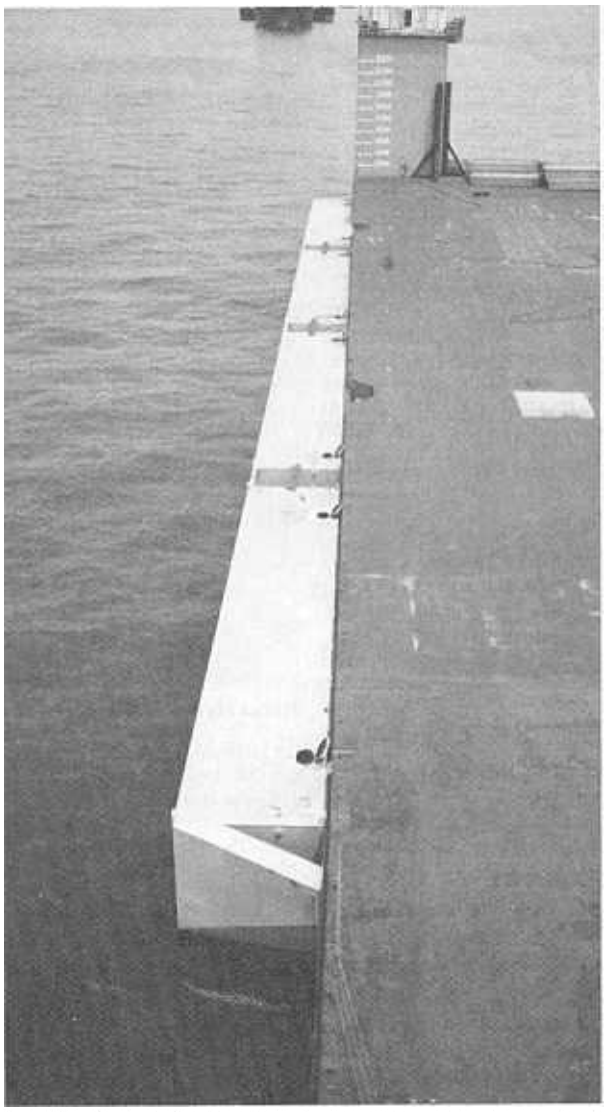

Once the Santa Fe Galaxy I jackup was loaded on the deck of the transport vessel (left), seafastening operations began in preparation for the long voyage to the North Sea. To ensure the initial stability of the vessel with her cargo, large, custom-built sponsons (right) were used.

Moving the Galaxy I: How the challenge was met

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MOVING FROM Singapore to the North Sea the largest jackup rig ever built was a remarkable feat that required detailed planning and painstakingly careful execution.

Final preparations for the long, unusual journey started in August, when the huge three-legged harsh environment jackup rig Galaxy I was delivered by Singapore-based Far East Levingston Shipbuilding Ltd. (FELS) to its owner, Santa Fe Drilling Co. The rig, a Friede and Goldman Mod VI design (see sidebar) is by far the biggest jackup in the world.

In a nutshell, following delivery the rig was loaded onto the semi-submersible heavy lift ship Transshelf by means of the float-on method. Seafastening of the rig took 2 days, after which the ship departed for the North Sea.

