

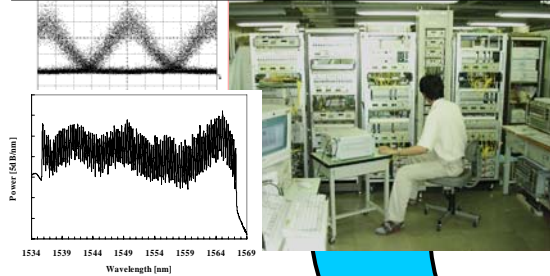
FUJITSU SUBMARINE NETWORKS



FUJITSU LIMITED

Provide Full Turn-Key Solutions

1. System Engineering



5. Maintenance & Support



Full Turn-key

2. Route Engineering



4. Installation & Testing



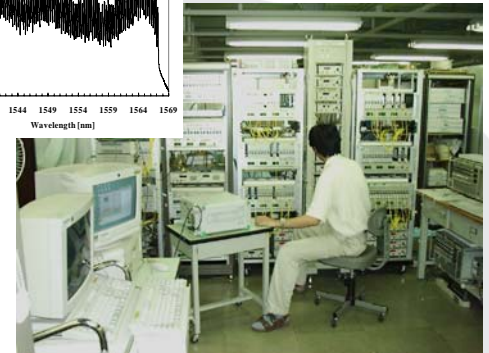
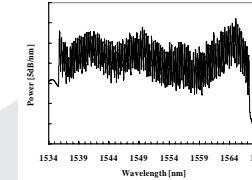
3. Procurement & Production



System Engineering & Route Engineering

■ System Design

- To minimize overall system cost
- To meet customer's needs and satisfaction
- To realize high performance and reliability

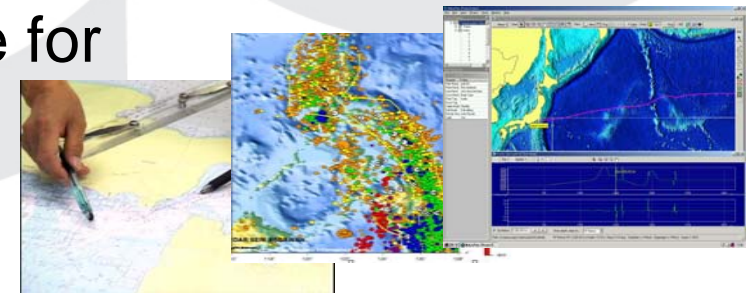


■ System Evaluation

- Evaluate a feasibility of the system design on test bed and simulation

■ Route Engineering (Desk Top Study & Marine Survey)

- Selection of best cable type and route for less expenditure during system life



Procurement & Production

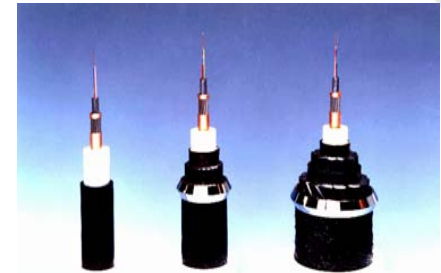
■ Submersible Plant

- Repeater, Branching Unit
- Cable resources from major cable manufacturers



■ Terminal Station Equipment

- Submarine Line Terminal Equipment (SLTE)
- Power Feed Equipment (PFE)
- System Supervisory Equipment (SSE)
- SONET/SDH Interconnecting Equipment (SIE)



Installation & Testing

■ Installation

- System Assembly & Loading
- Marine Installation including;
 - Burial assessment survey (BAS)
 - Shore end installation, beach works and civil engineering
 - Route clearance
 - Trenching - plough burial and jetting
 - Post lay inspection & burial (PLIB)
 - Charting
- Terminal Station Equipment Installation

■ Testing

- All necessary On-site Adjustment
- System Test
- Network Test



Maintenance Support

■ Fujitsu Customer's Maintenance Support Center

● Global Technical Assistance Center (G-TAC)

■ Service Contents

● Technical Service Assistance (TSA)

- 24 h x 7 days
- E-mail/ Telephone/ Fax in English

● TSA Includes;

- Advising on the localization and resolution of the problem
- Coordination of the hardware repair return
- Answering to the maintenance question, product technical inquiry etc.
- Logging and tracing the reported problem
- Provision of Monthly Report



