8th December, 2009
New Delhi

Case Study
“Construction of Offshore Platform – Risk Mitigation”

Presentation by
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Hydrocarbon Upstream
Larsen & Toubro Limited

Sections in the Study

• About L&T
  ✓ Upstream - Facilities

• Risk Management
  ✓ Definition
  ✓ Types of Risks
  ✓ Typical Risks faced by Client / Contractor
  ✓ Risk Analysis & Mitigation tools

• Case Study - BCP-B2 Project

• Successful Risk Management – Excellence in PM
**L&T - At a Glance**

- Founded: 1938
- Assets: USD 1 Billion
- Ownership: FIs + Public
- Professionally managed company. Among Top 10 in Indian Private Sector
- 30+ Offices In India; 34 Overseas
- Credit Rating: AAA Rating from CRISIL
- Awards won recently

**Technology-driven E&C Company, with additional interests in Manufacturing, Services and IT**

- Employees: 55,000
- Turnover: $8.5bn
- Works: 15
- Subsidiaries: 23
- Share holders: 500 K
- Associates: 14

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**Strategic Steps … Business Risk Mitigation**

- 2009-10 - Deep Water Structures / FPSO
- 2008 - Jack Up Rigs
- 2005 - Installation Joint Venture
- 2003 - First International Order
- 1999 - Pipeline Projects
- 1999 - Compressor Modules
- 1996 - Process Platforms
- 1992 - Well platforms
- 1986-91 - Helideck, SPM, Test Separators Fabrication for Offshore

**L&T's Journey to become Total Offshore Solution Provider**
L&T Upstream Facilities - Fabrication

- **Hazira – India**
  - 240,000 Sq M
  - Jetty – 250 M
  - Load out – 5,700 T
  - Established - 1985

- **Sohar – Oman**
  - 400,000 Sq M
  - Jetty – 300 M
  - Load out – 20,000 T
  - Established - 2007

- **Kattupalli – India**
  - Under Development
  - Operational by 2010

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L&T Upstream – Facilities

- **Heavy Lift cum Pipe Lay Vessel**
  - Crane - 3000 ST (Revolving)
  - Pipe lay – 6 to 60” (S-Lay)
  - Accommodation – 290 men
  - In service by Feb 2010

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**Engineering**
- L&T- Valdel, Bangalore, Delhi & Chennai
- L&T – Chiyoda, Vadodara
- L&T – S&L, Vadodara
L&T Upstream – Track Record

- 6 Well Platform & Pipeline Projects
- 7 Process Platform & Pipeline Projects
- 5 Pipeline & Modification Projects
- 1 Onshore Gas Plant & Pipeline Project

- On Time: 42%
- Early: 11%
- Delayed: 5%
- Time extended by Client: 5%

- Wellhead Platform Projects completed in 13 – 18 months
- Process Platform Projects completed in 18 – 27 months.

Risk Management

"Every Business is Risky...."
**Definition**

**Risk**
- An *uncertain* event or condition that, if it occurs, has a positive or negative effect on a project objective.

**Risk Management**
- Is the culture, processes & structures that are directed towards the effective management of potential opportunities and adverse effects in a project.
- Identifying, Analyzing and Responding to Risks *throughout the lifecycle of the project*.

**Types of Project Risk**
- **Inherent**: that result from the nature of project objectives, scope, and risks listed in the contract.
- **Acquired**: that result from the selected approach, methodologies, tools, techniques, skills and experience that are applied to the project.
- **External**: that result from change in client expectation, vendor non-compliance, statutory, legal, political, so on.
Why Offshore Construction Projects are inherently risky?

Environment - Inherent Risk
- Weather
- Proximity of Live Production Platforms / submarine pipelines
- Uncertainty related to subsea conditions (current / soil property / sea bed contour)

Monumental, Cascading repercussions of Certain milestones
- Delayed despatch from Onshore Yard - delayed Installations
- Marine spreads' standby.
- Spill over of onshore scope to offshore - prolong offshore campaign
- Uncertain completion - even extension by another season)

High Value Assets with inflexible contract conditions
- Heavy Lift Derrick Vessel
- Yards capable for offshore construction including critical yard commissioning (e.g. string test)

How Risks are distributed between Client and Contractor?

