Addressing project cost and delivery performance: Learning from other industries
Subsea Expo, Aberdeen, 12th Feb 2015

Faraz Ahmad
Strategic Growth & Innovation Manager
GE Oil & Gas – Subsea Systems

Imagination at work.
Capex increases are driven by escalation in input cost prices and greater project complexity

Annual capex\(^{1,2}\); USD bln

1: Upstream development capex  
2: BG, BP, Chevron, ConocoPhillips, Eni, ExxonMobil, Shell, Statoil, Total  
3: 3-year average; 04-06, 11-13

Source: Wood Mackenzie; Company filings; McKinsey analysis
Ways to drive capital productivity

<table>
<thead>
<tr>
<th>Category</th>
<th>Key Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardisation/modularisation</td>
<td>• Specification</td>
</tr>
<tr>
<td></td>
<td>• Interfaces</td>
</tr>
<tr>
<td></td>
<td>• Documentation</td>
</tr>
<tr>
<td>Design to value</td>
<td>• Avoiding feature creep</td>
</tr>
<tr>
<td></td>
<td>• Reduced R&amp;D time and Investment</td>
</tr>
<tr>
<td></td>
<td>• Work with customer to expand on pilot projects or not</td>
</tr>
<tr>
<td>Supplier ecosystem</td>
<td>• Performance management</td>
</tr>
<tr>
<td></td>
<td>• Structure</td>
</tr>
<tr>
<td></td>
<td>• Supply chain processes</td>
</tr>
<tr>
<td>Project management</td>
<td>• Capabilities</td>
</tr>
<tr>
<td></td>
<td>• Workforce availability</td>
</tr>
<tr>
<td>Execution insight</td>
<td>• Digital tools</td>
</tr>
<tr>
<td></td>
<td>• Virtual environments</td>
</tr>
</tbody>
</table>
Today in the Subsea Industry...

Oil Companies

Oil company procures “custom” equipment from the OEM’s via detailed specs, including their own and multiple industry standards

Subsea OEM’s

Significant engineering effort per project
Lack of standardization;
Little reuse of engineering

Sample of Industry Spec’s for a Subsea Tree Design

ANSI/ASME B16.11, ANSI/ASME B31.3, ANSI/ASME B31.4, ANSI/ASME B31.8,
ANSI/ISA 75.02 ANSI/SAE J517
API SPECIFICATION 17D, API Spec 17B, API Spec 5B
ASTM D1414, DNV RP B401, ISA 75.01.01
NACE No. 2/SSPC-SP 10, NACE SP0176
SAE/AS 4059

Plus…. GE’s Design Practices

Significant complexity driving risk, long lead times, high cost
Typical Subsea Contract

- A “typical” contract encompasses ~ 700 standards...

280 Client Documents Presented for Review

175 Documents screened out as not relevant to trees / engineering scope.

105 Documents Subject to Detail Review

- Reviewed by Project Engineering team with support from materials group on eleven documents.
- 63 documents classed as No comment/Info only.

42 Documents Commented

- 480 Comments and clarifications raised for PM action.

Approximately 4200 pages of detailed requirements reviewed
12 man weeks of engineering to screen/review and compile comments

Contract Execution

GE has ~100 inspection visits per week. Usually matched by clients Third Party Inspectors

Client assessment treat all components of equal importance

Multiple requirements, quality inspected in ...

Note: MRB – Master review Board

Where will I store the MRB?
Aviation: Roles, practices & collaboration

Regulatory Bodies – FAA, EASA … Harmonized Requirements

“Approves” design, manufacture, maintenance, operation. Does not tell the operators or OEM how to do it, sets requirements

Airlines
Airline purchase a “standard” product with options and standard interfaces

Airplane OEM’s
Airplane OEMs provide requirements, weight, thrust, etc; interfaces agreed.

Engine OEM’s
Engine OEM’s design to their own “design practices” not industry standards. Industry data shared to ensure continued improvement in reliability/safety.

Safety data shared to ensure continuous improvement in the industry. Trends support effectiveness of approach

Safety Bodies – CAST, NTSB, AAIB
Global data sharing – Industry and Regulators

Fewer standards, set by professional engineering bodies not industry participants

Note: FAA Federal Aviation Authority; EASA European Aviation Safety Agency; NTSB National Transportation Safety Board; CAST (Commercial Aviation Safety Team; AAIB Air Accidents Investigation Branch
**O&G is unlike other industrial sectors for managing changes**

