-3 days due to avoidance of steam time, repair prioritisations for the operator and allow customers an orderly way to manage traffic
- Total time to repair 2-3 days

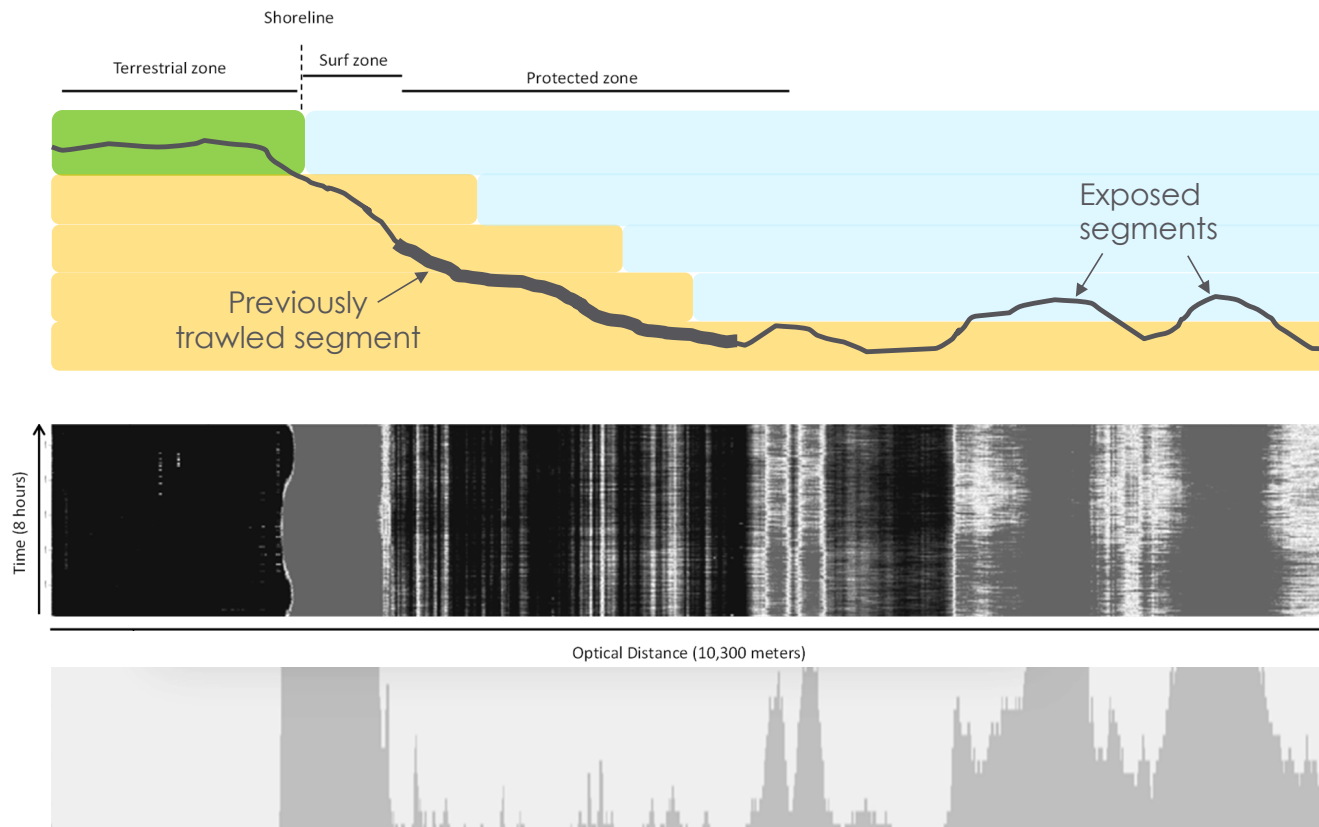
SMAP

- Ability to check for free spans during installation
- Ship to go back and relay sections outside tolerances
- Total time to repair 0 days

