

MATRIX LGS®

VIV SUPPRESSION WITHOUT THE DRAG

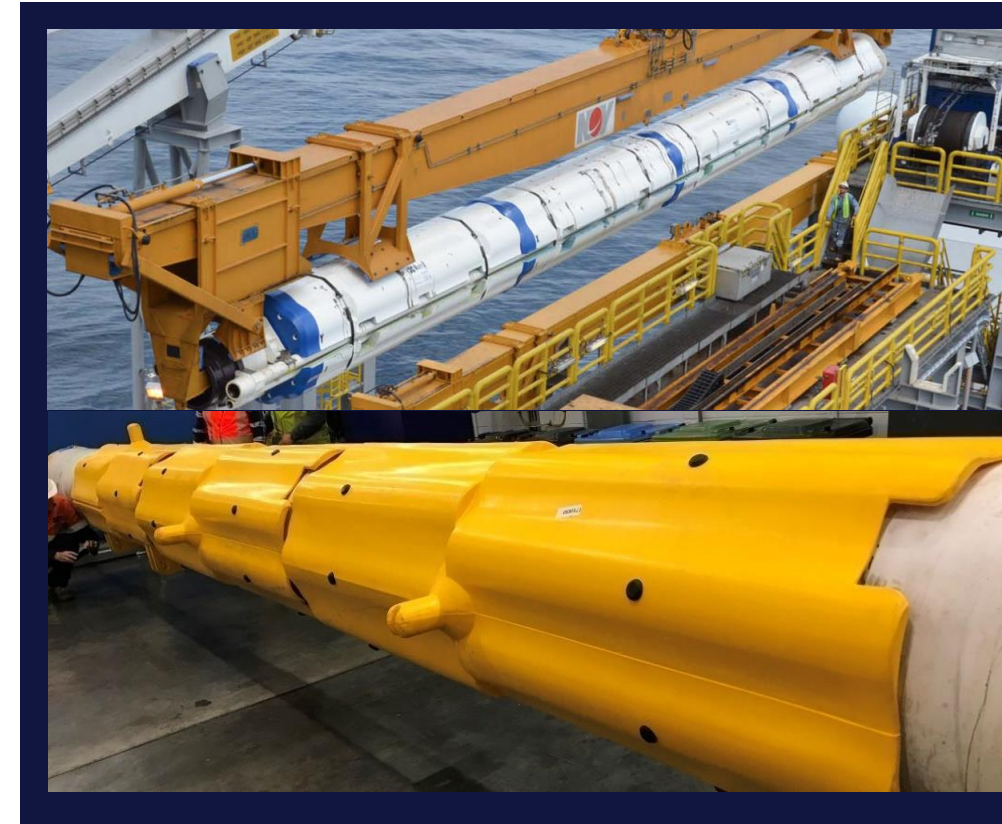
17 February 2021

MATRIXENGINEERED.COM



FROM DRILLING TO SURF

- Joint development between Matrix and AMOG
 - LGS® is a registered trademark of AMOG Technologies Pty Ltd.
 - Matrix holds exclusive commercial license for the LGS Technology
- Initially developed for drilling riser buoyancy
- Benefits of LGS equally relevant for SURF applications



DEVELOPMENT & QUALIFICATION

It starts with an idea...



INSPIRED BY NATURE

The Saguaro Cactus:

- Up to 12 m tall but slender
- Shallow root system
- Lifespan often exceeds 150 years
- Regularly exposed to windstorms

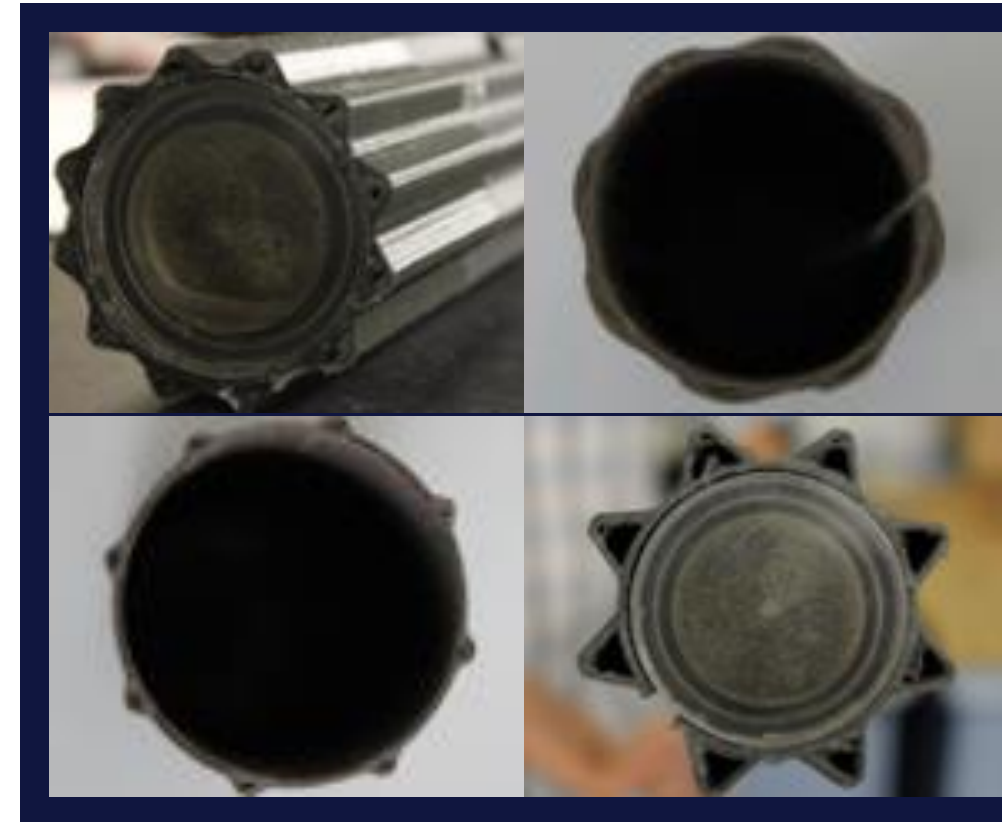
The cactus' grooved profile ameliorates the effect of high winds by interfering with the vortex formation process.



