

# ITALY : CONCORDIA WRECK REMOVAL PROJECT (THE PARBUCKLING OPERATION)

PROJECT	EQUIPMENT	WEIGHT
SALVAGE	SPMITS / GANTRY LIFTING SYSTEM/ BARGES / STRAND JACK AND TOWER LIFT SYSTEM	114,000 TON



After the accident occurred to the cruise ship Concordia on the 13th of January 2012, Fagioli were awarded by Titan Salvage company in partnership with the Italian Micoperi consortium a contract for the CONCORDIA WRECK REMOVAL PROJECT equipment and logistics support under the overall project coordination of Costa Crociere. The wreck recovery plan is divided into 5 steps:

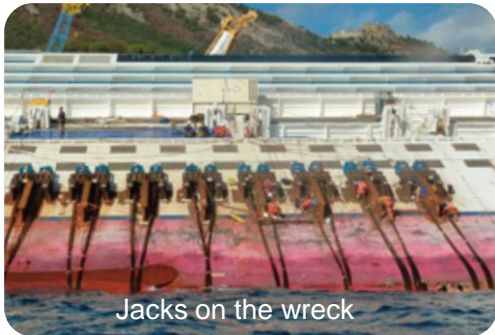
- Anchoring and stabilization of the wreck
- Preparation of the false bottom and positioning of sponsons and blister tanks
- The parbuckling operation
- Survey of wreck and installation of sponsons
- Refloating

Fagioli were awarded two separate contracts: one involving logistics activities and the other one concerning wreck removal operations.

The parbuckling project executed on the Costa Concordia was very remarkable because it has been performed for the first-time ever on a 300 mt-long and 114,000 gross ton heavy cruise ship.

After the debunkering and the collection and disposal of waste material and sewage, Fagioli carried out the second contract through the stabilization operations of the wreck by securing 4 anchor blocks to the sea bottom between the center of the wreck and the coast by means of 16 strand jacks (L300/L450) positioned on the wreck. 7 more anchor blocks and 12 towers (on top of which one were positioned strand jack system with L600 jacks) were installed and combined to complete the stabilization phase.

Some sections of the towers had been pre-assembled onshore in La Spezia before being moved by barge to Giglio Island for the final assembling and erection.



Jacks on the wreck

The client prepared the false bottom which should have supported the wreck after rotation. The subsea platforms (six sections made up of 1,180 individual removable grout bags with a volume of over 12,000 cubic meters and over 16,000 tons in weight) would have provided a stable base for the cruise ship once upright. For what concerns the logistics contract, Fagioli provided the equipment for the load out, load in and rotation upside down of the sponsons (big floating tanks), the transport of the blister tanks (attached to the bow of the wreck to provide 4500t of buoyancy and stabilization during the parbuckling). The 30 sponsons, which weight ranged from 350 to 460 ton, were fabricated in 4 different yards and Fagioli used 48 axle lines SPMTs to perform the load out operations in Genoa, Castellamare di Stabia and Palermo. Fagioli transported 22 sponsons to Livorno storage area by barges and overturned them by means of gantry cranes in order to make them ready to leave for Giglio Island. 11 big sponsons were installed on the wreck's starboard side: 2 long horizontal, 2 long vertical and 7 short vertical. On top of 9 of them Fagioli provided 36 strand jacks (L300/L600).

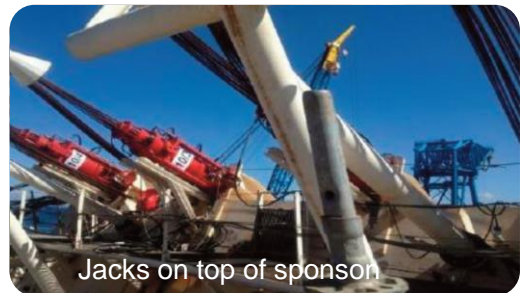


Seabed Detail



Detail of towers

The power pack units used to allow the 36 jacks working during the parbuckling operations needed to be placed on the wreck. This meant facing the PPU's stability problem while the operation going and Fagioli came up with the idea to use 2 swinging platforms installed onto the tallest sponsons equipped with generators and power pack units. Thanks to this platform the PPU's were able to remain stable as far as possible from water level during the rotation. The parbuckling operation started on the 16th of September (2013) at 9 am in the morning, after a delay of a couple of hours due to the bad weather conditions experienced during the night which removed some of the net barriers used to surround the operational area.



