Lecture 11 - System Deployment & Life of a Cable

Alan Cheung - Google Global Network Infrastructure (GNA APAC)

Subsea Optical Fiber Communication
Finland, 2019
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8. Check-list before Provisional Acceptance
9. Operations and Maintenance
10. Life of a cable (marine repairs, capacity upgrade)
11. Decommissioning
System Deployment - What do you need to know?

1. Contractual Documents
   a. Supply Contract
   b. Joint Build Agreement
   c. Landing Service Agreement
2. Purchasers Obligations
3. Supplier’s Obligations and Scope of Work
4. People
Supply Contract

Supply Contract generally consists of 6 Parts

Part 1 - Terms and Conditions of Contract
Part 2 - Technical Specifications
Part 3 - Price Schedule
Part 4 - Plan of Work
Part 5 - Billing Schedule
Part 6 - Supplier’s System Description
Supply Contract - Part 1 - Terms and Conditions of Contract

Key terms
1. Contract Price
2. Completion Date
3. Condition Precedent for Coming Into Force
   a. BM0 downpayment?
   b. Government approval?
   c. Letter of Performance Guarantee?
   d. Payment Assurance?
4. Acceptance
5. No suspension rights by Supplier - Supplier cannot suspend work even though non-payment from any of the Purchasers
6. Permits: Scope of Contractor
7. Liquidated Damages
8. Liability
   a) Normally cap at contract price with exception of personal injury and death and environmental damage, etc.
   b) Not joint but several liability among Purchasers
9. Financial liability of each Purchaser
10. Payment term
11. Force Majeure - extension of time but no money
12. Warranty
13. Long term support
Supply Contract - Part 2 - Technical Specifications

Key terms
1. Configuration
   a. Main trunk and branches
   b. Locations of Cable Landing Station / Point Of Presence
   c. Locations of Beach Manholes
   d. Number of Fibre Pairs
   e. Power feeding configurations
   f. Add / drop capacity to branch landings (e.g. optical switch and/or WSS)
   g. Stubbed Branching Units, Optional landings if any
   h. etc.
2. Transmission design parameters (e.g. OSNR, design capacity, etc.)
3. Commissioning Limit
4. Burial depths / Horizontal Directional Drilling (HDD) requirements
5. Route Position List / Cable types
6. Training
7. etc.
Supply Contract - Permit Matrix

The Contractor shall identify, plan, obtain and procure the necessary licences, operational permits, work permits, permit-in-principle ("PIP"), authorisations from the appropriate authorities and pipelines/cable crossing agreements

<table>
<thead>
<tr>
<th>No.</th>
<th>Permit Name/Description/Activity</th>
<th>Permit Granting Authority &amp; Point-of-Contact Details</th>
<th>Responsible Party</th>
<th>PIPs/Ops</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><strong>System Operating Permits</strong></td>
<td></td>
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</tr>
<tr>
<td>1.1</td>
<td>Unified Carrier Licence</td>
<td>Office of the Communications Authority</td>
<td>Purchaser</td>
<td>PIP</td>
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<tr>
<td></td>
<td><strong>Marine Route Survey Permits (inc survey vessel operational permits/notifications)</strong></td>
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<tr>
<td>2.1</td>
<td>Marine Department Notice (MDN) - Notice to Mariners</td>
<td>Marine Department</td>
<td>Supplier</td>
<td>OPS</td>
</tr>
<tr>
<td>2.2</td>
<td>Vessel Temporary Operating Licence - if non Hong Kong registered vessel</td>
<td>Marine department</td>
<td>Supplier</td>
<td>OPS</td>
</tr>
<tr>
<td>2.3</td>
<td>Personnel temporary working visas - all non Hong Kong residents</td>
<td>Immigration Department</td>
<td>Supplier - with Purchaser Support</td>
<td>OPS</td>
</tr>
<tr>
<td></td>
<td><strong>Cable Station (CS) Permits</strong></td>
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</tr>
<tr>
<td>3.1</td>
<td>Regulatory Permit</td>
<td>Local Gov. Authority</td>
<td>Purchaser</td>
<td>PIP</td>
</tr>
<tr>
<td></td>
<td><strong>Outside Plant (OSP) Permits: includes land ducts, manholes and/or handholes between and exclusive of the cable station and Beach Manhole</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4.1</td>
<td>Land Use Approvals</td>
<td>Highways Department</td>
<td>Purchaser</td>
<td>PIP</td>
</tr>
<tr>
<td>4.2</td>
<td>Excavation permit</td>
<td>Highways Department</td>
<td>Supplier</td>
<td>PIP</td>
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<tr>
<td></td>
<td><strong>Marine Installation Vessel(s) Permits/Notifications</strong> (i.e., Route Clearance, Pre-Lay Grapnel Run (PLGR), Main Lay, and Post-Lay Inspection &amp; Burial (PLIB))</td>
<td></td>
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<tr>
<td>8.1</td>
<td>Marine Department Notice (MDN) - Notice to Mariners</td>
<td>Marine Department</td>
<td>Supplier</td>
<td>OPS</td>
</tr>
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<td>8.2</td>
<td>Vessel Temporary Operating Licence - if non Hong Kong registered vessel</td>
<td>Marine department</td>
<td>Supplier</td>
<td>OPS</td>
</tr>
<tr>
<td>8.3</td>
<td>Construction Noise Permit</td>
<td>Environmental protection department (may be required for shore end operations)</td>
<td>Supplier</td>
<td>OPS</td>
</tr>
<tr>
<td>8.4</td>
<td>Marine Traffic Impact Assessment (MTIA)</td>
<td>Marine Department</td>
<td>Supplier</td>
<td>OPS</td>
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<tr>
<td>8.5</td>
<td>Personnel temporary working visas - all non Hong Kong residents</td>
<td>Immigration Department</td>
<td>Supplier - with Purchaser Support</td>
<td>OPS</td>
</tr>
</tbody>
</table>
Supply Contract - Part 3 - Price Schedule