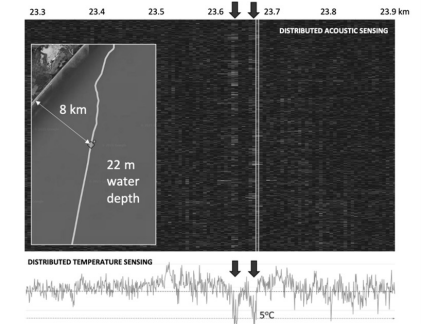
Exposure Detection & Location

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Monitor exposures with DAS instead of separate DTS



DAS – DTS
Validation

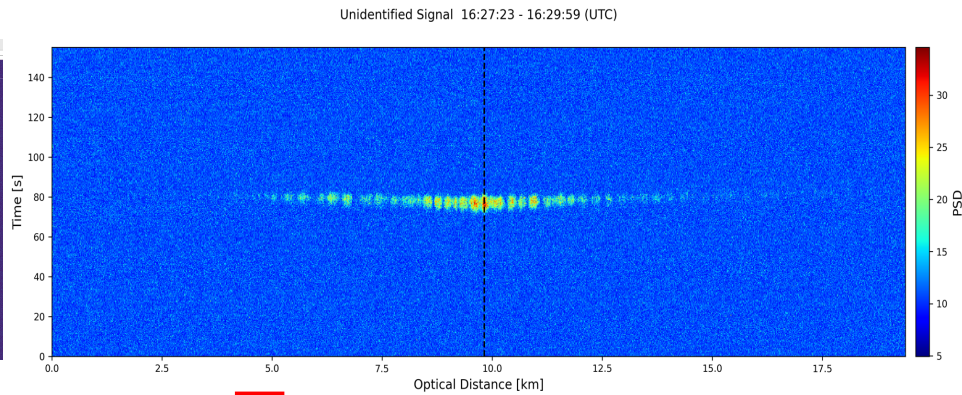


Marine Mammal Identification

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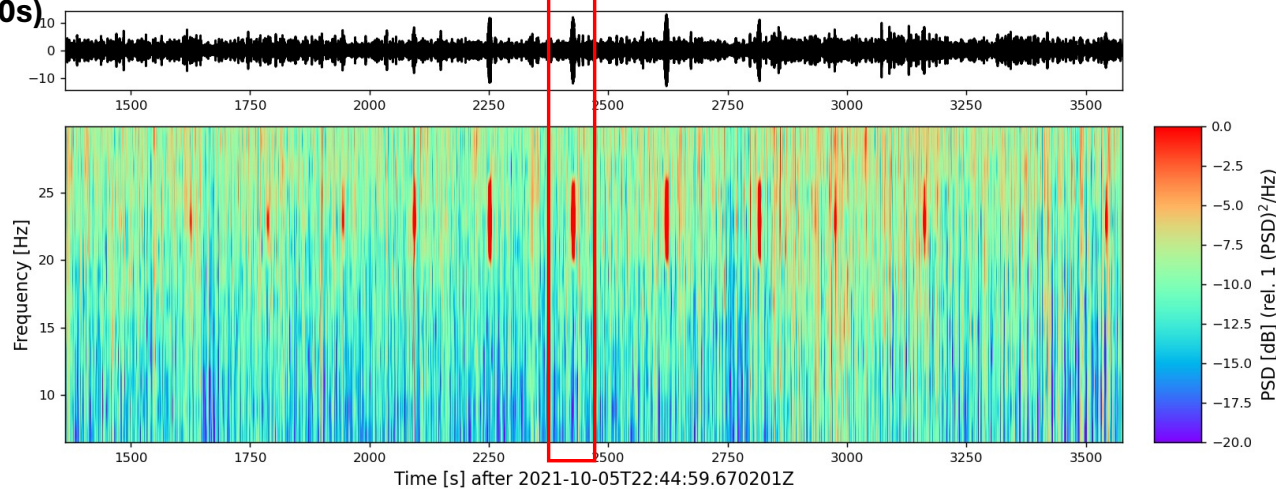
5 whale identifications in Sep/Oct 2021

