THE KEY TO BUILDING A MORE PROFITABLE FPSO

MAMMOET

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SMARTER, SAFER, STRONGER

BARRIERS TO BIGGER TOPSIDES

The scale of FPSO and FLNG vessels is growing at a rapid rate. The four decades between the first FPSO built in 1977 by Shell and Total's Egina FPSO in 2017 has seen an increase in storage capacity of more than 600%, and a similar uplift in weight.

This increase is due to the greater profits to be made from larger scale production facilities; their higher operating efficiencies mean an increase in the absolute output and better returns for every dollar invested.

This drive to build bigger and more productive assets has of course meant larger scale construction projects which are increasingly constrained by existing infrastructure and the availability of heavy-lifting equipment. Fewer shipyards are capable of building or converting these larger hulls, while a smaller range of equipment capable of performing the sheer scale of work involved limits the possibilities even further. These supply issues can be worsened by local content requirements - stipulating that portions of the construction must take place within a specific country – which whilst positive for the local economy can act as a barrier to the global supply chain.

The result is that the possibilities relating to the build size of the asset can be critically restricted by these factors. and in turn limit profitability of the project. This white paper explores how the latest lifting technology can help to alleviate these problems ensuring more productive FPSO and FLNG projects are given the green light.

The higher the crane capacity, the lower the number of modules needed

MODULAR CHALLENGES

Although stick-build methods are used for some projects, this approach can be time consuming as it is dependent on the capacity of the gantry cranes available at the shipyard. The lower the capacity of the cranes, the greater the number of individual components that need to be lifted, requiring more man hours to connect and test them prior to commissioning.

Employing a modularized method serves to increase the speed of integration using land or water-based cranes to install large preassembled units – the modules – which can be built in parallel to the hull construction. Fewer individual components to lift mean less time and resources needed for connecting and testing. This not only reduces cost, but can also help to minimize the construction program, meaning the asset can be deployed faster and is thus productive sooner than may otherwise have been possible.

However, as the size and scale of FPSO and FLNG projects has increased, so have the challenges involved in delivering a successful modularized build.

LOCAL CONSTRUCTION

Local content requirements typically mean that at least portions of the topside integration package are carried out in the stipulated country - with some of these modules built locally and installed prior to commissioning and deployment offshore.

But many countries lack the size and scope of facilities needed to undertake the scale of work these projects demand. This limitation in shipyard capacity can be a blocker in the critical path of the project.

Another challenge with local content requirements is that they can limit, and often eliminate, the availability of water-based lifting capacity. For example, in traditional shipbuilding markets such as Asia it is quite common to install topside modules with high capacity water-based cranes, but this is not possible in many markets where the equipment is simply not available. This can be a considerable barrier to project viability, and prevent investment flowing into the region.

Local shipyard capacity limits the work they can undertake

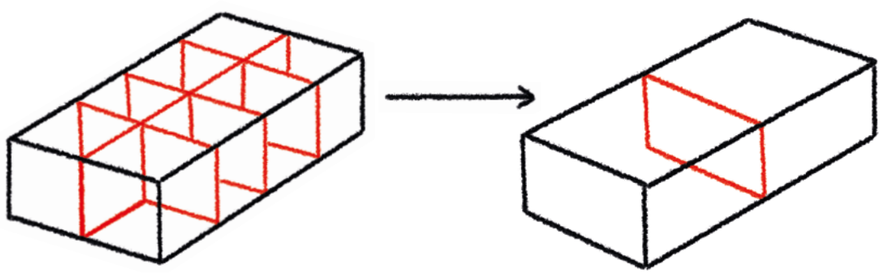
AVAILABLE TECHNOLOGY LIMITS PROJECT SCALE

Limitations in the availability of water-based lifting capacity means greater reliance is put upon land-based cranes. In these scenarios the maximum lifting capacity of land-based cranes has a direct impact on the extent to which the topside facility can be modularized because the lifting capacity of the crane used dictates the maximum possible module weight.

Larger modules enhance integration strategy.

