

# Exploring our planet through SMART cables

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TNC22, Trieste



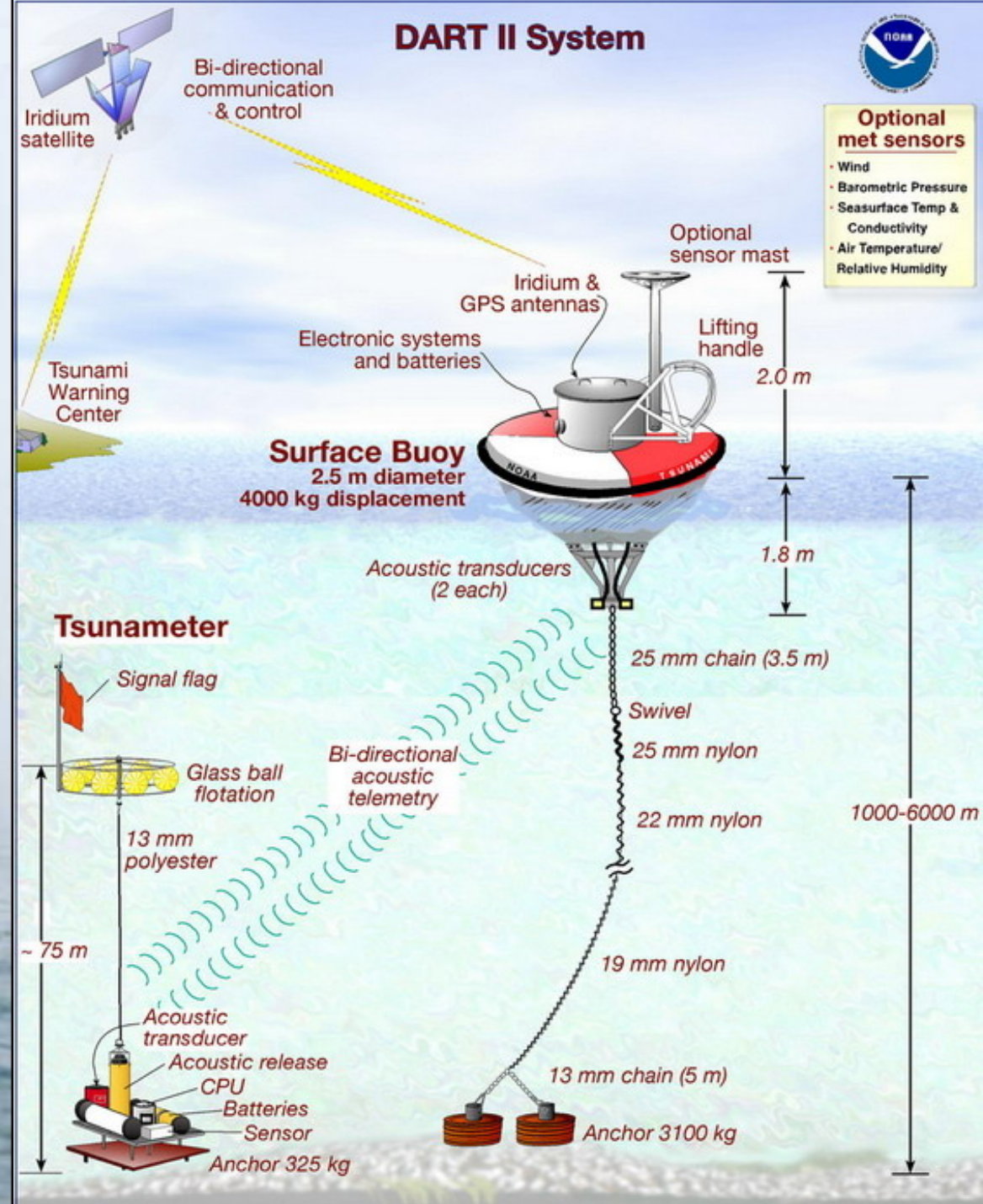






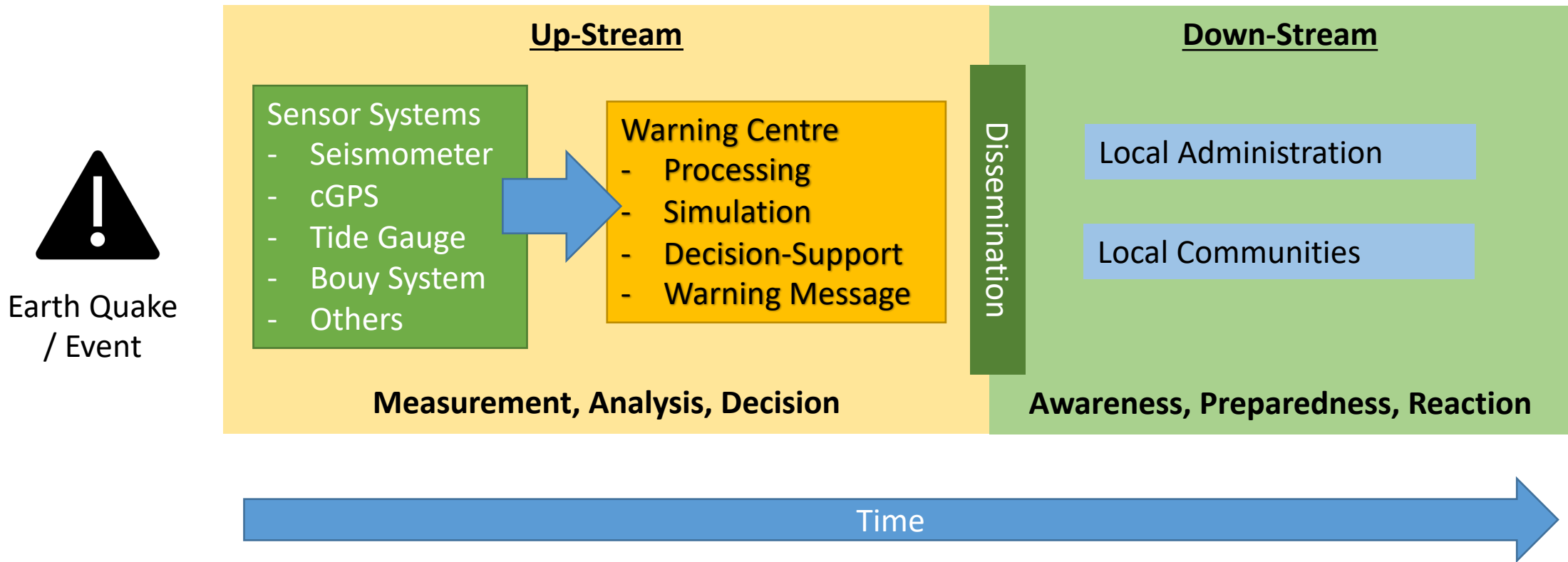
By U.S. Navy photo by Photographer's Mate 2nd Class Philip A. McDaniel - This image was released by the United States Navy with the ID 050102-N-9593M-040 (next), Public Domain, <https://commons.wikimedia.org/w/index.php?curid=8241767>