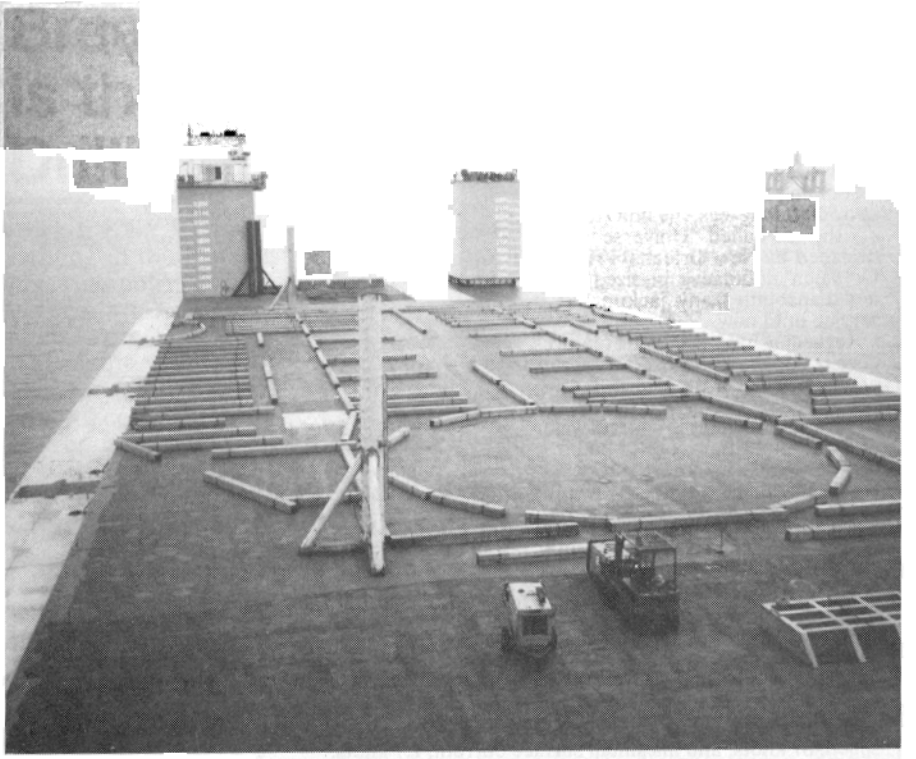
Simple as this sounds, the operation was nevertheless unusual. Given the sheer size of the unit (transport weight of 24,000 metric tons with a leg length of 170 m), a traditional wet tow was not a realistic option. This would have required cutting the legs in order to reduce the dynamic loads in the guides. Moreover, transit time would have been in excess of 100 days and the risk during this long exposure was unacceptably high.

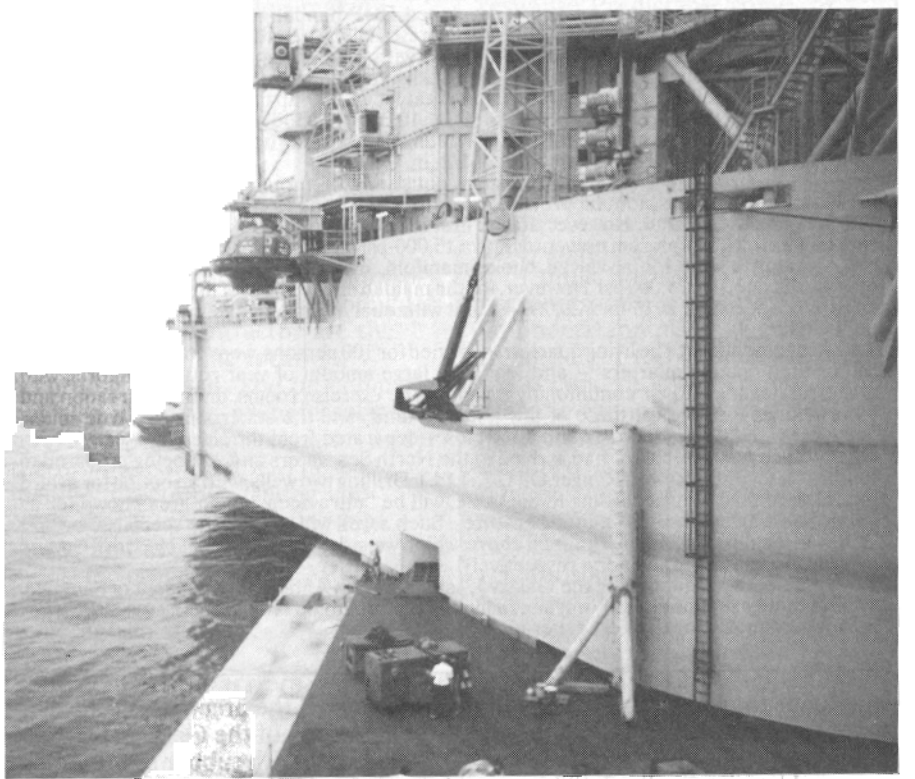
Dry transport of MODUs has in the past proven to be the fastest and safest method of transportation and, thus, this option was selected for the Galaxy I.

In May 1990, Wijsmuller Transport B.V. became involved in the transport feasibility studies. Use of the Mighty Servant 3 as well as the Wijsmuller-operated and Russian-owned Transshelf was studied and the following was concluded:

1. Transport of the Galaxy I with reduced leg length (140 m) would be feasible using either the Mighty Servant 3 or the Transshelf.