Smaller FPSO modules require more time to integrate, with increased working at height.

With sufficient lifting capacity available, larger modules can be integrated at ground level and lifted directly onto the hull.



Connecting two modules rather than eight means a 400% decrease in surface area that must be joined together, and therefore huge savings on integration time and working at height. However, lifting technology must be found that can install these heavier modules.

In short, the capabilities of land-based cranes have become a limiting factor in building bigger, more productive FPSO and FLNG assets – and a blocker to getting these projects to market efficiently.

This has become a greater problem as FPSOs and their modules have increased in size. In fact, growth in FPSO capacity now outpaces growth in land-based lifting capability, meaning that cranes are now a bottleneck in efficient topside integration and effectively impose a weight limitation on the design of projects.

This forces engineers to ‘cut’ the production facility into a greater number of building blocks.

The greater the number of modules, the greater the number of interfaces, and that means more connections, more time and higher costs.

MORE LIFTING POWER

Higher capacity land-based cranes have been developed to help keep pace with module growth - among them Mammoet's PTC and SK ranges, which have performed some of the world's most challenging topside integrations, such as the P-63 and P-76 builds in Brazil and the Egina project in Nigeria.

This technology had enabled installation of modules weighing over 3,000t, helping to turn modest shipyard facilities into FPSO integration terminals. But this increased lifting capacity can present challenges of its own.

- Useful space in a shipyard facility is space that generates revenue; be that via storage or production. Cranes which require a large part of the available real estate are productive when lifting, and arguably a hinderance when not. That is to say, the large crane footprint reduces the available space for other activities that generate revenues. This means that greater lifting capacity needs to be delivered within a footprint that won't significantly impact other yard operations.
- Furthermore, modest shipyard facilities may have ground pressure limitations which may require strengthening upgrades to lift heavier modules. But this can again impact the productivity of the yard. This means bigger lifts, and thus bigger cranes, often must be carefully engineered to operate with a ground bearing pressure comparable to that of much smaller cranes.

Building stronger cranes within the currently required footprint and ground loading pressure is no mean feat, and it helps to explain why the pioneering increases in lifting power that saw milestone launches such as the PTC 200-DS and SK 350 have slowed in recent years.

Lifting technology turns modest shipyards into FPSO integration terminals

Gavin Kerr, Manager Global Cranes at Mammoet explains:

"The challenges involved in bringing a crane to market capable of surpassing the current maximum land-based lifting capacity are significant. Which has meant that in recent years there has been a ceiling for the size of topside modules that can be lifted, and therefore the scale and profitability of FPSO and FLNG projects."

"We recognized that finding a solution to these challenges would mean we could break through that ceiling and support the continued progression in the efficiency of modular builds."

Gavin Kerr
Manager Global Cranes

UNLOCKING GREATER EFFICIENCIES

The right crane allows you to lift a greater number of components from the same position, reducing the time spent configuring the crane and increasing the time spend integrating.

To achieve this, Mammoet began with the proven design of its existing SK190 and SK350 cranes and explored how this design blueprint could provide the foundations for a new model with unprecedented lifting capacity and outreach. This approach would provide the following benefits:

- Greater lifting coverage from one position – meaning lifts at a greater radius are possible without the need for costly shifting of the hull along the quay or rotating it much further away from the yard, often out at sea where there is sufficient room to turn the vessel.
- No need to install a full ring track unless the project requires it. This small footprint frees site space by up to 45% and maximizes the ability of the client's other operations to continue in parallel, expediting the project schedule.
- The ability to operate at low ground bearing pressures, giving the SK cranes the versatility to work across a range of ground conditions without expensive remediation work.

Critically, these key capabilities have been combined with unprecedented lifting power of up to 6,000t to produce the SK6,000 – a crane designed with the huge 144m outreach, small footprint and minimal site impact to greatly reduce the time needed to perform topside integrations.

"The SK6,000 allows EPCs to consider construction methodologies involving heavier components than ever before; up to 6,000t. Its proven design allows modules to be lifted directly onto the hull – without a requirement to rotate the modules or shift the vessel."