Risks Retained by Client
- ☻ Damage to existing property
- ☻ Loss of production due to delay
- ☻ Change in Laws
- ☻ Changes in soil property limited to classified structural weight growth

Risk at Contractor's end
- ☻ Weather
- ☻ Delay
- ☻ Quantity Growth
- ☻ Cascading impact of changes in soil property
Typical Risks faced by Client / Contractor

Typical Risk faced by Client

- International volatility in Crude prices impacting margins and feasibility of the future projects.
- Accidental release of toxic gases at offshore causing loss of life.
- Contamination of sea by spilling hydrocarbons and affecting marine life.
- Loss or damage to client’s existing property due to fire / damage / accident (except in case of gross negligence or willful misconduct by contractor).
- Natural calamities like earthquake, cyclone, storm, typhoon etc.
- Security Threat
**Risk Mitigation – Client Perspective**

- Insurance cover for existing property.
- Proper Insurance cover for the contractors and the marine vessels working in the field.
- Thorough checking of systems at regular intervals to avoid accidental leakage of toxic gases.
- Inspection and mock drill of all the vessels entering the field from safety angle.
- Implement system of work permits & safe practices.
- Strict / elaborate screening procedure prior to granting offshore visit pass.

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**Typical Risks faced by Contractors**

1. **Operational**
   - Contracts
     - Ambiguous clauses
     - One-sided clauses
     - Disputes in claims
     - International
   - Estimation
     - Scope of work
     - Site conditions
     - Inaccurate specs
     - Engineering and design
   - Execution
     - LD
     - Key personal leaving
     - Vendor non-performance
     - Consequences of force majeure
     - Engineerin g and design

2. **Credit**
   - Customer default
   - Credit terms
   - Fin. health
   - Exposure to groups
   - Country exposure

3. **Market**
   - Forex
   - Interest rate
   - Commodity prices

4. **Macro-Environmental**
   - Political
   - Macroeconomic
   - Forces of nature
Risk Analysis & Mitigation Tools

Risk Analysis Chart

- **Initiation**
- **Planning**
- **Execution**
- **Termination**

**Opportunities and Risk**

**Amount at stake**

**Period of Highest Risk Impact**

**Time**

**Increasing Risk**

**Values**
Probability - Severity (PS) Chart

Prior to Mitigation measures

After Mitigation measures

Risk Level: High Risk, Medium Risk, Low Risk

Risk Analysis – Other Tools

Risk Register

<table>
<thead>
<tr>
<th>Name of Risk</th>
<th>Optimistic (Best Case) Impact</th>
<th>Most Likely Impact</th>
<th>Pessimistic (Worst Case) Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule overrun leading to payment of liquidated damages to the client</td>
<td>$50 M USD</td>
<td>$3 M USD</td>
<td>$10 M USD</td>
</tr>
<tr>
<td>Nickel price variation leading to increased costs of tubes</td>
<td>$0.5 M USD</td>
<td>$1 M USD</td>
<td>$3 M USD</td>
</tr>
</tbody>
</table>

Risk Modeling

Monte Carlo
EPC Project of Offshore Platform - A Case Study

Case 1:
Delays in Supply Chain
“Innovative Expediting – Turbo Machine”
**Risk context**

- Turbo machinery equipments are critical and long lead.
- 4 Trains of Turbines and Compressors were ordered on Siemens – UK, with 14 months FOB delivery.
- Compressors manufacturing was on critical path and getting delayed for assembly.
- Delay in arrival of Turbo machinery would delay the string test and Module delivery.

**Delay in Compressor were affecting fabrication & erection of interconnecting piping (4 to 6 weeks activity)**

**Risk Mitigation**

- Dummy Compressor casing with nozzles was fabricated & associated piping work completed prior to arrival of actual Compressors in assembly shop.
- Similarly with same Dummy casing Train ‘C’ & Train ‘D’ were also managed
Outcome

👍 Piping work was completed before arrival of Compressor with help of Dummy casing.

👍 With “Dummy Casing” concept, 4 weeks of delay in Compressors was recovered

👍 Testing and dispatch of Compressors were maintained as per schedule.

👍 Timely arrival of Turbo machinery in fab. yard facilitated timely string test and Module delivery on schedule.

Case 2:

Fabrication Management

“Vendor Backlog catch-up ”

DSS Piping to connect nozzles of coolers at a height of 28mtrs
**Risk Context**

- Air Coolers for Compressor Modules got delayed from vendor’s works.
- Critical DSS Piping to be erected after the installation of Coolers at height.
- Delay in Air Coolers will result in delay in piping erection and Modules Load out.
- Delay in load out would have resulted in standby of HLV.

