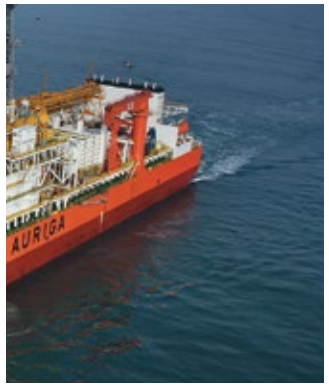
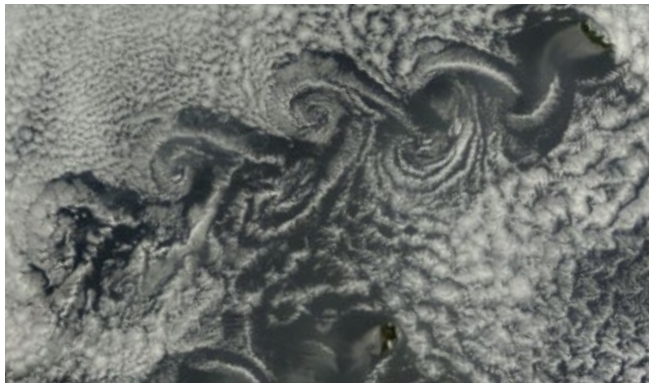




Matrix-LGS™

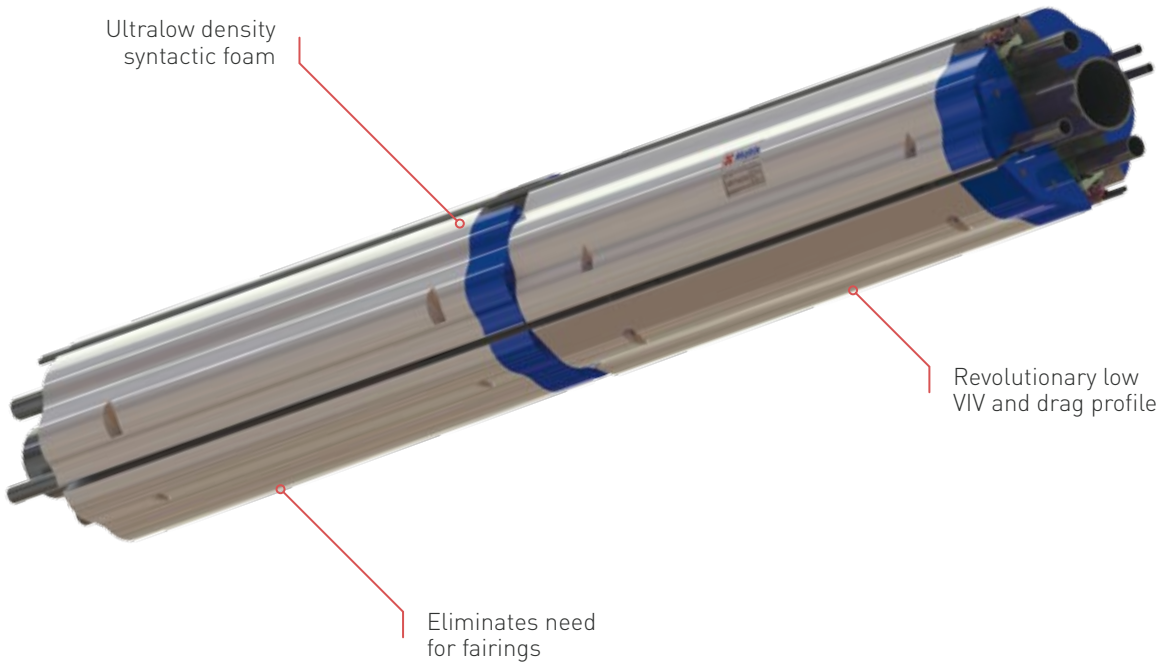
VIV AND DRAG REDUCTION DRILLING RISER BUOYANCY SYSTEMS

Matrix
Composites & Engineering

Keep drilling when others stop

The premise is simple: use Matrix-LGS™ and you can keep drilling when you would normally have to stop. Based on eddy profiles for the Gulf of Mexico, this can translate into an annual increase of 20% more uptime during eddy current events saving around $15 million in lost time per annum.

