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New ships need approved DP2 and loading systems

Environmental, redundancy and safety requirements have shaped classification society notation development for shuttle tankers

by Martyn Wingrove

Shuttle tankers need specific class notations and surveys that are not required for other crude carriers. The unique requirements for these tankers involve offshore loading, deepwater positioning and the constant shuttling of cargoes to regional ports. There are also crewing requirements that can include meeting local manning levels and the logistics of crew changes.

According to BRL Shipping Consultants, Det Norske Veritas classes around 70 per cent of the world's shuttle tanker fleet (56 of a fleet of 81 tankers), so it has developed unique notations for these vessels. As shuttle tankers are constantly docking at offshore loading terminals, often in deep water, they require dynamic positioning (DP) with redundancy. DNV has various notations for DP shuttle tankers. The lowest level of DP is covered with Dynpos-AUTS and the highest, Dynpos-AUTRO, is for a DP3 vessel.

The first generation of shuttle tankers were DP1 with DNV's Dynpos-AUTS notation. These tankers have an automatic DP, without any redundancy. The majority of new shuttle tankers are DP2 with the Dynpos-AUTR notation. This means the tanker has a redundant DP system and an independent joystick for back-up. The redundancy is in the power system, thrusters and DP controls. Dynpos-AUTR covers the automation and instrumentation, DP monitoring, mode control selection, position reference systems and sensors and power management system. It ensures that failure mode and effect analysis (FMEA) and sea-trial testing have been carried out.

In response to recent improvements in DP technologies and energy efficiency requirements, DNV introduced the Dynpos Enhanced Reliability (ER) notation. It enables ship operators to be more flexible and fuel efficient in the way it structures the DP system. For example, it includes provision for variations in power systems with standby start-up capabilities and the seamless changeover of generators and thrusters. Dynpos ER includes additional autonomous functioning



DNV classed Teekay's Aframax shuttle tanker Navion Svenita

of thrusters and generator sets, and advanced protection systems for failure detection.

DNV also has the HELDK notation with four variants that cover the classification of helicopter landing decks, which many shuttle tankers require for rapid and regular crew changes. Work patterns are more aligned with offshore oil and gas working practices than other crude carriers, especially for shuttle tankers operating in the North Sea.

There are notations covering the different kinds of offshore loading systems, including one for bow loading, another for loading at single point moorings (SPM) and for receiving oil from submerged turret loading systems. Other important additional notations cover the control and recycling of cargo vapours, or volatile organic compounds (VOC), and the NAUT-AW and NAUT-OC that cover onboard systems for reducing the risk of groundings and collisions.

Shuttle tankers require a multitude of additional systems for charterer and environmental requirements, says DNV director of tankers Jan Koren. "There are charterer requirements, which are way beyond the international requirements, on shuttle tanker operations to reduce the VOC emissions. So operators have installed VOC plants to avoid these emissions and any loss of cargo," he explains.

"Teekay and Knutsen have added VOC recovery systems on their tankers. On the Amundsen-class shuttle tankers, Teekay

found an alternative to the older style, large and expensive VOC processing plant. Teekay increased the tank overpressure on the tankers to 0.75 bar instead of 0.25 bar of overpressure. Knutsen patented its KVOC recovery method to reduce the formation of VOCs during loading operations. Also shuttle tankers have CVOC, which mixes the tank atmosphere with some cargo oil then injects this back into the cargo to minimise the loss of cargo and emissions. The combination of all these systems on the Amundsen-class shuttle tankers had never been done before." It will be included in Teekay's next generation of shuttle tankers.

Class societies have also developed winterisation and ice-class notations that are aligned with future shuttle tanker operations in Arctic conditions. The opening of the Barents Sea to oilfield developments has led to orders for shuttle tankers to operate in sub-zero conditions for several months. Mr Koren says shuttle tankers working in the Norwegian side of the Barents Sea would need to be winterised, but may not need ice-class hulls as they are unlikely to encounter ice packs or icebergs.

"The winterisation requirements depend on where the shuttle tankers will be operating," he explains. "Winterisation is about what is above the water line and ice-class is about the hull and whether shuttle tankers will be operating with ice breakers. Winterisation depends on the minimum temperatures expected during their

operating lifetime. Spray from the sea on the superstructures can lead to ice formation on these structures, and thus the need to remove the ice. This can be done manually with hammers or using heating coils – electric or hot water/steam heating. There is also the possibility of using waste heat recovery to provide the required heating.” Mr Koren says shuttle tankers may need to heat ballast tanks if operations are in temperatures below -40°C.

