LEWEK Constellation

Offshore Construction Technology by Singapore's EMAS AMC

by **Ng Eng Bin**

The surge in offshore construction activities over the past decade due to rising oil prices has led operators to explore and develop more oil fields in a frantic search for new sources of energy around the world. With depleting oil and gas reserves in fully developed and matured offshore oil and gas fields, operators are now moving towards remote and marginal fields. For instance, to reach the previously less attractive reservoirs in Brazil, West Africa and the Gulf of Mexico, it is necessary for operators to drill wells in deep and ultra-deep waters, and in increasingly remote regions. This presents a challenge for operators as subsea construction services for such jobs are limited in remote locations and thus have to be mobilized from established regions.

To overcome the above challenges, EMAS AMC, a Singapore home-grown company, has realized an innovative solution with the construction of Lewek Constellation, a state-of-the-art, Dynamic Positioning System Class 3 (DP3), ice class vessel with a multi-lay system and heavy lift capabilities. Not only does the vessel have the ability to install multiple risers, pipelines, flow lines, flexibles, umbilicals and platforms in a field, it can also do so in remote locations.

Vessel Specifications

Lewek Constellation's vessel specifications are presented in Fig. 1. Once fully commissioned in 2014, she will be able to install multiple types of pipelines, steel catenary risers, flexibles, flowlines, umbilicals and power cables in reel lay method. The vessel's multi-lay system (MLS) comprises an 800-ton tiltable tower, a 60-ton pipeline end termination (PLET) handling system for large PLETs, and a 1,200-ton Abandonment & Recovery (A&R) system.

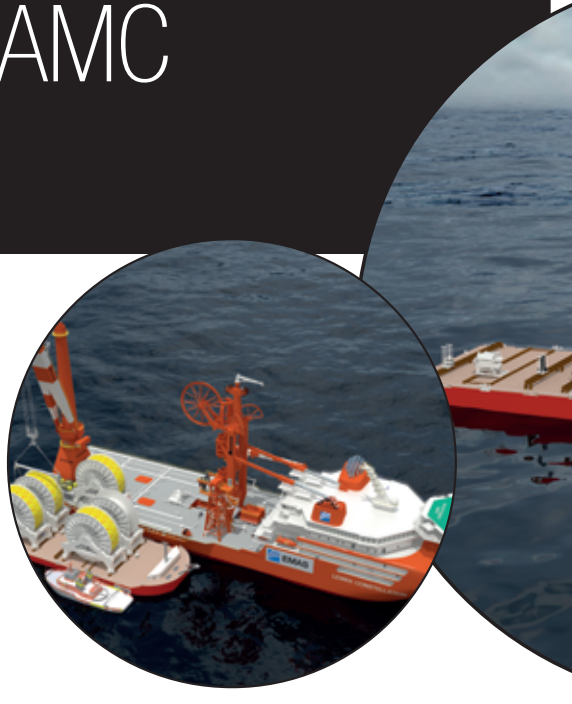


Fig. 2. Spooling barge and loading/offloading of reels onto Lewek Constellation.

The tower has dual 400-ton tensioners, a straighter for handling pipe-in-pipe flowline systems with outer pipe diameter up to 16 inches, a 900-ton hang-off module, and a movable work platform along the tower. The tower can be adjusted from 60° to 90° to accommodate pipe laying from shallow to ultra deep water.

The crane's heavy lift capability of 3,000 tons allows installation of offshore structures, such as large manifolds, platforms and topsides. Besides this, the main crane is also used to transfer reels from the spooling barge to the pipelay barge (Fig. 2).

Portable Reel Concept and Offshore Reel Transfer

The Lewek Constellation will utilize a spooling barge with a ballasting system to manage the heel and trim of the reels. The barge will be outfitted with a spooling system that includes a fleeting roller track assembly, a fleeting tensioner, a reel cradle assembly and winches. She will then be moored at the quayside where the pipe stalk will be pulled over the stern of the barge

