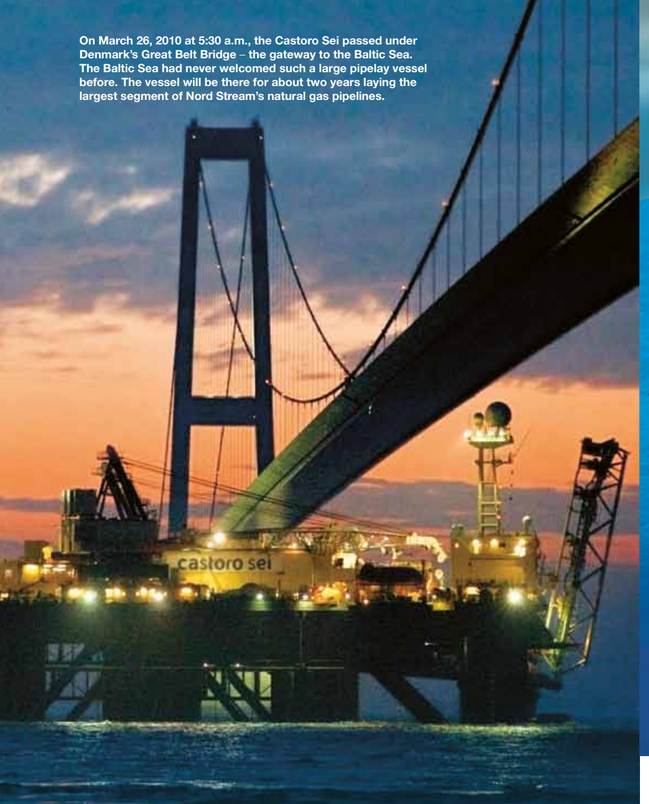


On March 26, 2010 at 5:30 a.m., the Castoro Sei passed under Denmark's Great Belt Bridge – the gateway to the Baltic Sea. The Baltic Sea had never welcomed such a large pipelay vessel before. The vessel will be there for about two years laying the largest segment of Nord Stream's natural gas pipelines.

Working 24/7 to Make the Pipeline a Reality

There are pipelines all over the world, but the Nord Stream Pipeline project is considered unique. Why is this?
Ruurd Hoekstra: At about 1,220 kilometres, this is one of the biggest infrastructure projects ever in the Baltic region. The two lines that make up the Nord Stream Pipeline system will require 200,000 pipes. Additionally, many contractors are involved in the project.

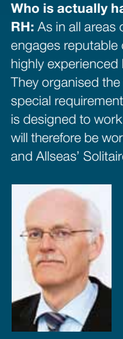
For example, for several months in 2010, three pipelay vessels will be working simultaneously at different locations, around the clock, seven days a week. Meanwhile, surveys, rock placement and landfall construction will be ongoing. To keep track of all operations and to guarantee that every day more than 1,000 people can work safely, we comply with the highest international standards.

What about environmental measures?
RH: We know that the Baltic Sea's environment is extremely sensitive, so we must work meticulously to ensure minimal impact throughout construction. This starts with the planning of a sophisticated pipelaying schedule to meet environmental restrictions while enabling the construction vessels to work as efficiently as possible. We took many factors into account to achieve this. For example, we planned construction so that no ice-breaking will take place during critical breeding periods for seals and to avoid important fish spawning periods.

The logistics behind the construction of the pipeline is also complex.
RH: Very. We assessed over 60 harbour sites but only five suited as viable locations along the Baltic Sea coast, considering our aim of minimising transport distances. Approximately 100 million euros were invested in building up the infrastructure required in these five ports, which are located no more than 185 kilometres from the route. This means that the delivery of pipes, from port to the pipelay vessel and back, takes no longer than one day.

How much time do you spend on the vessels overseeing the work?
RH: Personally, I will be overseeing the work of all vessels from our head office in Zug, Switzerland. All aspects of construction are coordinated from Zug. On board each vessel, Nord Stream is represented by a client delegate. Their task is to oversee all aspects of construction on the vessels and to report daily on activities. Periodically, I will also visit the construction sites and vessels.

