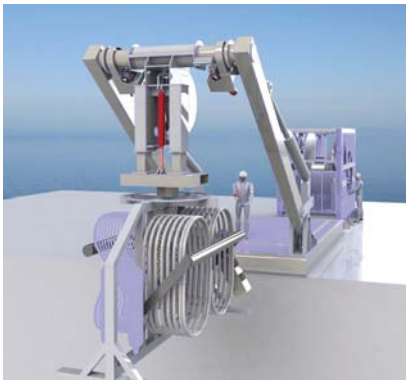
Offshore Systems

Portable Intervention Work Over Control (IWOC) Deployment System



Offshore handling systems specialist, Caley Ocean Systems now offers a portable IWOC deployment system designed to simplify the over boarding of Intervention Work Over Control Systems (IWOCS). It allows a single IWOC Deployment System to be readily transported between multiple offshore vessels.

Following Caley's successful development of an Alternative IWOCS (AIWOCS) Deployment System in 2014, the IWOC Deployment System is the second generation of Caley's topside handling equipment specially designed to provide access to wellheads and manifolds for intervention and workover.

Rapid mobilisation
In addition to rapid mobilisation and portability offshore, the Caley IWOC Deployment System requires less deck space, and is safer and more operationally efficient than a conventional IWOCS reeler and sheave arrangement. Mounted on a portable skid, the IWOC Deployment System comprises two elements: the reeler/power Unit and the A-frame Unit. All operations take place within the boundary of the skid unlike a conventional IWOCS, which uses an overhead crane and therefore significant deck areas are required to be cordoned off.

Safe Handling – dedicated A-frame and docking unit
The IWOC Subsea Deployment Frame and Umbilical are safely handled by the dedicated A-frame and docking unit. Equipment is fully captured during in-boarding and outboarding with minimum manual intervention, and increased protection of the equipment. The IWOC Deployment System is suitable for use in Sea State 6 conditions, enabling intervention and workover operations in a wider range of weather conditions than conventional systems.

The IWOC Deployment System marks a significant development in the ease with which operators will be able to use intervention and workover systems to increase field productivity, without the constraints experienced with conventional IWOCS.

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Caley OCEAN | systems

Case Study | Offshore Handling Systems

Caley develops MARS deployment and overboarding system

Caley Ocean Systems has developed a new deployment and overboarding system for Cameron's MARS™ (Multiple Application Re-injection System) for deepwater scale squeeze applications. The modular handling system will allow the MARS hardware to be more easily deployed onto the seabed from smaller vessels.

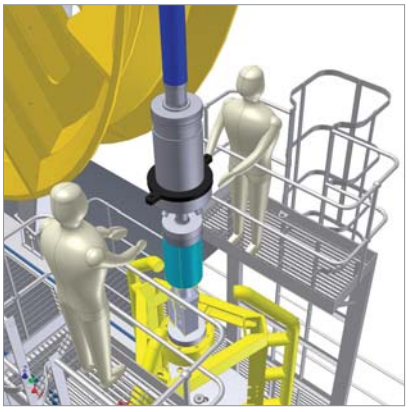
The MARS system is used to improve oil recovery as part of enhanced oil recovery (EOR) in mature basins, brownfield developments and greenfield projects. Caley is supplying a standalone handling system comprising a high performance spooler, hydraulic power unit (HPU) and control station. It will use a flexible riser to deploy the MARS system, and feature Caley's proven clamping technology to reduce fatigue loading on the riser.

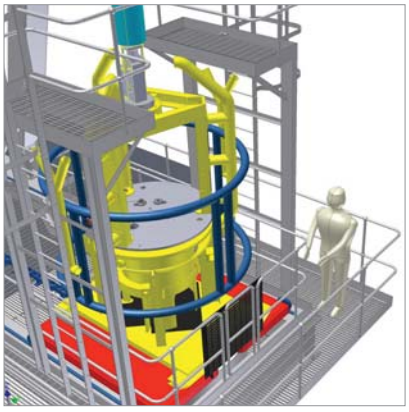
Cameron's Multiple Application Re-injection System serves as a universal interface for all trees (topside and subsea), enabling processing equipment to be installed between the existing isolation barriers, thus eliminating the need for high-risk and costly intervention to the field architecture.

MARS enables flexibility and choice for production optimisation in new and existing fields, providing a universal work platform, low-cost intervention and cost-effective wellhead processing.

High Performance, Offshore Handling Systems
Caley Ocean Systems supplies a range of rigid and flexible product handling systems suitable for loading, storing and laying of most cables, umbilicals, dynamic risers, flowlines and hoses used in offshore, marine and renewable projects.