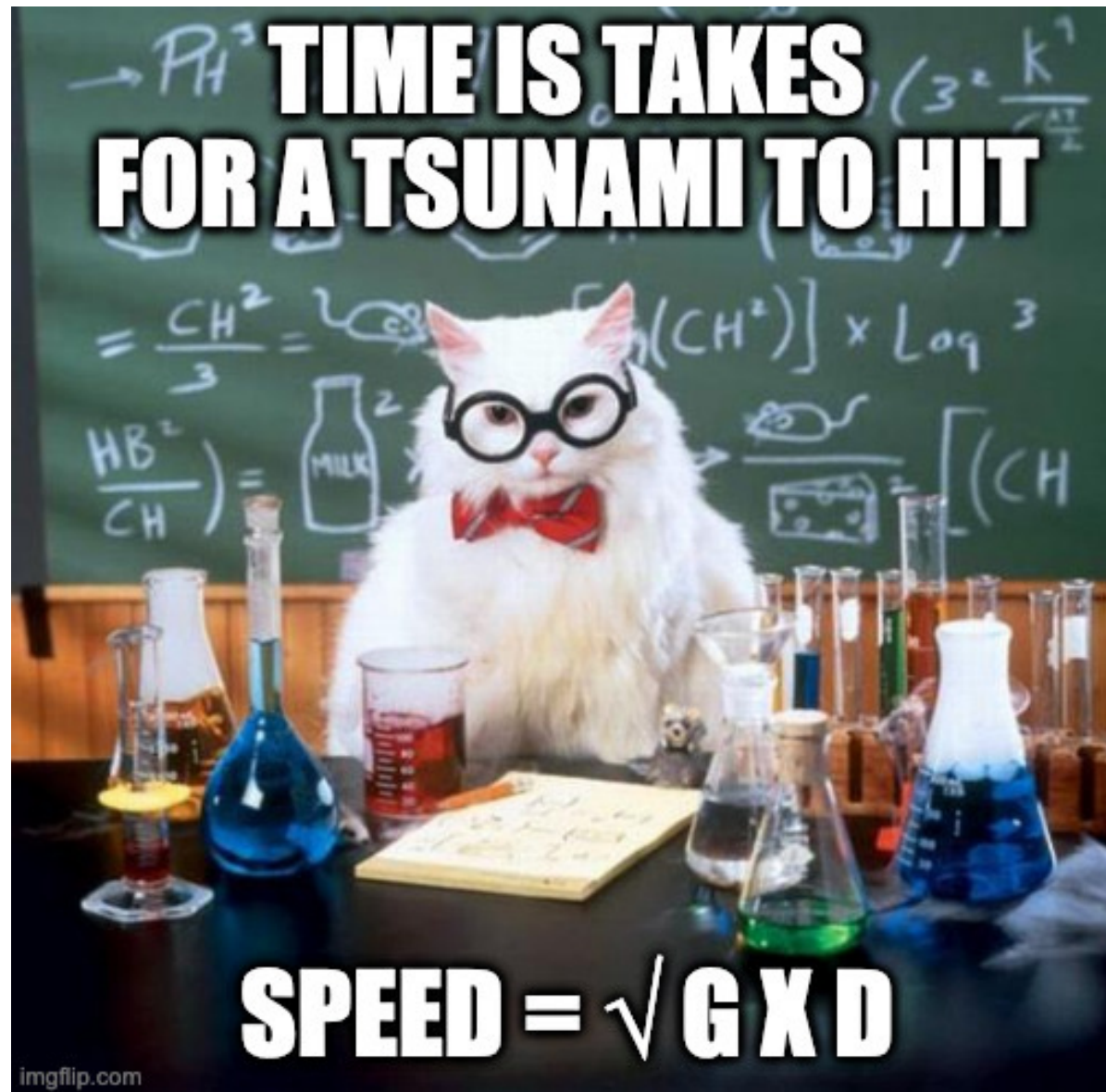




# How Tsunamis are monitored and reported







1000 meters  
water depth  
= 713 Km/s

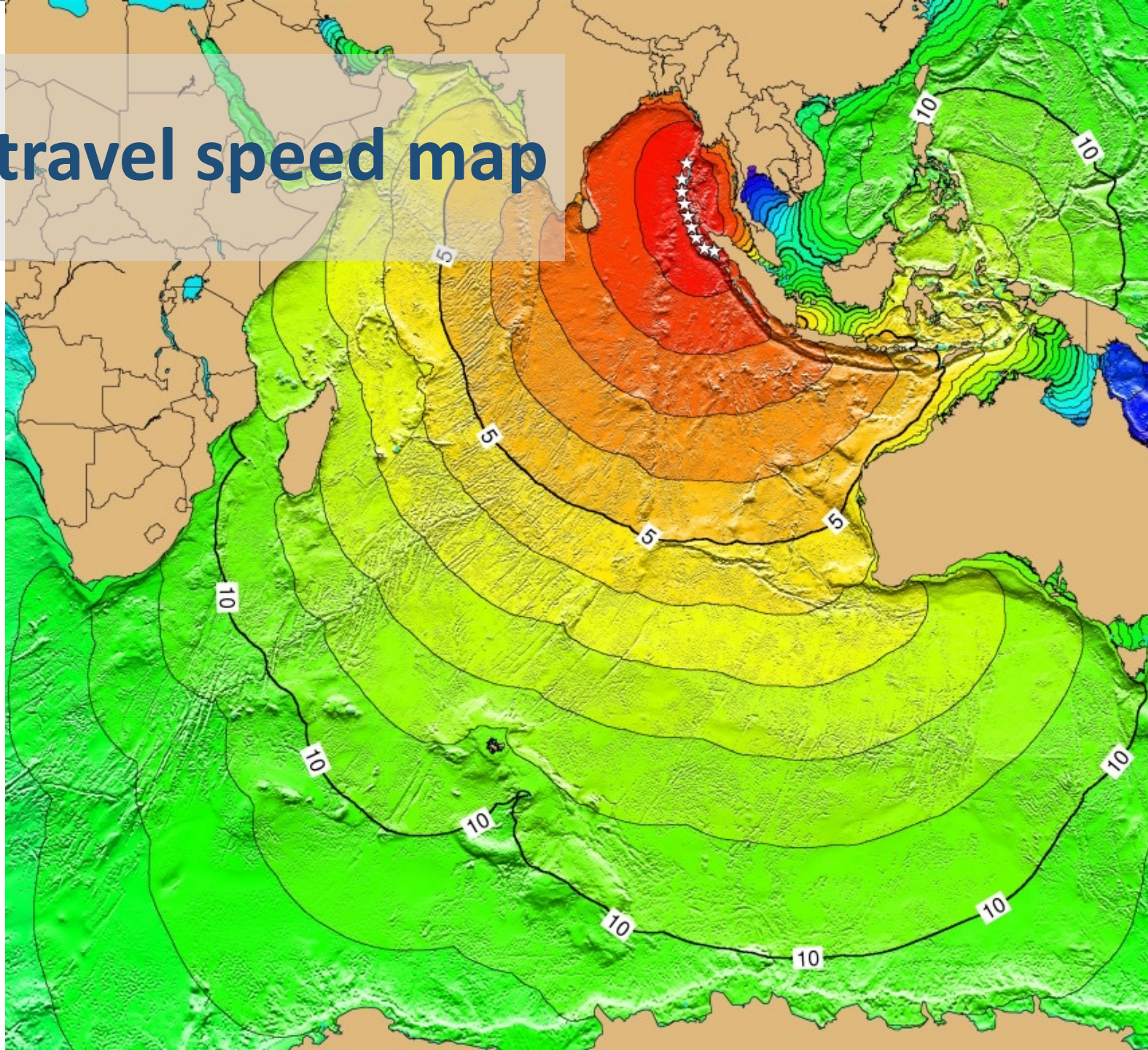
4000 meters  
water depth  
= 198 m/s

$$g = 9.81$$

d = Depth of water



# Tsunami travel speed map



Map contours: 1-hour  
intervals:  
Red: 1-4 hour arrival  
times

Yellow: 5-6 hour arrival  
times

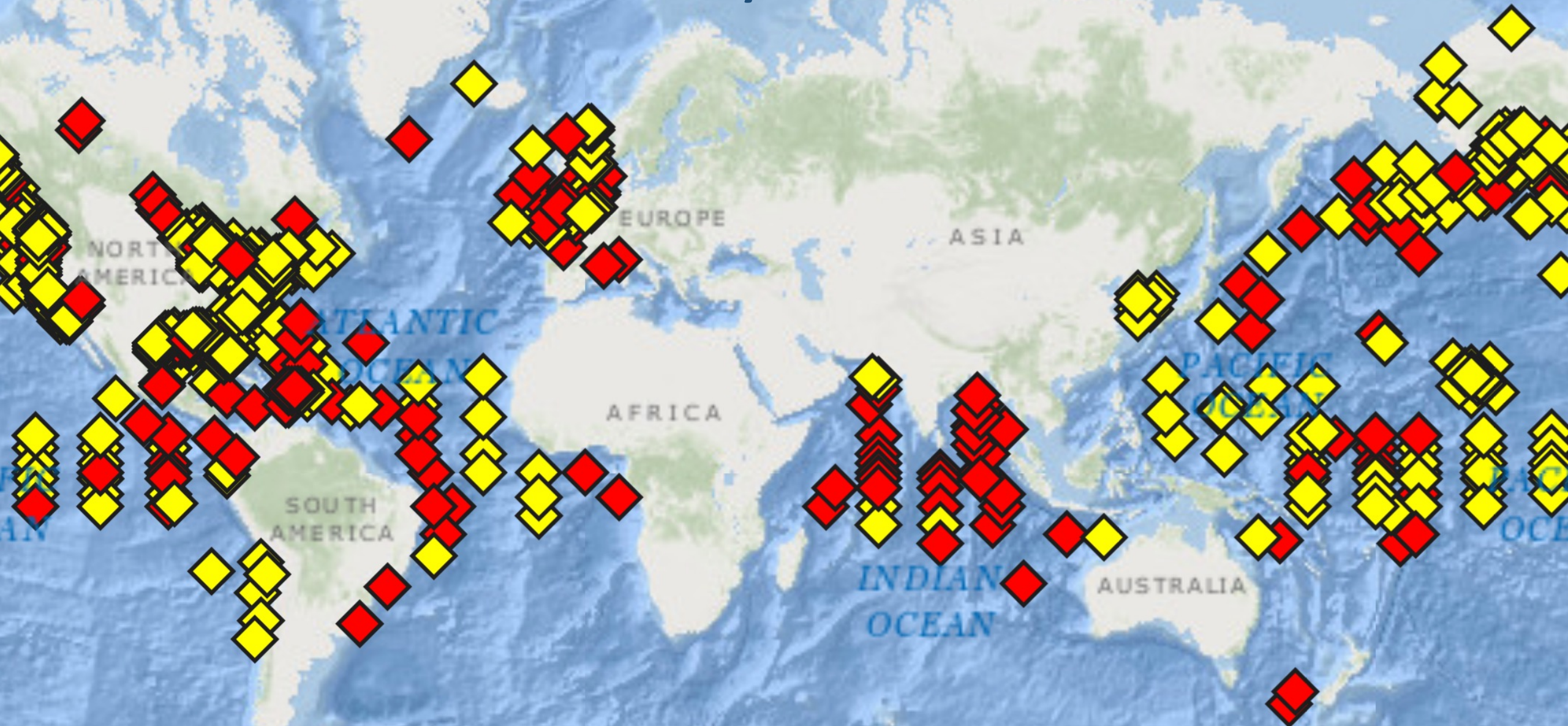
Green: 7-14 hour  
arrival times

Blue: 15-21 hour  
arrival times

[https://www.ngdc.noaa.gov/hazard/tsu\\_travel\\_time\\_event\\_ts.shtml](https://www.ngdc.noaa.gov/hazard/tsu_travel_time_event_ts.shtml)



