



Submarine Cable Network Security

A presentation to APEC by

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Submarine Cable Protection
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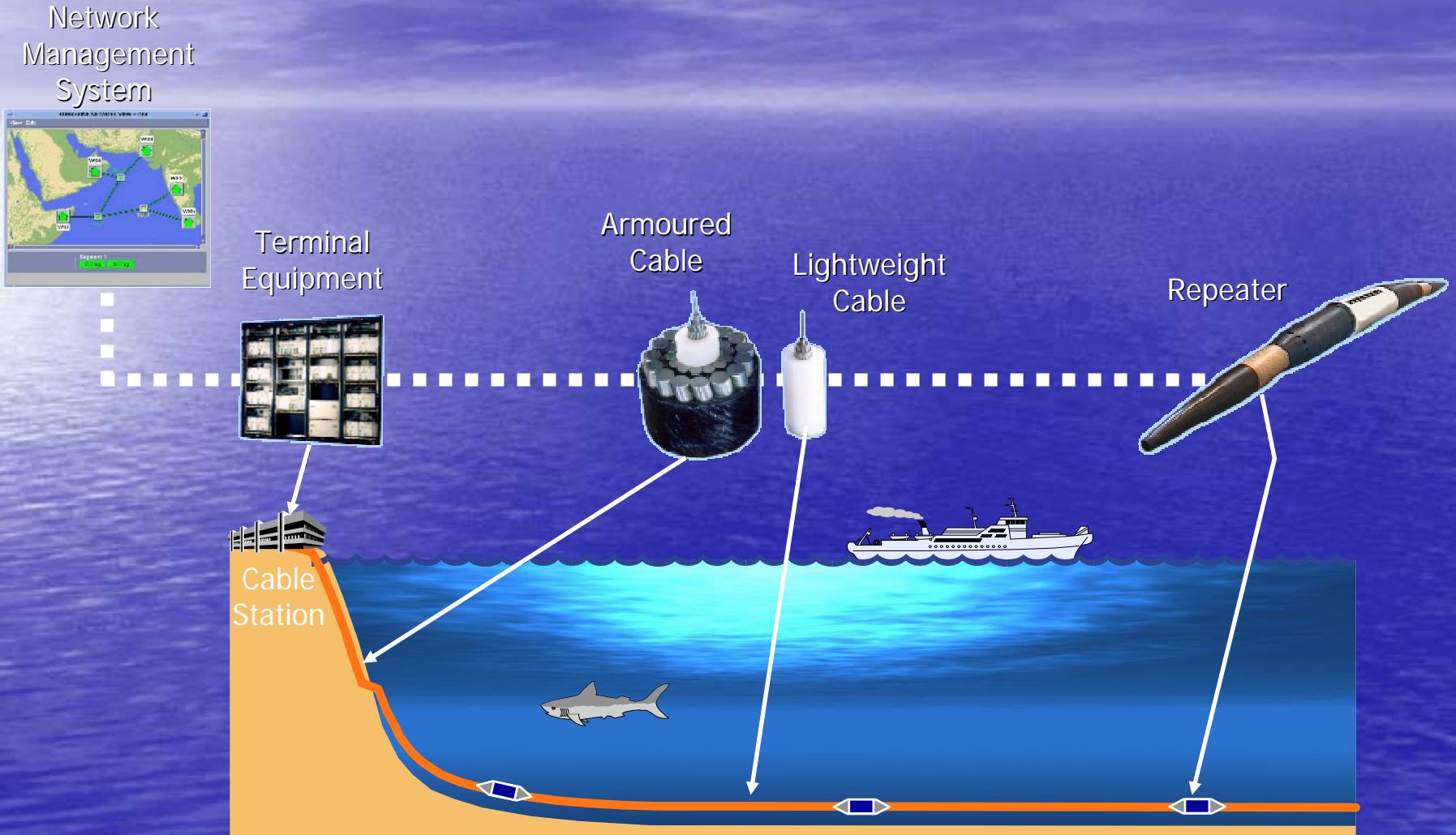
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- Threats to Network Security
- Legal Aspects
- How Governments Can Help

International Cable Protection Committee (ICPC)

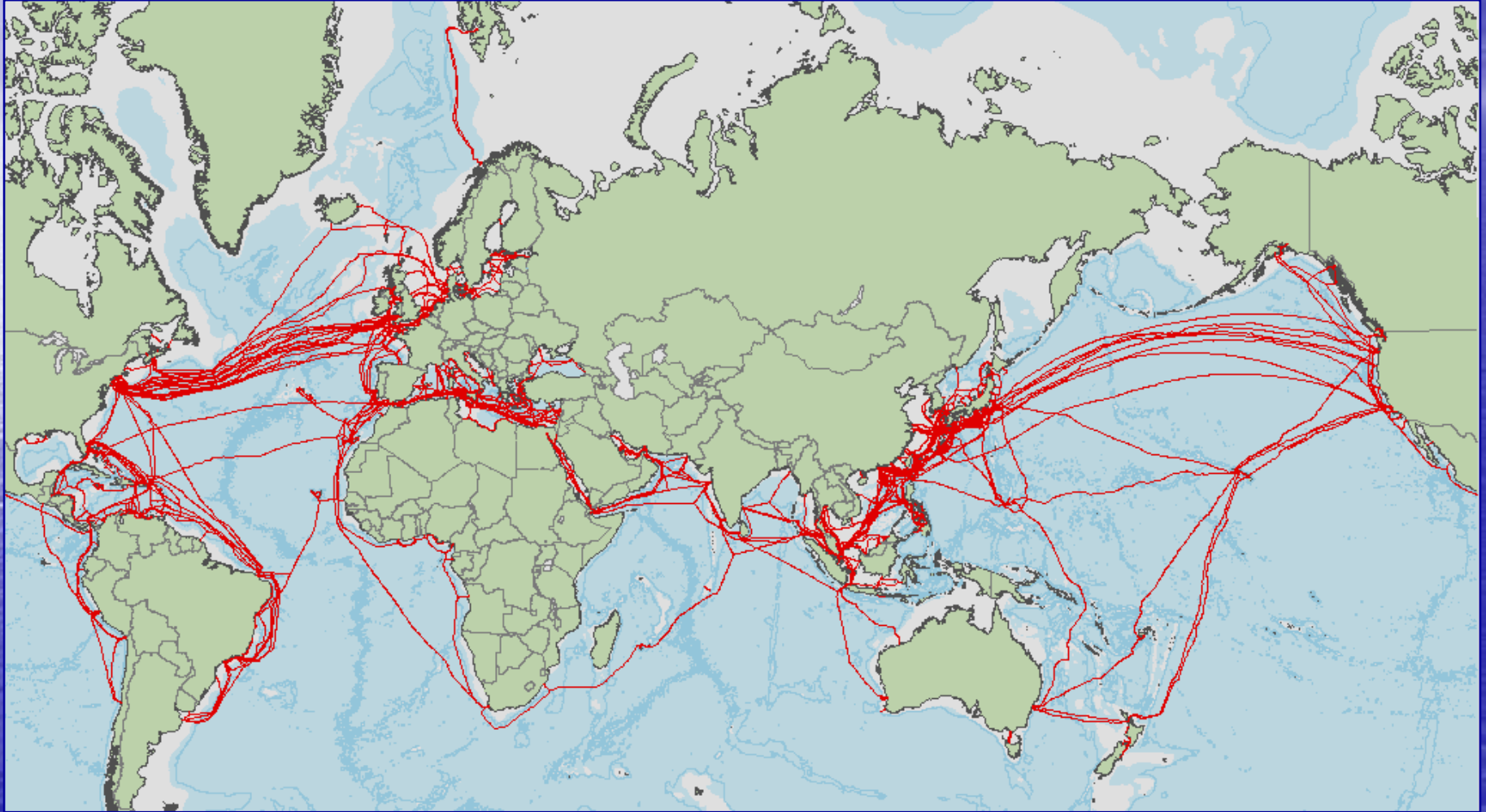
- The ICPC's 94 members include all major communications and cable companies from 53 economies
- The ICPC has a mandate to provide leadership and guidance on issues related to submarine cable planning, installation, operation, maintenance, protection and retirement
 - We monitor the evolution of international treaties and national legislation and help to ensure that submarine cables are fully protected
 - We promote awareness of how a large proportion of the global economy is now totally dependent upon the security of the submarine cable network

