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Report on China's Participation in the Construction and Protection of International Communication Submarine Cables

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Preface

International communication submarine cables are optical cable systems laid on the seabed and used for transnational communication and data transmission. They consist of submarine optical cables, submarine repeaters, submarine branching units, terrestrial terminal equipment, power feeding equipment, and other components. International communication submarine cables carry approximately 99% of the global intercontinental communication and data traffic, serving as the cornerstone, foundation, and backbone for countries to engage in global economic and social activities in the era of the digital economy. As essential global public infrastructure and critical international civil infrastructure, their efficient, stable, and secure operation is crucial for maintaining global network connectivity and enhancing the well-being of people worldwide.

The submarine cable industry encompasses various links such as the production and manufacturing of submarine cables, route surveying, laying and construction, operation and maintenance. The production and manufacturing of submarine cables have high technical barriers, and route surveying, laying, construction, maintenance, and protection are highly complex tasks that require specialized construction vessels, equipment and skilled personnel. After years of dedicated efforts, China has initially established a complete submarine cable industrial chain, positioning Chinese enterprises as key players in the equipment manufacturing,

construction and maintenance of global submarine cables. Chinese submarine cable products and services have gained widespread recognition.

Chinese enterprises have always adhered to the business philosophy of fairness and justice, honesty and trustworthiness, mutual benefit and win-win results, and quality-driven excellence. They actively participate in global submarine cable investment, operation, laying, construction, maintenance and protection, providing new options for countries along the routes to access the global Internet. This effectively reduces the cost of network access, ensures smooth global connectivity, accelerates the development of the digital economy, and enables more people to enjoy the dividends of the digital age.

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1. China Actively Conducts Research and Development on Submarine Cable Technologies

The submarine cable system is the pearl on the crown of the optical communication field. In recent years, Chinese enterprises have made substantial R&D investments, achieving fruitful results in the fields of technology, equipment, and engineering. They have become one of the most important technical forces in the global development of submarine cables.

（1）China has Achieved Significant Breakthroughs in Terms of Submarine Cable Technology

China's submarine cable technology began its development later than some global counterparts. Nevertheless, through active participation in international collaborations and leveraging the strengths of its communications industry, Chinese enterprises and research institutions have made significant strides in overcoming key technological challenges in the submarine cable sector. Over time, they have progressively narrowed the gap with global leaders. After years of dedicated effort, Chinese companies have successfully developed submarine cables, repeaters, and branching units with independent intellectual property rights. They now offer comprehensive, end-to-end submarine cable system solutions and have achieved remarkable progress in the production of submarine cables, terrestrial terminal equipment, wet plant equipment, submarine cable

construction vessels, onboard laying equipment, and underwater installation and maintenance tools. In several areas, they have reached world-class standards and are capable of undertaking the construction of transoceanic and intercontinental submarine cable projects.

Firstly, Ultra-Long-Distance Deep-Sea Submarine Cables. Submarine optical cables must be deployed and operational in diverse underwater environments, requiring resilience against varying water pressures and external interferences, and long-term performance stability. Chinese enterprises have gained international recognition for their submarine cable products. Leading companies such as Hengtong Group, Zhongtian Technology, and FiberHome have obtained UJ certification from the Universal Joint Consortium (UJC), a globally recognized authority in submarine cable technology, for multiple models of repeatered and repeaterless submarine cable products, achieving international advanced levels. Key components like submarine cable repeaters and branching units feature pressure-resistant and corrosion-resistant titanium alloy pressure chambers, highly sealed structural designs, and reliable redundant backup systems, ensuring stable operation for up to 25 years at depths of 8,000 meters.

Secondly, Ultra-High-Capacity Submarine Cable Transmission Systems. To meet the surging demand for global data flow, submarine optical cable systems are evolving toward ultra-high-speed and ultra-high-

capacity solutions. Chinese enterprises pioneered the industry's first 32-fiber-pair submarine cable system and a full range of related products. By leveraging innovative space division multiplexing (SDM) technology, these systems support Petabit-level transmission capacity for ultra-long-distance repeatered systems, effectively addressing the increasing demand on international bandwidth driven by global digitalization. For instance, the PEACE system, which entered full commercial operation in September 2024, boasts a designed capacity of 192 Tbps.

Thirdly, Intelligent Submarine Cable Management Systems. Submarine cable management systems are critical for enhancing operational efficiency, ensuring stable communication, and optimizing resource utilization. Chinese enterprises have developed intelligent submarine cable management systems that go beyond traditional fault location capabilities. These systems can automatically analyze issues such as service degradation, fiber loss variations, and pump failures. They also predict and evaluate the operational status and health of equipment and system-level components, identifying potential risks in advance. This enables rapid and accurate fault resolution, enhances system reliability, and improves the efficiency and convenience of managing long-distance and complex network architectures.

