

in depth

Passionate about ...

Cranes and Offshore Lifting



'Passion' is not a word generally associated with offshore technology, but here Hugh Williams, chief executive of IMCA, shares his passion about cranes and lifting and particularly heavy lifting as it applies to the offshore industry.

Much of my career has been involved with lifting and I feel really passionate about what has been achieved by the industry in a relatively short time.



Let's start at the beginning though. Think of the normal mobile crane you see moving down the street - perhaps a wheeled vehicle with a hydraulic jib, or a crawler crane being transported to a site on a low-loader. Or look at a construction site or the city skylines everywhere at the moment and consider the crop of tower cranes. They can all lift a few tens of tonnes, maybe even a few hundred. They provide vital assistance to all forms of land based construction.

To help build a mental picture of the sort of weights I'm going to be talking about, think first of the iconic Routemaster red double-decker London bus. That weighs about 8t (tonnes) unladen or 12t laden. A typical 40 foot container has a capacity of 22t and lorries are generally limited to about 40t on roads, whilst a cube of water measuring 10 x10x10m weighs in at 1,000t (yes, one cubic metre of water weighs a tonne!).

The very biggest mobile land based cranes which were used in offshore platform fabrication yards in Scotland a few years ago could lift up to 1,500t each. I think there were three of them and two sometimes worked together. Now, there is a pair of fixed derricks used for heavy lifting in a fabrication yard in America which can lift over 10,000t but as this is fixed, rather than mobile, it's not an accurate indication of what can be done offshore.

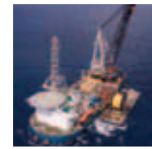
Back in the 1950s the only cranes available for offshore use were mounted on flat-bottomed barges capable of lifting about 200t, but by the 1960-70s ship-shaped monohull crane vessels had been developed and were hard at work with up to 3,000t capacity.

Enormous leap

Then, in the summer of 1979, came an enormous leap in capacity thanks to the introduction of the Balder and Hermod semi-submersible crane vessels (SSCV), each fitted with two enormous cranes. In the mid 80s, two even larger SSCVs came onto the market. DB102 and M7000, like Balder and Hermod before them, had capacities larger than anyone was designing liftable structures, but that did not last. Both vessels, Heerema's Thialf and Saipem's S7000, (by then renamed) were upgraded to the point where the combined lifting capacity of the two cranes on each vessel is now 14,200t and 14,000t respectively.

Indeed, S7000 holds the world record for an actual lift of 12,150 and in 2007 lifted the 9,500t jacket for Pemex in dynamic positioning mode (see *Passionate about dynamic positioning*, also available in this series of features).

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Yes, Thialf has a staggering lifting capacity of 14,200t! That's the weight of more than 1,180 fully laden London buses, or a sizeable ship, such as one of the 650 top-of-the-range supply vessels currently being built, or a cube of water measuring nearly 25x25x25m or even 32 Boeing 747s!

This truly 'giant leap' came about because of the requirement to build huge integrated decks weighing up to 12,000t and install them in one lift, rather than the earlier technique of using small pieces to build up the topsides 'jigsaw'. These integrated decks can perhaps be 100x30x30m high and only 'the heavy brigade' can deal with them in the offshore environment. They avoid the expensive and time-consuming requirements of 'hooking up' smaller modules, and the vessels can also be used efficiently to lift and install huge steel jackets such as the Pemex example mentioned above.

Nothing like these cranes exists on land and probably cannot exist on land – they need the forgiving support of buoyancy forces which support the vessels on which such huge offshore cranes are mounted.

These are the workhorses that continue to serve our industry and offer year-round workability. They have set some staggering lifting records.

For over 20 years, no new SSCVs have been added to the worldwide fleet of five, but the industry is so busy now that a new generation of massive heavy lift vessels, able to move at higher speeds than their predecessors, is either planned or under construction. The new generation includes another massive SSCV and two monohull crane ships, each with a lift capacity of 5,000t which are due in service in 2010.

Several multi-purpose construction vessels with slightly smaller cranes are also being built, so watch this space. We do indeed live in exciting times.

Scale is everything!

Objects also go extraordinarily deep below sea level as exploration and production moves into the deeper waters of the earth's continental shelves. Seismic survey has been completed in 3000m depths, whilst drilling and installation of structures and pipelines has been achieved below 2500m and new records are set each year. This means that not only are the offshore crane vessels equipped to lift and install jackets and decks, but they can place heavy objects and drive piles safely and accurately on the seabed some 2km to 3km below sea level.

For some deepwater operations it may not be the giant vessels that are required. Smaller but more specialised vessels may be better placed to do the work.

Just think of the length of wire that is needed for this sort of operation – the crane wires which hold up the jib and raise or lower the blocks kilometres below sea level are all reeved many times, so several kilometres of large diameter special wires are required. SSCV Balder is equipped with two 19km long wires that are designed to lower a 400t load to the seabed over 3000m deep.



Getting down to detail

The excitement and passion doesn't stop there! I like to think of more than just the vessel and what it can do. What about the people involved with lifting?

First there are the different streams of people who operate these highly sophisticated and computerised vessels and their cranes and other equipment; then there are the engineers who design, build and maintain the vessels and their cranes – they cover an amazing range of disciplines. Then there are the people who design and plan heavy lifts.

The heavy lift design engineer is the conductor of an orchestra ensuring that a structure which is designed to sit on its feet survives the trauma of effectively being lifted from its head. Large scale structural engineering, detailed design analysis, attention to detail on all the lift points (pad eyes, pad ears or trunnions) come to bear.

There is a long chain of components in any lift. The structure must hold itself together in the lift condition (the opposite loading to that seen during construction), transportation and the final installed condition and must also support the lift points.

The lift chain continues upwards perhaps through shackles to slings and perhaps spreader frames, and then into the crane hook. It then goes still further from there into the crane wires and the crane's jib and structure itself. Lastly the loads come back down to the crane foundations, which are tied into the vessel itself and the whole is neatly balanced on the vessel's buoyancy. All parts of this chain have to work in perfect unison – hence the conductor analogy.

There is such a wide variety of tasks in offshore lifting that finding the right crane for the job is essential too ... there's something to suit every operational activity be it offshore construction (heavy lift to or from the seabed or platform) or in support of pipelay, drilling, diving, ROV operations, trenching, wreck removal, well stimulation, mobilisation, offshore loading, personnel transfer and more.

Mast cranes, pedestal cranes, crawler cranes and A-frames all play their roles with various sorts of booms, heave compensation and power/control to be taken into consideration.

Working on and supporting these monsters of the deep are engineers and technicians trained in structural, civil, mechanical, electrical, electronic, hydraulic and systems engineering, in naval architecture and computing, right through to materials scientists and lubrication specialists, not forgetting the operators of sophisticated cranes, experts in rigging and more. The industry needs you all!

Further information

More details about IMCA's work in relation to offshore lifting can be found on our website via the Marine Division area at www.imca-int.com/marine

Also available from IMCA:

In depth feature articles:

- Passionate about
- Cranes and lifting
- Diving
- Dynamic positioning
- Materials
- ROVs
- Safety
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