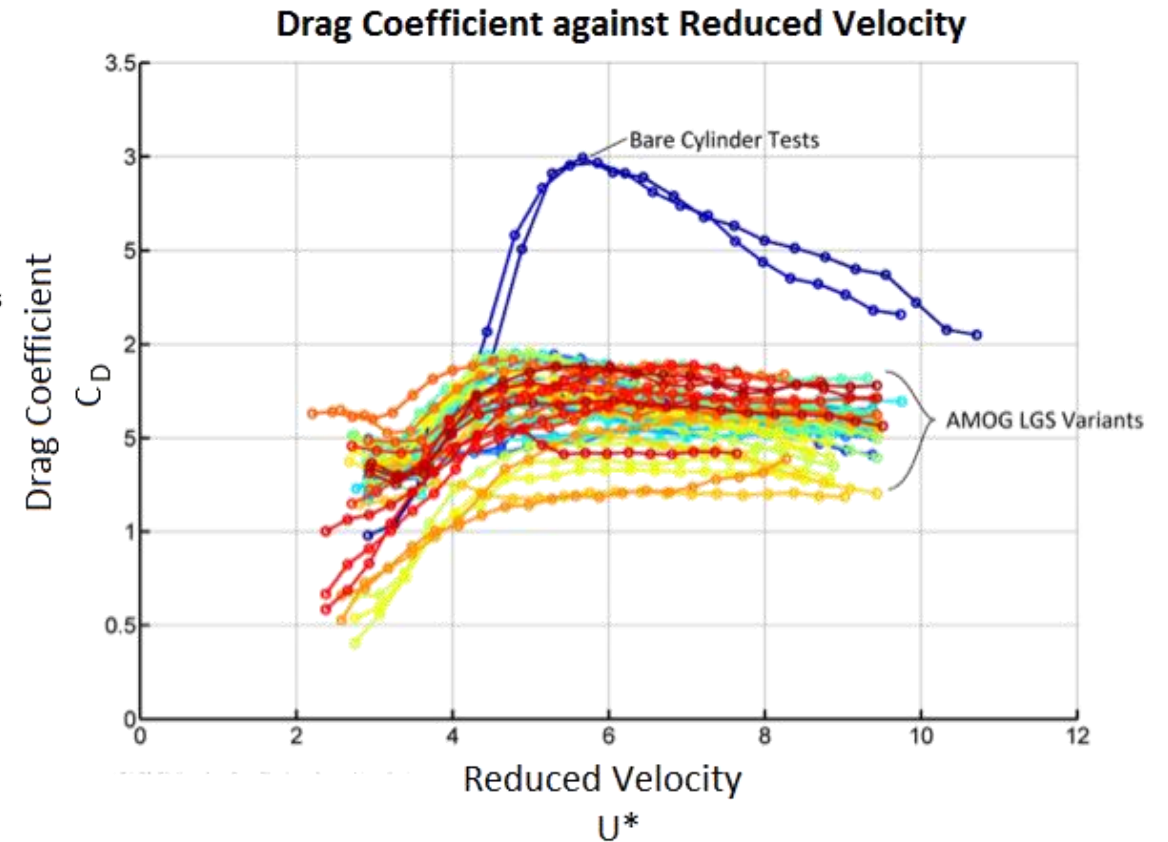
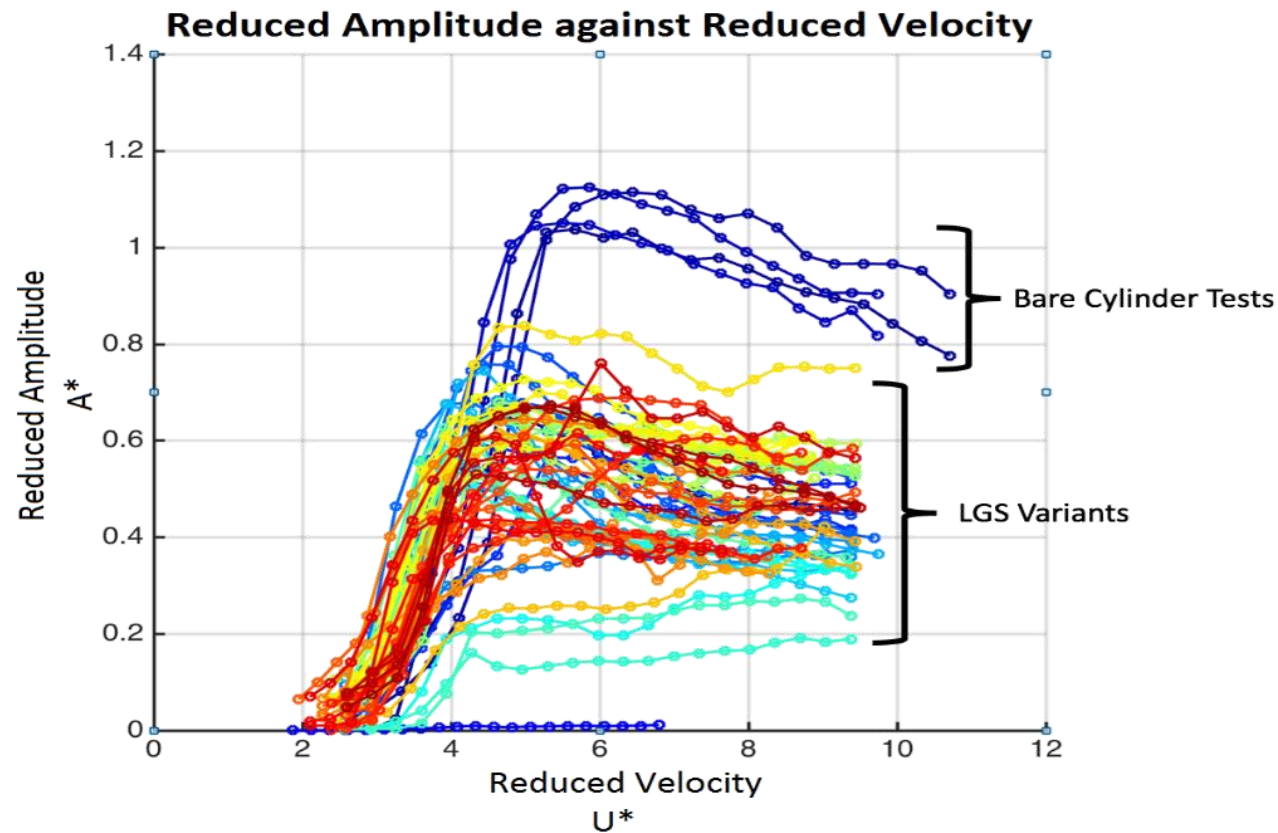
Picture by Matthew T Rader