# Where are Ocean Tsunami Buoys most effective?





**2 x tsunami strikes in 2018**

**TSUNAMI SELAT SUNDA  
PROVINSI BANTEN DAN LAMPUNG**  
Update 24 Desember 2018 Pukul 10.00 WIB

■ = Terdampak

Sumber : BPBD Prov. Banten dan BPBD Prov. Lampung

**Kab. Tanggamus**  
Korban :  
- 1 Orang Meninggal

**Kerusakan**  
- 4 Rumah Rusak  
- 70 Perahu Rusak

**Korban :**  
- 281 Orang Meninggal  
- 1.016 Luka-luka  
- 57 Orang Hilang  
- 11.687 Orang Mengungsi

**Kerusakan :**  
- 611 unit Rumah Rusak  
- 69 Hotel Rusak  
- 60 Warung Rusak  
- 420 Perahu dan Kapal Rusak  
- 10 Kendaraan Roda 4 Rusak  
- 38 Kendaraan Roda 2 Rusak

**Kab. Pesawaran**  
Korban :  
- 1 Orang Meninggal  
- 1 Orang Luka-luka  
- 231 Orang mengungsi

**Kerusakan**  
- 134 Rumah Rusak  
- 14 Perahu Rusak

**Kab. Lampung Selatan**  
Korban :  
- 60 Orang Meninggal  
- 213 Luka-luka  
- 22 Orang Hilang

**Kerusakan :**  
- 30 unit Rumah

**Kab. Cilegon**  
Merak  
Anyer  
Cilegon  
Se  
Pandeg

**Kab. Serang**

**Kab. Pandeglang**  
Korban :  
- 207 Orang Meninggal  
- 755 Luka-luka  
- 7 Orang Hilang  
- 11.453 Orang Mengungsi

**Kerusakan :**  
- 611 unit Rumah Rusak  
- 69 Hotel Rusak  
- 350 Perahu dan Kapal Rusak  
- 71 Kendaraan Rusak

Warning sent but it was inaccurate as the tsunami was triggered by a volcano landslide. The installed tidal gauges weren't able to distinguish the tsunami from the tide and the deep water buoys weren't monitored.