Project Management & Control

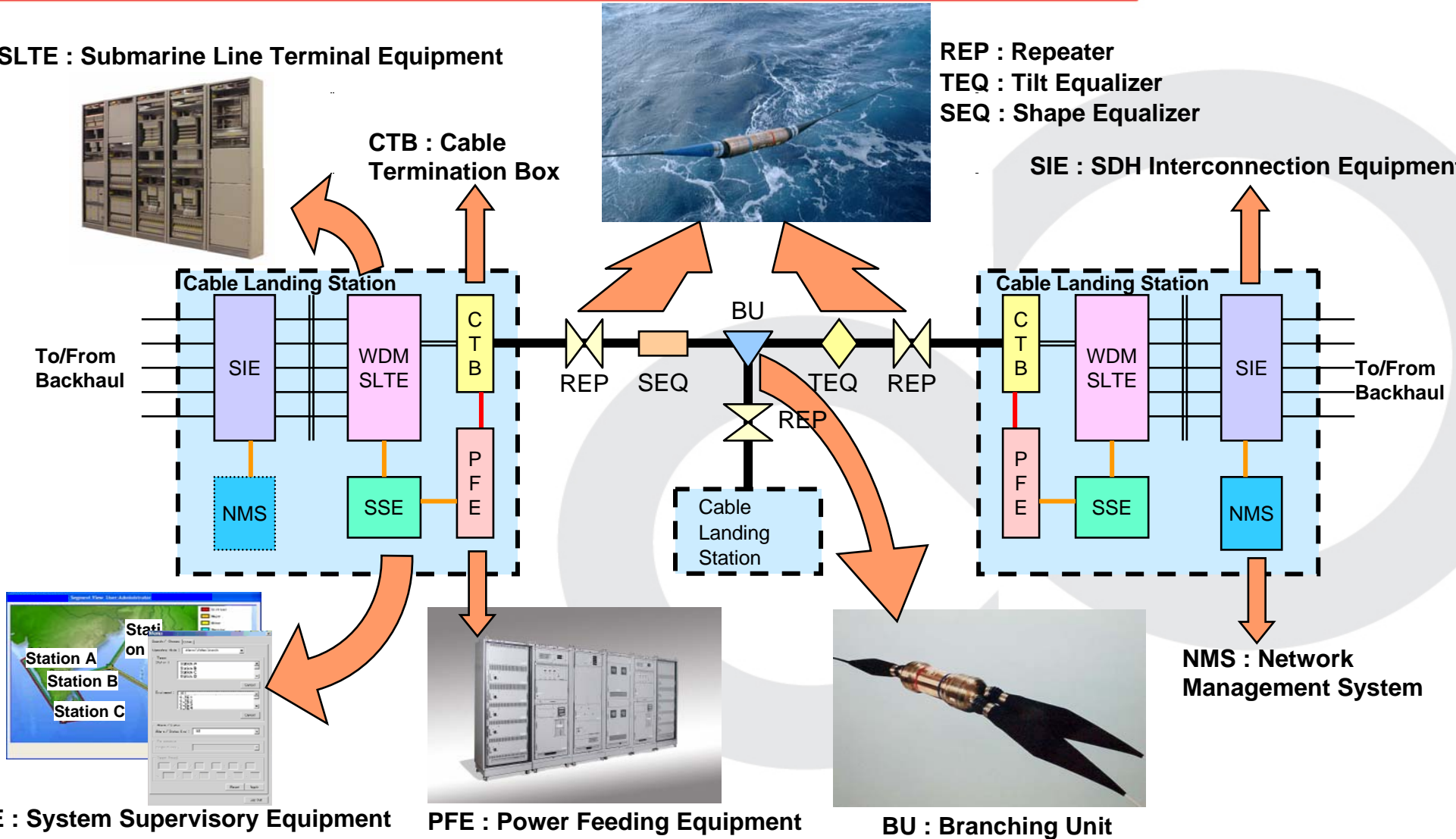
- **Managed and Controlled by Dedicated Project Team**
- **Senior Project Manager Nominated**
- **Strict Control of Project Implementation**
- **High Level of Quality & Production Management**
- **Management of Sub-Contractors**
- **Project Reporting Effectively Established**

Repeatered Submarine System

SLTE : Submarine Line Terminal Equipment

REP : Repeater
TEQ : Tilt Equalizer
SEQ : Shape Equalizer

SIE : SDH Interconnection Equipment



SSE : System Supervisory Equipment

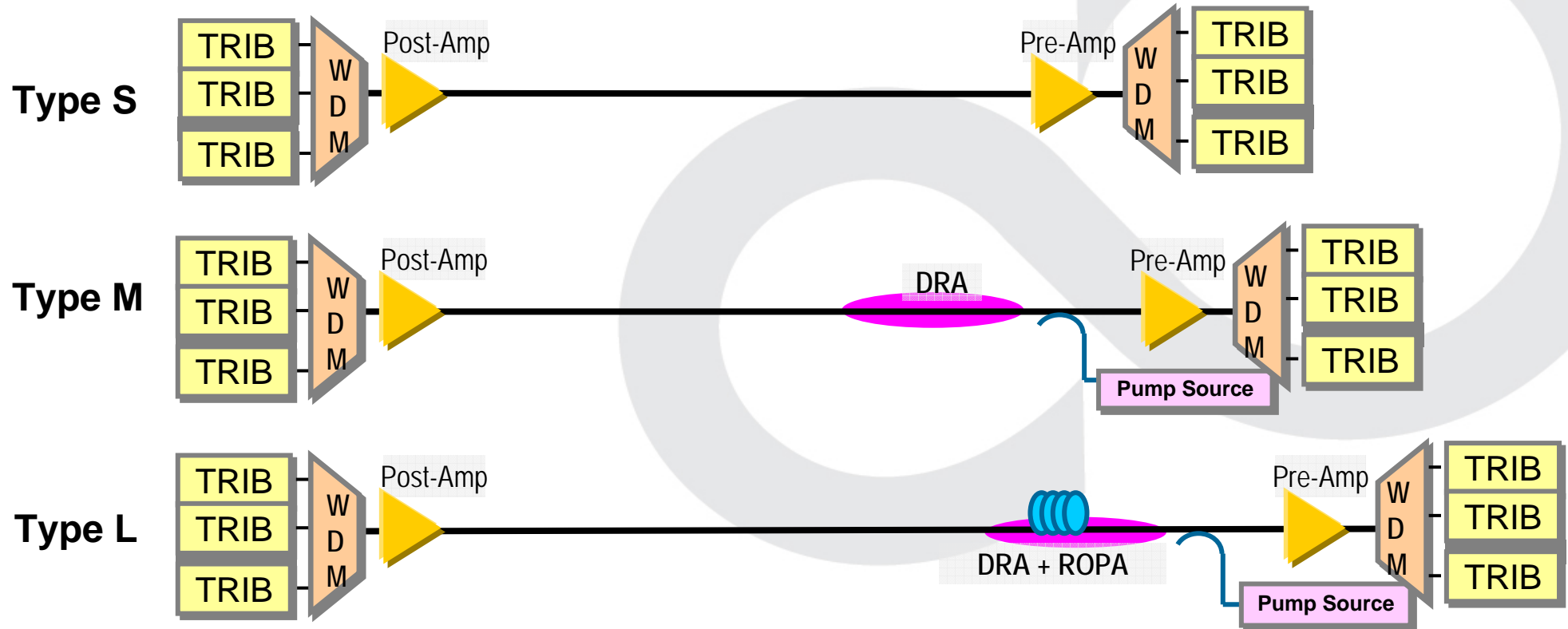
PFE : Power Feeding Equipment

BU : Branching Unit

Unrepeated Submarine System

Applied System Configuration by System Length

- Type S : Post / Pre Amplifiers
- Type M : Addition of Distributed Raman Amplifier (DRA)
- Type L : Addition of Remote Optical Pumped Amplifier (ROPA)

