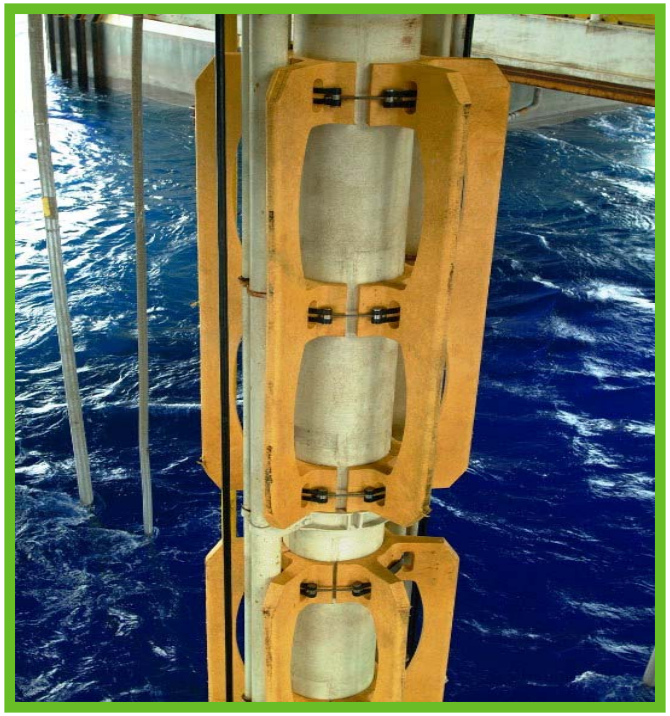
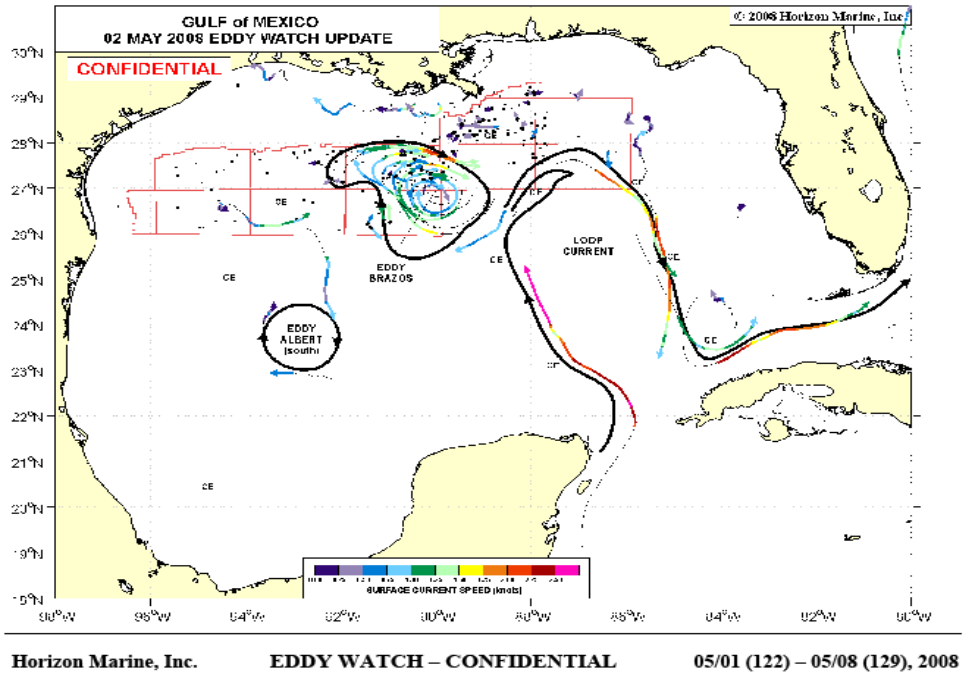
OMAE 2008-57047
Offshore Drilling Riser VIV Suppression Devices



What's Available to Operators?

