The Impact of Natural Disasters On Telecom Subsea Cable Systems

SUMMARY OF MAPUTO SALES REQUESTS 2018/2019/2020/2021/2022/2023

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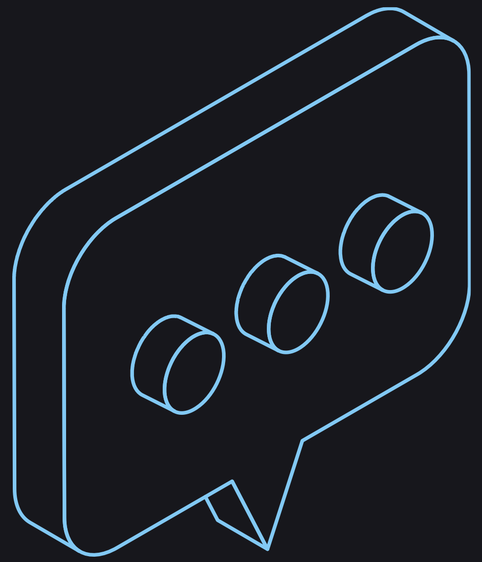

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ABSTRACT

Submarine Cable Systems are a valuable commodity in the 21st century global communication environment.

They play a crucial role in connecting different regions and continents, enabling the seamless flow of internet and communication traffic by providing high-speed and reliable connections between countries and continents.

Being the Global Backbone Network, and carry more than 95% of international traffic between continents, its key to understand that the submarine environment is not as friendly, stable, and predictable as the terrestrial environment, all possible fail causes have to be explored and faced.

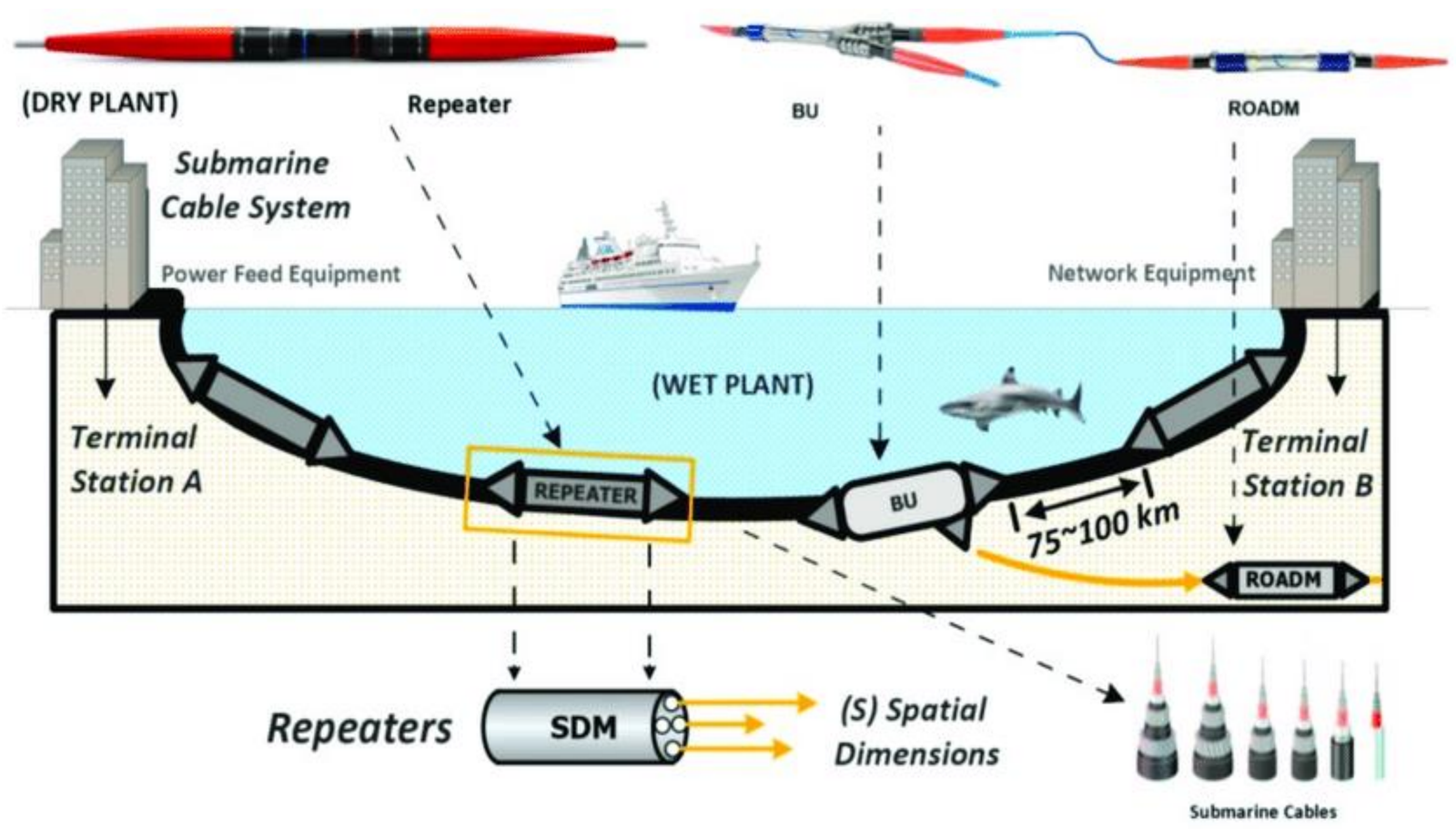
Despite their importance, subsea cables and their landing stations are vulnerable to damage by natural hazards, including storm surges, waves, cyclones, earthquakes, floods, volcanic eruptions, submarine landslides and ice scour.

