

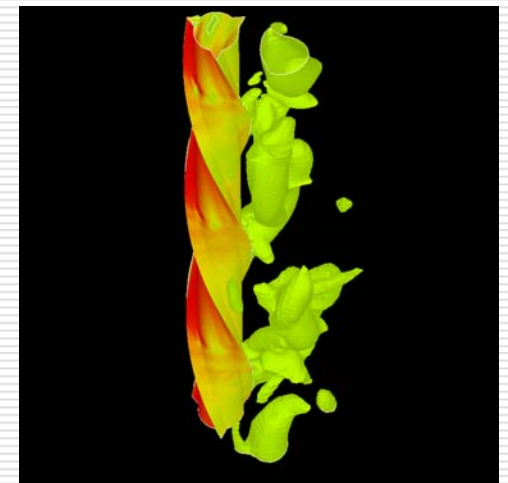
EFFECT OF VORTEX INDUCED VIBRATIONS IN OIL & GAS OPERATIONS: THE ROADMAP TO THE FUTURE

Operations Viewpoint

01/11/07

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Intro operations v3.ppt



Expectations

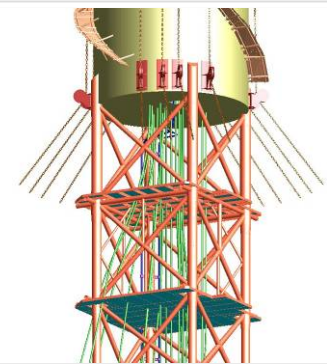
- ❑ Many DW challenges
 - ❑ VIV/VIM – difficult problem
 - ❑ Wide community interest
 - ❑ Opportunity – RPSEA matching funds
 - ❑ Challenge –
 - REPSEA/DeepStar timetable;
 - Find and allocate \$
 - ❑ Need prioritized list and common agreement by funders
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State-of-the-art & needs – operational viewpoint

1. Where do we see VIV?
 2. Current state & challenges
 3. Where are we going?
 4. What do we need & what is the desired end state?
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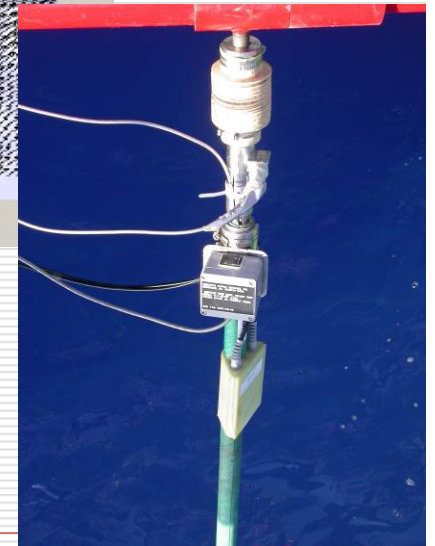
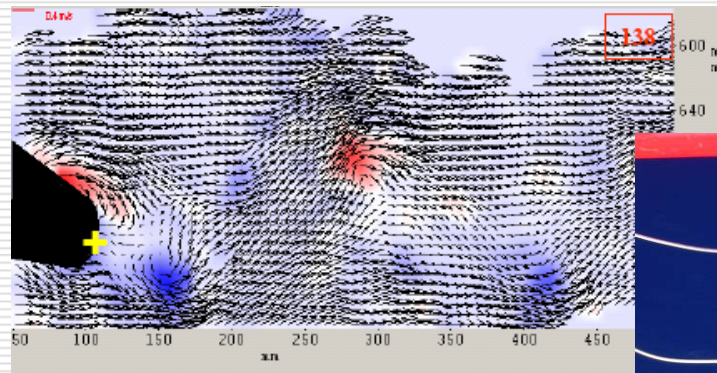
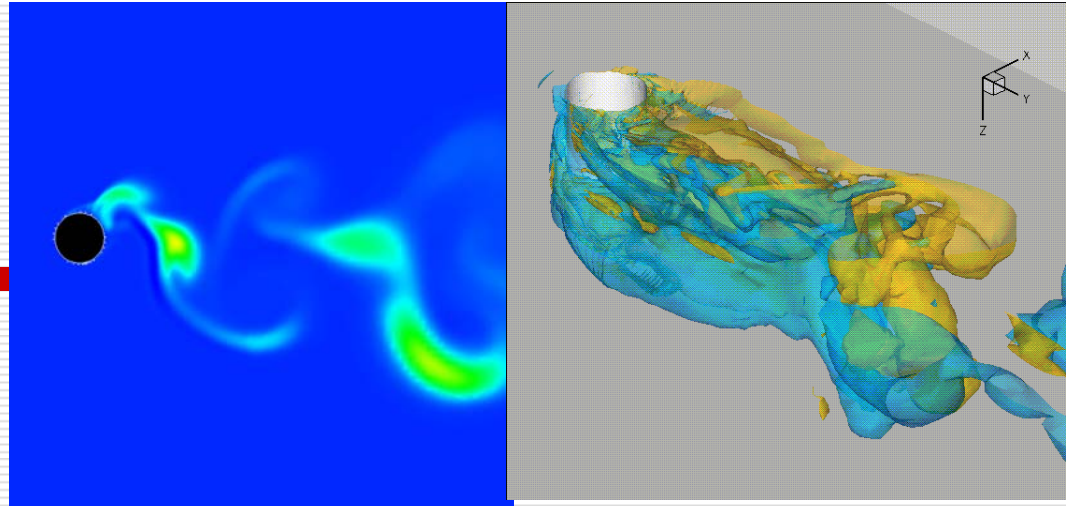
1. Where do we see VIV?