Samuel Taggart & Mike Tognarelli – BP America
June 2008

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**

Drilling Riser hard up against diverter housing in a 2 knot current

Some Passive Devices

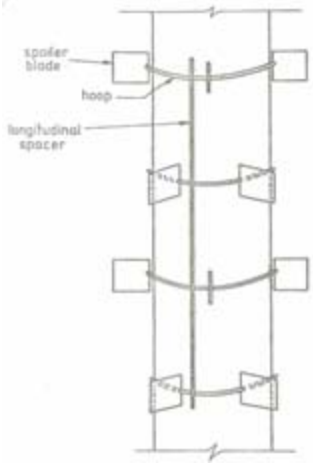
Passive Devices

- 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

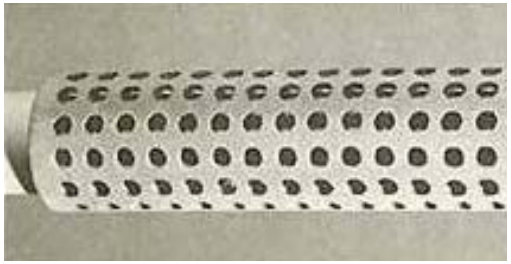
Full fairing

AIMS Splitter

Passive Devices, cont'd

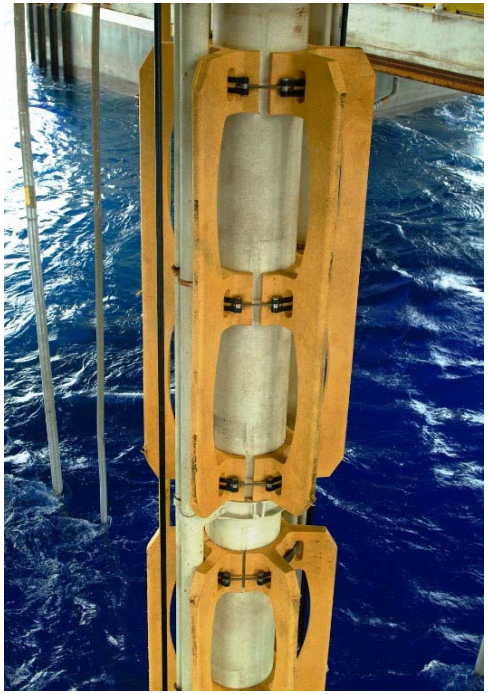


Hoops / Spaced Spoilers

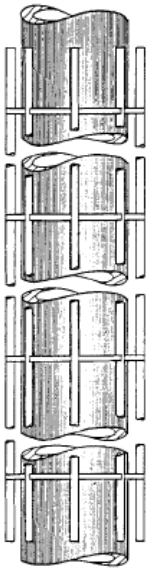


Perforated Cylindrical Shroud

Helical Rope Wrap

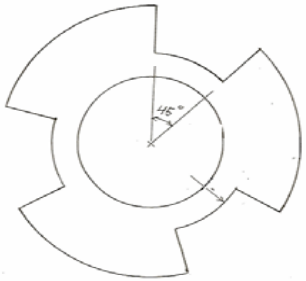


Lankhorst Fins on Drilling Riser



Axial Rod Shrouds

Wavy Buoyancy profile



Inverted Helically Grooved buoyancy

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)

Fairings – Need for Performance Acceptance

<u>To help understand and clarify Fairing Performance against Claims</u>

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**

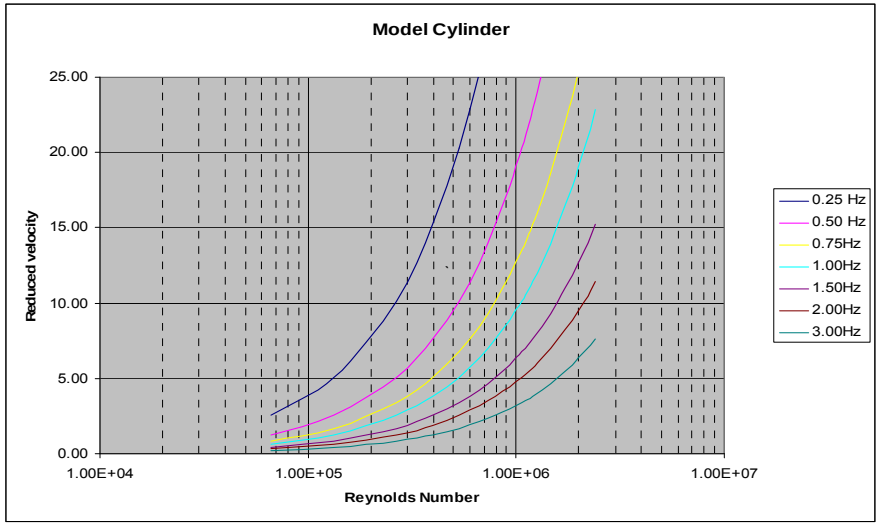
   <u>Two</u> fairing suppliers came forward with products