Typical Submarine Cable System



Source: U.K. Cable Protection Committee & Alcatel-Lucent Submarine Networks

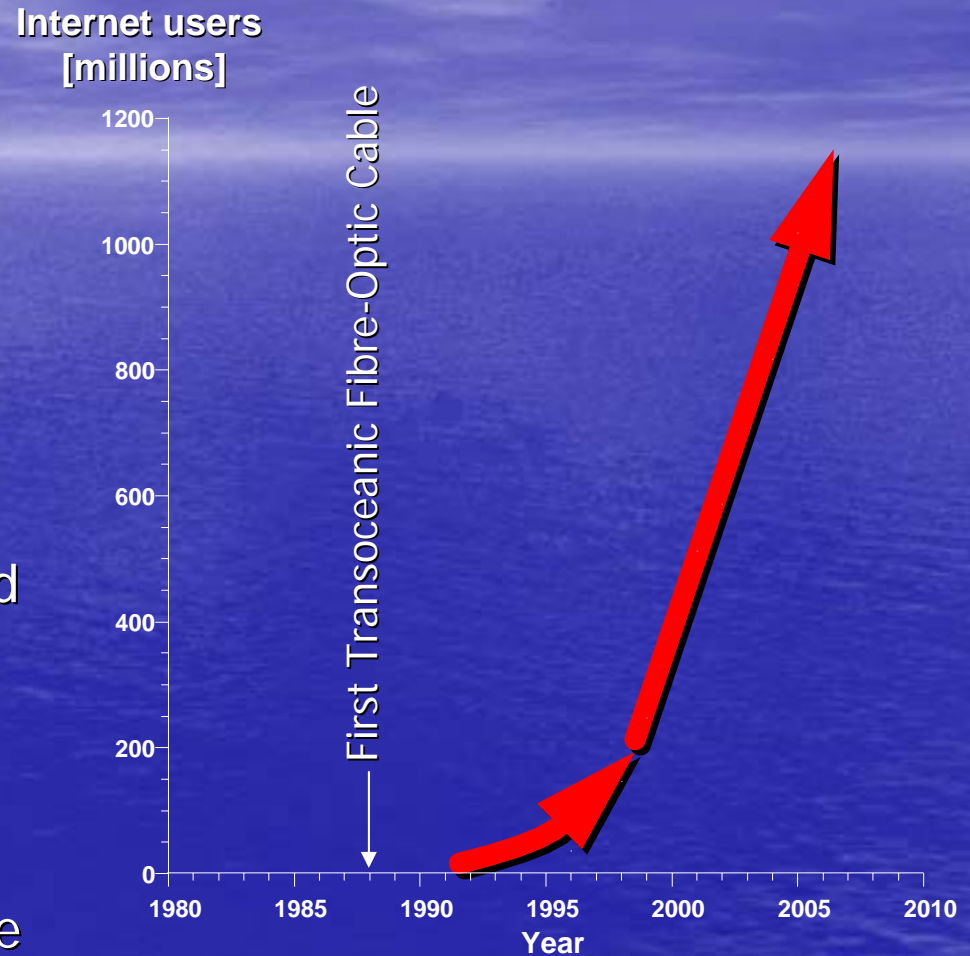
International Submarine Cable Network



Source: Global Marine Systems Ltd

Submarine Cables & the Internet

- 1988: First transoceanic fibre-optic cable installed
- 1991: Internet-based World-Wide Web (WWW) introduced
- The two new technologies complimented each other perfectly:
 - The growing network of fibre-optic submarine cables enabled large volumes of voice & data traffic to be rapidly carried around the globe
 - The Internet made data & information accessible & usable for many purposes
- The world changed!