SMALL SCALE TESTING

- 12-month program
- Testing at Monash University
- Limited to low Reynolds Numbers
- 35 geometries
- 80+ Tests
 - Free vibration
 - Forced vibration
 - Fixed/Static
 - Particle Image Velocimetry (PIV) testing

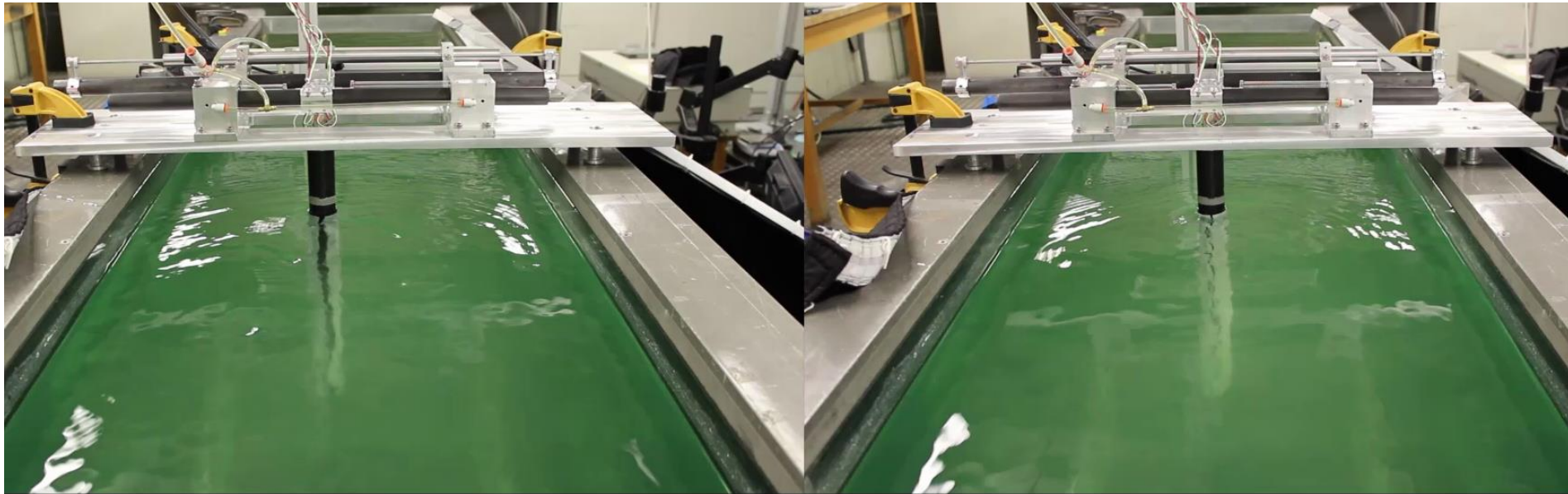


SMALL SCALE TESTING



SMALL SCALE TESTING

VIV Excitation under identical current
Bare Free Vibration vs. LGS Technology



Bare Cylinder

Maximum $A/D = 1.05$

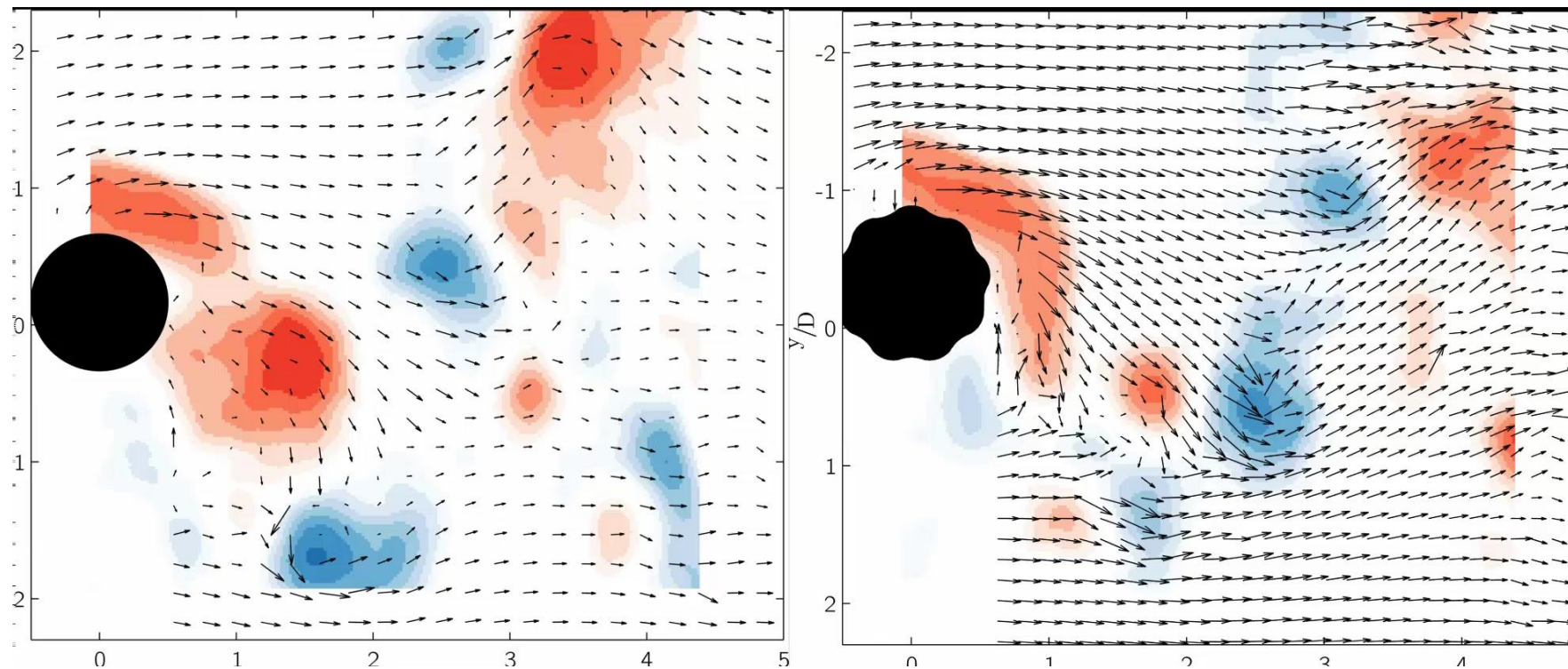
Maximum Effective $C_D = 3.0$

LGS Unit

Maximum $A/D = 0.75$

Maximum Effective $C_D = 1.75$

PARTICLE IMAGE VELOCIMETRY (PIV)