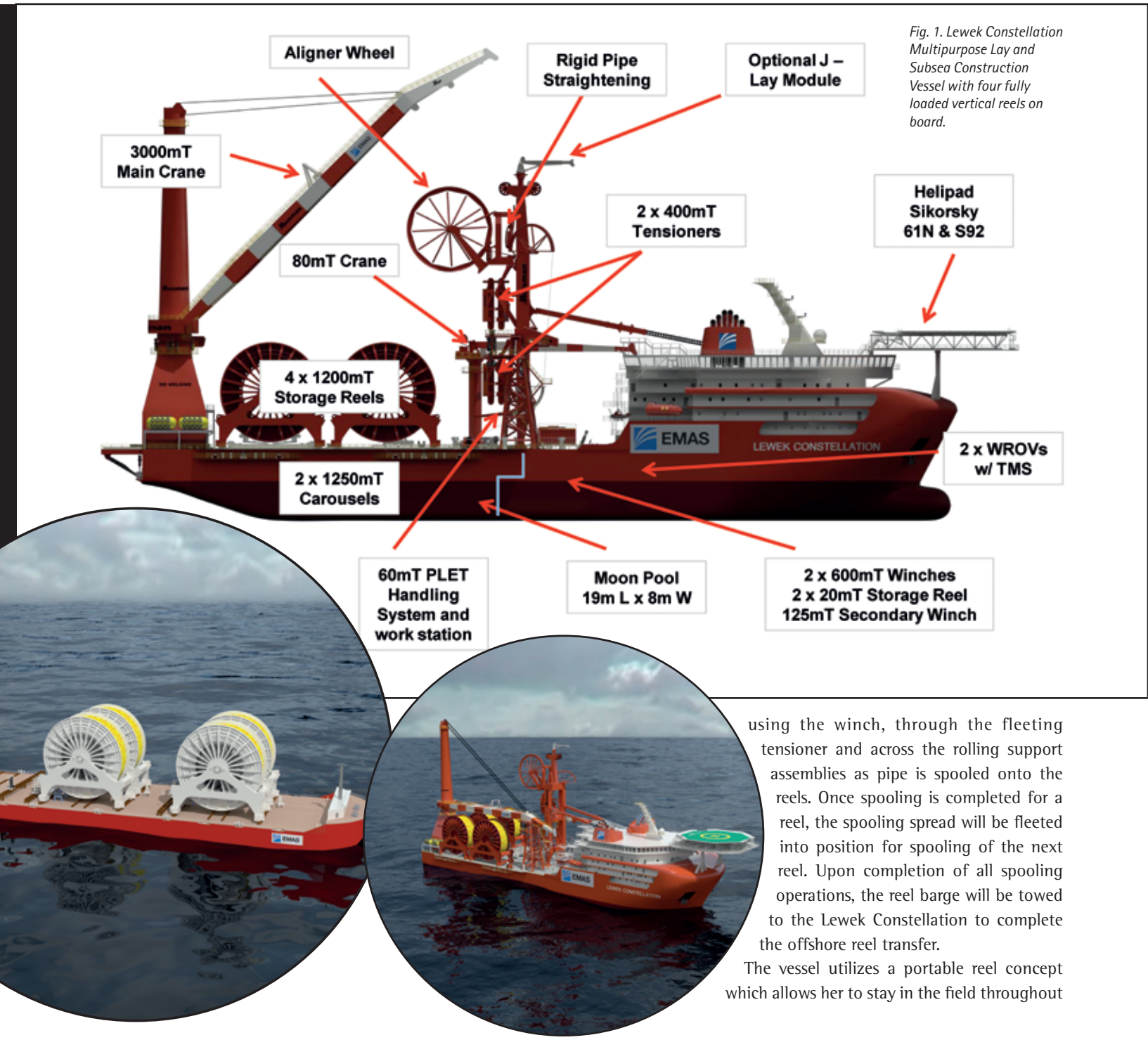


Fig. 1. Lewek Constellation Multipurpose Lay and Subsea Construction Vessel with four fully loaded vertical reels on board.

using the winch, through the fleeting tensioner and across the rolling support assemblies as pipe is spooled onto the reels. Once spooling is completed for a reel, the spooling spread will be fleeted into position for spooling of the next reel. Upon completion of all spooling operations, the reel barge will be towed to the Lewek Constellation to complete the offshore reel transfer.

The vessel utilizes a portable reel concept which allows her to stay in the field throughout

the duration of the project. The spool barge carrying reels of pipes will meet Lewek Constellation in the field, where the vessel will use its heavy lift system to offload empty reels and reload with fully loaded reels. In this manner, there is no need for the vessel to return to the spoolbase to reload pipes. This method allows optimization of the project duration by taking reeling off critical path and minimizing vessel transit time to return back to the spool base to pick up the remaining pipe reels.