Who is actually handling the pipelaying?
RH: As in all areas of the project, Nord Stream engages reputable contractors, in this case the highly experienced Italian contractor, Saipem. They organised the three laybarges; two with special requirements. Saipem's Castoro Dieci is designed to work in the shallow waters, and will therefore be working off the German coast, and Allseas' Solitaire – the biggest pipelaying vessel in the world – will be working in the Gulf of Finland. This vessel positions itself with thrusters, rather than anchors, ensuring minimal risk of contact with any dumped munitions in that region. The other laybarge, the Castoro Sei, is doing the bulk of the work. Saipem upgraded both Castoro vessels to prepare them for work on the Nord Stream project.



Ruurd Hoekstra, Deputy Project Director Construction, Nord Stream

Who verifies what Saipem is doing?
RH: Every activity is monitored and tested by the independent Det Norske Veritas, an Oslo-based foundation. They advise on risk assessment and risk management in all areas of the maritime industry. Their standards, procedures and certification are recognised internationally.

Building an Offshore Pipeline

Specialised vessels are now constructing the Nord Stream Pipeline – a major feat of engineering

Nord Stream
The new gas supply route for Europe

Nord Stream AG

Nord Stream AG is an international consortium of four major companies established for the planning, construction and subsequent operation of an offshore natural gas pipeline through the Baltic Sea. The majority shareholder OAO Gazprom holds a 51 percent stake in the pipeline project. Leading German energy companies Wintershall Holding GmbH and E.ON Ruhrgas AG hold 20 percent each, and the Dutch natural gas infrastructure company N.V. Nederlandse Gasunie holds a 9 percent stake. The combined experience of these companies ensures the best technology, safety and corporate governance for this project, which aims to provide secure energy supply for Europe.

The Nord Stream Pipeline through the Baltic Sea is the most direct connection between the vast gas reserves in Russia and energy markets in the European Union. When fully operational in 2012, the twin pipelines, each about 1,220 kilometres long, together will transport about 55 billion cubic metres of gas a year – that's enough to satisfy the energy demand of more than 26 million European households. The European Parliament and Council designated the project as being of "European interest". This status is given to projects that strengthen markets and reinforce security of supply.

Contacts

For more background information, visit our website at:
www.nord-stream.com

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Solitaire

> The Allseas' Solitaire is the world's largest pipelay vessel. This vessel will be working in the Gulf of Finland. Allseas has been subcontracted by Saipem for the Nord Stream project.

Facts and Figures

The precise manoeuvring of a fully dynamic positioning system enables the Solitaire to work without anchors, ensuring additional safety in the congested Gulf of Finland. This system is also advantageous for this area due to the number of mines that were deployed there during the First and Second World Wars.

The Solitaire was built in 1972 in Japan and was used for transporting goods, until it was purchased by the Swiss-based Allseas Group in 1992 and converted into a pipelay vessel. It has been operating as a laybarge since 1998, and has deep water pipelay record of 2,775 metres. It is scheduled to lay a 342.5-kilometre long segment of each of the pipelines.

- Length excluding stinger: 300 metres
- Length including stinger: 367 metres
- Breadth: 41 metres
- Operating draught: 6.5 to 9.2 metres excluding thrusters; 14.3 metres including thrusters
- Transit speed: 13 knots
- Dynamic positioning system: NMD Class 3 / LR DP (AAA), type Simrad Kongsberg 2 x ADP702 & 1 X ADP7013
- Accommodation: 420 people
- Layrate of Nord Stream Pipeline: about 2.4 kilometres a day

The Solitaire, at about 300-metres long, is the biggest laybarge in the world.

Castoro Dieci

> Saipem's Castoro Dieci is a flat-bottomed laybarge with low draught, which enables it to work within the near-shore segment of the parallel pipelines in German waters.

