Chapter 19. Submarine Cables and Pipelines

Group of Experts: Alan Simcock (Lead member)

1. Submarine communications cables

1.1 Introduction to submarine communications cables

In the last 25 years, submarine cables have become a dominant element in the world's economy. It is not too much to say that, without them, it is hard to see how the present world economy could function. The Internet is essential to nearly all forms of international trade: 95 per cent of intercontinental, and a large proportion

(Terabit, 2014). Figures 1 and 2 show diagrammatically the transatlantic and transpacific submarine communications cables that exist. More detailed diagrammatic maps showing submarine cables in the Caribbean, the Mediterranean, North-West Europe, South and East Asia, and Sub-Saharan Africa can be found here: http://submarine-cable-map-2014.telegeography.com/.

Two Arctic submarine communications cables are reported to be planned, linking Tokyo and London: one will go around the north of the Eurasian continent, the other around the north of the American continent through the North-West passage; both would service Arctic communities *en route*. In 2012, both were planned to be in service by 2016. The link by the American route is said to be under construction but is not now expected to be complete until 2016. The link around the Eurasian route is reported to be stalled (Hecht, 2012; Arctic Fibre, 2014; Telegeography, 2013; APM, 2015).

Deployed international bandwidth (in other words, the total capacity of the world's international cables) increased at a compound annual growth rate of 57 per cent between 2007 and 2011. It reached 67 Terabits per second (Tbps) in 2011, which was six times the bandwidth in use in 2007 (11.1 Tbps). It has increased steadily since then and was estimated to be increasing to about 145 Tbps in 2014 (Detecon, 2013). Submarine cable bandwidth is somewhat lower, as shown in Table 1. The investment necessary to support this steady stream of investment is provided through consortia. The precise balance of the different interests varies from case to case, but the major players are nearly always national telecommunications operators, internet service providers and private-sector equity investors. Governments are rarely involved, except through government-owned national telecommunications operators (Terabit, 2014; Detecon, 2013).

Table 1. Activated Capacity on Major Undersea Routes (Tbps), 2007-2013

The cable is normally buried in the seabed if the water depth is less than 1,000-1,500 metres and the seabed is not rocky or composed of highly mobile sand. This is to protect the cable against other users of the sea, such as bottom trawling. Known areas where mineral extraction or other uses are likely to disturb the seabed are avoided. In greater water depths, the cable is normally simply laid on the seabed (Carter et al., 2009). Where a cable is buried, this is normally done by a plough towed by the cable ship that cuts a furrow into which the cable is fed. In a soft to firm sedimentary seabed, the furrow will usually be about 300 millimetres wide and completely covered over after the plough has passed. On other substrates, the furrow may not completely refill. The plough is supported on skids, and the total width of the strip disturbed may be between two and eight metres, depending on the type of plough used. Various techniques have been used to minimise disturbance in specially sensitive areas: on the Frisian coast in Germany, a specially designed vibrating plough was used to bury a cable through salt marshes (recovery was monitored and the salt-marsh vegetation was re-established in one to two years and fully recovered within five years); in Australia, cables crossing seagrass beds were placed in narrow slit trenches (400 millimetres wide), which were later replanted with seagrass removed from the route prior to installation; in the Puget Sound in Washington State in the USA, cables were installed in conduits drilled under a seagrass bed. Mangroves are reported to have recovered within two to seven months, and physical disturbance of sandy coasts subject to high-energy wave and tide action is reported to be removed within days or weeks. Where burial has not been possible, it has sometimes been necessary to impose exclusion zones and to monitor such zones (as between the North and South Islands of New Zealand (Carter et al., 2009)).

Further disturbance will occur if a cable failure occurs. Areas of cable failure are likely to have already been disturbed by the activity that caused the cable failure. Normally, the cable will have to be brought to the surface for repair. This will involve the use of a grapnel dragged across the seabed, unless a remotely operated robot submarine can be used. Reburial of the cable may involve agitating the sediment in which it has been buried. This disturbance will mobilise the sediment over a strip up to 5 metres wide. Fibre-optic cables have a design life of 20-25 years, after which the cable will need to be lifted and replaced, with a recurrence of the disturbance, although there is also the possibility of leaving them in place for use for purposes of scientific research (Carter et al., 2009; Burnett et al., 2014).

Evaluating the impact on marine animals and plants of this disturbance is not easy, since the area affected, though long, is narrow. In general, the verdict is that the seabed around a buried cable will have returned to its normal situation within at most four years. In waters over 1,000-1,500 metres deep (where burial is unusual), no significant disturbance of the marine environment has been noted, although any repairs will disturb the plants and animals that may grow

1.3 Threats to communications cables from the marine environment

Soon after transoceanic communications cables were laid, problems were experienced from impacts of the marine environment on the cables: specifically, submarine earthquakes and landslides breaking the cables (Milne, 1897).

that facilitates the exchange of technical, legal and environmental information concerning submarine cable installation, maintenance and protection. It has over 150 members representing telecommunication and power companies, government agencies and scientific organizations from more than 50 countries, and encourages cooperation with other users of the seabed.

f these submarine cable connections, vital to global ussed.

marine communication cables, including how to survey environmentally eptable routes and allow for the submarine geology. Coastal States need access to decide on safe locations and to take account of areas of potential change and disruption, or (at least) to negotiate successfully with undertakings planning to install cables within their jurisdictions that involve uses of the seabed within their jurisdictions that may prevent or limit other legitimate uses of the sea, States

2.1 The nature and magnitude of submarine power cables The number and extent of submarine cables communications are much less significant, both in terms of their impact on the marine environment and in their importance to the world economy. They are essentially of only local interest. Most of the world's submarine power cables are found in the waters aroun The cables fall into one of two classes

The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 2. Diagrammatic map of transpacific submarine cables. Source: Telegeography, 2014.

The AC cables include those between the mainland of Germany and its island of Heligoland, between Italy and its island of Sicily, between Spain and Morocco, between Sweden and the Danish island of Bornholm and, outside Europe, between the islands of Cebu, Negros and Panay in the Philippines. The DC cables include cables linking the Danish islands of Lolland, Falster and Zealand to Germany, Denmark to Norway, Denmark to Sweden, Estonia to Finland, Finland to Sweden, France to the United Kingdom, Germany to Sweden, the Italian mainland to its island of Sardinia and to the French island of Corsica, the Netherlands to Norway (at 580 kilometres a much bigger area.

water. Submarine gas and oil pipelines fall into three groups: intra-field pipelines, which are used to bring the oil or gas from well-heads to a point within the operating

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