**Schedule**

<table>
<thead>
<tr>
<th>25 Jul</th>
<th>05 Oct</th>
<th>23 Oct</th>
</tr>
</thead>
</table>

10 weeks

<table>
<thead>
<tr>
<th>22 Sep</th>
<th>05 Dec</th>
<th>23 Dec</th>
</tr>
</thead>
</table>

3 weeks

**Forecast**

- Installation of Cooler
- Readiness of piping
- String Test

8 weeks

**Delay**

**Risk Mitigation**

- Template of nozzles collected from vendor.
- As per template, piping spools fabricated.
- Headers at yard tested & chemical cleaned.
- Lifted immediately after coolers installation
<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Start Date</th>
<th>Finish Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation of Coolers</td>
<td>22-Sep-07</td>
<td></td>
</tr>
<tr>
<td>Preparatory work for readiness of piping system</td>
<td>23-Sep-07</td>
<td>30-Sep-07</td>
</tr>
<tr>
<td>Readiness of piping system</td>
<td>30-Sep-07</td>
<td></td>
</tr>
<tr>
<td>Preparatory work for string test</td>
<td>01-Oct-07</td>
<td>08-Oct-07</td>
</tr>
<tr>
<td>String Test Completion</td>
<td>09-Oct-07</td>
<td></td>
</tr>
</tbody>
</table>

**Outcome**

**ACTUAL**

*Maintained string test & load out schedule*

**Case 3:**

**Construction Management**

*“String test of 9 Trains”*
**String Test ??**

- String test is a full load / full speed test of gas compressor, carried out at yard for 4 hours to ascertain mechanical integrity of compressor Trains.
- String test at yard means smooth commissioning at offshore
- Without string test, module from fabrication yard cannot be taken out to offshore.

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**Risk Context**

“I have learnt a lot about L&T’s capability to provide complete solutions for compressor modules, but I am really worried how L&T would undertake string test of 9 compressor trains in a short span of less than two months, which has never happened in the Oil & Gas industry - I wish L&T good luck”

Mr. Peter Velzing
Project Director - SIEMENS
Risk Mitigation

- Meticulous planning
- Creating & testing necessary infrastructure at Hazira yard.

Outcome

- Successful completion of string test for 9 Compressor trains on schedule.
- Record in L&T and probably in Oil & Gas Industry.
- Smooth & timely Commissioning of Turbo machinery at offshore
Case 4: Crisis management “Cargo Barge at Distress”

Risk Context
- Cargo Barge Miclyn 3318 hired for transportation of Compressor Modules.
- Tow tug Profit Majestic commenced towing of empty Miclyn 3318 from Singapore on 09/09/2007 with 20 days voyage.
- On 22/09/2007 – 8 days away from Hazira, tow wire between Tug & Barge breaks & Cargo Barge started drifting due to inclement weather.
**Risk Mitigation**

- Rescue tug “Ferrari” mobilized from Chennai.
- Decided to mobilize another similar barge “Miclyn -3320” with high power tug “Miclyn Moon” from Singapore.
- Tug “Nancy-11” is mobilized from U.A.E. to take over the barge “Miclyn-3318”.

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**Outcome**

- “Miclyn Moon” towing barge “Miclyn-3320” arrived Hazira on 30/10/2007 (On schedule for load out).
- “Profit Majestic-I” reached Hazira on 27/10/2007 (to be used as Channel assist tug).
- Tug “Nancy-11” towing barge “Miclyn-3318” arrives Hazira on 02/11/2007 (This pair, which missed the load out schedule was used for load out of concurrent project).
Case 5: New Concept for “Deck Crane Installation”

Risk context

- New concept of installing crane in single piece as against conventional assembly in 3 parts
- Challenge – First Eqpt to get Commissioned.

Risk Mitigation

- Designed the assembly as a “Single frame”
- Installation & rigging engineering for single lift.
- Design vetted by Marine Warranty surveyor.
- Assembled Crane tested at yard - Minimum Offshore Hook-ups.
Outcome

- Saving ~Rs. 6 Cr. (3 days of installation HLV) and reduced Installation schedule.
- Crane was made operational in 2 days time as against 2 to 3 weeks of normal philosophy.
- Vendor deputation period at offshore reduced as crane was tested in yard.
- Earlier commissioning of cranes helped in subsequent Hook-up activities.

Case 6:
Financial Risk Management
“Deemed Export benefits”
**Risk Context**

- Deemed Export Benefit on the project was available only after 01.10.2007 (after renew of Mining lease with Govt.)
- Major Imports were prior to 01.10.2007 to achieve target delivery of 28.02.2008
- Absence of License means Imports under Duty payment and claim Drawback after completion of project.
- Resulting in the blocking of huge funds for indefinite period.