- High Capacity Carousels, Turntables and Spoolers
- Loading Systems
- Pipe and Cable Tensioners
- Storage Reels
- SMART Winches.





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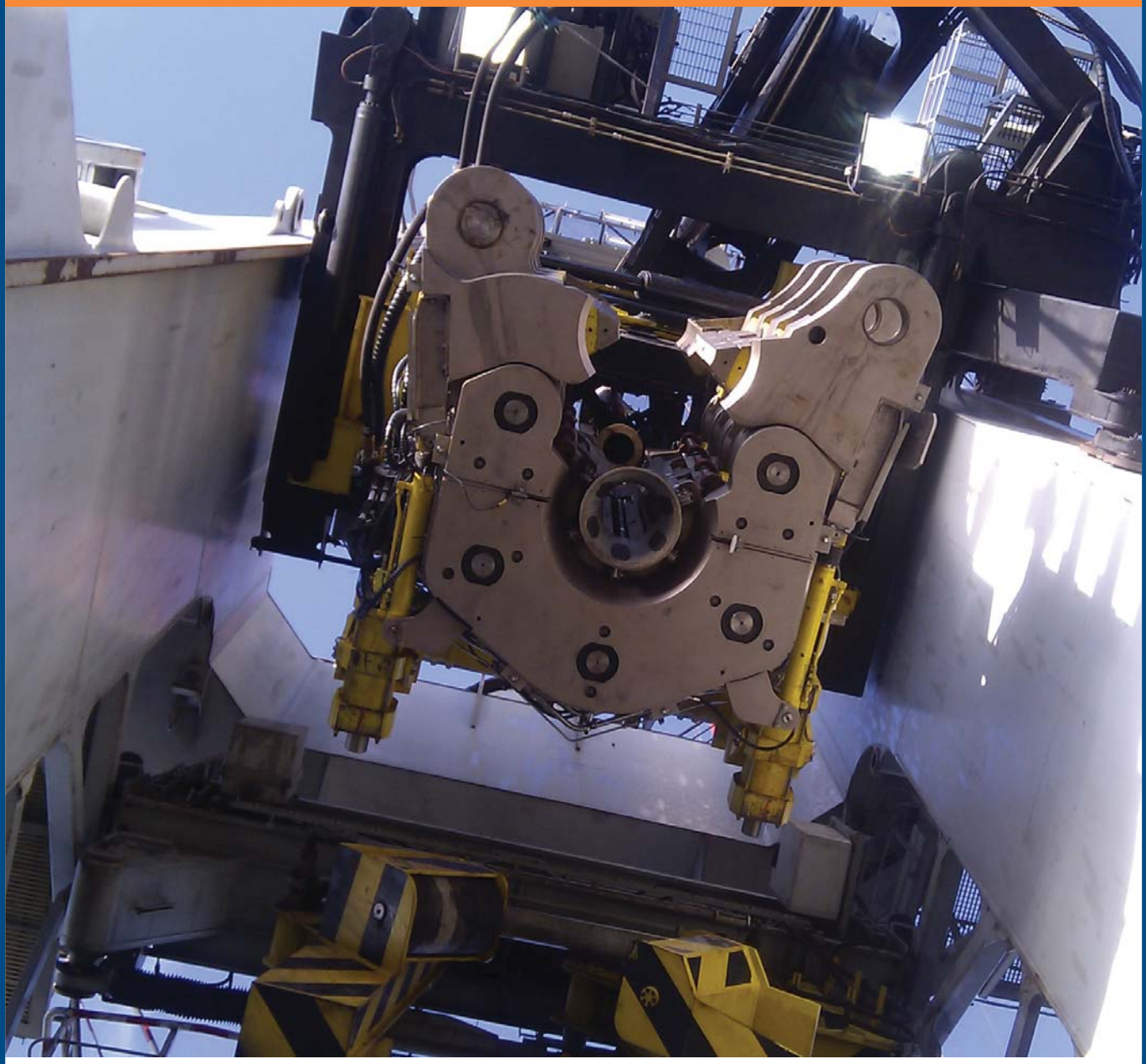
Case Study | Offshore Handling Systems



Taking Control Improves Pipeline Installation and Safety

When the Seven Borealis, Subsea 7's flagship pipelay and heavy lift vessel, enters service later this year, it will have many new features not least of which is a 'J' lay pipe clamp and control system supplied by Caley Ocean Systems. The control system has set a high standard for the safe installation of deepwater pipelines.