Fourtly, Open and Reliable Open Cable Solutions. Compared to traditional submarine cable systems, Open Cable solutions offer greater

flexibility and adaptability by enabling seamless integration with equipment and systems from other manufacturers. This reduces costs for users while improving equipment selection options. Chinese enterprises are committed to delivering end-to-end customized submarine cable solutions and are at the forefront of Open Cable technology. Their solutions allow customers to freely choose terminal transmission equipment and incorporate spectrum management and Optical Add-Drop Multiplexing (OADM) technologies. These innovations support multi-vendor transmission equipment interoperability and multi-owner interactive management, enabling flexible bandwidth allocation tailored to diverse customer needs and enhancing the market competitiveness of submarine cable operators.

Fifthly, Advanced Shipborne Marine Equipment. The installation and maintenance of submarine optical cables require state-of-the-art submarine cable ships and specialized marine equipment. Chinese marine equipment manufacturers, in collaboration with submarine cable companies, have developed cutting-edge technologies for remotely operated vehicles (ROVs), ploughs, and cable laying machines. The domestically designed and manufactured submarine cable operation equipment has achieved world-leading performance, significantly enhancing the capabilities of submarine cable laying and maintenance.

（2）China Actively Participates in International Standardization

Chinese enterprises and research institutions have long been engaged in the development of submarine cable-related standards and actively encourage experts to participate in the activities of international organizations. They fully support the work of ITU-T Study Group 15 and implement the "SMART CABLE" initiative, making significant contributions to this field.

At the ITU-T SG15 plenary meeting held in Montreal, Canada, in July 2024, China Mobile led the revision of ITU-T Recommendation G.972, "Definition of Terms Relevant to Optical Fibre Submarine Cable Systems". China Unicom spearheaded the formulation and publication of the new standard ITU-T Rec. G.9730.1, "Dedicated Scientific Sensing Submarine Cable Systems" and the revision of ITU-T G.sup41, "Design Guidelines for Optical Fibre Submarine Cable Systems". Additionally, the meeting set up a new work item on the revision of ITU-T Rec. G.979, "Characteristics of Monitoring Systems for Optical Submarine Cable Systems," which is led by HMN Tech and expected to be completed by 2025.

Over the years, Chinese institutions have also led or participated in the compilation and revision of numerous international submarine cable standards, including ITU-T G.971, ITU-T G.973, ITU-T G.976, ITU-T G.977.1, ITU-T G.978, and ITU-T G.9730.2, among others.

2. Chinese Enterprises Successfully Construct and Safely Operate Submarine Cable Systems

Chinese submarine cable operators, system integrators, and maintenance companies have become key players in global submarine cable construction and protection. They have successfully completed and safely operated multiple submarine cable projects, enhancing the ability of countries and regions along the routes to access the global internet, reducing internet access costs, and enabling people worldwide to benefit from the digital economy.

（1）Actively Participate in Submarine Cable Investment and Construction

China actively engages in the construction of international communication submarine cables in key directions. China has always prioritized the construction of international communication submarine cables. China's first optical fibre submarine cable system is the China-Japan Submarine Cable, which runs from Nanhui, Shanghai, China to Miyazaki, Kyushu, Japan. It was jointly constructed by the Ministry of Posts and Telecommunications of China, KDD Corporation, and AT&T through a tripartite contract signed in 1990, and completed and put into operation in December 1993. As of the end of 2024, Chinese enterprises have invested in and constructed 17 in-use international submarine cable systems, including Trans-Pacific Express (TPE) and New Cross Pacific

Cable (NCP) in the China-US direction; Asia-Pacific Cable Network 2 (APCN2), Asia-Pacific Gateway (APG), Southeast Asia-Japan Cable (SJC), and Asia Direct Cable (ADC) in the Asia-Pacific direction; Asia Africa Europe-1 (AAE-1), South East Asia-Middle East-Western Europe 5 (SMW5), and PEACE cable in the China-Europe direction; South Africa Far East (SAFE) cable in the Asia-Africa direction, and South Atlantic Inter Link (SAIL) in the Africa-South America direction, etc. In addition, Chinese enterprises are participating in several ongoing submarine cable projects, including Southeast Asia-Japan Cable 2 (SJC2), 2Africa, Asia Link Cable (ALC), South-east Asia Hainan-Hong Kong Express (SEA-H2X), South East Asia-Middle East-Western Europe 6 (SMW6), India-Asia-Xpress (IAX) and India-Europe-Xpress (IEX), Hong Kong-America Cable (HKA), Bay to Bay Express (BtoBE), etc.

China accelerates the interconnection of global communications networks. Chinese enterprises' active participation in the construction of international communication submarine cables has accelerated the network interconnection and information exchange between China and countries around the world. Countries along the routes can also more conveniently access the global Internet infrastructure, which promotes the diversification of submarine cable routes and improves the availability of regional networks. For example, the SAIL cable led by China Unicom in 2016 is the world's first submarine cable crossing the South Atlantic Ocean

and directly connecting Africa and South America. It has established a highly reliable, highly secure, low-latency, and large-capacity interconnection channel from Africa to South America and opened up new Internet routes from South America to Europe and from Africa to North America. In 2020, China Mobile, together with 8 international operators, jointly initiated the construction of the 2Africa submarine cable project. This cable encircles the entire African continent and connects the hotspots in Europe, the Middle East, and Asia, with a total length of approximately 45,000 kilometers. It is the largest transoceanic submarine cable in the world to date and an "information superhighway" that strengthens the connection between Africa and Europe and the Middle East. It will provide more efficient and convenient international connections for 33 countries along the route. In 2024, the ADC submarine cable initiated by China Telecom and China Unicom was officially put into operation. It connects China, Japan, Singapore, and several other Southeast Asian countries, with a system capacity of over 160 Tbps, further enhancing the redundancy and stability of the network in the Asia-Pacific region.