   - **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 -**

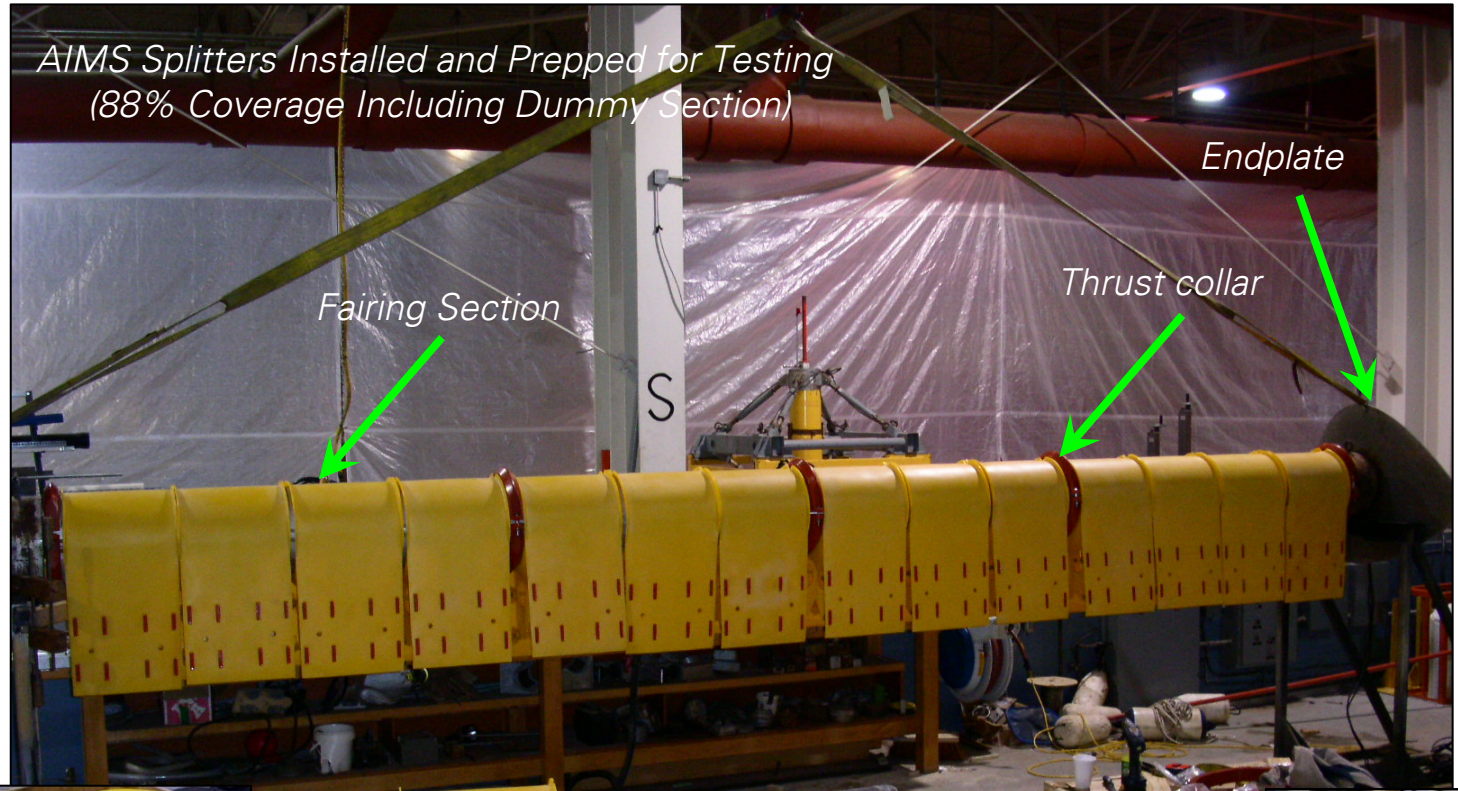
Fairings – Acceptance Model Tests

- **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**

