

Monobuoy Reference Project for



Premuda S.p.A



Eni S.p.A



...Four Rainbow Upgrade

Four Rainbow 2009-2010 Upgrade



Four Rainbow Project

Clients:

Premuda S.p.A

Location:

Keppel Shipyard, Singapore
Wolffbuttt Field, Australia

Project Characteristics:

Disconnectable Single Point Mooring
FPSO

Project Size:

undisclosed

Dates:

Pre-engineering:

- April – June 2009

Dry Docking:

- July – December 2009

Offshore installation:

- January – February 2010

Monobuoy Scope:

- Design & Manufacture of 300 bar hydraulic swivel.
- Supervision of 4 product swivel overhaul.
- Complete overhaul of installation winch system.
- Reconnection to offshore disconnectable buoy.
- MIB Valve change out during reconnection phase

Project Highlights

Introduction

In June 2009 Monobuoy was contracted to carry out the following work on board the Four Rainbow FPSO:

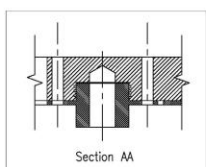
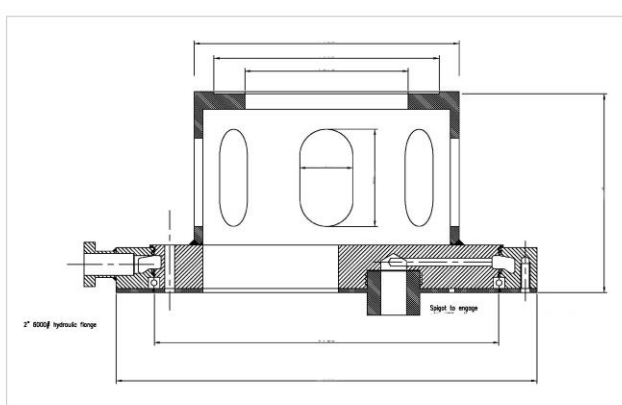
- Lowering and replacement of MIB Valves offshore
- Hydraulic Winches control system replacement
- Winch motor changeout
- New reconnection winch pressure swivel
- New reconnection winch emergency lower manifold
- Winch deck leak tank
- Function testing of reconnection winches
- Reconfiguration of HUS paths
- Supervision of the Overhaul of Framo swivel
- Supervision of upper MIB Valve replacement

Here are the main highlights of the Project.

Hydraulic Swivel

Monobuoy was contracted to design, manufacture and install a new swivel for the Four Rainbow in order to improve the reconnection winch system onboard.

Main Swivel Characteristics:



FPSO "Four Vanguard"
Proposed Swivel/HUS Support
Sheet 2 of 2

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- ABS design review
- Hydraulic Mineral oil
- Max working pressure: 300 bar
- Pressure tested at 390 bar with zero leakage at swivel.
- Max Flow: 2,400 liters/min
- Effective diameter of toroid path: 3"
- Fluid Design Velocity: 7.9m.sec