A spreadsheet detailing the Supply Contract Cost giving the below breakdown:

1. Project Management and Support
2. Submarine Plant - International Waters
3. Submarine Plant - Territorial Waters
4. Land Cable
5. Terminal Station Equipment
6. Training and Documentation
7. Marine Operations - International Waters
8. Marine Operations - Territorial Waters
Supply Contract - Cost Allocation (Example)

Supply Contract Cost Allocation

- Marine Operations - Territorial Waters: 17.0%
- Marine Operations - International Waters: 26.0%
- Project Management and Support: 3.3%
- Submarine Plant - International Waters: 38.3%
- Training and Documentation: 6.3%
- Terminal Station Equipment: 5.0%
- Submarine Plant - Territorial Waters: 6.3%
- Land Cable: 1.7%
# Supply Contract - Price Breakdown

## Trunk Segments

<table>
<thead>
<tr>
<th>Segment</th>
<th>Description</th>
<th>Price</th>
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</thead>
<tbody>
<tr>
<td>S1.1</td>
<td>CLS1 - BU1</td>
<td>$?</td>
</tr>
<tr>
<td>S1.2</td>
<td>BU1 - BU2</td>
<td>$?</td>
</tr>
<tr>
<td>S1.3</td>
<td>BU2 - BU3</td>
<td>$?</td>
</tr>
<tr>
<td>S1.4</td>
<td>BU3 - BU4</td>
<td>$?</td>
</tr>
<tr>
<td>S1.5</td>
<td>BU4 - CLS2</td>
<td>$?</td>
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## Branch Segments

<table>
<thead>
<tr>
<th>Segment</th>
<th>Description</th>
<th>Price</th>
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<tbody>
<tr>
<td>S2</td>
<td>BU1 - CLS3</td>
<td>$?</td>
</tr>
<tr>
<td>S4</td>
<td>BU4 - CLS4</td>
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## Stubbed BU

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<tr>
<th>BU2</th>
<th>Price</th>
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<tbody>
<tr>
<td>Stubbed BU</td>
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## Optional branch

<table>
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<tr>
<th>S3</th>
<th>Price</th>
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<tbody>
<tr>
<td>Optional branch</td>
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</table>

[Diagram of supply contract with CLS1, CLS2, CLS3, CLS4, and CLS5 segments and connections.]
# Supply Contract - Price Breakdown

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<thead>
<tr>
<th>Cost</th>
<th>Power Switch Branching Unit</th>
<th>Optical Switch</th>
<th>Wavelength Selective Switch</th>
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<td></td>
<td>$?</td>
<td>$?</td>
<td>$?</td>
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## Cable Type and Cable Cost Breakdown

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<th>Cable Type</th>
<th>Cable</th>
<th>Repeater</th>
<th>Shape Equaliser</th>
<th>Tilt Equaliser</th>
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<td>DA</td>
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Supply Contract - Part 4 - Plan of Work