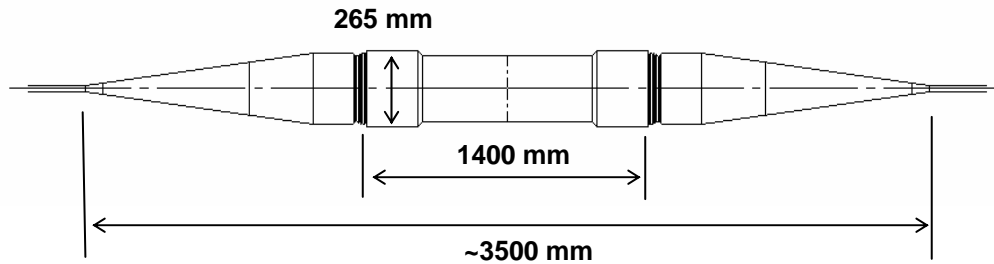


WDM In-service Capacity Upgrade

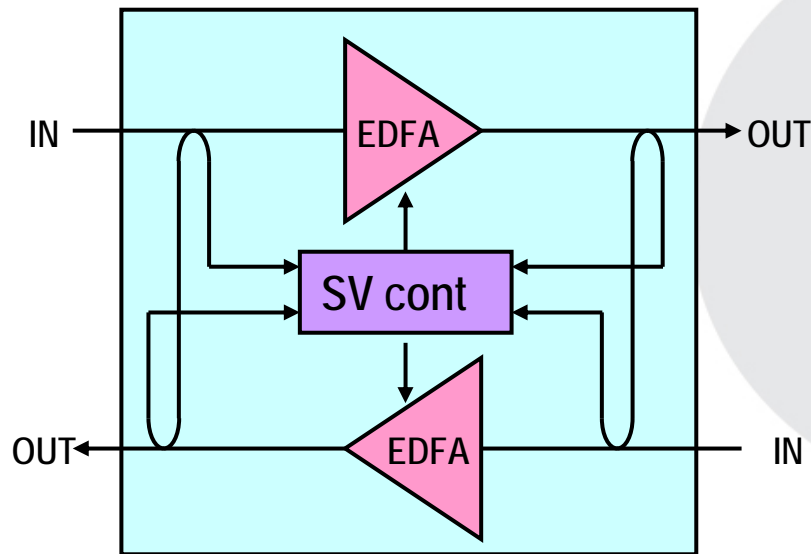
- Expand Designed Capacity
 - Non-WDM system to WDM system (e.g. 5G x 1w to 10G x 8w)
 - Increase Transmission Speed (e.g. 2.5G x 16w to 10G x 16w)
 - Increase Maximum number of WDM (e.g. 10G x 16w to 10G x 32w)
- Addition of Tributary
 - Install new Tributaries into vacant WDM channel slots

Upgrading other vender's system possible !!

Product Detail : Repeater



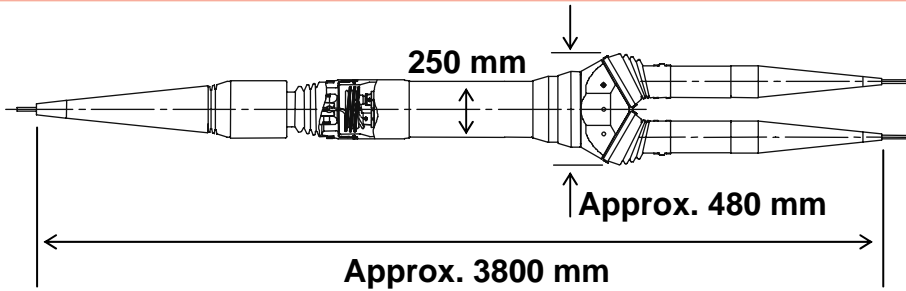
Weight including Coupling: approx. 300kg (4 f.p.)



Features

- Ultra High Reliability
No single failure in operation for almost **40** years
- High Power 980nm Pump LD
- ALC (Automatic Level Control)
- Active Supervisory (Command & Response)

Product Detail : Branching Unit

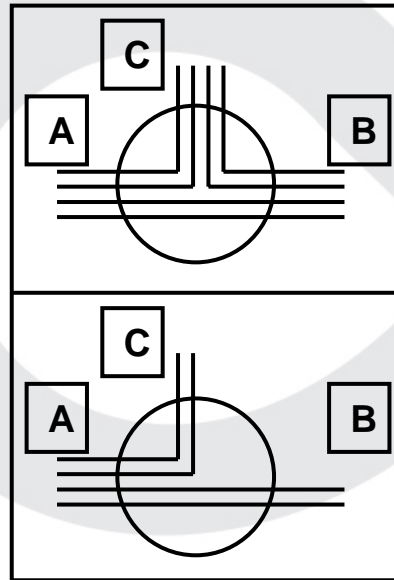


Weight including coupling: 4.7kN

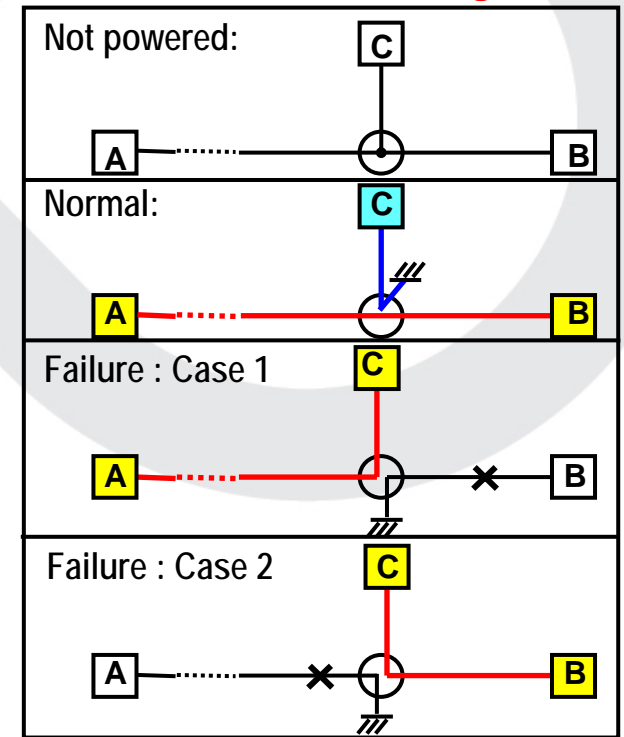


- High Reliability (No single failure in operation for 20 years)
- Field Proven (Largest Supplier in the World)
- Fiber Path Branching (Shown below-left)
- Power Path Switching (Shown below-right)
- Applicable to Multi-branch system