Lewek Constellation's 3,000-ton crane situated at the stern of the vessel is a versatile crane that can be utilized to perform heavy lifts for large manifolds, platforms and topsides, as well as to transfer the reels from the material/spooling barge to its deck. The reels will have a weight of approximately 850 tons when empty and approximately 2,100 tons when fully loaded.

Pipe Laying Capabilities

In rigid reel lay, Lewek Constellation can apply up to 800 tons of dynamic top tension on flowlines and rigid risers with up to 16 inch nominal pipe diameter. With this tension, pipelay at deep and even ultra-deep waters are no longer a remote possibility. The maximum lengths of pipe to be installed and the maximum water depths for pipe with diameter ranging from 8 to 16 inches with varying wall thicknesses are presented in Fig. 3. Current exploration efforts have not shown any potential projects at water depth exceeding 3,000 m and hence, Lewek Constellation is well placed for the field development of deep and ultra deep projects in the near and distant future.

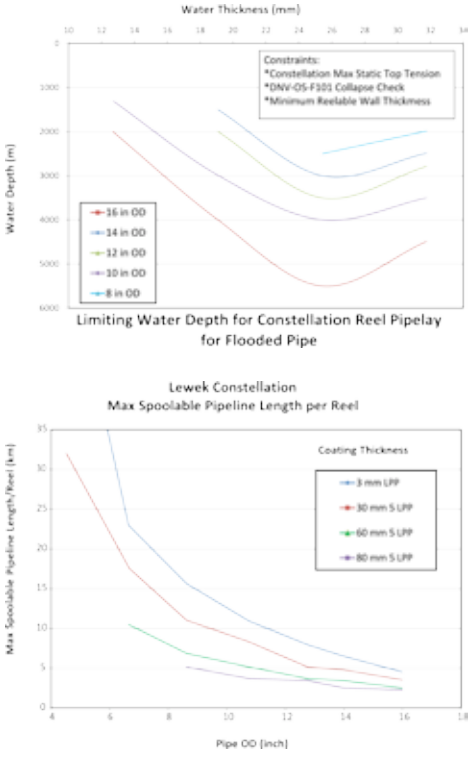


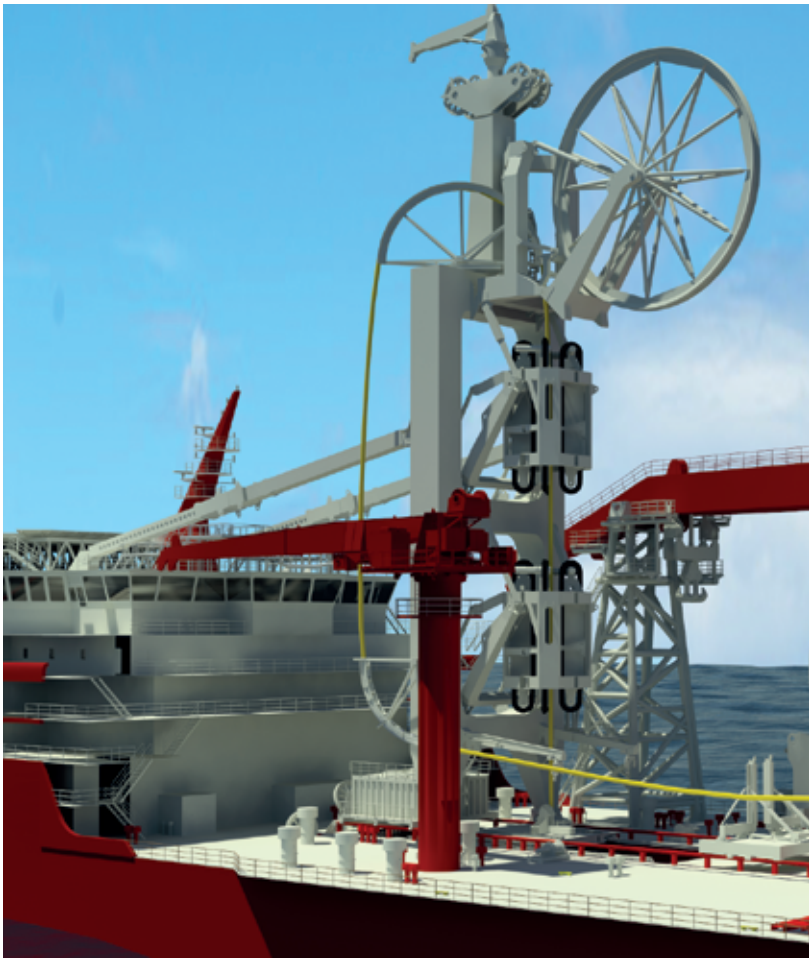
Fig. 3. Layability of 8-16 inch rigid pipeline in deep water using Lewek Constellation.