- ❑ Spar & semi VIV
- ❑ Loop current drilling: high drag offsets
- ❑ Wellhead/casing motions
- ❑ TLP tendon VIV
- ❑ Pipeline & flowline IL VIV
- ❑ SCR heave induced VIV
- ❑ Deepwater loading buoys and riser systems – FPSO & FSO applications

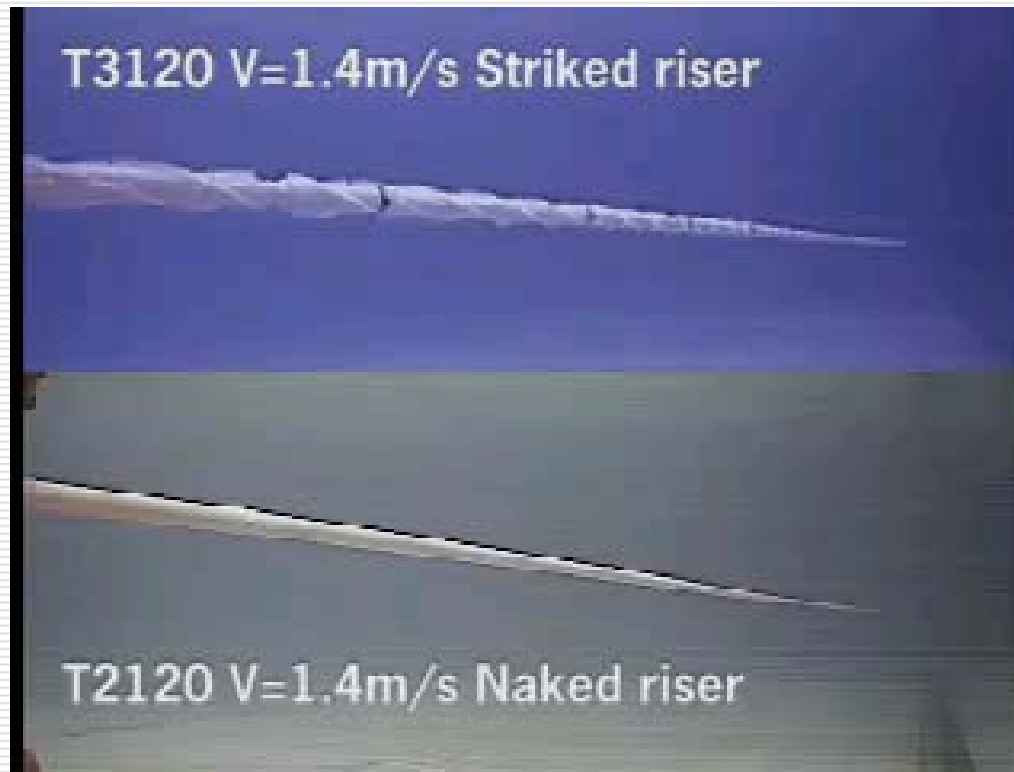


Good News

- ❑ Active VIV/VIM experimental & monitoring program
- ❑ Greatly improved understanding of the flow details
- ❑ Developing new instrumentation
 - PIV
 - Accelerometers & fiber optic strain gauges