<table>
<thead>
<tr>
<th></th>
<th>Wind</th>
<th>Nuclear</th>
<th>Aviation</th>
<th>Oil &amp; Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design change</strong></td>
<td>Certification from 3rd party technical authority (e.g. Garrad Hassan)</td>
<td>Approval from Nuclear regulatory authority</td>
<td>Approval from Aviation authority (e.g. FAA) as required Real life test not necessarily required</td>
<td>Requalification for each project that uses design. Must be approved by each individual O&amp;G company</td>
</tr>
<tr>
<td><strong>New material</strong></td>
<td>Certification from 3rd party technical authority</td>
<td>Approval from Nuclear regulatory authority</td>
<td>Approval from authority as required</td>
<td>Must be approved by each individual O&amp;G company</td>
</tr>
<tr>
<td><strong>New manufacturing process (e.g. 3D Printing)</strong></td>
<td>Certification from technical authority 3rd party</td>
<td>Approval from Nuclear regulatory authority</td>
<td>Approval from authority as required</td>
<td>Must be approved by each individual O&amp;G company</td>
</tr>
<tr>
<td><strong>New Industry standard</strong></td>
<td>Certification from 3rd party technical authority (e.g. Garrad Hassan)</td>
<td>Certification from central body – processes relied upon rather than specification</td>
<td>Certification from central body – processes relied upon rather than specification</td>
<td>All designs that were certified under older revisions no longer valid</td>
</tr>
</tbody>
</table>
Emergence of certification in Subsea with controls obsolescence management

Joint industry effort on subsea obsolescence for control systems

Certified by third party company with aviation background

Different bodies dictate different equipment scopes (e.g. IEC for electronics and API for mechanical)

TLS* Ltd – 3rd party completing certification – originating from aerospace industry

Obsolescence set by other higher volume industries (telecoms, semiconductors)

Scope:
- Electrical & Electronic assemblies
- Software & firmware

Obsolescence Management for Subsea Production Control Systems

Joint Operator Specification 3428A
Version 1.4

Electronics specifications and obsolescence determined by industries other than O&G – forcing different industry approach

* Through Life Support
## Operator & contractor relationships: how can the supplier ecosystem be improved?

| **Reliance on sub-contractors** | • Natural evolution as industries mature  
|                                  | • Slow adoption in Oil & Gas |
| **Supply chain innovation**     | • Full engagement of suppliers at concept stage  
|                                  | • Key advances in components from supply chain  
|                                  | • Examples include aerospace, automotive, telephony (50% of Toyota innovation from suppliers, e.g. ABS, Audio, GPS, heating seats…)
| **Planned innovation**          | • Once demands are known, time from discovery to FID to execution allows fit for purpose technology development |
| **Partnering for joint operations** | • Remote monitoring of assets (e.g. jet engine in aviation)  
|                                  | • Planning service requirements at beginning of field lifecycle |

Already present in O&G but maturity and implementation not to same extent as other industries
Innovation can play a key role in applying new technologies and changing business models

<table>
<thead>
<tr>
<th>Description/Examples</th>
<th>Potential application to O&amp;G</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Substitution</strong></td>
<td>• Materials certification</td>
</tr>
<tr>
<td>• Using higher performing, less expensive or less scarce materials (e.g. carbon fibre vs aluminium)</td>
<td></td>
</tr>
<tr>
<td><strong>Eliminating waste (in process)</strong></td>
<td>• Certifying innovation in manufacturing process</td>
</tr>
<tr>
<td>• Reducing material requirements with 3D printing</td>
<td></td>
</tr>
<tr>
<td><strong>Increase ‘circularity’ of product</strong></td>
<td>• Design for decommissioning</td>
</tr>
<tr>
<td>• Refurbishment, re-use, recycling</td>
<td>• Re-use of obsolete equipment</td>
</tr>
<tr>
<td>• Design with end of life needs</td>
<td></td>
</tr>
<tr>
<td>• Harvest waste streams</td>
<td></td>
</tr>
<tr>
<td><strong>Optimisation of resources</strong></td>
<td>• Digital platform to allow operators to rent equipment to each other</td>
</tr>
<tr>
<td>• Predictive real time analytics to reduce resources, improve asset utilisation</td>
<td>• Predictive well performance to improve vessel utilisation</td>
</tr>
<tr>
<td><strong>Virtualisation</strong></td>
<td>• Digital oilfield applications to reduce staffing</td>
</tr>
<tr>
<td>• Increased automation, remote connectivity</td>
<td>• Autonomous production systems under supervision</td>
</tr>
<tr>
<td>• Embedded software which is remotely upgradeable</td>
<td></td>
</tr>
</tbody>
</table>

Closing thoughts

Software & data ... allow real time use via automation
OEMs ... standardisation, modularisation, design to value
... supplier ecosystems, Project management, IT
EPCs ... ongoing value improvement rather decision
gate justification
Assets ... reverse continued decline in efficiency
Services ... optimise how activities are planned and executed
Government ... co-ordinate standards, set minimum safety &
performance requirements

- Clear definition of roles and responsibilities: autonomy
  within boundaries
- Continual build on established database of test and
  experience, don’t “reinvent the wheel”
- Incentivise supply chain contribution

Learnings
From other sectors
Thank you for your attention

Faraz Ahmad,  
Strategic Growth & Innovation Manager, Subsea Systems, GE Oil & Gas

faraz.ahmad@ge.com  
General Electric, The Ark, 201 Talgarth Rd, London W6 8BJ  
Tel: 07886823053