INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.971

(11/96)

SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

Digital transmission systems – Digital sections and digital line system – Optical fibre submarine cable systems

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General features of optical fibre submarine cable systems

ITU-T Recommendation G.971

(Previously CCITT Recommendation)

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ITU-T RECOMMENDATION G.971

GENERAL FEATURES OF OPTICAL FIBRE SUBMARINE CABLE SYSTEMS

Summary

This Recommendation applies to optical fibre submarine cable systems. The purpose of this Recommendation is to identify the main features of optical fibre submarine cable systems, and to provide generic information on relevant Recommendations in the field of optical fibre submarine cable systems.

This Recommendation was firstly issued in 1993. Amendments have been made taking into account the establishment of new Recommendation (G.975). An updated version of a list of cable ships and submerged equipments, which was available in the *Blue Book, Volume III, Supplement 11*, is also included.

Source

ITU-T Recommendation G.971 was revised by ITU-T Study Group 15 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 8th of November 1996.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

INTELLECTUAL PROPERTY RIGHTS

The ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. The ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, the ITU had/had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

Recommendation G.971

GENERAL FEATURES OF OPTICAL FIBRE SUBMARINE CABLE SYSTEMS

(revised in 1996)

1 Scope

This Recommendation applies to optical fibre submarine cable systems.

The purpose of this Recommendation is to identify the main features of optical fibre submarine cable systems.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

– ITU-T Recommendation G.972 (1997), *Definition of terms relevant to optical fibre submarine cable systems.*

– ITU-T Recommendation G.973 (1996), *Characteristics of repeaterless optical submarine cable systems.*

– ITU-T Recommendation G.974 (1993), *Characteristics of regenerative optical fibre submarine cable systems.*

– ITU-T Recommendation G.975 (1996), *Forward error correction for submarine systems.*

3 Terms and definitions

Terms used in this Recommendation are defined in Recommendation G.972.

4 Abbreviations

This Recommendation uses the following abbreviations.

BU Branching Unit

CTE Cable Terminating Equipment

PFE Power Feeding Equipment

TTE Terminal Transmission Equipment

5 Features of optical fibre submarine cable systems

An optical fibre submarine cable system has specific technical features:

1) A submarine cable system should achieve a long lifetime and a high reliability; the main reason is that, due to the difficulty in accessing the submerged plant, the construction and

maintenance of a link are long and expensive; moreover most of submarine links are of strategic importance in the transmission network and the interruption of a link usually results in significant loss of traffic and revenue.

2) A submarine cable system should possess mechanical characteristics which enable it:

- to be installed accurately with correct slack and with due safety consideration on the sea bed; deep water installations may reach 8000 metres. [In general, submarine cable systems shall be installed, buried or inspected by specially designed cable ships and submerged equipments. Detailed information of such cable ships and submerged equipments (i.e. ploughs, ROVs, etc.) is contained in Appendix I];
- to resist the sea bottom environment condition at the installation depth, and particularly hydrostatic pressure, temperature, abrasion, corrosion, and marine life;
- to be adequately protected (i.e. by armoring or burying) against aggression, due for example to trawlers or anchors;
- to survive recovery from such a depth, and subsequent repair and relay, with due safety consideration.

3) The material characteristics of a submarine cable system should enable the optical fibre:

- to achieve its desired reliability over its design lifetime;
- to tolerate stated loss and ageing mechanisms, especially bending, strain, hydrogen, stress, corrosion and radiation.