China promotes the innovative development of the digital economy in countries along the routes. Chinese enterprises' participation in the construction of submarine cables accelerates the development of global digital infrastructure and will assist countries along the routes in developing their digital economies. Submarine cables can increase the

international Internet bandwidth of countries along the routes, reduce international communication costs, and meet the growing demand for data generated by Internet applications and the business of multinational enterprises. Better network infrastructure conditions are also conducive to countries along the routes in attracting investments from enterprises in Internet, cloud computing, and AI, etc., giving rise to new business models such as digital content creation, e-commerce, e-education, and e-health. They can directly and indirectly create tens of thousands of local jobs in the ICT field and continuously improve the local professional capabilities in digital services.

（2）Submarine Cable System Integration Services are Going Global

Chinese submarine cable enterprises have secured a place in the global submarine cable system integration market. Around the globe, enterprises with the capability of delivering intercontinental submarine cables mainly include SubCom of the United States, ASN of France, NEC of Japan, and HMN Tech of China. The world's submarine cable systems are mainly constructed by these four general contractors. With the enhancement of the ICT industry in China, Chinese submarine cable enterprises have rapidly improved their integration capabilities, continuously enriched their experience in delivering overseas projects, and won extensive trust and recognition from global customers. Chinese

submarine cable enterprises have undertaken international and domestic submarine cable projects, helping to accelerate the improvement of network connectivity and contributing to the vigorous development of the digital economy in countries and regions along the routes.

The global submarine cable system integration and delivery capabilities of Chinese submarine cable enterprises are rapidly improving. Currently, HMN Tech has cumulatively built more than 100,000 kilometers of submarine cable systems globally and has undertaken over 140 submarine cable projects, with its business covering more than 70 countries and regions. Among them, 75% are repeatered submarine cable systems, and all undersea communication equipment has run for 16 consecutive years with a cumulative record of zero failures. The submarine cable integration capability of FiberHome has also achieved a breakthrough in the international market. It has completed multiple construction or upgrade projects of submarine cables in countries such as Malaysia and Indonesia, with a cumulative length reaching thousands of kilometers.

Chinese submarine cable enterprises have undertaken and completed several ultra-long-distance and large-capacity submarine cable systems. Since 2018, Chinese enterprises have successively delivered projects including the world's first 16-fiber-pair repeatered submarine cable system (Hainan to Hong Kong Express), the first

submarine cable spanning the South Atlantic Ocean with a length of 6,000 kilometers (SAIL), and the 2,000-kilometer submarine cable at the southernmost end of the world (Chile's FOA Cable), etc. On September 19, 2024, the Singapore section of the PEACE cable system constructed by HMN Tech was delivered and connected, realizing the full-line commercial operation from Singapore to France. The total length of this system exceeds 22,000 kilometers, connecting multiple countries in Asia, Africa, and Europe. Since the French, Egyptian, Kenyan, and Pakistani sections of the PEACE cable system were put into commercial use in December 2022, it has continuously provided high-speed and stable communication services for enterprises and people along the route. Currently, Chinese enterprises are delivering multiple large-scale submarine cable projects such as SEA-H2X and ALC.

（3）Submarine Cable Construction and Maintenance Have Gained Widespread Recognition.

China’s construction and maintenance capabilities of submarine optical cables are gradually growing and strengthening. Since the early 1990s, China began to establish submarine cable construction enterprises. With the vigorous development of China's Internet, both the demand for submarine cable communication and the construction capabilities of China have witnessed a huge leap. At that time, the Ministry of Posts and Telecommunications of China and Cable & Wireless plc jointly established

the S. B. Submarine Systems (SBSS) as a joint venture. Currently, many Chinese enterprises such as SBSS, HMN Tech and FiberHome possess the capabilities of submarine cable laying, construction, and maintenance. They own professional submarine cable construction vessels with unlimited navigation zone, and are equipped with professional construction and maintenance equipment as well as professional construction teams.

Chinese submarine cable enterprises have become key players in the construction and maintenance of international submarine cables. Chinese submarine cable enterprises have accumulated rich experience in submarine cable inspection, maintenance, and fault handling, and possess first-class maintenance capabilities. At present, Chinese submarine cable construction enterprises have participated in more than 130 key domestic and international projects, including the TPE, APCN2, ADC, SJC, AAG, SMW3, and CUCN, etc., and installed a cumulative length of over 70,000 kilometers, covering the areas of the Pacific Ocean, the Indian Ocean, and the Atlantic Ocean.