National Board for Disaster Management (BNPB) -  
t.com/sutopo\_pn/status/1077092955389812736, Public Domain,  
ons.wikimedia.org/w/index.php?curid=75301355

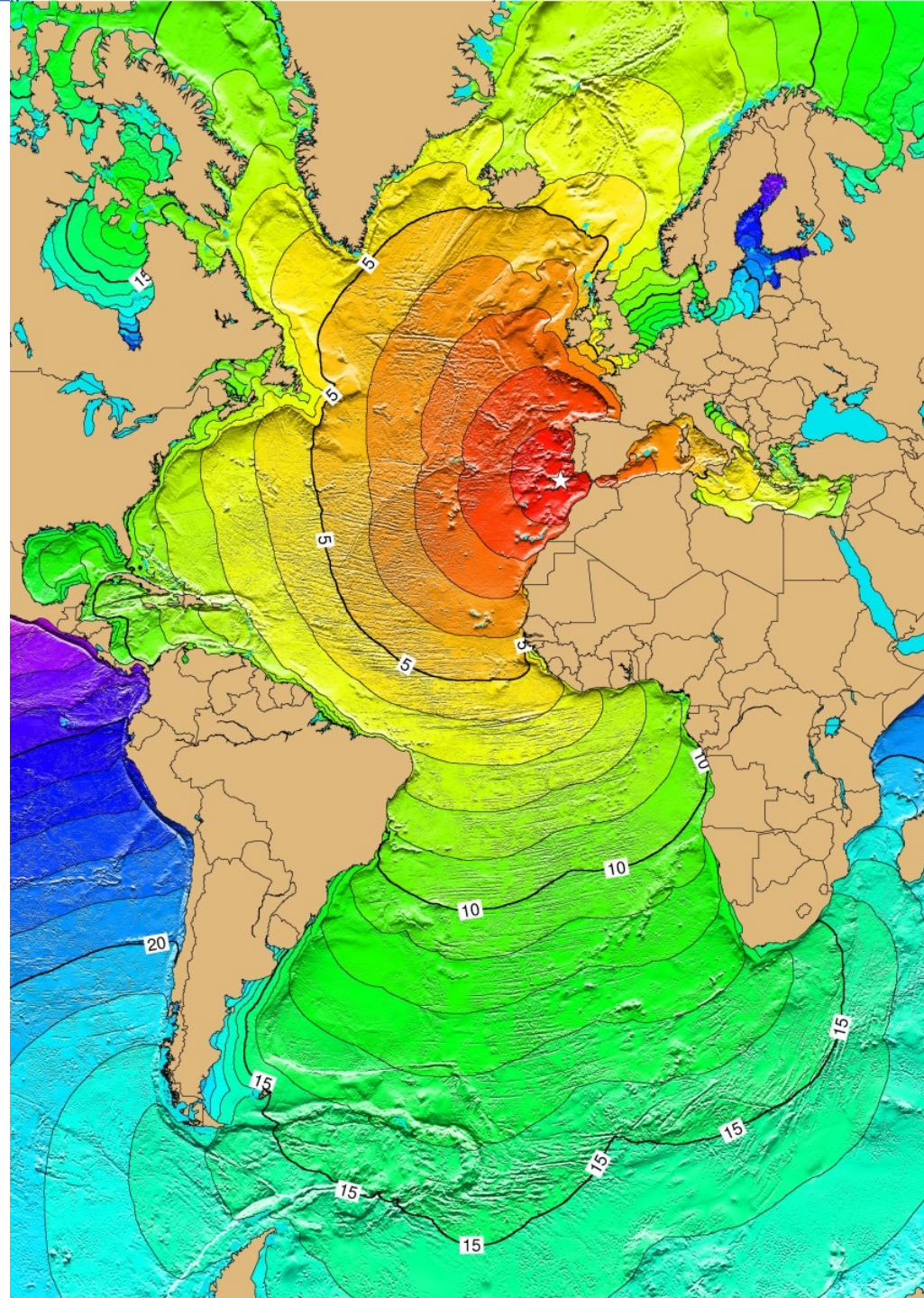
Skala 1 : 1.000.000  
Ukuran Kertas A4  
Datum WGS'84  
Sistem Koordinat Geografis

Warning sent but it wasn't accurate as the tsunami was triggered by a volcano landslide. The installed tidal gauges weren't able to distinguish the tsunami from the high tide and the deep water buoys weren't monitoring.

By Indonesian National Board for Disaster Management (BNPB) -  
[https://twitter.com/sutopo\\_pn/status/1077092955389812736](https://twitter.com/sutopo_pn/status/1077092955389812736), Public Domain,  
<https://commons.wikimedia.org/w/index.php?curid=75301355>



# Tsunami's in Europe



Map contours: 1-hour intervals:  
Red: 1-4 hour arrival times  
Yellow: 5-6 hour arrival times  
Green: 7-14 hour arrival times  
Blue: 15-21 hour arrival times





Another societal challenge from lack of  
deep ocean observations

Photo by [Rob Curran](#) on [Unsplash](#)



A world map showing deep ocean temperature. The landmasses are black, and the oceans are colored in a gradient from dark blue to light blue. The title "Global Deep Ocean Temperature" is overlaid in white text.