Plan of Work to show the Milestones and Start / Finish date of each activity

<table>
<thead>
<tr>
<th>Contract CIF</th>
<th>Permit (Country X)</th>
<th>Permit (Country Y)</th>
<th>Desk Top Study</th>
<th>Survey Permits</th>
<th>Survey</th>
<th>Cable Manufacture</th>
<th>Repeater / BU Manufacturer</th>
<th>Dry Plant manufacturer</th>
<th>Ready to Load</th>
<th>Marine Lay</th>
<th>Station Installation</th>
<th>Training</th>
<th>Testing and Commissioning</th>
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<td>2022 Q4</td>
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Supply Contract - Part 4 - Plan of Work

Purchasers’ Deliverables - Purchasers’ critical delivery and option decision dates will be shown in the POW:

- Readiness of Beach Manhole
- Readiness of CLS
- Decision dates for options election (add / reduction of FP, branches, etc.)
- Finalisation of spares
- Finalisation of marine maintenance and depot storages
- NOC location
- Readiness of licence
Supply Contract - Part 6 - Supplier’s System Descriptions

System Description is Supplier’s document to specify how they implement the project so as to meet the Technical Specifications specified by the Purchasers.

1. Configuration and options
2. Optical connectivity
3. Power Configuration
4. Submerged plants
5. Terminal Station Equipment
6. System Performance
7. Acceptance test
8. Training
9. Documentations
10. Marine Descriptions
11. Permit Services Descriptions
12. Product descriptions
   a. Cable
   b. Repeaters
   c. Branching Units
   d. Management System
   e. Dry Plants
   f. SLTE, if applicable
   g. etc.
Billing Milestones with criteria for achievement are well defined. The % allocation on each BM is mutually agreed prior to Contract CIF.

<table>
<thead>
<tr>
<th>BM No.</th>
<th>Billing Milestone [BM]</th>
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<tbody>
<tr>
<td>BM 0</td>
<td>Contract Agreement</td>
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<tr>
<td>BM 1</td>
<td>Desk Top Study</td>
</tr>
<tr>
<td>BM 2</td>
<td>Project Management</td>
</tr>
<tr>
<td>BM 3</td>
<td>Product Design</td>
</tr>
<tr>
<td>BM 4</td>
<td>Route Survey</td>
</tr>
<tr>
<td>BM 5</td>
<td>Route Survey (Report)</td>
</tr>
<tr>
<td>BM 6</td>
<td>Sea cable manufactured (including spares) 25%</td>
</tr>
<tr>
<td>BM 7</td>
<td>Sea cable manufactured (including spares) 50%</td>
</tr>
<tr>
<td>BM 8</td>
<td>Sea cable manufactured (including spares) 75%</td>
</tr>
<tr>
<td>BM 9</td>
<td>Sea cable manufactured (including spares) 100%</td>
</tr>
<tr>
<td>BM 10</td>
<td>Repeaters (including spares) 50%</td>
</tr>
<tr>
<td>BM 11</td>
<td>Repeaters (including spares) 100%</td>
</tr>
<tr>
<td>BM 12</td>
<td>Branching Units (including spares) 100%</td>
</tr>
<tr>
<td>BM 13</td>
<td>TSE’s (including spares)</td>
</tr>
<tr>
<td>BM 14</td>
<td>In station test</td>
</tr>
<tr>
<td>BM 15</td>
<td>System Assembly</td>
</tr>
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<td>BM 16</td>
<td>Permitting</td>
</tr>
<tr>
<td>BM 17</td>
<td>Marine and Land Cable Installation</td>
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<td>Provisional Acceptance</td>
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<tr>
<td>BM 19</td>
<td>Deficiency List</td>
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![Billing Milestones Diagram](image-url)
Joint Build Agreement

Key terms
1. System Configuration
2. Investment Level and Cost sharing principles
3. Participating Interest and Voting Rights
4. Open access principles
5. Management Structure, Decision and Voting
   a. Management Committee
   b. Procurement Group
   c. Investment & Administrative SubCommittee
   d. O&M Working Group
6. Landing Parties / Service Providers Responsibility and Obligations
7. Decommissioning
8. Joint System Maintenance Document Key Terms
9. Terms of Reference for
   a. PG
   b. OMG
   c. NOC
   d. CBP
Joint Build Agreement - System Config & Cost Sharing

Trunk: Segment A & Segment B
Branch: Segment C
No. of FP: Trunk (5); Branch (2)
OSNR: XX dB
Design capacity: XX Tbps per FP