Giovanni Alders
Sales Director

Creating the technology to make larger module lifts a possibility would require smart, innovative thinking. Kerr continues:

"We knew that bringing a higher capacity crane to market would have an important impact on the size and scale of projects that FPSO and FLNG engineers could consider. The capability to work with larger building blocks means less time connecting and testing and more time producing."

"Any potential solution needed to meet a series of strict criteria in order that it not only delivers the desired lifting power but also be able to operate in the realities of local shipyards where space is often limited and ground conditions vary."

Gavin Kerr
Manager Global Cranes

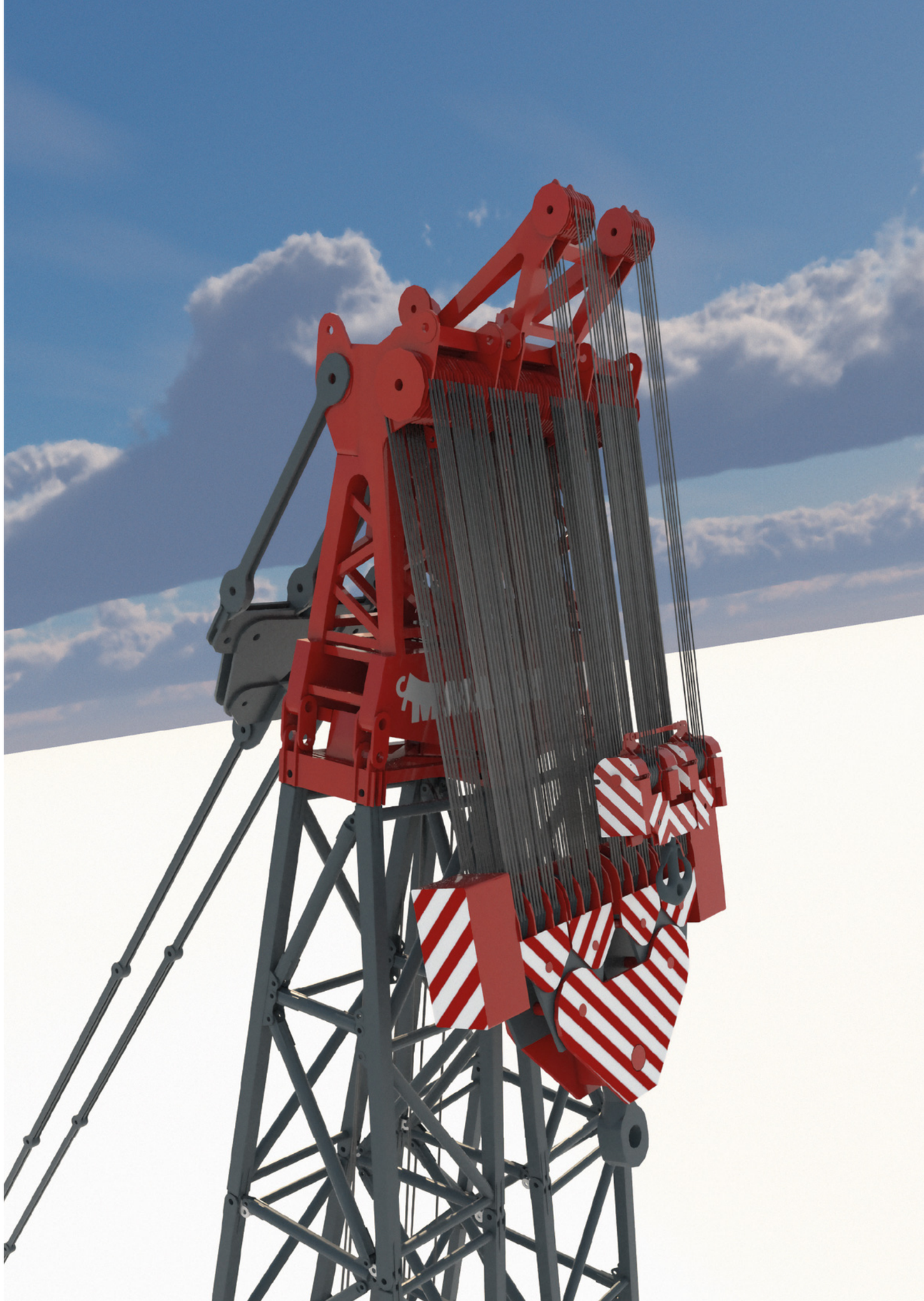
LIFT SMARTER

The SK6,000 means the lifting of topside modules weighing more than 6,000t is now achievable with a land-based crane.