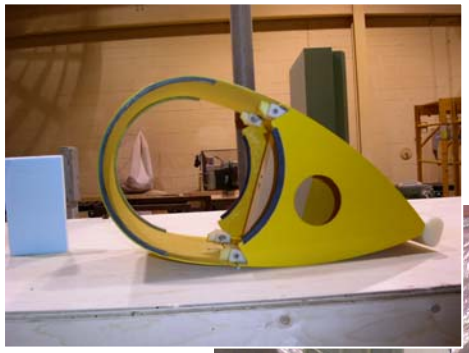


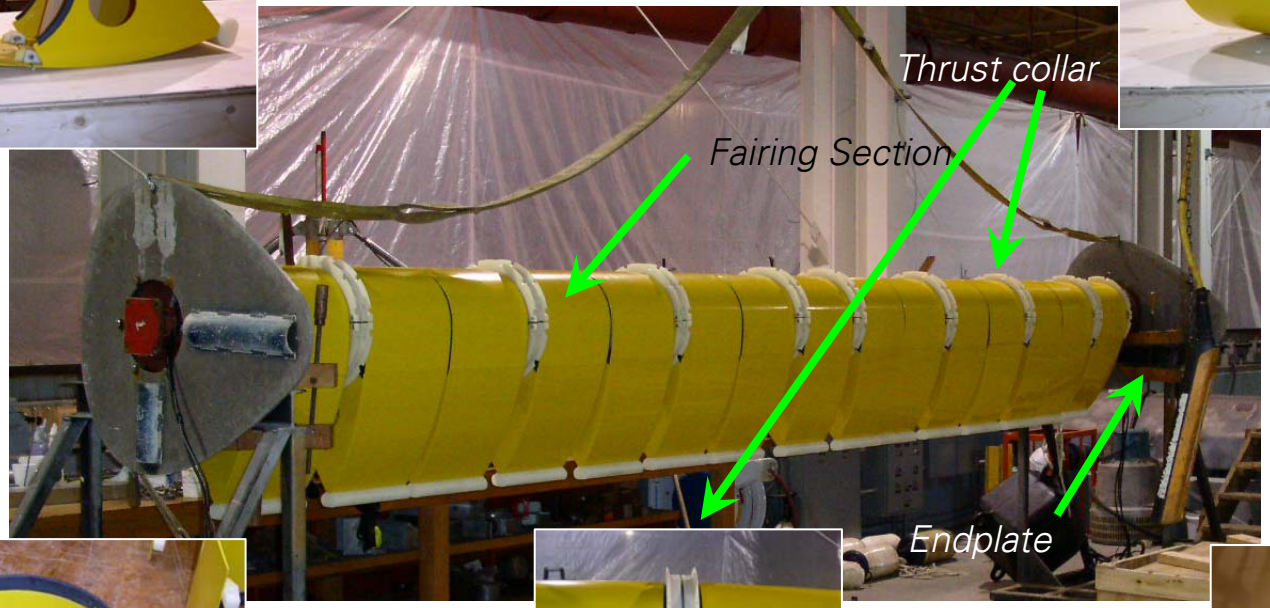
- **Comprehensive fixed and freely vibrating tests performed**
  - **Bare pipe benchmarking tests**
  - **2 Off fairing type acceptance test sets**