This presentation will cover the incidents cable operators face with a focus on outages caused by natural disasters which represent less than 10% of the total Submarine Cable faults but with devastating impacts.

AGENDA

1. Introduction – Submarine Networks Ecosystem
2. Submarine Cable Types
3. Do cables break?
4. Submarine Cable Faults
5. **Cable Damage From Fishing and Others**
6. Impact of Natural disasters
7. Subsea Cable Repairs
8. Outlook of Submarine Cables in Africa
9. Take Aways

1. **Introduction – Submarine Networks Ecosystem**



- Submarine networks consist of the dry plant (the coastal supporting equipment) and the wet plant (the submerged part).
- The dry part includes the transponders (which transmit and receive the optical data carried by the submerged Fiber Pairs), the PFE-Power Feed Equipment to the wet plant, the monitor and control equipment to perform network management tasks.
- The wet plant includes the cable (with the fiber and the conductor which manages the high-voltage supplied by the PFE), the repeaters and Branching units.

- Branching units (BU) are deployed in systems having three or more landing sites. Optical signals are routed among the three cables that connect to the BUs.
- Power switched BUs provide controllable electrical connections among the three cables and the sea-ground electrode. The electrical connectivity within the BU is controlled using an optical signal.

Source: Toward SDM-Based Submarine Optical Networks: A Review of Their Evolution and Upcoming Trends

2. Submarine Cable Types

- Submarine cables are designed for an effective protection for optical fiber and power conductor for 25 years or more in a marine environment.
- Robust design able to withstand the stresses and strains associated with laying and recovery operations.
- Average operating temperature range is –20 °C to +50 °C.
- LWA: Typically used for burial in areas of decreased risk of external aggression. Depth to 2000 m.
- SA: Rocky terrain; moderate risk of trawler damage. Depth to 1500 m.
- DA: Very rocky terrain; high risk of trawler damage; pipeline crossings. Depth to 800 m.

Shallow- to deep-water (left to right) fibre-optic cables, with a core supporting pairs of hair-like optical fibres surrounded by a layer of wire to provide strength, a copper conductor to power the repeaters or amplifiers that process the light signal, and a case of polyethylene dielectric. Wire armour is added for protection.

Source: Lonnie Hagadorn.

Do cables break

Yes! Cable faults are common. On average, there are over 100 each year.

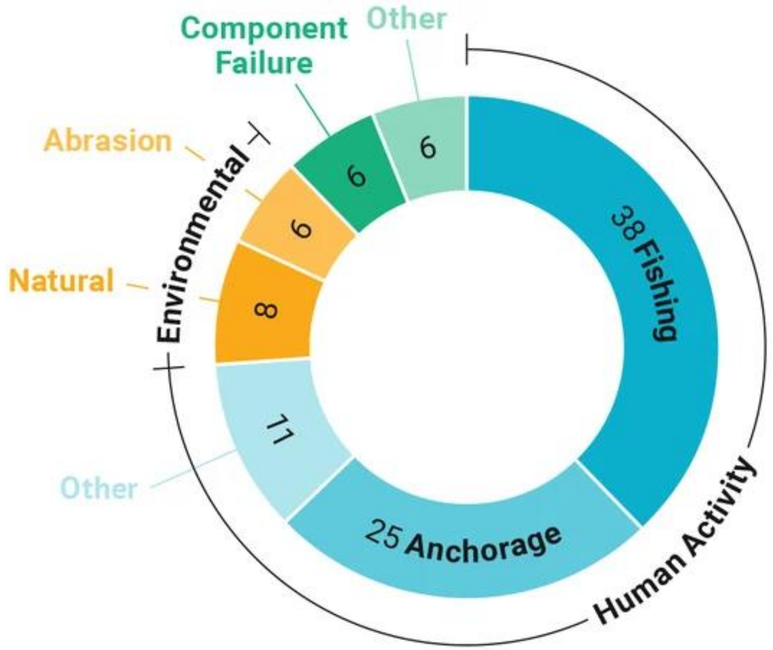
You rarely hear about these cable faults because most companies like **SEACOM** follow a “safety in numbers” approach to usage, spreading their networks' capacity over multiple cables; so that if one breaks their network will run smoothly over other cables while service is restored on the damaged one.