<table>
<thead>
<tr>
<th>Segment</th>
<th>Purchaser 1</th>
<th>Purchaser 2</th>
<th>Total</th>
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<td>Segment A</td>
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<td>40%</td>
<td>100%</td>
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<tr>
<td>Segment B</td>
<td>60%</td>
<td>40%</td>
<td>100%</td>
</tr>
<tr>
<td>Segment C (including BU)</td>
<td>0%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Joint Build Agreement - Open Access

Cable Landing Station

Open Access:
1. By local terrestrial fibre providers
2. Cross connect to other cable system
Landing Service Agreement

Key terms

1. Facilities / Services to be provided
   a. Beach Manhole (BMH)
   b. Land route from BMH to Cable Landing Station
   c. Cable Landing Station Space and power (X sq meters, Y kW)
   d. Permit application
   e. Negotiation and signing of any fishery agreement, pipeline agreement
   f. Manpower for Operations and Maintenance (O&M)
   g. Importer of Record

2. Non Recurrent Cost and Recurrent Cost

3. Open access
Purchasers’ Obligations

1. Provision of cable landing facilities (Cable Landing Station, Land route, Beach Manhole)

2. Make timely payments to Supplier

3. Obtain Purchasers’ permits
   a. submarine cable landing license (e.g. FCC license in USA)
   b. permits needed to operate the System
Supplier’ Obligations and Scope of Work

1. Design review and demonstration of technology

2. Route engineering to optimise the cable route

3. Complete the work on time
   a. Permits acquisition
   b. Manufacturing
   c. Timely qualification for First Office Application (FOA)

4. Comply with laws and regulations

5. Meet technical specifications

6. Meet acceptance criteria

7. Mitigation of cost exposure
People You need to know

1. Project Team from Supplier
   a. Project Manager
   b. Contract Manager
   c. Marine Manager
   d. Quality Manager
   e. Escalation contact

2. Your own consortium members
Project Implementation and Management
Project Implementation

Supply Contract CIF

Route Survey

Route Engineering

Design Review

Technology Demonstration

Manufacture

Marine Installation

Test & Commissioning

Provisional Acceptance
Project Management

1. Forming Subcommittees and Working Groups

2. Meetings / Conference Calls
   a. Contractor Coordination meetings
   b. Purchasers’ internal meetings

3. Quality checks / audits
   a. Factory audit

4. Factory Release Certificates

5. Sending Purchasers’ shipboard representatives onboard vessels

6. Monthly Reports / Incident Reports


Committees / Meetings

Committees
1. Management Committee (MC) - decision making - exist throughout the cable life
2. Investment and Administrative SubCommittee (I&ASC) - deal with Joint Build Agreement / Landing Party Agreements - exist throughout the cable life
3. Procurement Group (PG) - deal with Suppliers
4. Technical Working Group (TWG) - assist PG on technical matters
5. Marine Working Group (MWG) - assist PG on marine matters
6. Operations and Maintenance SubCommittee Group (O&MSC) - Established ~9-12 months before Provisional Acceptance to deal with O&M matters

Meetings
1. MC / I&ASC - Bi-annually / Quarterly / Ad-hoc
2. PG Meeting / TWG / MWG / Contract Coordination Meetings - Quarterly / Bi-monthly / Ad-hoc
3. O&MSC Meeting - quarterly before PA; once annually after PA
Project Management - Reports

Monthly Report

1. Critical project risks
2. Update on Milestones
3. Near term decisions
4. Purchasers deliverables and due dates
5. Manufacturing status
6. Dry plant installation
7. Permit and license acquisition status
8. Installation Programs
9. New product development
10. Updated Plan of Work
11. Revised Billing Milestones and payment status

Marine Survey and Installation Report
Outside Plant Installation Report
Site Installation Report

Ship Representative Reports
Factory Release Certificate
Testing and Commissioning Report
Commissioning
High Tech & High Reliability Systems

- Recommendation: thorough testing & controlling by supplier & qualified inspection authority at
  - Pre-manufacturing
    - Technology Demonstration
    - Qualification
  - Manufacture
    - Component supply
    - Factory test
    - Assembly tests
  - Installation
    - Load & lay tests
    - On-site equipment tests
    - System test

- Why so many tests?
  - System shall perform 25 years!
  - Time-consuming now but time-saving later
  - Many functionalities

- Test examples
  - Optical power, spectrum, margins, etc
  - Confidence trials, software tests
  - OSNR, GOSNR, Gain Tilt and Gain Shape

- Test passed -> Get the cash and go to next one
- Test failed ->

![Sad Face]
Acceptance
Acceptance

1. Acceptance - rejection

2. Commercial Acceptance - commissioning test not fully satisfied -
accept part of the System for commercial traffic

3. Provisional Acceptance - commissioning tests satisfied. May have
some minor deficiencies but the System is good for carrying traffic.