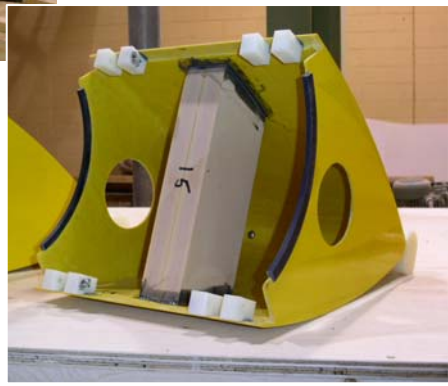
AIMS Dual Fin Splitter - ADFS



Trelleborg RiserFin Fairing



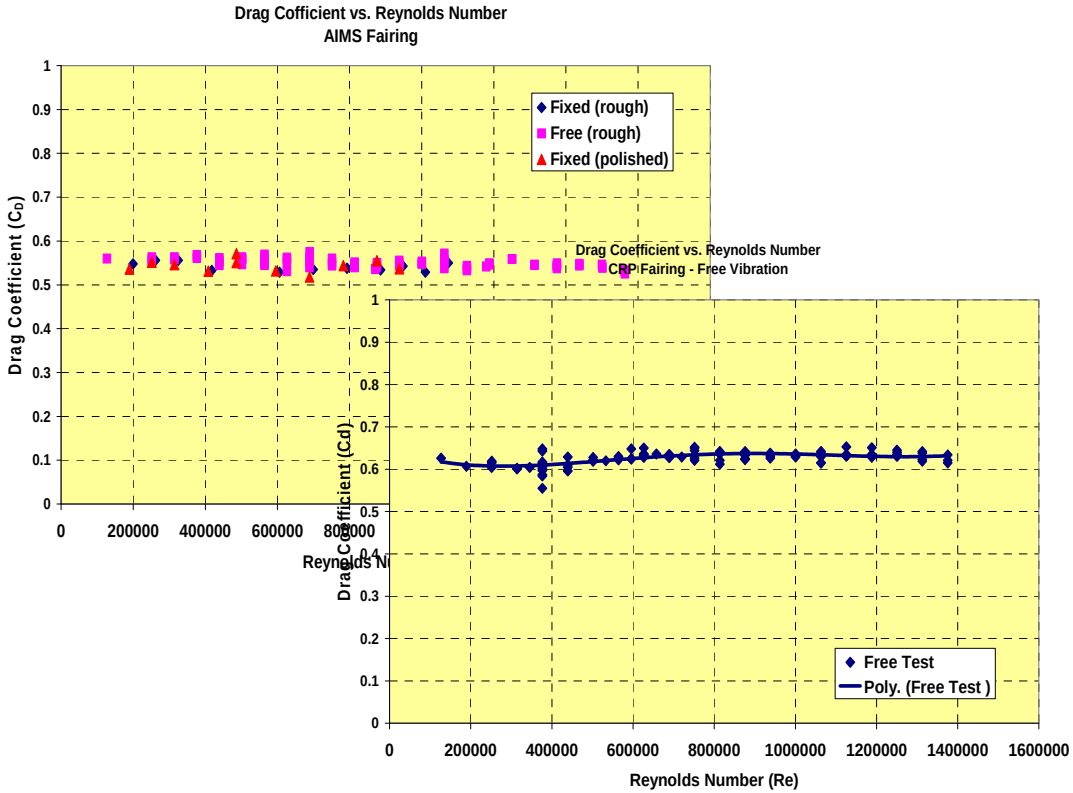


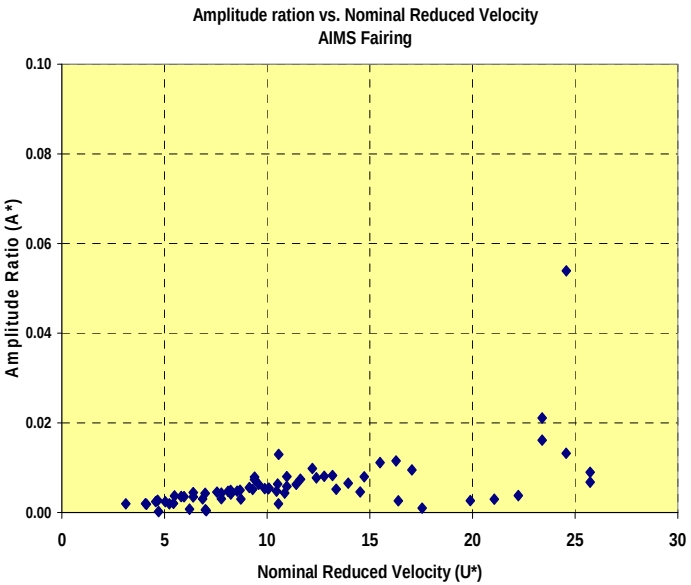


Fairing Results + Conclusions

- **<u>Both</u> 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**



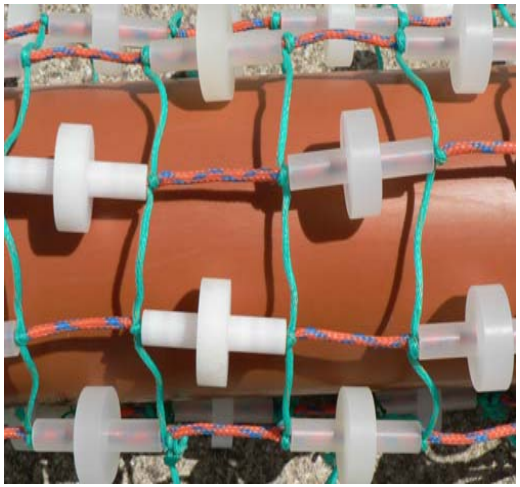


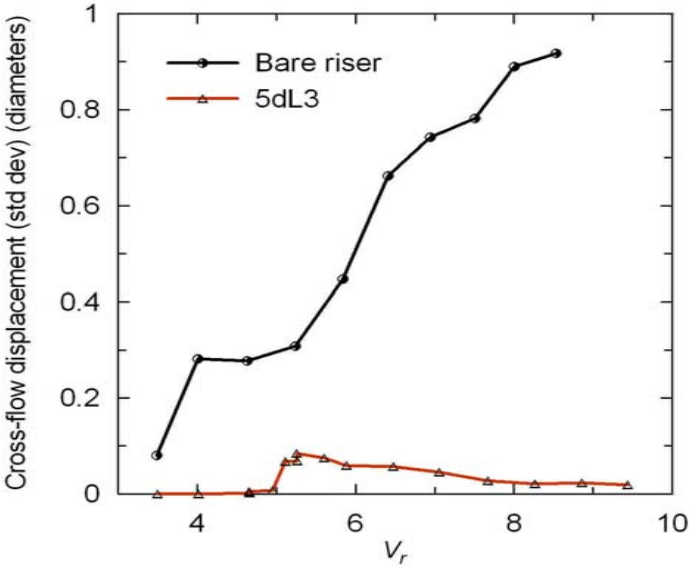
VT Fairing – Concept Proving

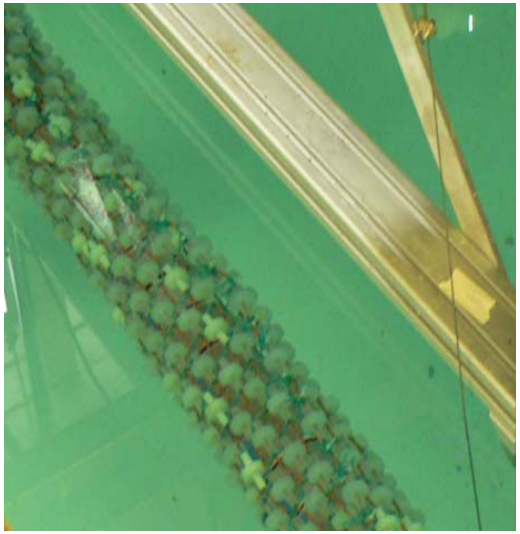
- **Operational target is to get over some of the downside impact of working with rigid fairing – lighter , flexible , easy storage , less work area demand**

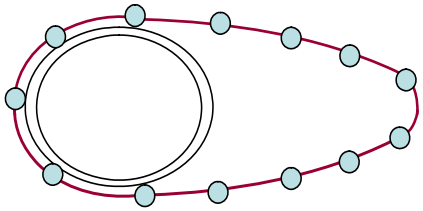
- **Concept proving model tests completed at University of Southampton – limited Re range tested**

- **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 under taken with different types of fairings (SGSI designs)**
- **Indications are that the fairings did suppress VIV behaviour in higher current situations**