Source: https://blog.telegeography.com/what-happens-when-submarine-cables-break

4. Submarine Cable Faults

Submarine cables are exposed to natural hazards in all water depths

1. Fishing vessels and ships dragging anchors account for ~70% of all cable faults.
2. Natural effects causing under 10% of cable damage incidents.



Natural hazards dominate in water depths greater than 1000m. These include:

- Submarine earthquakes, fault lines and related landslides - break or bury cables
- Density currents - break or bury
- Currents and waves - abrasion, stress and fatigue
- Tsunami, storm surge and sea level rise - damage coastal installations
- Extreme weather (e.g. hurricanes) - break or bury
- Rarely, icebergs, volcanic activity and Climate change

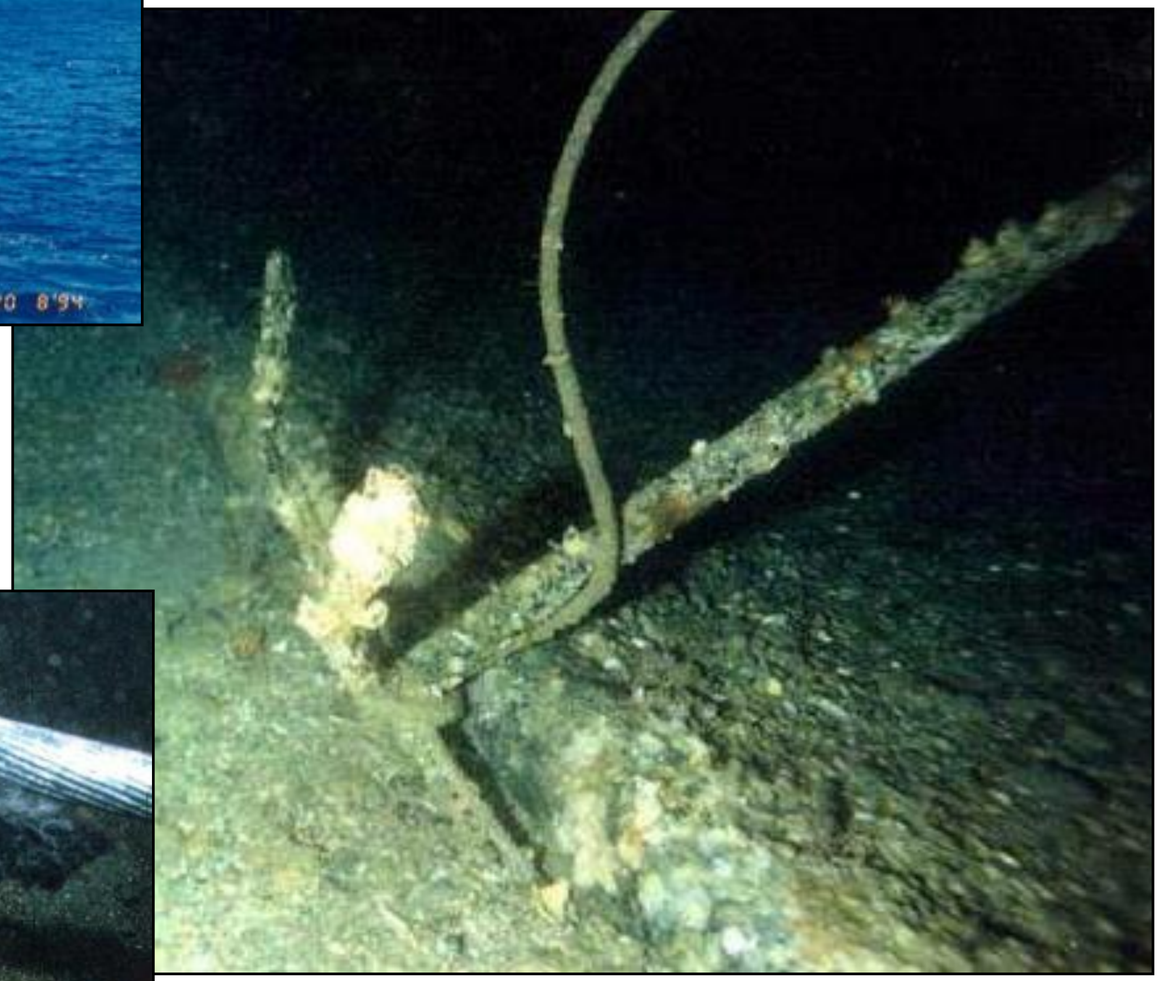
In depths less than 1000 m, the main hazards are human activities:

- Fishing: high incidence but impact restricted to individual cables.
- Anchors: Medium incidence but can impact several cables

