

Oceaneering Completes Manufacturing of Retrofit Hydraulic Flying Leads at its Angola Facility

Extensive reverse engineering enables a customer to use existing termination heads to overcome operational fault

Project Overview

In late 2017, a customer engaged Oceaneering to help rectify an issue with leaking couplers on hydraulic flying lead (HFL) termination heads installed on subsea christmas trees. The customer wanted to re-use the termination heads on the 14 faulty HFLs.

The Oceaneering Solution

The hydraulic couplers of the HFLs were leaking and reducing the flow rate of chemical injection, which was being used to inhibit corrosion, between subsea assets. In order to re-establish flow, the customer needed to either manufacture new HFLs or repurpose existing components. The customer chose to reuse the original equipment manufacturer's (OEM's) termination heads and contracted Oceaneering to develop a solution to rectify the leaking couplers. With the arrival of customer furnished termination heads at Oceaneering's Angola manufacturing facility, reverse engineering, procurement, and manufacturing of the components that required replacing commenced. After replacing these faulty components with new, and upon completion

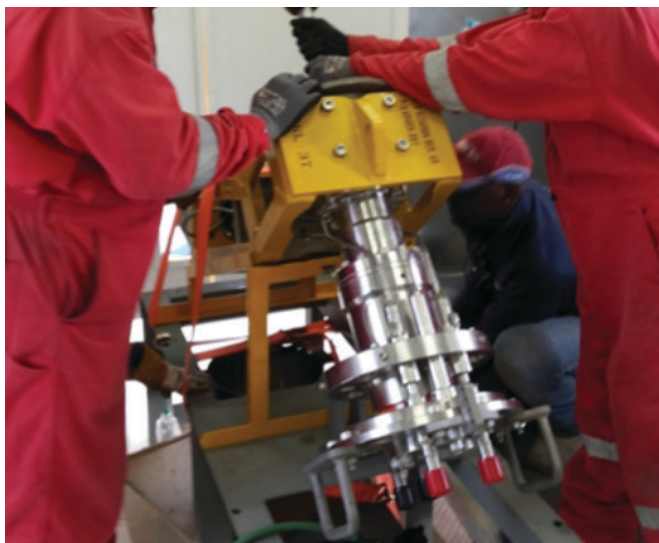


of the reverse engineering, Oceaneering was then successful in interfacing these new components with in-house manufactured small bore tubing and hydraulic hose bundles.

The 14 hydraulic flying leads varied in configuration which meant that each was unique and, therefore, required different levels of engineering and management. The hydraulic flying leads varied in length, varied in the number of hydraulic lines each contained, and varied in the size of small bore tubing contained within each hydraulic line. These variances in configuration contributed to extensive engineering analysis.

Execution Plan

The customer contracted Oceaneering to complete the work scope in December 2017. The procurement of the raw materials required to manufacture the required thermoplastic hoses at Oceaneering's Subsea Distribution Solutions site in Niteroi, Brazil commenced in January 2018. Upon receipt of the existing termination heads, engineering efforts to develop the detailed design solution kicked off using a team based in Angola and Oceaneering's Offshore Design Center in Chandigarh. Assembly of the newly-



designed HFL assemblies was completed at Oceaneering's Angola manufacturing facility which commenced in January 2019 and continued through to December, when factory acceptance testing was completed.

Challenges

The project saw the highly-experience team overcome various challenges. For example, the material procurement process for items being imported to Angola were affected by extremely long lead times. There were no existing engineering drawings or manuals

related to the HFLs that could be used as reference material.

There was a significant amount of reverse engineering required to meet the customer's desire to use the existing termination heads. This included ensuring the Oceaneering supplied equipment could be properly interfaced and ensuring that the termination heads themselves were suitable for reuse. Part of the manufacturing process, the welding procedure specification (WPS), had to be adapted to accommodate various sizes and lengths of tubing adaptors and hoses.

The project was also under a very accelerated timeline to meet the customer's delivery expectations.

Project Highlights

In order to complete the project, Oceaneering undertook extensive non-recurring engineering (NRE) to ensure the appropriate manufacture of the necessary termination head bend restrictors and tubing adaptors. The project also required an applicable and unique WPS. Several locally-based welders were trained and qualified against this new standard and supported the project's manufacturing efforts.

Results

The customer benefited from a cost- and time-effective solution to their initial challenge and the HFLs were fully manufactured using Angolan talent at Oceaneering's Angola site. Three HFLs, all of various lengths and various termination head configurations, are currently stored at Oceaneering Angola's manufacturing facility while the remaining 11 have been delivered to the client and are currently in use offshore Angola.