Fiber Path Branching

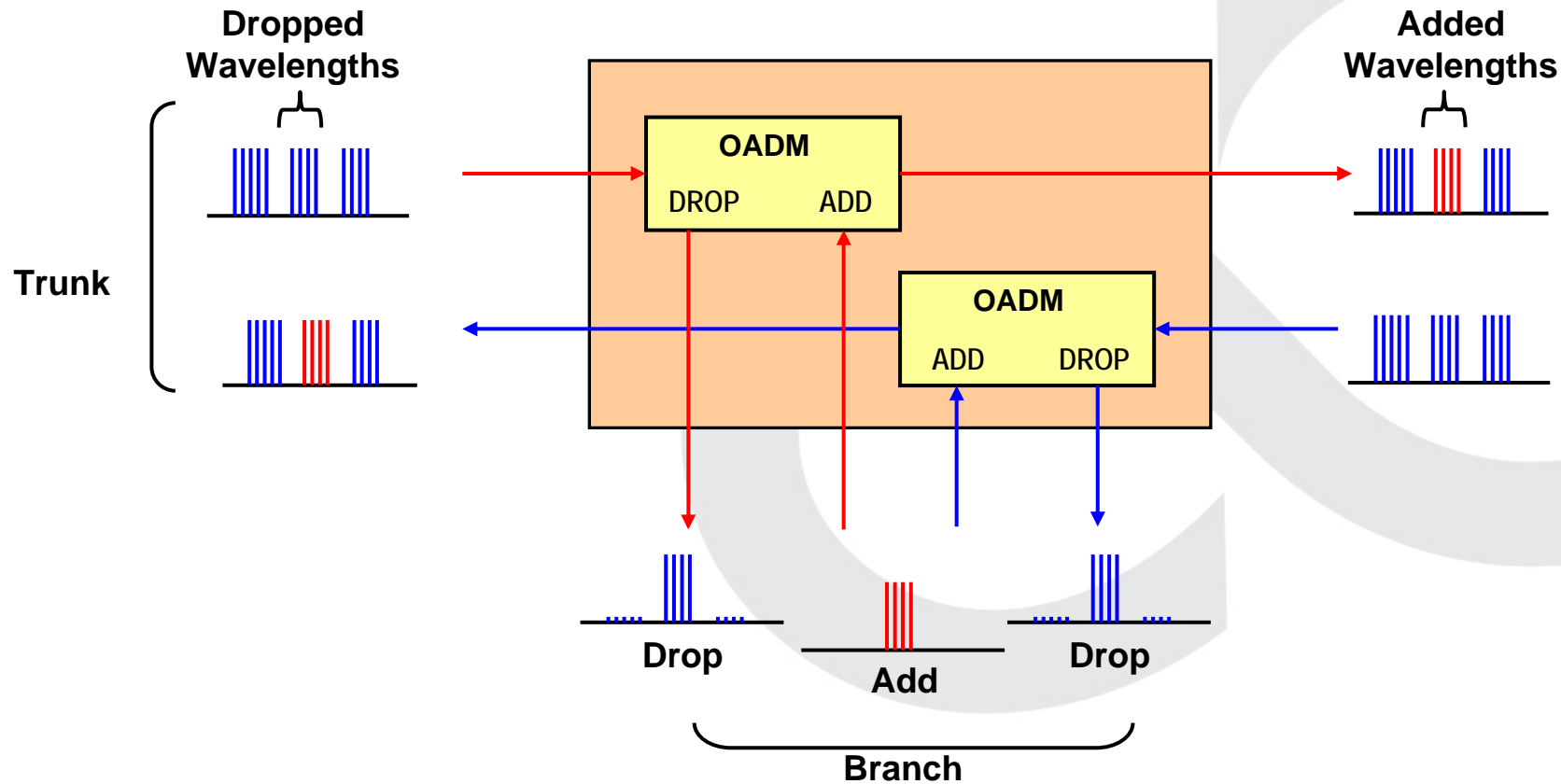


Power Path Switching

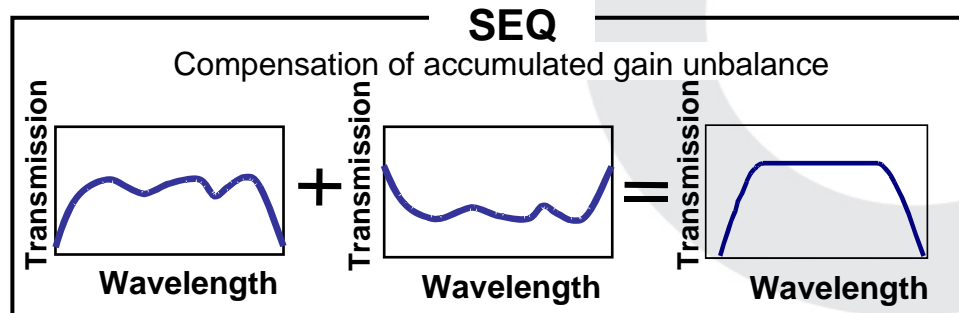
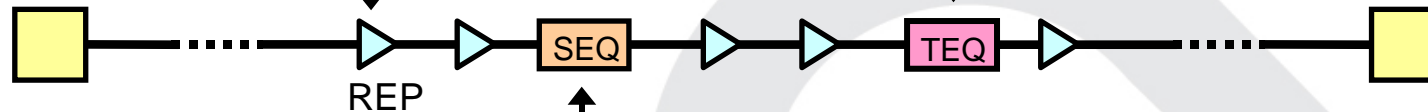
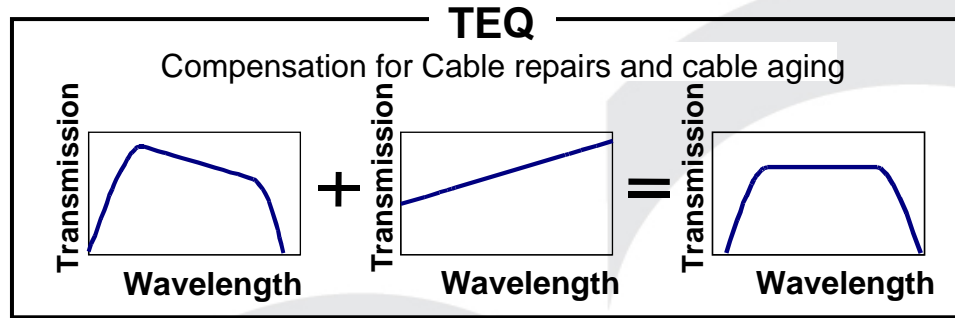
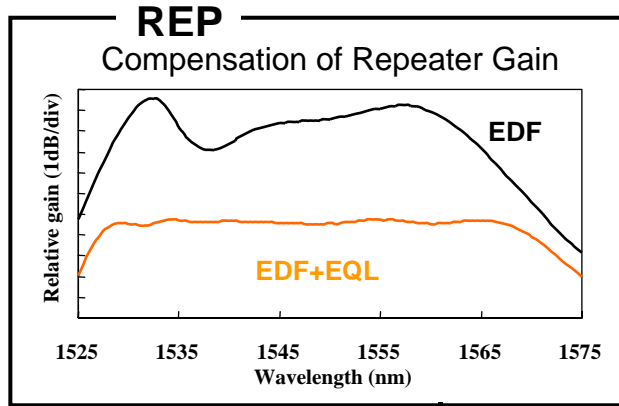


