Figure 1. The SmartTrack™ remote tracking and pressure monitoring system (pictured on top) uses through-wall communication technology to track and monitor the SmartPlug tool as it travels through a pipeline.
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TDW recently completed a pressure isolation operation on a major export gas pipeline offshore Malaysia, during which the pipeline was hydro-tested and made ready for commissioning.

The isolation was carried out on a newly installed subsea pipeline between the floating production system (FPSO) pipeline end manifold (PLEM) and a key gas complex, located approximately 240 km (149 miles) offshore Terengganu, in the South China Sea.

The complex features a production platform, riser platform connected to the production platform by bridge, vent bridge and vent boom.

The gas export pipeline designated for isolation stretches 53 km (32 miles) from a primary platform to a PLEM attached to the FPSO. As part of the precommissioning project, it was necessary to hydro-test the 16 in. gas export pipeline that stretches from the platform to the FPSO PLEM. This had to be completed following the pipeline spool and PLEM installation, but prior to the dewatering and drying operation. The operator specified the SmartPlug isolation tool to create an isolation in the PLEM. The tool was to be used to maintain the pressure rate between the riser and the PLEM, while the pipeline was being tested, in order to prevent testing pressures from occurring at the site of the three open ball-valves in the PLEM.

The key objective was to provide the operator with an isolation solution whereby the entire line, from the platform to the subsea PLEM, could be hydro-tested, with the exception of the three open ball-valve sites in the PLEM which had been tested previously.

With just three months to prepare and execute the operation, TDW drew upon the expertise of its engineers and technicians in Malaysia, Australia and Norway.

The targeted section was isolated by launching the remotely-operated SmartPlug tool from a temporary subsea launcher, moving it 7 m (22 ft) into the pipeline through the main PLEM valve, before setting it. TDW isolated the section of the PLEM, while the 16 in. gas export line was hydro-tested to a pressure of 188 bar (2726 psi) for 24 hours. Throughout the operation, TDW used the SmartTrack system to enhance control during launching, pigging, setting, pressure monitoring, unsetting and retrieval of the SmartPlug tool.

With the PLEM securely isolated, the operator could safely hydro-test the export gas pipeline, confident that it would complete the critical phase, safely and reliably.

While this application is useful for the precommissioning sector, a great majority of isolations are carried out to remove and replace defective valves.

**Swift valve replacement offshore Norway**

Replacing pipeline valves is commonplace in the pipeline maintenance world. It is so predictable that a major operator in Norway, renowned for its dedication to emergency preparedness, has made valve replacement an essential element of its comprehensive emergency pipeline repair system (EPRS).

Why does this operator go to such lengths? A case in point: when engineers discovered a defective valve on a 36 in. dry gas pipeline attached to a riser platform in the Norwegian sector of the North Sea, gas production was halted. But not for long. Because the operator shares a frame agreement with TDW to provide pipeline pressure isolation services when repair work is required, the two companies are prepared to move quickly. Pre-engineering was complete, and specialist pipeline pressure isolation

**Secure isolation facilitates safe hydro-testing in Malaysia**

Although the pressure isolation method is used primarily to facilitate pipeline repair, maintenance and tie-ins to new pipelines, it also plays a key role in precommissioning new lines. To illustrate, TDW recently completed a pressure isolation operation on a major tie-ins to new lines, hydro-testing of sections of new line and mid-line repair work.

Central to the success of this isolation method is the SmartPlug® tool, the first tetherless pipeline pressure isolation system to be operated remotely. Designed by global pipeline services provider T.D. Williamson (TDW), the system is a double-block pressure isolation system that is bi-directionally piggable and capable of navigating 3D bends. This isolation technology, certified by Det Norske Veritas (DNV), is rated for 200 barg (2900 psi) working pressure and is typically designed as dual module.

The SmartPlug tool is operated and monitored entirely by remote control using the SmartTrack™ system, which transmits commands and receives pipeline and operational data through the pipe wall. Whether the SmartPlug tool is inserted into a subsea, topside or onshore pipeline, the SmartTrack system pinpoints its location, identifies it via a unique identification code attached to the SmartPlug tool’s transponder and monitors the pipeline pressure. Should an unplanned stop of the isolation tool occur, the location is quickly communicated so that immediate steps can be taken.

