From Russia with LNG

Aspirations for Russian LNG
The three terminal development projects have resulted from the ambitions of potential importers and exporters wishing to trade Russian LNG to North American gas markets. These players will become increasingly reliant on Russia for the supply of LNG in the future, and the projects have therefore been met with enthusiasm from all quarters.

In Washington, D.C. in October 2005, Alexander Medvedev, Deputy Chairman of Gazprom, with responsibility for the company’s international activities, indicated that he saw Gazprom’s LNG activity in the US developing over time. “In the future... we will enable large-scale LNG deliveries from our own projects, namely Baltic LNG and Shtokman LNG,” he said.

When the agreement about commencement of the engineering design for the Baltic LNG project was announced in March this year, Ron Brenneman, Petro-Canada’s President and Chief Executive Officer observed: "LNG is going to be a big part of the future of the gas market in North America. As this project moves forward, we will be in an excellent position to import long-term gas supply...from Russia.”

At the current time, three gas export terminals are at the planning stages or already under construction in the harsh environments of Russia – one at Prigorodnoye, one near St. Petersburg and one near Murmansk. Liquefied natural gas (LNG) carriers will be required to serve each of these terminals, and all of them will need to be constructed with special features designed to help them operate in the ice and cold conditions that prevail.

The first ice-class LNG ships for Sakhalin Island service are now under construction to Lloyd’s Register class. What considerations have been taken into account during design of these ships for ice and cold operation, and what further considerations will be required as reliance on Russian gas reserves increases?
The first five ships for Sakhalin

Lloyd’s Register has been involved with the Sakhalin II LNG project from its early stages and has for some time been assisting shipbuilders and owners with the design and development of the ships that will export LNG from this first Russian LNG terminal. A total of five LNG ships are now on order or under construction to Lloyd’s Register class and will eventually serve the gas export terminal at Prigorodnoye in Aniva Bay.

Three of these ships are being built in Japan, employing a Moss-type independent tank containment system. The hull construction has been designed to Finnish-Swedish ice class 1B standard and the propeller and line shafting to Russian Maritime Register of Shipping (RMRS) ice class LU2 standard. Lloyd’s Register will issue a letter of compliance for the application of the RMRS standard, as well as certifying that the winterisation features meet the technical specification. Two of the vessels are being constructed at Mitsubishi Heavy Industries (MHI) for a joint venture between Sovcomflot and NYK Line; the other is being built at Mitsui Engineering & Shipbuilding (MES) for a joint venture between Primorsk Shipping Co, MOL and K-Line. All of these vessels are being built for long-term time charter to Sakhalin Energy for LNG export service to Japan, as well as to the west coast of the US.

The other two Sakhalin ships will be built to Lloyd’s Register class in Korea: one at Hyundai Heavy Industries (HHI) employing the Technigaz Mk III membrane containment system and the other at Daewoo Shipbuilding and Marine Engineering (DSME) employing the Gaz Transport NO96 membrane containment system. The latter of these two vessels is for Korea Line and will deliver LNG from Sakhalin on long-term charter to the gas receiver KOGAS.

Both of the Korean-built ships will have RMRS ice class LU2 standards applied to the hull, propeller and shaft line. Drawings for the ship to be constructed at HHI have recently received RMRS approval, and an ice certificate and certificate of engine power have been issued by the Central Marine Design and Research Institute (CNIIMF) and approved by the Russian Ministry of Transport (ROSMORNEFT).

Beyond the first five ships

Lloyd’s Register has kept abreast of the projects planned for gas export from Russia, and has an in-depth understanding of the technical challenges that might materialise for the LNG carriers designed to ply these trades in the future. Each new project will have its own special characteristics in terms of the ice and cold regime, and specification of new ships will require careful consideration if they are to meet the challenges presented.