Source: M. Wood and L. Carter, IEEE, 2008; Base data provided by Tyco Telecommunications & Global Marine Systems Published in Wood & Carter (2008) IEEE Journal of Oceanic Engineering ;. https://blog.telegeography.com/what-happens-when-submarine-cables-break

5. Cable Damage From Fishing and Others

Illegal fishing in
cable protection zone



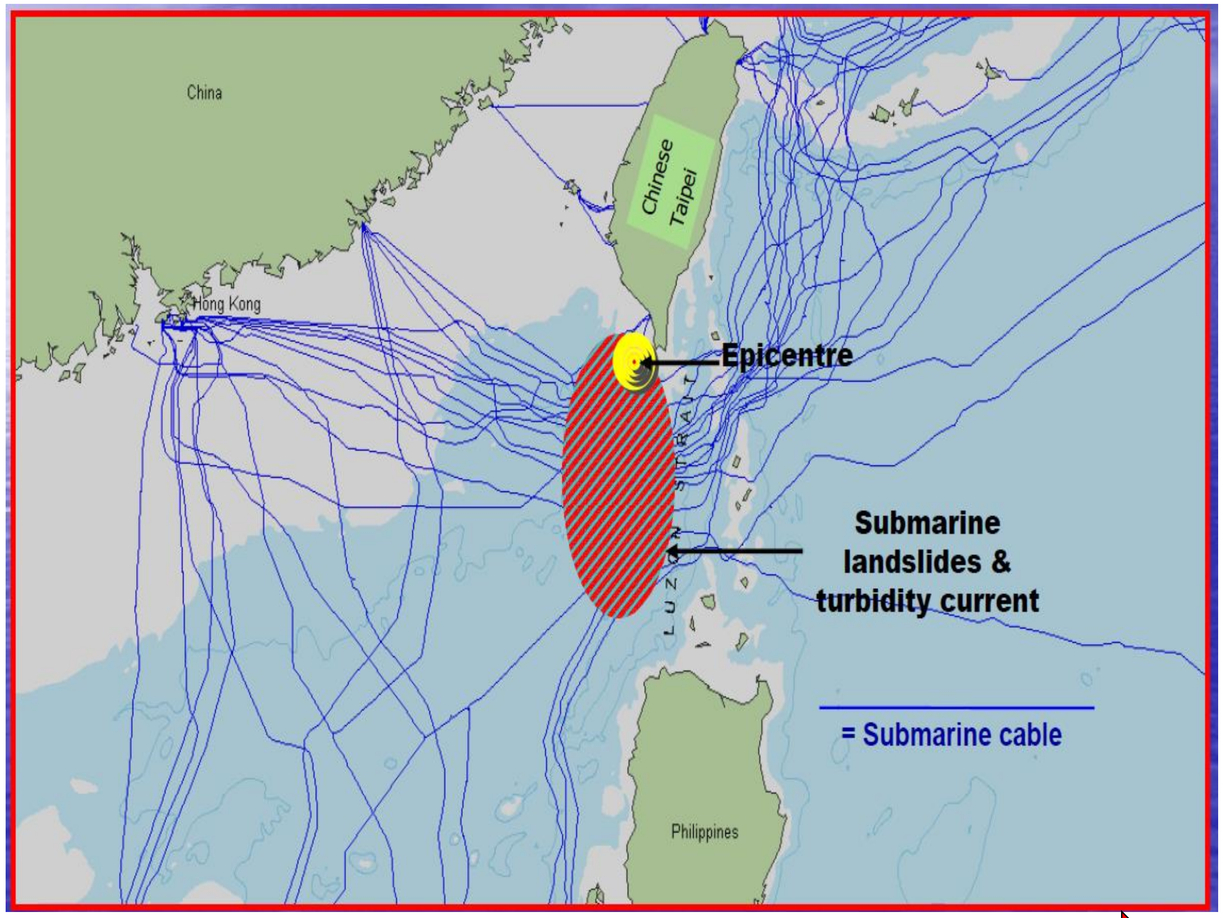
Cable snagged and moved by trawl gear

Cable damaged by trawl gear

Subsea cable damage caused by shifting sea bed conditions

Source: https://www.datacenterdynamics.com/en/news/subsea-cables-are-at-risk-from-climate-disasters/; ***Seaworks and Transpower NZ***

6. **Impact of Natural disaster:** Hengchun 2006 - An Earthquake that Caused Major Disruption to the Cable Network



Earthquake triggered submarine landslides near junction of 2 tectonic plates.

Landslides caused turbidity current that flowed over 330 km & broke 9 cables in sequence.

Damage occurred in water depths to 4000m & some cables covered with mud from current.