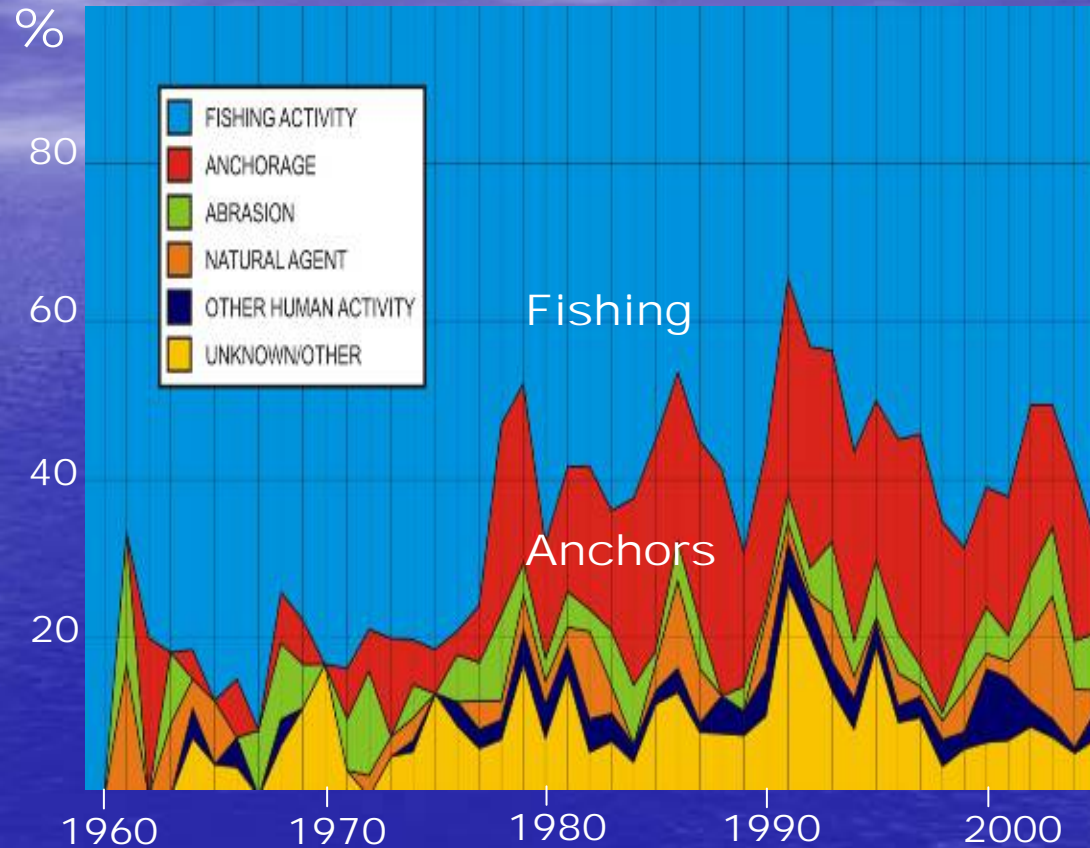
Source: Internet World Statistics

Submarine Cable Security

- Submarine cables are the backbone of the international telecommunications network
- Over 95% of transoceanic communication is sent via submarine cable
- The submarine cable network is designed to be resilient, however there are several threats that can cause major disruption to the global economy

Threats From External Aggression

- **Fishing** – high incidence but impact restricted to individual cables
- **Anchors** - medium incidence but can impact several cables
- **Natural Hazards** (e.g. earthquakes) – low incidence but can impact multiple cables



Cable faults caused by external aggression demonstrate the impact of human activities

Base data provided by Tyco Telecommunications & Global Marine Systems
Published in Wood & Carter (2008) IEEE Journal of Oceanic Engineering

Threat #1 - Fishing Activity



Cable damaged by trawling gear
Source: Tyco Telecommunications

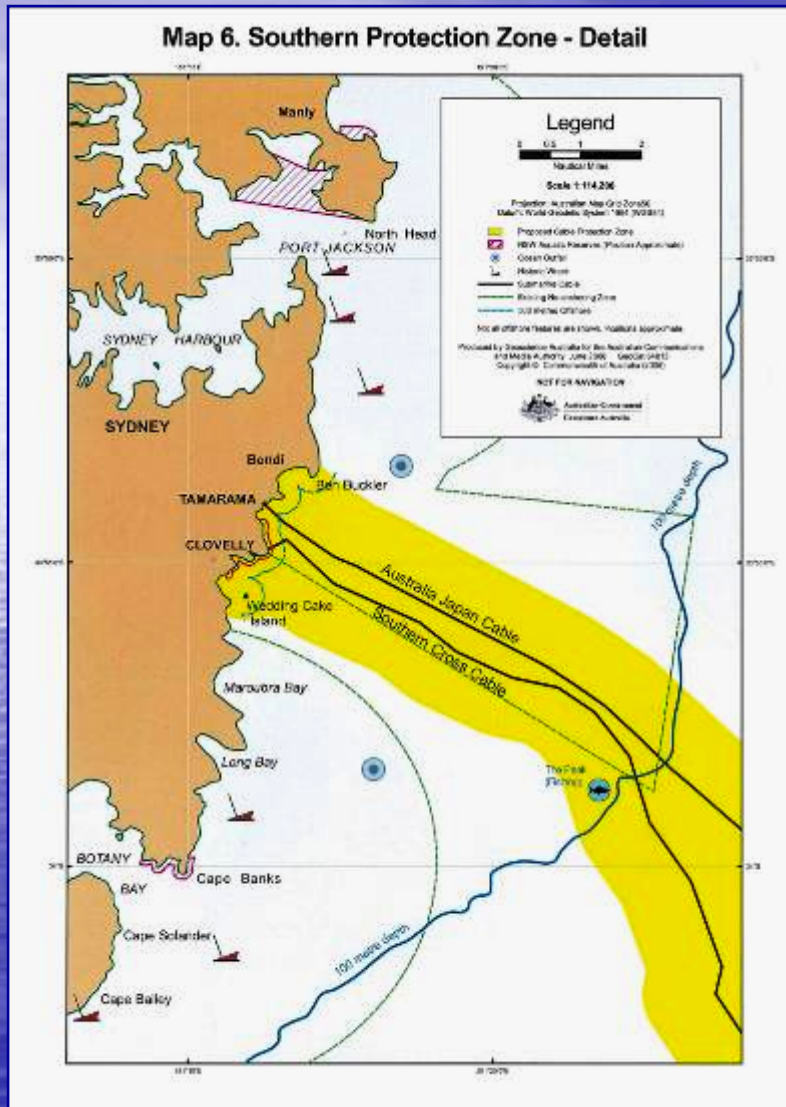
Protecting Cables from Fishing Activity: Best Industry Practice

- Conduct surveys to identify the safest cable route
- Select the best cable type for each part of the route
- Bury the cable into the seabed wherever possible
- Maintain cable awareness programmes
- Provide 24x7 telephone support so that a ship's crew can easily seek guidance if their gear is believed to be caught on a cable
- Make Governments aware of the problem and encourage formation of cable protection zones

Protecting Cables from Fishing Activity: How Governments Can Help

- Educate fishermen about the importance of submarine cables
- Implement tougher cable protection regimes
- Consider creation of Cable Protection Zones
- Ensure that the law is enforced

Cable Protection Zone Example



- Australian Government has recognised the strategic importance of submarine cables
- Protection zones designated for Southern Cross & Australia-Japan cable systems
- Zones are 3.7km wide & run to 2000m water depth
- High risk operations banned & low risk activities restricted
- Criminal penalties up to \$A330,000 &/or 10 years prison

Source: Australian Communications & Media Authority

Threat #2 - Ship Anchors



Source: Tyco Telecommunications

Protecting Cables from Ship Anchors: Best Industry Practice

- Route cables outside designated anchorage areas and port approaches
- Provide cable overlays for port radars
- Use Automated Identification Systems (AIS) to provide early warning systems
- Liaise with port authorities and shipping industry
- Maximise diversity between cables to minimise risk of multiple failures
- Bury cables to sufficient depth where feasible
- Make Governments aware of the problem

Ship Anchors: How Governments Can Help

- Facilitating the application of AIS and closer liaison with submarine cable industry
- Help the shipping industry to be aware of the risk of dragging anchors whilst underway
- Consider creation of Cable Protection Zones
- Ensure that the law is enforced

Threat #3 – Piracy

- 2 active submarine cable systems were extensively damaged by depredations committed by 3 Vietnamese fishing vessels in 2007
- The motive was recovery of copper components under a state program
- Actions are piratical under UNCLOS 100/101 and violate UNCLOS 113
- These incidents were unprecedented in the history of submarine cables and caused tremendous disruption to the telecommunications network
- There is potential for exceptionally long outage if remanufacture of equipment is required to bring any depredated cable system back into service