3. Chinese Enterprises Abide by the Rules of the International Submarine Cable Market

Chinese submarine cable enterprises adhere to the principle of fair competition, actively participate in global submarine cable industry activities, provide high-quality and cost-effective submarine cable products and services, and offer new options for the submarine cable

construction.

（1）Chinese Submarine Cable Enterprises Adhere to Open and Cooperative Cable Construction

The Chinese government has always encouraged Chinese enterprises to carry out foreign investment and cooperation in various fields, based on market principles and international rules and complying with local laws. Chinese submarine cable general contractors actively participate in global submarine cable bidding and provide high-quality submarine cable products and services.

Most Chinese submarine cable operators participate in submarine cable construction and operation in the form of a consortium. They adhere to the principle of fairly selecting submarine cable general contractors, submarine cable products, and construction enterprises, and oppose discriminatory restrictive requirements. The existing submarine cables landing in China are mostly constructed by submarine cable general contractors from the United States, Japan, and France and use products from these enterprises. For example, the TPE and NCP cables in the US direction are constructed by SubCom of the US; the APCN2, APG, SJC,ADC and other submarine cables in the Asia-Pacific direction are mainly constructed by NEC of Japan, and some sections are constructed by ASN of France and SubCom of the US; among the submarine cable systems under construction, SJC2 are constructed by NEC, 2Africa is

constructed by ASN, and the ALC and SEA-H2X cables are constructed by HMN Tech of China.

（2）Chinese Enterprises Participate in Global Submarine Cable Protection and Maintenance

Chinese enterprises have long been involved in the protection and maintenance of international submarine cables, making significant contributions to the stable operation of the global international submarine cables. SBSS is a leading provider of submarine cable installation and maintenance solutions in Asia and one of the three submarine cable maintenance service providers in the Yokohama Maintenance Area. For a long time, one of its submarine cable vessels has participated in the rotation work in this Area. The Yokohama Maintenance Area, an organization composed of international telecommunications operators from 19 countries and regions, is mainly responsible for the maintenance of submarine cables in the Northwest Pacific region. Vessels from China, Japan, and South Korea all participate in the maintenance work.

Since 1997, SBSS has signed a long-term cooperation agreement with the Yokohama Maintenance Area and has participated in the daily maintenance work in this area. Up to now, SBSS has more than 27 years of maintenance experience in the Yokohama Maintenance Area. It is responsible for the maintenance and emergency repair of more than 80,000 kilometers of submarine cables in the Area and has participated in more

than 200 emergency repair operations. Its work fully complies with the standards of the maintenance area, ensuring high-quality services and effectively maintaining the stability of international Internet communication.

In addition, the submarine cable construction vessels of FiberHome have also successfully completed multiple submarine cable construction and maintenance projects in countries such as Malaysia, the Philippines, Indonesia, Kenya, and Chile.

4. China Attaches Great Importance to the Protection of Submarine Cables

The protection, maintenance, and repair of submarine cables are crucial tasks for ensuring the normal operation of submarine cables. According to the report of the International Cable Protection Committee (ICPC), there are approximately 200 submarine cable failures globally each year, more than 80% of which are caused by anchoring, fishing, and unknown human activities. The Chinese government and enterprises attach great importance to the safety operation of international submarine cables. They adopt various measures to reduce the damage to submarine cables caused by activities such as fishing and shipping and promptly address submarine cables failures, to ensure smooth international communication.

（1）The Chinese Government Regulates Submarine Cable Projects in Accordance with the Law

The Chinese government has established a sound legal system, clarifying the rights enjoyed and obligations to be assumed by relevant entities in laying international submarine cables in China's jurisdictional sea areas in accordance with the law and providing a good legal guarantee for international submarine cables to transit through China's jurisdictional sea areas.

According to the *Regulations on Telecommunications of the People's Republic of China*, enterprises which participate in the construction and landing of international submarine cables and provide related services must obtain the relevant licenses. The *Regulations on the Administration of the Laying of Submarine Cables and Pipelines* (Decree No. 27 of the State Council) and the *Implementation Measures for the Regulations on the Administration of the Laying of Submarine Cables and Pipelines* (Decree No. 3 of the State Oceanic Administration in 1992) provide a legal basis for the orderly laying and protection of submarine cables. The *Regulations on the Protection of Submarine Cables and Pipelines* (Decree No. 24 of the Ministry of Land and Resources in 2004) further clarifies the requirements for the protection of submarine cables, aiming to ensure the safe operation of submarine cables and safeguard the legitimate rights and interests of their owners. To facilitate enterprises' applications, the Ministry

of Natural Resources has formulated the *Guide to the Approval of the Laying and Construction of Submarine Cables and Pipelines*.

At the same time, China fully implements the *United Nations Convention on the Law of the Sea*, and welcomes and supports communication enterprises of other countries to cooperate in laying international submarine cables in the sea areas under China's jurisdiction. To adapt to the new situation, relevant departments are actively promoting the revision of laws and regulations on submarine cables and pipelines and the optimization of the approval procedures.

