Multi-Disciplinary Risk Review Method to Ensure Readiness of Offshore Installation Operations

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Abstract. Subsea Oil & Gas Projects often experience costly learning curves at the start of offshore campaigns to debug installation operations. As a mitigation, a simple and efficient risk assessment methodology has been developed, inspired from System Engineering principles, that brings rigor during the installation engineering phase and maximizes the chances to "***D***o It ***RI***ght the ***F***irst ***T***ime!" during the offshore campaign. This method, named DRIFT (***D*efine** components, assess ***R*equirements**, ***I*nvestigate** Issues, ***F*ix** them and ***T*ransmit** the results) has been applied recently on MOHO NORD Project by Technip FMC, with its client, Total EP Congo, for the preparation of a critical marine operation and did contribute to successful operations with no incident. It is particularly useful for subsea project with critical offshore operations and the ambition of anticipating issues rather than debugging them offshore. MOHO NORD is an oil and gas field located in Republic of Congo developed and operated by Total EP Congo with its partners Chevron and SNPC.

1 Introduction

Subsea Oil & Gas Field projects face high risks during the offshore installation works phase. This is especially the case for activities that are completely new or different from past projects. Project experience demonstrates that traditional risk assessment sessions sometimes fail to identify all the risks. During these sessions, the stakeholders focus mostly on the solution domain and do not spend enough time understanding what is really expected from each component of the installation system. Therefore, some aspects of the installation activity being risk assessed may be inadvertently occulted and not fully reviewed by the experts. Also, even if potential issues and failure modes are thought of in the office, the operation actors that will take care of these issues offshore may not be sufficiently aware of them. For instance, a crane operator is typically aware of the lifting limitations a few hours or minutes before the operation takes place. This can be detrimental to the success of an operation, and can result in intensive debugging. Up to now, most projects faced learning curves in the offshore work schedule to debug the first time each operation is performed. With the O&G focus on reducing costs and personnel exposure to risks, there is more and more necessity to reduce such loss time and hazards, improving the vessel productivity while keeping a safe operation.

2. DRIFT Method

The DRIFT method is very simple and consists in five stages:

2.1 Defining the Installation System Components

The Installation System can be decomposed into four main components categories:

- Product: what equipment part of final & permanent system is being installed?
- Equipment: what are the enabling equipment used for the installation?
- Operations: what are the main installation steps?
- Operators: who are the actors involved in the operation?

2.2 Assess Requirements:

List all expectations for each component highlighted in step 2.1. What are the associated requirements for each operation? The first 2 steps correspond to the architectural description of the installation system (decomposition, use cases, stakeholders). For efficiency reason, they should be prepared in advance of any risk assessment.

2.3 Investigate Potential Issues:

Investigate potential issues that may prevent each of the above requirement to be met. Involve a multidiscipline group. For each requirement listed in step **2.1**, answer collectively the following questions: 1/ What are the possible impediments for this requirement? 2/ Based on our collective experience and perspicacity what are the potential failure preventing this requirement to be met? All requirements should be reviewed in this manner. The outcome is a list of risks to mitigate and associated actions to close prior to the start of the operation. These can include checks to perform (engineering or physical checks), procedural steps to improve, flags in the procedure, specific focus of the familiarization, special equipment and related operator’s readiness.

2.4 Fix the Issues:

Identified action list above is worked out & closed prior to the operations. The operation level of readiness can be tracked by looking at how many actions have been closed.

2.5 Transmit the Information:

The identified failure modes can serve as an input for the familiarization of the construction crew offshore, for them to understand what wrong can happen & what is planned to avoid it.