“So the design of shuttle tankers needs to be tailored to the operations and trade they intend to go for. In the Barents Sea there are freezing temperatures, but no sea ice, so using winterisation is good enough. But if they will be operating in Greenland or eastern Canada then ice-class hulls are required”

ABS is the second largest classifier of shuttle tankers. It classed 17 tankers, including four ships operated by Overseas Shiphoulding Group (OSG), three tankers operated by Canship Ugland in eastern Canada, and tankers for Viken, Conoco, Chevron and ExxonMobil. ABS classed OSG’s *Overseas Cascade* and *Overseas Chinook*, which are assigned to Petrobras’ Cascade-Chinook deepwater oil project in the Gulf of Mexico. These are the first shuttle tankers to load crude from an FPSO in the US. They are US flagged, manned with US crews and were built at Aker Philadelphia shipyard to comply with the Jones Act.

There are specific notations for the helicopter decks, DP redundancy and loading systems. For example, ABS has notation for bow loading and SPM, and DPS-2 for a redundant DP system. The R2 notation is for tankers that are fitted with multiple propulsion and steering systems. The cross DPS-2 notation is for a tanker that has been fitted with DP that provides fully redundant automatic controls and is capable of automatically

SHUTTLE TANKERS BY CLASSIFICATION SOCIETIES			
class society	no	main owners	total dwt
DNV	56	Knutzen, Lauritzen, Teekay	6,338,683
ABS	17	Canship Ugland, OSG, Viken	1,595,133
LR	6	SCF, Neste, Knutsen	572,205
GL	2	Knutsen	71,499
total	81		8,577,520

Source: BRL Shipping Consultants (Data as of 1 December 2012)

maintaining the position and heading of the vessel within a specified operating envelope and under specified maximum environmental conditions during and following any single fault excluding a loss of compartment or compartments.

The ABS notation CRC is relevant if the tanker has an ABS-approved crane that has been constructed under ABS survey. A shuttle tanker with the SPM notation complies with OCIMF’s *Standards of equipment employed in the mooring of ships at single point moorings* for emergency towing arrangements and SPM arrangements, including bow mooring equipment.

ABS is classing two new Suezmax shuttle tankers under construction at Sungdong shipyard in South Korea for Tsakos Energy Navigation. These two 157,000 dwt tankers are scheduled to be delivered in the first and second quarters of 2013 and will be trading offshore Brazil for Petrobras. They will be under two 15-year time charters that combined could generate US\$520 million in revenues. In November, Tsakos ordered another Suezmax shuttle tanker from Sungdong for delivery in 2014. ABS is also classing Teekay’s Samba-class shuttle tankers that are under construction at Samsung Heavy Industries in South Korea and will be working for BG Group in Brazil.

Lloyd’s Register has experience in classing ice-class shuttle tankers that are dedicated to all-

round operations in the Russian Arctic. LR worked with Russian Maritime Register of Shipping (RS) in the generation of rules and the classification of double-acting tankers. These can sail stern-first through ice and bow-first through open seas, says LR’s technical manager for new constructions Robert Tustin. LR and RS classed SCF’s 2010-built *Mikhael Ulyanov* and *Kiril Lavrov*, which will be used to shuttle oil from the Pirazlomnoye production platform in the Pechora Sea to the *Belekamenka* storage and offloading vessel that is moored off Murmansk.

Experience in classing these tankers led to LR publishing the first dedicated rule set for stern-first ice-class tankers. The rules include a framework for creating load scenarios for operating in ice, says Mr Tustin. The rules consider tankers to be acting as both stern-first and bow-first for ice-class and navigation-related operations. For all other rules and regulations the tankers are considered as bow-first ships.

According to BRL, LR also classed two Neste-operated double-acting tankers, 106,200 dwt *Mastera* and *Tempera*. Germanischer Lloyd classed 2004-built, 35,692 dwt *Siri Knutsen* and 1999-built, 35,807 dwt *Betty Knutsen*. Its subsidiary GL Noble Denton provides independent technical reviews of FMEAs of DP systems and shuttle tanker bow loading systems. GL provides design and review, redundancy analysis and failure testing.

Korean Register of Shipping has not classed any shuttle tankers, but has worked closely with South Korean shipyards that are building them. It has DP system notations – DPS1, 2 and 3 – reflecting the various levels of sophistication. In addition, the minimum number of control systems, position reference systems and environmental sensors differ for each grade of DPS, KR says. For example, for DPS1 a vessel would need one set of automatic and remote control systems to maintain a desired heading. The automatic controls should be arranged to operate independently so that a failure in one control system will not render the other system inoperative. KR’s DPS1 notation also requires two sets of position reference systems and three sets of environmental sensors. A DPS2 has two sets of automatic control systems, three sets of position references, and multiple environmental sensors. This includes three sets for heading reference, another three for vertical reference and three ways to ascertain wind direction. **TS**



ABS-classed *Overseas Chinook* is one of the first shuttle tankers operating in the US Gulf