Intervention Technology for Subsea Well Incidents

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Purpose

The purpose of this presentation is to provide an overview of the offset installation system (OIS), and show how industry has access to this new capability. An animation of the OIS deployment will be shown during the conference presentation.

Background

The International Association of Oil and Gas Producers (IOGP) established the Global Industry Response Group (GIRG) in the aftermath of the Macondo incident in April 2010, to examine what could be done to reduce the likelihood and impact of well incidents. GIRG made recommendations in three core areas:

- Prevention - developing better capabilities and practice in well engineering design / management
- Response - delivering effective oil spill response
- Intervention - improving well capping response readiness

These recommendations resulted in the formation of the Subsea Well Response Project (SWRP), a group which was tasked to design and build:

- A subsea dispersant system which allows for the subsea application of oil dispersant at the wellhead. This will create safer surface working conditions for response personnel and enhance the degradation of oil.
- A capping toolbox consisting of four capping stacks with ancillary equipment that have been built for use in waters up to 3,000 meters deep and in a variety of international metocean conditions. Made available to the industry in 2013, their purpose is to maintain the integrity of the well by providing a choke on the incident well until such times as a relief well or other option can be put in place.
- A containment system designed for capturing the released hydrates in the event that the well cannot be contained using the capping stack.
- A system to install/remove equipment where there is no direct vertical access above an incident well ; the offset installation system (OIS)

This presentation will focus on the OIS which is now available to supplement the capping and containment capabilities for use in waters between 75 and 600 m depth, where direct vertical access above an incident well is not possible due to surface conditions and location of the plume.

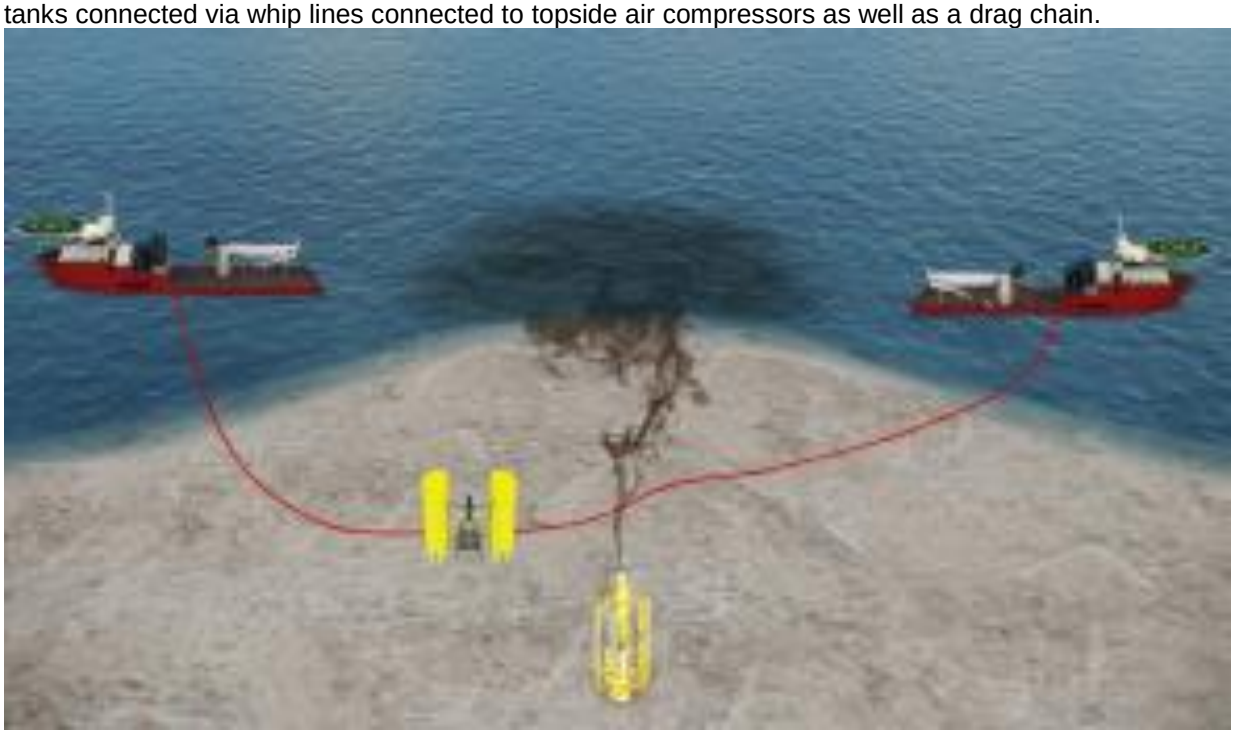
Its main purposes are to provide a lifting capability for subsea equipment, such as debris, the DMAs, etc. and to position and install the capping stack onto an incident well with the aid of ROV's.