Attempted Theft of Cable & Equipment



Source: Tyco Telecommunications

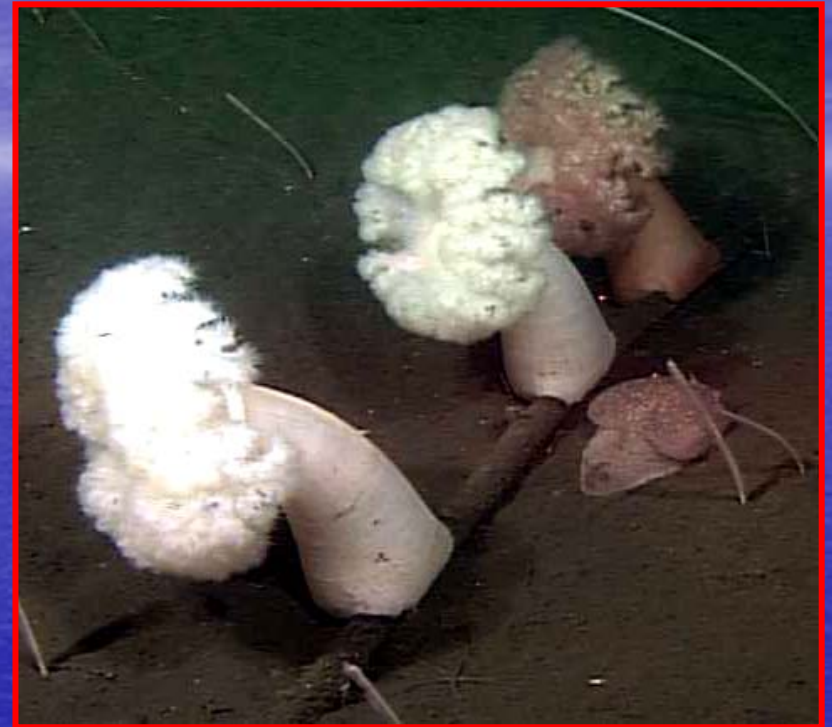
- Cables ship left the end of a cable attached to a buoy and returned to port for operational reasons
- Returned a week later to find that this trawler had retrieved the buoy (the yellow object in the photo)
- Several hundred metres of mooring line and 300 metres of submarine cable were found onboard

Protecting Cables from Piracy: How Governments Can Help

- Develop a protocol among relevant Government agencies to provide a fast and coordinated response in the event of pirate attacks
- As part of the protocol, provide a single point of contact for cable owners to call in an emergency
- Deploy naval forces to help protect submarine cables
- Undertake naval exercises & war games involving the submarine cable industry to test protocols in an international setting
- Extend international law to protect international cable systems and cable ships from hostile acts, e.g. those committed by pirates or terrorists

Submarine Cables & the Environment

- Properly installed fibre-optic cables have neutral to benign effect on marine environment.
- Their small diameter means “footprint” is small, especially when compared to submarine pipelines.
- Composed of non-toxic materials stable in sea water.
- Provide substrates for marine organisms.
- Seabed disturbed by burial, recovers.



ATOC/Pioneer cable with marine life on & close to cable

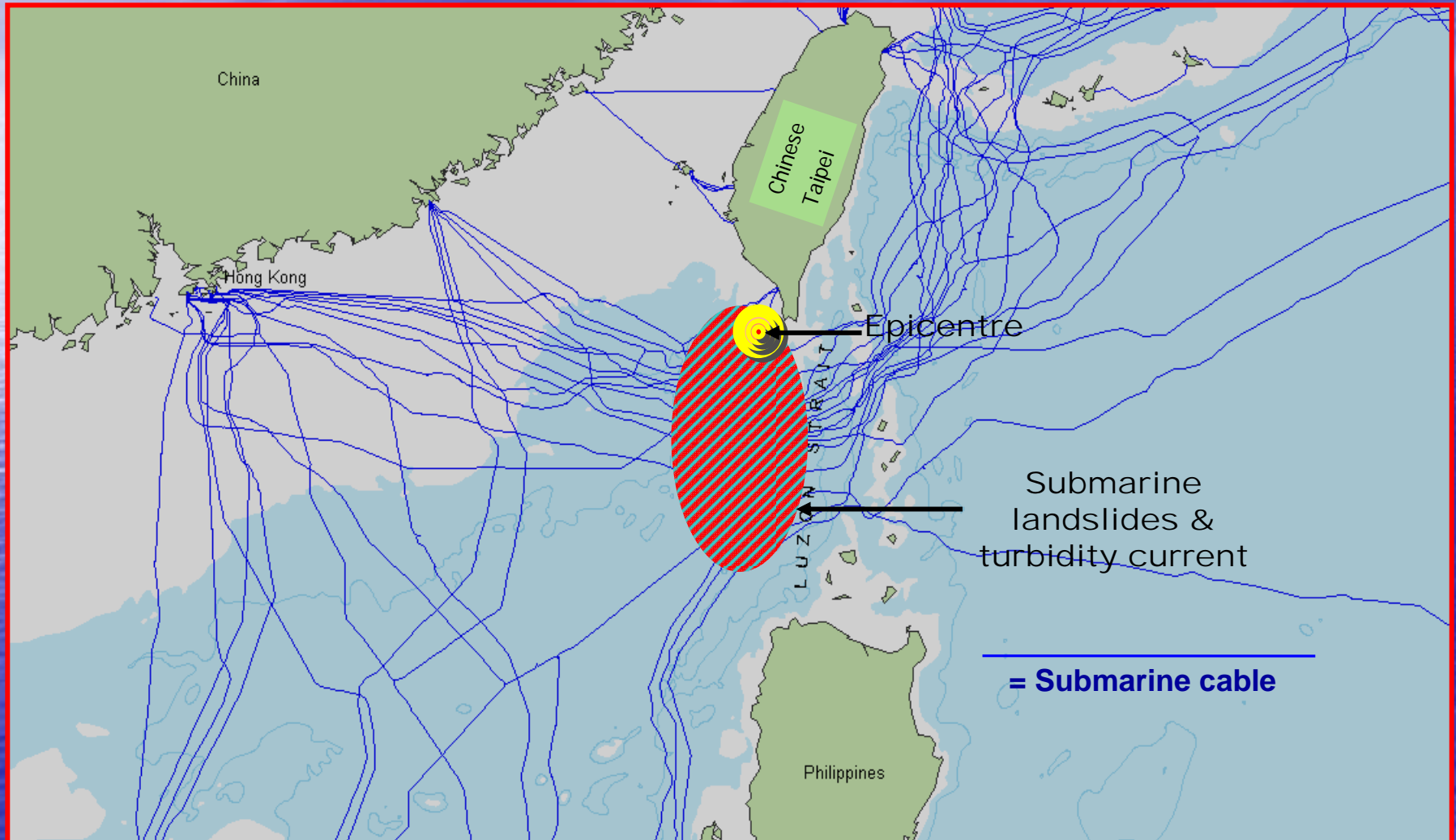
Courtesy: Monterey Bay Aquarium Research Institute