Product Detail : Branching Unit – OADM BU –

- Configurable one(1) Fiber pair between two(2) trunk stations
- Fixed Number of Add-drop channels from manufacturing stage

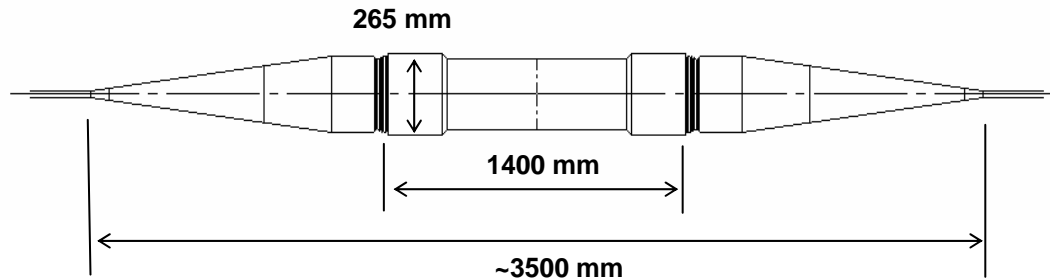


Product Detail : Gain Equalizer (TEQ & SEQ)

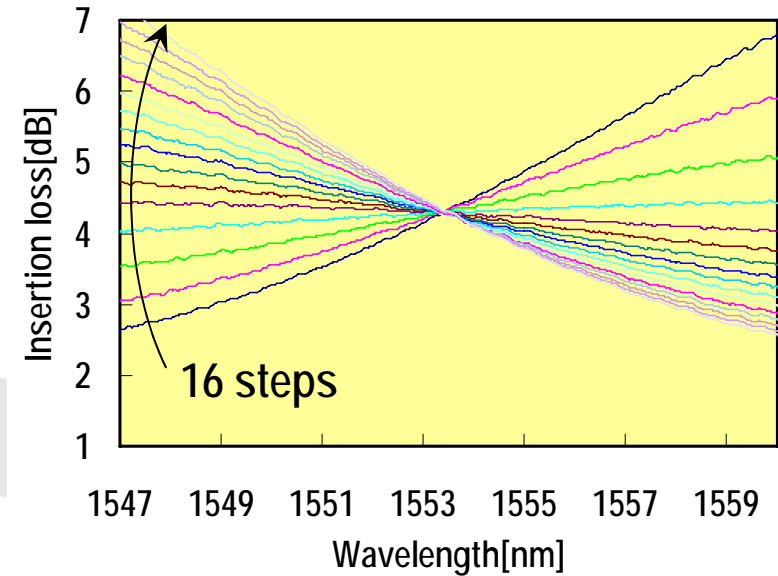
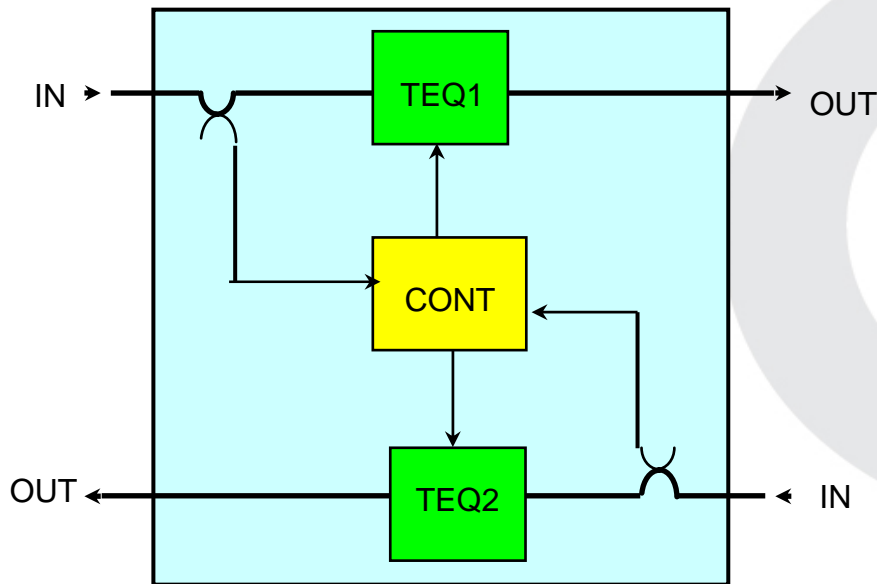


TEQ : Tilt Equalizer (Active)
SEQ : Shape Equalizer (Passive)

Product Detail : Tilt Equalizer Unit (TEQ)

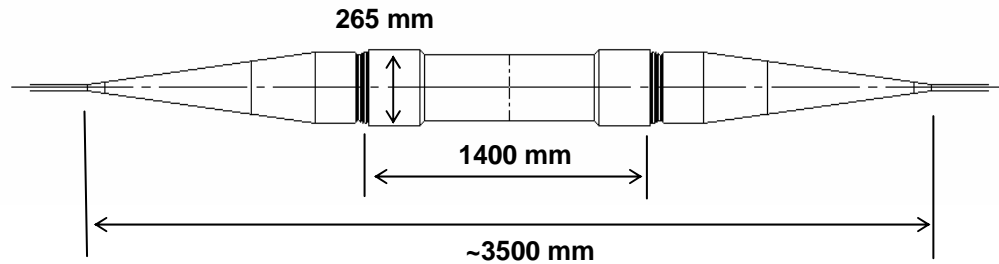


Weight including Coupling: approx. 3.4KN (4 f.p.)

