

# Triple-hulled carrier meets dual carriage requirement

The 11,000 dwt sulphur/bitumen tanker *FS Charlotte* represents not only one of the most sophisticated vessels ever delivered by a Turkish yard, but also one of the few – if not the only – triple-hulled tankers in existence

Designed by Istanbul-based consultancy Delta Marine Co and built by compatriot Yardimci Shipyard, *FS Charlotte* can trade two different cargoes thanks to its entirely separated cargo systems. A typical round-trip could be carrying liquid sulphur on southbound routes from Bayonne to the Mediterranean and asphalt on the return leg. The ship is now on long-term charter to French oil major Total.

*FS Charlotte* has 11 cargo tanks and two slop tanks integrated in the cargo area. Six of the cargo tanks are designed to carry molten sulphur (1.80 tonne/m<sup>3</sup>) at 140°C. The other five are designed to carry bitumen (1.30 tonne/m<sup>3</sup>) at up to 250°C, although in service 160°C has generally speaking been sufficient. The cargo system is arranged with four double-valve segregations, and sulphur and bitumen are never loaded simultaneously.

As well as having a double hull, *FS Charlotte* also has a void space to isolate the cargo from ballast tanks. In this way it is possible to carry the cargo without any heating for at least seven days. Should the heating system fail, the cargo heat loss is designed to



*FS Charlotte* can carry alternate cargoes of liquid sulphur and bitumen

be limited to just 1°C per day. In the event of any technical problems, the temperature of molten sulphur can be maintained at 140°C and asphalt at up to 250°C to keep the cargoes liquid.

The cargo tanks are fully independent of the hull structure, and mounted on special supports, to allow for expansion of the cargo at high temperatures, and so *FS Charlotte* is, effectively, a triple-hull ship. Each of the cargo tanks can expand up to 80mm and weighs around 400 tonnes, and this presented a significant challenge to the designers. The Ulepsi tank support system from the Dutch company Beele Engineering was able to demonstrate that it could meet this specific requirement, after extensive strength, thermal and CFD analysis carried out by Mesh Engineering Co.

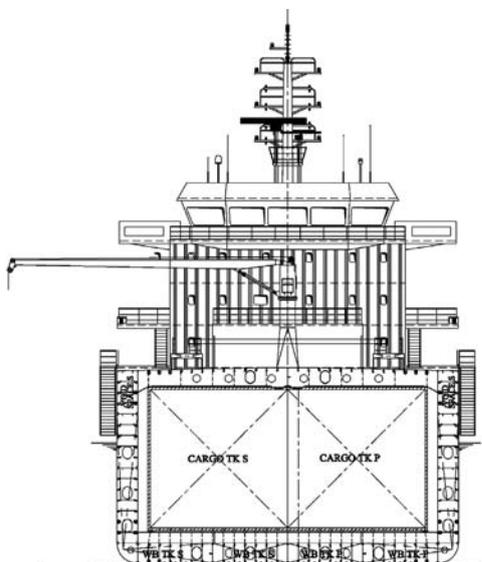
In view of the strains caused by the temperature differences between the cargo and sea water, the tanks cannot be directly secured to the ship's hull. The purpose of the Ulepsi tank support system

is therefore to reduce the temperature from around 200°C to a reasonable level. Further requirements to be met are compressive strength to absorb the weight of the cargo tanks in addition to an optimised coefficient of friction of the various system components.