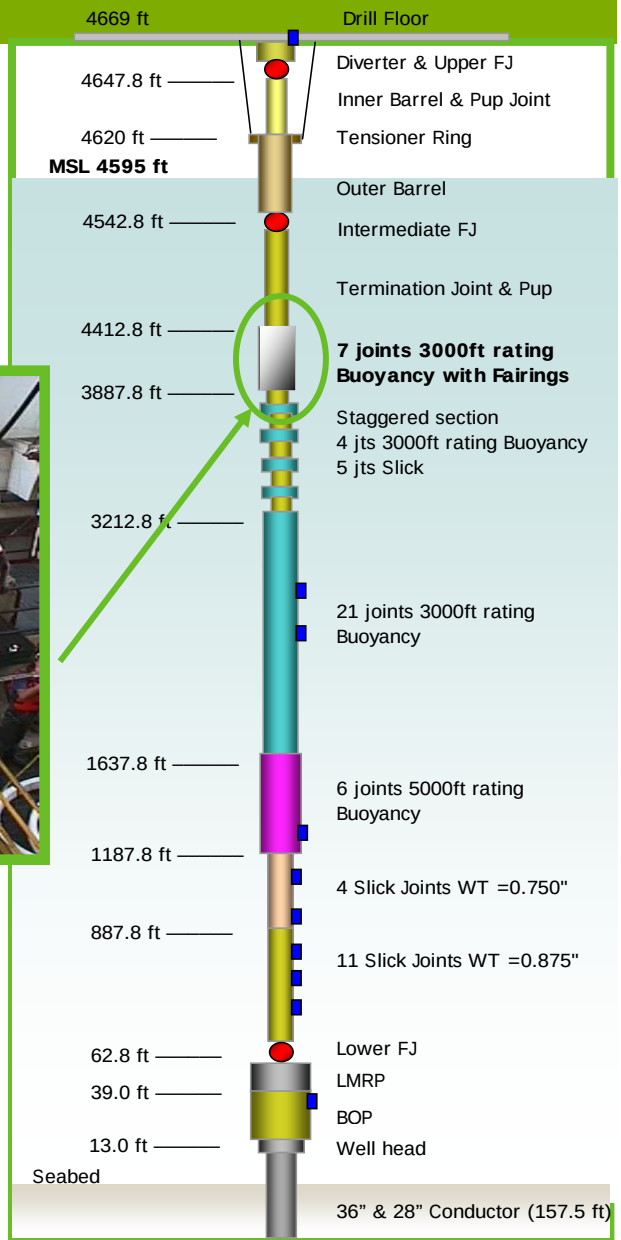
GSF Explorer Drilling Riser

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:

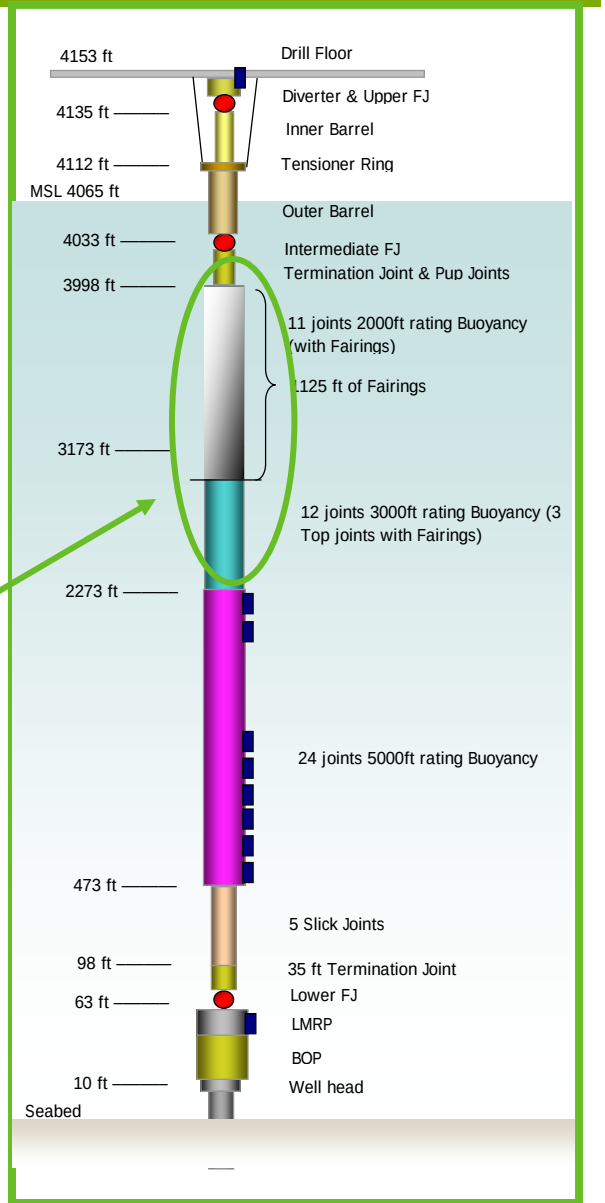
- 9 months of monitoring
- VIV occurs 1.6% of time
- Max current below 0.5 knots except for period of 21st July to 27th July 07 when a max current speed of 2.1 knots observed



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

- 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