Case Study | Offshore Handling Systems

Developed originally for the Subsea 7's Seven Polaris, a DP3 multipurpose pipe lay and construction vessel for 'S and J' type pipe laying, as part of the vessel's refurbishment, the control system applies plant control techniques more commonly found in the manufacturing industry to offshore handling projects, significantly improving handling performance and offshore safety.

J-lay installation involves deploying the pipeline in an almost vertical position, via a tall tower. Compared with S-lay, the reduced stress on the pipe make J-lay more suitable for pipeline installation at deeper water depths.

Caley Ocean Systems was asked to replace an existing bushing / collar catenary holding pipe handling arrangement with a friction clamp system comprising a travel clamp and fixed workstation clamp, and their respective control systems. Critical to the modernisation of the clamps and control systems was the decision to opt for a high availability, hot standby configuration for the PLC (programmable logic controllers) and remote IO (input-output) to control and monitor the clamp operations, in order to optimise pipe lay operation and work cycle monitoring. Specifically, Caley was tasked with the design, test and commissioning of the new clamp control system, design and coding of system's PLC, and design and coding of the Supervisory Control and Data Acquisition (SCADA) system.

Offshore Handling Systems

The Caley pipe handling system features two friction clamps: a travelling friction clamp (SWL 500 Te), workstation clamp (SWL 750 Te), and welding platform.

Located in the J-Lay tower, the pipe handling system is configured to lay double-joint sections of pipe. Each double-joint is raised from deck on a pipe escalator system and handed to an erector arm which raises the pipe from horizontal to vertical. The travelling friction clamp is used for double-joint insertion before welding and pay out after welding. The workstation clamp holds the pipeline catenary during welding. On the welding platform, the two sections of pipe are welded together using an automatic rotary welding machine. After welding, the whole pipe catenary is lowered the distance of one double joint by the travelling clamp. The work station clamp then grips the pipe and the travelling clamp releases it allowing the insertion of the next pipe section.

The Caley friction clamp system can handle pipe and pipe-in-pipe diameters ranging in size from 4 to 24 inches. The workstation friction clamp is a two piece circular design, splitting along the vertical axis into two approximate semi circular halves. Each clamp half is independently operated to open and close by a pair of hydraulic cylinders, and is capable of opening to clear the pipe and allow the passage of 72" outside diameter, special pipe/connectors, if necessary.

The pipe handling system's travelling clamp is a 2-door hinged and locking gate system which accepts pipe loading from the erector arm. The lower face of the clamp is provided with a collar support shoulder adaptable to a range of pipe sizes and to the same capacity as the friction grip clamp.

The friction clamps feature rows of six radial hydraulic cylinders each capable of exerting a 'squeezing' force of 320 Te: the workstation clamp uses three rows while the travelling clamp has two rows of cylinders. The cylinders are fitted with a linear variable displacement transducer (LVDT) and a pressure transducer. The pipe handling system's operating philosophy is to advance the squeeze cylinders to a preset position under "position control" mode, to centralise the pipe using LVDTs for feedback. Once almost in contact with the pipe, the cylinders are changed to "pressure/ squeeze control" mode to obtain the selected squeeze pressure for the desired top tension. As a result, the weight of the pipe is supported by the clamps applying the required amount of squeeze force to support the axial pipe load. The same modus operandi applies to handling pipe with collars. In this case the axial load is supported on the hang off collar which is fitted to the clamps to suit the size of pipe.

Safe operation

Operator safety was critical to the design of the J-lay pipe handling system. The Caley friction clamp system incorporates a number of detectors to pick up an abnormalities during pipe handling, in addition to inductive proximity switches fitted to detect clamp gates open/closed, locked/unlocked, and used as interlocks for the safe operational use of the system.

To detect the presence of the pipe in the clamps, LVDTs are used to make sure the cylinders are not at risk of collision with the gates. The original system featured a pipe end proximity detector to ensure that the pipe is at the correct elevation for the insertion of the internal line-up clamp. For the Seven Borealis, this has been replaced with infrared sensors to detect the pipe is at the correct height before a squeeze can take place in automatic mode.

A slippage detector is used in each clamp to detect any axial movement of the pipe relative to the clamp when in "squeeze mode". In the event of an alarm the clamp will automatically increase the set-point pressure to the squeeze cylinders.