4. Final Acceptance - it is generally a 5-year period after PA to ensure the
System is up and running before Final Acceptance.
Commercial Acceptance

1. Purchasers are not satisfied with the results of the Acceptance Tests but wish to put a part of or all the System into Commercial Services.

2. Terms and conditions to be mutually agreed between Purchasers and Supplier

3. Supplier shall continue to carry the risk of loss of the System or relevant Segments

4. Upon Supplier’s remedy the deficiencies to meet full conformance of contract, Purchasers will issue a Certificate of Provisional Acceptance.
Provisional Acceptance / Final Acceptance

Ready For Provisional Acceptance Date (RFPA)

Provisional Acceptance Date

Purchasers review period for test results (e.g. 14 days)

Warranty period (e.g. 5 years)

Final Acceptance Date

Warranty Expiration
Performance Bond
Performance Bonds

In order to guarantee the good and timely execution of all of the Contractor’s contractual obligations from the signature date of the Contract through Final Acceptance, Contractor shall provide a Letter of Performance Guarantee (LPG) for a value equal to 10% of the Contract Price, which shall be reduced to 5% of the Contract Price upon the Provisional Acceptance, in favour of the Purchasers and in the form of an irrevocable and unconditional Bank Guarantee issued by a bank approved by Purchasers.

![Diagram showing the sequence of events with LPG: 10%, Provisional Acceptance with Warranty Bond: 5%, and Final Acceptance with Parental Guarantee: X%]
Construction Challenges
Construction Challenges

1. Permits / License - often on the critical path

2. National Security Agreement - Relevant authorities are increasingly more protective of its critical infrastructure.

3. Environment Impact Assessment - increased durations and scopes

4. Fishery agreements
Construction Challenges

5. Pipeline / Cable crossing agreement

Phase-1 Cease Ploughing 500m before Crossing

Phase-2 Plough Recovery to onboard Ship

Phase-3 Surface Lay over Pipeline

Phase-4 Launch Plough after 500m from Crossing

Phase-5 Resume Ploughing
Construction Challenges

6. Weather delay - wind, weather, sea conditions and currents that would force curtailment of the work (“Unworkable Weather”).

7. Route engineering - route selection, cost versus quality.
Delay in Completion

1. Liquidated Damages for late completion - the compensation imposed on Supplier due to the delay in completion caused by Supplier

2. LD structure
   a. Generally not exceeding 10% of the contract price
   b. 0.1% of contract price per calendar day of delay up to 10% cap.
System Budget
## System Budget (Capex)

<table>
<thead>
<tr>
<th>Supply Contract Cost</th>
<th>Budget</th>
<th>Sharing Percentage</th>
<th>Financial Liability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Party A</td>
<td>Party B</td>
</tr>
<tr>
<td>1.1</td>
<td>Trunk</td>
<td>$300,000,000</td>
<td>33.33%</td>
</tr>
<tr>
<td>1.2</td>
<td>Branch A</td>
<td>$10,000,000</td>
<td>100.00%</td>
</tr>
<tr>
<td>1.3</td>
<td>Branch B</td>
<td>$15,000,000</td>
<td>0.00%</td>
</tr>
<tr>
<td>1.4</td>
<td>Branch C</td>
<td>$20,000,000</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Sub-total</td>
<td>$345,000,000</td>
<td></td>
</tr>
</tbody>
</table>

### 2 Non Supply Contract Cost

| MOU Cost       | $100,000  | 33.33% | 33.33% | 33.33% | $33,333 | $33,333 | $33,333 |
| Duries and Taxes| $3,000,000 | 33.33% | 33.33% | 33.33% | $1,000,000 | $1,000,000 | $1,000,000 |
| Project Management| $2,000,000 | 33.33% | 33.33% | 33.33% | $666,667 | $666,667 | $666,667 |
| Permits & Fishery Compensation| $5,000,000 | 33.33% | 33.33% | 33.33% | $1,666,667 | $1,666,667 | $1,666,667 |
| Jointing Kits     | $900,000  | 33.33% | 33.33% | 33.33% | $300,000 | $300,000 | $300,000 |
| NOC               | $500,000  | 33.33% | 33.33% | 33.33% | $166,667 | $166,667 | $166,667 |
|                      | Sub-total | $11,500,000 |        |        |        | $3,833,333 | $3,833,333 | $3,833,333 |