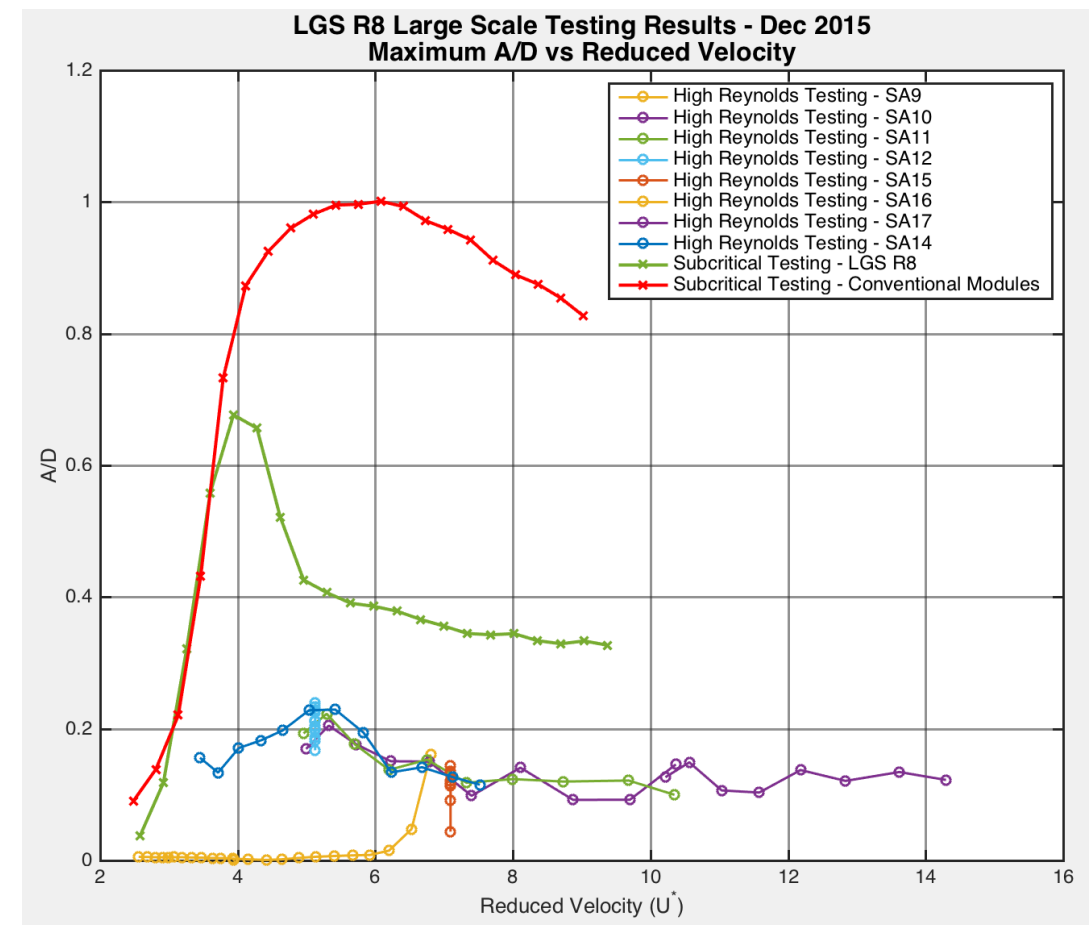
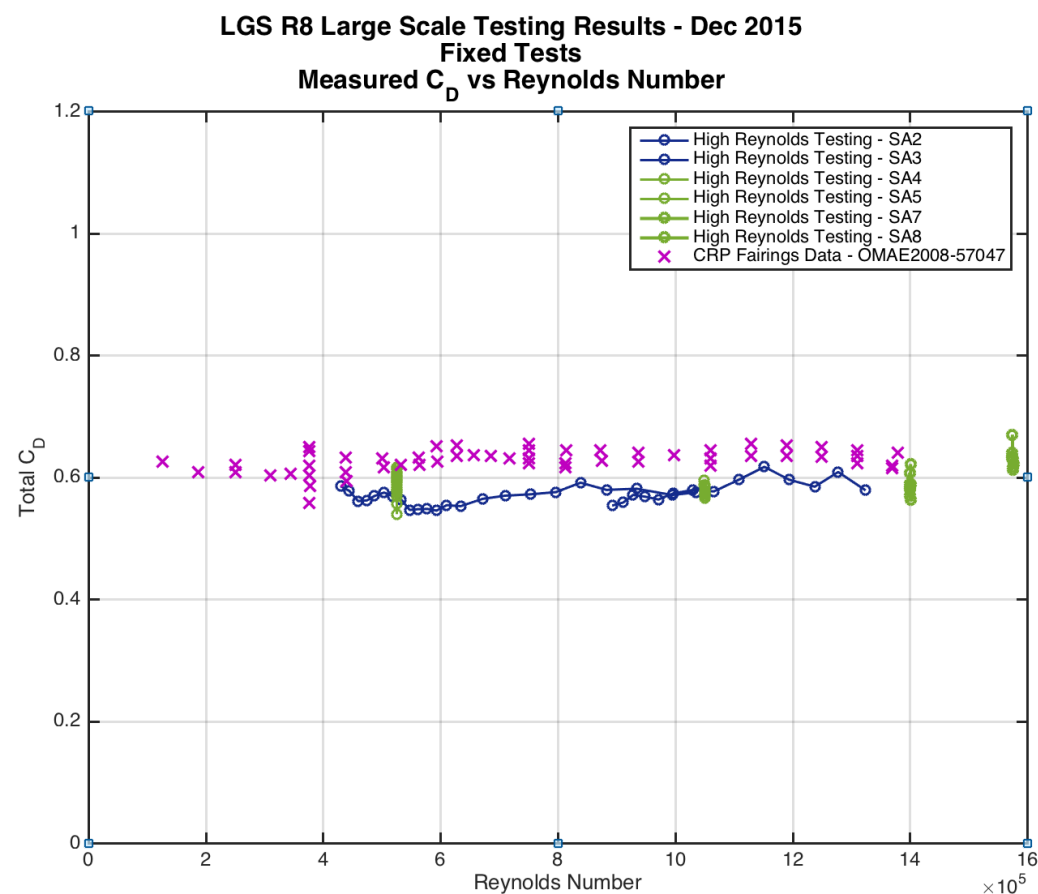


