Alternative heavy lift system uses truss formation

Increasing energy demands have thrust offshore operators into an era of aggressive exploration and development, with the resulting need for heavy lifting systems. Peter Devine reports.

Traditionally, the offshore heavy lift industry has relied upon derrick barges to bear the brunt of the workload when jackets, decks, modules, or other large components are installed or removed.

High capital costs, relative scarcity of available units, and access limitations for the large capacity derrick barges have prompted the search for alternative heavy lift technologies. One of these systems has been engineered by Versatruss Americas.

The Versatruss heavy lift system, which was initially designed by civil engineer Jon E. Khachaturian in 1990, is a balanced, symmetrical, underside lift system which uses multiple lift points to distribute the load evenly along the centreline of two barges. In doing so, it achieves not only a greater redundancy than conventional lift systems, but also maintains what the company says is a remarkably shallow draft during lifting.

This system was selected by Chevron Technology Company to install three production topsides in Venezuela's Lake Maracaibo in August 1999. The Urdaneta Bridge at the entrance to the lake created a clearance problem for any derrick barge of sufficient capacity to achieve the required lifts of 4700, 5300, and 6100 short-tons respectively, thus creating an opportunity for the unconventional system to showcase its capabilities.

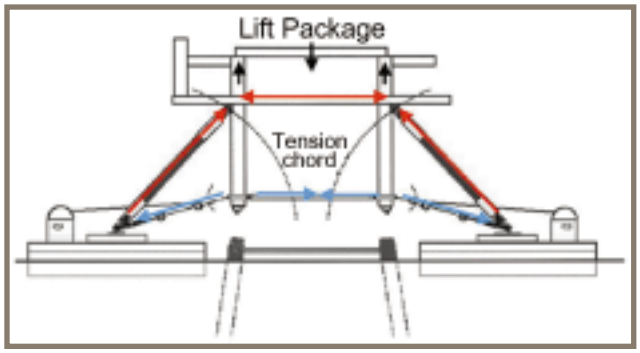
Versatruss is so called because it makes use of a truss formation which is an efficient way to lift a heavy load (see Fig. 1). The upper portion of the truss, in red, is formed by the booms and the lift and the lift package itself. The lower segment, in blue, is formed by the Versatruss rigging and a tension chord inserted between the platform legs. This arrangement results in a highly efficient distribution of load into the deck.

A further distinguishing feature of the system is the low capital cost and relative ease of fabrication. Because it utilises commonly available components—standard cargo barges, steel booms, hydraulic winches—it can be inexpensively transported to remote locations, or even assembled locally. The systems used at Lake Maracaibo went from initial blueprint to operation status in less than one year at a cost of $12 million, a low sum in the light of its 6800 lift capacity.

See Fig. 2 to see how lift occurs: synchronised winches are engaged (1), causing the barges to move together (2) and shortening the lower span of the truss. When this happens, the booms rotate on their heel pins (3), increasing the boom angle and generating vertical lift (4). The process is reversible at any time, with lifting and set-down taking a matter of minutes.

Early versions of this heavy lift system were used to decommission topsides in the Gulf of Mexico, the largest weighing 1350 short tons. For the Chevron contract, engineers replicated the essential features of the pervious designs, simply increasing the size of barges, winches and booms to accommodate the heavier lift packages (Fig. 3). Fabrication and assembly took place in Louisiana at Versatruss and McDermott yards, and the system was then towed to Lake Maracaibo by a single tug in a tandem tow.

Once having cleared Venezuelan customs, the system immediately set about hooking up to the first of the three topsides. First, the boomtips were stabbed into the receiving pins welded directly to



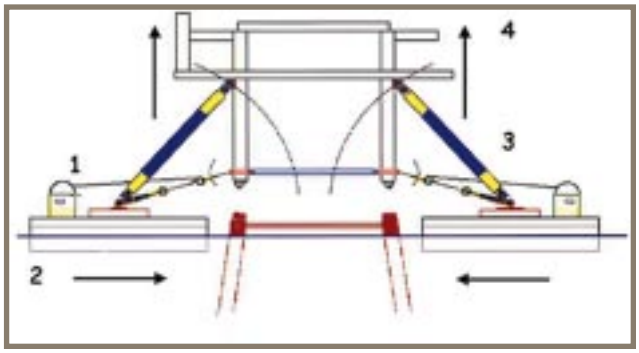


Fig. 3. The lift system incorporates previous designs.

the deck. Then the lower rigging assembly was attached to pad-eyes slotted through the deck legs. A dockside test lift and systems check were performed before the system and the transport barge bearing the deck set out for the installation site under tow in trimaran formation. During the tow, Versatruss bore about 2000 tons of the deck weight. When severe squalls with six-foot seas and 50 mph winds were encountered (as they were on two of the three tows), load fluctuation on the lower tension chord was within 10 per cent, a fact which highlights the remarkable stability of the catamaran or trimaran tow feature.

Upon reaching the installation site, Versatruss lifted the deck clear of the transport barge and, manouevering without anchors, floated over the jacket before releasing the load and setting the topside in place (Fig. 4). Average elapsed time for each of the three installations from arrival on site to final disconnect was about six hours.

Each deck was installed as a single piece, fully piped, instrumented, and pre-commissioned—the largest single piece installations in Lake Maracaibo to date. This enabled Chevron engineers to schedule production start-up considerably earlier than any operation involving piecemeal installation would have done, and was of course the major consideration in awarding the Maracaibo contract to the Versatruss heavy lift system.

Upon return to Versatruss Yard in Louisiana, the system was promptly dismantled, with booms and winches being stored for future projects, and the rented barges being returned to their owners. Versatruss engineers have already begun finalising designs for a system with a 25000 ton lift capacity. ❑

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Fig. 4. Setting the topside in place.

International Oil & Gas engineers
August 2000