Whereas previously FPSO and FLNG projects were limited to lifts of around 3,000t, there is now the potential to go nearly 70% heavier. This will have a profound impact on the timescales of FPSO and FLNG projects. Even where modules are lighter, the crane's longer outreach and stronger load moment means both it and the hull must be moved far less often – meaning you can spend less time moving equipment around site, and more time integrating.

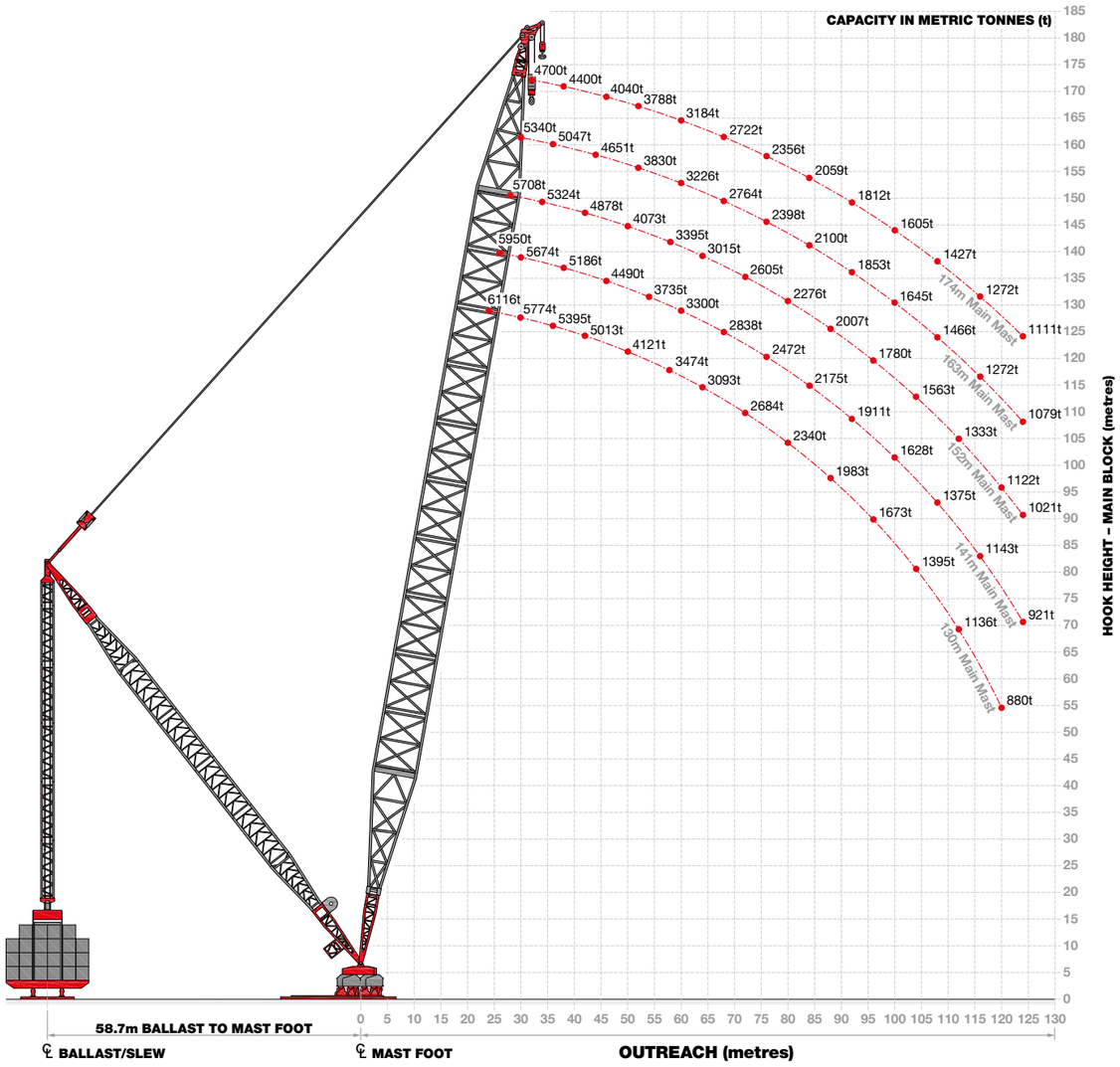
"The possibility of lifts over 6,000t will mean we see new standards being set in efficiency, safety and time to production. The lifting power of the SK6,000 also means that relatively smaller lifts in the order of 2,000t or 3,000t can now be executed at a greater radius, further helping to open new methodologies."