LARGE SCALE TESTING

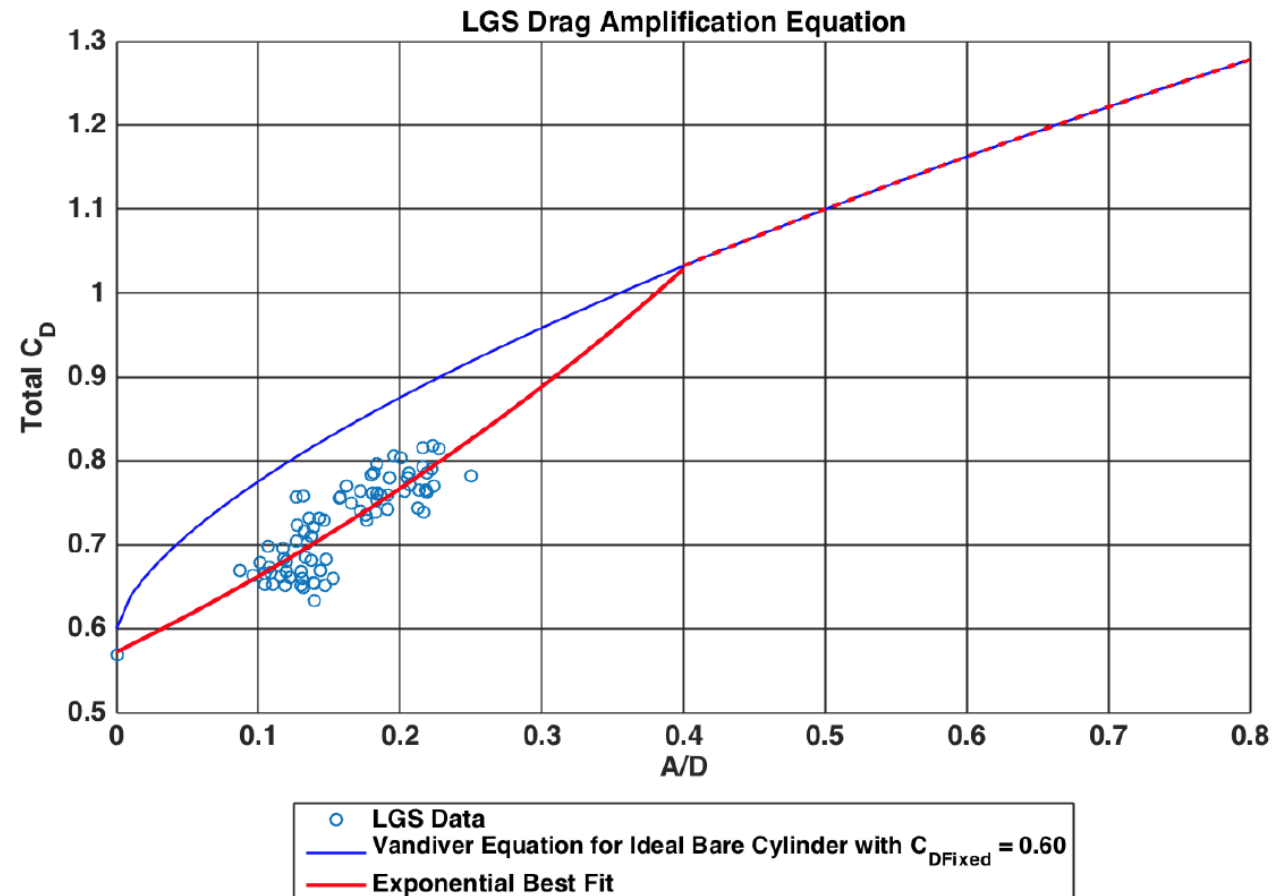
- 200 m tow tank at NRC facility in St. John's, Canada.
- Test apparatus from DeepStar JIP
- Over 30 tests
- Modes of testing conducted:
 - Traditional free vibration test, and with additional external damping
 - Pluck test
 - Fixed mode
 - Ramp tests (novel for this type of system)