（2）The Chinese Government Protects Submarine Cables in Accordance with the Laws and Regulations

The Chinese government has established and improved laws and regulations for the protection of submarine cables, clarifying the responsibilities for submarine cable protection and punishment measures. Submarine cables are important public telecommunications facilities. According to the *Criminal Law of the People's Republic of China*, the *Law of the People's Republic of China on Administrative Penalties for Public Security*, and the *Regulations on the Protection of Submarine Cables and Pipelines*, those who damage communication submarine cables will bear serious legal responsibilities, including but not limited to economic compensation, administrative penalties, and even criminal liabilities.

Article 124 of the *Criminal Law of the People's Republic of China* stipulates that if a person damages radio and television facilities or public telecommunications facilities and endangers public safety, he/she shall be sentenced to fixed-term imprisonment of not less than three years but not more than seven years; if serious consequences are caused, he/she shall be sentenced to fixed-term imprisonment of not less than seven years. Article 13 of the *Regulations on the Administration of the Laying of Submarine Cables and Pipelines* stipulates that operators engaged in various maritime activities must protect the laid submarine cables and pipelines, and those who cause damage shall make compensation in accordance with the law. The *Regulations on the Protection of Submarine Cables and Pipelines* also explicitly stipulate the safe operation of submarine cables and pipelines, the legitimate rights and interests of the owners of submarine cables and pipelines, the protection of maritime operations and submarine cables and pipelines, the settlement of disputes over submarine cables and pipelines, and penalties.

The Chinese government handles incidents of submarine cable damage in accordance with the law. On February 21, 2023, during the voyage from Hai Phong, Vietnam to Ningbo, the Ship S encountered severe meteorological and sea conditions. The anchor wire of the left bow anchor, the chain stopper, and the anchor winch brake successively failed, and the left anchor chain slipped into the water, hooking and breaking four

communication submarine cables, affecting China's international communication. The Shantou Marine Police Bureau has filed a case for investigation against the relevant responsible persons on suspicion of the crime of sabotaging public telecommunications facilities and transferred the case for prosecution.

On January 29, 2019, the fishing vessel "Qionglinyu 02**5" was engaged in fishing operations in the waters off Lingao, Hainan. As its fishing net hooked a communication submarine cable, it cut the communication submarine cable without authorization, affecting about 100,000 users. The failure lasted for 4,303 minutes, and the direct economic loss was more than 2.68 million yuan. The relevant responsible persons were sentenced to seven years in prison for the crime of damaging public telecommunications facilities and were ordered to compensate more than 2.68 million yuan.

（3）Multiple Parties Collaborate to Strengthen the Protection of Submarine Cables

China supports the joint maintenance of the security of international submarine cables and conduct international submarine cable cooperation in a fair and just manner. The Chinese government and enterprises actively participate in the International Advisory Body for Submarine Cable Resilience initiated by the International Telecommunication Union (ITU). A total of 4 high-level representatives

from the Ministry of Industry and Information Technology, China Telecom, China Unicom, and HMN Tech have been elected as members of this advisory body. In July 2024, the China-ASEAN Submarine Cable Cooperation Forum was held in Beijing. Government representatives, enterprise representatives, and experts and scholars from China, the ten ASEAN countries, and international organizations jointly discussed the hot topics and development opportunities in the submarine cable industry, explored the working framework for China-ASEAN cooperation in digital connectivity and submarine cable protection, promoted innovation in the investment, financing, and maintenance models of submarine cables, and continuously improved the level of regional connectivity.

China strengthens cross-departmental coordination to jointly carry out submarine cable protection as well as regular and special patrol and protection work. Departments such as the Coast Guard, Marine Surveillance, and Fisheries Law Enforcement strengthen their maritime patrol and law enforcement capabilities, enhance the management of fishing boat operations, promptly persuade and drive away vessels that pose a threat to the safety of submarine cables, and severely crack down on maritime operations such as sand excavation, drilling, anchoring, and fishing within the submarine cable protection area that may damage the safety of submarine cables, which minimize the risks to the safety of submarine cables caused by maritime operations and jointly

ensure the safety of submarine cables. For example, during major events, relevant departments jointly carry out special operations for the protection of submarine pipelines. A formation for the protection of submarine pipelines is jointly composed of China Marine Surveillance ships, China Fisheries Law Enforcement ships, and China Telecom's submarine cable construction and emergency repair ships, which conduct inspections and maintenance along the route of the landing communication submarine cables to fully ensure their safety. Since 2015, the cable protection team of Chinese telecom operators have patrolled a mileage of more than 5 million kilometers and persuaded and drove away 60,000 vessels that endangered the safety of international submarine cables, among which 2,358 fishing vessels engaged in "sail-assisted stow net" operations and posed the greatest threat to the safety of submarine cables.

