The Role of Governments in Subsea Cable Repair:

Views from the Indo-Pacific

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About the Author

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CONTENTS

ABBREVIATIONS & ACRONYMS

AIS	Automatic Identification System
AJC	Australia Japan Cable
APMMSA	Asia Pacific Maritime Maintenance Service Agreement
ASN	Alcatel Submarine Networks
BMH	Beach Man Hole
BU	Branching unit
CCRC	Cable Connectivity and Resilience Centre
CDN	Content Delivery Networks
CLS	Cable Landing Station
CPZ	Cable Protection Zones
DAS	Distributed acoustic sensing
DNS	domain name service
ICT	Information Communication And Technology
JCNSS	Joint Committee on the National Security Strategy
LEO	Low Earth Orbit
PFE	Power Feed Equipment
ROADM	Reconfigurable Optical Add-Drop Multiplexer
ROV	Remotely operated vehicles
SEAIOCMA	South East Asia and Indian Ocean Cable Maintenance Agreement
SLTE	Submarine Line Terminal Equipment
SOP	State of Polarisation
SPMMA	South Pacific Marine Maintenance Agreement
UJ	Universal joint

1. EXECUTIVE SUMMARY

Submarine cables carry almost all international data for the island nations of Oceania. As digital economies grow and dependence on connectivity deepens, this infrastructure is increasingly seen as a strategic asset for both socio-economic development and national security. The connectivity it provides is a public good, but the majority of the cables, and the system that repairs them are privately owned and commercially operated under maintenance agreements. Governments worldwide are asking what role they should play in ensuring cables can be reliably repaired when they fail, a question sharpened by a changing security environment and by cable fleet capacity pressures. This paper sets out what the commercial system in Oceania provides, where its limits sit, and a non-exhaustive list of options available to governments.

The commercial system works under normal conditions. The great majority of cable faults are caused by fishing and anchoring and repair operators routinely service this need, usually under a maintenance agreement, at a balance of service level and cost for its customers. The interdependency between communication networks is an incentive for cooperation between competing system owners and by extension repair operators because each company's network depends on others for redundancy.

There are several key factors that could disrupt current trends. The significant increase in cable kilometres planned for the region leaves an open question over whether fault numbers will rise in proportion. Climate change is increasing the frequency and severity of natural hazards. Extreme natural disasters can create multi-fault events, and severe storm events can reduce the windows in which ships can safely operate to repair them. Hyperscaler-owned cables are now a significant and growing presence in the region, but how those owners interact with existing maintenance structures in the future is still taking shape.

Two failure modes are worth separating. The first is slow repair under normal conditions when extended outages exceed what a country can absorb. Long Pacific Ocean transits cannot be designed out, but other components, including regulatory friction and fault reduction, can be addressed. The second is non-response or unavailability of a repair capability in a crisis, where the question is whether anyone will or can come at all. This could arise because of hostilities, a foreign government directing its operators not to service particular countries, or a multi-cable event that overwhelms available capacity. The two failure modes call for different responses. How acutely either failure mode is felt depends on the redundancy a country has in place.

The region relies on commercial interest to be served. No nation in Oceania owns or operates a specialised cable repair vessel, or maintains a workforce capable of doing so. This is not globally exceptional, but it does mean the region relies on commercial interest in serving it. Where the commercial conditions favour response, the system delivers. Where they do not, there is no immediate solution.

The paper examines options for governments across five areas: regulatory measures that reduce friction and fault frequency; maintenance and resilience-by-design choices at the point cables are planned and funded; vessel tracking and fibre sensing technologies; workforce development; and repair capabilities. These options are neither exhaustive nor mutually exclusive. Each carries different costs, control, and assurance trade-offs, and not every option will suit every nation.

2. METHODOLOGY

The research for this discussion paper involved consultation with a wide range of industry and government stakeholders, industry experts across the world, as well as desk research. This informed my perception of stakeholder views and the various options that might be possible.

3. DEFINITIONS

Bareboat charter

A chartering arrangement in which a vessel is leased without crew, provisions, or operational management. The charterer assumes full responsibility for crewing, maintenance, insurance, and regulatory compliance for the duration of the charter.

Branching unit (BU)

A piece of equipment used inline of a subsea telecoms cable to allow the cable to split off the main trunk line and serve more than one destination.

Cable landing station (CLS)

An onshore facility where a submarine cable makes landfall, housing the equipment that interfaces the marine cable with domestic terrestrial infrastructure. The concept of cable landing stations is increasingly fuzzy. Where it was once common to have cables come on shore at a Beach Man Hole (BMH) and then go into a cable landing station, which contained the Submarine Line Terminal Equipment (SLTE) and the Power Feed Equipment (PFE), it is becoming more common to have a PFE hut close to the BHM and the SLTE housed in a colocation space in a data centre. Alternatively, both the PFE and SLTE can be housed in a data centre, or even have different fibre pair owners within a cable choose to host their SLTE in different data centres. There are a variety of engineered solutions.

Cable ship

Unless otherwise specified, "cable ship" in this paper refers to a vessel equipped to lay, recover, splice, and repair submarine fibre optic telecommunications cables. These ships carry cable in dedicated tanks, use precision navigation and dynamic positioning systems, and support fault localisation and repair operations. Repair vessels are typically fitted with remotely operated vehicles (ROVs) for work in shallower water. They are also fitted with grapnels to help hook and recover the cable. Onboard power and optical testing capabilities further allow crews to test any cable brought on deck. Cable ships are distinct, but not always mutually exclusive, from cable installation vessels used in power, oil and gas, or offshore wind. The Lodbrog, currently based in Oceania, is a telecoms cable ship that can also handle power cables.

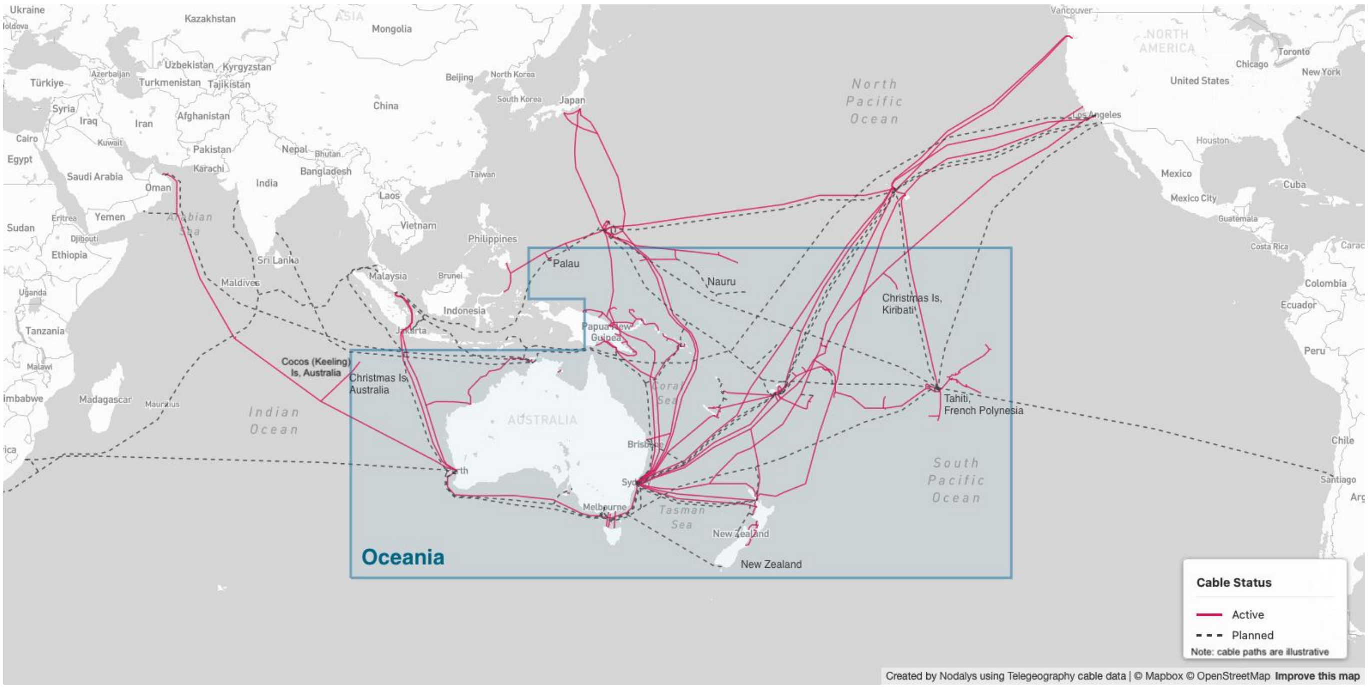
Figure 1 An illustration of a cable ship capable of installation and repair. (Image: Ulstein[1])

[1] 'OMS Group contracts Ulstein for two next-generation cable-laying vessels', Ulstein Group, 16 March 2020, online.

Oceania

Oceania is defined in this paper as Australia, New Zealand, and the South Pacific islands, spanning from the Cocos (Keeling) Islands in the west to Tahiti in the east, and extending north to just south of Guam. The diagram below is illustrative.

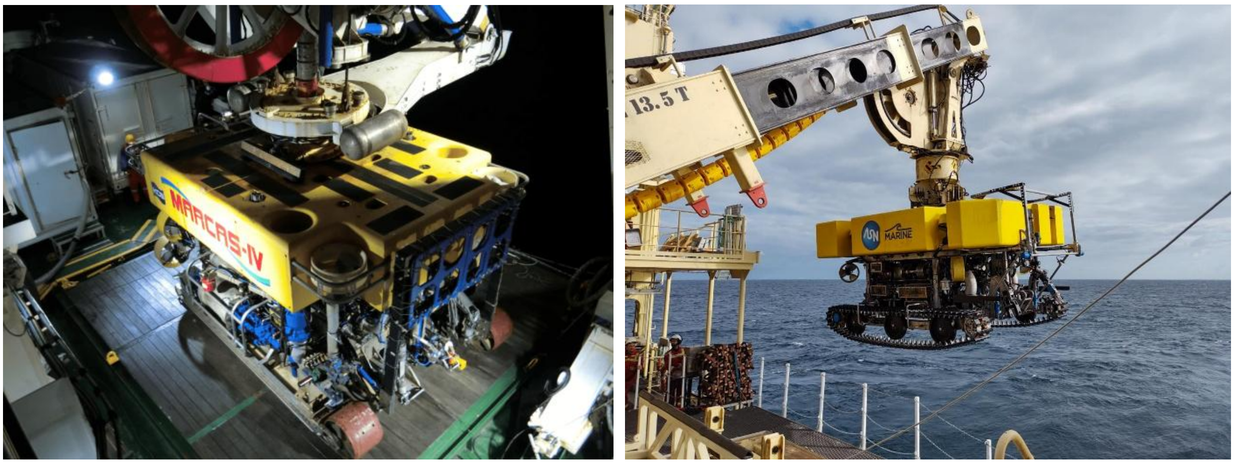
Figure 2 A diagram of Oceania as defined in this paper.