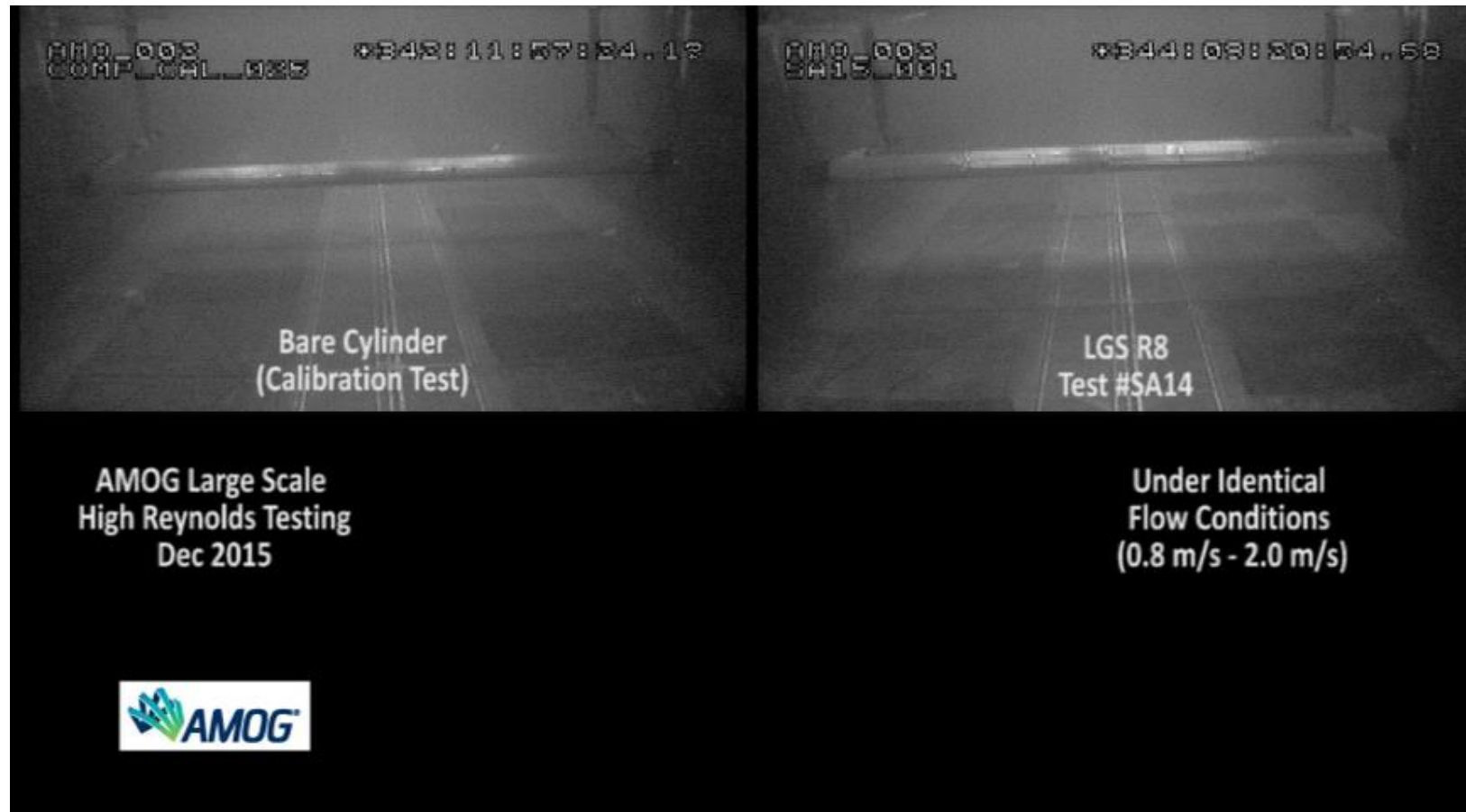
LARGE SCALE TESTING



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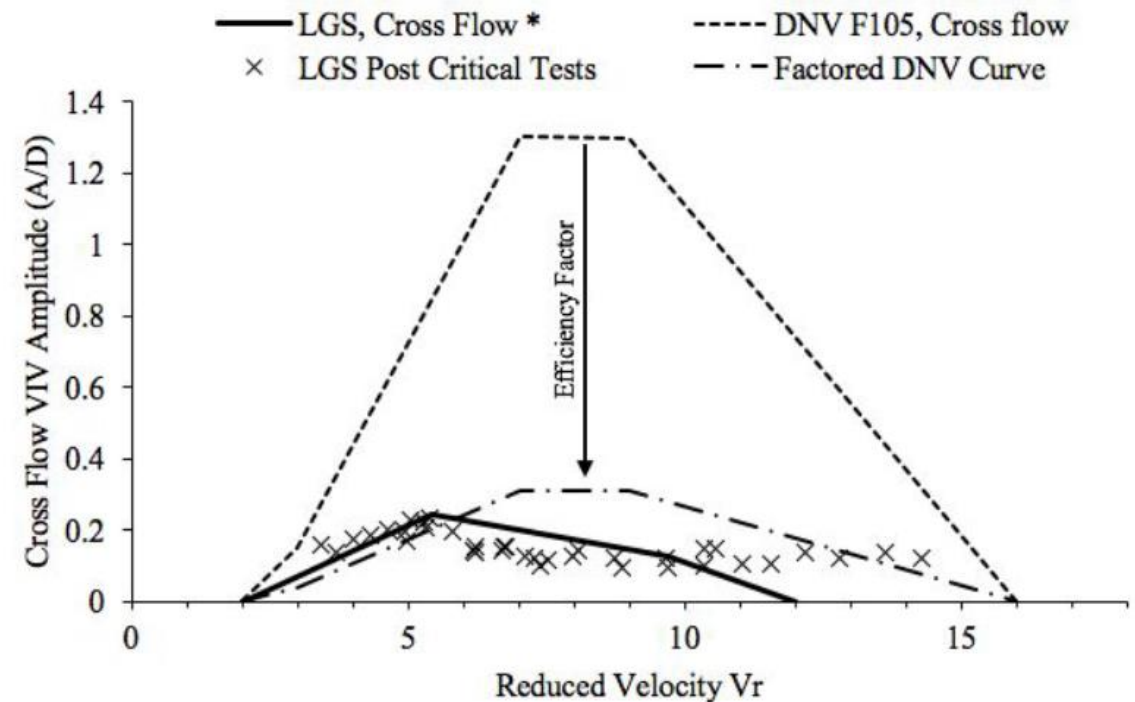