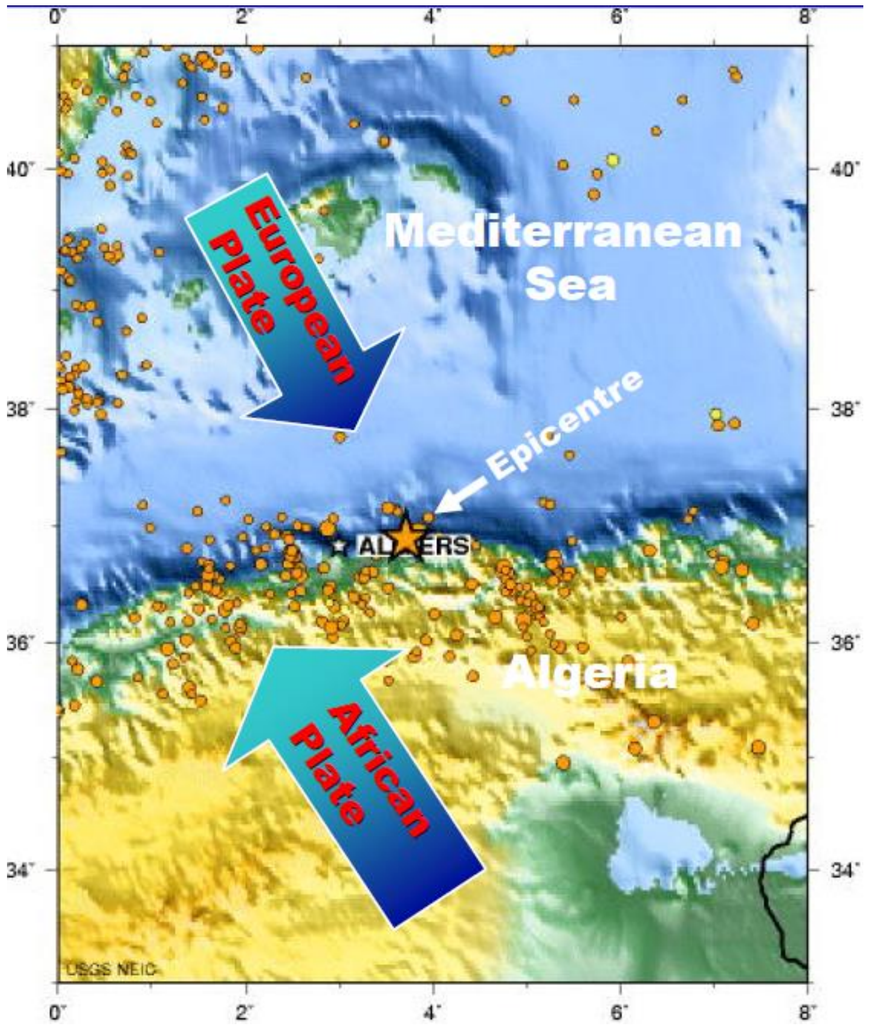
Cable repairs involved 11 ships & took 49 days.

Impact:

- **Internet linking China, Hong Kong, Vietnam, Taiwan, Singapore, Japan & the Philippines was seriously impaired.**
- **Banking, airline bookings, email & other services were either stopped or delayed.**
- **Although most traffic was quickly re-routed via undamaged cables, some delay was still apparent even 2 months after the earthquake**

Source: Global Marine Systems Ltd

6.1 Impact of Natural disaster: Boumerdes(Algeria) Earthquake: 21st May, 2003



- 6.8 magnitude earthquake 7km offshore at boundary between 2 tectonic plates.
- Tsunami 2 metres high traveled across the Mediterranean Sea.
- The repair of 1 of these cables involved replacement of a 120 km long section.
- 4 cable ships undertook the repairs with the last completed 6 weeks after the earthquake

Impact:

- **Caused damage estimated at US$100 million.**
- **5 telecommunications cables were extensively damaged by sediment charged turbidity currents caused by an earthquake**
- **Interruption of general communications, banking & commerce**
- **Traffic to Algeria restored to 60% within 48 hrs via re-routing**

Source: US Geological Survey

7. SUBSEA CABLE REPAIRS: Permit Requirements

1. States require permits to be issued before cable repair operations are allowed to start.
2. This introduces a delay, which can be significant
3. Any delay increases risk of multiple cable failure
4. Multiple cable failure can cause major disruption to the telecommunications services in the region.

