

The traditional method for installing offshore pipelines in relatively shallow water is S-Lay. The pipe moves in a horizontal plane through the welding and inspection stations and across the lay barge's stern. The pipe is then supported by a truss-like stinger which controls the deflection in the over-bend and prevents buckling. The pipe is fed progressively over the stinger as the lay vessel goes forward.

The problem is that if a general purpose ship has to be converted for pipelay, this essentially means excising the stern of the ship, often taking with it, the original propulsion system.

Amongst Allseas' fleet are two dynamically positioned pipelay vessels, *Lorelay* and *Solitaire*. When the company recognised the market opportunity for a new pipelay vessel with a capacity between the two, to be called *Audacia*, it looked for a bulk carrier conversion.

To solve the stinger/propulsion system position conundrum however, Allseas came up with a novel idea of relocating the stinger to the bow and leaving the steering and propulsion system at the stern intact.

The *Audacia* design has a 106m stinger. The 770t, three-section steel stinger is strong and rigid enough to carry a pipeline length to 3500 m water depth. Allseas tried a number of different designs before selecting the final layout concept.

The stinger is suspended from a frame over the vessel's bow. This consists of four compression and four tension members as well as two transverse girders. The frame is 57m long, 13m wide and 27m high. It is integrated in the vessel's bow structure with an inclined firing line ramp.

To avoid impact with the water in extreme weather conditions, the stinger tip can be lifted to a height of 40m above sea level.

The pipes are assembled welded, tested and coated in the firing line running from the stern to the bow on the vessel's centre line. It consists of eight welding stations,

an x-ray testing station, two pipe-coating stations and three tensioning stations. Three 175t tensioners keep the pipeline under tension to prevent pipeline buckling. They clamp the pipe and increase tension with weight or water depth.

### Weather

Rough weather may prevent the dynamic positioning (DP) system from doing its work properly, forcing the vessel to head for a safe harbour, which means that the partly finished pipeline must be abandoned. *Audacia* therefore features two 550t abandonment and recovery (A&R) winches, which are used to lay down and pick up the pipeline on the seabed.

The pipeline is closed at the end with a plug connected to a heavy steel cable. The A&R winches use the cable to lay the pipeline onto the sea bottom, assuming power from the tensioners make sure that the correct tension is carefully maintained on the pipeline preventing pipe rupture. A buoy indicates the position of the unfinished pipeline so that the A&R winches can pick up the pipeline and resume pipe laying.

### Construction

Throughout 2006 and 2007, the 74,000 dwt Panamax bulk carrier *Geeview* underwent conversion to the *Audacia* at the Dutch shipyard Keppel Verolme in Rozenburg near Rotterdam. The Chinese-built bulk carrier has a length of 225m, a 32m width and at a draught of 8m. This hull is large enough to accommodate two pipe transfer cranes and four pipe storage holds as well as the firing line. The holds can store standard lengths of 12m in many varieties, up to a maximum diameter of 60in, transported by overhead crane.

*Audacia* has the capacity to lay 7 km of pipeline per day and can work at depths up to a maximum of 3000m. The total project costs have been put at €350 million.

A very useful attribute to any service vessel is its sailing speed from one job to another worldwide. Converted pipelaying vessels with their stinger astern, rely on azimuthing propellers. While these have seen rapid improvements in recent years, they are still only able to achieve lower speeds.

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The retention of the diesel engine and shaft and gearbox and the original propeller however, means that the *Audacia* can reach high sailing speed of 16kts.

### Dynamic Positioning

Another important feature of a modern pipelaying vessel is its DP capability. The *Audacia* has a ship management system incorporating automatic speed and position control, navigation and communication systems.

It uses four reference systems: Differential Global Positioning System (DGPS), radar (only if a fixed reference point exists nearby), HiPap (operating through sound signals from beacons on the sea bottom), and Tautwire (detecting ship movements by a tightly stretched cable fixed to a

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The Audacia with its bow stinger

heavy weight on the sea bottom). If even a minor deviation from the position, speed or direction is detected, an automatic correction is made to allow the vessel to follow a pre-programmed pipeline path on the sea bottom with accuracy. In addition to the original 10 500 kW propulsion system, the dynamic positioning system required two new engine rooms, each with three 5850 kW Wärtsilä FS3500 marine diesel units.

Pipe-laying employs six 5000 kW azimuth thrusters, each with a 80t bollard pull. When in sailing mode however, they can be retracted to reduce resistance.

For the ship's power, there are also six diesel generators (11 kV, 8,000 kVA), connected to two main switchboards with six transformers for the electrical power and four for the cranes, welding machines and lighting. Because of the high power demands of the various pieces of equipment, Automatic power distribution is essential.

The Audacia is now ready to commence its work. This year three of Allseas' pipe laying vessels will start laying gas pipelines in the Bay of Bengal with a total length of 313 km at a depth up to 1200m.

Audacia will start here together with the pipe laying vessels Lorelay and Tog Mor.

## Pieter Schelte - The project commences

For a number of years, Allseas has been waiting for suitable market conditions to improve in order to begin the construction of its vessel *Pieter Schelte*. It now seems that the time has arrived.

The innovative twin hull tanker sized vessel was originally designed to satisfy the predicted decommissioning market as it was developed for removing the entire topsides of some of the larger integrated deck platforms from its bow, while lifting the jacket over its stern.

A number of factors such as improvements in production technology and the use of existing structures to provide

production support for increasingly long distance tie-backs, has delayed this anticipated abandonment boom. This allowed the designers at Allseas to incorporate platform installation and pipelay facilities into the design.

Allseas has now determined that the time for the project has arrived and has placed orders for long lead items.

The delivery of eight diesel engines with generators sets, providing the vessel with 95 MW total installed power, was awarded to MAN. The second main award was for the delivery of the twelve thrusters was awarded to Rolls Royce.

This equipment is to be supplied

by end 2009, on schedule for the targeted delivery of the completed ship by 2011.



The Pieter Schelte removing a platform