LARGE SCALE TESTING



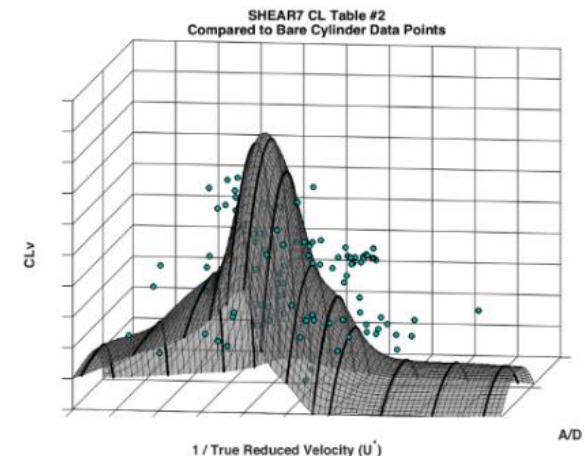
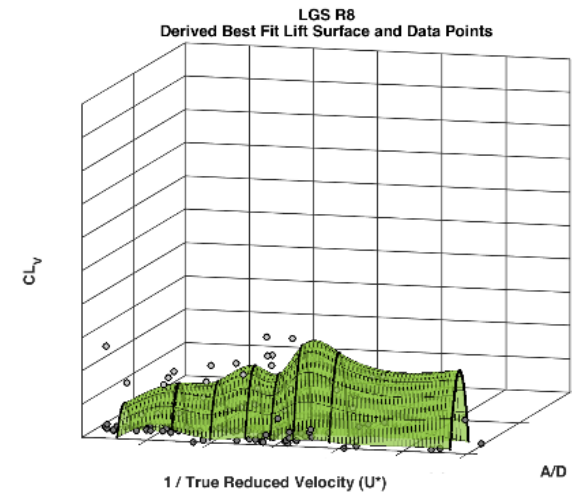
RESPONSE MODEL

- Derived from large scale test data
- Applicable to cross-flow VIV
- Uses DNV RP F105 approach
- Equivalent to an efficiency factor of approximately 81%
- Derived a methodology for reduction factors for partial coverage



FORCE MODEL

- Derived from large scale test data
- Hydrodynamic coefficients used in Orcaflex
- Lift tables used in Shear7
- Drag amplification used in global assessment
- Inherently accounts for partial coverage



APPLICATION

Turning Idea into Product



DRILLING RISER BUOYANCY

- Field trials performed by a Super Major
- First deployment in 2016
- Currently operating on 3 drilling rigs across the world



RETROFIT PIPELINE VIV SUPPRESSION

- Problem: Unpredicted pipeline spans due to scour
- Solution: ROV installable VIV suppression
- Strakes designed and manufactured by Matrix
- ROV installation tool & deployment frames developed by Oceaneering



Images courtesy of Oceaneering

RETROFIT PIPELINE VIV SUPPRESSION



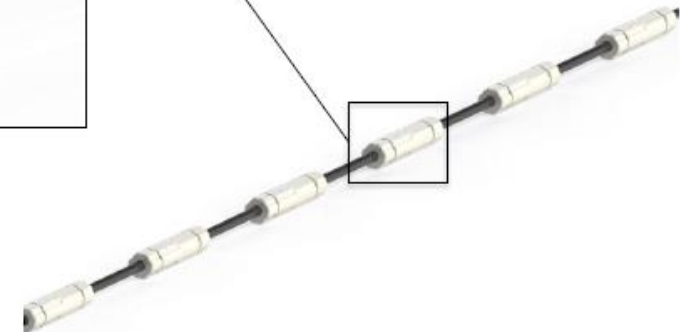
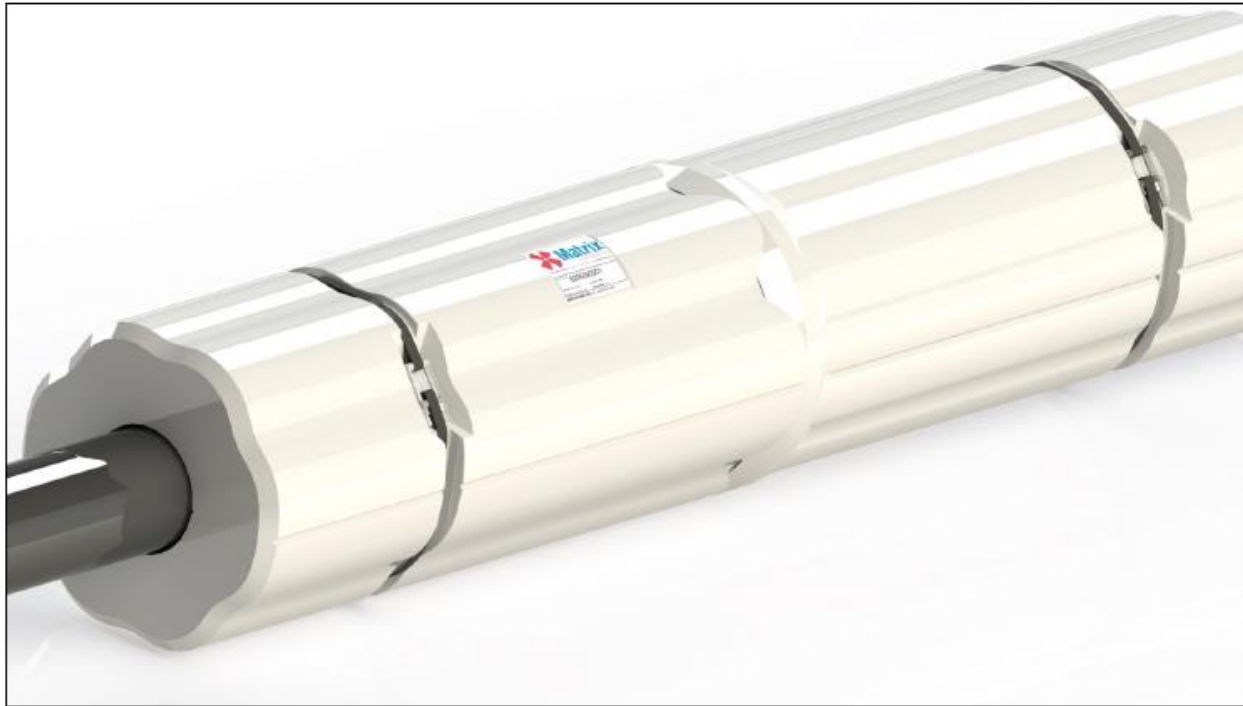
Images courtesy of Oceaneering

ADDITIONAL CONCEPTS

The future is bright (yellow?)