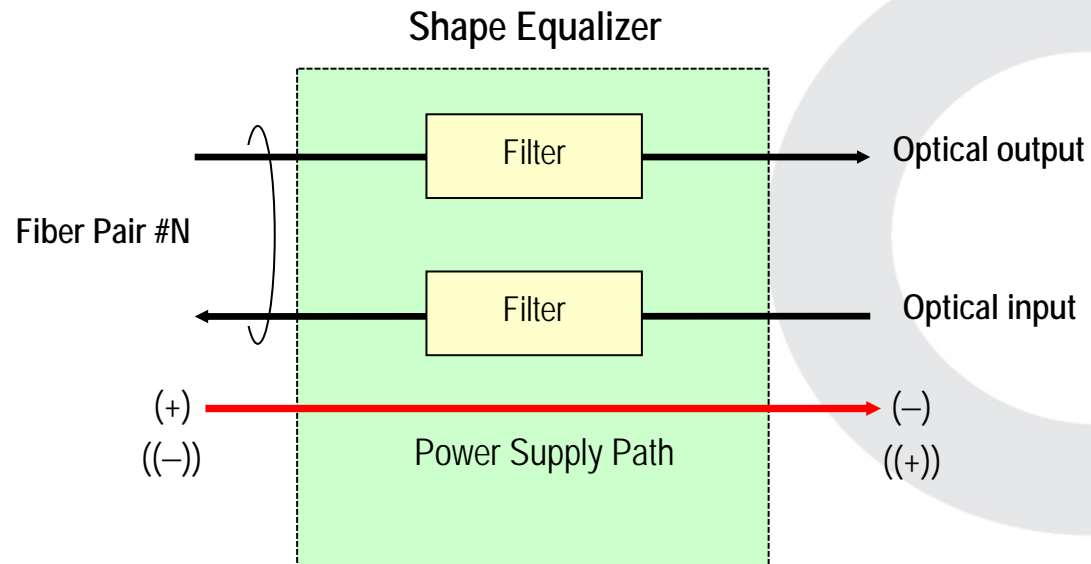


- Precise Amplitude-Slope Equalization from Remote Terminal
- Field Proven Technologies

Product Detail : Shape Equalizer Unit (SEQ)



Weight including Coupling: approx. 3.4KN (4 f.p.)

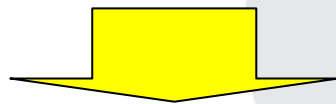


- **Passive component only, high reliability**
- **Residual gain profile compensation**
- **Field Proven Technologies**

Product Detail : Cable

■ A variety of cable resource Fujitsu can offer

- ✧ Field Proven, Flexible interface between FUJITSU repeater and submarine cables of all major supplier.
- ✧ A close professional business relationship with cable sub-contractors through experiences as full-turnkey contractor



to meet our customers specific requirements especially in costs, lead-time from geographic advantage point of view !



Product Detail :

FLASHWAVE S650 SLTE

■ High Density Tributary

- Maximum 24 Tributaries per one ETSI rack
Rack Dimension: 2200(H) x 600(W) x 300(D) mm
Back to Back Installation Possible

■ Flexible Terrestrial Interface

- STM-64 (Clear Channel)
- STM-16x4 (Asynchronous Clear Channel)
- 10GbE

■ High Quality Transmission Performance

- Ultra FEC (Net Coding Gain : 8.2 dB)

■ Easy Commissioning and Maintenance

- Automatic Decision Threshold
- Automatic Pre-Emphasis Control
- Full Tunable Laser



Product Detail :

FWP-1000 PFE

- Field Proven
- Higher Availability (No PFE Shutdown for almost 40 years)
 - M+N On Line Converter Redundancy
 - Plant consist of multiple converter with bypass diode.
 - Current Controller Redundancy
 - Three independent current controller system
 - Redundant Alarm System and Automatic Shutdown
 - Three independent current/voltage output detection.
 - Two out of three majority logic method is applied to automatic shutdown.



Line Up

Type SS	:	900 V
Type S	:	3,600 V
Type M	:	7,200 V
Type L	:	10,200 V
Type VL	:	14,400 V

Product Detail :

System Supervisory Equipment

EM and Sub-Network Manager Functionality

■ System Surveillance

- Alarm and Status
- Performance Monitoring
 - Line (Submarine Cable) Error Count
 - Tributary B1 Error : BBE, ES, SES, UAS
 - WDM Analog Data : Output Power, Input Power

■ Repeater Monitoring

- In-service Active Supervisory
 - Input / Output power monitoring
 - Pump LD bias current monitoring