The OIS is primarily based around a carrier, which is designed to be deployed up to 500 meters away from an incident well and is pulled into position near the vicinity of incident well using two anchor handling tugs (AHTs). The precision movement of the carrier within the exclusion zone is controled via the mooring line system in a triangulated pattern.

The carrier structure comprises of four ballast tanks with buoyancy modules which gives the carrier a positive buoyancy of 10 tone while flooded. The depth and uplift of the carrier is managed utilising a depressor weight, and the movement of the subsea equipment aided by ballasting the tanks. Typical subsea operations of the carrier is sustained approximately 10 m above the seabed. It is stabilized using mooring lines attached to three dead man anchors (DMAs) sunk into the seabed. It is attached to these using work class remote operated vehicles (WROVs).

The Capping Stack final connection and installation on the wellhead/BOP is performed by a Cardan joint fixed to the main frame of the carrier, which can accommodate both vertical and angular alignment. This allows a controlled landing out of the capping stack onto an incident well to aid in preventing further damage.

The carrier maintains its normal working height of 10 metres from the seabed using the four ballast tanks connected via whip lines connected to topside air compressors as well as a drag chain.



All the above items (CS excluded) are powered and controlled by a specifically designed control system, using an ROV of opportunity connected to a custom designed IHPU. The ROV acts as the intermediary for the communications and assists in the connection of the air supply whip line that is used to adjust the carrier system ballast.

Qualification, Testing and Validation

To prove functionality of the OIS, it was subjected to an Extended Factory Acceptance Testing (EFAT), Site Integration Tests (SIT) and Commissioning Tests (CT). The testing was carried out by the main contractor at the fabrication site and offshore in Rijeka, Croatia. Here it was tested for a range of mechanical, functional and load testing conditions in a water depth (WD) of 45 metres. Capability of the system up to 600 metres WD was verified and confirmed in a workshop by subject matter experts from all major partners. It is not possible to fully replicate and test the carrier for fully simulated uncontrolled well conditions, therefore the well plume was not present, however it was assessed as part of the model testing.
In addition to the system verification it also allowed the contractor carrier team to become familiar with the motion control and ballasting/de-ballasting operations and allowed for the collation of practical information regarding the carrier response.