Threat #4 - Natural Hazards

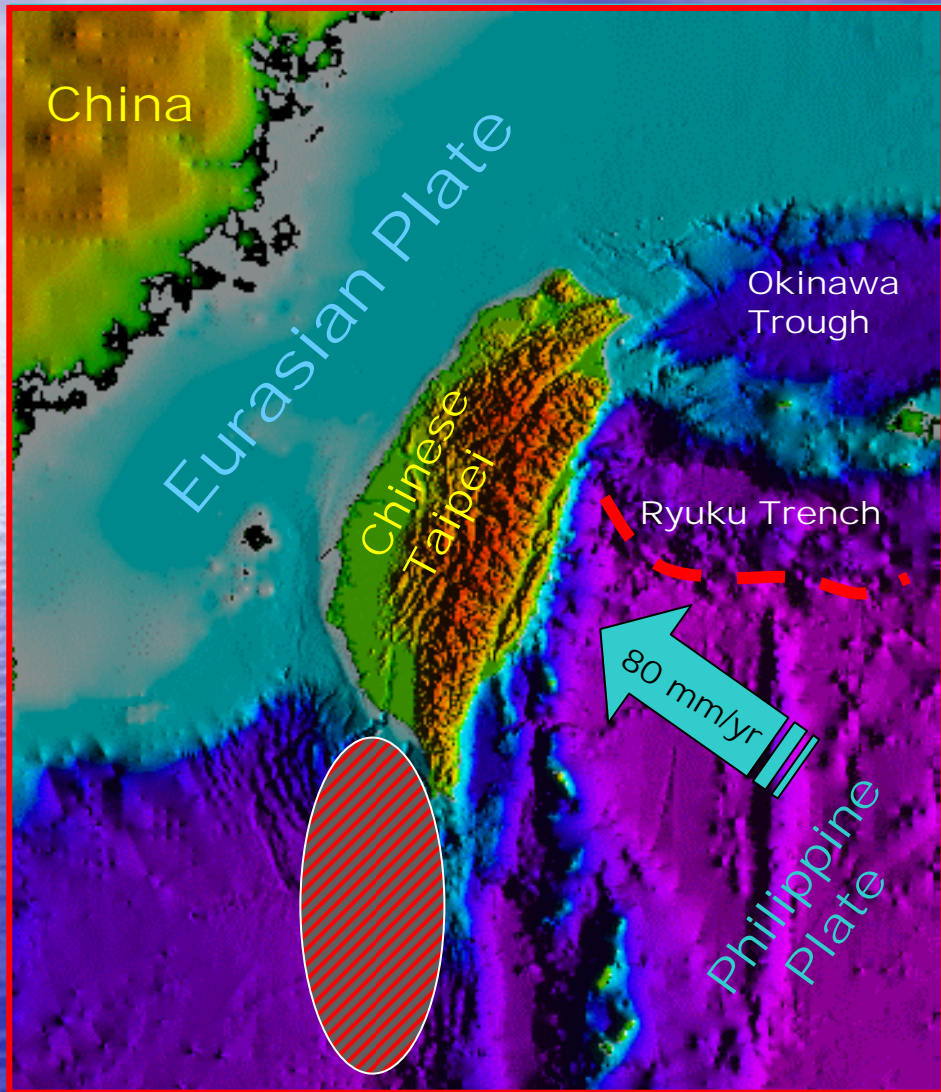
These include:

- Submarine earthquakes & landslides;
- Waves & ocean currents;
- Tsunami and storm surges;
- Extreme weather (e.g. hurricanes);
- Icebergs or volcanic activity;
- Climate change.

Hengchun 2006: An Earthquake that Caused Major Disruption to the Cable Network



Hengchun 2006: What Happened?



- Earthquake triggered submarine landslides near junction of 2 tectonic plates.
- Landslides caused turbidity current that flowed over 330 km & broke 9 cables in sequence.
- From the timing of breaks, the average speed of the turbidity current was $\sim 20\text{km/hr}$.
- Damage occurred in water depths to 4000m & some cables covered with mud from current.
- Cable repairs involved 11 ships & took 49 days.

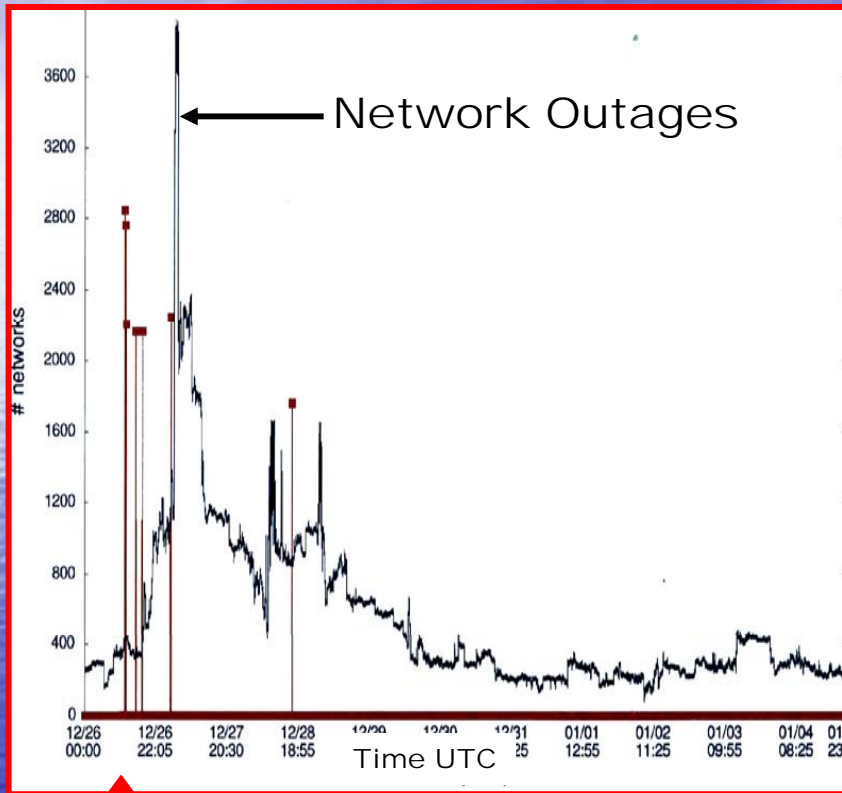
Modified from Source: Anderson M., U. Arizona Geosciences

Simulation of Turbidity Current



**Subaqueous Debris Flow
shedding a turbidity current
St. Anthony Falls Laboratory
University of Minnesota
Provided by: Gary Parker**