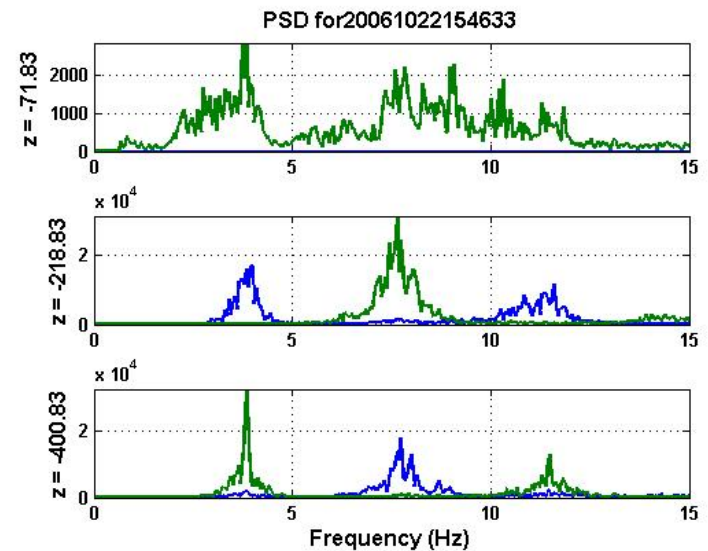
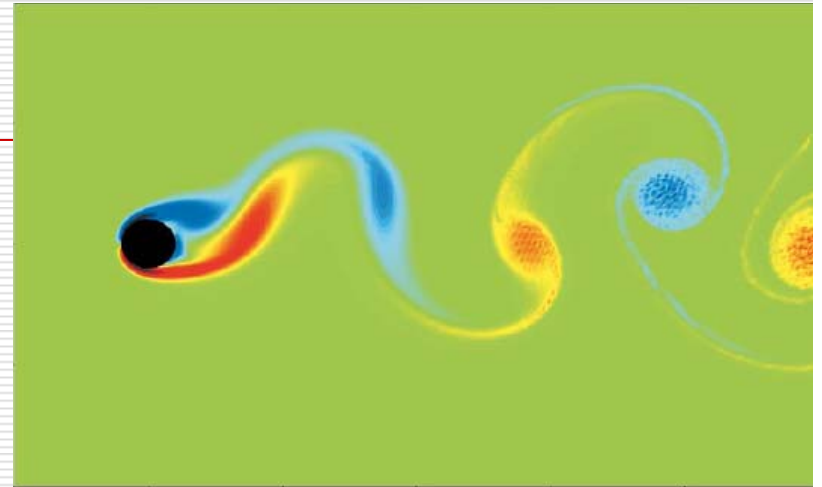


Bare & Straked Riser - lab tests



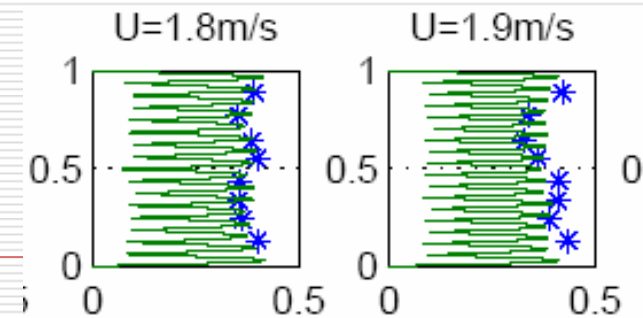
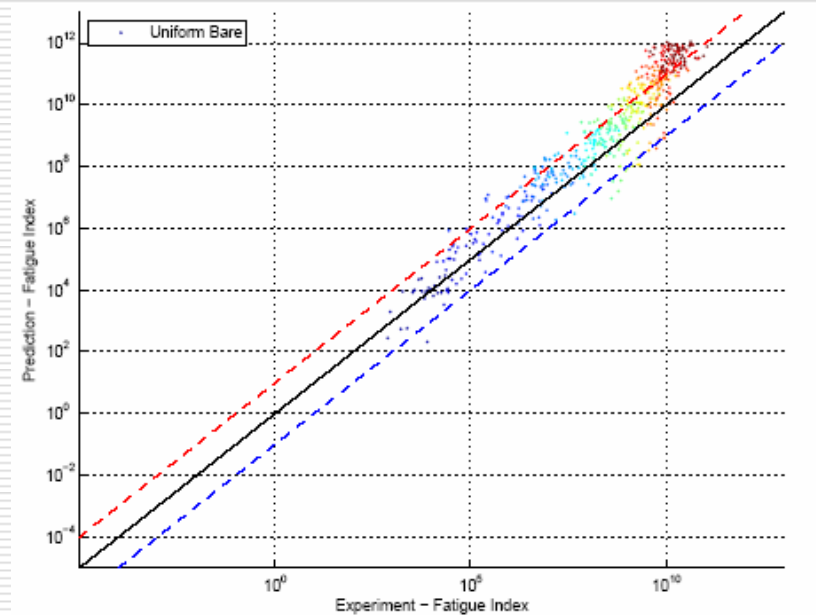
Bad News