Narrowband Detection



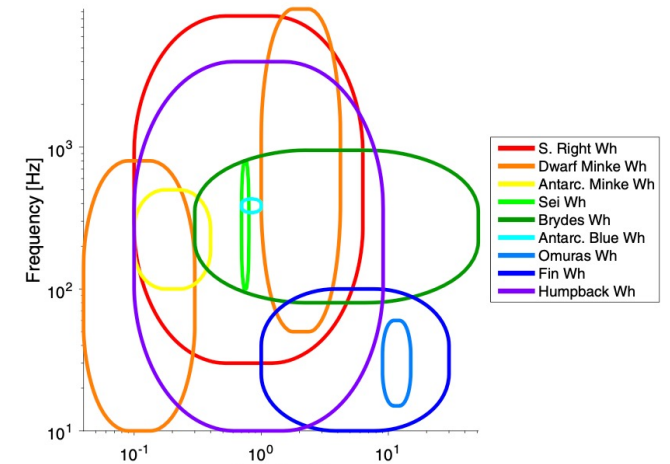
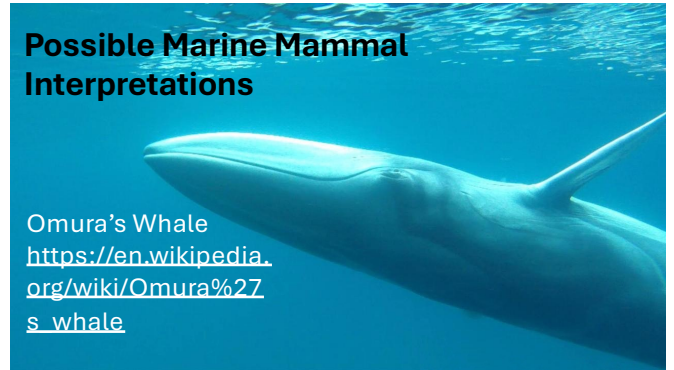
Repeating signal (every

Subco/Soda - AusNOG 2024 ~ 120s)



Possible Marine Mammal Interpretations

Omura's Whale
https://en.wikipedia.org/wiki/Omura%27s_whale

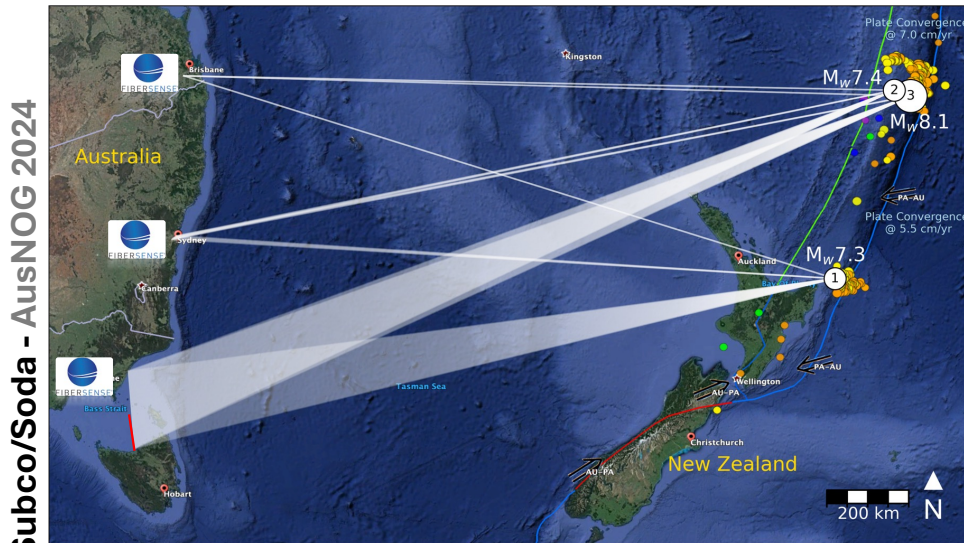
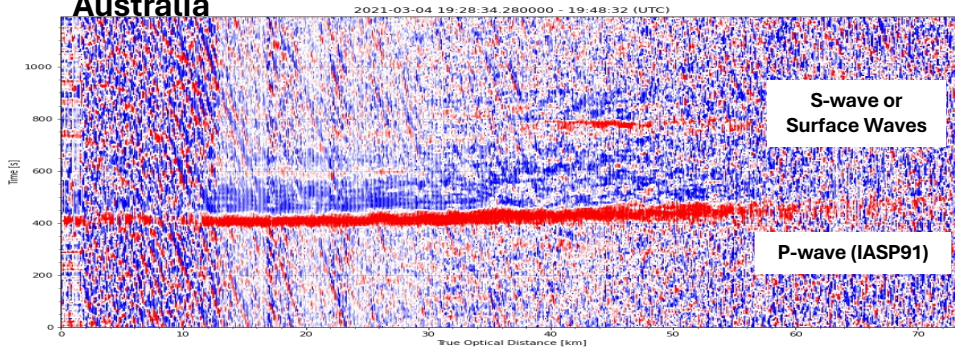