# Global Deep Ocean Temperature

Credit: Imagery processed by the NASA Earth Observations (NEO) team in collaboration with Gene Feldman and Norman Kuring, NASA OceanColor Group.



# We need more data!



Long term data sets for:

- Climate modelling
- Weather forecasting
- AI and all that



A photograph of a research vessel's deck. A metal frame containing several yellow dome-shaped instruments is being hoisted by a crane. A crew member in a red life vest and blue helmet is visible on the right, and another in a blue helmet is at the bottom. The ocean is in the background.

# What about dedicated infrastructure?



# Expensive to install





# Expensive to maintain







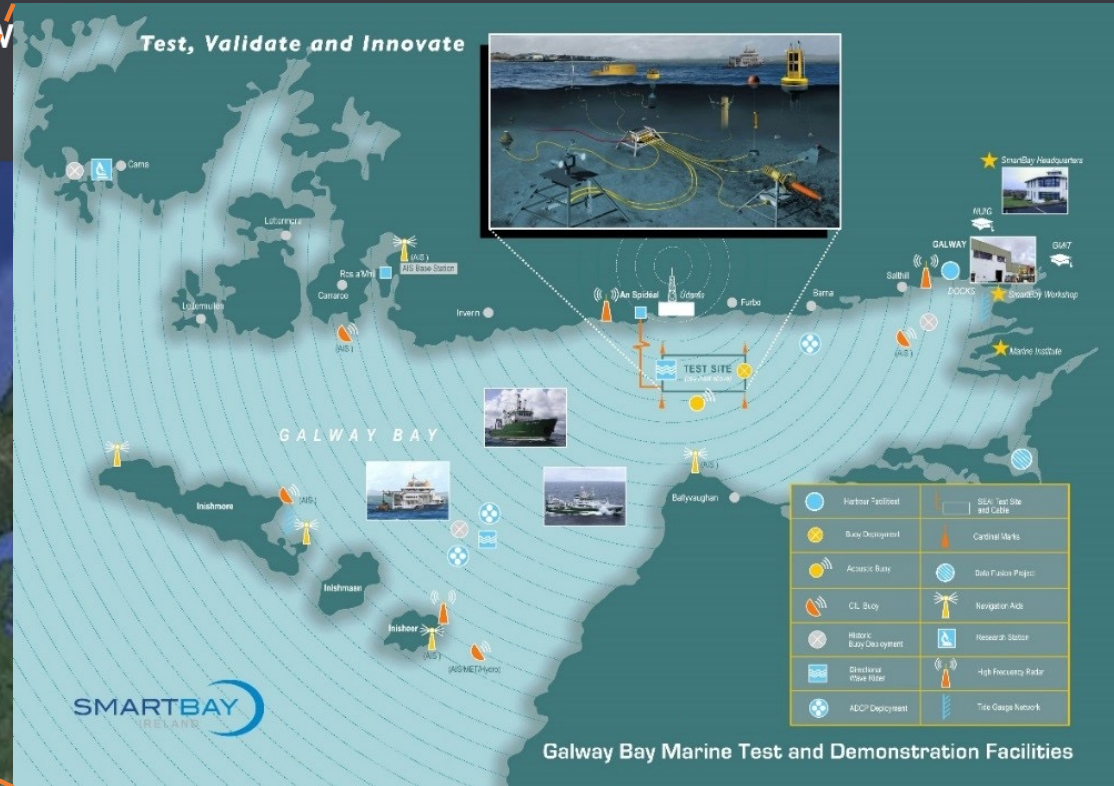
**who pays?**



# Who is responsible?







There have been  
dedicated cables and  
infrastructure installed!



# What about Space?



Photo by [NASA](#) on [Unsplash](#)



