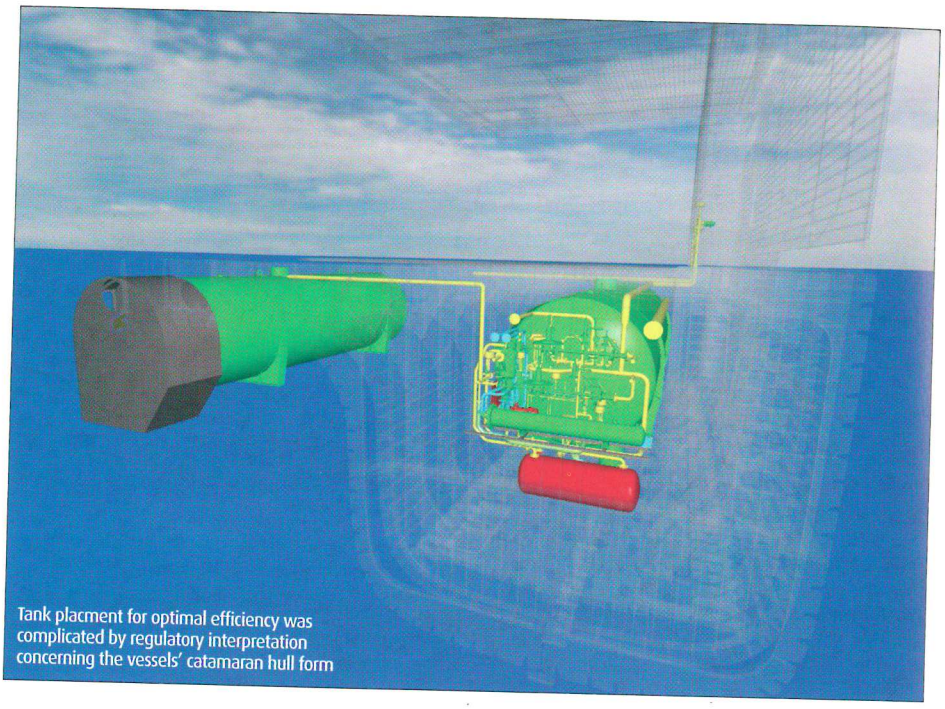
Strategic Marine partnered with specialist companies with significant experience in gas-fuelled ship technology for the supply of services and systems. After some months of close engagement, shipbuilding agreements were signed on April 8, 2016 for the two vessels with expected final hand over during April 2018.

LNG system designer and supplier Marine Service Noord had to balance several considerations when designing the fuel system. As LNG is the only fuel on board the gas fuel supply should never fail, but the amount of gas carried on the ship needed to be minimal - requiring frequent bunkering with only limited time available. The Wadden Sea sometimes gets rough, so additional forces on the LNG installation had to be considered. And the big transient power of the MTU engines requires a fast response from the LNG system. Automation and ease of operation were also key considerations, and complete redundancy was also demanded.

As a result two LNG systems will be installed in the ship, one each in the starboard and port hulls. Each hull contains a 46m³ LNG tank and conditioning system that serves the gas engines in that hull. This means that the tank does not have to be pressurized to the gas feed pressure. The design pressure of the tank may be kept low and the weight of the tank minimized. Pressure fluctuations in the LNG tank caused by violent sloshing in rough seas therefore have no impact on the feed pressure to the engines. And because of the low tank pressure the holding time is increased and time needed for bunkering is shortened.



Tank placment for optimal efficiency was complicated by regulatory interpretation concerning the vessels' catamaran hull form

> "In order to provide a large, unobstructed vehicle deck, the decision was made from early concept to position the LNG tanks below main deck, one in each hull of the catamaran configuration"

PROJECT CHALLENGES

One part of the vessels' design that was particularly challenging was manoeuvrability. These vessels routinely experience high winds during berthing. Initially conventional shafts driving controllable pitch propellers (CPPs) were examined to take into account the inherently low torque common in gas engines at low rpm. Azimuthing thrusters with CPPs were also investigated, but were found to be a more complex and costly solution.

Once it was discovered that MTU was developing gas engines with a torque curve very similar to that of a diesel engine, the option of using fixed pitch propellers (FPPs) was available and it was decided that the best solution was the MTU engine driving two Veth azimuth thrusters with contra rotating FPPs. However, it quickly became apparent that the engine delivery time did not meet the vessel construction schedule. The solution to this problem would be to ship the vessels from Vietnam to the Netherlands without the main engines, install the main engines and commission the LNG system after arrival in The Netherlands and then finish the testing and conduct sea trials.

There were also regulatory challenges to addess. The vessels are being built for inland waterways service to Lloyds Register (LR) class. The current applicable flag state regulations for a Dutch inland waterways ship is EU Directive 2006/87/EC. This regulation does not address the use of LNG as a fuel. From the start of the project this created uncertainty as to how to position the LNG tank in the vessel and what set of rules to follow in the design of the LNG fuel system particularity with regards to the categorisation of spaces and the providing of appropriate ventilation.

In order to provide a large, unobstructed vehicle deck, the decision was made from early concept to position the LNG tanks below main deck, one in each hull of the catamaran hull configuration. The only fully implemented set of rules for LR classed gas-fuelled ships is Lloyds Register's rules and regulations for the classification of natural gas fuelled ships (2015). These require an LNG tank placed under bulkhead deck to be located a distance of B/5 - here, some 3.4m - from the side shell. This is clearly impractical for a catamaran configuration where the inboard shell of each demi-hull is only 5.5m from the outer shell.

TANK PLACEMENT

Initially the LNG tank was positioned as far from the outer shell as possible along the lines of a previous LNG fuelled catamaran built to the HSC code. As the design progressed to a build contract the decision was made by the owner in conjunction with the Dutch flag authority to make use of new set of regulations for the LNG system which are awaiting implementation into Dutch Law. These regulations, ESTRIN edition 2015/1, are due to replace 2006/87/EU. These regulations prescribed a position for the LNG tank appropriate for catamarans configurations but requiring the introduction of a wing longitudinal bulkhead and a tank top into the space containing the LNG tank to offer protection from damage during a collision.

Whilst having a prescriptive set of rules to position the LNG tank is usually helpful to the designer, in these circumstances the design required modification and moving forward with two sets of regulations (LR Gas Fuelled and ESTRIN) has led to some ongoing technical challenges. The two sets of rules are similar in their approach in some areas but also differ in some key areas which has made compliance with both impractical at times. To our knowledge no example vessels have been build using the LNG aspects of ESTRIN.

Working with two sets of regulations and the risk-based approach to design required for LNG fuelled vessels leads to a more time-consuming design process than a designer might be used to for a conventionally fuelled vessel. It also requires regular contact with the authorities to ensure that the system design is acceptable and risks are being managed appropriately.

While the use of LNG as a fuel is not new and the rules for seagoing steel monohulls are now well developed, there is some way to go when the vessel deviates from this. In this project the vessel is non-seagoing, of multihull configuration, of aluminium construction and with the LNG tank below main deck. In this regards it sits somewhat awkwardly within the existing regulations, making it a pioneering but challenging project for all involved. MS