Facts and Figures

The Castoro Dieci will be operating in the shallow waters within Germany's Greifswalder Bodden, an area inaccessible to large pipelay vessels. The Castoro Dieci is able to work in these waters because it has less draught, which is the vertical distance measured from the lowest point of a ship's hull to the water surface. With no means of self propulsion, the vessel relies on towing and anchor winching for travelling and manoevering. Its 8-point mooring system enables it to maintain accurate positioning during pipelaying. The Castoro Dieci was built in 1976 and is owned by Italian-based Saipem, a leading offshore pipeline construction company. It will be laying the shortest segment (28 kilometres) of each of the twin pipelines.

- Length excluding stinger: 139 metres
- Length including stinger: 165 metres
- Breadth: 37 metres
- Operating draught: typically 5.2 metres
- Mooring system: 8 anchors, 7 tonnes each, 58 millimetre diameter anchor wires
- Accommodation: 170 people
- Layrate of Nord Stream pipelines: about 500 metres a day

The Castoro Dieci is ideal for pipelaying in shallow waters.

Making of: From Pipes to Pipeline

> In April 2010, Nord Stream began constructing the first of its two natural gas pipelines through the Baltic Sea. The Nord Stream Pipeline system will deliver natural gas from Russia's vast reserves to Europe's ever-growing energy market via the European gas network.

The Nord Stream Pipeline is a major feat of engineering, involving complex logistics, along with suppliers and contractors from all over the world. The project consists of two pipelines running almost parallel to one another. Each of the approximately 1,220-kilometre pipelines will be made up of about 100,000 pipes. The first line will be transporting gas in 2011. That same year, Nord Stream's contractors will begin laying the second pipeline, which will be on stream by late 2012. Pipelaying activities for the first pipeline began in April 2010 in the Swedish Exclusive Economic Zone, about 60 kilometres off the coast of the Swedish Island of Gotland, at a point located 675 kilometres from the pipeline's starting point near Vyborg, Russia and 549 kilometres from the end point at Lubmin near Greifswald, Germany.

How It's Done

Along the pipeline route, five existing harbour sites will supply pipes on a continuous basis to the laybarges owned and operated by Nord Stream's contractor, Saipem, and its subcontractor, Allseas. Three vessels will be used to complete the pipelines, working at different segments of the route. Construction of the pipelines is scheduled to minimise environmental impacts. For example, so as not to interfere with critical seal breeding and fish spawning seasons.

In preparation for pipelaying, the seabed is surveyed with a remotely operated vehicle (ROV) to ensure pipelay safety and to confirm the previous seabed data gathered during the lengthy route planning phase. Additionally, in some locations along the route the strategic placement of coarse gravel is necessary to create a stable base on which the pipeline can rest. Gravel will be transported and placed by dedicated rock placement vessels to the specific locations where support is required prior to pipelaying.

On board the pipelay vessels, the construction cycle is made up of several steps including bevelling, welding, testing and the lowering of the pipeline onto the seabed (refer to the pipelaying graphic on the back of this pamphlet). There are exact procedures defined for each process to ensure quality and compliance with health and safety regulations. Following the laying process, the pipeline is again monitored underwater by ROV to ensure correct positioning. After completion of the construction works, the three pipeline segments will be flooded with water and pressure tested to ensure mechanical integrity. Then the pipeline segments will be connected by welding them underwater. Once connected, the pipeline will be emptied of water, then filled with nitrogen before gas is safely introduced. From 2011, gas transport to Europe will start.

Castoro Sei

> Saipem's Castoro Sei is scheduled to lay about 70 percent, or 853.5 kilometres, of each of the two pipelines. It started working in April 2010.

Facts and Figures

The Castoro Sei pipelay vessel was refurbished and upgraded to prepare it for the Nord Stream project. Each piece of equipment was tested in port and again tested in the Baltic Sea prior to the start of pipelaying in April 2010. The Castoro Sei, built in 1978, is owned by Saipem, an Italian company with extensive offshore pipelay experience in shallow and deep waters.