# This isn't just a theoretical problem

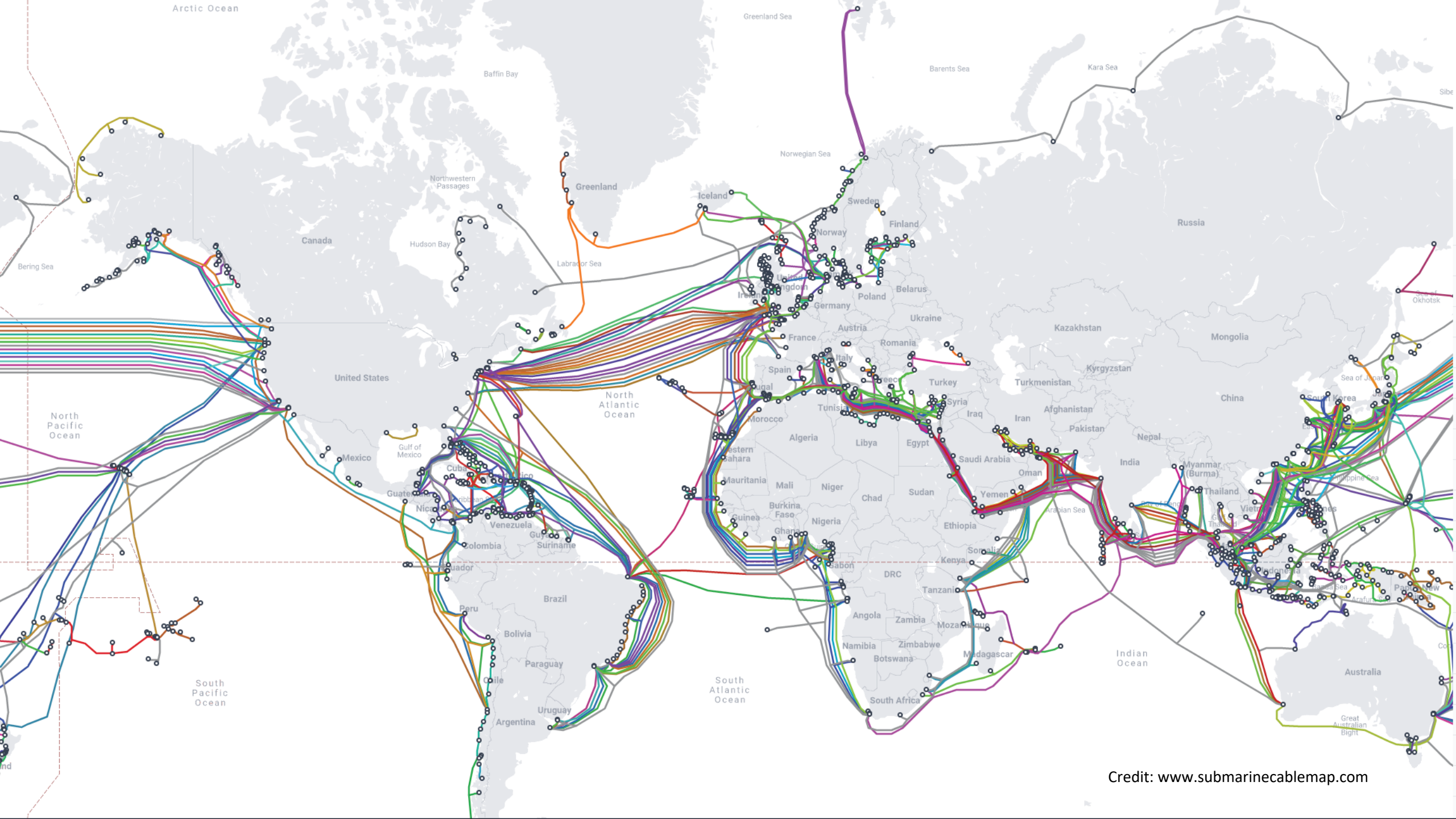


IOC



WMO







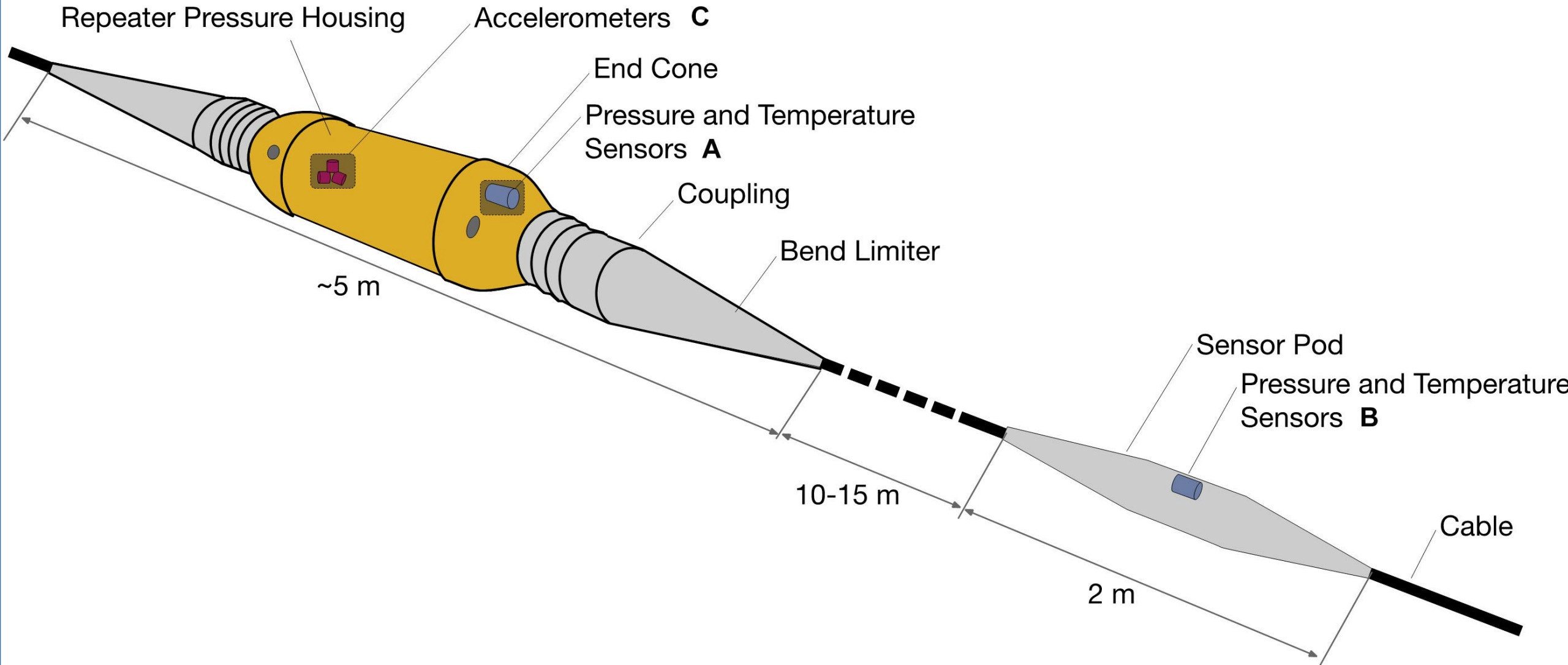
# Science Monitoring And Reliable Telecommunications