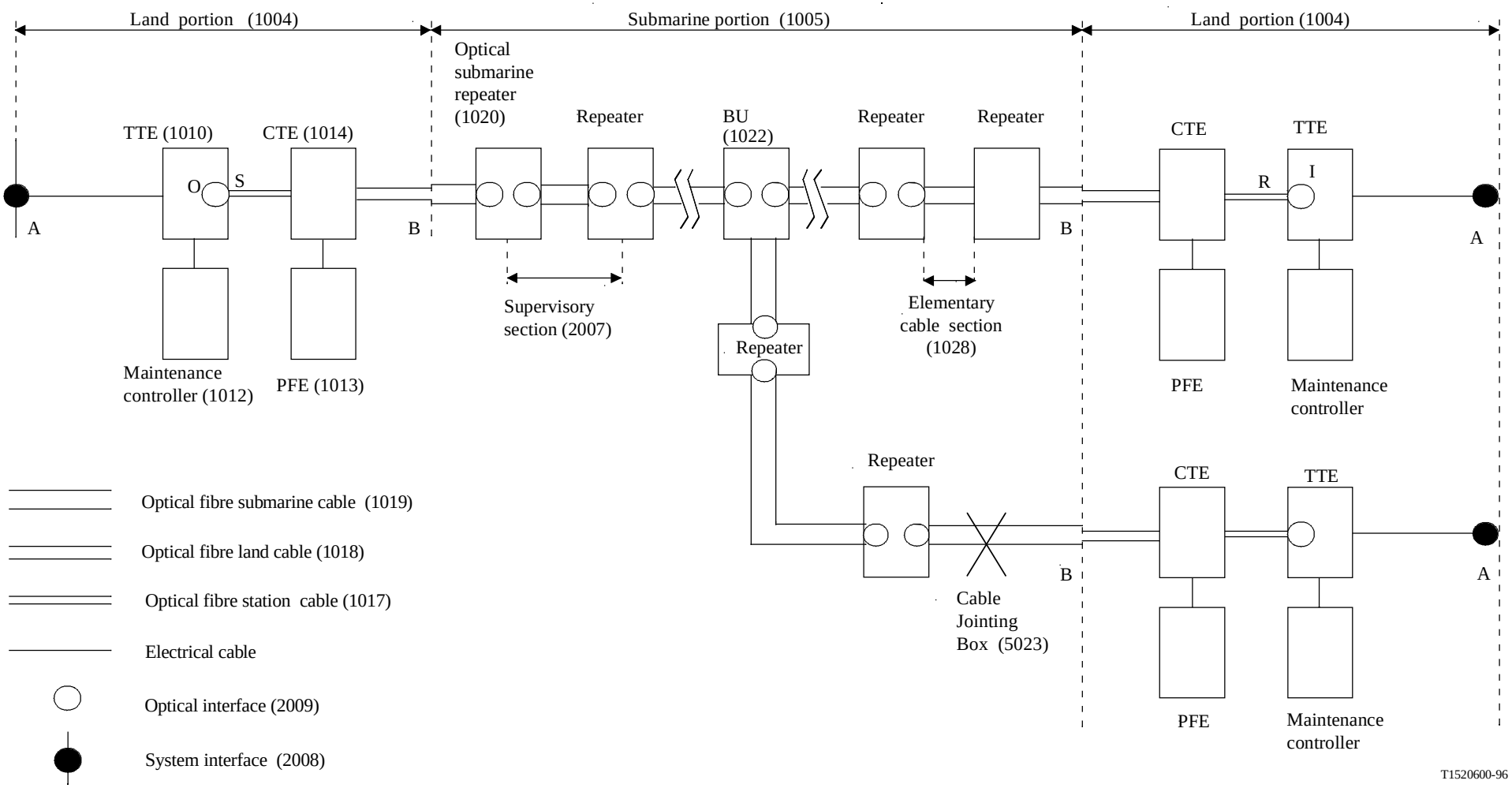
4) The transmission quality of a submarine cable system should follow as a minimum Recommendation G. 821.

Figure 1 shows the basic concept of optical fibre submarine cable systems and boundaries. Optical submarine repeaters or optical submarine branching units could be included, depending on each system requirement.

In Figure 1, A denotes the system interfaces at the terminal station (where the system can be interfaced to terrestrial digital links or to other submarine cable systems), and B denotes beach joints or landing points. Numbers in brackets in the Figure refer to Recommendation G.972.