In transit, the vessel is usually towed by two tugs. During construction, it is positioned by means of a 12-point mooring system. The vessel, which is semi-submersible, floats on twin pontoons that can be submerged by adding ballast water, making the vessel more stable in turbulent seas.

- Length excluding stinger: 152 metres
- Length including stinger: 193 metres
- Breadth: 70.5 metres
- Operating draught: typically 14 metres
- Mooring system: 12 anchors, 25 tonnes each, 76 millimetre diameter anchor wires
- Accommodation: 330 people
- Layrate of Nord Stream pipelines: about 2.5 kilometres a day

The Castoro Sei positions itself with a mooring system and thrusters.

Nord Stream Pipeline Construction

> In April 2010, Nord Stream began installing the first of its two natural gas pipelines through the Baltic Sea. Construction started in Swedish waters with the Castoro Sei, the laybarge that will handle the majority of the job. Another two vessels will work on sections within the Gulf of Finland and at the German landfall.

From Vyborg in Russia to Lubmin near Greifswald, Germany, each pipeline runs about 1,220 kilometres along the Baltic seabed. Once fully operational, they will transport 55 billion cubic metres of natural gas a year – enough to satisfy the needs of 26 million European households. Nord Stream has commissioned Saipem, a leading Italian offshore project company, with the construction of the pipelines. About 70 percent of each of the pipelines will be laid by Saipem's Castoro Sei, a moored pipelay vessel. In the Gulf of Finland, the Allseas' Solitaire, a laybarge that can position itself without the use of anchors, will be used in this area known for dense ship traffic and historic sea mines. Each vessel is a floating factory where pipes are received from carrier vessels, welded together and then laid at an average pace of about 2.5 kilometres a day. In the shallow waters near the German landfall, Saipem's anchored, flat-bottomed Castoro Dieci will lay an average of 500 metres daily. Once completed, the pipelines will be subjected to rigorous testing before gas can be transported. From the receiving terminal in Lubmin, the gas will enter the European gas grid where it will reach consumers in countries such as Denmark, France, Germany and the UK.

Construction Schedule for the First Pipeline

From April 2010, vessels will work 24 hours a day, seven days a week to construct the first of the two pipelines. The schedule takes many environmental factors into account. For example, installation will not take place during seal breeding and fish spawning seasons.

Helipad
Personnel is transferred to and from the vessel via helicopter, which lands on the helipad at the stern of the Castoro Sei.

Pipe Carrier Vessel
Pipes weighing about 22 tons each are shipped to the laybarge from five stockyards strategically located along the route.

Crane
Two cranes that fully revolve and travel on rails on the main deck. Each can lift up to 200 pipes a day onto the barge.

Stinger
The stinger provides support to the pipeline as it is progressively lowered to its designated place on the seabed.

Pre-Pipelaying Survey
Though the seabed was surveyed during the route planning phase, a pre-pipelaying survey performed before pipeline installation confirms past data and ensures pipelay safety.

Post-Pipelaying Survey
As it touches down on the seabed, the pipeline is monitored to ensure that it is correctly positioned.

ROV
A remotely operated vehicle (ROV) fitted with sensors and instruments including cameras transmits information from the seabed directly to the survey vessel.

S-Curve
As the pipeline is lowered to the seabed, it forms an "S" shape, which prevents it from being damaged during installation.

Rock Placement
The strategic placement of coarse gravel is necessary in some locations along the route to create a stable base on which the pipeline can rest.

Pontoons
The Castoro Sei floats on twin pontoons located below the water surface. The pontoons can be submerged by adding ballast water, making the vessel more stable in turbulent seas.

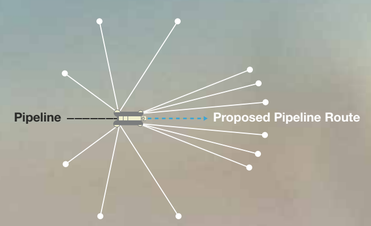
Castoro Sei Laybarge

Saipem's semi-submersible Castoro Sei pipelay vessel has an extensive track record of installing complex pipeline systems in deep and shallow waters. It will lay 70 percent of each of the pipelines.