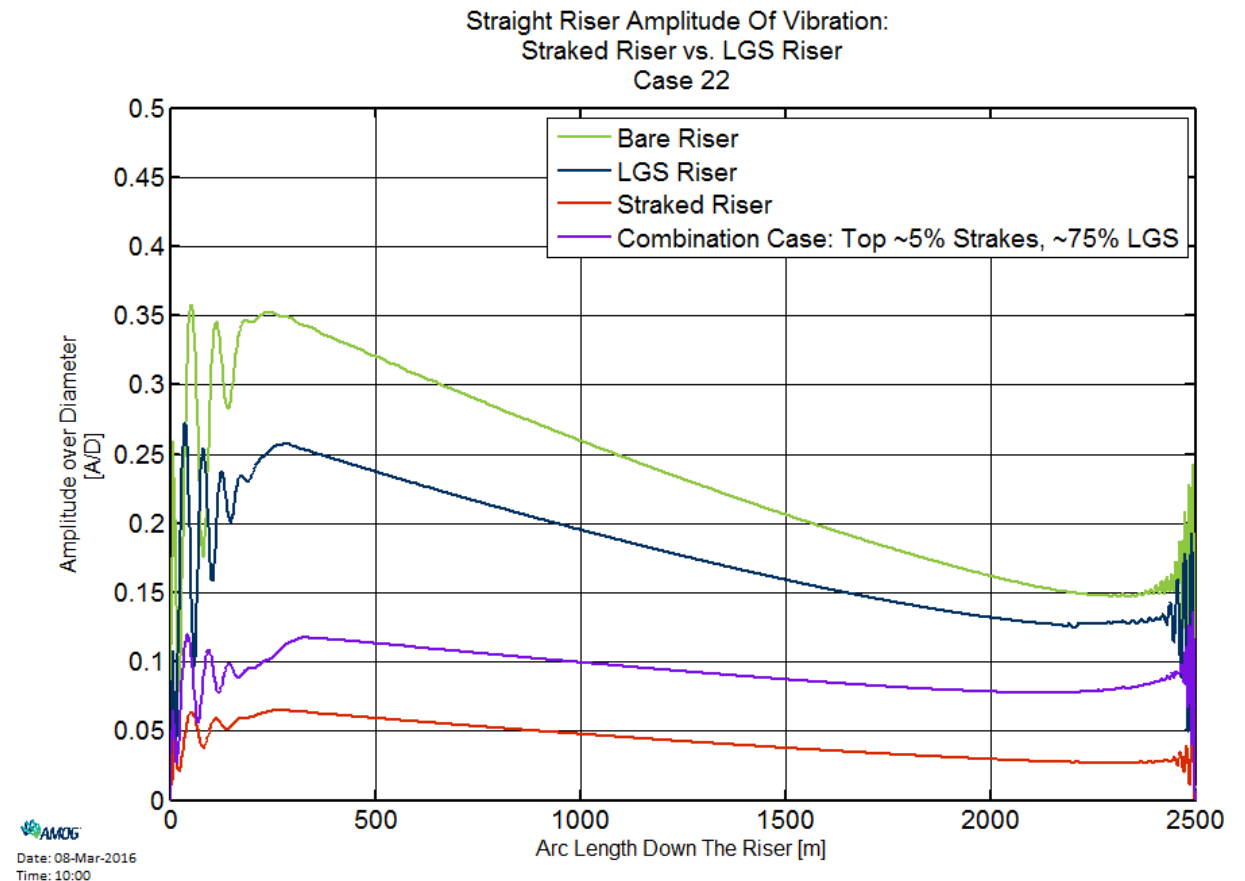


SLWR BUOYANCY



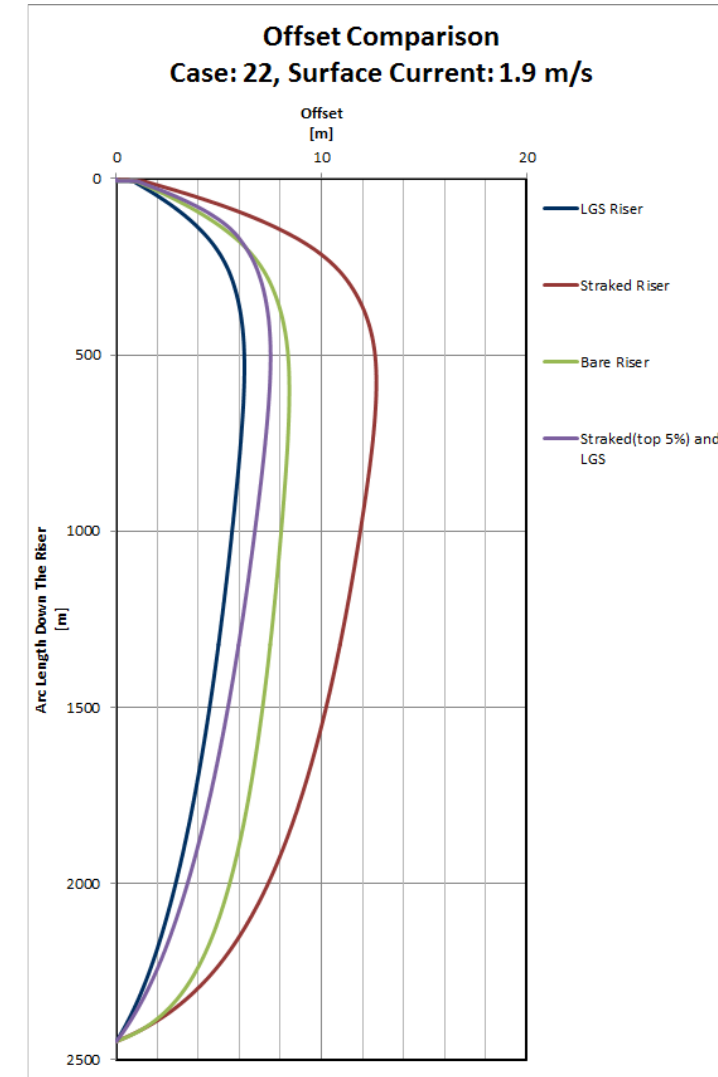
TTR WORKED EXAMPLE

- Based on an existing asset
 - Deepwater (2,500 metres)
 - Straked region in upper ~85% of riser
- 50% Reduction in offset and lateral load
- Reduced VIV amplitude



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ACKNOWLEDGEMENTS

- Dr. Hayden Marcollo
- SUT
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CONTACT

THANK YOU FOR YOUR ATTENTION

Christian Wiebe
SME - SURF & VIV
T +61 8 9412 1200
M +61 448 880 756
E: Christian.wiebe@matrixengineered.com

MATRIXENGINEERED.COM