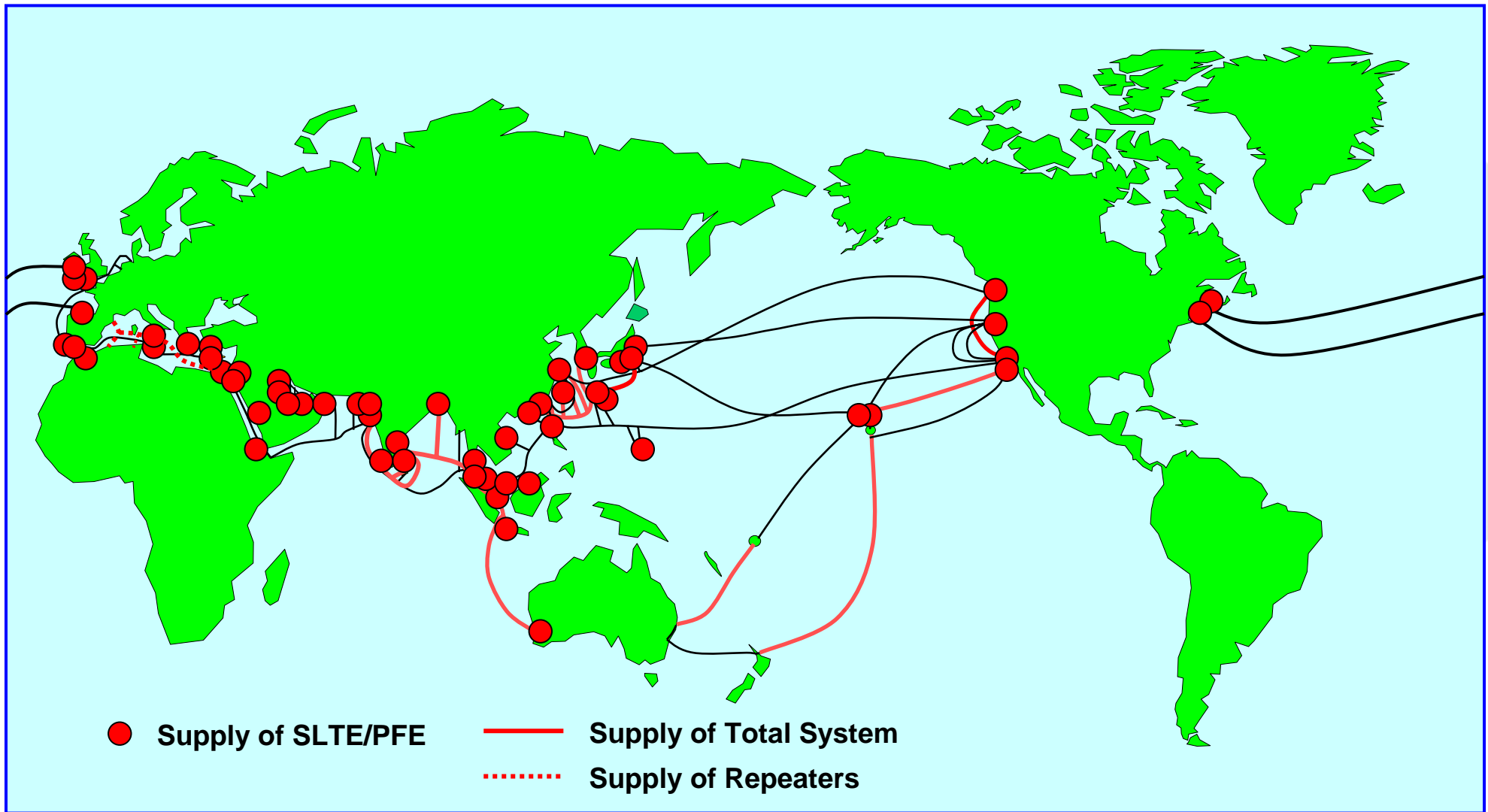
■ Report

- Past Summary / Alarm & Status / Events, etc.

■ Remote Operation Position (ROP)

- ROP is available at each station.

Supply Records - *Recent Highlights* -



Repeatered System - 1st Generation

(Regenerator System by 1.31 micron wavelength)

System	Landing Countries	Capacity	Route Length	Maximum Water	Delivery
TPC-3 (Note 1)	Japan, USA (Guam, Hawaii)	560Mbps (280Mbps x 2fp)	3,760km	-	Dec. 88
Honk Kong-Japan-Korea	Hong Kong, Japan, Korea	560Mbps (280Mbps x 2fp)	4,700km	6,400m	Apr. 90
Kuantan-Kota Kinabaru	Malaysia	840Mbps (420Mbps x 2fp)	1,570km	2,650m	Dec. 90
North Pacific Cable (NPC)	Japan, USA (Mainland)	1,680bps (420Mbps x 4fp)	9,400km	4,950m	Apr. 91
Surabaya-Banjarmasin	Indonesia	280Mbps (280Mbps x 1fp)	410km	70m	Dec. 91

Note 1: The very first Branching Units deployed in the Pacific

Repeatered System – 2nd Generation (Regenerator System by 1.55 micron wavelength)

System	Landing Countries	Capacity	Route Length	Maximum Water	Delivery
UK-Germany No.5 (Note 2)	UK, Germany	3.6Gbps (1.8Gbps x 2fp)	500km	70m	Oct. 91
Brunei-Singapore	Brunei, Singapore	1,120Mbps (560Mbps x 2fp)	1,500lm	2,500m	Nov. 91
Brunei-Malaysia-Philippines (BMP)	Brunei, Malaysia, Philippines	1,120Mbps (560Mbps x 2fp)	1,500lm	5,000m	Jan. 92
TPC-4	Japan, USA (Mainland)	1,680bps (560Mbps x 3fp)	5,000km	-	Oct. 92
APC	Japan, Hong Kong, Taiwan, Malaysia, Singapore	1,680bps (560Mbps x 3fp)	7,600km	6,400m	Aug. 93
Malaysia-Thailand (incl. Petchaburi-Sri Racha)	Malaysia, Thailand	1,120Mbps (560Mbps x 2fp)	1,500lm	-	Aug. 94
Russia-Japan-Korea	Russia, Japan, Korea	1,120Mbps (560Mbps x 2fp)	1,700km	-	Nov. 94
Thailand-Vietnam-Hong Kong	Thailand, Vietnam, Hong Kong	1,120Mbps (560Mbps x 2fp)	3,400km	3,500m	Nov. 95

Note 2: The very first Giga bit submarine cable system in the world

Repeatered System – 3rd Generation (Optical Amplifier System)

System	Landing Countries	Capacity	Route Length	Maximum Water	Delivery
Malaysia Domestic (Southern Link)	Malaysia	10Gbps (5Gbps x 2fp)	2,300km	2,300m	Jul. 95
Malaysia Domestic (Northern Link)	Malaysia	10Gbps (5Gbps x 2fp)	1,800km	2,500m	Mar. 96
APCN	Korea, Japan, Taiwan, Philippines, Hong Kong, Thailand, Malaysia, Singapore,	10Gbps (5Gbps x 2fp)	11,800km	-	Sep. 96
TPC-5	Japan, USA (Mainland)	10Gbps (5Gbps x 2fp)	24,500km	-	Dec. 96
Jasuraus	Indonesia, Australia	10Gbps (5Gbps x 2fp)	2,800km	-	Sep. 96
Fiber Optic Gulf (FOG)	Bahrain, Qatar, U.A.E, Kuwait	20Gbps (5Gbps x 4fp)	1,300km	80m	Mar. 98