System Equipment

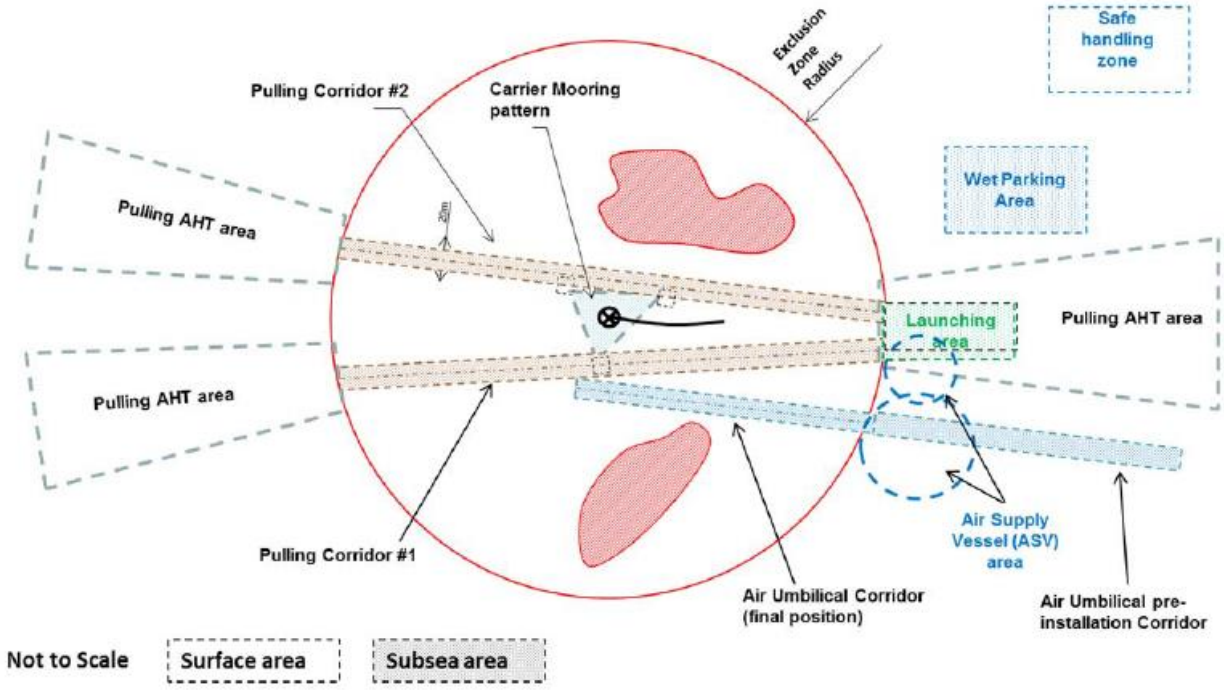
The OIS is split between the equipment provided by OSRL and that provided by the WO.
OSRL will supply the carrier and its ancillary equipment and it will be the responsibility of the WO to obtain the remaining equipment needed to ensure maximum functionality of the system as detailed in the following table:

Item	# of	Purpose
DP survey vessel	1	For subsea survey and ROV support
DP anchor handling tugs	2	For pulling the carrier into position via the predefined corridors
DP air supply vessel	1	To carry the air supply equipment
DP installation vessel	1	To overboard and control the carrier
ROV control van	2	1 of WROV and 1 of auxiliary for emergency release
ROV umbilical	2	One WROV and one auxiliary for emergency release
ROV	3	1 of WROV, 1 of ROV Operations and 1 of Auxiliary ROV for emergency release
Capping stack	1	For capping activities/ well control
Air compressor	2	Supply air to ballast tanks.
Deck lines	Set	Link between compressor and subsea air umbilical

Item	# of	Purpose
Reel spooler	1	For umbilical transfer to/from umbilical winch
Structure foundations	Multiple	Foundation structures for the DMA's and support frame structures

Operation of the OIS

Operation of the OIS requires multiple working zones defined around the incident area in which the system operates.



OIS Working Zones

These zones can be described as:

- Exclusion Zone: circular area of maximum radius of 500m around incident well where no vessel shall enter whilst well is uncontrolled.
- Launching area: area at the edge of the exclusion zone used for deployment or relocation of equipment that shall be handled by the carrier
- Wet parking area: area subsea outside of the exclusion zone and launching area where equipment is temporarily stored prior to being moved to the launching area.
- Well head area: area around well head containing the mooring DMAs.
- Safe handling zone: free area outside of the exclusion zone where equipment shall be over boarded prior to being landed in the launching area or wet park area.
- Carrier stand-by position: location at which the carrier waits following handling of load until launching area is cleared by the Installation Vessel (IV).

Deployment and Installation Process