3 Case Study: Second End FLET Installation – Moho Nord project

3.1 MOHO NORD Project Description

The project aims at developing the northern part of the Moho Bilondo PEX as a standalone hub identified as Moho Nord and the central area, at the northern part of Moho Bilondo, identified as Moho Phase 1 Bis. The fields are located offshore Congo, at approximately 75 km from the shore in water depths between 600 m and 1 050 m. TechnipFMC was responsible for the project execution of the Umbilical Flowlines and Risers (UFR) EPSIC Package, which encompassed design, fabrication, transportation, installation, pre-commissioning of the Umbilicals, Flowlines and Risers Package for greenfield and brownfield works, and installation of subsea equipment from Total. The scope includes in particular the installation of 16 inches Oil Export pipeline from Moho Nord Field to Djeno Terminal onshore (75km).

3.2 Critical Operations:

The Oil Export pipeline is terminated by a FLET (Flowline End Termination) weighing 57t and sizing 16m long x 6m wide. As opposed to other similar equipment, this FLET is too big to pass through the firing line and the stinger, i.e. it is installed from the installation vessel side, using the PHD (PLET Handling Device), a frame that supports the FLET during the weld to the pipeline. The pipeline installation catenary is secured by the hang-off clamp. The main steps are summarized and illustrated below:

- At quay, the FLET is upended and installed in the PHD with the G1200 main crane,
- After transit to field, the flowline is recovered from seabed and clamped in the hang off porch on vessel side,
- With the PHD and its hydraulic system, the FLET is upended from transit position (left picture below) to the welding position (right picture below) for tie-in to the flowline,
- After tie-in, the FLET is deployed using G1200 main crane and A&R winch.

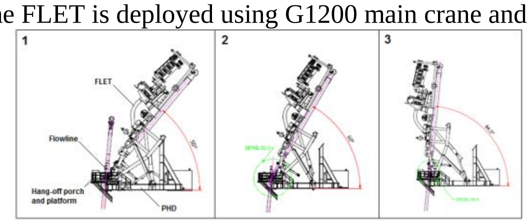

Figure 1 - Main FLET upending steps in PHD

For Total, this operation was critical, being a first on project and very close to first oil. Thus, a DRIFT assessment was performed to maximize the level or readiness.

3.3 DRIFT process for Moho FLET:

Three sessions of three hours each with an experienced multidisciplinary team were necessary: Installation engineer responsible for the scope, Operation engineer, Structural engineer, Welding and fabrication engineer, Project engineering manager, Installation discipline head, Project manager, Offshore Construction Manager, PHD hydraulic system technician. Before the meetings, the installation engineer prepared, the description of: product, installation equipment, operations, operators and their associated functions expected. Each points of the functional analysis then led to the actual failure analysis. A dedicated session was devoted to PHD equipment and hydraulic system. The actions resulting from the DRIFT review were gathered into an action register.

3.3 Joint Risk assessment

The results of the DRIFT review were used as an input to run an efficient risk review with COMPANY. The clear elicitation of system components & associated requirements, gave the company the opportunity to better provide input into the risk assessment.

3.4 Main findings from the DRIFT review and benefits for 16in OE FLET:

Even if the procedure was at very advanced stage, the review raised about 45 actions. Some of the main actions are summarized below:

- Adding mitigating measures to the procedure,
- Performing final checks to confirm risks are limited as realistically feasible as possible (presence of secondary restraint for instance if applicable),
- Ensuring operation personal training, especially the specialized technicians and crane driver. A dedicated crane lift simulation model was built to this purpose.
- Re-calibration of cylinders counterbalance valves with the latest loads

Eventually, this review allowed to fully highlight the most critical parts of the operations. A clear picture and special focus on the most critical steps raised during the DRIFT review was particularly helpful to prepare the familiarization of the vessel crew.

4. Conclusion

The DRIFT methodology has proven its benefits to the project by improving the robustness of the procedure, reducing the Hazards ahead of the operations and improving offshore schedule. The focus on the “architectural vision” of the solution to be implemented (components of the installation system and their associated requirements), on the level of qualification required by each person involved in the offshore work, and the facilitation of the access to the information and the involvement of multidiscipline and experts are the key elements of this review. The effort for implementing this methodology, in engineering man-hours, as shown by MOHO NORD project case, is very worth when we realize the risks that are at stake.