Jacks on top of sponson

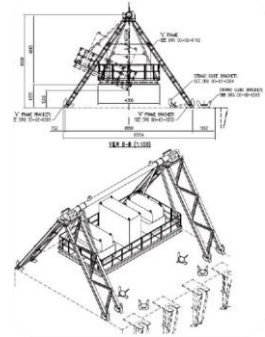


Sponsons with jacks on top

Transport of blister tanks



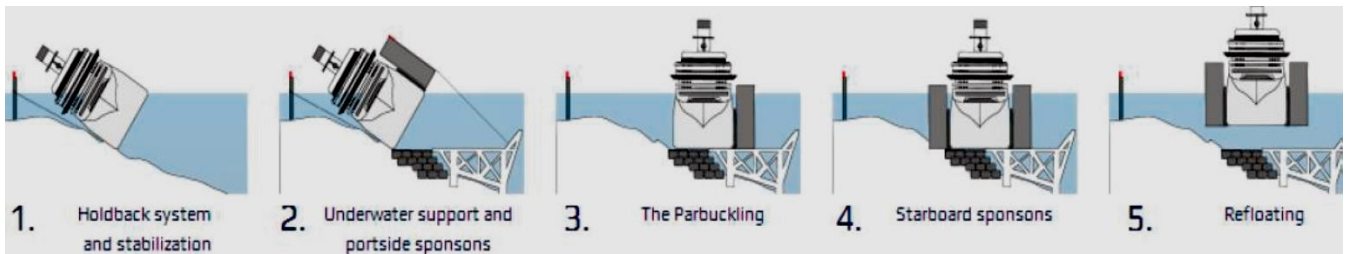
Detail of swinging platform



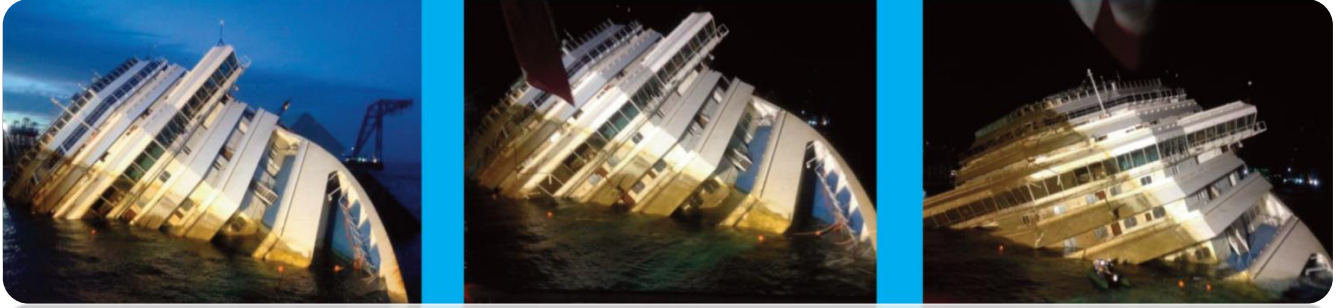
During the operation, the wreck remained secured by means of 11 towers and 22 L600 strand jacks, as a result of the anchoring and stabilization phase. The total pulling force was up to 13.800 ton by means of N°20 L450 strand jacks and N°16 L300 strand jack (total quantity = 36). Strand jacks load on parbuckling equipment were increased gradually in steps according to Salvage Master instructions, with continuous monitoring of deflections movement of the wreck. At the same time, continuous monitoring and setting up of the loads on the strand jacks of the Tower System were executed, in order to maintain the proper load distribution throughout the operation. The wreck started putting upright with a consequent reduction of the angle between the keel of ship and the base of the lattice platform up to an equilibrium at 44° which represented the point of no return of the operation. The pulling load was constantly controlled by the jacking systems. During wreck rotation, the swinging platforms self-rotated and maintained horizontal position for proper functioning of the equipment on board.

A particular attention was paid to strands movements below and above the strand jacks, to verify proper movement and no interference, mainly through pipe guides. At 44° the strands were almost slack and, before strand jacks on lower sponsons entered in the sea water, the electric equipment on the jacks were removed and power supply disconnected to avoid potential damages to Fagioli equipment by short circuit. From this point on the control of the movement of the wreck and the completion of the parbuckling passed from Fagioli strand jacks to the ballasting system of the sponsons. At the end of the operations, the wreck laid onto the base of the lattice platforms and was controlled by means of the sponsons ballast system. The parbuckling operation was safely and successfully completed at 4 am on the 17th of September.

More than 500 people from 26 different countries performed 280.000 hours of engineering, 30.000 hours of activities executed by ROV (remote operated vehicles) robots under water and more than 12.000 diving operations.



## LAST PHASES OF PARBUCKLING OPERATION



16/09/2013 - 7.44 P.M. - 16/09/2013 - 10.59 P.M. - 17/09/2013 - 2.59 A.M.



17/09/2013 - 3.24 A.M. - 17/09/2013 - 3.28 A.M. - 17/09/2013 - 4.01 A.M.