Source: www.iscpc.org

7. SUBSEA CABLE REPAIR: The Operation

Bringing the cable ashore

Source: Global Marine Systems

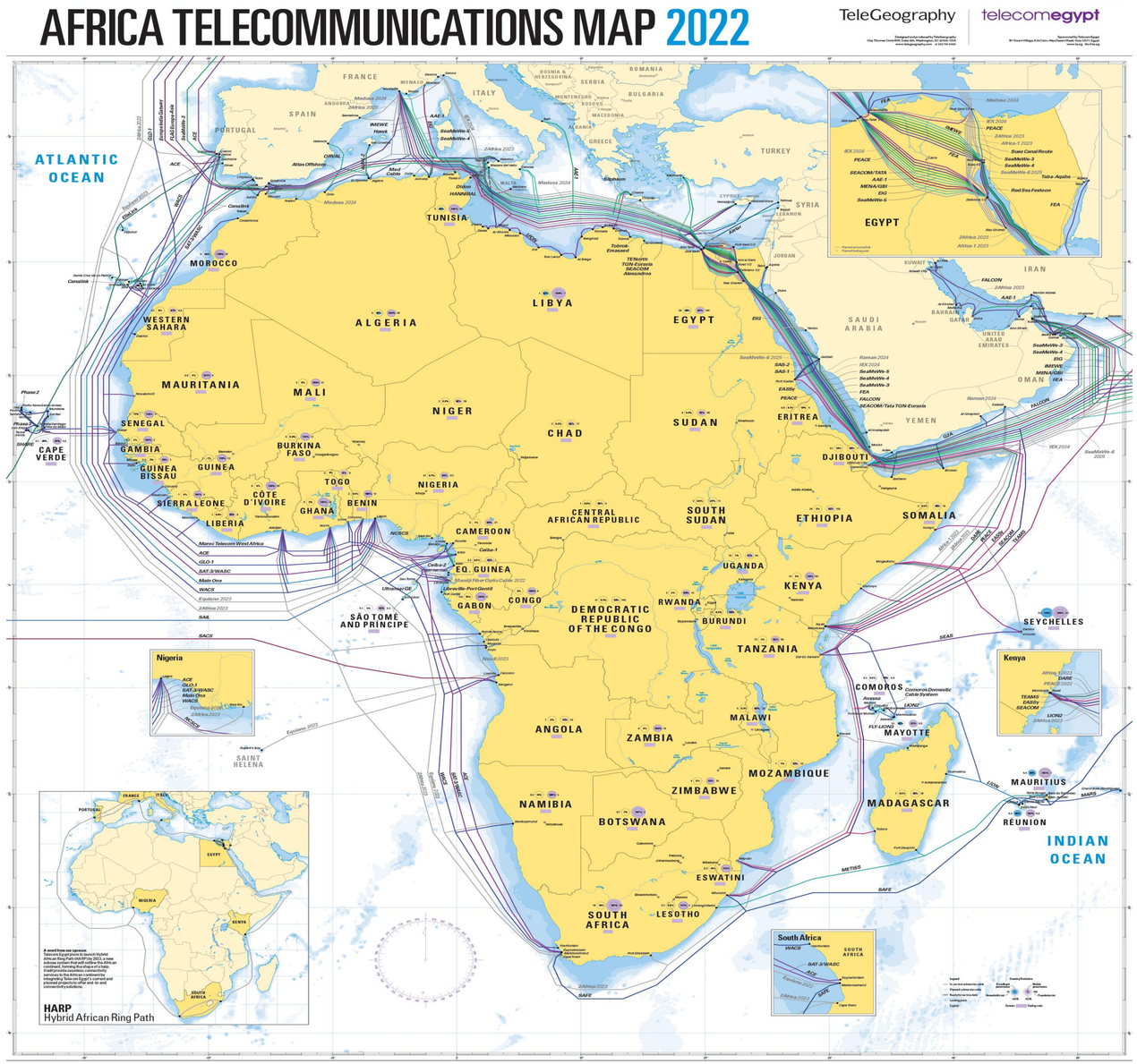
Cable and repeaters inside a cable ship

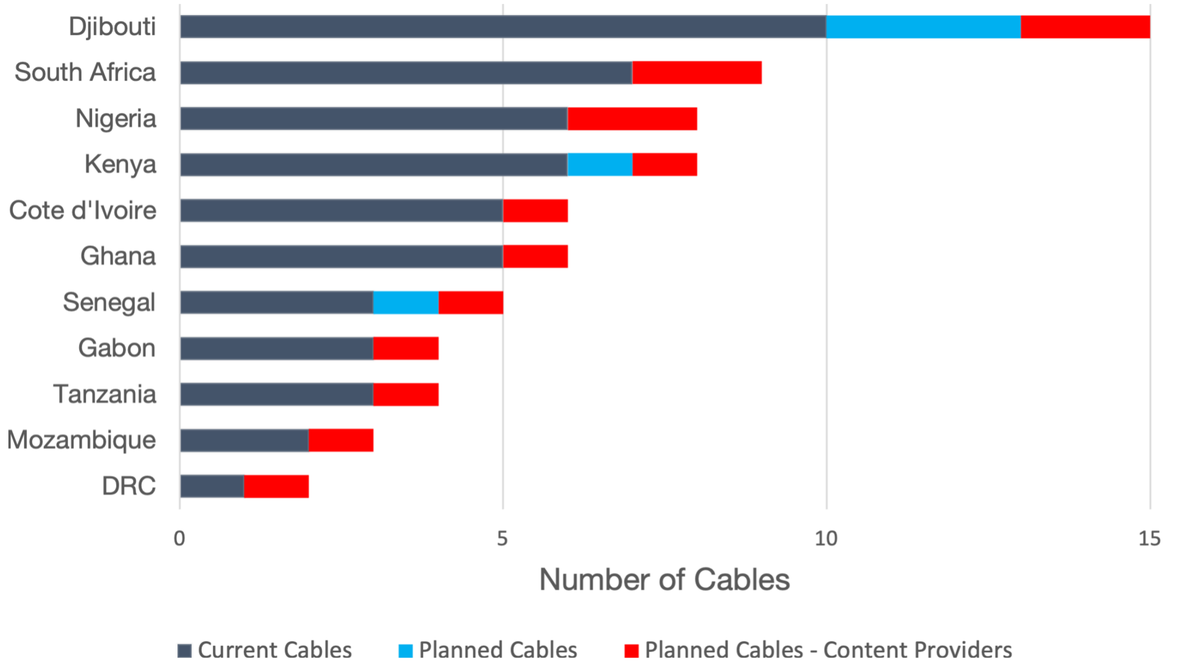