Remotely operated vehicles (ROV)

An underwater robot tethered to a cable ship by an umbilical cable that provides power and data transmission, and piloted by an operator onboard the ship. ROVs used in cable repair can dive down to around 2000-2500 metres and are equipped with cameras, sonar, and manipulator arms to inspect, recover, and reposition cables on the seabed. They are also fitted with a high-powered water jet capability that assists with burial (at installation) or reburial (during repairs) of cable. The same vehicles are widely used in offshore oil and gas, and pilots from that sector bring directly transferable skills.

Figure 3 Examples of ROVs. Left: The Marcas-IV[2] is used on the KDDI Ocean Link cable ship and can perform in water depths of up to 2500m. Right: an ROV used on the cable ship, Ile de Molene (Image sources: KCS & ASN)



[2] 'MARCAS-IV', KDDI Cableships & Subsea Engineering Inc., no date, online.

Repair operators

Companies that own or manage cable repair vessels and provide maintenance services to submarine cable systems. Repair operators are contracted, often through zone-based maintenance agreements, to respond to faults within defined geographic areas. Their role includes fault detection support, mobilisation of vessels, cable recovery, repair, testing, and redeployment. Repair vessel crew also support the update of the as-built cable system documentation to capture the details of each repair including location of joints, insertion of additional cable or subsea bodies, route of the repair cable bight and post-repair test results. These operators maintain specialised crews and equipment and must meet strict response time and operational readiness requirements.

Reconfigurable Optical Add-Drop Multiplexer (ROADM)

A device used in fibre-optic networks to route and manage light signals remotely. It allows network operators to dynamically add, drop, or redirect data channels across different paths.

Shunt fault

A shunt fault happens when a subsea cable’s outer insulation is damaged, allowing seawater to touch the internal power core and leak electricity into the seabed. Depending on the leak's severity and the cable’s power setup, it can either be compensated for by the power feed equipment (non-service affecting) or cause repeaters to fail (traffic affecting).

System owners

Entities that own or hold capacity rights in a submarine cable system. These may include telecommunications carriers, technology companies, infrastructure investors or a consortium of these entities. System owners are responsible for the governance, financing, and lifecycle management of the cable system, including contracting maintenance zones, funding repairs, and coordinating responses to faults.

Universal joints (UJs)

A standardised way of connecting almost all types of submarine optical fibre telecommunication cables, using a common set of equipment, methods, and parts. However, each vendor’s different cable family still needs their own unique UJ jointing kit.

4. INTRODUCTION

Beneath the world's oceans are the cables that make the internet truly global. Data underpinning international trade, global financial systems, and everyday communication flows through these garden hose-sized conduits. The connectivity provided benefits many areas including education, healthcare, and even cultural preservation.[3] Over the last decade, subsea cable connectivity in Oceania has been steadily growing. Density of cable connectivity varies across the region, but almost all countries are connected by at least one cable connection.[4] As digital economies grow and dependency on them deepens, national prosperity and security are becoming inextricably linked to reliable connectivity, increasing the need to ensure its resilience to disruption.

Although cable faults are routine, public and government interest in subsea cable security has grown sharply in recent years. Many countries now treat these digital assets as nationally critical infrastructure. Around the UK, Europe and Taiwan in particular, threats to telecom cables are increasingly suspected of being intentional, state-led damage, set against the broader pattern of coercive behaviour in those regions. The ongoing conflicts in Ukraine and Iran have reinforced concerns about the vulnerability of critical infrastructure and the security of maritime traffic. Together, these developments have brought a silent and largely unseen layer of communications infrastructure into public view. Some governments are now asking what their role should be in cable repair, particularly given that, since the turn of the century, most of this infrastructure is privately owned and operated.

Submarine cables in Oceania have also become a focus of strategic competition.[5] Ownership and operation of cable infrastructure confers influence over network equipment, landing stations, and the flow of data. The United States, Japan, Australia and New Zealand have funded cable infrastructure to shape who builds and operates it, framed by the US as creating “trusted networks”. The contest is ongoing and forms part of the backdrop to the repair capability question.

Many governments around the world have worked through similar questions within their own regional contexts. For instance, the UK ran a parliamentary inquiry in 2025, and in 2026 the EU produced a comprehensive cable security toolbox.[6] This paper explores this issue through the particular situation of Oceania. It does not argue for any specific intervention, but rather sets out the commercial repair system, its limits, and practical options for governments to consider reflecting Oceania's specific situation.

[3] Tuvalu’s "First Digital Nation" project is installing two submarine cables to provide the bandwidth necessary to migrate its sovereignty, government, and cultural archives to the cloud as its physical land faces submersion from rising sea levels. ‘Tuvalu the First Digital Nation’, Tuvalu.tv, no date, online.
[4] John Hibbard, Paul McCann, ‘Commercial challenges for Pacific island cables’, SubTel Forum Issue #137 - Regional Systems, *Submarine Telecoms Forum*, 15 July 2024, online.
[5] Jocelinn Kang, Jessie Jacob, ‘Connecting the Indo-Pacific: the future of subsea cables and opportunities for Australia’, Australian Strategic Policy Institute, 2024, online. Joe Brock, ‘U.S. and China wage war beneath the waves - over internet cables’, *Reuters*, 24 March 2023, online. Rob Powell, ‘Hibernia’s Express Buildout Suspended Due to Huawei’s US Problems | Telecom Ramblings’, 11 February 2013, online.
[6] ‘Undersea cables - Committees - UK Parliament’, no date, online. ‘Submarine Cable Security Toolbox and Cable Projects of European Interest | Shaping Europe’s digital future’, 5 February 2026, online.

5. UNDERSTANDING THE PROBLEM

The commercial cable repair industry is, on the whole, a functioning system. It handles 150-200 routine faults each year, the majority of which the industry assesses to be caused by human maritime activity. It has operated for several decades without direct government involvement, and under business-as-usual conditions, it works. However, most of this infrastructure is privately owned and operated, which means the system is designed for commercial efficiency rather than national resilience, and risk is weighed in commercial terms rather than national security terms.

The geopolitical environment in which the industry operates is changing. Great power competition is driving states to scrutinise critical infrastructure incidents through a security lens, raising suspicion that cable damage could be intentional or that physical and digital supply chains could be compromised. Whether attacks or accidents, the effect is the same: governments are directing policy attention toward high-consequence, low-likelihood scenarios that the commercial system is not incentivised to plan for.

That gap is best understood by looking at how connectivity is actually maintained. Two things working in combination keep it intact. The first is redundancy, meaning the ability to route traffic across alternative links so that if one cable has a fault, others can carry the load. The second is repair, meaning the capacity to restore a damaged cable to service. For the most part, what the commercial market delivers and what a country needs to stay reliably connected are aligned. The points where that overlap ends, and what that means for governments, is what this section examines.

5.1. Redundancy shapes the repair calculus

This paper focuses on repair, but repair is only one part of how connectivity is sustained. The other is redundancy, meaning having more than one way for traffic to reach its destination. Redundancy can be built through multiple cables on diverse routes, dispersed landing points, alternative connectivity technologies such as satellite or terrestrial links and also consideration to diverse supply chains. The likelihood of faults occurring in the first place can also be reduced, for example through cable protection measures and engagement with other maritime industries that share these spaces.

How acutely a fault is felt depends on what redundancy sits behind an affected cable. Where redundancy is robust, traffic continues over alternative paths, often without end users noticing. In these cases, slow repair is a commercial inconvenience rather than a national problem. Where redundancy is thin or absent, repair carries the full weight of the resilience question.

Countries in Oceania have varied connectivity profiles, so not every country in the region will experience cable faults in the same way. A country with multiple cable landings points with alternative terrestrial fibre pathways between them, resilient domestic internet infrastructure (e.g. domain name service (DNS), local caching, content delivery networks (CDN) are implemented in a way that ensures essential local websites and services still load inside the country even if international links fail), and established satellite backup, can absorb a prolonged outage in a way that a country without alternative routes cannot. For the latter, even a routine fault lasting several weeks can mean significant disruption.

These connectivity profiles are not fixed. As additional cables, or satellite services are connected, a single outage becomes less acute. In Scotland, the three-day disconnection of the Shetland Islands in 2022 is well known. What is less widely known is that five days prior there was an outage on their first cable. Connectivity held until there was a concurrent fault on the second cable. Similarly, in the Baltic Sea, despite extensive media coverage of the

November 2024 cable cuts, end-user impact was minimal because of the region's dense network of alternative submarine and terrestrial paths.[7]

Investment in redundancy and fault prevention will reduce the weight that falls on repair in the first place. The options examined later in this paper reflect this range, beginning with measures that reduce fault likelihood and consequence before moving to those that address repair directly.

5.2. Two failure modes worth separating

The tension between commercial efficiency and national resilience creates two distinct failure modes. The first can be improved in many areas by reducing friction in the existing system, improving processes and regulatory reform. Addressing non-response in a crisis raises the question of obligation and how to create assurance that repair will happen quickly, regardless of commercial conditions at the time.

5.2.1. When extended outages exceed what a country can absorb

In Oceania, a single repair vessel currently covers an enormous area. The total time from fault notification to restored connectivity is the sum of several components: the processing of any repair permit application(s), vessel and crew mobilisation, any transit required to collect spares from the depot, transit to the fault site, and then work on the repair. Total restoration is typically two to four weeks in Oceania. With only one ship covering the region, a concurrent fault elsewhere means the later fault must wait its turn.

Some of this time is structural and difficult to reduce, particularly long Pacific Ocean transits which can dominate the timeline. Pre-existing repair commitments can extend that wait, and spare parts availability can add further delay. Other components, including regulatory friction and how technology can improve situational awareness around faults and marine asset management, are examined in the options section. The increasing need for maintenance of older vessels can also affect vessel availability.[8]

5.2.2. Non-response

The second failure mode is when the commercial system does not or cannot respond. The question here is less how long a repair will take, but whether it can happen at all.

This could occur if hostilities make the operating environment too risky for commercial operators, both from an insurance standpoint and safety of the crew; if a foreign government directs its operators not to service particular countries; or if a simultaneous multi-cable event overwhelms available repair capacity in excess of commercial norms.

Additionally, the commercial arrangements underpinning repair capacity are subject to decisions made outside governments' control. A repair operator may exit a maintenance agreement[9], relocate vessels to a more commercially attractive region, or be acquired by a new owner with different priorities.

The boundary between the two failure modes is not always clean, as a deteriorating security environment or hostilities may slow down repair, before preventing it entirely, or slow it without preventing it at all. Blockades or hazardous military activity, such as unannounced

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[7] 'Resilient Internet connectivity in Europe mitigates impact from multiple cable cuts', *The Cloudflare Blog*, 20 November 2024, online. Emile Aben, 'How the Internet routed around Cable Damage in the Baltic Sea', 20 December 2025, online.
[8] Elaine Stafford, 'PTC'19 Submarine Cable Workshop Recap', *SubTel Forum Magazine*, Submarine Telecoms Forum, 18 March 2019, online.
[9] Around 2022, SubCom exited from providing maintenance and repair services globally to focus on cable installation for Google and their retainer arrangement with the United States Government's Cable Security Fleet.

live fire exercises in the location of a repair may temporarily delay the repair operation, rather than stop it completely.