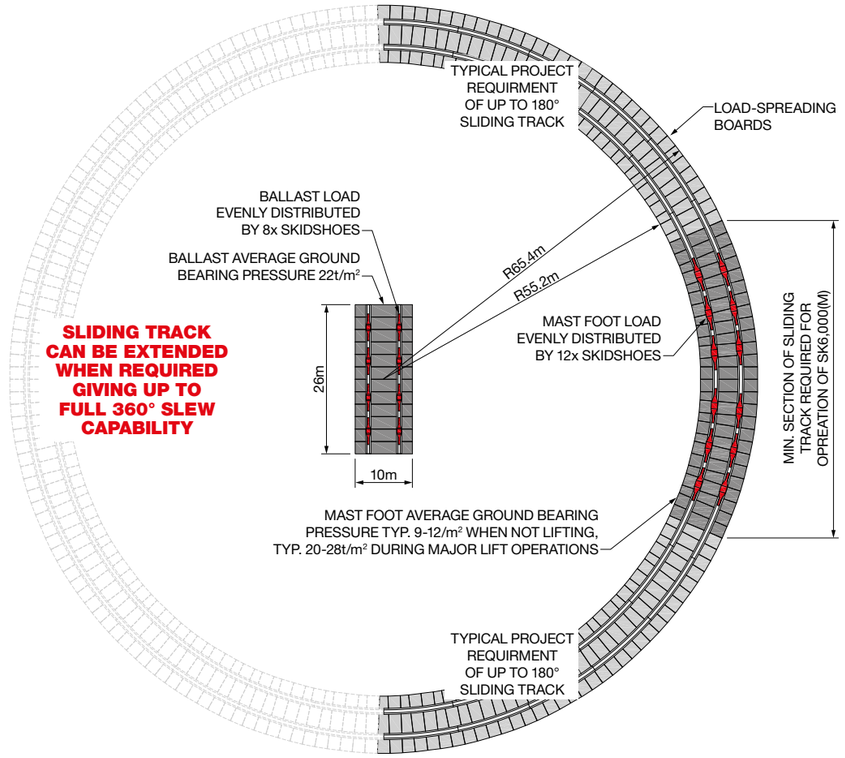
Gavin Kerr
Manager Global Cranes



SK6000

The SK6000 at a glance





SK6000 (CONFIGURATION M) FOOTPRINT

KEY FEATURES

- Install modules up to 6,000t
- Static ballast is ideal for FPSO projects (full width installation)
- Avoid rotating FPSO during construction
- Maximize local content requirements
- Low ground bearing capacity

SPECIFICATIONS

- 6,000t capacity
- Utilizes the same proven design as the SK190 and SK350, with similar footprint
- Outreach up to 144m
- The load moment of the crane is 510,000 t/m.

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