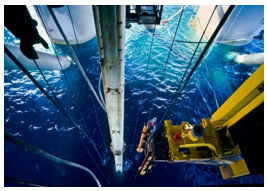
Lightweight riser design approach with m-pipe®

Since the start of the offshore industry steel has been the structural material of choice for riser systems. Steel pipe has served well until recently, and has allowed progression from shallow water (150m) to ultra-deep water (2,000m +) in the space of just 25 years. But steel is now reaching its absolute limits for deep water applications.

Magma m-pipe® offers a light, strong alternative to steel pipe and a new approach to lightweight riser design.

Where steel comes unstuck



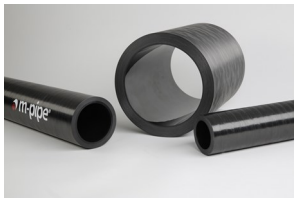
As water depths have increased, steel riser design solutions have been extrapolated from successful shallower water applications. Whilst there has been some investigation and application of other materials such as aluminium and titanium, steel has remained technically and commercially the material of choice.

The challenge presented by the weight of such steel risers has been managed by ever larger buoyancy modules and increasing installation vessel specification with associated increasing costs. Consequently, the latest Tier 1 installation vessels are orders of magnitude more capable than 20 years ago with respect to riser payloads, crane capacity, station keeping, reel storage capacities and deck payload. However, the downside is that these vessels also have much higher day-rates associated with them and limited availability.

This mix of ever increasing riser weight, buoyancy requirement, vessel payload and installation cost, means deep water risers are in the region of 20% of the total development cost. In fact they are often the most technically challenging and schedule critical aspect of a deep water development.

This all adds to the industry challenge of ever increasing offshore development costs and these type of developments must remain competitive with other hydrocarbon sources. In any period of lower oil price, a high or increasing deep water development cost becomes more difficult to justify.

m-pipe® responds to the riser challenge



The industry needs to find more cost effective solutions to the riser challenge, reducing high Capex and also addressing the high Opex that arises from the need to manage corrosion and general riser degradation and susceptibility to damage. m-pipe® responds to these common riser design difficulties.

m-pipe®

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Steel riser limitations

Steel has achieved much in oil and gas subsea applications, through ongoing improvements in steel specification, welding technology and the development of analytical methods, all assisted over the years by a huge increase in computational capacity.

Whether in the form of a non-bonded flexible pipe or rigid pipe, steel has almost exclusively been selected as the material to resist the complex loads that a typical riser must withstand.

Steel is the industry 'workhorse' material with excellent and predictable structural properties and is manufactured in such volume that it is remarkably low cost.

But the disadvantage of steel is its high density, low resistance to corrosion in sea water and its susceptibility to embrittlement in a sour subsea environment.

These issues are relatively well understood, and manageable with appropriate riser design methods. However, it is perhaps steel's high density that causes the biggest challenge for the riser designer and leads to a nonlinear increase in riser cost with increasing water depth. This is combined with high deployment vessel costs and a need for large, expensive buoyancy modules.

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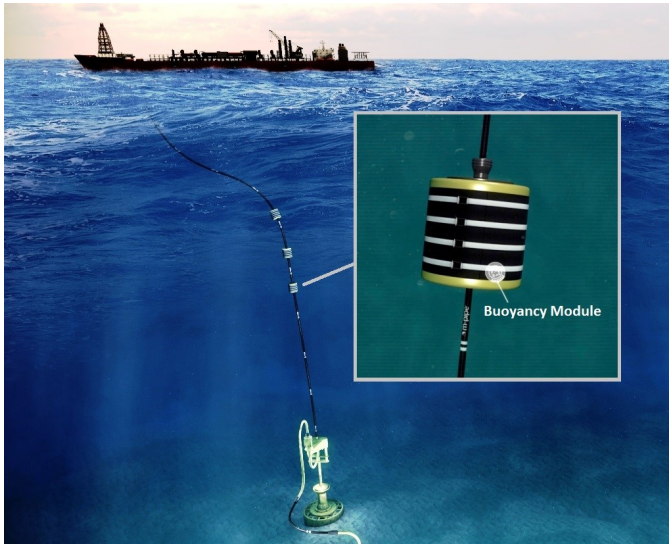
The m-pipe® lightweight riser solution

In creating an industry-changing lightweight riser solution, Magma has used sophisticated, strong and very light weight carbon fibre as the key component of both the m-pipe® riser pipe and supporting buoyancy modules.

Free standing risers (SLORs), have been the preference for many medium and deep water fields, but the use of steel pipe and steel buoyancy modules produces a negative design spiral where high weight leads to high drag loads, requiring more tension and high drag buoyancy. This leads to a riser design which is structurally and hydro-dynamically inefficient, and also needs a high cost vessel for installation. Additionally the riser payload on the vessel can be high and, since all aspects of the design, procurement and installation processes are on the limit of feasibility, both the installation contractor and operator carry significant risk, despite steel pipe based solutions being 'proven technology'.



Magma's m-pipe® m-SLOR riser design approach reduces riser weight and drag loading, giving a greatly improved riser response. Buoyancy module size and weight and installation and foundation loads are all also significantly reduced.

From a riser perspective, m-pipe® has the benefit of being light weight, around one tenth that of steel pipe in water, is fatigue and chemical resistant and can also withstand high operating pressures of up to 20ksi (20,000psi).

For the buoyancy elements the composite carbon fibre solution reduces the effective density from around 350kg/m3 to less than 90kg/m3. This greatly simplifies all aspects of installation but, most importantly, reduces drag loads and added mass and hence improves overall riser response.

Conclusion

The Magma m-pipe lightweight design approach reduces the cost of deep water risers and also enables access to hydrocarbons in frontier water depths beyond 3,000m, making an m-pipe® solution preferable over steel pipe risers. By using Magma m-pipe® a cost effective riser solution is achieved, with m-pipe® costs more than offset by savings in buoyancy costs and vessel installation costs. It's a new riser design approach delivering both lower cost and lower risk.

For m-pipe® lightweight riser details and 40% project cost savings see our website or email sales@magmaglobal.com

Riser applications web page: http://bit.ly/maginterw See the riser application animation: http://bit.ly/MagmSLOR

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