Summary

From the 1960's a lot of offshore structures were placed in the North Sea. Oil companies got only permissions to place them provided that they would be removed at the end of the technical or economical lifetime. Now more and more platforms become useless and have to be removed. Using the current removal methods where the platforms have to be dismantled in modules the procedure takes about nine months. Allseas will join this decommissioning market with the new ship "Pieter Schelte". The Pieter Schelte will be able to lift complete topsides from jackets using semi submersible techniques, a U – shaped slot is installed at the front so that the vessel can sail around the platform. At the stern the Jacket Lift System (JLS) is present which will be able to lift the complete jacket from the sea bed. The removal procedure of the platform will then be a couple of weeks.
This report handles the conceptual design of the upend system of the JLS. The JLS consists of two Tilting Lift Beams (TLB's) which can lift the jacket and then tilt the jacket until the TLB's lay horizontally on the deck with the jacket on top of it. Because jackets vary in width, the TLB's are adjustable along the stern. The TLB's are about 165 meters long, weigh 7000 tons each and are hinged at the stern of the vessel. During transit, the TLB's lay on the deck horizontally. When arrived at the hoisting location, the TLB's are upended using the upend system. The upend system can only act in the upending direction. The upend system can only act in the outboard direction. If the resultant force due to external loads acts in the outbourd direction, the derrick cables take over the load and the upend system runs with a defined pretension. The derrick cables are between the deck and the top of the TLB and can only act in the inboard direction. During upending several loads work on the upend system, such as the own weight of the TLB, the tension forces due to unrolling of the derrick cables, wind load, ship motions and inboard-outboard hoisting of modules (when something is hoisted from the deck, the upend system holds the load. The major load comes from the own mass of the TLB. The upend system is located at 39 m from the hinge on the deck. The maximum upend force occurs at the beginning of the upend cycle and is about 11,000 tons.
To fulfill the upending, eight base concepts are surveyed. One concept pulls the TLB at the tail using dyneema cables and the other concepts are all above the deck.

The chosen concept, handles a concept with two actuators, a lattice strut to be built up under the TLB for the first upend part, and a slider at the back of the TLB for the second upend part.
First the TLB is jacked up using hydraulic cylinders. Then a strut part is placed under the TLB between the cylinders. This repeats for five times. When the strut is completed, the length is 46 meters and the TLB is upended 70.7°. Then the slider starts to slide along the TLB to fulfill the upend cycle until 115°. The slider, located at the back of the TLB, has a stroke of 25.8 meters and is driven by a hydraulic push-pull system.

The main conclusions are:
- In the concept choice the best concept handles a strut being built up under the TLB which slides towards the hinge.
- To reduce the required upending force, the TLB bottom can be ballasted by filling it with water. The required upending force is than reduced by 17%. When the TLB's are tilted back, the bottom has also to be filled.
- The maximum upend cycle duration of 1 hour may be too short due to the push-pull actions and locking/unlocking actions.
- Strut build up actions can be optimized to shorten the upend cycle duration time.