2. Transport of the Galaxy I with full leg length (170 m) would only be





Top: Soft wooden cribbing on the cargo deck of the Transshelf transport vessel, matching the rig's hull framing, was used to transfer static and dynamic loads to the vessel. Above: Partial view of the Galaxy I already sitting on deck. Notice, at left, one of the sponsons.

possible with the Transshelf, outfitted with sponsons to guarantee initial stability. This option was selected by Santa Fe in April of 1991, when the transport contract was awarded to Wijsmuller.

Custom-built sponsons

At the outset, it was decided to design and custom build sponsons consisting of a number of independent tanks, temporarily fitted to the ship. The sponsons are re-usable and, in fact, can be fitted in the future to other heavy-lift vessels of the Wijsmuller fleet.

Much attention was paid to optimization of the dimensions and the shape of the sponsons, in combination with minimizing of construction and installation costs.

The sponson design evolved from 10 tanks, each measuring 20 x 30 x 5.5 m to 8 tanks, each measuring 20 x 3.5 x 5 m. Not only did this result in a weight savings of approximately 100 tons and a reduction of installation time and cost, but also the initial stability increased by 20%. A further increase of the width would have resulted in an effect too large for the ship's resistance rating.

The application of 20 m-long tanks resulted in:

1. Tanks that could easily be handled by cranes (each approximately 50 tons).
2. No stresses due to deflection of the ship hull in seaway.
3. Additional safety in case of damage/loss of tank.
4. Flexibility for future applications.

The gaps between the tanks were closed by means of channel profiles between which a wooden beam was inserted. This flexible connection allows for relative motion, while providing some streamlining. The forward and aft tanks were outfitted with tapered streamlining plates.

The tank depth was limited to 5 m so that they could be installed or removed with the Transshelf on its lightship draft.

The tanks are independent, with only the front and aft closing plates connected to the ship hull. The top plate was chain welded to the ship's rubrail. Ballasting/deballasting is accomplished through drain and vent valves, which can be operated from the top of each tank. Manholes are provided for access to the tanks. In order to have sufficient clearance over the tanks for valve operations, the top of the tanks are about 2 ft below main deck level.

The final sponson design was translated into a construction drawing which was submitted to the ship's classification society for approval.

The USSR Register of Shipping approved the construction and later surveyed the construction and installation. Construction bids were requested both in the Netherlands (as the Transshelf would call at Rotterdam before sailing to Singapore) and Singapore. The logistic advantages and a longer lead time associated with construction in the Far East, in combination with a competitive price, resulted in a contract award to FELS in May 1991. The sponsons were constructed and installed well ahead of schedule.

Loading

On August 29, the Galaxy I was

loaded onto the Transshelf at the Singapore Western anchorage. While the rig was towed from the shipyard to the loading location, the heavy-lift ship submerged to its loading draft.

The addition of sponsons to the Transshelf did require a modified ballasting/deballasting procedure. Ballasting of the vessel for loading was done with the sponsons in free flooding condition. That is, the flood valves and the vent valves were open and the sponsons were flooded during the submersion operation.

As soon as a sponson started to submerge, its flood valves and aft vent valve were closed. The forward vent valve remained open for pressure equalization. Once all sponsons were submerged and closed, ballasting continued until the loading draft was reached.

At 11:00 am, with the Galaxy I reaching the submerged ship, the tugger wires of the Transshelf were connected to the rig and the tugs were disconnected. The rig was then slowly maneuvered over deck towards the guideposts.

Upon positioning of the rig, the Transshelf started to deballast. Once the rig was firm on its soft wooden cribbing, the trim was gradually increased to 5 m by stern.

Deballasting continued until the main deck emerged. During the minimum stability phase (from 12 to 10 m draft), stability was maintained by a small list of 1° to starboard, thus keeping one side of the rig in the water.

The trim was then reduced to zero and deballasting continued until the departure draft was reached at 8:00 pm. At this point, the sponsons were still completely filled.

In sets of two (port and starboard simultaneously), the flood valves and the aft vent valves of the sponsons were opened and the sponsons were deballasted by gravity until the water level inside was equal to that outside the sponsons.

The sponsons were then completely closed (both flood valves and both vent valves) and the next two sponsons were opened. The remaining dead water was removed the following day using small submersible pumps.

Seafastening

The transport analysis, based on the route via the Suez Canal resulted in the following design criteria: significant wave height, 8.59 m; mean wave period, 8.2-11.4, sec.; mean wind speed, 53.5 knots; and 1-min. sustained wind speed, 65.0 knots.

The resulting motion responses and wind loads totaled the following forces to be counteracted by the seafastenings: Transversely, 5,300 tons; and longitudinally, 2,400 tons.