### 3 Cable Landing Station Costs

| CLS 1    | $3,000,000 | 33.33% | 33.33% | 33.33% | $1,000,000 | $1,000,000 | $1,000,000 |
| CLS 2    | $3,000,000 | 33.33% | 33.33% | 33.33% | $1,000,000 | $1,000,000 | $1,000,000 |
| CLS 3    | $3,000,000 | 33.33% | 33.33% | 33.33% | $1,000,000 | $1,000,000 | $1,000,000 |
|          | Sub-total | $9,000,000 |        |        |        | $3,000,000 | $3,000,000 | $3,000,000 |

### 4 Contingency

| $17,250,000 | 33.33% | 33.33% | 33.33% | $5,750,000 | $5,750,000 | $5,750,000 |
| Sub-total | $17,250,000 |        |        |        | $5,750,000 | $5,750,000 | $5,750,000 |

Total | $382,750,000 |        |        |        | $122,583,333 | $127,583,333 | $132,583,333 |
# System Budget (Opex)

<table>
<thead>
<tr>
<th></th>
<th>Budget</th>
<th>Sharing Percentage</th>
<th>Financial Liability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Party A</td>
<td>Party B</td>
</tr>
<tr>
<td><strong>1. Marine Maintenance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Zone 1: Cableship Standing Charges</td>
<td>$2,500,000</td>
<td>33.33%</td>
<td>33.33%</td>
</tr>
<tr>
<td>1.2 Zone 2: Cableship Standing Charges</td>
<td>$1,000,000</td>
<td>33.33%</td>
<td>33.33%</td>
</tr>
<tr>
<td>1.3 Zone 1: Repair Cost</td>
<td>$500,000</td>
<td>33.33%</td>
<td>33.33%</td>
</tr>
<tr>
<td>1.4 Zone 2: Repair Cost</td>
<td>$800,000</td>
<td>33.33%</td>
<td>33.33%</td>
</tr>
<tr>
<td>1.5 Spare consumption</td>
<td>$300,000</td>
<td>33.33%</td>
<td>33.33%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$5,100,000</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>2. Cable Landing Station Costs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 CLS 1 - Manpower O&amp;M</td>
<td>$300,000</td>
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<td>33.33%</td>
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<tr>
<td>2.2 CLS 2 - Manpower O&amp;M</td>
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<td>33.33%</td>
<td>33.33%</td>
</tr>
<tr>
<td>2.3 CLS 3 - Manpower O&amp;M</td>
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<td>33.33%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$1,050,000</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>3. Power Consumption</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 CLS 1</td>
<td>$300,000</td>
<td>33.33%</td>
<td>33.33%</td>
</tr>
<tr>
<td>3.2 CLS 2</td>
<td>$200,000</td>
<td>33.33%</td>
<td>33.33%</td>
</tr>
<tr>
<td>3.3 CLS 3</td>
<td>$300,000</td>
<td>33.33%</td>
<td>33.33%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$800,000</strong></td>
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<tr>
<td><strong>4. Alternative DCN</strong></td>
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<tr>
<td>Circuit 1</td>
<td>$15,000</td>
<td>33.33%</td>
<td>33.33%</td>
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<tr>
<td>Circuit 2</td>
<td>$20,000</td>
<td>33.33%</td>
<td>33.33%</td>
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<tr>
<td>Circuit 3</td>
<td>$10,000</td>
<td>33.33%</td>
<td>33.33%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$45,000</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>5. Others</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5.1 Waysleave / Permits</td>
<td></td>
<td></td>
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<tr>
<td>5.2 Supplier Technical Support (after warranty period)</td>
<td></td>
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<tr>
<td>5.3 Cable protection</td>
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<td></td>
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<tr>
<td>5.4 NOC</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5.5 Central Billing Party</td>
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<td></td>
<td></td>
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<tr>
<td>5.6 Etc</td>
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<td></td>
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<tr>
<td><strong>Sub-total</strong></td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$8,495,000</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Check-list before Provisional Acceptance
Check-list before Provisional Acceptance

1. Satisfactory acceptance test
2. List of deficiency items, if any
3. Record of permits / licenses
4. Marine maintenance in place
5. Spare submersible plants, jointing kits
6. Readiness of Network Operation Centre (NOC)
7. Appointment of Central Billing Party (CBP)
8. Completion Training (NOC, CLS, land cable, etc.)
9. Land cable maintenance
10. Test equipment (CLS and depot)
11. System Manuals / Handbooks, update of Route Position List (RPL)
13. Alternative Data Communications Network
14. Supplier’s issuance of performance bond from 10% of contract price to 5%
15. Check fulfilment of Terms of Reference of each SubCommittee and Working Groups
16. Press Release ?