6 Relationship among Recommendations relevant to optical submarine cable systems

Relationship among the various Recommendations pertaining to optical fibre submarine cable systems are shown in the flow chart presented in Figure 2.



NOTE 1 – A denotes system interface.
NOTE 2 – B denotes landing points or beach joints (1006).
NOTE 3 – X denotes cable jointing box (5023).
NOTE 4 – Numbers in brackets relate to Recommendation G.972.

Figure 1/G.971 – Example of optical fibre submarine cable systems

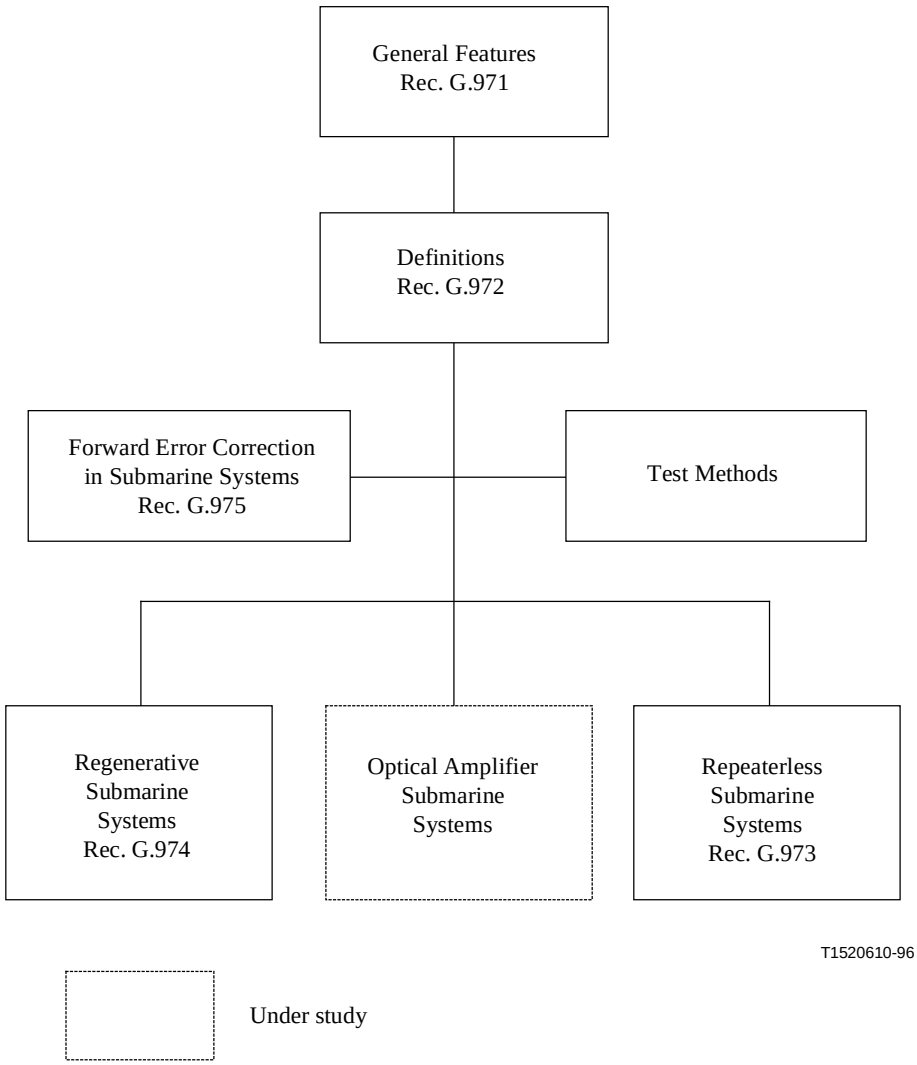


Figure 2/G.971 – Relationship between Recommendations relevant to optical submarine cable systems