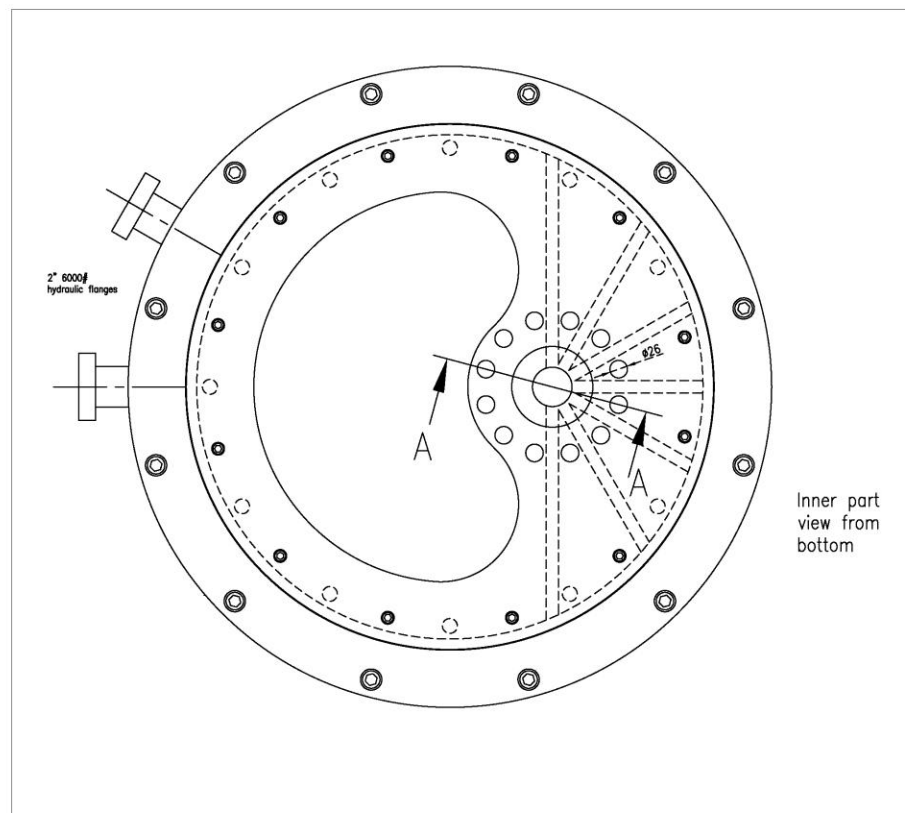
Swivel was designed in-house in the Monaco design office. Review was then carried out by ABS London, with final manufacturing taking place in Leeds, UK with the supervision of a Monobuoy fabrication engineer.

The swivel was then shipped to Keppel shipyard