Hengchun 2006: Repercussions



Courtesy Popescu et al., 2007

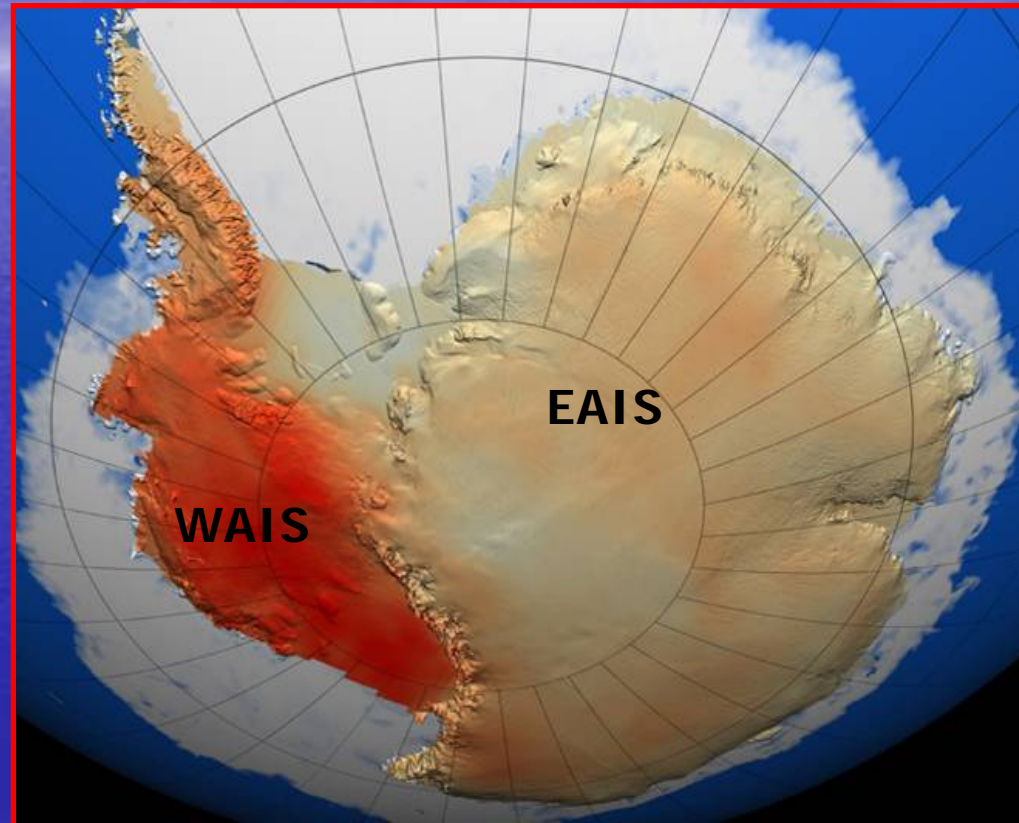
E'quake

- Internet linking China, Hong Kong, Vietnam, Chinese Taipei, Singapore, Japan & Philippines was seriously impaired.
- Banking, airline bookings, email & other services either stopped or delayed.
- Financial markets & general commerce disrupted.
- Although most traffic quickly re-routed via undamaged cables, some delay apparent 2 months after earthquake.

Climate Change

Cables exposed to more hazards under global warming:

- Rising sea level due to thermal expansion of ocean & melting ice sheets.
- Increased winds & related wave/current activity.
- More intense hurricanes, cyclones, typhoons.
- Changes in marine activities, e.g. fishing.



Warming trends in Antarctica 1957-2006
Red equal to 0.25°C warming per decade

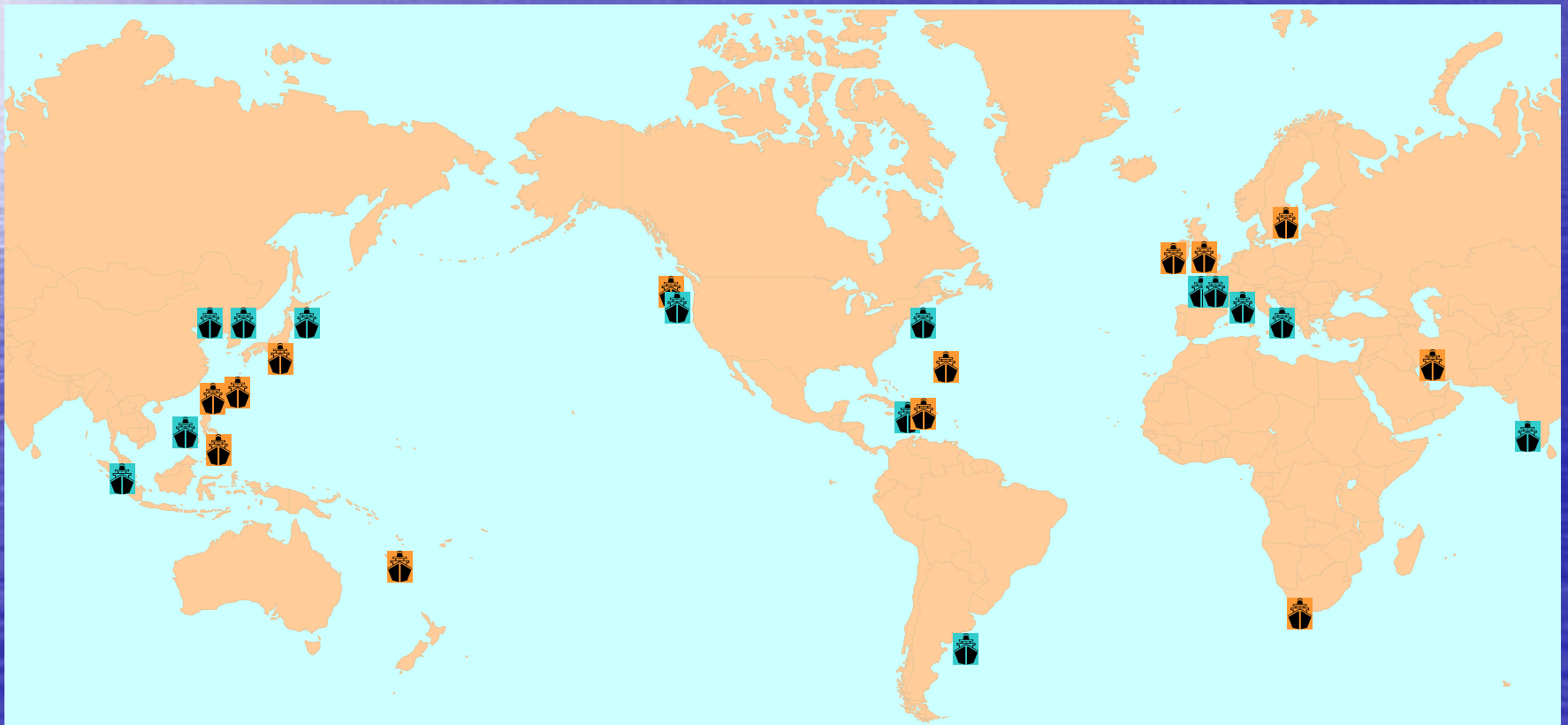
Courtesy Earth Observatory NASA

Cable Protection & Marine Sanctuaries

- Cable protection zones can serve a dual purpose by acting as marine sanctuaries to improve biodiversity & fish stocks.
- To be effective, each zone must have a habitat that is suitable for marine life and the zone must exist long enough for ecosystems to develop.
- Strong policing against illegal fishing essential.