China improves the monitoring, early warning, and fault handling capabilities by enhancing information sharing. Submarine cable operators cooperate with government departments in charge of fisheries and transportation to strengthen the monitoring of ships engaged in maritime operations, and use ICT means to provide early warnings for behaviors that may cause damage to submarine cables. Submarine cable operatiors strengthen the monitoring of the operation of submarine cables, and intensify the inspections of key facilities and equipment such as the offshore section of submarine cables, the onshore extension section, and

the landing stations, to eliminate all kinds of risks and potential hazards that affect the safe operation of submarine cables. Submarine cable maintenance enterprises speed up the repair of damaged submarine cables by pre-stocking spare parts and emergency repair materials in advance.

China enhances the publicity and raises the awareness of submarine cable protection. Through publicity activities such as policy explanation, poster posting, and sending text messages, China strengthens guidance for fishermen and other maritime workers. On August 26, 2024, the ICT Administration of the Ministry of Industry and Information Technology, together with relevant departments, launched the third Communication Submarine Cable Protection Policy Publicity Week with the theme of "Communication Submarine Cable Protection: Everyone Participates and Shares Responsibility". Through publicity, it reminds marine operators that operations such as anchoring, dragging anchors, bottom trawling, drilling, piling, aquaculture, sand excavation, etc. that may damage the safety of submarine cables within the submarine cable protection area prohibited. Vessels are required to turn on the AIS safety communication and navigation equipment when navigating. If a submarine cable is accidentally hooked within the submarine cable protection area, it is strictly prohibited to forcibly raise the anchor or cut off the submarine cable to avoid causing major accidents and ensure the safety of communication submarine cables.

5. China Actively Safeguards the Data Security on Submarine Cables

China is an active builder, reliable operator, and security maintainer of international submarine cables. The Chinese government and Chinese enterprises attach great importance to the data security of communication submarine cables. They always adhere to the principles of openness, cooperation, security, and mutual trust, and provide high-quality services for various users.

（1）The Design of International Submarine Cable Systems Ensures the Secure Transmission of Data

The communication submarine cable system is a transmission channel that transmits data in the form of optical signals. In the system design, the security, integrity, and accuracy of the data transmission process are fully considered. Currently, submarine cable systems feature high speeds and large capacities. Through measures such as the adoption of encryption technology, strengthened detection, and improved physical protection, the security of data during transmission through submarine cables can be ensured.

（2）Chinese Enterprises Provide Safe and Reliable International Submarine Cable Solutions

Chinese enterprises have always maintained a good record in terms of network security. Chinese submarine cable manufacturing enterprises

and system integrators adhere to the development of neutral and open submarine cable communication technology solutions. They will not take submarine cable network surveillance technologies as a future exploration direction.

Chinese enterprises are supporters of the international standard of "Open Cable" for submarine cables. The submarine cable systems constructed by Chinese enterprises can, through the "Open Cable" standard, be compatible with the terminal transmission equipment of different manufacturers from countries including the United States and France, etc.

Chinese enterprises provide submarine cable products and integration services to users. After the completion and acceptance of the project, they will deliver the relevant equipment and network management systems to the operators of the submarine cable systems for management and operation and will not access any data transmitted through the submarine cable.

6. Concluding remarks

International communication submarine cables are of vital importance to the global Internet connection and the development of the digital economy. China regards the submarine cable network as a cornerstone for jointly building a community with a shared future in cyberspace. The growth and expansion of Chinese submarine cable enterprises have provided new opportunities and alternatives for global

submarine cable construction. This development effectively addresses the limited production capacity of mainstream manufacturers, significantly accelerating the global deployment of submarine cable infrastructure and reducing the costs for developing countries to access the global internet.

With the rapid development of the digital economy, the increasingly frequent exchanges among countries cannot do without the extensively interconnected international submarine cable network. Governments and international organizations should strengthen cooperation in submarine cable construction and protection, so as to provide higher-quality network services and digital products for global users.

The Chinese government and Chinese submarine cable enterprises will continue to work together with the international community, actively promote the construction of international communication submarine cables, jointly ensure the protection of submarine cables, foster a shared future in cyberspace, and contribute to the development and progress of human society.

Appendix I: Abrreviations

No.	Abrreviation	Full form
1	PEACE	PEACE Cable
2	C-J	China-Japan Fiber Optic Submarine Cable System
3	TPE	Trans-Pacific Express Cable System
4	NCP	New Cross Pacific Cable System
5	APCN2	Asia-Pacific Cable Network 2
6	APG	Asia Pacific Gateway
7	SJC	Southeast Asia-Japan Cable
8	ADC	Asia Direct Cable
9	AAE-1	Asia Africa Europe-1
10	Sea-Me-We 5 /SMW 5	South East Asia-Middle East-Western Europe 5
11	SAFE	South Africa Far East Cable
12	SAIL	South Atlantic Inter Link
13	SJC2	Southeast Asia-Japan Cable 2
14	2Africa	2Africa Cable
15	ALC	Asia Link Cable
16	SEA-H2X	South-East Asia Hainan-Hongkong Express Cable
17	Sea-Me-We 6	South East Asia-Middle East-Western

No.	Abrreviation	Full form
	/SMW6	Europe 6
18	IAX	India-Asia-Xpress
19	IEX	India-Europe-Xpress
20	HKA	Hong Kong-America Cable
21	BtoBE	Bay to Bay Express Cable
22	H2HE	Hainan to Hong Kong Express
23	FOA	Fibra Optica Austral
24	AAG	Asia-America Gateway
25	Sea-Me-We 3 /SMW3	South East Asia-Middle East-Western Europe 3
26	CUCN	China-US Cable Network

Appendix II: Terminology

1. Submarine cable system

A set of equipment designed to allow the interconnection of two or more terminal stations. The submarine cable system is usually composed of terrestrial terminal equipment (terminal transmission equipment, power feeding equipment, maintenance controller, etc.), and undersea equipment (cable, repeater(s), branching unit(s), etc.).