- ❑ Von Karman type shedding ubiquitous
- ❑ Moving into deeper water – bigger loads, new geometries
- ❑ Long term installations
- ❑ Believe we understand VIV, but continuously surprised, e.g. role of higher harmonics
- ❑ See when not expected & not when expected!
- ❑ Software of necessity is very conservative
- ❑ As a result.....



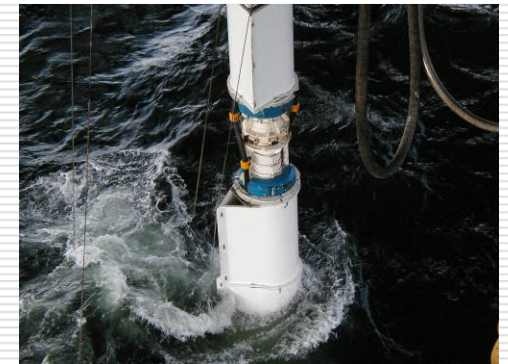
2. Current state: Procedures and practices

- Incomplete understanding
- Inadequate software
- Inconsistent analysis
- Out of date guidelines, procedures & rules
- Limited benchmarks
 - To challenge academics
 - For code developers
 - For analysts for calibration
 - Remove the confidentiality clauses for better engineering understanding

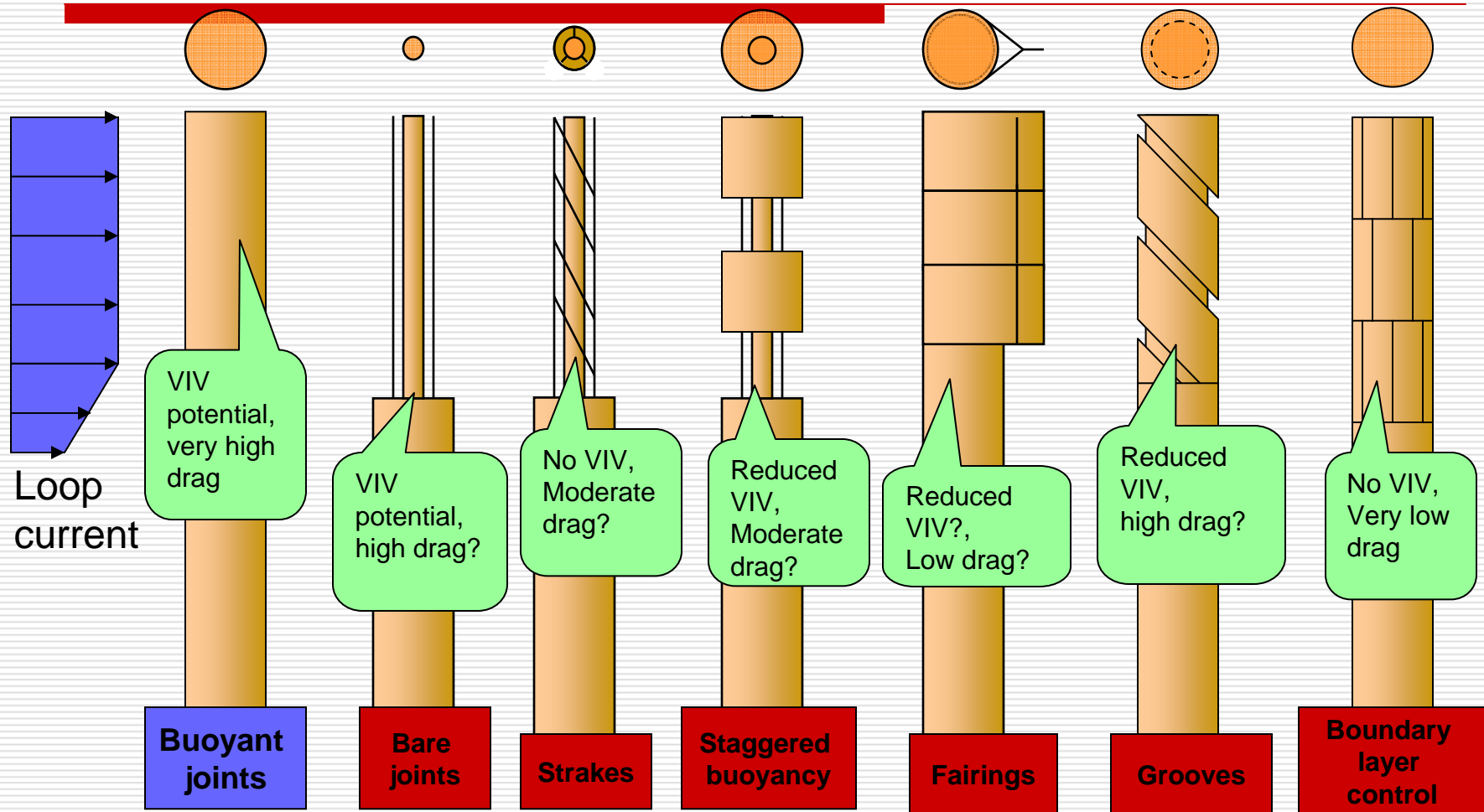


2. Current state: Suppression

- ❑ Lack of openness – proprietary data
- ❑ Suppression device testing
- ❑ What is used now to suppress VIV?
 - Strakes - questions on efficiency, coverage, fouling, installation/removal, drag
 - Fairings - drag reduction, but raise many questions: stability, fouling, installation/removal,
- ❑ Lacking guidelines for selection.
- ❑ Competing patents for suppression devices



2. Current state: Drilling VIV Suppression Options



2. Current state: Monitoring

- ❑ Flood of full scale data
- ❑ Industry openness
- ❑ Data management?
- ❑ Continuous monitoring:
 - Cost
 - Interfaces: installation, maintenance, data acquisition, decommissioning; how to do it, do it cheaply and minimize interferences
 - Piggyback with other operational data?
 - Data: interpretation & feedback to the operator



2. Current state: Issues

- Is low Re data valid for design?
 - Need industry approved software
 - How to close the ignorance gap?
 - Safety factors?
 - Consistency in prediction and design?
 - Arrays & interference
 - Improved fatigue estimates
 - Fatigue resistant materials
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3. Where are we going?

- ❑ Deepwater GoM + Loop current => DP drilling
 - ❑ Deeper water
 - Limited production experience in 5-10,000 ft
 - Deeper production?
 - ❑ HPHT/Sour challenges
 - Impacts configuration, damage tolerance
 - ❑ New areas of VIV?
 - Mooring lines?
 - Novel drilling systems?