Matrix-LGS™ delivers a significant increase in rig capability at a small capital cost and will give those who adopt this new technology a clear market advantage over competitors who don't. Engineers are ready to carry out detailed riser drag analysis to estimate just how much your operation would benefit from using Matrix-LGS™.



The revolutionary Matrix-LGS™

Matrix-LGS™ is an integral system that incorporates a drag and VIV reduction profile with low density, high performance syntactic foam riser buoyancy.

Its revolutionary profile was inspired by the Saguaro cactus whose modest root system manages to keep the slender plant upright even when buffeted by the strongest of winds. It's the cactus' grooved profile that ameliorates the effect of high winds by interfering with the vortex formation process.

This is exactly what the Matrix-LGS™ profile does with high currents and gives the system the following performance properties:

- Significantly reduces VIV and drag when compared with conventional buoyancy
- 20%-30% increase in raw operable current speeds (in regions of the world investigated). Reduces drag and resultant loads during deployment and recovery, riser disconnect and riser hang off
- VIV fatigue damage rates five to ten times lower
- Negligible loss of buoyancy from conventional modules
- Outperforms fairings and completely eliminates assembly/recovery times
- Easily stacked both vertically and horizontally
- Can be used with existing riser handling and storage equipment

Matrix-LGS™ cross section

Saguaro cactus

Testing and performance

Large scale post-critical tests at the National Research Council Canada facility in St John's have demonstrated that the Matrix-LGS™ system reduces both VIV amplitude and the resulting drag coefficient.

This program of large scale post-critical tests supports the findings of earlier smaller scale sub-critical testing. Importantly, the larger scale allowed the tests to work at higher Reynolds numbers (up to 1.6×10^6). This is well into the post-critical flow regime that would be experienced offshore.

Fixed mode tests: lower drag than fairings

The fixed drag coefficient over a range of towing speeds (and, therefore, Reynolds numbers) averaged below 0.6.

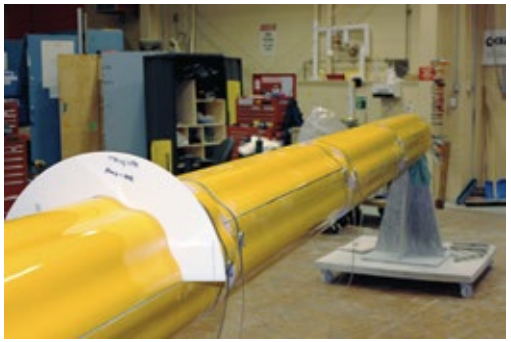
This level of drag is lower than that achieved by fairing-equipped risers and significantly lower than that achieved by a bare cylinder.

Free vibration mode tests: VIV amplitude less than 0.25 A/D

VIV during the tests was minimal. So small, in fact, that the test assembly was often 'plucked' to initiate VIV and provide a conservative estimate of VIV behavior.

The typical VIV amplitude was less than 0.25 diameters, a significant reduction from the earlier sub-critical testing. This reduction in VIV amplitude further reduced the amplification of the drag coefficient. The maximum total measured Cd was 0.8 including VIV amplification.

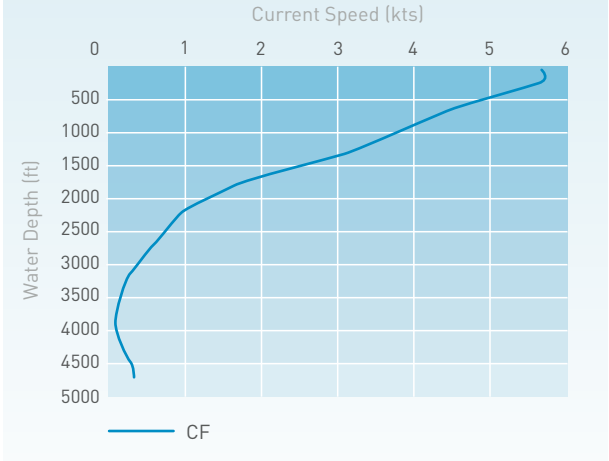
Overall, the high Reynolds number tests confirmed the clear advantage offered by Matrix-LGS™ technology for use on drilling risers in high currents, with resultant low drag and minimal VIV excitation.