in Singapore for installation on the Four Rainbow.

Swivel Fabrication in the UK



Swivel GA Drawing



FPSO "Four Vanguard"
Proposed Swivel/HUS Support
Sheet 1 of 2

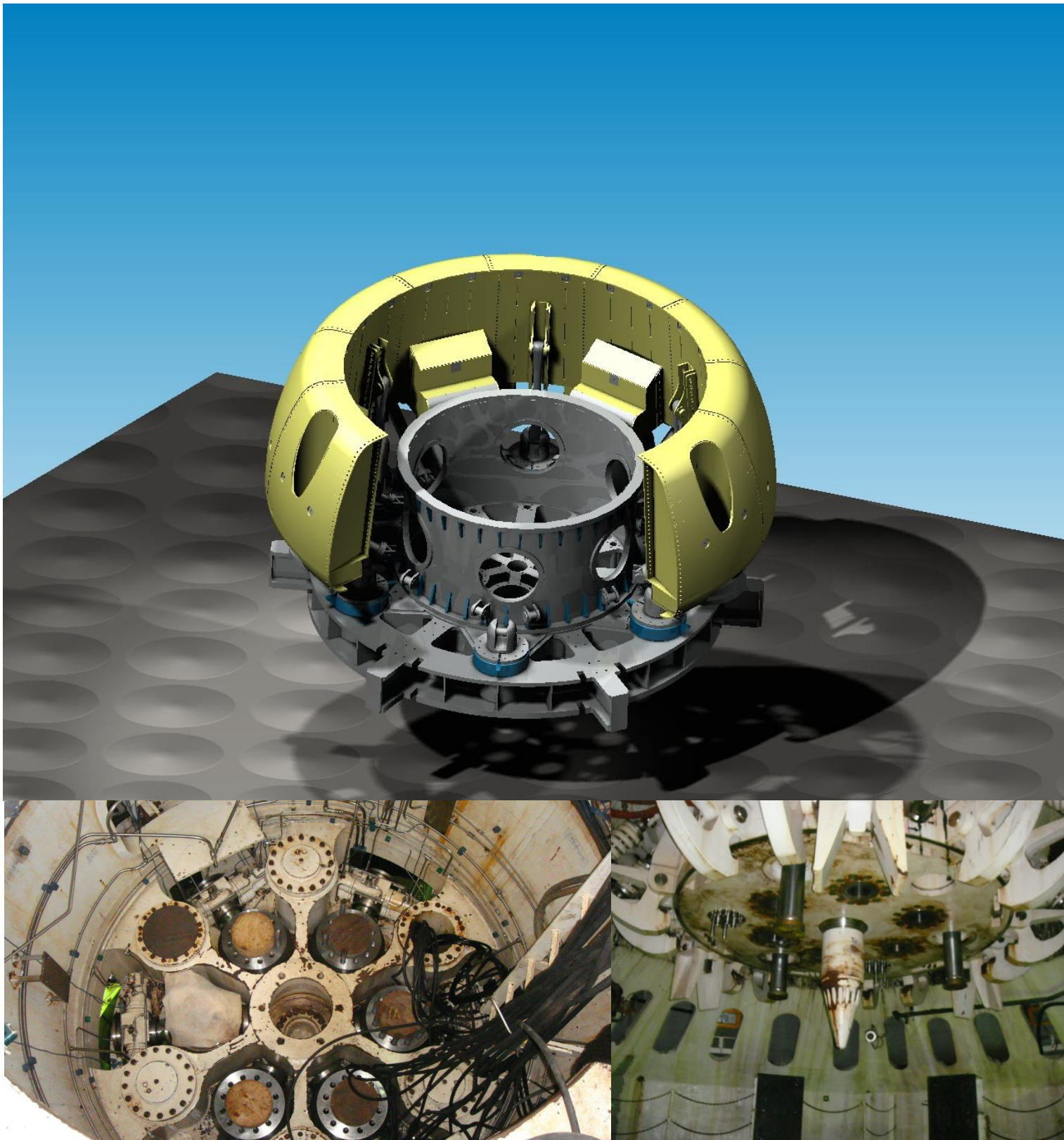
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Swivel installation at Keppel

