Provide Full Turn-Key Solutions

1. System Engineering
2. Route Engineering
3. Procurement & Production
4. Installation & Testing
5. Maintenance & Support

Full Turn-key
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
- **CTB**: Cable Termination Box
- **REP TEQ SEQ**: Branching Unit
- **PFE**: Power Feeding Equipment
- **BU**: Branching Unit
- **SIE**: SDH Interconnection Equipment
- **NMS**: Network Management System

**Legend**:
- **SLTE**: Submarine Line Terminal Equipment
- **REP**: Repeater
- **TEQ**: Tilt Equalizer
- **SEQ**: Shape Equalizer
- **CTB**: Cable Termination Box
- **PFE**: Power Feeding Equipment
- **BU**: Branching Unit
- **SIE**: SDH Interconnection Equipment
- **NMS**: Network Management System
Unrepeatered 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 vendor’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

- 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

Power Path Switching

Failure : Case 1
- Not powered:
  - A
  - C
  - B

- Normal:
  - A
  - C
  - B

- Failure : Case 2
  - A
  - C
  - B

Fiber Path Branching

- Approx. 3800 mm
- Weight including coupling: 4.7kN

250 mm
Approx. 480 mm
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

[Diagram showing OADM (Optical Add-Drop Multiplexer) configurations for trunk, dropped, added wavelengths, and branch connections]
Product Detail: Gain Equalizer (TEQ & SEQ)

**TEQ**: Tilt Equalizer (Active)

**SEQ**: Shape Equalizer (Passive)

- **REP**: Compensation of Repeater Gain
- **TEQ**: Compensation for Cable repairs and cable aging
- **SEQ**: Compensation of accumulated gain unbalance
Product Detail:

Tilt Equalizer Unit (TEQ)

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

Weight including Coupling: approx. 3.4KN (4 f.p.)
Product Detail:
Shape Equalizer Unit (SEQ)

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

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

Fiber Pair #N

| (+) | (-) |
|     |     |

Optical input
Power Supply Path
Filter
Optical output
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
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.

Product Detail:

FWP-1000 PFE

Line Up

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS</td>
<td>900 V</td>
</tr>
<tr>
<td>S</td>
<td>3,600 V</td>
</tr>
<tr>
<td>M</td>
<td>7,200 V</td>
</tr>
<tr>
<td>L</td>
<td>10,200 V</td>
</tr>
<tr>
<td>VL</td>
<td>14,400 V</td>
</tr>
</tbody>
</table>
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 -

Supply of Total System
Supply of Repeaters
Supply of SLTE/PFE
# Repeated System - 1st Generation
(Regenerator System by 1.31 micron wavelength)

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

**Note 1:** The very first Branching Units deployed in the Pacific
# Repeatered System – 2nd Generation
(Regenerator System by 1.55 micron wavelength)

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

Note 2: The very first Giga bit submarine cable system in the world
<table>
<thead>
<tr>
<th>System</th>
<th>Landing Countries</th>
<th>Capacity</th>
<th>Route Length</th>
<th>Maximum Water</th>
<th>Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia Domestic (Southern Link)</td>
<td>Malaysia</td>
<td>10Gbps</td>
<td>2,300km</td>
<td>2,300m</td>
<td>Jul. 95</td>
</tr>
<tr>
<td>Malaysia Domestic (Northern Link)</td>
<td>Malaysia</td>
<td>10Gbps</td>
<td>1,800lm</td>
<td>2,500m</td>
<td>Mar. 96</td>
</tr>
<tr>
<td>APCN</td>
<td>Korea, Japan, Taiwan, Philippines, Hong Kong, Thailand, Malaysia, Singapore,</td>
<td>10Gbps</td>
<td>11,800km</td>
<td>-</td>
<td>Sep. 96</td>
</tr>
<tr>
<td>TPC-5</td>
<td>Japan, USA (Mainland)</td>
<td>10Gbps</td>
<td>24,500km</td>
<td>-</td>
<td>Dec. 96</td>
</tr>
<tr>
<td>Jasuraus</td>
<td>Indonesia, Australia</td>
<td>10Gbps</td>
<td>2,800km</td>
<td>-</td>
<td>Sep. 96</td>
</tr>
<tr>
<td>Fiber Optic Gulf (FOG)</td>
<td>Bahrain, Qatar, U.A.E, Kuwait</td>
<td>20Gbps</td>
<td>1,300lm</td>
<td>80m</td>
<td>Mar. 98</td>
</tr>
</tbody>
</table>
## Repeatered System – 4th Generation
(Optical Amplifier System with WDM Technology)

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

**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.
## Unrepeatered System

<table>
<thead>
<tr>
<th>System</th>
<th>Landing Countries</th>
<th>Capacity</th>
<th>Route Length</th>
<th>Maximum Water</th>
<th>Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Digital Transmission Network</td>
<td>Philippines</td>
<td>15Gbps (2.5Gbps x 6fp)</td>
<td>1,300km</td>
<td>3,800m</td>
<td>Feb. 99</td>
</tr>
<tr>
<td>Korea-Japan Cable Network (KJCN)</td>
<td>Korea, Japan</td>
<td>2.88Tbps (10Gbps x 24wl x 12fp)</td>
<td>500km</td>
<td>190m</td>
<td>Feb. 02</td>
</tr>
<tr>
<td>Fiber Optic Backbone Network</td>
<td>Philippines</td>
<td>3.84Tbps (10Gbps x 32wl x 12fp)</td>
<td>1,300km</td>
<td>3,400m</td>
<td>Jul. 03</td>
</tr>
</tbody>
</table>
## WDM In-Service Capacity Upgrade

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

### - Continued -

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