Baltic LNG project

With a gas export terminal near St Petersburg and a gas receiving terminal likely at Gros-Cacouna, Quebec, the LNG carriers for this trade will need to be designed for first-year sea ice conditions in the Gulf of Finland, as well as the Gulf of St Lawrence. It is likely, then, that the ice-class standard selected to strengthen the hull, propeller and shaft for the intended service, as well as the standard of power installed, will need to be a hybrid of the requirements applied by the national and port authorities of both Canada and Russia.

As seasonal sea ice conditions are generally more severe at St Petersburg than those prevailing in Aniva Bay, with a longer sea ice season of 120 days compared to 95 days on average, a higher standard of ice class is also likely to be necessary for ships built for this trade. A lower standard of ice class might be applied, however, if the ships are to have dedicated ice breaker support, giving them access to ice management and assistance where necessary.

The Three Russian LNG Terminals

Sahkalin II LNG project: Prigorodnoye terminal

At this terminal, a two-train gas liquefaction plant with an annual capacity of 9.6 million tonnes is currently under construction by Sakhalin Energy. The terminal is located on the shores of Aniva Bay at the southern end of Sakhalin Island and first-year ice conditions prevail.

Baltic LNG project: terminal near St. Petersburg

Earlier this year, Petro-Canada and OAO Gazprom announced an agreement to proceed with the initial engineering design required to build a Baltic gas liquefaction plant near St Petersburg. It is envisaged that supply from this Baltic LNG plant will be shipped to Petro-Canada’s LNG regasification facility in Gros-Cacouna, Quebec. First-year ice conditions prevail both at the gas exporting and the gas receiving terminals.

Shtokman LNG project: terminal near Murmansk

Development of a gas liquefaction plant near Murmansk is planned early in the next decade as part of the Shtokman field development. This plant is expected to produce up to about 15 million tons per year of LNG for export to the American market.
A satellite photo of the western Kara Sea during the winter of 2002 shows that the probable routes for Arctic LNG ship operations will take place in ice-bound waters. (Photo courtesy of NASA: Visible Earth web site.)

However, it is conceivable that these ships might be required for transportation of LNG to a gas receiving terminal in the Gulf of St Lawrence, where first-year sea ice is experienced, and it may be advisable to take this into account when the ships are specified and designed.

The Barents Sea is characterised by a combination of severe wave conditions in a cold environment, and a particular characteristic of any exporting LNG ships will be their high degree of winterisation – particularly with regard to features designed to combat deck icing. For year-round open-water service in the harsh Barents environment, special attention will also need to be given to hull and cargo tank design to ensure that fatigue-inducing wave load considerations are taken into account.

Looking further ahead
If exploitation of gas fields in ever more remote locations continues, there will be a need for LNG vessels that are equipped to perform in even more extreme conditions and multi-year ice. Vessels serving the harshest parts Russia’s Western Arctic, which contains what are thought to be among the world’s largest natural gas reserves, will have to be constructed to a much higher ice class than the Sakhalin ships currently being built, and fresh design approaches are likely to be necessary.

An indication of what form such Arctic LNG carriers might take can be gleaned from recent developments in large LNG carrier design and propulsion and from the large ice-class double-acting tankers that have been produced. It is highly likely, though, that they will incorporate technologies and solutions that we have not seen in the LNG industry to date and, with the development of shuttle LNG ships also now a distinct possibility, we may also see changes in the commercial and operational aspects of LNG delivery when the Russian reserves begin to be exploited fully.

Currently classing more LNG ships than anyone else, and with over 1,000 ships totalling in excess of 11 million gt having been built to Lloyd’s Register ice class over the past 25 years, Lloyd’s Register has vast experience of LNG and ice-class vessels. Coupled with our extensive knowledge of ice and cold operations and our unique involvement in Arctic maritime research, this experience enables us to provide advice of the highest quality on ice class and winterisation issues. We look forward to helping owners, operators and yards with the technical specification, design and construction of the Arctic LNG carriers of the future.

Source: www.lr.org
Ice Focus April 2006
Robert Tustin, Technical Manager–New Constructions