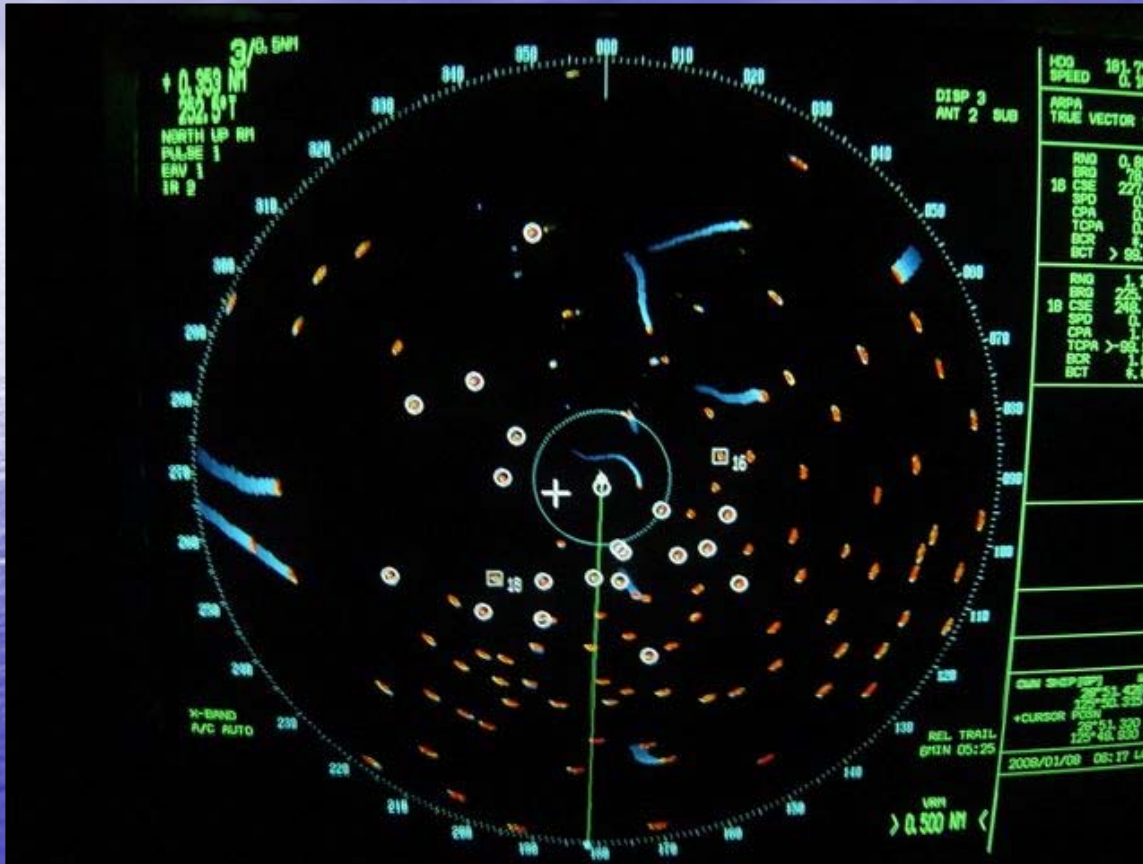
Cable Repairs

Cable owners maintain guaranteed access to strategically located specialist ships that can mobilise for a cable repair within 24 hours:



Source: Alcatel-Lucent Submarine Networks

Potential for Interference from Fishermen



- Radar from operational cableship showing more than 50 fishing vessels within a 5 km radius in the East China Sea
- More than 10 were within a mile of the cableship, causing interference with the cable operation
- Some fishing vessels approach far too close, risking collision & entangling nets

Source: Tyco Telecommunications

Threat # 5 – Interference during Operations



Source: Tyco Telecommunications

- This fishing vessel approached within 5 metres of a cables ship that was engaged in cable operations
- Its crew did not respond to radio & physical warnings
- The vessel left only after a warning flare was fired

Threat # 6 - Permitting Delays

- Some States require permits to be issued before cable repair operations are allowed to start
- This introduces a delay, which can be significant
- Any delay increases risk of multiple cable failure
- Multiple cable failure can cause major disruption to the telecommunications services in the region
- There is no legal or practical reason for requiring permits before repairs are undertaken

Permit Delay Example #1

Permits required for a repair in Territorial/EEZ Waters:

- | | |
|-----------------------------------|---------|
| 1. Ministry of Home Affairs | 28 days |
| 2. Ministry of Defence | 14 days |
| 3. Specific Period Licence | 14 days |
| 4. Indian Coastal Conference | 14 days |
| 5. Vessel Temporary Importation | 3 days |
| 6. Importation Duty – Consumables | 3 days |
| 7. Naval Security Inspection | 1 day |

Minimum period to obtain permit for repair = items 1 + 5 + 7

= **32 days delay**

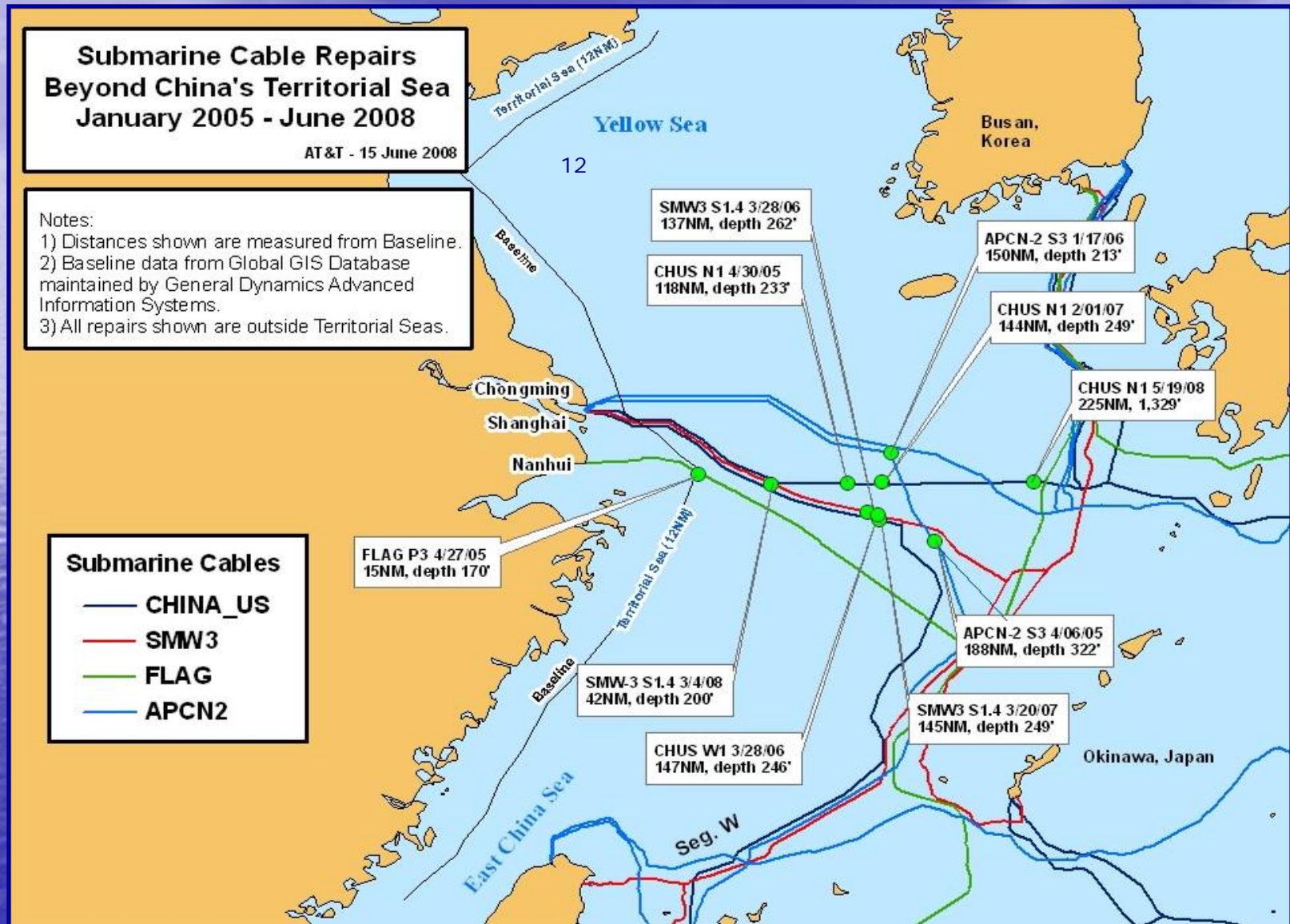
Note: Pre-clearance may reduce delay to 16 days