2. Submarine repeater

The core function of the submarine repeater is to amplify the attenuated optical signals during long-distance transmission, thereby extending the transmission distance of the optical cable, allowing the cable to cover thousands of kilometers or even farther, thus enabling transoceanic communication.

3. Submarine branching unit（BU）

The submarine branching unit is used to distribute the optical fibers and power lines of the submarine cable to different sites, enabling connections between the main trunk line and branch lines, thereby supporting communication at multiple landing points or branch points.

4. Terrestrial terminal equipment

Terrestrial terminal equipment is crucial for submarine cable communication systems. It's typically installed at submarine cable landing stations to connect submarine cables to terrestrial communication networks.

It includes transmission, power feeding equipment, management equipment, and related management units, ensuring seamless connectivity between submarine cables and terrestrial networks.

5. Wet plant equipment

Wet plant equipment refers to the part of the submarine cable system that is located on the seabed between the beach joints or landing points, which includes submarine cable, submarine repeaters, optical submarine branching units, submarine cable jointing boxes, etc.

6. Submarine cable laying vessel

Specialized vessels designed for the installation and maintenance of submarine cable systems. These ships are typically equipped with a dynamic positioning system (DP), cable tanks, and remotely operated vehicles (ROVs), etc.

7. Shipboard cable laying equipment

The shipborne laying equipment mainly includes cable tanks, cable sheaves/guide wheels, ploughs, high-pressure water jetting systems, armour stripping tools, remotely operated vehicles (ROVs), cable repair/recovery tools, and jointing platforms, etc.

8. Submarine installation & maintenance equipment

The primary equipment includes dynamic positioning systems (DP), submarine cable guide wheel systems, plough-type burial systems, high-pressure water jetting systems, water jet trenching machines, remotely

operated vehicles (ROVs), and grapnel tools, etc.

9. Repeatered submarine cable

A communication cable integrated with optical repeaters within a submarine fiber-optic system, designed to compensate for signal attenuation over long-distance transmission, thereby enabling transoceanic or ultra-long-haul (typically>400 kilometers) optical communication.

10. Repeaterless submarine cable

A communication cable within a submarine fiber-optic system that does not incorporate active repeaters. Its design relies on shore-based optical amplification techniques and high-sensitivity receivers to achieve optical signal transmission over medium-to-short distances (typically<400 kilometers).

11. Fiber pair

A bidirectional communication unit within a submarine cable system, consisting of two independent optical fiber cores—one for transmitting signals and the other for receiving signals—that collectively enable full-duplex data transmission. Fiber pairs serve as the fundamental capacity unit of submarine cable systems, where the number of pairs directly determines the system’s total bandwidth capability. With technological advancements, modern submarine cables have evolved from the initial 4-8 fiber pairs to configurations of 12, 16, 24, or even 32 pairs.

12. Space Division Multiplexing (SDM)

A technology enhances the capacity of optical communication systems by expanding spatial dimensions. Its core principle lies in leveraging the physical spatial resources of optical fibers to transmit multiple signal channels independently, either within a single fiber or across multiple parallel fibers, thereby overcoming the Shannon Limit of conventional single-mode fibers.

13. Service degradation

Refers to a phenomenon in the fields of telecommunications, networking, or service management where the performance or quality of a user's service declines, failing to meet predefined Service Level Agreements (SLAs) or user experience standards. Its defining characteristic is that the service remains partially available, but critical performance metrics (e.g., latency, bandwidth, packet loss rate) deviate significantly from normal ranges, adversely impacting the user's actual experience.

14. Optical fiber loss variation

Refers to the fluctuation in signal power attenuation during optical fiber transmission caused by environmental factors, material properties, or external interference, which varies over time or space. This variation directly impacts the stability and transmission quality of communication systems and is a critical consideration in the design and maintenance of submarine cable networks.

15. Pump failure

Refers to a phenomenon in optical communication or laser systems where the pump source (e.g., semiconductor laser diodes or fiber-coupled pump modules) fails to deliver sufficient energy to excite the gain medium (such as erbium-doped fibers, EDF) due to aging, electrical faults, or environmental anomalies. This results in significant performance degradation or complete functional failure of the system. Such failures directly impact critical components like optical amplifiers and lasers, making pump reliability a core risk factor in the design of submarine cable networks.