Source: TE SubCom

ROV used for cable inspection, recovery and burial

Source: TE SubCom

8. Outlook of Submarine Cables in Africa





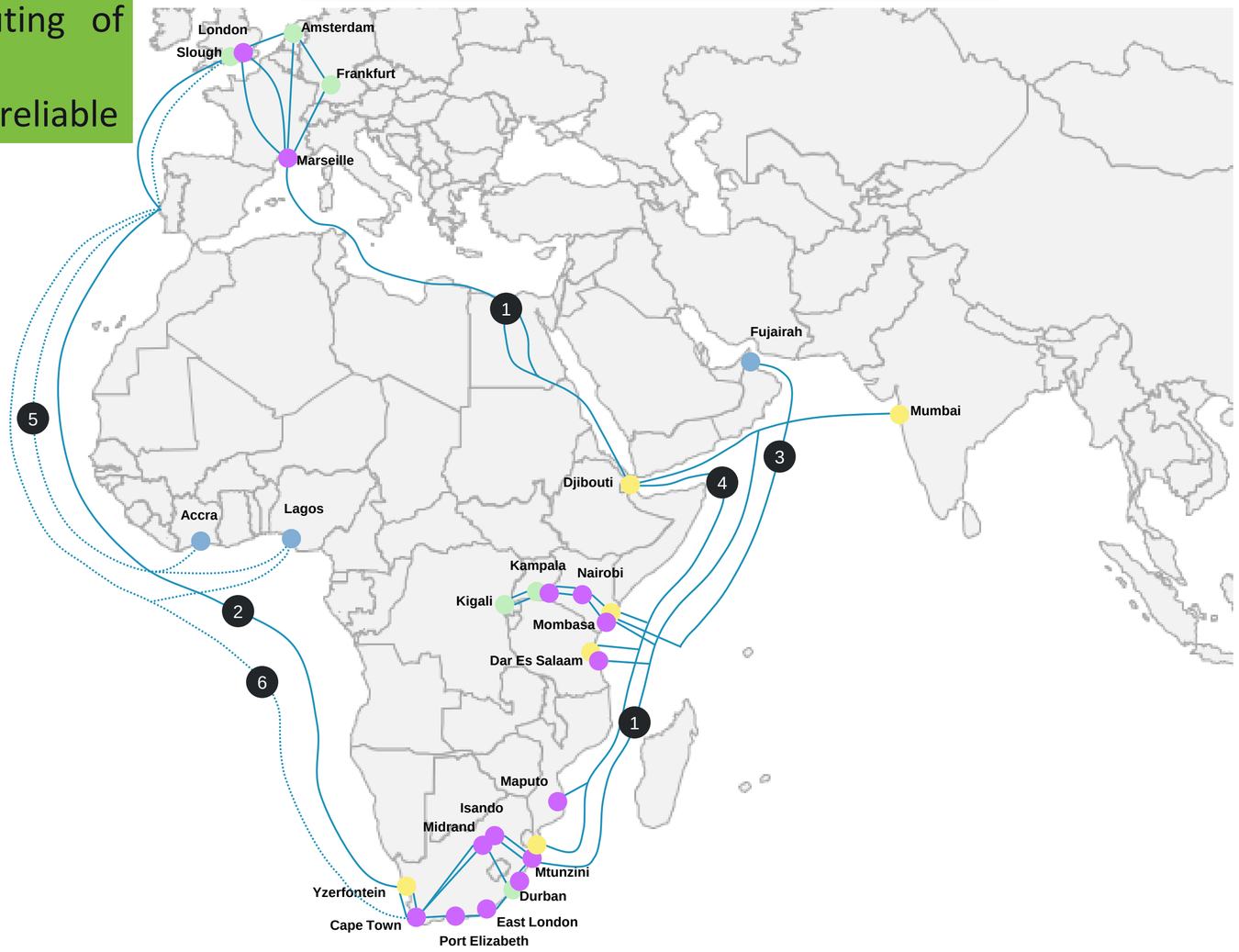
Source: https://manypossibilities.net/african-undersea-cables/