EVALUATION IN EXTREME CURRENT CONDITIONS

A comparative evaluation of three identical risers (conventional buoyancy, conventional buoyancy with fairings and Matrix-LGS™) in extreme current conditions clearly demonstrates the superior performance of Matrix-LGS™ when compared with fairings. Based on the current profile (see table) a SHEAR7 and Orcaflex analysis was conducted to calculate a riser offset comparison.

Current profile



Riser declination angles 30% lower, lateral loads 40% lower

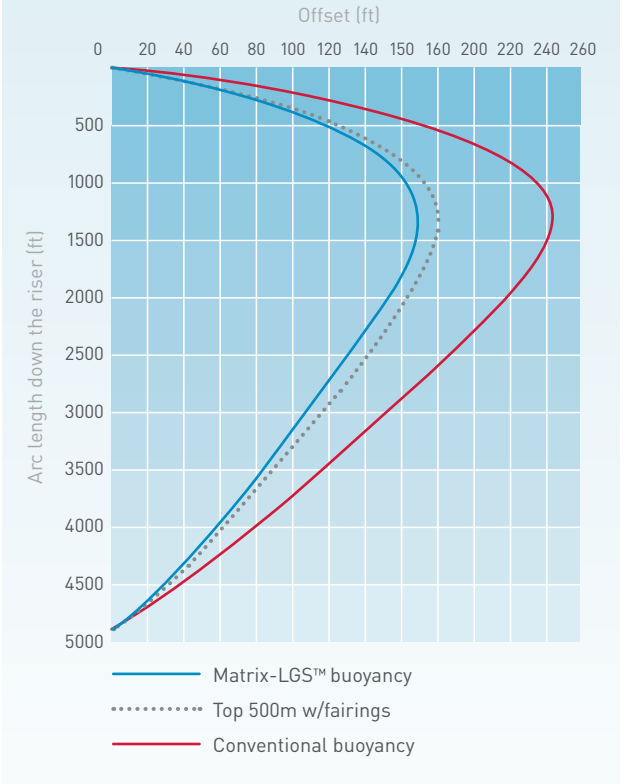
When compared with a conventional buoyant riser the maximum declination angle was 30% lower and total lateral loads were 40% lower.

Matrix-LGS™ outperforms fairings

When compared with an equivalent length of fairings, an LGS™-equipped riser experiences less drag. This improved performance over fairings is more pronounced for a riser fully equipped with Matrix-LGS™, or where a loss of fairings occurs.

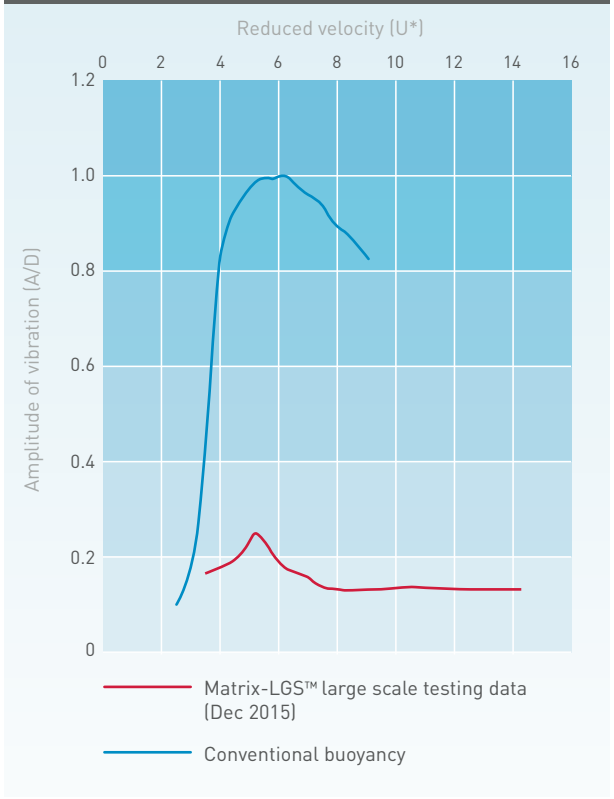
Industry experience on the loss of fairings has been reported at over 50%. Matrix-LGS™ is immune to the performance loss associated with a loss of fairings, as it is an integral system with no detachable or moving parts.