6. THE COMMERCIAL REPAIR SYSTEM IN OCEANIA

This section sets out how the commercial repair system works, its limits, and what the regional picture in Oceania looks like against that backdrop. It runs from the mechanics of routine repair, through the structural pressures bearing on the industry, to what happens when the system is pushed beyond business-as-usual conditions.

6.1. How the repair system works

Repairs are largely organised through commercial maintenance agreements in defined geographic zones. Cable system owners contract with repair operators, who position vessel(s) strategically and economically within those zones.

When a fault is detected, the network operator first works to locate it, at least to the repeater span if not the exact location, and identify the type of fault: a shunt fault or fibre break or both, an undersea repeater, branching unit or ROADM failure, or a joint failure. The type of fault determines what spares may be required, how to get them on board, and where from. Additionally, it determines whether any specialist crew and/or owner's representative need to be mobilised before the vessel transits to the work site. The network operator then notifies the contracted repair operator, and a ship is mobilised, often contracted to move within 24 hours. The ship picks up spares from the spares depot if not already on board the ship, transits to the fault site, and pinpoints the fault with the help of teams on shore.

Recovery of the cable differs by depth. In shallow water, ROVs are deployed; in deeper water, like in the Pacific Ocean, grapnels are used to hook, cut and raise the cable.[10] The first cable end is secured at the surface with a buoy while the second end is recovered and the faulty section removed. The splicing of the replacement cable then starts. Typically, one UJ is applied on each end of the inserted cable. The length of the inserted repair cable is roughly three times the water depth. For example, in 5,000m water depth, about fifteen kilometres of cable is inserted. In some deep-water repairs, an additional repeater may be inserted along the replacement cable to maintain system performance to compensate for the long length of cable introduced into the repeater span. Once tested, the restored cable is returned to the seabed.

After locating the cable, the work itself typically takes five to seven days in good conditions.[11] But overall time varies depending on factors such as water depth, location, weather, how long fault-finding takes, and whether reburial is required.

Oceania is covered predominantly by three overlapping zones: South East Asia and Indian Ocean Cable Maintenance Agreement (SEAIOCMA), Asia Pacific Maritime Maintenance Service Agreement (APMMSA) and South Pacific Marine Maintenance Agreement (SPMMA). Most system owners in the region are members of SPMMA which covers all of Oceania. OMS Group (OMS), headquartered in Malaysia and partially owned by US private equity firm, KKR,[12] won the most recent contract and operates it in partnership with French government-owned Alcatel Submarine Networks (ASN). Currently, around 30 system owners are party to the private zone agreement, each holding an individual contract with the provider. As this is a private agreement, the particulars of the arrangement change as agreed by the parties.

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[10] There are a variety of methods to retrieve cables. SubCom, 'Subsea Fiber Optic Cable Recovery, Splice, & Release Animation', 23 May 2023, online.

[11] According to a professional in the subsea telecoms cable industry, repair vessels should have the capability to work in rough seas, up to sea state 5 or 6 (or even 7), but deployment of tools like ROVs and/or spooling out cable bights or jointing might not be safe in such conditions. The ship's hull will tolerate such conditions, but the feasibility of repair operations may be impacted until the waves decrease to 2.5-3.0m.

[12] Expert Group under Recommendation 2024/779 on Secure and Resilient Submarine Cable Infrastructures, '*Security and Resilience of EU Submarine Cable Infrastructures. Mapping, Risk Assessments, Stress Tests (Annex)*', October 2025, 55, online.

Figure 4 The Lodbrog (image courtesy of ASN)

In high-fault zones such as in the shallow waters and busy maritime shipping areas off East Asia, multiple vessels may service a single maintenance zone. In lower-fault areas, like the South Pacific, a single vessel covers the zone, spending much of its time on standby and, if the contract allows, taking on outside work such as cable laying, when not needed for repair.

The current vessel assigned to the zone is the Lodbrog, based in Fiji. The spares depot is located in Apia, Samoa. Both are designated by the members of SPMMA. As Oceania is serviced by only one ship, some spares are currently stored on the ship, so the Lodbrog does not always need to transit to the depot before each repair. The SPMMA zone encompasses all of Oceania and extends further still up to Hawaii and out to Indonesia. For repairs in Indonesia, the Teneo, an Indonesian-flagged vessel conducts those repairs. The size of the zone can grow and shrink based on the contract between the repair operator and the maintenance agreement members. Some system owners whose cables extend beyond the SPMMA zone boundary are also party to separate maintenance agreements. The Australia Japan Cable (AJC), for example, is in the Yokohama Zone agreement for its cable lengths north of Guam.[13] Not all cable systems in the region are part of the SPMMA, some systems are in bespoke private arrangements, and others, given the cost of maintenance, have chosen not to be part of any agreement. Although some cables in the zone have never needed repair, sitting outside an agreement is risky. A vessel of opportunity can be engaged directly, but the full cost of the repair falls on the cable owner alone, with none of the cost-sharing a zone maintenance agreement provides. In a cable laying boom finding an available vessel is harder still.

Cable faults are more common than most people may realise. The industry handles a global annual average of around 190 repairs, with 42 per cent caused by fishing and anchoring, and a further 42 per cent assessed to likely be caused by those activities (see Figure 5 below). In recent years there has been an unprecedented number of new systems coming into service. Despite this increase in cable kilometres and the causes of faults remaining

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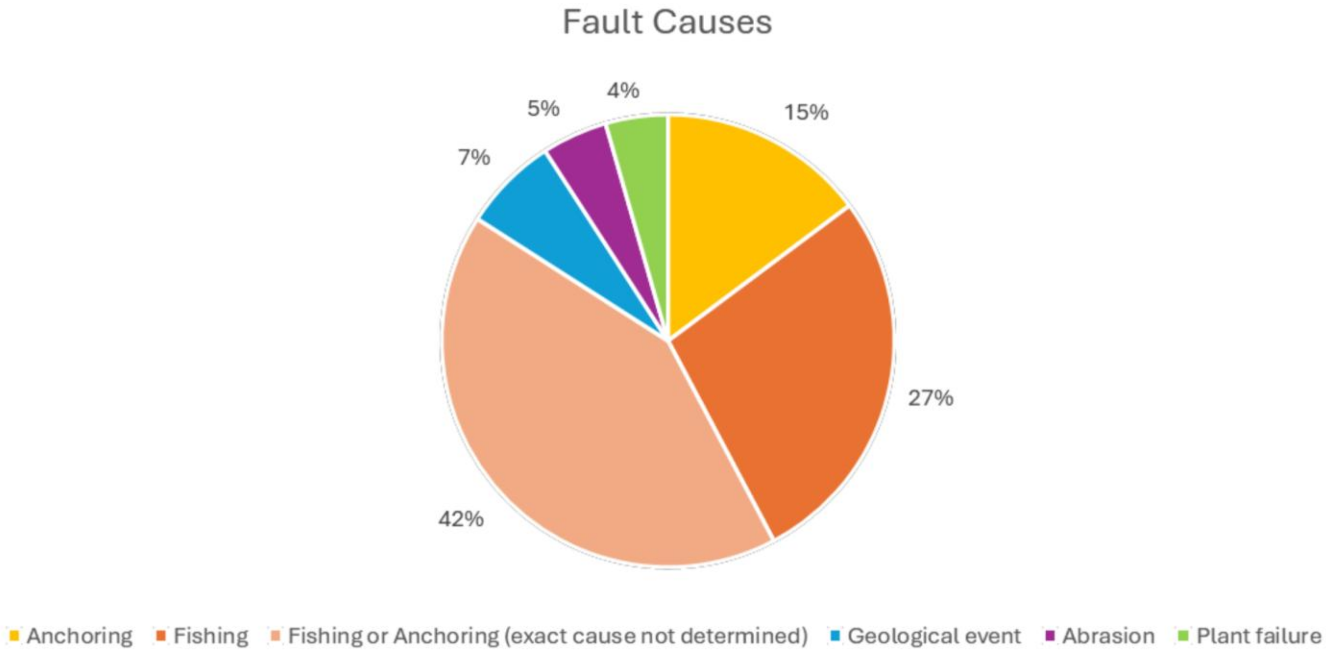
[13] 'Cable Ship', *Australia-Japan Cable*, no date, online.

much the same as in the 1880s, repair events have remained steady.[14] ICPC data shows a slight decline in fault rates globally, but there are regional differences, including Oceania.

Figure 5 Causes of subsea cable repair.



Fault data up to 2025 breaks down as follows: 15% Anchoring; 27% fishing; 42% Fishing or Anchoring (exact cause not determined); 7% Geological event; 5% Abrasion; and 4% Plant failure. (source: International Cable Protection Committee[15])

Industry interviews put Oceania's long term fault rate at around two per year on average, though that figure has roughly doubled over the last five years, driven by several multi-fault incidents discussed in the next section, and by the growth in cable kilometres now in the water. These fault rates are considered low. Faults generally occur in shallow water and busy shipping lanes, and Oceania has relatively little of either. Many of the islands have short continental shelves and sit in open ocean rather than the dense maritime corridors of regions like Taiwan. Furthermore, countries like Australia, New Zealand and Solomon Islands have established cable protection zones (CPZ) which aid in awareness and deterrence.

But the figure does not capture the full picture of the region's connectivity. Submarine cables connect at least two ends, and faults can occur anywhere along their length, including outside Oceania. Australia, for instance, has cables that run through the waters between Indonesia's many islands to reach the cable hub of Singapore. Indonesian cabotage rules require repairs in these waters to be carried out by an Indonesian-flagged ship and crew. The related permit application process adds approximately 6-7 weeks to the time line, according to a recent incident[16], as ships will not mobilise until a permit is secured, even when the fault sits close to the repair vessel.

Geography cuts both ways. The same open oceans that keep fault rates low mean that reaching a fault site takes days, sometimes weeks. Travelling from Fiji at around eleven knots (20km/hr or 500km per day), it would take approximately eight days to Port Moresby or Sydney, and two weeks to Perth, excluding weather delays.[17] If the assigned vessel is occupied and a supplementary vessel was brought in from the nearest alternative ports

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[14] '6. Cable Ships', *Submarine Telecoms Industry Report*, issue 14, Submarine Telecoms Forum, 30 October 2025, online.

[15] From the document 'Global Submarine Telecoms Cable Repair Data Analysis May 2026' provided to the author by the International Cable Protection Committee.

[16] 'GSL Status', Global Secure Layer, 14 February 2026, archived 14 February 2026, online.

[17] The South Pacific tropical cyclone season typically runs from November to April. 'South Pacific tropical cyclone season monitoring', Bureau of Meteorology, October 2025, online.

(Singapore, Philippines or Taiwan) it would still take ten to fourteen days to arrive. Distance is an inescapable feature of the region.

6.1.1. Cooperation and its limits

The system is more collaborative than its commercial structure might suggest. Networks are interdependent, using each other for failover and redundancy, sometimes through formal capacity swaps between competing systems. Even when a fault occurs on a competitor's cable, it is often in the operators' interest to see it repaired quickly, since the affected cable could be the backup for their own traffic.