**Risk Mitigation**

- Brainstormed on various options to obtain the advance license for duty free imports.
- For the first time in India, decided innovative approach of obtaining company wide “Annual Advance Authorization License”.
- After submitting Dispatch documentations, we obtained Export Obligation Discharge Certificate from DGFT towards redemption of this Annual Advance Authorization License.
Outcome

- Interest saving
- Avoided uncertainty on refund

Successful Risk Management - Excellence in Project Management
Schedule v/s Actual Progress Curves

BCP-B2 : Overall Progress ‘S’ Curve

Customer Delight & Appreciations

Inaugurated by Mr. N.K. Mitra – Director (Offshore), ONGC on 26th Feb 2008 (3 Days ahead of schedule)
Recognized For Expertise & Excellence Over the Years

- **Padma Bhushan** for Mr. A M Naik
  Jan 2009

- **Forbes Asia’s ‘Fabulous 50’ for 3rd consecutive year**
  Dec 2008

- **Platinum Award - Manufacturing Excellence**
  Dec 2008

- **KPMG-Infrastructure Today Award 2008**
  Dec 2008

- **L&T Ranks First in Quality in India.**
  Wall Street Journal Asia Survey
  July 2008

- **Govt. of India releases Commemorative Stamp on Henning Holck-Larsen**
  June 2008

- **Business Today-ERNST & YOUNG Study Ranks L&T as ‘India’s Best Managed Company’**
  Mar 2008

- **Top Export Award in ‘Engineering and Machine Tools’ category**
  May 2008

"L&T is unique... it belongs to the national sector... this is an example of entrepreneurship and the ability and confidence to chart the most difficult frontiers of business...”

- Finance Minister of India, on celebrating 70 years of L&T, December 2007

### Upstream – Track Record

<table>
<thead>
<tr>
<th>Well Platforms</th>
<th>Value (MUSD)</th>
<th>Schedule</th>
<th>Actual</th>
<th>Over/Under-run</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-173A (1) (ONGC)</td>
<td>20</td>
<td>12</td>
<td>12</td>
<td>On Time</td>
</tr>
<tr>
<td>S1-Sand (3) (ONGC)</td>
<td>74</td>
<td>16</td>
<td>16</td>
<td>On Time</td>
</tr>
<tr>
<td>I-MNTW (4) (ONGC)</td>
<td>143</td>
<td>25½</td>
<td>25</td>
<td>½ mth early</td>
</tr>
<tr>
<td>N9/N10 (2) (ONGC)</td>
<td>73</td>
<td>13</td>
<td>13</td>
<td>On Time</td>
</tr>
<tr>
<td>9WPP (9) (ONGC)</td>
<td>222</td>
<td>22</td>
<td>18½</td>
<td>3½ mth early</td>
</tr>
<tr>
<td>4WPP (4) (ONGC)</td>
<td>219</td>
<td>18</td>
<td>18</td>
<td>On Time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Process Platforms</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HRC (ONGC)</td>
<td>74</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>TPP (Enron/ BG)</td>
<td>30</td>
<td>24½</td>
<td>14</td>
</tr>
<tr>
<td>AHC (ONGC)</td>
<td>38.3</td>
<td>19</td>
<td>18½</td>
</tr>
<tr>
<td>MNW (ONGC)</td>
<td>126</td>
<td>26</td>
<td>25½</td>
</tr>
<tr>
<td>Bundug GIP (Bunduq)</td>
<td>52.5</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>BCP-B2 (ONGC)</td>
<td>290</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>VEDP (L&amp;T Scope)</td>
<td>168</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pipelines &amp; Modifications</th>
<th>Value (MUSD)</th>
<th>Schedule</th>
<th>Actual</th>
<th>Over/Under-run</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRMP-T1 (ONGC)</td>
<td>42.9</td>
<td>17</td>
<td>16</td>
<td>1 mth early</td>
</tr>
<tr>
<td>PPM (ONGC)</td>
<td>40</td>
<td>15</td>
<td>15</td>
<td>On Time</td>
</tr>
<tr>
<td>BHPRP (ONGC)</td>
<td>26</td>
<td>13+1</td>
<td>13</td>
<td>1 mth early</td>
</tr>
<tr>
<td>QP PS2/ PS3 (QF)</td>
<td>98.3</td>
<td>18/19</td>
<td>21/22</td>
<td>Time extended</td>
</tr>
<tr>
<td>PRP (consortium with Global)</td>
<td>600</td>
<td>38</td>
<td>38</td>
<td>½ mths early</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Onshore projects</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Songo-Songo (Songas)</td>
<td>100</td>
<td>18</td>
</tr>
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