- 152-metres long, 70.5-metres wide
- Operating draught (typically): 14 metres
- Nord Stream Pipeline lay rate: Circa 2.5 kilometres daily

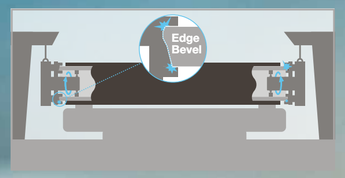
Anchor Pattern

During construction the Castoro Sei is positioned by means of a 12-point mooring system. This system enables it to maintain accurate positioning. Each of the 12 mooring lines, or anchor lines, are controlled by a tension winch weighing 124 tons. The vessel also features thrusters to further ensure precise positioning.

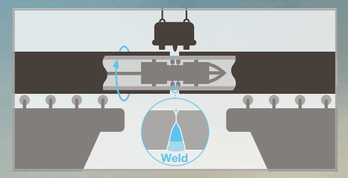


Pipelaying Process

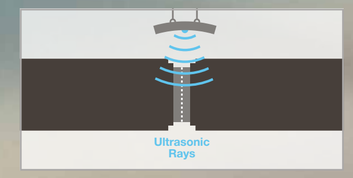
1 The pipes are unloaded from the pipe carrier vessels and stacked on the storage areas on each side of the laybarge. Pipes are delivered regularly to ensure that there are always enough supplies on board to maintain the 24-hour construction schedule.



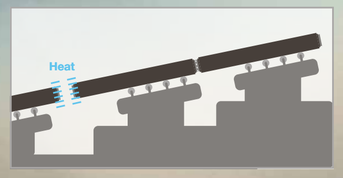
2 To prepare the pipes for welding, the ends are bevelled to make them exactly the right shape to be fitted together. The inside of the pipe is then cleaned using compressed air before it is conveyed to the double-joint welding station.



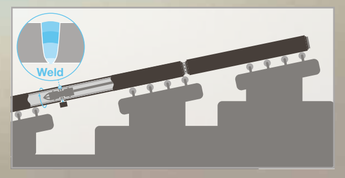
3 At the double-joint welding station, two bevelled, 12-metre pipe joints are aligned and welded together to create a double-joint segment measuring 24 metres. These double-joint sections will later be connected to the main pipe string.



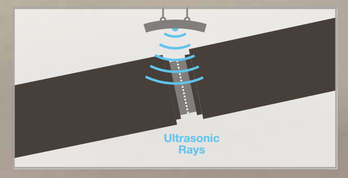
4 The double-joint is moved to the non-destructive testing station where every millimetre of the weld undergoes ultrasonic testing to detect any unacceptable flaws. If required, the defect will be repaired and the weld rescanned to meet international quality standards.



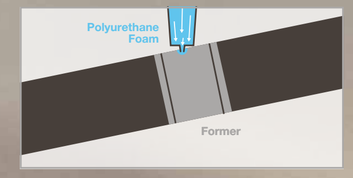
5 Following non-destructive testing, the double-joint is moved in a pipe elevator to the central assembly line, or "firing line". There, the insides are checked for debris. The ends of the double-joint are then pre-heated in preparation for welding onto the main pipe string.



6 The prepared double-joints are now joined to the end of the pipeline in a semi-automatic welding process. Qualified welders oversee each of the steps to ensure that welding procedures meet Nord Stream's and authority approved quality standards.



7 The weld of the double-joint that has been welded onto the main pipeline also undergoes ultrasonic testing at another non-destructive testing station. Any unacceptable flaws will be repaired, and the weld rescanned so that it meets international quality standards.



8 Once the weld is confirmed acceptable, a corrosion-resistant, heat-shrink sleeve is applied around its entire circumference. Then, polyurethane foam is poured into a mould surrounding the weld area. This foam hardens, providing further protection.

Infographic produced by KircherBurkhardt, April 2010
Pipes shown in yellow for clarity.

Nord Stream
The new gas supply route for Europe