This extends beyond data. SPMMA members share a pool of common components such as universal joints (UJs) and consumables, and these system owners will lend spares to competitors to speed up a repair. Cable itself is harder to share as it's not as easy to replace, since it varies by manufacturer and may carry different numbers of fibres. This makes the willingness to share it more significant. To aid Tonga's international cable repair following the 2022 volcano eruption, telecommunication provider OPT-NC in New Caledonia supplied 59km of cable, and Southern Cross Cable Network gifted three repair kits, "in the spirit of South Pacific cooperation".[18]

For major incidents that cause simultaneous damage to multiple systems, this interdependence, and the prospect of country-wide outages tends to bring the industry together. When earthquakes struck Taiwan in 2006 and damaged 9 cable systems at once, 11 ships converged from different zones and completed repairs in 49 days[19]. One repair operator reportedly coordinated across seven countries, two regions and nine telecommunications operators.[20]

Cooperation may also extend across maintenance zones more formally. For instance, there is a cross-zone agreement between SPMMA and APMMA which are private zone agreements operated by the same repair operator. These agreements mean that the operator's customers may agree to allow their repair asset to work outside the zone. These arrangements may reduce the pain of an extraordinary multi-fault event, but they are contingent on commercial availability and agreement member discretion. They all currently sit outside any formal mechanism that governments can call on directly.

Whether driven by commercial logic, genuine goodwill or both, this cooperative instinct has served the industry and its customers well so far. It is however voluntary and commercially contingent, not guaranteed, and willingness alone does not always translate into repair. External factors can further constrain what any commercial entity can do. After the Tohoku earthquake and resulting tsunami in 2011, operators were willing to coordinate, but repair was delayed while waiting for aftershocks to subside and nuclear contamination around Fukushima to recede.[21] In 2023, all five of Vietnam's submarine cables suffered faults over a period of months. Multiple cables were damaged by anchors and fishing, some in multiple locations along the cable; others suffered technical problems. Cable ships for the area were busy with other repairs and could not attend.[22]

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[18] Linny Folau, Mary Lyn Fonua, 'Torn apart, missing 110km domestic fibre optic cable may take year to replace', *Matangi Tonga*, 1 March 2022, online. João Tomé, 'Internet is back in Tonga after 38 days of outage', *The Cloudflare Blog*, 22 February 2022, online.
[19] ICPC Press Release, 'Subsea Landslide is Likely Cause of SE Asian Communications Failure', International Cable Protection Committee, 21 March 2007, online.
[20] 'KDDI Announces Restoration of Undersea Cables Destroyed by the Taiwan Earthquake', *KDDI Corporate Information*, KDDI, 13 February 2007, online.
[21] Comments by Kent Bressie, Legal Adviser, International Cable Protection Committee, 'Roundtable on Subsea Cables as Critical Infrastructure | UN Web TV', 30 March 2026, online.
[22] 'The untold story of a Japanese submarine cable repair ship that began repairing undersea cables severed in the Great East Japan Earthquake immediately after the disaster', *GIGAZINE*, 18 April 2024, online.

Beyond willingness, a ship can work only one fault at a time, so the system is built around sequential repair. When faults are spread across time, this is sufficient. When they are not, a backlog can build. More vessels on standby would reduce that risk, but at an additional cost.

The prioritisation of repairs is determined by commercial agreements and the cable owners within them, not by any government's assessment of which connection is most critical. While specific procedures vary by contract, the sequence is often determined by who reports a fault first. In scenarios involving multiple simultaneous faults, a fault where there is a total outage would take precedence over a non-service affecting shunt fault where traffic is still flowing. However, these rules aren't entirely rigid. Also, cable owners do negotiate with one another to bring forward a particular repair.

Supply chain constraints compound these operational limits. There is a finite stock of spare cable. If spares are heavily drawn down on one repair or the length of cable required exceeds spare cable in stock, it can take six to nine months to manufacture and deliver replenishment stock. The latter was the case in 2022 when undersea turbidity currents from the volcanic eruption destroyed an extremely long section (110km) of Tonga's domestic cable.[23] As a result, the cable took almost 18 months to repair. That timeline was governed by production schedules, not national need.

6.2. Pressures on the industry

Although the system functions, there are structural pressures that exist in the industry.

The fleet of cable ships is aging. According to a June 2025 SubOptic Association industry report, of the approximately 62 cable ships in the world, only around 19 are contracted maintenance vessels, with a further 17 performing repair ad-hoc when not installing.[24] The same report suggests that 15 maintenance vessels will need replacing by 2040, five of those within five years; and along with the need for up to five additional vessels in Asia, will require roughly $3 billion in investment. Operators are extending vessel lifetimes partly because maintenance contracts are typically only five years, making it difficult to justify the capital expenditure of a replacement. Other industry sources have noted some shift in cable ship investment since the report's publication, with new, mostly installation vessels, being planned or launched, and governments announcing support.[25] This includes marine services companies such as LD Armateurs (formerly Louis Dreyfus Armateurs) that services ASN, which has recently been backed by a massive €1 billion investment which would enable it to double its fleet tonnage across the sectors it services, including telecoms.

Day rates for cable laying are around four times that of repair work in a region like SPMMA, which pulls vessels toward installation contracts when new-build demand is high. For Oceania specifically, this is less constraining than the headline figures might suggest. Any vessel that can lay a cable can in principle repair one, and the region has for many years been serviced by older installation vessels. The same demand cycle is now driving orders for new ships and conversions, for both to expand fleets and as replacements for old vessels. OMS has four new vessels expected for completion in 2028.[26] In 2025, NTT WEM expanded their fleet with the conversion of the CS Vega II.[27] Japanese cable manufacturer and installer, NEC, is reportedly planning around 50 billion yen (USD$314 million) on five vessels,

[23] Folau, 'Torn apart, missing 110km domestic fibre optic cable may take year to replace'.
[24] Mike Constable, Lane Burdette, Alan Mauldin, 'The Future of Submarine Cable Maintenance: Trends, Challenges, and Strategies', SubOptic, June 2025, online.
[25] '6.2 Future Cable Ships', *Submarine Telecoms Industry Report*, issue 14, Submarine Telecoms Forum, 30 October 2025, online.
[26] 'Construction begins on CS GENESIS and CS TRIUMPH for OMS Group', Royal IHC, 16 December 2025, online. 'OMS Group contracts Ulstein for two next-generation cable-laying…', *Ulstein Group*, 16 March 2020, online.
[27] 'VESSEL REFIT | Vega II – Walk-to-work vessel upgraded for cable-laying operations for Japanese owner', *Baird Maritime / Work Boat World*, 7 October 2024, online.

with Japan's government considering subsidies.[28] In 2025 the global fleet of ships spent 55% of its time on cable installation and 25% on maintenance and repair, with the remaining time unable to be classified.[29]

Vessels operating in the oil and gas and offshore wind sectors could in principle lay telecoms cables, but they don't because telecoms work pays less than the jobs already available to them. Converting them for cable repair also takes time, meaning they cannot serve as an immediate fallback in a crisis.[30]

The workforce faces parallel pressures. While some roles are easier to fill than others, the global pool for telecoms cable ships is small, ageing, and hard to grow. A single repair ship is made up of a crew of 50 to 60 people with skills learned largely on-the-job. A cable engineer, for instance, can take seven to ten years to develop to a point where they can work confidently and safely. Awareness of the telecoms cable industry outside the sector is low, and pipelines for new entrants are limited.[31] There is some overlap with adjacent offshore sectors in marine skills, cable handling, and ROV piloting, but overall the operations differ enough that meaningful crossover would take a concerted effort, one made harder by the better pay and living conditions offered by the other sectors.

One industry survey conducted by SubTel Forum revealed the scale of the problem.[32] In 2024, around 43 per cent of respondents assessed skilled labour availability as insufficient; by 2025 that figure had risen to 73 per cent. Attracting talent, cited by around a quarter of respondents as the biggest workforce development challenge in 2024, was named by 43 per cent in 2025.[33] Some repair operators try to address this internally, while industry bodies such as SubOptic run wider initiatives, including university partnerships, to attract new entrants.[34]

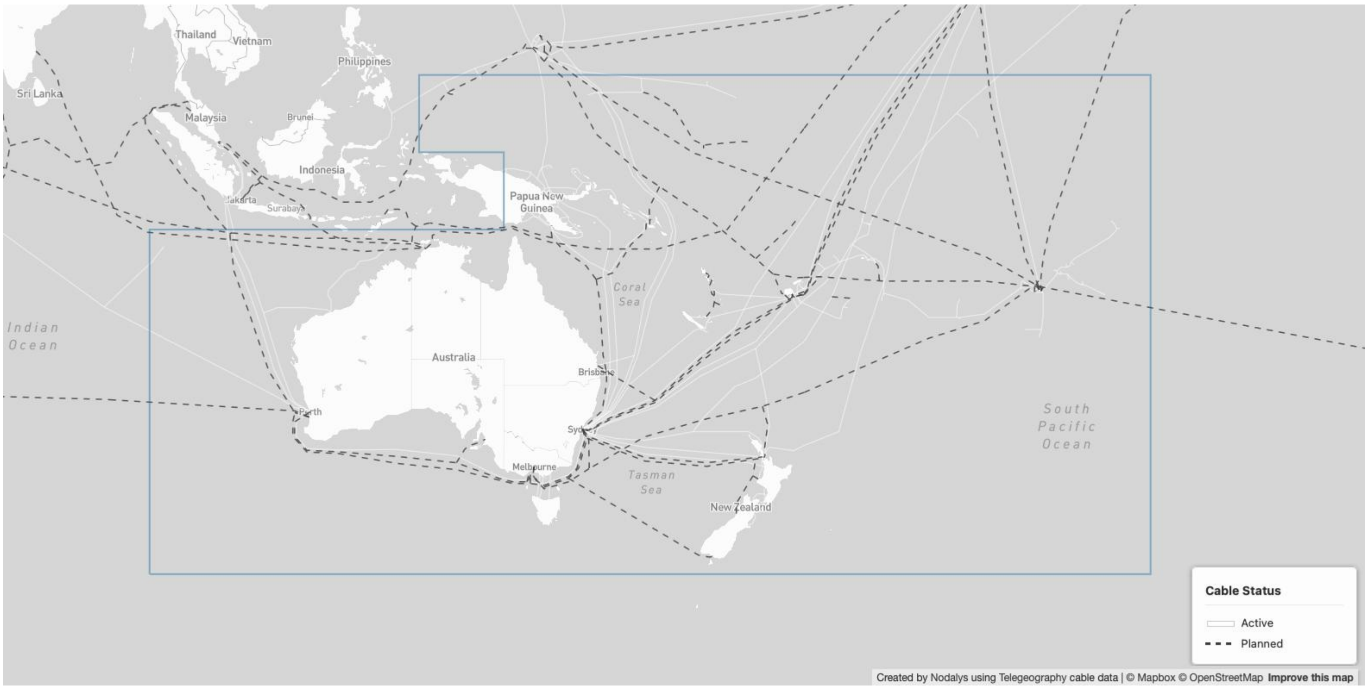
6.3. The changing regional environment

Three regional trends sit alongside the global pressures above, each bearing on how Oceania's repair needs may evolve.

