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SUBSEA TREES INSTALATION IN DRAGON FIELD MARISCAL SUCRE PROJECT, PHASE I

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ABSTRACT

PDVSA Offshore Division develops The Mariscal Sucre Project with the exploitation of the gas fields Dragon, Patao, Mejillones and Rio Caribe located north of the Paria Peninsula, in Sucre State, Venezuela. For the Phase I of the Project two field production stages were planned. The first one includes the Dragon field's production by an accelerated production system and after that the inclusion of the Dragon and Patao field production through a platform. This work describes the installation campaign of the first four subsea tress in Venezuela corresponding to the subsea infrastructure of the Dragon Field's Accelerated Production System. This was a milestone that marked the history of the offshore industry in the nation. These trees are horizontal type and they are set for ten thousand pounds design pressure and a configuration that allow performing well interventions without removing the tree. The subsea trees installation was held with the support of a multipurpose vessel, two working class ROVs, tree handling tools, connection equipment, etc.

The produced gas of the Dragon field during the Accelerated Production System will be collect by a 16 inch and 19 kilometer length pipeline the transported to shore through a 36 inch export pipeline for distribution in the internal market. The subsea system control will be manage by a control vessel and the gas dehydration will be handle for temporary skids located in the Conditioning Plant for the Internal Market (PAGMI) in the CIGMA complex.

The Dragon field subsea production system will permit the delivery of 300 MMCFD of dry gas to the internal market achieving a social commitment with the gasification of the north east side of the country substituting liquid fuels which have a high value in the export market. This substitution will facilitate the production of the electric generation plants in that region.

Keywords: gas fields, subsea system, Dragon field, Mariscal Sucre Project, Accelerated Production System.

ABREVIATIONS

a **APS:** Acelerated Production System
b **ROVs:** Remote Operated Vehicules
c **Km** : Kilometers
d **mts**: Meters
e **Ton:** Tons
e **CIGMA** : Complejo Industrial Gran Mariscal de Ayacucho.
f **MMSCFD**: Million Standar Cubil Feet per Day
g **THT:**Tree Handling Tool
h **PETU:** Portable Electric Test Unit

INTRODUCTION

The main objective of this paper is to describe the subsea tree installation procedures for the Dragon field. The installation activities described were performed by a multipurpose vessel. The subsea tree installation procedure for the Dragon field was elaborated by a Contractor and revised with PDVSA to serve as a trust foundation reference for supplementary information during the trees installation operations with safety and efficiency.

Next is a description of a summary of the methodology used for the trees installations. The main activities are highlighted as follows:

A. Preparation of the tree
B. Lifting of the tree from the compensation system multipurpose vessel
C. Lowering of the tree 20 meters above the wellhead
D. Mobilization of the vessel from the deployment area to the installation location
E. Landing and positioning of the tree inside the wellhead
F. Disconnection and recovery of the tree handling tool
G. Test to the VX of the tree
H. Tree landing study

DESCRIPTION OF THE SUBSEA TREE

It consists in a valve arrangement, connectors, metering, flow and pressure instruments and coupling accessories to the production elements. Its main function is to control the gas volume produced in the well for a safe and reliable operation adjusted to the production requirements.
The subsea production trees of the Dragon field are designed for a 10 thousand pounds pressure. They are horizontal type and have a configuration that allows well interventions without removing it.

Table 1. Subsea tree dimensions

Property		Units	
		Feet	Meters
Dimensions	Length	17,8	5,43
	Wide	14,8	4,53
	Height	12,8	3,91
Center of gravity	In the air (Tons)	50	
	In the water (Tons)	43,5	
	X (mts)	Y (mts)	Z (mts)
	0	0	2,345

PROCEDURES

The subsea tree installation was performed using high power remote operated vehicules (ROVs) which monitored the operation and actuated the valves and the 400 tons crane which has a compensation system necessary to maintain the tree stability during lowering it to the seabed, likewise it was necessary the use of wellhead cleaning tool and communications tests.