APPENDIX I

Data on cable ships and submersible equipments of various countries

(Mar del Plata, 1968, amended at Geneva, 1972, 1976, 1980, 1984, 1988 and 1995)

Section 1 – Cable ships

Name of ship	Year of construction	Displacement (tons)	Overall length (m)	Draft (m)	Normal speed (knots)	Range (autonomy) (nautical miles)	Number of tanks	Cable capacity			Cable gear				Maximum operating depth (m)	Capability
								Cable		Repeaters	Cable engine		Unwinding pulley			
								Cubic metres (m^3)	Weight (tons)		Drum (diameter) (m)	Linear (pairs of wheels)	Bow sheave (diameter) (m)	Stern sheave (diameter) (m)		
CANADA																
John Cabot	1965	5 318	97	6.7	12/15	16 000	3	543	1 500	24	1 × 3.0 (30t)	18	3.0	–	All	Repair ship. Plough capabilities. Ice breaker Lloyd's 100 A1
DENMARK *Ships belonging to Telecom Denmark*																
Peter Faber	1982	Open 750 Closed 1 830	78.4	Open 3.8 Closed 5.0	14.0	7 000	1 tank 1 hold	310 230	600 400	App. 10	3.0		3.0	–	4 000	Reinforced for operation in icefilled waters. On the aft deck: one A-frame with hydraulic topping. Max. load 35 tons. One hydraulic towing and general purpose winch. Two hydraulic double-drum warping winches.
Maersk Fighter	1992	2 961	82.5	6.24	15.7 Max	7 700	2	1 263	2 400	–	4.0 (25t)	65 (4t)	–	–	–	Laying/burying and repair of all types of cables (coaxial, optical fibre and power cables) Ploughs and ROV capability.

Name of ship	Year of con-struc-tion	Dis-place-ment (tons)	Overall length (m)	Draft (m)	Normal speed (knots)	Range (auto-nomy) (nautical miles)	Number of tanks	Cable capacity			Cable gear				Maximum operating depth (m)	Capability
								Cable		Re-peaters	Cable engine		Unwinding pulley			
								Cubic metres (m^3)	Weight (tons)		Drum (diameter) (m)	Linear (pairs of wheels)	Bow sheave (diameter) (m)	Stern sheave (diameter) (m)		
FINLAND ***Ship belonging to Telecom Finland***																
M/S Telepaatti	1978	322	36.6	3.0	10.5	–	1	–	150	–	2 × 3.0					Laying by linear engine. Specially equipped for cable route survey and submarine cable repair. Det Norske Veritas double strength class 1A1 keel,1B ice protection.
FRANCE ***Ships belonging to France Telecom***																
Vercors	1974	11 000	136	7.2	16.6	12 000	3	2 425	4 900	144	3.0	24	3.0	Chute	All	Laying and repair of all types of telecom cables. Burying of cables with plough.
Leon Thevenin	1983	6 800	107	6.24	15.0	10 000	2 + 1	1 420	2 000	11	3.4	12	3.0	Chute	All	Laying and repair of all types of telecom cables. Burying of cables using Scarab.
Raymond Croze	1983	6 800	107	6.24	15.0	10 000	2 + 1	1 420	2 000	11	3.4	12	3.0	Chute	All	Laying and repair of all types of telecom cables. Burying of cables using Scorpio 2000.
ITALY ***1) Ship belonging to Elettra S.p.A***																
Teliri	1995	6 500	111.5	6.5	16.5	10 800	3	2 050	2 400	27	2 × 6.0 (45t)	1 × 18 cp × 15t	3.5	3.5	All	Laying and repair of armoured coaxial and optical fibre cables; survey.