The number of kilometres of cable laid in the region is expected to grow significantly by 2030. Maintenance providers charge by the kilometre, so this growth makes Oceania a larger and more profitable market to service. With more cable kilometres in service there is a natural increase in the number of faults. These cables are being laid to new locations and along new routes with no operational history, making fault rates and locations harder to anticipate. No equivalent expansion of the number of vessels or depots serving the region has been announced in line with this cable growth. Whether a gap emerges will depend on fault rates along these new routes, which will take years to establish. The net effect on repair capacity is uncertain.

Figure 6 Planned cables in Oceania as of March 2026 (dashed lines).

[28] Harry Dempsey, David Keohane, 'Japan set to make subsea cables a national security issue with support for new fleet', *Financial Times*, no date, online. Kyoko Hariya, 'Japan's NEC to pour $630m into undersea cable business', *Nikkei Asia*, no date, online.
[29] 'Cable Ships 6.1.6 Conclusions and Forward Outlook', *Submarine Telecoms Industry Report*, issue 14, Submarine Telecoms Forum, 30 October 2025, online.
[30] According to a source familiar with the marine industry, a conversion could take under 12 months, if the right ship is found.
[31] Josh Dzieza, 'The invisible seafaring industry that keeps the internet afloat', *The Verge*, 16 April 2024, online. 'Global Overview. 1.1 Industry Sentiment', *Submarine Telecoms Industry Report 2025/2026*, issue 14, Submarine Telecoms Forum, 30 October 2025, online.
[32] 'Global Overview. 1.1 Industry Sentiment', Submarine Telecoms Industry Report 2025/2026 Page 35
[33] 'Global Overview. 1.1 Industry Sentiment', Submarine Telecoms Industry Report 2025/2026 Page 36
[34] 'SubOptic Next Gen: Shaping the Future of Subsea', *SubOptic*, no date, online.



White lines represent existing cables. All lines are illustrative of the cable path. (Cable source: Telegeography)

Climate change increases the frequency and severity of natural hazards, creating localised hotspots of elevated risk that bear on both faults and repair conditions.

Oceania sits in one of the more exposed regions. Australia and the Pacific are identified as global hotspots for sea-level rise. Northwest and northern Australia face additional risk from severe storm tides and coastal erosion. Increasing wave heights and rough seabed conditions can expose buried cables and cause long-term damage through abrasion and suspension fatigue. The central and south Pacific face elevated risk from tropical cyclones and subsea landslides.[35]

Several nations in Oceania are collocated with tectonic plate boundaries, making them more vulnerable to seismicity and volcanic eruptions. However, one global study on small islands found no significant relationship between an island's exposure to natural hazards and how often its cables break.[36] Routine natural hazards account for only a small share of cable faults globally; when extreme events do occur, however, they can damage or destroy multiple cables at once. For a region typically served by a single repair vessel, this means countries unaffected by the hazard, but suffering a concurrent fault, may find the zone's vessel already committed elsewhere.

Furthermore, intense and less predictable weather, particularly heightened cyclone activity, reduces the windows in which a cable ship can safely hold station and work, adding time to repairs already logistically complex across a dispersed region.

Since 2021, Oceania has encountered several multi-fault events. Two were from anchors dragging during storms off Perth (2021[37]) and Port Hedland (2022[38]), one from an earthquake affecting Papua New Guinea[39], and one following the eruption of the Hunga Tonga–Hunga

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[35] M. A. Clare, I. A. Yeo, L. Bricheno, Y. Aksenov, J. Brown, I. D. Haigh, T. Wahl, J. Hunt, C. Sams, J. Chaytor, B. J. Bett, L. Carter, 'Climate change hotspots and implications for the global subsea telecommunications network', *Earth-Science Reviews*, issue 237, 1 February 2023, 104296. online.
[36] Isobel A. Yeo, Michael A. Clare, Matthew West, Stuart Wilson, Lucy Bricheno, John Wrottesley, Keir Preedy, Paul Komboi, Lane Burdette, Taaniela Kula, Rennie Vaiomounga, Semisi Panuve, Camino Kavanagh, 'Hazards and resilience of subsea telecommunications connections for small islands', *International Journal of Disaster Risk Reduction*, issue 142, 1 August 2026, 106213. online.
[37] Bevan Slattery, 'Perth Incident', AusNOG 2024 Day 1 Keynote, 3 December 2024, online.
[38] Jonathan Gleeson, 'Fixing Australia's internet lifelines', *Vocus Blog*, 2 March 2025, online.
[39] Kieran Clark, 'PNG Earthquake Causing Multiple Cable Disruptions', *SubTel Forum*, 12 September 2022, online.

Ha'apai volcano[40]. The turbidity currents from the volcano took out both of Tonga's subsea cables, and the resulting information blackout hampered humanitarian coordination.[41] If the frequency or severity of those events increases, fault rates could exceed what historical data would predict. These pressures would weigh most heavily on small island nations, where limited redundancy means a single extreme multi-fault event could cause a complete loss of international connectivity.

The growing presence of hyperscaler-owned cables adds a further element of uncertainty. These operators bring significant buying power and financial backing unlike any traditional telecoms system owner. They currently participate in existing maintenance agreements, but their increasing cable lengths, the limited number of repair vessels globally, and the US government reportedly warning them against using Chinese repair operators further constrains the pool of ships available to service those cables. How their new sole-ownership cables, which carry mostly their own data, will interact with existing maintenance structures into the future and what obligations they carry toward regional governments is unclear.

6.4. The economic burden of resilience

For many island nations in the Pacific, the financial weight of infrastructure maintenance is disproportionately high. The majority of system owners within the SPMMA spend between 25 per cent and 50 per cent of their total annual operating costs on marine maintenance.[42] This is likely in smaller markets where data traffic is rarely sufficient to make a cable commercially viable on its own. Many regional links have been funded by multilateral development banks or foreign government donors as a result. These projects deliver essential connectivity, but they also create a state of "digital fragility" once banking, government, health and other essential services come to rely on the link.

In these small island nations, satellites have served as both a primary link before cables arrived, and now a fallback since most Pacific island countries have at least one subsea cable. But high costs limit how much capacity operators can realistically procure. In practice, service providers typically provide satellite backup for 10 to 15 per cent of traffic, enough for essential services such as banks, airlines and government services.[43] The arrival of low earth orbit (LEO) mega-constellation satellites offers scope to increase this percentage.[44] However, satellites cannot match the capacity of subsea cables.

The obvious answer to that fragility is a second cable, but in a thin market a second cable rarely brings enough new traffic to pay for itself. As industry experts have noted, resilience in the Pacific is not a one-time cost. A cable funded for security or development reasons brings ongoing operating costs the host country may struggle to absorb.[45] Donor support that covers running costs, not just construction, more closely matches the real challenge. The same logic applies to the wider system: diverse landings, separated cable landing stations and the terrestrial network behind them all carry recurring costs of their own.

6.5. When pushed beyond business-as-usual

The pressures above describe normal commercial operation. Outside it, the system faces sharper limits.

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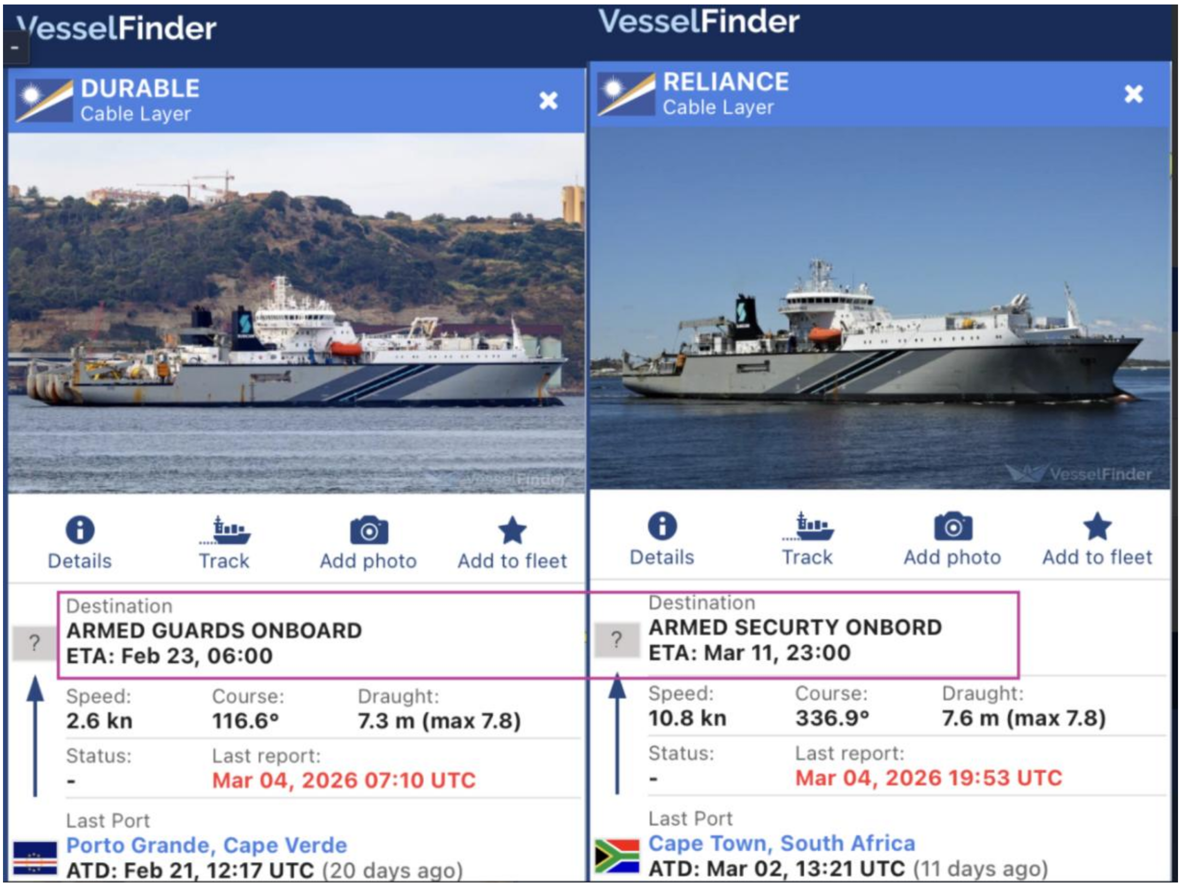
[40] Samanth Subramanian, 'Extremely offline: what happened when a Pacific island was cut off from the internet', *The Guardian*, 30 September 2025, online.
[41] The SubOptic Foundation, *Dean Veverka, 'Cut off from the World'*, SubOptic CrewTube, 17 February 2023, online.
[42] Constable, 'The Future of Submarine Cable Maintenance: Trends, Challenges, and Strategies'. Page 75
[43] John Hibbard, Paul McCann, 'Opinion: The Pacific - Securing the Future', *Islands Business*, 27 June 2023, online.
[44] Cable Connectivity & Resilience Centre, 'Low Earth orbit satellites in the Pacific: Opportunities, risks, and governance for resilient connectivity', no date, online.
[45] Hibbard, 'Opinion: The Pacific - Securing the Future'.