After the isolation tool is pigged into position and set, one section of the isolation is depressurised while the other section of the pipeline maintains pressure and production. Work on the pipeline is then performed at ambient pressure. Should more than two production facilities be connected to the same pipeline, this isolation method allows work to be performed on the pipeline at one facility, while the other remains at full production.

To appreciate the benefits and ease with which the isolation tool is used; the following operations in Malaysia and Norway demonstrate how isolating the line makes it possible for such critical work to be carried out.

![Figure 2. With the remotely operated SmartPlug® pipeline pressure isolation tool, a safe work zone is created while valves are replaced, new sections constructed, tie-ins, and hydro-testing of new lines takes place.](image)

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equipment and an experienced crew were on-hand, ready to respond, saving time and money.

In this particular instance, TDW was retained to provide a 36 in. SmartPlug isolation to create a safe environment while the valve was replaced.

The tool had been used previously to isolate pressure in a portion of the line, so TDW knew that it would operate properly. However, because the valve was located on a section on the platform topside, it would have to be customised quickly.

Just 10 days after receiving the order from the operator, the TDW team mobilised to the platform to prepare. The newly-designed SmartPlug tool was ready two days later, having been equipped with a triple-plug and triple-pigging module that would enhance its ability to negotiate the bends in the line as it travelled to its set destination. Working from the platform, TDW launched the tool into the line and monitored its progress with the SmartTrack system. For three days, the pipeline was isolated and sealed against a pressure of 122 bar (1769 psi) while the valve was replaced. With the repair work safely completed, production resumed, reducing disruption to gas supply.

The EPRS that the operator has in place – which was developed in part by TDW – meant that they were prepared to move quickly, in keeping with the specific procedures for valve replacement on this particular platform. The objective of an EPRS is to facilitate a rapid response, in an effort to reduce downtime, enhance safety and protect the environment. This operation achieved all of these objectives.

When a major gas export pipeline – such as the one attached to this riser platform, used as a distribution point to transport Norwegian gas throughout Europe – is down for even one day longer than planned, it is a loss to all stakeholders. It is also a major interruption to business, affecting customers upstream and downstream. In this case, the rapid turnaround was the result of the combined care and attention that both the operator and TDW invested in a plan that made it possible to respond as promptly and efficiently as possible.

The operations in Malaysia and Norway illustrate how isolation technology made it possible to complete two very different tasks: to safely hydro-test a new subsea line and to replace defective valves. The benefits realised, however, are the same: safety, efficiency and minimal disruption to flow.

While the pipeline precommissioning and maintenance markets are the greatest consumers of isolation services, construction operators have recently begun to recognise its safety advantages for the construction site.

New application: preventing disaster during subsea construction works

Although enhancing safety by isolating a section of a line in the “dropped object zone” is a relatively new application, the benefit to operators is clear. For example, during construction activity around a platform, TDW recently isolated a section of a gas export line over a short distance away from the platform. The SmartPlug tool was pushed with inhibited seawater and set in the line just outside the dropped object zone of the construction vessel so that only a short section needed to be isolated without bleeding down the entire line.

The benefit of this isolation was that in the event that an object was dropped from the vessel, and hit and ruptured the pipeline inside the zone, only inhibited seawater will flush out of the line, as opposed to a flashback of the entire gas inventory inside the long export pipeline. If this were to happen, the result would be disastrous: huge gas bubbles would surge into the sea, swallowing all floating objects in the area, and explosive clouds would immediately form throughout the inhabited platform area. The isolation removed the possibility of such a calamity. For construction zone isolations such as this, the isolation period may be a few weeks or months, creating a safe work zone throughout construction.

**Shifting market needs trigger demand for new applications**

Applications for pipeline isolation technology are wide-ranging and continue to expand as needs arise. Because pipelines will always require maintenance, and as the number of pipeline networks increases, the demand for pressure isolation will continue to rise. The number of isolations executed annually will climb even further as operators embrace the remote methodology for other applications, including tie-ins, hydro-testing, construction drop zones and pipelaying. The safety, cost-savings, efficiency and environmental benefits realised by operators as a result of using the SmartPlug pipeline pressure isolation method remain unparalleled, making it a cornerstone of maintaining and operating a safe, reliable pipeline network.

While the responsibility for pipelines is still critical and remains unchanged, with access to reliable tools and an experienced team, the pipeline engineer’s daunting burden is much lighter.

Figure 3. TDW responded quickly, using a 36 in. SmartPlug® tool to create the secure work zone while the valve was replaced offshore Norway.