Pulse-like sounds by species from Erbe et al., 2017 Review of Marine Mammal Acoustics

Tsunami Detection

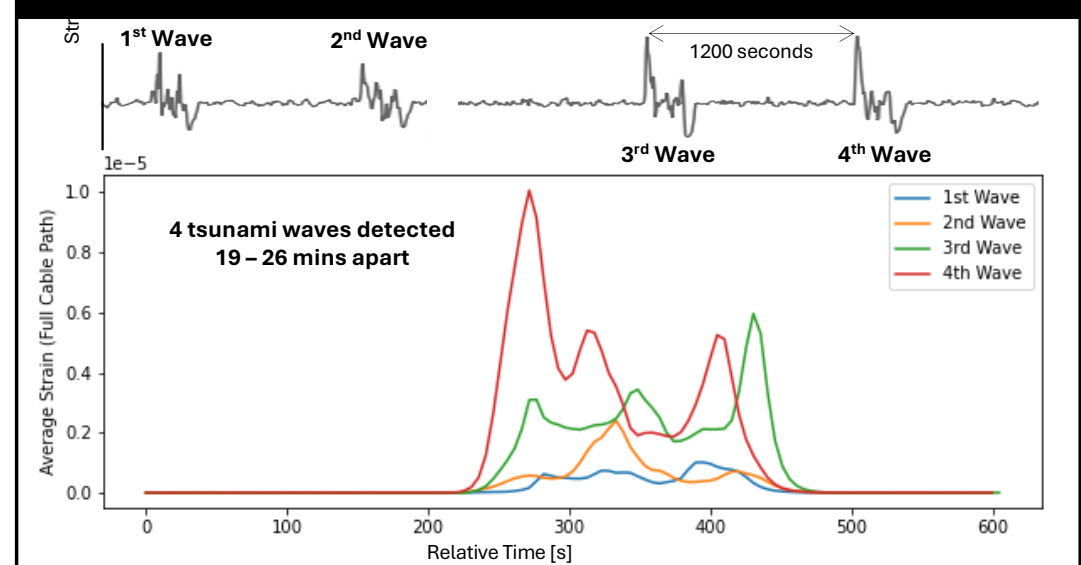
Kermadec Arc Tsunami detection on Submarine Cable
M_w8.1 Mar-2021 Earthquake DAS Recording over Bass Strait, Australia

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Megathrust earthquake north of New Zealand generated ~0.3 m of wave height in Bass Strait (3430km away) which is consistent with FS observations.

Tsunami Observations in Bass Strait 8.5 hrs after M_w8.1 Earthquake



Moving Forward Event Centre + Digital Twin

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- Every passive and active piece of equipment including every SLTE, PFE, router, switch, DCN/OOB, PDU, fibre cable, rack, patch panel, patch lead is record both spatially and logically
- Internal front/rear cameras in every rack
- every space in every facility will also have facial recognition cameras
- Every power circuit monitored whether it be at PDU, breaker
- All environmentals continually monitored both on hardware and in facility
- All ingested into Operational Intelligence Platform called "Event Centre"
- All accessible via upcoming digital twin that is full integrated into OSS/BSS and asset management systems as well as our new customer "Glass" platform

The background is a dynamic, abstract composition. It features flowing, wavy bands of deep red and magenta that sweep across the frame. Interspersed within these bands and the surrounding dark space are numerous small, bright particles and bokeh lights, some appearing as sharp points of light while others are soft, out-of-focus circles. The overall effect is one of depth and movement, reminiscent of a cosmic nebula or a digital data stream.

Questions?