Name of ship	Year of construction	Displacement (tons)	Overall length (m)	Draft (m)	Normal speed (knots)	Range (autonomy) (nautical miles)	Number of tanks	Cable capacity			Cable gear				Maximum operating depth (m)	Capability
								Cable		Repeaters	Cable engine		Unwinding pulley			
								Cubic metres (m^3)	Weight (tons)		Drum (diameter) (m)	Linear (pairs of wheels)	Bow sheave (diameter) (m)	Stern sheave (diameter) (m)		
2) Ships belonging to Pirelli Cavi																
Arabella	1975	2 620	76.66	5.18	11	2 000	2	1 100	2 000	–		–	–	3	All	Lay/repair.
G.Verne	1984	16 900	128.5	8.5	10	8 000	2	2 600	8 000	20	6.0 (50t)	1 (Pads type 10t)	–	6.0	All	Stern only.
SPAIN ***Ships belonging to TEMASA***																
Teneo	1992	4 000	81	5.7	14.5	4 200	2	500	1 000	20	2 × 3.5		2 × 3	3	All	
Atlantida	1987	7 853	114.03	6.5	12.5 (Max) 15.7	6 800	3	1 500		33	2 × 3.5		3.0	3.0	5 700	
JAPAN ***1) Ships belonging to KDD***																
KDD Maru	1967	6 026	113.83	6.3	16	7 000	3	1 012	2 700	70	3.6		3.0	Chute 4.0	All	Lays and repairs all types of telephone cables.
KDD Ocean Link	1992	12 000	133.5	7.0	15	10 000	Main 3 Spare 4	2 600	4 500	57	3.6	21 (18 inch)	3.2	–	All	Laying by linear engine. Lays and repairs all types of telephone cables.
2) Ships belonging to NTT																
NTT Kuroshio Maru	1974	5 656	119.3	5.60	16.5	6 883	3	1 429	1 900	95	3.8	8 (24 inch)	3.0	3.0	All	Lays and repairs all types of telephone cables.
NTT Setouchi Maru	1979	819	64.8	3.50	12.0	3 690	2	139	250	20	2.5	–	–	1.5	5 000	Lays and repairs all types of telephone cables.
NTT Koyo Maru	1983	1 336	74.0	43.50	13.5	4 500	2	169	250	20	3.0	6 (18 inch)	2.5	2.0	All	Lays and repairs all types of telephone cables.

Name of ship	Year of con-struc-tion	Dis-place-ment (tons)	Overall length (m)	Draft (m)	Normal speed (knots)	Range (auto-nomy) (nautical miles)	Number of tanks	Cable capacity			Cable gear				Maximum operating depth (m)	Capability
								Cable		Re-peaters	Cable engine		Unwinding pulley			
								Cubic metres (m^3)	Weight (tons)		Drum (diameter) (m)	Linear (pairs of wheels)	Bow sheave (diameter) (m)	Stern sheave (diameter) (m)		
UNITED KINGDOM																
1) Ship belonging to British Telecom																
Sovereign	1991	13 018	131	7.0	13.5	14 000	4	2 800	6 200	90	3.50		3.00	3.50	All	Lays, repairs all types of coaxial and optical fibre cable. (Operated by C&W marine.)
2) Ships belonging to Cable & Wireless (Marine) Limited																
Alert	1961	9 477	130	7.1	14	10 000	3	1 509	3 100	48	2.98		2.98	2.98	All	Laying by linear engine and sea-bed burial by plow. Lays/repairs all types of coaxial and optical fibre cables.
Cable Venture	1962	16 983	153	8.97	12.5	10 000	4 + 1 (spare)	5 086	9 000	400	2.80		3.00	3.39	All	Laying by linear cable engine. Ploughs, lays and repairs armoured and lightweight cables.
Mercury	1962	11 683	144	7.5	14.5	8 000	3	2 970	3 500	144	3.05		3.50	Chute 3.05	All	Ditto (no plough).
Cable Enterprise	1964	5 759	113	5.84	13	8 000	3	887	2 150	30	2.8		3.00	Chute 3.05	All	Lays/repairs armoured cables. Repairs lightweight cables. (Note *)
Monarch	1975	4 639	97	5.5	14	7 000	4	417	850	12	3.00		3.00	None	All	Lays/repairs armoured coaxial and optical fibre cables. Repairs lightweight coaxial and optical fibre cables. Detrenching/ reburial by submersible jetting.

