The first successful high seas lift has already been carried out with the lifting system for offshore platforms aboard the Pioneering Spirit. In August 2016, the ship launched the first tests at sea. And successfully, which led the Pioneering Spirit to Norway where the 13,500-tonne Yme mobile offshore production platform was dismantled. Less then a year later, Shell's Brent-Delta platform was delivered back to land. Never before was such a large platform removed by one ship. The 24,000-tonne topside of the platform was lifted at the end of April 2017; it took only ten seconds to completely lift the platform. A world record in the field of lifts!
The Pioneering Spirit is a unique ship from Allseas. Allseas is a Swiss offshore company with an engineering and project management office in Delft and is one of the world’s largest companies in the field of installation of offshore pipelines and associated subsea constructions. The Pioneering Spirit is the largest ship in the world. Its dimensions are as big as two super tankers and in area equal to eight football pitches. In addition to installing and removing topsides and substructures of large offshore platforms in one piece, the vessel is also deployed to install large pipelines for oil and gas transportation. In close cooperation with Allseas, Iv-Consult has been working on Allseas’ test platform and the Tilting Lift Beams design of the Jacket Lift System (JLS). Iv-Consult has also been involved in the design of the Stinger.

Project Manager Michael de Zwart calls the design of the JLS ‘special.’ ‘It’s purely about research and development; when everything is new it makes it challenging and unique! Cooperation between Iv-Consult and Allseas was crucial, and was successful! We worked hard with a team from different disciplines.’

A new life for the test platform

For the installation and removal of offshore energy or production platforms and topsides, Allseas’ vessel Pioneering Spirit is equipped with the Topside Lift System (TLS). Iv-Consult worked on the design and engineering of the removable steel test platform, consisting of a jacket substructure on suction caissons and a separate steel topside with water ballast.

For testing the functionality of the TLS beams Iv-Consult designed two structures. The first structure is a full scale single beam steel foundation at the Keppel Verolme yard in the Bosphor in Rotterdam for testing on shore. The second structure is the already referred to test platform for testing the TLS beams following installation on board of the Pioneering Spirit. ‘A test installation design for such a complex ship is not easy,’ says Lead Engineer Jan de Graaf. ‘Up until the very last moment, the design and operation have been adjusted and optimised. I really like the last minute quick switches!’

The TLS consists of 2 sets of 8 retractable, motion compensated lifting units that are installed on both bows of the vessel. Together, the 16 beams are able to support, lift and install platforms up to 48,000 tons of weight in one single lift. The function of the test platform is to work as a platform mule for the TLS system to simulate real life (de-)installation scenarios. Special feature is that the jacket substructure and topside of the platform are assembled from parts of an existing N.W. Hutton Field production platform (build in 1980). The original structure was divided in a midsection and two equal end sections. The midsection formed the basis of the topside; the end sections were twisted, welded together and extended with a newly designed steel structure to form the basis for the jacket substructure. Michael: ‘The test platform is also very durable. After all, tons of steel have been reused from other platforms and buoyancy tanks that would otherwise be disregarded.’

On top of the topside platform four buoyancy tanks, filled with water, are mounted that are used for ballast and testing weight. For the (de-)installation of lifting equipment and the operation of the ballast tanks, (boat) platforms and ladders are attached to the legs, between the topside platform box girders and on top of the tanks. Yoke connection provisions are designed below the outer parts of the box girders and leg meeting units (LMUs) are integrated in the lower part of the legs to form the connection with the supporting jacket substructure.

After completion of harbour and offshore trials with the topside in the beginning of August 2016, Pioneering Spirit successfully fulfilled her first real jobs with the TLS: the removal of Repsol’s Yme MOPU platform and removal of Shell’s Brent Delta platform topside. But these successes do not mean the end for the test platform: After all, from every operational effort, new experience is gained and the need for updating and testing of the system remains. Therefore in the beginning of May 2017 the test platform was reinstalled again at the original location in the North Sea. There it will stay in function until 2019 or 2020 waiting for the Pioneering Spirit to do her testing activities with the TLS.