Flexible Laying Capabilities

In flexible mode, the vessel system and lay system can accommodate sizes of up to 24 inch nominal outer diameter while applying 400 tons and 430 tons of top tension respectively. Lewek Constellation has two 1,250-ton carousels located in the vessel's hold. When in flexible lay mode, the pipe is guided over chutes towards the tensioner.

Lewek Constellation Versus Other Reel Lay Vessels

Traditional reel lay vessels have spooling operations occurring on critical path because traditional reel lay vessels have to transit to a spool base to reel pipe. By using portable reels, the spooling operations are moved off the critical path. This allows Lewek Constellation to have continuous operation, thereby increasing her efficiency during the installation campaign, while other vessels have to return to the spool base to re-load. Having a continuous pipelay campaign also allows the pipelay to be carried out in a reduced time frame. This is ideal for remote locations close to the Arctic region in terms of minimizing the downtime due to weather.



Closing Remarks

Reeled pipe lay method is normally used in fully developed and matured offshore oil and gas field areas with close proximity to onshore support, onshore logistics and short offshore transit distance to onshore spool bases for loading the pipeline stalks onto the reel. This is usually an activity that requires comprehensive planning both onshore and offshore and is often on critical path of the overall pipe laying endeavor.

Lewek Constellation could be a "game-changer" in this regard. By utilizing the portable reel concept, it will be possible to decrease the overall project cost by minimizing the amount of time a pipelay vessel is on hire. Construction can be accelerated because spooling operations can be done off critical path, allowing the vessel to stay in field working on installation and commissioning activities.

In addition, with the heavy lift crane and multi-lay system, Lewek Constellation can be a "one stop shop". The vessel's ability to reconfigure from pipe lay to flexible and umbilical lay mode allows for the installation of field developments with multiple flow lines and umbilical products. Furthermore, she can be reconfigured to heavy lift mode to install large manifolds, subsea pump stations and fixed platforms. By using Lewek Constellation to install an entire field development, the need for additional vessels is minimized, thereby reducing the chances of schedule slips and the costs associated with multiple mobilizations and transits to remote locations.

Fig. 4. Lewek Constellation in flexible lay mode.

Ng Eng Bin has been in the oil and gas industry for 35 years, and has held design, field, project and managerial positions. His specialty is in the field of submarine pipelines (engineering and installation). He is presently the Vice-President of Engineering with EMAS AMC, a division of the EMAS Group of Companies. For more information about the article, please contact Dr Ng at engbin.ng@emas.com

Glossary

Dynamic Positioning System Class 3 (DP3)
The capability of a vessel to maintain its position and heading by its thrusters according to a pre-defined setting in a DP software. Class 3 represents the highest degree of redundancy to maintain the position in the event of a single component or compartment failure due to fire or flooding.

Platform
A structure with facilities to drill wells, to extract and process oil and natural gas, and/or to temporarily store product until it can be brought to shore for refining and marketing. In many cases, the platform contains facilities to house the workforce as well. Depending on the circumstances, the platform may be fixed to the ocean floor or may float.

PLET
Pipeline End Termination.

Reservoir
The oil bearing strata tapped by the hole.

Steel Catenary Riser (SCR)
Deepwater steel riser suspended in a single catenary from a platform (typically a Floater) and connected horizontally on the seabed.

Spoolbase
A shore-based facility used to facilitate welding of line pipes into a continuous length of pipe for continuous spooling onto a pipe-laying vessel, typically a reel barge.

Topside
The superstructure of a platform.

Umbilical
An assembly of steel tubes and/or thermoplastic hoses which can also include electrical cables or optic fibres used to control subsea structures from a platform or a vessel.

Critical path
The longest necessary path through a network of activities for completion of a project, and the accumulated time taken to complete the activities along this path represents the minimum amount of time needed to complete the project.

Abandonment & Recovery System
A system that typically comprises a constant tension winch with a long length of wire to allow an offshore pipeline (or other structures) to be lowered to sea bed and abandoned there, when bad weather is encountered during the installation campaign, so that the installation vessel can be removed from the site. The same A&R system is then used to recover this pipeline back to the installation vessel when the weather has subsided.