* NOTE – Only relatively short cables are laid and only shore-end.

Name of ship	Year of con-struc-tion	Dis-place-ment (tons)	Overall length (m)	Draft (m)	Normal speed (knots)	Range (auto-nomy) (nautical miles)	Number of tanks	Cable capacity			Cable gear				Maximum operating depth (m)	Capability
								Cable		Re-peaters	Cable engine		Unwinding pulley			
								Cubic metres (m^3)	Weight (tons)		Drum (diameter) (m)	Linear (pairs of wheels)	Bow sheave (diameter) (m)	Stern sheave (diameter) (m)		
							2) Ships belonging to Cable & Wireless (Marine) Limited (cont.)									
Iris	1976	4 639	97	5.5	14	7 000	4	417	850	12	3.00		3.00	None	All	Lays/repairs armoured coaxial and optical fibre cables. Repairs lightweight coaxial and optical fibre cables.
MV Cable Installer	1980	6 065	89.42	5	12	42 days	4	840	1 600	None	3.0	4-track pair	–	3.0	–	Repeaterless installation vessel fully DP Cegelec 901 system.
Seaspread	1980	10 887	116	6.8	13	65 days	2	1 010	1 701	–	2 × 3	–	–	3	All	Lays/repairs by aft drums. Burial by plough. Lays/repairs armoured and lightweight cables.
Pacific Guardian	1984	7 526	116	6.32	14.0	8 000	3	1 416	3 470	96	3.5		3.00	3.00	All	Laying by linear cable engine. Lays and repairs armoured and lightweight cables.
Sir Elic Sharp	1988	7 526	115	6.3	13.5	9 600	3	1 416	1 700	96	2 × 3.5	–	3	3	All	Laying by linear cable engine. Repairs and lays armoured and lightweight cables. Post lay/repair burial by integral ROV.
MV Cable Innovator	1995	–	142	8.3	14.5	42 days	4	4 900	7 500	180	4.0	21 pair (min)	–	4.0	–	Simplex D/P system. Lays/repairs cables.
							UNITED STATES OF AMERICA *Ships belonging to AT&T*									
Charlie Brown	1952	2 881	99.9	5.8	15	7 000	3	660	2 122	–	3.66		3.66	N/A	All	Repairs all types of telephone cables. Lays short and shore systems.
Long Lines	1963	11 326	156	7.9	15	10 000	3	4 420	7 000	125	3.66		3.05	3.66	All	Lays/repairs all types of telephone cables.

Section 2 – Submersible equipments

Type of submersible	Weight (tons)	Overall length (m)	Width (m)	Height (m)	Trenching system	Trenching	Propulsion	Max.operating depth (m)	Capability
				FRANCE *Submersibles belonging to France Telecom (FTRSI)*					
ELISE2 Submersible Plough system	17	7.60	2.90	2.95	Ploughshare	Immediate burial up to 1.1 m	Towed by support ship	1 500	Lay and bury all types of cables.
ELISE3 Submersible Plough system	17	7.60	2.90	2.95	Ploughshare	Immediate burial up to 1.1 m	Towed by support ship	1 500	Lay and bury all types of cables.
Self-advancing buried system CASTOR2	12	7.0	2.40	3.00	Trenching wheel or chain	Burial of existing cables down to 2 m	Tracked vehicle	1 000	Burial of cables and pipes. Visual inspection.
Scarab 3	9	4.0	3.50	2.10	High pressure water jets	Up to 60 cm depth	Thrusters (inspection) Back drive (burial)	1 000 (burial) 2 000 (inspect)	Visual inspection, post lay burial, cable location, cable manipulation, cable cutting.
Remote control submersible Scorpio 2000	3.4	2.9	1.5	2.11	High pressure water jets	Up to 60 cm depth	Thrusters	1 000	Visual inspection, post lay burial, cable location/ manipulation/cutting.
				ITALY *Submersibles belonging to Pirelli Cavi*					
Plough 1	10	7	2.7	3	Plough share	Up to 1 m	Towed by support ship	50	Lay and bury cables.
Plough 2	9	8.5	3.8	3.5	Plough share	Up to 1.2 m	Towed by support ship	50	Lay and bury fibre optic cables.
				UNITED KINGDOM *Submersibles belonging to Cable & Wireless (Marine) Ltd.*					
Submersible trencher	17.0	6.6	4	3.4	Fluidization and cutting jets and dredge pump	Up to 1 m depth with cutting and fluidization jets	Three vertical and four horizontal thrusters, track drive differential steering	274	Trench in existing cable and pipe.