ICT (information communication and technology) infrastructure has historically been among the first targets in conflict, from subsea cables in the Spanish-American War of 1898[46] to land-based telecoms infrastructure in the early days of the invasion of Ukraine in 2022[47], to drone strikes on Amazon AWS datacentres in the ongoing conflict in Iran in 2026.[48]

Figure 7 Two of Subcom's large Reliance-class cable installation vessels advertising the presence of armed security onboard via AIS as they transit around the African continent. (source: VesselFinder, retrieved 13 March 2026



For cable operations, conflict introduces a different set of constraints tied to vessel insurance, the safety of civilian crew and access issues. Insurance on commercial vessels is unlikely to cover operations in or near a conflict zone, or be exorbitantly expensive, as the disruption to commercial shipping through the Strait of Hormuz in 2026 made clear.[49] At time of writing, the laying of Meta's 2Africa Pearls extension project has been suspended, with the installer, ASN declaring force majeure, citing unsafe conditions because of the ongoing Middle East conflict.[50] Other projects in the region that are reportedly similarly delayed include: SEA-ME-WE 6, Fibre in Gulf and WorldLink.[51]

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[46] Jonathan Reed Winkler, 'Silencing the Enemy: Cable-cutting in the Spanish–American War', *War on the Rocks*, 6 November 2015, online.
[47] 'Tracking Cyber Operations and Actors in the Russia-Ukraine War', *Council on Foreign Relations*, 24 March 2022, online. Tetyana Lokot, 'Russia's Networked Authoritarianism in Ukraine's Occupied Territories during the Full-Scale Invasion: Control and Resilience', *LSE Public Policy Review*, issue 1, 8 September 2023, online.
[48] Reeta Raman, Liv McMahon, 'Amazon says drones damaged three facilities in UAE and Bahrain', 3 March 2026, online.
[49] Samantha Gross, Ryan Beane, 'From chokepoint to crisis: The Strait of Hormuz and global oil markets', *Brookings*, 08 June 2026, online. Howden Re Business Intelligence, *Strait of Hormuz: (Re)insurance impact from recent events in the Middle East*, 26 March 2026, online.
[50] Saf Malik, 'Meta consortium pauses 2Africa Pearls cable work amid Iran-linked conflict', *Capacity*, 16 March 2026, online.
[51] 'The Strait of Hormuz & Beyond: Cables, conflict and connectivity analysed', *FastNetMon*, 10 April 2026, online.

In locations where security risk is routine, such as off the coast of Africa, ship operators have found ways to manage these environments. This includes engaging security contractors to come aboard for transit through those areas, employing on-board fortifications to discourage unauthorised boarding (see Figure 8), and transiting in groups of other commercial vessels accompanied by a navy escort.

Cable vessels are inherently exposed during operations. Repairing or laying cable requires a ship to hold position or move slowly for extended periods. An installation vessel is performing plough burial, for instance, moves less than one kilometre per hour, tethered to the seabed by the plough tow line and umbilical cable. Recovering that equipment from the ocean floor takes time, and the ship cannot quickly break off if conditions deteriorate. During a UK parliamentary inquiry, one repair operator noted that they would be unlikely to operate in a conflict zone without military escort.[52] Even where conflict has receded, access problems can persist. Efforts to repair cables severed by the dragging anchor of the sinking RubyMar in the Red Sea were complicated by territorial disputes creating further delays to repair. Short of conflict, heightened geopolitical tension could result in the home country of a foreign repair operator compelling its companies not to service a particular country.

Figure 8 Razor wire installed on a cable ship. An example of on-board fortifications. (Source: Image courtesy of Steven Onley)

The suspicion of grey zone activity targeting underwater infrastructure has become a feature of the security assessments in parts of Europe and Asia-Pacific. Vessels loitering near critical underwater infrastructure, damage to gas pipelines and energy cables, incidents that fall below the threshold of open attack but are coercive or intimidating if intentional. So far, no telecoms cable damage has been legally proven to be intentional, state-led actions, though many have been suspected. Many of these incidents have happened in regions with strong network redundancy available through alternative subsea or terrestrial international routes, which helps to reduce the impact of such incidents. Many Pacific island countries do not all have a similar level of network resilience, much like Scotland's Shetland Islands in 2022 or Taiwan's Matsu Islands in 2023, when in each of these cases, both cables to the islands were cut within days of each other. For the latter, after implementing greater redundancy through

52 'Subsea telecommunications cables: resilience and crisis preparedness. First Report of Session 2024-2026', *UK Parliament*, 19 September 2026, online.

microwave links and trials of LEO satellites, the subsequent faults in 2025 created less of a disruption.[53]

Each Pacific nation will reach a different view of its environment, shaped by its connectivity profile, security assessments, and risk tolerance. How a government weighs the options that follow depends on that prior judgment about the threat environment it is preparing for. Where the judgment is not clear and public, options are harder to weigh, and harder for industry, partner countries, and communities to plan around.

There is no repair operator, nor specialised cable repair vessel domiciled in Oceania. Nor does any one nation in the region maintain the trained workforce required to deliver a professional repair capability. The region is serviced entirely by foreign-owned operators with foreign-flagged ships and crews drawn predominantly from outside the region. Although this situation is common in many parts of the world, given the specialised vessels and workforce skills required, it does mean that the ability to repair cables in Oceania rests entirely on whether a commercial operator finds it worthwhile to service the region. In any scenario where that commercial calculus shifts, whether through conflict, geopolitical pressure that causes a foreign government to compel its operators to stop servicing a particular country, there is no assured fallback.

53 'Taiwan activates back-up communication for Matsu Islands after undersea cables malfunctioned', *Reuters*, 22 January 2025, online.

7. OPTIONS FOR GOVERNMENTS

The measures below move from those that reduce the likelihood of a fault or limit its consequences, through those that work alongside the commercial system, to those that address what happens when commercial incentives are insufficient. Some options speak to the first failure mode identified above: slow repair under normal conditions, where timeliness and process matter; other measures are more aligned to the second: non-response in a crisis, where the question is not how fast a repair occurs but whether there's a capability that can be directed to respond at all. Several measures bear on both. These are options to weigh, not a set to adopt in full. What is most relevant will depend on factors such as a country's connectivity profile, financial capacity, and assessment of risk, and no measure will suit every nation.

7.1. Regulatory measures

Regulatory friction is among the most tractable problems governments can address. Doing so can reduce the time it takes to complete a repair. Some such areas include streamlining and simplifying the process of application of repair permits (if any repair permit requirements exist at all. E.g. Australia and New Zealand do not require a repair permit[54]), expediting crew visas and clarifying customs treatment of cable spares. The ICPC, industry's leading body for the protection of cables, has published detailed best practice guidance on precisely these measures for years.[55] Examples of countries that have implemented such measures include Australia, which expedites visa processing for cable repair crews, and Malaysia, which exempts cable ships from cabotage restrictions.[56]

The vast majority of cable faults result from fishing and anchoring activity in shallow water of depths less than 200m. Policies and regulations that can help reduce fault frequency would reduce how often repair is needed, which benefits operators, system owners, and the governments alike.

Cable protection zones restrict activities near cables and create a legal basis for enforcement. How they are implemented matters. Where establishing a new protection zone is commercially unattractive for operators, there is the risk that new cables will be squeezed into existing zones, unintentionally clustering multiple cables in a narrow corridor that a single incident could affect.

A related area where regulation intersects with industry practice is engagement with the fishing sector, which accounts for a substantial share of accidental cable damage globally. In countries like the UK, USA and Australia, cable developers use fishing liaisons for awareness and engagement with fishing communities. They have found that sustained engagement and communication that integrates well with existing processes used by the fishing industry perform better than one-off advisory notices, which can be missed or filed away unused.

Beyond domestic regulation, governments active in digital economy negotiations have an opportunity to embed cable resilience norms into the formal terms of those agreements which helps for building mutual accountability among partner nations on resilience standards. An example of this is Article 22 of the Australia-Singapore Digital Economy Agreement.[57]

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[54] 'Global Submarine Telecoms Cable Repair Data Analysis May 2026', International Cable Protection Committee.
[55] 'ICPC Best Practices for Governments', *International Cable Protection Committee*, 25 November 2024, online.
[56] Malaysia exempted cable ships from cabotage rules in 2019, reversed the decision in 2020, and in 2024 again allowed foreign ships to perform repairs. The 2024 decision is thought to reflect concern that cabotage was deterring investment from firms such as Google and Meta, putting Malaysia's digital development plans at risk.
[57] 'Article 22, Australia-Singapore Digital Economy Agreement', online.

7.2. Maintenance and resilience-by-design

Not being part of an agreement or arrangement for cable repair is risky. Where development finance is involved in funding a cable, it could also cover an initial period of maintenance costs, giving the recipient operator time to grow revenue before absorbing the full ongoing cost alone.

The same logic applies at the design stage. Network design and engineering choices made at the point of investment shape resilience for the life of the cable. Where multiple cables land at the same landing station, a single event can affect all of them simultaneously. Governments and development finance institutions involved in funding cable infrastructure are, at the project design stage, positioned to influence and create redundancy and resilience through diversity of such things as landing sites, terrestrial pathways that facilitate diverse landings, suppliers and development partners.

Physical protection of cable landing stations is important, as they concentrate the infrastructure in fixed, identifiable locations, and access is typically granted to staff from multiple companies. They are among the most accessible points in a cable system, especially when situated in isolated locations and not integrated with datacentres. The robustness of their security depends on decisions made by the cable developer, cable operator and by the government of the country in which it resides.

7.3. Vessel tracking and fibre sensing

Reducing the frequency and severity of faults is as important as improving response when they occur. A growing set of technologies, both above and below the waterline, can help. Realising their value depends on close public-private cooperation, since the infrastructure is largely private, but the resilience benefit is public.

On the water's surface, enforcing the use of vessel tracking systems, such as Automatic Identification System (AIS) near cable routes within a nation's waters would give network operators visibility of ships approaching cable positions. Anecdotally, the system owners having this kind of visibility has improved their ability to have more informed conversations with the fishing industry and port authorities after a cable strike.

When a vessel is identified as a risk to a cable, a process would need to be put in place to contact the ship directly and redirect it before contact occurs, or warn it that its anchor is close to the asset. Currently this falls to the individual cable owner/operator, or the third-party service providers they engage to monitor vessels via AIS to contact someone able to reach the vessel.[58] In August 2025, New Zealand piloted a nation-wide regime called, National Surveillance and Warning Capability. It combined a multi-source maritime domain awareness software platform, drawing on AIS and other data to flag threats, with human operators who monitored the alerts, and then broadcast warnings to turn away ships posing a risk to the infrastructure.[59]

Below the surface, sensing technologies integrated into cable systems offer awareness along and around the cable. Distributed acoustic sensing (DAS) and state of polarisation (SOP) are two of several being used or developed. DAS detects movement around the cable to within metres, giving good fault localisation along its length, and can classify what produced the signal, for example whether trawling gear is touching the seabed. Very strong signals can saturate the system, making it harder to distinguish nearby movement from a direct strike. The technology is developing quickly towards monitoring the full length of transoceanic cables.