Ready to Go!
Operations and Maintenance
Joint System Maintenance Document

JSMD sets out the agreed by all the Maintenance Authorities to be followed for all aspects concerning the maintenance and repair of equipment and facilities.

O&M Organisation, Maintenance Representatives and Contacts:

a) Maintenance Authority
b) Cable Landing Station contacts
c) Marine Maintenance arrangement
d) Land cable maintenance arrangement
e) NOC

Power Safety: provides procedures to handle electrical and optical power handling during normal operation and during repair. To define Power Safety Rules and Power Safety Rules:

Power Safety Officer (PSO)

a) Terminal Power Safety Office (TPSO)
b) Deputy Terminal Power Safety Office (Deputy TPSO)
c) Ship PSO
Power Safety Message (PSM)

The purpose of power safety message (PSM) is to ensure the communication between cable stations and cableship during cable repair so as to avoid any misunderstanding among all the participants of the repair work and prevent any accident.

“One Action One PSM” is the fundamental rule and the most important for safety operation. The message to be used for the PSM must be as simple as possible so that cable stations and cableship can understand quickly and easily. Time to be used in PSM must be UTC in principle.

The exchange of PSM must be made on in a written form.

After receiving the PSM, recipient must be acknowledged by PSM.

Copies of PSMs must be retained in the submarine power safety logbooks.

Reference Number must be put on PSM.
Joint System Maintenance Document (Cont’d/…)

**Power Safety Message (PSM) - PROHIBITED ACTIONS FOR POWER SAFETY OFFICER**

☠ To omit the respective power safety procedures and to communicate other PSOs verbally without exchange of power safety messages (PSM).
☠ To prepare signed PSMs in advance of each process.
☠ To make judgments at the mere sight of situation without confirmation.
☠ Not to observe power feeding process step by step.
☠ To make other staff to sign the PSM.
☠ To send PSM other than PSO or deputy PSO.
☠ To accept the existence of plural power control at the stations or cableships, in case of simultaneous cable repairs in the same system (in terms of power feeding configuration) by plural number of cableships.
Joint System Maintenance Document (Cont’d/...)

Power Safety Message (PSM) - Sample

Cableship

PSM - ABC Cable Segment 1 Repair No. 1

Cableship to CLS PSM No. 1 Date

Cableship XX will arrive at repair ground at XX LT on DDMMYY. Cableship PSO is XXX, Deputy PSO is YYY.

Please nominate Terminal Station Power Safety Officer and your contact point and advise the PFE status.

Signature

PSM - ABC Cable Segment 1 Repair No. 1

Cableship to CLS PSM No. 2 Date

Your PSM No.1 is received. Please inform the power feeding (voltage and current) of your Power Feeding Equipment and transfer responsibility of power safety control from CLS to cableship.

Signature

CLS

PSM - ABC Cable Segment 1 Repair No. 1

CLS to Cableship PSM No. 1 Date

Your PSM No. 1 is received. Our TPSO and DPSO are XXX and YYY. Contact information is xxx.

Signature

PSM - ABC Cable Segment 1 Repair No. 1

CLS to Cableship PSM No. 2 Date

Your PSM No. 2 is received. Our PFE current status is: V= XX Volt; Current = XX mA

The Power Safety Control is handed over to cableship

Signature
Marine Maintenance

Zone Maintenance Agreements

NAZ – North America Zone
ACMA – Atlantic Cable Maintenance Agreement
MECMA – Mediterranean Cable Maintenance Agreement
SEAIOCMA – South East Asia and Indian Ocean Cable Maintenance Agreement
YZ – Yokohama Zone

Companies/Zones
- Orange/GMSL (ACMA)
- Orange/Eletra (MECMA)
- Orange (2OCMA)
- GMSL (NAZ)
- KCS/KTS/SBSS (YZ)
- ACPL/IOCPL/GMSL (SEAIOCMA)