Type of submersible	Weight (tons)	Overall length (m)	Width (m)	Height (m)	Trenching system	Trenching	Propulsion	Max.operating depth (m)	Capability
				UNITED KINGDOM ***Submersibles belonging to Cable & Wireless (Marine) Ltd. (cont.)***					
Submersible Plough system	9.75	6.1	2.6	2.6	Ploughshare proceeded by disc	Immediate burial of cable on ploughing	Towed by support ship	900	Lay and bury cable, umbilical and pipe in one action giving full cable protection.
Remote control submersible 2 off Cirus A&B	3.2	3.5	2.1	2.3	Water jets	Trenching capability 0.3 m	Thrusters (7)	1 000	Visual inspection, cable location/inspection/deburial, manipulation. Tools include cable cutter, cable gripper and 2 manipulators with line cutters.
Plough 2 off A&B	14.5	9	4.1	4	Passive blade	Trenching capability 1.0 m	Towed	1 000	Steerable, repeater burial.
Remote control submersible ROV 128	7.5	2.9	1.8	2.0	Jetting tool	Trenching capability 0.6 m	Tracked burial Thrusters survey	1 000 (burial) 2 000 (survey)	Tools include cable cutter, cable gripper and 2 manipulators with line cutters.
Underwater vehicle-MARLIN	7.8	4.191	2.438	3.175	Burial skid	To 1.0 m (Optimized for 0-30 kPa soil)	Hydraulic driven thrusters	2 500	Burial, deburial, inspection. Maintenance and repair. Tools include cable cutter, cable gripper.
Scarab I – Umbilically tethered ROV	3.2	2.74	1.82	1.52	Jetting tool	Up to 0.6 m	Thrusters: 2 vertical 4 vectored	2 000	Cable detection and inspection. Visual survey. Cable manipulation and cutting Debris elimination. Cable and repeater burial/ deburial.
Subtrack – ROV	10.0	8.0 (Max)	3.7	3.8	Jetting tool	Burial to 1.0 m	Electro hydraulic track drives	1 000	Cable burial and deburial. Inspection. Maintenance and repair.

Type of submersible	Weight (tons)	Overall length (m)	Width (m)	Height (m)	Trenching system	Trenching	Propulsion	Max.operating depth (m)	Capability
				UNITED KINGDOM ***Submersibles belonging to Cables & Wireless (Marine) Ltd. (cont.)***					
EUREKA: Deepwater burial + trenching system	17 (Max)	5.5	4.2	3.85	Jetting tool Rock wheel cutter Mechanical chain excavator	1 m 1.2 m 2.2 m	Electro hydraulic track drives	1 500	Capable of burying cable, small flexible flowlines and also rigid pipes. Can also debury cable and restore. Visual and electronic inspections.
Plough 5	14.0	9.0	4.6	3.7	Passive blade	Variable from 0-1100 mm (600-900 mm in all conditions)	Towed	1 000	Simultaneously lay and bury cables and umbilicals at varying depths.
Plough 6 and 7	14.0	9.0	4.6	3.7	Passive blade	Max burial depth: 1100 mm	Towed	1 000	Simultaneously lay and bury cables and umbilicals at varying depths.
Cable Plough 1000 mm	14.4	9.75	4.1	3.9	Passive blade	1000 mm (Good conditions: 1100 mm; Repeaters/Joints: 500 mm)	Towed	1 000	Simultaneously lay and bury cables and umbilicals at varying depths.
				DENMARK ***Submersibles belonging to Telecom Denmark***					
Plough 1	12.2	7.2	3.75	2.5 (3.1 m including camera cage)	Plough share	Variable to 800 mm	Towed by host vessel	1 000	Lay and bury telecom cables, power cables and umbilicals. Cables: Up to 120 mmϕ (bary). Joints and repeaters: Up to 400 mmϕ (pass).
Plough 7	13.5	9.0	4.6	3.7	Plough share	Variable from 0-1100 mm (600-900 mm in all conditions)	Towed by surface vessel	1 000	Lay and bury fibre optic cables, power cables and umbilicals.