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58 According to interviews with some industry stakeholders in Oceania, in practice this has meant contacting water police or harbour masters.

59 'Progress report on improvements to the resilience and security of New Zealand's critical underwater infrastructure', Ministry of Transport, 17 March 2026, online.

DAS also picks up seismic activity, opening secondary uses for the data.[60] SOP draws its readings from the commercial traffic already on the cable, detecting mechanical or thermal changes that affect the polarisation of light in the fibre. It works along the full cable length and does not saturate like DAS, but localises events much more coarsely. Both can be retrofitted onto existing systems, though SOP is more straightforward to add to long cables already in service.

These technologies, particularly in combination, could serve several purposes: trigger early warnings that prevent accidental damage, inform decisions about whether to dispatch a repair vessel, and help to assess the cause, nature and urgency of the fault before marine assets are committed.

The interests of cable owners and governments in sensing are related but not identical. Owners are focused on the asset and using the technology to anticipate faults, reduce maintenance costs, and gather evidence for legal action when damage occurs. Governments are increasingly interested in sensing as a tool for maritime domain awareness and attribution after an incident. These purposes can be served by the same technologies, but the business case for deploying any given system depends on which purpose is being prioritised, and by whom. The ICPC set out its position on fibre sensing in February 2026, cautioning that prescriptive regulation or mandates to deploy particular sensing technologies risks stifling innovation and may impair the business case for the cable investment governments are otherwise trying to encourage, as the development of the technology is moving very quickly.[61] Sensing is therefore potentially not a neutral upgrade. Its value, cost, and data-sharing arrangements vary by purpose, and remain to be worked through between governments and cable owner/operators.

7.4. Workforce

The workforce challenge has direct implications for the vessel options below. A government that commissions a vessel without a workforce plan risks ending up with an expensive hull rather than a repair capability. If multiple governments pursue vessel ownership independently, they end up competing for the same scarce pool, compounding the constraint.

The region has a structural disadvantage on this front. Oceania currently has no domiciled cable repair operator, and therefore lacks the institutional knowledge base and skills pipeline that an established operator provides. Newer operators globally, such as OMS Group and SBSS, emerged from association with established companies (ASN and Global Marine, respectively), drawing on existing expertise rather than building it from scratch. The low regional fault rate adds a further constraint. Conversations with industry professionals have revealed that there is a noticeable performance difference between crews that repair cables routinely and those that do so only occasionally, and the Oceania zone has too few faults to keep crews proficient on regional work alone.

Several approaches could be combined to address this.

Governments with existing maritime workforce programs or national strategic fleet initiatives could extend them to cover cable repair, building on training infrastructure already in place rather than starting from scratch.

A 2025 UK Joint Committee on the National Security Strategy (JCNSS) report recommended the Royal Navy train reservists and serving personnel on cable repair skills on commercial repair vessels.[62] It is unclear on which operators' ships were envisaged, given there is no

[60] Winston Qiu, 'ASN's SMART CC Solution Captures Japanese Earthquake from Les Ulis, France', *Submarine Networks*, 1 May 2026, online.
[61] 'As fibre-optic sensing in submarine cables develops rapidly, governments should exercise restraint in regulating', *ICPC Viewpoints*, International Cable Protection Committee, 16 February 2026, online.
[62] 'Subsea telecommunications cables: resilience and crisis preparedness. First Report of Session 2024-2026', *UK Parliament*.

longer any UK-owned repair capability. As a general option, training berths could be negotiated with established commercial operators and would allow nationally trained personnel to build proficiency on operational vessels. Feasibility would depend on factors including cost and available space onboard these fleets.

Some skills, cable jointing being the clearest example, can be drilled and trained regionally without access to operational vessels. This complements the berth-based pathways above rather than substituting for them, and offers a faster route to building useful capability for parts of the workforce.

Over a longer horizon, the workforce question could be approached differently. Cable repair today remains a highly specialised, manual process requiring expert human assessment, jointing and testing at sea. But the research and development from other sectors such as defence, health and offshore energy could potentially be used to alter the required skills of the crew needed offshore. These include innovations such as unmanned underwater vehicles, and robots with touch-feedback used in telesurgery on humans that are operated over a network by a remotely located surgeon.[63] The skills to advance these technologies—in robotics, AI, remote sensing, and over-the-horizon communications—sit outside the traditional maritime sector, and may be easier to recruit. Autonomous vessels have already been used for cable route surveys. However, telecoms cable repair runs on thinner margins than offshore oil and gas and lacks the in-house development capacity to drive modernisation of this kind alone. The case for government involvement in this area is less near-term workforce intervention than long-horizon investment in technologies the commercial sector has limited capacity to pursue.

7.5. Repair capability

The options in this section concern repair capability: how it can be funded, structured, operated and crewed, and made available to governments when needed. The models below are not necessarily discrete alternatives. Each draws on the same components (vessel funding, ownership, operation, workforce, and placement) configured differently, and elements of one often qualify or build on another. They differ mainly in cost, the control they leave with the government, and the level and type of assurance they deliver. They are best read together.

The economics of the region support one assigned vessel. What they do not support is a second. In most single-fault scenarios, the assigned contracted vessel responds as per the maintenance agreement. The gap opens when multiple cables are damaged at once, the assigned vessel is unavailable, or geopolitical pressure makes the contracted operator unable or unwilling to attend. Cable owners can in extremis go to the market for a vessel of opportunity, but at significant cost and with no guarantee of availability. Governments cannot treat that as a planning basis.

A cross-cutting economic constraint that shapes all the options below is that basing a second vessel permanently based in-region is difficult to justify economically. Without a significant increase in cable kilometres or fault volume, it would roughly double per-kilometre maintenance costs. The network operators of Pacific island countries may struggle to absorb that increase, given the long branching cables connecting them, the historically low fault rate, and the difficulty some system owners already have in supporting existing maintenance costs. An alternative would be for institutional or foreign government funders of subsea cable infrastructure to support standing charges associated with the maintenance vessel, alongside construction of the cable. The models that follow largely work around the problem by placing the additional vessel commercially elsewhere, where it earns revenue between government call-outs, though that approach brings its own trade-offs.

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[63] Sofiah Nichole Salivio, ‘Uncrewed vessel surveys subsea cable route off WA coast’, *TelcoNews Asia*, 20 February 2026, online. 7NEWS Australia, *Robotic surgery debuts in Sydney with remote touch technology*, 3 April 2026, online.

Two further practical constraints apply across all of them. Firstly, the vessel better suited to this work would be a larger hull, typically over 100 metres, comparable to those currently operating in the region. Larger vessels handle better in heavier weather, which matters in the Pacific. Furthermore, most Pacific cables lie in deep water, requiring rigging capable of supporting operations down to those depths.[64] Smaller repair vessels common in shallower-water regions, where ROVs do most of the work at 1,000 to 1,500 metres, are not well-suited to repair the depths of the Pacific, but near shore faults. Secondly, where the new vessel is not the primary one servicing the region, the location of spares matters, as the ship will need to load the right components before transiting to a fault, adding time to the transit itself.

Full sovereign ownership and operation provides the highest degree of control. A nationally flagged vessel with a sovereign crew is available on the government's terms but the personnel and institutional knowledge constraints set out in this paper apply most heavily to this model.

A purpose-built maintenance vessel costs between US$105 and 180 million including mission equipment.[65] They take about three to five years to build, with schedules generally reliable, which allows for predictable times for preparation in areas such as workforce training and supporting infrastructure. A flatback supply vessel could also be converted into a cable repair ship. An example of such a conversion is ASN's Ile d'Ouessant[66] (see Figure 9). Conversions typically take less time and cost less than new purpose-built vessels.

Figure 9 The Ile d'Ouessant was an offshore light construction vessel later converted into a maintenance vessel. (Source: Image courtesy of ASN)

[64] An industry insider familiar with subsea cables in the region provided that there are trenches in the south Pacific that submarine cables cross that descend to 8000-9000m.
[65] Numbers were acquired from discussion with industry system owners and repair operators. Further figures from a European Commission report calculate a large basin maintenance vessel to be US70.3-93 million (EUR60-80 million). Expert Group under Recommendation 2024/779 on Secure and Resilient Submarine Cable Infrastructures, 'Security and Resilience of EU Submarine Cable Infrastructures. Mapping, Risk Assessments, Stress Tests (Annex)', October 2025, 83, online.
[66] The Ile d'Ouessant was originally built in 2011 as an offshore construction vessel. She was purchased in 2019 by ASN for US$6M from a shipping company under liquidation. It was then converted to a cable maintenance vessel and is now managed by LD Armeteurs for ASN. John Snyder, 'French cable systems provider acquires construction vessel', *Riviera*, 4 October 2019, online. Louis Dreyfus Armateurs, 'Cable Maintenance Vessel C/S Ile d'Ouessant', no date, online.

The vessel need not be repair-only. A multipurpose hull could extend the vessel's usefulness into adjacent roles such as disaster response, which has its own value in the Pacific. An example is the NTT WEM's Kizuna (see Figure 10).

Figure 10 NTT WEM's Kizuna was designed as a multi-purpose vessel used for cable laying and maintenance as well as disaster relief. (Source: NTT WEM[67])

International cables, by definition, connect to a foreign country, therefore a government-owned vessel may face restrictions on where it can operate, or have difficulties securing repair permits in another jurisdiction, meaning sovereign ownership does not guarantee access to the far end of a cable. In practice, this may matter less than it first appears: if relations with the other country have deteriorated to that point, a government may not want its country's traffic transiting that country in the first place.

A further dynamic to consider is that a sovereign vessel could weaken the membership base of the commercial maintenance agreement. These agreements operate on a principle of exclusivity, where the contracted ship services only members. The introduction of a sovereign capability in parallel could reduce demand for commercial agreement membership, eroding the funding base that sustains the existing repair system.

If the intention is to run the vessel commercially, where the flag state requires crew wages be set at domestic rates, a nationally flagged vessel with a domestic crew may struggle to compete commercially.

Government-financed, commercially operated models address the workforce challenge by embedding the vessel within a commercial operator's fleet. Under a bareboat charter arrangement, a government, or group of governments, funds the construction or ownership of a vessel and leases it to a trusted commercial operator, who manages its commercial operations and maintenance. Crew can be rotated across the operator's larger fleet, repairing, resting, or performing higher-tempo cable installation work. The government retains ownership and step-in rights, allowing it to call the vessel for government-directed operations when needed. The operator is compensated for any operational disruption from such call-outs, while charter payments provide revenue to the government to recover capital costs over time. This structure may also open the door to negotiating training berths for a sovereign workforce.

A practical question is where the vessel operates when not called upon by the government owner. As noted earlier, the trigger for government-directed use is unlikely to be a routine

[67] 'Cable-Laying Vessel KIZUNA', NTT World Engineering Marine Corporation, no date, online.

fault, which maintenance agreements already handle, but a multi-fault event that reduces national connectivity to a level the government finds unacceptable.