Offset comparison case surface current speed 5.7kts

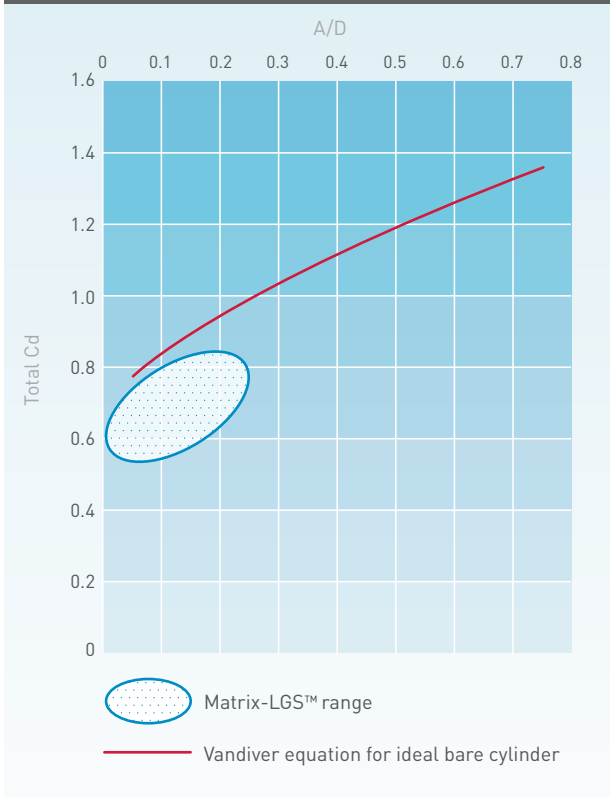


Additional testing results

Maximum A/D vs reduced velocity



Free vibration tests - total measured Cd (including drag amplification from VIV) vs A/D



Lower total drag

Matrix-LGS™ experiences substantially lower total drag than conventional buoyancy. Lower total drag increases the maximum allowable current speeds and operability during eddy current events for LGS™-equipped risers when compared to risers equipped with conventional buoyancy.

Collective innovation

Matrix and AMOG have brought together their collective expertise to develop and test Matrix-LGS™

The technology partnership is an exclusive arrangement that combines the strengths of the industry's leading subsea buoyancy company with a global leader in riser system design and analysis services. Collectively, the companies have serviced the oil and gas industries for more than thirty years.

Matrix Composites & Engineering has an established reputation for developing and utilising advanced composite and polymer materials technologies, and innovative manufacturing processes. In 2011 the company opened the largest composites syntactic manufacturing plant in the world. It has delivered numerous operational efficiencies allowing greater output, shorter production turnaround times and superior product quality. Matrix is the world's leading supplier of riser buoyancy systems.

AMOG Consulting has a proven track record in providing cutting-edge engineering solutions. The company performs design analyses using advanced numerical techniques and software, covering a broad range of issues pertinent to the design and installation of mooring and riser systems. The company's expertise and experience in VIV analysis extends to a key role in the development and maintenance of SHEAR7, the industry-leading tool for the prediction of VIV effects. LGS™ is a trademark of AMOG Technologies.

ABOVE: Matrix is located in the Australian Marine Complex, the southern hemisphere's premier integrated marine industrial facility

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