Permit Delay Example #2: SE Asia

- The Hengchun earthquake in 2006 resulted in 21 submarine cable faults
- This caused severe disruption to telecommunications services in the SE Asian region
- Cable repair permits were required in an area where there are conflicting maritime boundary claims
- This caused significant delays to the start of cable repair operations
- One Government caused further delay by increasing its permit fee without notice

Repairs Beyond China's Territorial Sea

January 2005-June 2008



Source: AT&T

Ship Operator's Prudent Approach

- After obtaining a permit from one nation, cables have been approached by Coast Guard of neighbouring nation due to lack of permit (it became clear that area was disputed)
- Having a cable ship detained by authorities is a risk that ship operators will not take
- Fault locations are sometimes uncertain
- Nations' requirements & agencies change
- So, for every operation near any country's territorial sea and extended area, we must have our local representatives ask whether a permit (or multiple permits) are needed

Cable Repairs

How Governments Can Help

- Facilitate repair of international cables by reinforcing duty of all Nations to cooperate in repairs
- Eliminate all repair permits/licenses/fees/guard boat requirements for all repairs to international cables beyond territorial seas
- Accord cable repair ships innocent passage status for the purpose of undertaking repairs in territorial seas
- Ensure that the law is enforced

Submarine Cables & International Law

- The importance of international communications to humanity has been recognized & enshrined in international law since 1884
- Submarine cables are covered by the United Nations Convention on Law of the Sea (UNCLOS)
- They have a priority status under UNCLOS, particularly in international waters
- Ships engaged in the laying or repair of submarine cables have protected status under rules of the sea

UNCLOS - 1

- Article 21.1(c):
Law and regulation of the coastal state relating to innocent passage
- Article 51.2:
Existing agreements, traditional rights and existing submarine cables
- Article 58.1-2:
Rights and duties of other States in the exclusive economic zone
- Article 79.2/5:
Submarine cables and pipelines on the continental shelf
- Article 87.1(c):
Freedom of the high seas

UNCLOS - 2

- Article 112:
Right to lay submarine cables and pipelines
- Article 113:
Breaking or injury of a submarine cable or pipeline
- Article 114:
Breaking or injury by owners of a submarine cable or pipeline of another submarine cable or pipeline
- Article 115:
Indemnity for loss incurred in avoiding injury to a submarine cable or pipeline
- Article 297(1)(a):
Limitations on applicability of section 2

ARTICLE 112: Right to Lay Submarine Cables....

1. All States are entitled to lay submarine cables and pipelines on the bed of the high seas beyond the continental shelf
2. Article 79, paragraph 5, applies to such cables and pipelines

ARTICLE 78:

Legal Status of the Superjacent Waters.....

1. The rights of the coastal state over the continental shelf do not affect the legal status of the superjacent waters or of the airspace above those waters
2. The legal exercise of the rights of the coastal State over the continental shelf must not infringe or result in any unjustifiable interference with navigation and other rights and freedoms of other States as provided for in this Convention

Article 79:

Submarine Cables & Pipelines..... 1

1. All States are entitled to lay submarine cables and pipelines on the continental shelf, in accordance with the provisions of this article
2. Subject to its right to take reasonable measures for the exploration of the continental shelf, the exploitation of its natural resources and the prevention, reduction and control of pollution from pipelines, the coastal State may not impede the laying or maintenance of such cables or pipelines
3. The delineation of the course for the laying of such pipelines on the continental shelf is subject to the consent of the coastal State

Article 79:

Submarine Cables & Pipelines..... 2

4. Nothing in this Part affects the right of the coastal State to establish conditions for cables or pipelines entering its territory or territorial sea, or its jurisdiction over cables and pipelines constructed or used in connection with the exploration of its continental shelf or exploitation of its resources or the operations of artificial island, installations and structures under its jurisdiction
5. When laying submarine cables or pipelines, States shall have due regard to cables or pipelines already in position. In particular, possibilities of repairing existing cables or pipelines shall not be prejudiced

ARTICLE 58:

Rights & Duties of Other States in EEZ

1. In the exclusive economic zone all States, whether coastal or land-locked, enjoy, subject to the relevant provisions of this convention, the freedoms referred to in article 87 of navigation and overflight and of the laying of submarine cables and pipelines, and other internationally lawful uses of the sea related to these freedoms, such as those associated with the operation of ships, aircraft and submarine cables and pipelines, and compatible with the other provisions of this Convention
2. Article 88 to 115 and other pertinent rules of international law apply to the exclusive economic zone in so far as they are not incompatible with this Part

Threat #7 – Failure to Enforce the Law

Some coastal states do not comply with UNCLOS because they:

- Require permits, fees & guard boats for repairs beyond territorial seas
- Fail to enact domestic legislation to protect submarine cables
- Fail to update existing legislation to comply with UNCLOS
- Fail to enforce existing legislation

Failure to Enforce the Law : How Governments Can Help

- Suspend and/or remove requirements for permits, fees, guard boats, etc for repairs of international cables outside territorial seas
- If not already done, enact or update national law to comply with UNCLOS cable protection provisions
- Ensure that international & national law is enforced

Summary

- The submarine cable industry operates a network that is designed to be robust and resilient
- This is to maintain an infrastructure that is vital to the global economy and society
- Nevertheless, threats from human activities and natural hazards persist
- Coordinated efforts between the cable industry and Governments are required to ensure maximum protection

Way Forward

Governments can help by:

- Implementing UNCLOS compliant laws (where none exist) and enforcing them
- Establishing a single point of contact for cables within governments for addressing repairs and any other emergencies
- Developing , testing and practicing emergency maritime response procedures with industry participation on an international, bilateral or multilateral basis for threats to cables and repairs
- Discontinuing the requirement for repair permits, fees and guard boats
- Considering the establishment of zones and/or regulations in accordance with international law to better protect cables



Sharing the seabed in harmony

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