These forces included a reduction of 15% of the static weight of the rig because of friction between the rig bottom and the soft wooden cribbing. The rig was provided with special seafastening recesses and matching seafastening boxes which were already prefabricated, needed to be installed.

At 6:00 pm, with only the fore part of the main deck well out of the water, the local subcontractor arrived and started the preparations for seafastening of the Galaxy I. The steel boxes with rubber seafastening fenders were installed, jacked against the recess bulkheads and welded to the ship's deck. A total of 6 boxes were installed, a task that took a little over 2 days to complete.

On Sept. 1, at 3:00 pm, the Transshelf heaved anchor and departed for Rotterdam, via the Suez Canal. The successful voyage took a total of 39 days, including the Suez transit. The rig was scheduled to be re-delivered to Santa Fe Drilling on Oct. 10.<>

What's so great about the Galaxy?

BUILT AT a cost of some $100 million, the Galaxy I represents the biggest investment to date by a single drilling contractor for a single deep-water, harsh-environment jackup.

Standing tall with a 244 x 250 ft hull and 560-ft long legs, the unit (the first of the so-called Universe Class, designed by New Orleans' Friede & Goldman), outpaces in size, weight and capabilities any jackup put in service until now.

Regarding basic specs and features, here're some of the most outstanding characteristics of the Galaxy I:

- Water depth: Capable of operating seasonally in 440 ft of water, or year round in excess of 360 ft of water – in extremely adverse offshore environments, such as the central portion of the North Sea, with 483 ft of maximum usable leg length below the hull.
- Drilling capacity: Rated to drill 30,000-ft wells, either in cantilever or tender mode. In the cantilever position it uses a drilling envelope of 55 x 30 ft, with a maximum drill floor and substructure load of 2,600 kips, extending to 52 ft aft of the stern. For use as a tender, the Galaxy I has the ability to skid the entire drilling substructure off the cantilever beams onto an adjacent fixed platform.
- Environmental ratings (for the North Sea): Maximum wave height, 94 ft; maximum wind speed, 87 knots; and maximum surface current, 2.7 knots.
- Equipment: The unit has a newly developed BOP handling and storage system that, according to Santa Fe, results in safer and more efficient handling of the BOP stacks. In addition, the rig has an integral 500-psi diverter with 2,000 psi housing and 16-in. OD twin outlets; four diesel engine/generator packages with a combined output of 10,000 hp; a variable speed, high-torque top drive; a 49 1/2-in. rotary table; a 3,000-hp drawworks; three 2,000-hp, 7,500-psi triplex mud pumps, with 5-in. OD, 10,000-psi mud discharge piping system; automated pipe handling system capable of handling and storing up to 30,000 ft of drill pipe of up to 6 5/8-in. OD and drill collars up to 9 1/2- in. O.D.
- Well control: Dual stack BOP system, consisting of three 21 1/4-in., 5,000-psi ram preventers plus 5,000 psi annular preventer; and four 13 5/8-in., 15,000-psi ram preventers and a 10,000-psi annular unit. However, for its first mission (see below), the Galaxy I will use a special 11-in., 20,000-psi ram preventer and a 15,000-psi annular preventer being provided by the operator. The 3 1/2-in. valved choke manifold, hydraulically actuated and manually operated is rated for 15,000 psi. However, for the maiden engagement of the rig, the operator is providing a special 2 9/16-in. x 20,000 psi unit with dual automatic and manually adjustable dual chokes.
- Accomodations: The living quarters, designed for 100 persons, were conceived as a hotel, rather than boating quarters – and feature a large amount of year round comforts, with complete heating and air conditioning systems. The exercise rooms, dining, recreation and entertainment areas rival those of any hotel on land; and the staterooms are true suites, complete with lavatory, shower and watercloset, separated from the sleeping area.

At press time, the Galaxy I had arrived in the North Sea waters and was being prepared to fulfill its first contract (with Ranger Oil U.K. Ltd.): Drilling two wells, with an option for a third one. One of the wells, according to Santa Fe, will be "ultra deep," in an area known for its abnormally high pressures and temperatures. Such a well will require the special 20,000-psi BOP and manifold systems mentioned above, which were designed and built by Hydril Co. and Worldwide Oilfield Machinery, respectively.

"Our objective in launching the Galaxy I," said Gordon Anderson, President of Santa Fe, "was to build a technologically advanced jackup that would be recognized by the industry as setting a standard for the next generation."<>