Base Ports
- Brest, France; Portland, UK; Curacao
- La Seyne Sur Mer, France; Catania, Italy
- Cape Town, South Africa
- Victoria, Canada
- Yokohama, Japan; Kooje, Korea; Wujiang, China
- Singapore; Colombo, Sri Lanka; Manila, Philippines

source: ICPC
Marine Maintenance

Private Maintenance Agreements

APMA - Atlantic Private Maintenance Agreement, including Med
APMMSA - Asia Pacific Marine Maintenance Service Agreement
NPMMSA - Northern Pacific Marine Maintenance Service Agreement
SPMA - South Pacific Maintenance Agreement
Red Sea, Arabian Gulf, Indian Arabian Sea

Companies

- ASN / TE SubCom
- TE SubCom
- ASN
- eMarine

Base Ports

- Calais, France; Cape Verde; Curacao (APMA)
- Taichung, Taiwan (APMMSA)
- Portland, USA (NPMMSA)
- Noumea, New Caledonia (SPMA)
- Hamriya, UAE; Salalah, Oman

Source: ICPC
Considerations for selection of Marine Maintenance Providers:

1. Geographical coverage
2. Based ports and depots locations
3. Capability of cableships and ROVs
4. Service availability
5. Number of scheduled cables covered
6. Commercial (Standing Charges, Running Costs, Storage Charges)
7. Direct Measure of Quality (DMOQ)
   a. Time to mobilize Cableship
   b. Average transit speed
   c. Time to complete a cable repair
   d. Time to issue Completion Report after the repair
NOC & Network Administrator

NOC = Network Operation Center
- Overall control of the System
- A 24/7 experienced team
- Location may be restricted due to licensing requirement

Tasks
- Monitor wet plant performance
- Coordinate fault localisation
- Coordinate cable repairs
- Coordinate planned maintenance
- Coordinate capacity upgrades
- Implement and supervise traffic
- Monitor traffic quality
- Generate capacity reports
- Keep logs of daily events (alarms, etc.)
NOC & Network Administrator - Report on Activated Capacity

Activated Capacity By Party (No. of 100G Wavelength)

- Upgrade No. 3
- Upgrade No. 2
- Upgrade No. 1

Party A
- Upgrade No. 3: 20
- Upgrade No. 2: 10
- Upgrade No. 1: 10

Party B
- Upgrade No. 3: 15
- Upgrade No. 2: 10
- Upgrade No. 1: 5

Party C
- Upgrade No. 3: 10
- Upgrade No. 2: 5
- Upgrade No. 1: 5
NOC & Network Administrator - Report on Activated Capacity

Activated Capacity By FP (No. of 100G Wavelength)

- Party C
- Party B
- Party A

FP1 - Party A: 20 units
FP2 - Party B: 15 units
FP3 - Party C: 5 units
FP4 - Party A & B: 10 units
Life of a Cable
Life of a Cable

1. Cable Repairs
2. Update of JSMD, System Handbooks and maintenance procedures
3. Update of system parameters (SLD, RPL)
4. Marine Maintenance
5. Replenishment of spares
6. Renewal of licenses / permits
7. Compliance to regulations
8. Route diversions (land and subsea)
Life of a Cable

9. Cable Landing Station O&M
   a. Security
   b. Routine Maintenance
   c. Repair and return
   d. Land route patrol

10. Capacity Upgrades

11. Update of Mux Plan (channel assignment table)

12. Cable Protection / Awareness

13. Keeping of maintenance of records

14. O&M Budget Control

15. Annual O&M meeting
Capacity Upgrade

1. System is Dark on day-1. Need to augment capacity on a regular basis to meet demand
2. Open Cable: Purchasers can freely select any equipment suppliers
3. Consider individual upgrade versus consortium upgrade
4. Selection of upgrade supplier (cost, lead time, modulation formats, channel spacing, FEC limit, etc.)
5. Wavelength allocations / assignment
6. Guard band between spectrum from different suppliers and different technology
7. Ensure no interruption on existing capacity throughout the upgrade operations
8. Perform capacity upgrade during any maintenance window
9. Engage NOC to monitor traffic throughout the upgrade operation
10. Provide training to CLS and NOC if a new platform is introduced
Decommissioning
Decommissioning

1. Decision on decommissioning or retirement shall be contemplated at JBA stage.

   For example:

   i. Design life is 25 years
   ii. Unanimous decision: early decommissioning or retirement if the cable is operated for less than 25 years
   iii. Simple Majority: if the System has been in operations for more than 25 years

2. Upon decommissioning, Parties shall:
   a. use all reasonable efforts to liquidate System
   b. The net proceeds or costs of decommissioning such as removal / recovery of plants shall be shared by the Parties.
Photos - Cable Landing