9. TAKE AWAYS

Network Resilience:

- Which results from immediate re-routing of traffic via other submarine cables.
- Cable repair operations that are fast and reliable

SEACOM GLOBAL NETWORK



1. SEACOM Cable System
2. WACS
3. TEAMS
4. EASSy
5. Main One
6. Equiano[1]

- **Point of Presence (PoP)** *Transmission*
- **Point of Presence (PoP)** *Transmission and IP*
- **Point of Presence (PoP)** *IP/MPLS*
- **Meet Me Point (MMP)**
- **SEACOM Network**
- **SEACOM Partner Network**

9 TAKE AWAYS: Cont

Cable Repair Facilities:

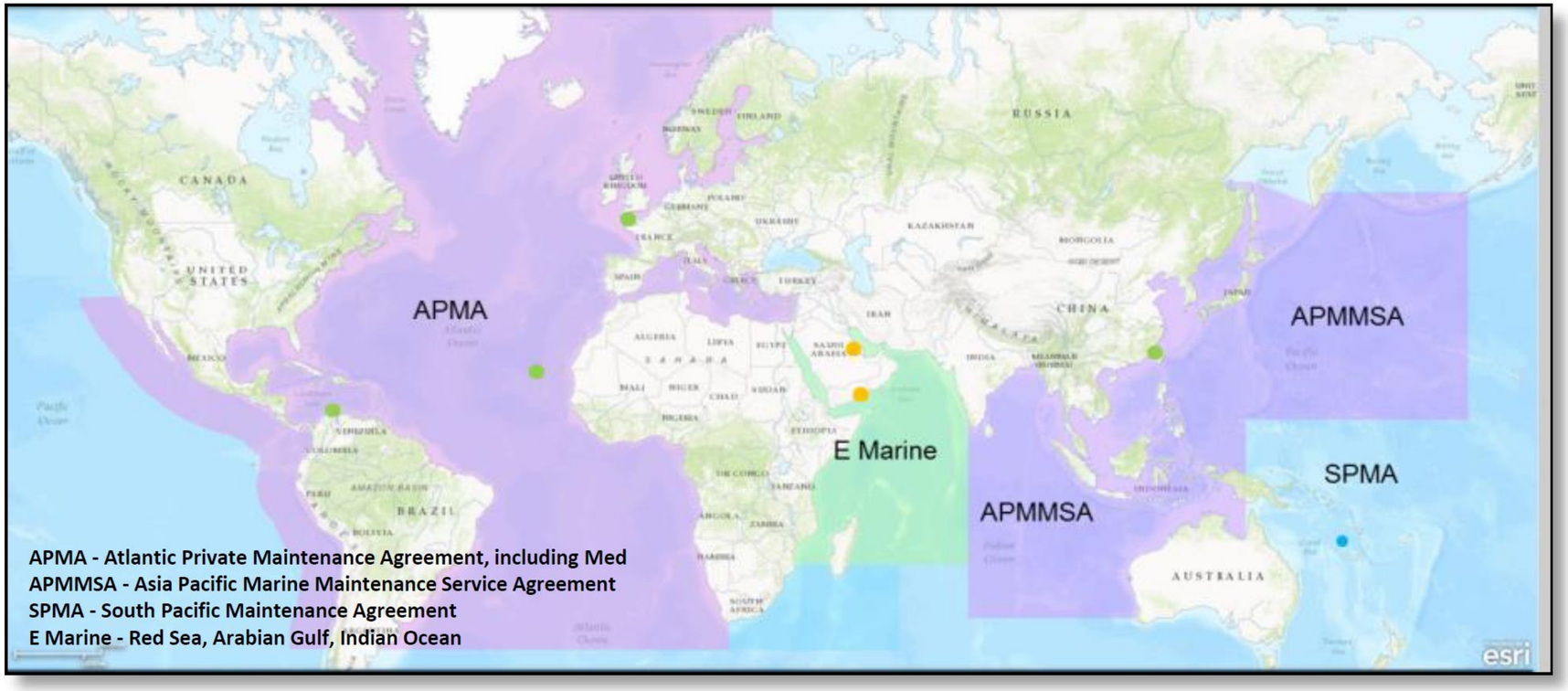
- To speed up repairs to the submarine cable network, cable repair ships are on standby at strategically located ports

Protection:

The submarine cable network must be regarded as **Critical Infrastructure.**

It must be given protection due to the huge economic, social & strategic impact when it´s disrupted.

Private Cable Maintenance Agreements



Companies	Base Ports
= ASN / TE SubCom	Calais, France; Cape Verde; Curacao *(APMA)*
	Taichung,Taiwan *(APMMSA)*
= Subcom	Samoa *(SPMA)*
= eMarine	Hamriya, UAE; Salalah, Oman

Map courtesy of TE SubCom

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