16. Open Cable

Open Cable is a novel decoupled network architecture emerging in the submarine cable industry, which separates the terrestrial terminal equipment (e.g., Submarine Line Terminal Equipment, SLTE) from the wet plant (e.g., submarine repeaters, branching units) within a submarine cable system. This enables multi-vendor equipment to share the same fiber channel. Its core lies in breaking the limitations of traditional closed systems through technical decoupling and standardized interfaces, achieving multi-vendor compatibility and flexible network configuration, thereby forming an open and scalable ecosystem.

17. Spectrum management

Refers to the practice of precisely partitioning, allocating, and

adjusting the wavelength ranges and spectral grids of optical signals within a fixed fiber capacity to enable differentiated service delivery for diverse applications, such as international leased lines and cloud computing traffic.

18. Optical Add-Drop Multiplexing (OADM)

Optical Add-Drop Multiplexing in Submarine Cable Systems is a critical technology for flexible wavelength-level signal management and scheduling within submarine cable networks. Its core function is to dynamically insert (add) or extract (drop) specific wavelength channels at designated nodes without interrupting the main optical signal transmission, thereby enabling multi-regional interconnection, dynamic traffic scheduling, and network redundancy protection.

19. Underwater robotics

Underwater robotics in the submarine cable domain refers to intelligent subsea operation equipment specifically designed for the deployment, maintenance, inspection, and repair of submarine optical cables. Their core functions involve performing precision operations and maintenance on cable systems in extreme environments such as deep-sea high-pressure conditions and strong ocean currents, enabled by mechanical manipulation, sensor-based monitoring, and remote control. These systems are primarily based on remotely operated vehicles (ROVs) with umbilical tethering, supplemented by hybrid robots (ARVs) with autonomous decision-making capabilities.

20. Plough-type burial systems

Plough-type burial systems is a critical equipment in submarine cable deployment and maintenance, designed to excavate trenches on the seabed and bury cables at predetermined depths to protect against external physical damages such as fishing trawls, anchor strikes, and ocean current erosion. Its core function is to create continuous trenches under complex seabed geological conditions through mechanical cutting, hydraulic jetting, or vibrational excavation, ensuring the long-term stable operation of the cables.

21. Cable laying machine

Cable laying machine is a core equipment in submarine cable deployment projects, responsible for safely and controllably deploying optical cables from construction vessels or land-based stations to the seabed or underground pipelines. It ensures compliance with bending radius limits, tension control, and path accuracy requirements during the laying process. Its primary functions include cable storage, deployment speed adjustment, dynamic tension management, and real-time status monitoring, making it a critical asset for guaranteeing the physical integrity and long-term reliability of optical cables.

22. ITU Study Group 15 (SG15)

The International Telecommunication Union (ITU)'s Study Group 15 (SG15) is a central technical group within the ITU Telecommunication

Standardization Sector (ITU-T). It is responsible for developing international standards for global transport networks, access networks, optical communications, and data infrastructure. Its scope covers full-stack technical specifications ranging from the physical layer (e.g., optical fibers, cables) to the network layer (e.g., transmission protocols, synchronization technologies), directly impacting the interoperability and technological evolution of global communication networks.

23. SMART CABLE

Scientific Monitoring and Reliable Telecommunications Cable is a next-generation submarine optical cable system that integrates sensing, communication, and ocean observation capabilities. By embedding sensor modules (such as seismometers, thermometers, and pressure gauges) within traditional submarine communication cables and incorporating real-time data transmission capabilities, it achieves dual functionality of communication and marine environmental monitoring.

24. Unlimited navigation zone

A technical term in a ship's seaworthiness certificate, indicating that the vessel's navigational capability covers all global maritime areas without geographical restrictions. For submarine cable companies, this signifies the ability to independently execute international projects and reduce collaboration costs.

25. Yokohama Maintenance Zone

One of the world's five major submarine cable maintenance zones and the most critical operation and maintenance hub for submarine communication cables in the Asia-Pacific region. Centered in Yokohama, Japan, this zone covers the northwestern Pacific Ocean and northern Asian maritime areas, responsible for maintaining, repairing, and providing disaster emergency response for international submarine cables within the region. Maintenance vessels from China, Japan, and South Korea participate in the maintenance work.

26. The International Cable Protection Committee (ICPC)

ICPC was founded in 1958 and its Membership comprises of governmental administrations and commercial companies that own or operate submarine telecommunications or power cables, as well as other companies that have an interest in the submarine cable industry—including most of the world’s major cable system owners and cable ship operators. The primary purpose of the ICPC is to help its Members to improve the security of undersea cables by providing a forum in which relevant technical, legal and environmental information can be exchanged.

27. International Advisory Body for Submarine Cable Resilience

Initiated by the International Telecommunication Union (ITU) and the International Commission for the Protection of Submarine Cables (ICPC), the International Advisory Body for Submarine Cable Resilience aims to explore potential ways to improve the resilience of communications cables,

provide strategic guidance for improving the resilience of communications cables, develop and promote best practices for the protection of communications cable systems, and promote international cooperation in technology development, policy frameworks and investment models. A total of four high-level representatives from the Ministry of Industry and Information Technology, China Telecom, China Unicom, and HMN Tech were elected as members of the advisory body.

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