What’s Available to Operators?

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Deepwater Drilling in Loop Currents

Operational Issues:

- Types of drill rig – DP and Moored – manoeuvrability
- In combination with hurricane season – retrieval ability
- Production drilling over subsea architecture – consequential damage
- Unproductive drilling time – 2005 many tens of millions of dollars
Improving Drilling Operations in High Currents

A company equipment review produced two main areas of interest:

1. Riser devices that decrease drag and suppress VIV

2. Development of improved mechanical drilling riser centraliser
   - Increases the operational window for retrieval of riser
   - Particularly important during hurricane season
   - To be deployed for operation in 2008

This paper will address the work done in the area of available devices for drag reduction and suppression of VIV
FLOW DEVICES – Summary History

The BENEFITS

• Reduce drag - Riser top and bottom angle
• Suppress VIV – Riser vibrations

Types of flow improving devices:

Passive Devices

• fairings, shrouds, etc.

Active Devices

• Air, water jetting, etc.
Some Passive Devices

Passive Devices

- Fairings (rigid)
- Deformable Shrouds
- Buoyancy Modules
  - Distribution
  - Helical Grooved
- Axial Rod Shrouds
- Perforated Shrouds
- Windings / helical wraps
- Hoops / Spaced Spoilers
- Fins / Bumper Bars
- Splitter plates
- Bumps / Waves

Full fairing

AIMS Splitter
Passive Devices, cont’d

- Hoops / Spaced Spoilers
- Perforated Cylindrical Shroud
- Axial Rod Shrouds
- Lankhorst Fins on Drilling Riser
- Inverted Helically Grooved buoyancy
- Wavy Buoyancy profile
- Helical Rope Wrap

OMAE2008-57047
Operational Device Review - Findings

Nearer Term most favourable options for operation

1. Fairings (rigid) – various designs and associated performance claims
2. Fairings (flexible) – prototype construction underway
3. Fins / Bumper bars – designs in use
4. Helical Wraps – previously used as temporary mitigation

All but one in use today on GoM Drill Rigs

Benefit Decision for Deployment

a. Performance – dynamic behaviour benefit?
b. Robustness – survivability
c. Marine logistics – container transfer, storage and available work areas
d. Deployment/Recovery efficiency – time management GoM Hurricane impact
e. Mechanical Handling – Crew resources, cross lifting, rig modifications
f. Health/Safety/Environment – dropped objects, failure risks and consequence

Need to perform an Operational Benefit Analysis – Numeric (Time / Cost)
To help understand and clarify Fairing Performance against Claims

1. Establish a performance acceptance criteria for fairing products (i.e. see paper for specifics)
   - Drag Reduction level set
   - VIV Suppression, Stability and Motion Amplitude

2. Invite suppliers to put forward products for large scale BP proving tests
   Two fairing suppliers came forward with products
   - AIMS Inc. – Dual Fin Splitter Fairing
   - Trelleborg Offshore – RiserFin Fairing

3. A 3rd company Allbrown also requested proof of concept tests on their flexible fairing -
Fairings – Acceptance Model Tests

- Performed at Institute for Ocean Technology in St. John’s – Free Vibration on Springs
- Specific deepwater drilling riser (OD=1.33m) scaled to 0.24 for tests
- Model test matrix targeted for full scale ranges of Re and Vrn

- Comprehensive fixed and freely vibrating tests performed
  - Bare pipe benchmarking tests
  - 2 Off fairing type acceptance test sets
AIMS Dual Fin Splitter - ADFS

AIMS Splitters Installed and Prepped for Testing
(88% Coverage Including Dummy Section)

Fairing Section

Endplate

Thrust collar
Trelleborg RiserFin Fairing
Fairing Results + Conclusions

- Both Fairing Products tested satisfied the ‘Acceptance Criteria’ for Drag Reduction and VIV suppression

- Typical drag coefficient (Cd) were around 0.6 with good VIV suppression
VT Fairing – Concept Proving

- Operational target is to get over some of the downside impact of working with rigid fairing – lighter, flexible, easy storage, less work area demand

- Concept proving model tests completed at University of Southampton – limited Re range tested

- Results showed that VT highly effective at suppressing VIV with reduced dynamic drag loading
Full Scale Operational Experience

- Model tests indicate benefit but how do fairings perform for real?

- BP measuring and monitoring behaviour of deepwater drilling risers for a number of years

- Two drilling campaigns have been undertaken with different types of fairings (SGSI designs)

- Indications are that the fairings did suppress VIV behaviour in higher current situations
GSF Explorer Drilling Riser

Fairings Data:
- 7 buoyant joints equipped with fairings
- Shell Global Solutions, Inc. (SGSI) - full wrap fairings
- Chord/Diameter (C/D) Ratio: 1.5
- Length: 6 ft

Monitoring Data:
- 9 months of monitoring
- VIV occurs 1.6% of time
- Max current below 0.5 knots except for period of 21st July to 27th July 07 when a max current speed of 2.1 knots observed
Ocean Confidence Drilling Riser

Fairings Data:
- 14 buoyant joints equipped with fairings
- SGSI - tailfin fairings
- Chord/Diameter (C/D) Ratio: 1.45
- Length: 6 ft

Monitoring Data:
- 2 months of monitoring
- VIV occurs 4.1% of time
- Max current speed: 0.95 knots
Conclusions

• Fairing performance has been demonstrated to various levels of rigor

• The final choice for fairing use on a drilling riser for a particular well location tends to be a pure Cost / Benefit Decision

Cost / Benefit Decision

• Recommendations:
  − Operability analyses using fairing performance data
  − Cost-benefit analysis: “saved” downtime vs. “lost” trip time and handling / storage issues
  − Attention to minimizing “lost” time in fairing designs