If the ship is used by the incumbent operator in the region, then the region still only has one ship. If the incumbent operator operates a wider fleet, a pre-arranged cross-zone agreement could manage this, though this would also likely require the new ship to leave Oceania when needed in the other zone. If used in addition to the current contracted ship in the zone, the small number of faults in the region risks the new ship sitting idle most of the time, raising the question of how its operating costs are covered. As noted earlier, system owners are unlikely to absorb additional cost. It could be made available for 'outside work' installing new systems in the region, but would possibly compete with the current ship under the region's maintenance agreement.

For these reasons there is limited value in basing the vessel permanently in Oceania. Based outside the region, in a high-fault zone like East Asia or Southeast Asia, the asset stays productive and the crew more proficient. The trade-offs are that it distorts the market in the host region and adds transit time back into Oceania when a fault occurs.

A regional Oceania cooperative vessel, commercially operated, shares ownership across several nations in the region. Nations could contribute to their strengths, with capital from some, more commercially competitive flagging from others, and better-positioned base ports and depots. It may also work better for smaller countries with less cables, where carrying the full cost of a ship in a low-fault zone is hard to justify economically. The vessel would be held through a shared governance structure and bareboat chartered to an established commercial operator, with step-in rights vested in the group rather than any single nation. In peacetime the vessel operates commercially. In an emergency it is available on the region's terms. This may be another opportunity to negotiate training berths to build a regional cable repair workforce.

The model spreads the capital and benefits the region more broadly than a single-nation sovereign model but the limitations of a single ship in the region still apply. The practical realities of operating in such a structure, particularly around decision-making on repair priorities may be complex with so many government stakeholders making decisions on private assets, and with regards to any non-repair work the vessel can do. Earlier regional ventures in maritime assets, including the Pacific Forum Line established by Pacific island governments in 1977 to provide maritime transport of container freight offers a relevant case history on the operational and governance pressures these structures may encounter over time.[68]

An Oceania cable ship, commercially operated by an Indo-Pacific partner residing outside Oceania that has experience operating cable ships, formalised through bilateral or multilateral arrangements (see Figure 11 below for cable ship company ownership). Engaging the operator's government as a formal party strengthens credibility, treating the arrangement as an element of the bilateral relationship rather than a purely commercial contract. This arrangement could also bring a second flag state into the region's repair picture, adding diversity of ownership. It does not, however, remove the long transit time problem or circumvent cabotage restrictions of any state. Governments pursuing this option are securing assurance of response, not speed of response. Two configurations are possible.

In the first, Oceania government(s) fund the construction of a cable lay ship, recognising that any vessel that can lay cable can also repair one. The operator runs the vessel commercially as a capex-free lay ship, available for commercial work on the understanding that it is interruptible when Oceania needs it. Interruptibility may narrow the kind of commercial work the vessel can take, since it cannot be committed to contracts requiring guaranteed availability, but ships that install and do maintenance ad-hoc are not unusual in the industry. This may be less of a concern to the operator if they already run a larger fleet of fully available vessels for major installation work, and the interruptible ship serves as a marginal

[68] 'A Blue Transformation for Pacific Maritime Transport. Overarching Regional Report', The World Bank, 2023, online.

addition. The trade-off for Oceania governments is cost by bearing a higher capital cost for an asset whose government-directed use for repair is expected to be infrequent. Cable ships built as installation vessels are larger than repair vessels and therefore more expensive to build and operate.

In the second configuration, Oceania governments fund a purpose-built cable repair ship, operated commercially by a repair operator, in East or Southeast Asia. Government retains step-in rights for Oceania response. A purpose-built repair vessel would cost less than a lay ship. The repair operator gains a capex-free addition to its fleet, with substantial commercial draw. Asia has sustained high levels of repairs, despite the rates in the rest of the world, combined, declining.[69] An additional repair vessel, available commercially when not called by Oceania government(s), could capture overflow work and reduce queue times for cable owners across that wider region, potentially building goodwill that encourages system owners to allow their contracted ships to assist a crisis in Oceania. Interruptibility is less of a constraint than for a lay ship, since repair work is booked for shorter periods.

Figure 11 Submarine cable installation and maintenance suppliers worldwide (Source: Security and Resilience of EU Submarine Cable Infrastructures[70])

Vessel owners	Ownership	Cable laying vessels	Maintenance vessels	Total vessels
Subcom	Ceberus Capital Management (US)	8	–	**8**
ASN	80% French government, 20% Nokia (Finland)	4	3	**7**
GMSL	Keppel Infrastructure Fund (Singapore)	2	4	**6**
OMS	Private (Malaysia), KKR (US)	1	4	**5**
E-Marine	e& (formerly Etisalat) (UAE)	1	3	**4**
Orange Marine	Orange Group (France)	1	3	**4**
Elettra	Orange Group (France)	1	1	**2**
S.B. Submarine System	Joint venture between China Telecom and GMSL (China and Singapore)	3	–	**3**
Kokusai Cable Ship (KCS)	KDDI Group (Japan)	1	2	**3**
NTT	NTT Group (Japan)	1	2	**3**
Asean Cableship (ACPL)	Singtel as majority shareholder (Singapore)	–	2	**2**
FiberHome	FiberHome Telecommunication Technologies (China)	1	–	**1**
IT International Telecom	Privately owned (Canada)	–	1	**1**
LS Marine Solution	67% LS Cable and System, 6% KT Corporation	–	1	**1**
Limin Marine & Offshore	Privately owned family business (Indonesia)	–	1	**1**
Bina Nusantara Perkasa (BNP)	Privately owned (Indonesia)	–	1	**1**
Jala Nusantara Mardika	Sarana Global Indonesia (Indonesia)	–	1	**1**
Total		**24**	**29**	**53**

Modular repair equipment on multipurpose host vessel is a different shape of solution, where a cable repair module is integrated onto an existing vessel, rather than relying on a dedicated repair ship. The EU intends to pilot this approach, where the criteria is that it is in a state where the module can be installed within three days.[71] This modular idea is not new to the region. It is how Australia's Basslink power cable interacts with the telecoms cable repair ship under the SPMMA, as power cables require different equipment to telecoms cable for repair.[72]

This model involves maintaining specialised, portable cable handling and repair equipment. In the event of a critical outage, the equipment is integrated onto a pre-configured and tested, flat-deck multipurpose vessel such as an offshore supply ship. The approach is designed to provide a state-controlled response capability for situations where commercial repair services are unavailable.

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[69] Global Submarine Telecoms Cable Repair Data Analysis May 2026', International Cable Protection Committee.
[70] Expert Group under Recommendation 2024/779 on Secure and Resilient Submarine Cable Infrastructures, 'Security and Resilience of EU Submarine Cable Infrastructures. Mapping, Risk Assessments, Stress Tests (Annex)', October 2025, 55, online.
[71] Connecting Europe Facility, 'Call: CEF-DIG-2026-Submarine Cables Repair Capacity', 5 February 2026, online.
[72] APA, *Basslink Transmission Proposal Attachment 7: Capital Expenditure*, 15 September 2023, online.

For governments, the primary advantage over the other models above is the reduced capital expenditure by leveraging existing maritime assets compared with acquiring a dedicated cable ship. While the capability is not tied to a single hull, the hull would need to be prepared to receive the equipment if the intention is a rapid response.

The model faces several logistical challenges. Large offshore supply vessels of the kind required are specialised and difficult to find in the region, and the management of spares raises further questions, not least who pays for them. Spare components are currently held across the contracted repair ship, the Samoa depot, and in some cases multiple countries. This model would require strategic spares to be pre-purchased and stored. Delicate equipment such as repeaters, branching units and ROADMs will need specialised storage and periodic testing. The workforce issues previously discussed also still apply. The model also raises a broader question. By offering an alternative to dedicated repair vessels, it may reduce the incentive for anyone to invest in additional cable repair vessels, worsening the fleet constraints discussed earlier, in the longer term.

Models used elsewhere that are unlikely to fit Oceania include the French government's controlling stake in ASN[73] and the US Cable Security Fleet program[74]. Both leverage a national operator; No country in Oceania has an equivalent. The US program is structured as a government subsidy to an active, commercial viable operator[75], paying an annual retainer of US$5 million for each of the two US-flagged, US-crewed cable ships. These ships in return make themselves available to the government when required. When activated, the operator receives additional compensation on top of the retainer.[76] Nations in the region have neither the equivalent in crew, and the arrangement assumes a volume of installation and repair work that the region as a whole is unlikely to generate.

One potential source of additional work for a regional vessel is the installation and maintenance of dedicated fibre sensing cables for monitoring protected marine areas, though feasibility on the detection of small vessels and the cost benefits would need to be assessed.

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[73] 'L'Etat a signé une promesse d'achat en vue d'acquérir 80% du groupe Alcatel Submarine Networks (ASN) auprès de Nokia' [The state has signed a purchase agreement to acquire 80% of the Alcatel Submarine Networks (ASN) group from Nokia], *Ministère des Finances*, 27 June 2024, online.
[74] As of time of writing in early 2026, the program is funded until the end of the financial year. No new funding has been requested for 2027 onwards. 'MARAD CJ FY 2027 Estimates', US Department of Transportation', no date, online.
[75] 'U.S. Maritime Administration (MARAD) Shipping and Shipbuilding Support Programs', *Library of Congress*, Congress.gov, 31 January 2026, online. 'Request for Applications To Be Considered for Enrollment in the Cable Security Fleet', *Federal Register*, 5 January 2021, online.
[76] '46 USC Ch. 532: CABLE SECURITY FLEET', U.S. House of Representatives Office of the Law Revision Counsel, no date, online.

8. CONCLUSION

Subsea cable repair globally, including Oceania, is a commercial system based on commercial interests that works well balancing cost against speed. It was not built to meet the evolving expectations of nations security including the prospect of state-initiated threats to cable repair. Most of what a government would want for resilient connectivity for its country, the commercial system already delivers under “business-as-usual”. The difference surfaces at the edges, when nation-state power competition, regulatory hurdles or logistics delay the repair of an outage beyond what a country can absorb, or when it prevents a repair service from coming at all. The question this paper has tried to frame is what to do about the places where it stops short.

Repair is only part of resilience. Another part is redundancy — the alternatives that help a country absorb an outage while it waits for repair. How much a country has depends on the physical, digital and regulatory structures supporting its communications networks, and their capacity to operate under pressure. A country with strong redundancy can treat a slow repair as an inconvenience; a country with little of it cannot. Layered onto redundancy are each nation's financial capacity and its own reading of the threats it faces, weighed against the disruption it is willing to tolerate. No single solution will suit every nation, so the decisions reached across the region will differ, each reflecting national circumstances.

Two things, though, hold across that range. The capability to repair cables rests on having the skilled people to carry it out, so supporting workforce development is an option open to every government, including those not considering a ship of their own. And while the role a government chooses to play in cable repair is a domestic decision, its effects can impact neighbours and commercial operations. Coordination among nations, and close engagement with the private sector who own and operate these cables, and run the ships that repair them, is central to improving the resilience of a global network that no single entity owns or controls.