Repeatered System – 4th Generation (Optical Amplifier System with WDM Technology)

System	Landing Countries	Capacity	Route Length	Maximum Water	Delivery
SEA-ME-WE 3 Segment S3 (Note 3)	Singapore, Indonesia, Australia	40Gbps (2.5Gbps x 8wl x 2fp)	4,600km	6,450m	Apr. 99
SEA-ME-WE 3 Segment S1 (Note 3 & 4)	Korea, Japan, Taiwan, China, Hong Kong	40Gbps (2.5Gbps x 8wl x 2fp)	4,600km	5,400m	Sep. 00
Southern Cross Cable Network	Fiji, New Zealand, Australia, USA	640Gbps (10Gbps x 16wl x 4fp)	29,400km	7,600m	Nov. 00
North Asia Cable System (NACS)	Hong Kong, Taiwan, Japan	2.52Tbps (10Gbps x 42wl x 6fp)	3,600km	-	May 01
Japan-US Cable Network	Japan, USA (Mainland)	640Gbps (10Gbps x 16wl x 4fp)	22,000km	4,850m	Jul. 01
China-US Cable Network	China, Japan, Taiwan, Guam, Hawaii, USA(Mainland)	80Gbps (2.5Gbps x 8wl x 4fp)	31,000km	-	Sep. 01
SEA-ME-WE 4 Segment S1	Singapore, Malaysia, Thailand, Bangladesh, Sri Lanka, India	1.28Tbps (10Gbps x 64wl x 2fp)	8,000km	4,400m	Oct. 05
SEA-ME-WE 4 Segment S4	Egypt, Italy, Tunisia, Algeria, France	1.28Tbps (10Gbps x 64wl x 2fp)	3,400km	-	Oct. 05

Note 3 The very first WDM submarine cable system in the world.

Note 4 The very first submarine cable system in the world employing O-ADM Branching Units.

Unrepeated System

System	Landing Countries	Capacity	Route Length	Maximum Water	Delivery
National Digital Transmission Network	Philippines	15Gbps (2.5Gbps x 6fp)	1,300km	3,800m	Feb. 99
Korea-Japan Cable Network (KJCN)	Korea, Japan	2.88Tbps (10Gbps x 24wl x 12fp)	500km	190m	Feb. 02
Fiber Optic Backbone Network	Philippines	3.84Tbps (10Gbps x 32wl x 12fp)	1,300km	3,400m	Jul. 03

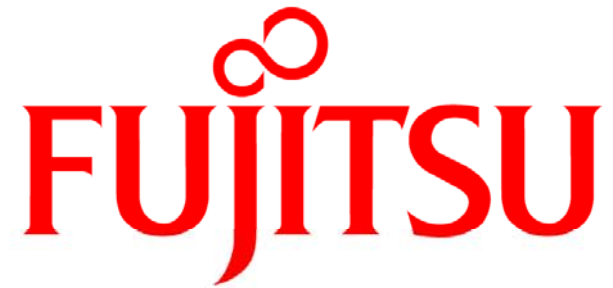
WDM In-Service Capacity Upgrade

System	Landing Countries	Original Capacity	Capacity post Upgrade	Delivery
SEA-ME-WE 3 1st 10Gbps Upgrade	China, Hong Kong	40Gbps (2.5Gbps x 8wl x 2fp)	55Gbps (2.5Gbps x 7wl x 2fp plus 10G x 1wl x 2 fp)	Jan. 03
Capacity Upgrade Project (Phase 1)	Egypt, Jordan, Saudi Arabia, UAE	10Gbps (5Gbps x 1wl x 2fp)	20Gbps (5Gbps x 1wl x 2fp plus 10G x 1wl x 1fp)	Sep. 03
Capacity Upgrade Project (Phase 3)	UK, Italy, Egypt	15Gbps (5Gbps x 1wl x 2fp plus 10Gbps x 1wl x 1fp)	25Gbps (5Gbps x 1wl x 1fp plus 10G x 2wl x 1fp)	May 05
SEA-ME-WE 3 2nd 10Gbps Upgrade	Portugal, Italy, Greece, Turkey, Cyprus, Egypt, India, Sri Lanka, Thailand, Malaysia, Singapore, China	35Gpbs x 5fp	Various (Original Capacity plus 25Gbps to 55Gbps x 5fp)	Dec. 05
Capacity Upgrade Project (South East Pacific)	Hong Kong, Taiwan, Japan, Korea	80Gbps (10Gbps x 4wl x 2fp)	290Gbps (10Gbps x 17wl x 1fp plus 10Gbps x 12wl x 1fp)	Jan. 06

WDM In-Service Capacity Upgrade

- Continued -

System	Landing Countries	Original Capacity	Capacity post Upgrade	Delivery
Capacity Upgrade Project (Phase 4)	UK, Spain, Italy, Egypt	10Gbps (5Gbps x 1wl x 1fp plus 2.5Gbps x 2wl x 1fp)	25Gbps (5Gbps x 1wl x 1fp plus 10G x 2wl x 1fp)	Jan. 06
Capacity Upgrade Project (Atlantic North)	USA, UK	320Gbps (10Gbps x 16wl x 2fp)	320Gbps (10Gbps x 16wl x 2fp plus 230Gbps x 23wl x 1fp)	Nov. 06 Jan. 07
Capacity Upgrade Project (Atlantic South)	USA, France	320Gbps (10Gbps x 16wl x 2fp)	320Gbps (10Gbps x 16wl x 2fp plus 230Gbps x 23wl x 1fp)	Nov. 06 Jan. 07
SEA-ME-WE 3 3rd 10Gbps Upgrade	Portugal, Morocco, Italy, Egypt, Djibouti, UAE, Pakistan, India, Indonesia, Malaysia, Singapore, Vietnam, Philippines, China, Taipei, Japan	25Gbps to 85Gbps x 8fp	Various (Original Capacity plus 7.5Gbps to 42.5Gbps x 8fp)	Apr. 07



THE POSSIBILITIES ARE INFINITE