

Contract: Corocoro FSO Installation
Client: ConocoPhillips
Location: Offshore Venezuela



Challenge

Struggling with limited availability of local infrastructure, minimal marine equipment and challenging sea conditions, ConocoPhillips approached Noble Denton for advice and consultancy on the installation of its Corocoro FSO in Venezuelan waters.

Expertise provided

The scope of the work covered pre-installation and cross-tensioning of a ten-point chain-wire mooring system; connection of the FSO to the moorings and setting of operating pre-tensions; installation of two flexible risers, complete with distributed buoyancy and ballast elements; installation of sub-surface PLEM; installation of structures such as boat landings; and various commissioning and demobilisation activities.

Services provided included the development of all installation procedures; all temporary-phase analysis; procurement and/or leasing of third-party equipment and services; offshore attendance throughout all phases of the work; and preparation of as-built documentation.

Facing the challenge head-on, Noble Denton developed innovative solutions including:

- The drag-embedment 39te anchors used in the mooring system were required to be proof loaded to 700te tension. In order to achieve this Noble Denton developed a cross-tensioning system of strandjacks mounted on a deck barge. Opposed mooring legs were pulled against each other by means of the strandjacks until the required tension was achieved and held as dictated by Class requirements. It is believed that this was the first use of strandjacks for such a scenario, and the system proved both reliable and cost-effective

- The FSO operating pre-tensions far exceeded the capacity of the vessel's mooring pull-in system. This created challenges in achieving the required pre-tensions, as the available equipment had inadequate capacity. The problem was solved by means of a combination of procedural methods and temporary equipment; with the FSO oriented in a highly offset position it was possible to pull in all bow mooring legs to their required length using the low-capacity winches on board the vessel. However, for the stern legs, a crane barge provided the required pre-tension, using temporary rigging made up to the inboard end of the mooring legs

- The positional tolerance of the PLEM relative to the bow of the FSO was extremely tight at less than one metre. In order to meet this requirement, the flexible risers were first connected to the FSO's bow and then reeled out along the deck of a construction barge. The PLEM was made up to the flexible risers on the deck of the barge before lowering it to the seabed. It was possible therefore to lower the complete assembly while constantly referencing the FSO bow position until set-down could be accomplished within tolerance.

Outcome and benefit

Noble Denton's ability to apply technical excellence to complex engineering challenges, along with its customer focus, sense of urgency and rigorous approach to safety enabled the project to be delivered on time, within budget and to the highest quality standards.