SMART Cables Partner Organizations and Endorsements





# SMART Cable concept



Howe et al., (2019, August 2). *Smart cables for observing the Global Ocean: Science and implementation*. SMART Cables for Observing the Global Ocean: Science and Implementation. Retrieved June 10, 2022, from <https://www.frontiersin.org/articles/10.3389/fmars.2019.00424/full>



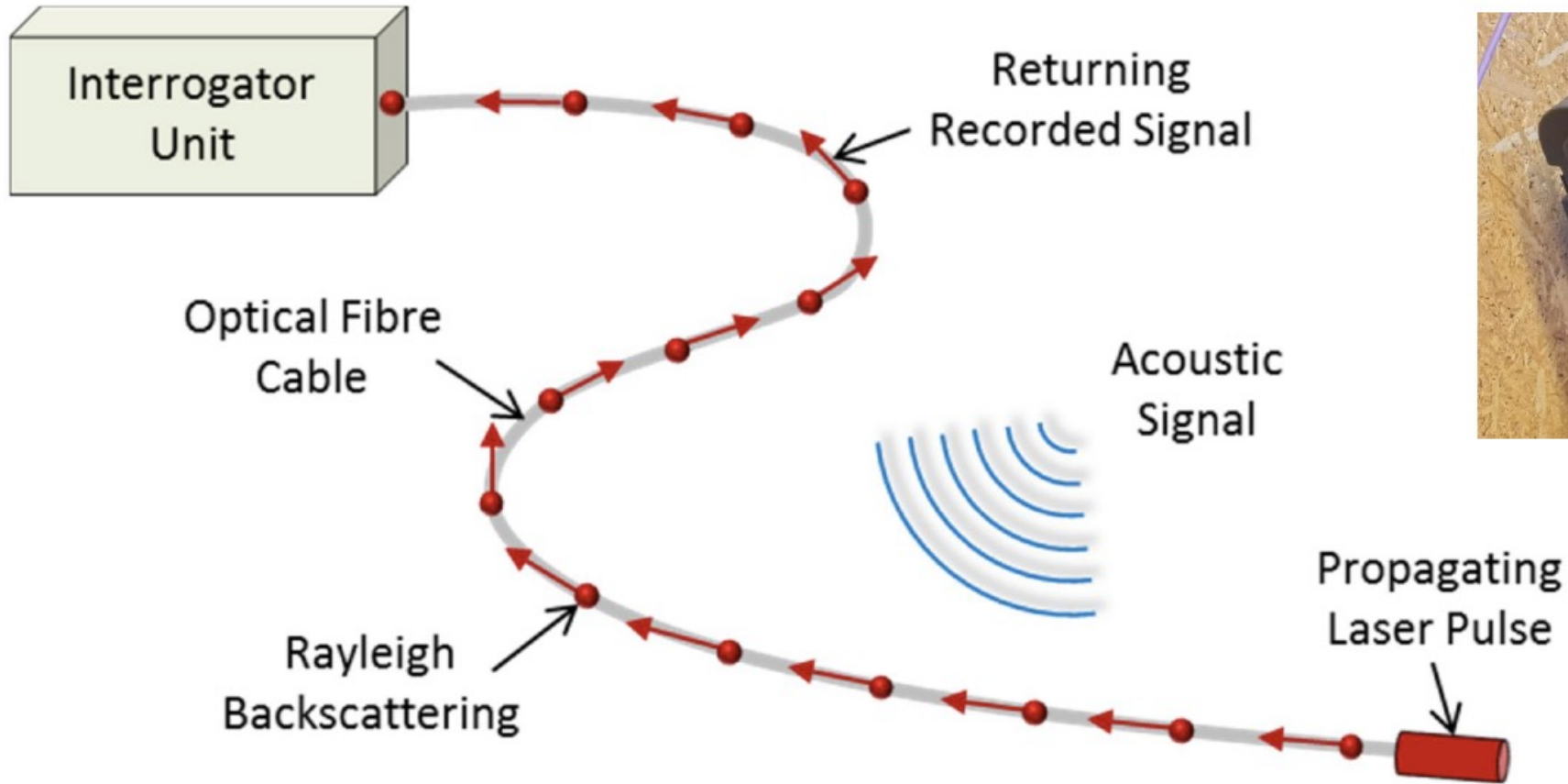
A photograph of a dirt path winding through a dense forest. The path is covered in brown leaves and leads into the distance. On the right side of the path, a small, light-colored animal, possibly a dog or a small horse, is standing. The forest is filled with tall trees and lush green foliage. The text "Is there another way?" is overlaid in white, bold, sans-serif font across the middle of the image.

# Is there another way?

Photo by Beth Macdonald on Unsplash



# DAS: Distributed Acoustic Sensing



Can also measure transmitted signal or perform polarization analysis at the end of the fibre: SOP