“Difficulties strengthen the mind, as labor does the body.”

Lucius Seneca
(4 BC – 65 AD)
100+ Worldwide Salt Tectonic Basins (pre-salt & sub-salt)

Source: Martin P. A. Jackson, 2007
Conceptual Model – Ultra-Deep Play
ONSHORE to SHELFF to DEEPWATER

Source: McMoran IR
Debottlenecking → Major Conversion
Life extension → Major Conversion
Relocation → Upgrade
Thin line between success and failure

- Good news: it is not difficult to succeed
  Knowing the business (following golden rules)

- Bad news: it is easy to fail
  Risky for newcomers
• Are you responsible for the original integrated design?
• Do you have the entire design in hand, with all native format files?
• Do you have the ‘as-built’ drawings and models?
• Do you have the O&M history, with access to the data log?
• Do you have the Integrity Data along the operational life?
There are several cases:

- FPSO II
- FPSO Capixaba
- FPSO Espadarte
99% Uptime in Fleet

REVENUE UP 17%

7,493 people

Dutch Public Company

0.06 LTI

18 Units in production

Integrated Life-Cycle EPCI, O&M

2012: US$ 3.7 Bln Turnover
The industry’s 1st FPSO relocation:

- Cadlao, Philippines, 1981 (Amoco/Alcorn)
- West Linapacan, Philippines, 1992 (Alcorn)
- 1st deepwater Marlim Sul, Brazil, 1997 (Petrobras)
- 2nd deepwater Marlim Sul, Brazil, 1999 (Petrobras)
Case History
From FPSO VI to Espadarte to Anchieta

 FPSO VI
   Nigeria, 1986-1998

 Espadarte FPSO
   Brazil, 2000-2011

 Anchieta FPSO
   Brazil, 2012-2030
### Case history – FPSO Espadarte

<table>
<thead>
<tr>
<th>Client</th>
<th>Petrobras</th>
<th>Petrobras</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water depth</td>
<td>850 m</td>
<td>1220 m</td>
</tr>
<tr>
<td>Field</td>
<td>Post-Salt, Espadarte, Brazil</td>
<td>Pre-Salt, Baleia Azul, Brazil</td>
</tr>
<tr>
<td>CO₂</td>
<td>0%</td>
<td>4%</td>
</tr>
<tr>
<td>H₂S content</td>
<td>0%</td>
<td>200 ppm</td>
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<tr>
<td>WI / Pressure</td>
<td>110,000 bwpd @ 200bar</td>
<td>110,000 bwpd @ 290 bar</td>
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<tr>
<td>Gas export</td>
<td>88 MM scf/d</td>
<td>121 MM scf/d</td>
</tr>
<tr>
<td>Design life</td>
<td>16 Years</td>
<td>18 Years</td>
</tr>
</tbody>
</table>
Design & Construct while Operating

Module Fabrication
Topside & Main Deck – On Arrival Early Aug ‘11
Topside & Main Deck – end Aug ‘11
Topside & Main Deck – end December ‘11
Debottlenecking & Life Extensions

Pre-investment: Refurbishment at a shipyard
Postpone investment: Refurbishment on-site

Constraints:
- Safety
- POB
- Logistic
- Cost

Alternate Flexible Design
Disconnectable Unit allowing cheaper and faster mob & demob
Success Factors

Debottlenecking
Refurbishment
Life Extension
Relocation

Original Design (native format)
In-house EPCI, Risers
Integrated planning
Historical Maintenance Data
Accurate assessment of scope

Historical Integrity Data
In-house O&M and Logistics
Concentrate all activities at one site
Planning for:
- Debottlenecking
- Refurbishment
- Extend Lifetime
- Relocation

Summary
- Growing demand from the industry
- Add flexibility when developing challenging reservoirs
- Makes new frontiers economically viable
- Strategically required for full field development

Knowing the business
- Planning up-front

- Minimize risk
- Minimize Cost
- Minimize downtime
Thank you!

Carlos Mastrangelo
Senior Vice-President
Projects and Technology Development
SBM Offshore