-

4. What does operations want?

Drilling:

- Able to operate in high currents (& waves) with confidence (stable, low drag, full suppression)
 - Little disruption while storing, running & retrieving
 - Monitoring if necessary (low cost, real time, simple to use)
 - Incentive: e.g. DW drill rigs at \$500k/day + \$300/day support = \$800/day
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4. What does operations want?

Production riser, flowlines, pipelines:

- ❑ Lower development costs; Reduced damage risk
 - ❑ Able to operate in high currents (& waves) with confidence (stable, low drag, full suppression)
 - ❑ Solve: fouling, wear & replacement
 - ❑ Easy installation: S-lay, J-lay, ROV
 - ❑ Monitoring (if necessary): low cost, real time, simple to use - automatic; remote
 - ❑ Want to be able to tell the health of my riser:
 - Accumulated damage?
 - How much time is left?
 - ❑ Multiple options: software, hardware, suppliers
 - ❑ Incentive:
 - Reduced high cost of intervention;
 - High installation barge cost
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4. Operator desires - Summary

- Reduced risks for drilling & production risers
 - Increased openness
 - Understand physics – no surprises
 - Improved offshore monitoring systems
 - Consistent & accurate predictions
 - Guidelines
 - Gain the acceptance of deepwater technologies by industry and regulators
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4. What does operations want? – Conclusion

- VIV/VIM – extremely complex physics
 - Need to close the loop
 - RPSEA opportunity
 - R&D program to the end state
 - Project list
 - Priorities
 - Benefits
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Needs & Projects

Physics & Information	Operations
<ul style="list-style-type: none">• Physics• Laboratory & field model experiments• Academics	<ul style="list-style-type: none">• Full scale data acquisition• Monitoring• Suppression• Handling
Prediction	Rules & Guidelines
<ul style="list-style-type: none">• Design• Prediction software• CFD	<ul style="list-style-type: none">• Guidelines• Benchmarking• Rules

Needs & Projects

Physics & Information	Operations
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