Type of submersible	Weight (tons)	Overall length (m)	Width (m)	Height (m)	Trenching system	Trenching	Propulsion	Max.operating depth (m)	Capability
				DENMARK					
				Submersibles belonging to Telecom Denmark (cont.)					
Subtrack-Subsea tractor	10.0	8.0 (Max)	3.7	3.8	Jetting tool	Burial to 1.0 m	Electro hydraulic track drives	1 000	Cable burial and deburial. Inspection. Maintenance and repair.
Super Phantom S4 - ROV	0.09	1.5	0.75	0.6	–	–	Thrusters 4 prop fwd/aft 2 prop vertical 2 prop transvers	300	Inspect cables and other underwater objects. Can also be used to inspect seabed conditions.
				JAPAN					
				1) Submersibles belonging to KDD					
KS-2 cable plough	9.3	11.2	2.56	2.0	–	Immediate burial of cable on ploughing	Towed by support ship	200	Lay and bury cable in one action.
MARCAS crawler	4.7	4.0	3.0	2.15	Fluidization jets	Fluidization jets	Track drive	200	Trench in existing cable.
MARCAS-2500	3.6	2.65	1.8	1.9	Fluidization jets	Fluidization jets	2 vertical and 4 horizontal thrusters	2 500	Post-lay burial, maintenance of cable and survey of seabed.
				2) Submersibles belonging to NTT					
Plough-type MARK-5 submarine cable burying system	19.0	9.1	4.0	4.0	–	Up to 1.5 m depth immediate burial of cable on ploughing	Towed by support ship	600	Simultaneous or post-lay burial of cable.
Submarine cable repair burial and inspection system	6.2	3.8	2.1	2.3	Fluidization jets	Fluidization jets	Vertical and horizontal thrusters	1 000	Post-lay burial maintenance of cable and survey of seabed.
Seabed surveying and cable burying equipment	6.2	4.7	3.0	1.7	Fluidization jets	Fluidization jets	Towed by support ship	200	Lay and bury cable in one action.
High pressure water jets type	6.5	4.7	3.0	1.7	High pressure water jets	–	Towed by support ship	200	Lay and bury cable in one action.

Type of submersible	Weight (tons)	Overall length (m)	Width (m)	Height (m)	Trenching system	Trenching	Propulsion	Max.operating depth (m)	Capability
				SPAIN					
				1) Submersible belonging to TEMASA					
ARADO	12	9	4.6	4				1 000	
				2) Submersible belonging to Consorcio ESCARAB					
ROV	8.5	4.0	3.9	2.1		Up to 1 m		2 000 1 000	
				UNITED STATES OF AMERICA					
				Submersibles belonging to AT&T					
Sea plough IV A	–	–	–	–	–	–	–	–	Plough trench 16 inch wide to maximum 24 inch depth.
Sea plough V	–	–	–	–	–	–	–	–	Same as S*ea Plough IV A.*
Scarab I/II	–	–	–	–	–	–	–	–	Multi-owners used for maintenance.

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