



Innovations in submarine networks technology
for enhanced protection
and environment monitoring

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Undersea infrastructure security • Many aspects to consider

Route selection (avoid risky areas)

Protection of physical infrastructure

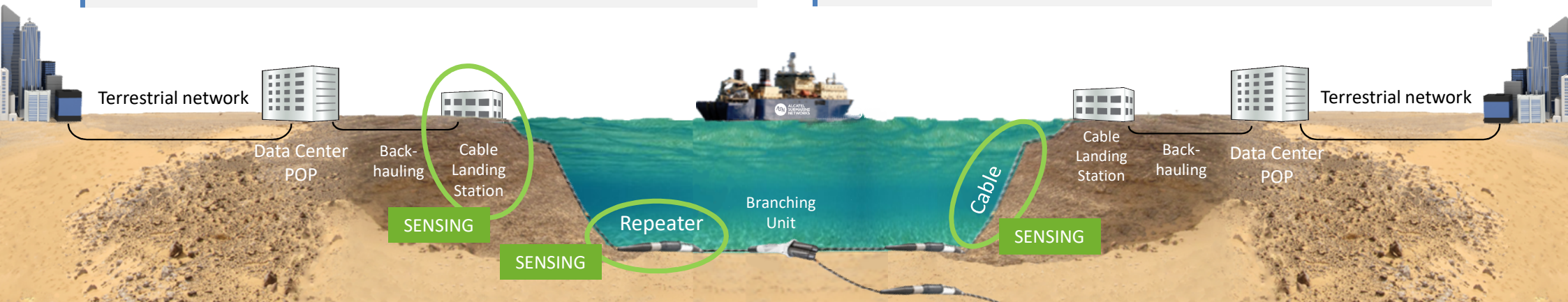
- Cables (armouring, burial)
- Submerged equipment (repeaters, branching units)
- Terminal stations (controlled access)
- Segregation of traffic flows
- Traffic rerouting in case of cable cuts
- Maintenance cable ship strategy

Monitoring of physical infrastructure

- Optical reflectometry
- AIS
- SENSING

Protection and monitoring of network infrastructure

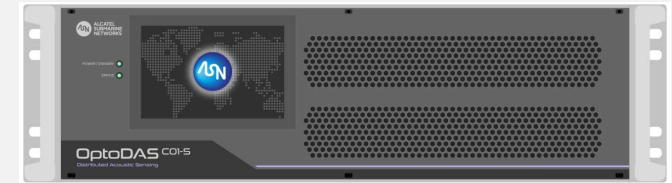
- Encrypted network management
- Cyber-protection



An example: DAS for protection of submarine cables

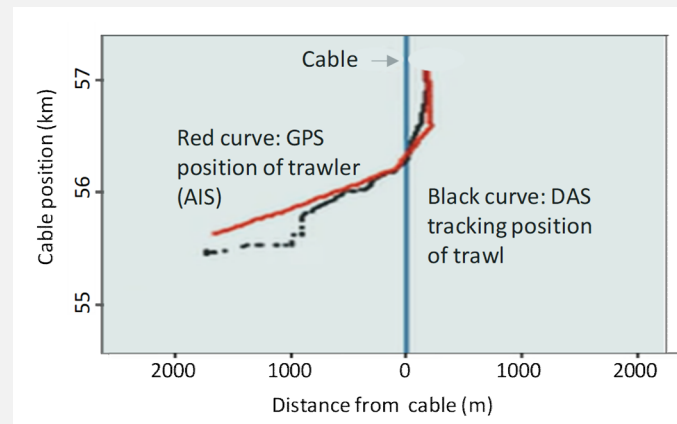
Advanced **Distributed Acoustic Sensing** (DAS) over a dedicated optical fiber inside a submarine telecom cable allows to monitor threats to that submarine cable

- Early detection, localization and identification of **external threats** (fishing activities, dredging, anchor drops,...)
- Monitoring and localization of **natural threats** (sea currents, underwater landslides and seismic activity)

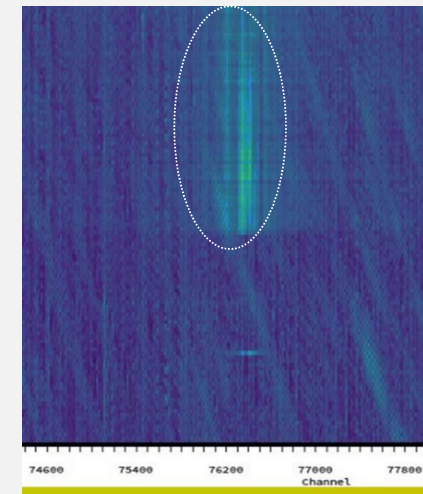


Seabed trawl activity

A trawl touching the sea bottom will generate acoustic surface waves propagating on the seabed. With DAS equipped on submarine Telecom cable, trawl activities can be continuously tracked and localized. Warnings can be issued when trawls are approaching the cable, for triggering protection measures. Vessel identification can be made through AIS data.



Field test of trawl activities in the area of an operational telecom cable installed in the North Sea



Anchor drop

This picture shows a waterfall plot of DAS recorded signal from an anchor dragging event at positions around 76 km along a submarine cable (x-axis with time along y-axis)

ASN is committed to climate action → S.M.A.R.T !

SMART repeaters, currently under development, will add, on top of the core telecom amplification, a range of environmental measurement capabilities (ocean temperature, sea bottom pressure, undersea currents, undersea seismic activity, etc.)

Data collected by SMART repeaters will be carried back to shore through the telecom cable, for further processing, allowing a variety of analyses needed to better understand climate change and its effect on the oceans ecosystem.

Applications will range from tsunami / earthquake early warning to collecting data on global warming and sea level rise.