Offshore MIB Valve Changeout

After a 4 month dry docking in Keppel, the ship was then towed back to site, offshore Australia for reconnection. The Four Rainbow uses a DSPM system (disconnectable single point mooring system). During this reconnection phase, Monobuoy was contracted to supervise the reconnection, as well as changing out the old MIB valves on the buoy.



Monobuoy was asked to find a solution to the replacement of these MIB valves. A team of engineers worked on several propositions:

- Option 1: Disconnecting the whole buoy and overhauling it at shipyard with the tanker
- Option 2: Lifting up the buoy with a crane barge and carrying out the work offshore
- Option 3: Lowering the buoy after tanker reconnection and carrying out the changeout work inside the buoy body.

The third option was the most cost effective but also the riskiest. After careful planning and the overhaul of vital reconnection components (winch system), the client allowed Monobuoy to carry out this work

Monobuoy mobilized a team of 5 engineers to carry this highly delicate offshore operation and work was successfully completed over a two week period in February 2010 without any incidents.

2004 Incident Orcina Study

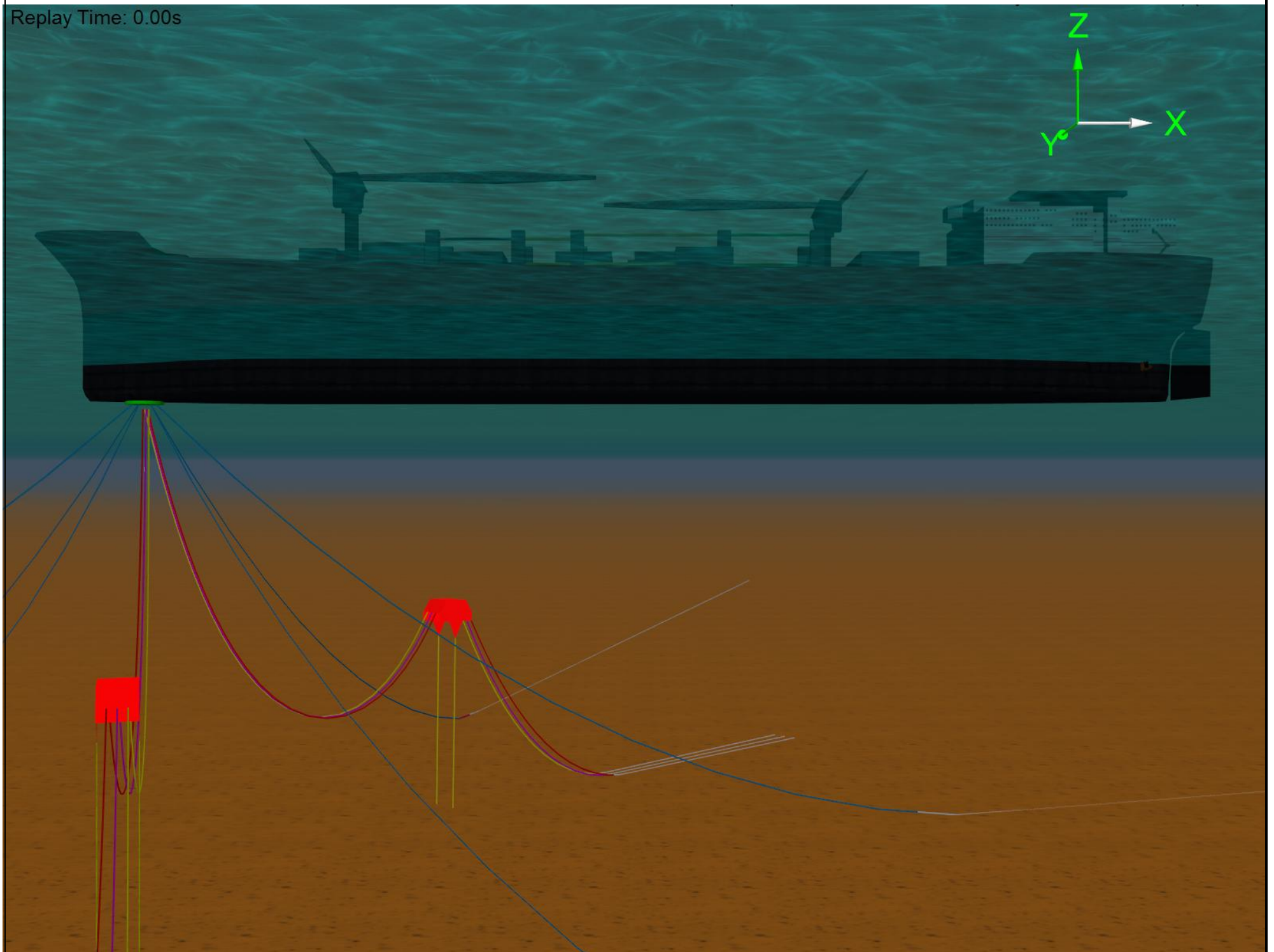
Monobuoy was requested to perform a study by FVSN of the motions of the DSPM during an incident in May 2004 when following a reconnection the turret was jammed inside the FPSO moonpool and rotated with the FPSO causing twisting to the mooring chains, risers and Wellhead hydraulic control umbilicals. It was suspected that this twisting may have been detrimental to the umbilicals.

On the 19th March 2004 the FPSO Four Vanguard disconnected from the DSPM buoy in the Woollybutt Oilfield, offshore Barrow Island, NW Australia and sailed to Singapore for repairs. The FPSO was unusually in light draft at the time of disconnection which was estimated to be 7.2m and the disconnection was made by quick release of the DSPM buoy.

In early May 2004 the FPSO returned to the field and reconnected to the DSPM on the 5th May 2004. Ten days after reconnection one of the hydraulic cores of one of the WB1A umbilical failed.

The purpose of this study was to simulate the disconnection operation and the twisting incident following reconnection and consequently assess the loads, motions and bending of the umbilicals in order to determine if the DSPM motions could have been a probable cause of the umbilical failure.

Replay Time: 0.00s



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