Using signal splitters, Caley took signals from load measurement pins previously fitted to the travelling clamp's two attachment padeyes to interlock the clamp from unsqueezing. Both clamps are operated from the SCADA station in the master control room. An operator's mimic screen displays the friction clamp load and all alarm status associated with the functioning of the clamp and associated hydraulic power unit.

Taking Control

The initial J-lay pipe handling system design specification required that each of the two clamps use two PLCs – one PLC controlling the clamp and the other in reserve should the first PLC develop a fault. A total of four PLCs. In the event of a failure of the first PLC,

it would need to be un-plugged and the stand-by plugged in and turned on. This posed a potential safety and operational risk as the programming of the second (standby) PLC may have been independently modified.

Caley proposed a safer approach to the control system design. Instead of two PLCs per clamp, Caley recommended one PLC per clamp linked together so that each PLC acts as a hot standby should the other fail. The two systems run in parallel, if one fails the other takes over; the changeover is automatic while the SCADA highlights the fault has taken place for maintenance personnel to take the appropriate action. Importantly each PLC is of the same type and firmware, the control program was downloaded to both PLC's at the same time and synced together across a dual duplex fibre communication link. This configuration ensures that each PLC always has the same software configuration.

All PLC network devices are Profibus (Process Field Bus) compliant for field bus communications in distributed control. The Profibus communications is connected by two Profibus communication modules installed onto an active backplane. This configuration ensures that no loss of communications will occur in the event of a wire break or communications fault on a Profibus network ensuring a high availability to all devices attached to the Profibus node, and making safety an integral part of the control system. If the hot standby kicks in, the faulty PLC I/O module held in the system's active backplane can be simply unplugged and replaced while the system is running. In the event of a catastrophic failure of the control system, Caley has designed the friction clamps to remain closed holding the pipe; emergency backup accumulators release pressure to the cylinders.

Flexible Control System Design

Caley used a modular approach to programming the PLCs. This allowed it to simulate and fully test the control systems on-shore where problems and modifications can be made before the handling equipment is shipped offshore. It also allowed faster commissioning offshore and made it easier to incorporate unexpected changes. For example, after the control system was implemented offshore, it was realised that the friction clamp system had to include an additional 18 hydraulic units. As there is only one PLC program for each of the hydraulic units - the main point of using a fail safe / fault tolerant redundancy PLC system - the control program was quickly updated onshore and uploaded offshore.

The Caley control system has proven to be as flexible as it is safe. It was successfully deployed for pipeline installation in deepwater in West Africa, and has now been readily adapted for J-lay pipeline operations on the Seven Borealis.

Case Study | Cable, Umbilical, Hose and Flowlines

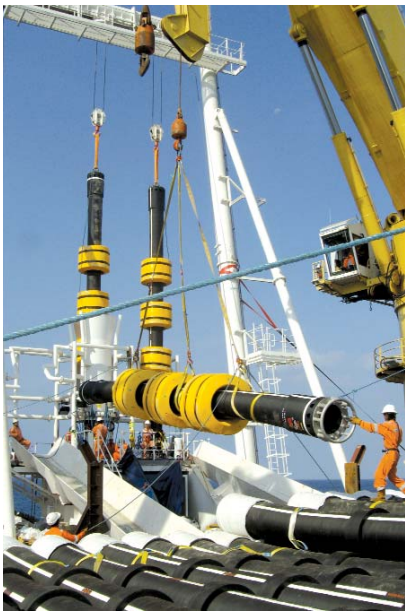
CALM buoy hose deployment system for SBM Offshore

Caley Ocean Systems has supplied a large diameter hose deployment system to SBM Offshore N.V. for the installation of two, large-diameter, reinforced, bonded rubber hose offloading lines for a catenary anchor leg mooring (CALM) buoy.

Based on a SBM design concept, the hose deployment system will be used to assemble and deploy lengths of Trelleborg Trelline hose, some of which will be fitted with buoyancy modules. Caley Ocean Systems has built on the SBM concept, teaming up with SBM to refine the hose deployment and lifting system's design, reducing the size and weight of the A-frame structure, and the overall cycle times. In addition, guidance of the hose both above and below the deployment system's friction clamp enables safer operation.

The Caley hose deployment system comprises an A-frame assembly, which includes winches and lifting gear with a top tension of 26 tons, outrigging platform structure designed to withstand 200 tons of load, including clamp, guidance system, handrails and walkways, and 6.8m diameter deployment wheel.

The hose deployment system was fully tested at Caley's quayside facility, in Glasgow prior to being shipped for integration onboard SBM Normand Installer. The system was then successfully used to deploy two offloading lines without any disruption in the assembly process.



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