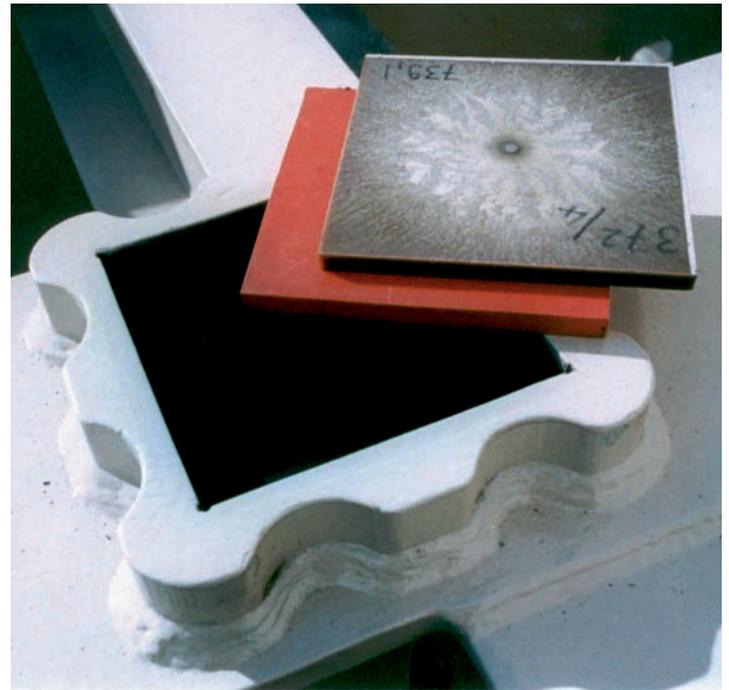
An Ulepsi independent tank support consists of a vertical set of slabs which are held immobile inside a steel housing. The housing (200 x 200mm or 350 x 350mm) is attached to the ship's hull. Each tank support contains one slab of EPDM rubber, one slab of silicone rubber and one slab of Ultem. The slabs of Ultem glass filled synthetic material are manufactured by injection moulding. The rubber slabs used are developed by Beele Engineering. Their principal function is to absorb the heat, so that the temperature at the underside of the bottom-most rubber slab has fallen to around 80°C.

*FS Charlotte's* cargo discharge system is based around four Bornemann hydraulic pumps in two separate pump rooms. Two of the pumps have a capacity 400 m<sup>3</sup>/hr, for bitumen; and two are rated at 337 m<sup>3</sup>/hr for molten sulphur. Considerable attention also had to be paid to the effectiveness of the tank insulation system.

To meet the charterers' trading and safety requirements and to provide convenient trim conditions with full loads of either sulphur or bitumen, the optimisation of the vessel's hull form was made diligently, including the minimisation of resistance of wave and friction. Resistance and powering tests were carried out in Istanbul Technical University's Ata Nutku Ship Model Testing Laboratory. The faculty primarily examined the powering requirements needed to meet the contract speed and the implications for fuel consumption.



| FS CHARLOTTE          |                                  |
|-----------------------|----------------------------------|
| Shipbuilder           | Yardimci Shipyard                |
| Length, oa            | 129.00m                          |
| Length, bp            | 123.90m                          |
| Breadth               | 22.00m                           |
| Draft, design         | 7.80m                            |
| Draft, scantling      | 8.20m                            |
| Deadweight, design    | 11,000 tonnes                    |
| Deadweight, scantling | 12,497 tonnes                    |
| Gross tonnage         | 9,416gt                          |
| Cargo capacity, 100%  | 11,090m <sup>3</sup>             |
| Water ballast         | 4,725m <sup>3</sup>              |
| Main engine           | Caterpillar MaK 6M4 <sup>3</sup> |
| Output                | 5,400kW at 500 rpm               |
| Bow thrusters         | 1 x 800kW Schottel               |
| Crew                  | 6 + 1                            |
| Flag                  | France                           |
| Classification        | Bureau Veritas                   |



(left:) FS Charlotte on sea trials prior to delivery (right:) ULEPSI tank support showing the steel housing welded to the hull frame

A Cat MaK 6M43 main engine with an output of 5,400kW at 500 rpm turns a 4,400mm-diameter controllable pitch propeller at 150 rpm through a ZF Marine gearbox. A PTO/PTI arrangement enables a 1,490kW AvK shaft generator to provide an emergency propulsion system. Three Yanmar 6N21AL-UV medium speed diesel generators burn heavy fuel oil and each has an 750 kW output. Heat for all cargo and domestic services is generated by two pieces of thermal oil heaters

and economisers.

To increase the manoeuvring capability an 800kW Schottel bow thruster is fitted. Five pieces of mooring winches with two drums are fitted aft, fore and cargo area. Accommodation is arranged for 19 people, one hospital, one pilot/owner cabin all with separate WC and shower.

FS Charlotte is the latest in a sequence of tankers order by French concern Fouquet Sacop (now part of the Eitzen Group). These include a range of smaller

tankers intended for smaller Corsican trades where there is not a lot of draft. A defining feature of these designs, made also by Delta Marine, is the fact that they have two SPJ82 Schottel pump jets placed symmetrically on the forward part of the engine room in the bottom on each side of the central line. The power is 400kW each feed, or by the main auxiliary generator or by the shaft generator. There are two ships already sailing with this system and one under construction in Turkey. **TST**