Much bigger than we think

If we think of a test model, we think of a small model that is by no means large. The test platform, on the other hand, is of a very different category. Think of big, bigger, and biggest. The 60 metres length of the Allseas test platform is comparable to a building of almost 17 floors.
Maritime

Beams of the Jacket Lift System similar to the Euromast
One of the main contributions of Iv-Consult in its collaboration with Allseas for the Pioneer Spirit consists of the construction design of the Jacket Lift System (JLS), including all connectors for external interfaces. In addition to the levers, Iv-Consult was also involved in the design of the tailpiece. Each beam of the Jacket Lift System has a length comparable to the height of the Euromast in Rotterdam. Iv-Consult has gained its rich experience through design of specialised and innovative constructions. For the design activities, a comprehensive automated BIM environment has been created, showing all links with third parties. The BIM environment is used for clash checks, optimisation of structures, routing of electrical systems, instrumentation and maintenance and manufacturing processes. It always shows the latest information. As a result, the whole process functions more efficiently.

Stinger
From the beginning, Iv-Consult was also involved in developing the stinger. Allseas implemented the design and Iv-Consult played a role in producing the detailed design as well as of certain parts of the stinger. The drawings were carried out at the Allseas offices in cooperation with Allseas engineers. The stinger has an overall length of approximately 140 metres and consists of three sections, each with a length of around 50 metres. The stinger sections can hinge in relation to each other to create a rough curve (polygon). Five or six roller boxes are fitted to each section of the stinger. Each roller box is individually adjustable in height. This enables the required pipe curve to be created.

The stinger must be accessible at all times for settings, inspections and maintenance, even on the open sea. This required the fitting of large numbers of stairs, ladders and walkways in order to reach all points safely.

The Pioneering Spirit can continue working even in heavy weather, with the stinger extending far in front of the ship below the water line. The stinger and the walkways on it are capable of withstanding the large hydrodynamic loads that occur under these conditions. These accesses were developed by Iv-Consult in close consultation with Allseas. Iv-Consult used the Inventor software program at its Papendrecht office to work out the detailed designs for many of the accesses.

Length of each beam of the JLS is comparable to the height of the Euromast

Ins en outs of the Pioneering Spirit
The twin-hulled vessel is 382 metres long and 124 metres wide. At the bow is a slot, 122 metres long and 59 metres wide, that enables Pioneering Spirit to straddle a platform and remove entire topsides (up to 48,000 tonnes) in a single lift using eight sets of horizontal lifting beams. Two tilting lift beams for the installation and removal of jackets (up to 25,000 tonnes) will be located at the vessel’s stern. Complementing the lifting systems is a 5000 tonnes special purpose crane for additional lifts such as lighter topsides and jackets, modules and bridges.

As a result of her unique lifting capacity, Pioneering Spirit will significantly reduce the amount of offshore work associated with platform installation or decommissioning, largely moving this work to shore, where it is cheaper, safer and more environmentally friendly.

Iron Lady and Bumblebee aboard the Pioneering Spirit
Ever heard of the Iron Lady and Bumblebee? Both can be found aboard the Pioneering Spirit. Of course, this is not about former British Prime Minister Margaret Thatcher nor is it about the popular character from the hit movie Transformers. Iron Lady and Bumblebee are two large pontoons especially built for the transfer of jackets and topsides to and from the Pioneering Spirit. Iron Lady (200 metres long and 57 metres wide with its relatively shallow draught) will enable loading and unloading of structures to and from the yard when the water depth at the quayside is insufficient for the Pioneering Spirit. The transfer of structures between Pioneering Spirit and Iron Lady will take place in sheltered water close to the yard. When the Pioneering Spirit is deployed to place or remove topsides from platforms, the stinger is removed from the bow section and brought on board the Bumblebee, a pontoon especially built for this purpose.