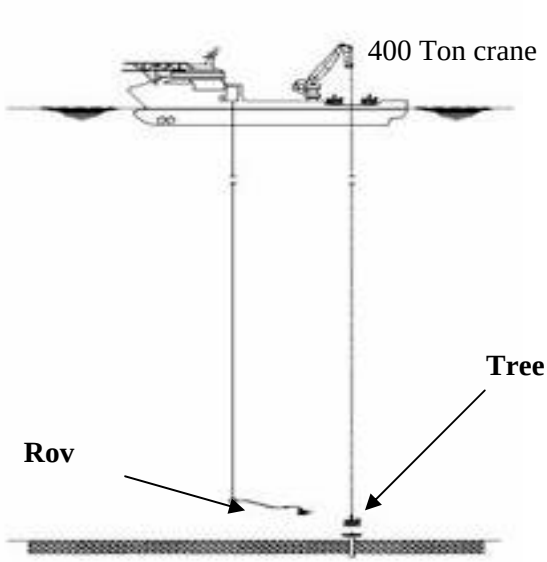

Figure 1. Tree lowering technique

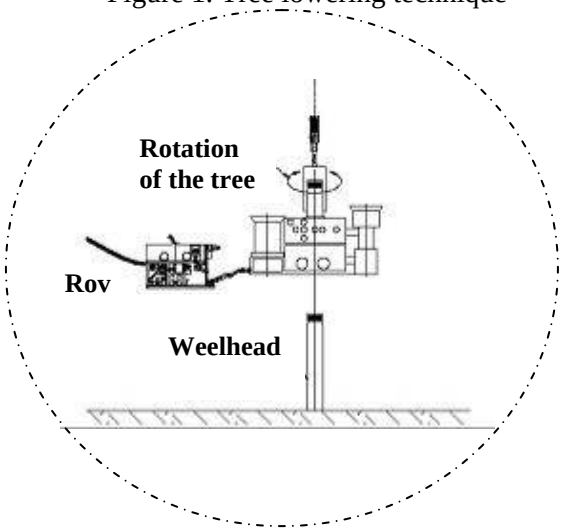

Figure 2. Detail of the tree installation to the wellhead

The next description compiles the procedures for the subsea trees installation [1]:

1.- Checking prior deployment of the first subsea tree: this consist in a visual inspection of the tree, oil levels verification, tree handling tool (THT) verification and plot of the route for the deployment area to the wellhead.

Figure 3. Preparation of the subsea tree in the vessel deck

2.- Pre-deployment of the tree from the vessel to the inspection base: revision of the personnel involved and safety talk, communication checking and positioning of the crane, tree lifting and cleaning of the area.

3.- Lifting of the tree using the main 400 Tons crane: elevate the tree by starboard for a period of 50 seconds before the horizontal immersing into the water.

Figure 4. Lifting of the subsea tree

4.- Beginning of the tree lowering: up to a 20 meters distance to the seabed.

Figure 5. **Beginning of the tree lowering**

5.- Tree orientation: with the ROV and the THT support which will be attached to the suspended wireline of the vessel main crane.

Figure 6. Subsea tree orientation with ROV

6.- Tree location above the wellhead: in the pre-determined position.

Figure 7. Tree location above the wellhead

7.- Verification of the tree to the wellhead adjustment and installation of the debris cap over the tree: to avoid drop objects to the interior of the tree.

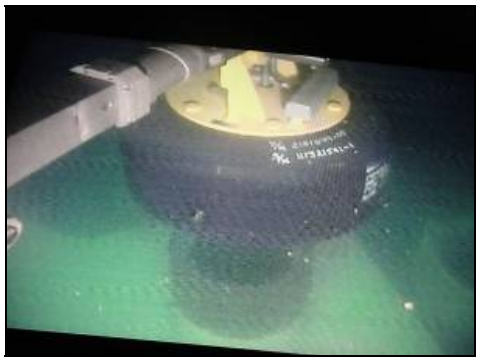

Figure 8. Installation of the debris cap

RESULTS Y ANALYSIS

The operation of the subsea trees installation takes about 8 hours, but this depends on the weather conditions of the area. In Dragon field the weather conditions made the operations, in some cases, to take longer than expected.

These are the major conditions registered during the operations in Dragon field:

Table 2. Weather conditions in Dragon field

Major conditions registered during the installation		
Wind (knots)	**Waves (mts)**	**Marine currents (m/seg)**
15-18	2,5	03-05

Due the adverse weather conditions in the Dragon field during the operations of the subsea trees installations it was necessary the use of high power ROVs.

The required equipment for the subsea trees installation in the Dragon field was:

1.- Multipurpose vessel for installation: Dynamic Positioning (DP2) vessel equipped with two cranes (400 Tons and 120 Tons capacity each)

2.- Work class remote operated vehicles (WROVs)

3.- Tree Handling Tool (THT).

4.- ROV operated wellhead cleaning tool

5.- Tree inspection support.

6.- Portable Electric Test Unit (PETU) and other connection equipment.

7.- Support vessels.

For the subsea trees installation it was indispensable the use of the 400 tons crane which has a compensation system necessary to maintain the tree stability during the lowering to the seabed

CONCLUSIONS

1.- Using the multipurpose vessel the installation of the first four subsea production trees for the Dragon field subsea production system was performed successfully.

2.- The subsea production trees installation for the Dragon field was an immense challenge for Petróleos de Venezuela S.A. (PDVSA) because it was the first time that this kind of operations took place in the tropical waters of the country.

3.- The operation for the Dragon field subsea production trees installation required high power ROVs due to the adverse weather condition in the area.

4.- The subsea production system for the Dragon field will allow the delivery for the internal market of 300 MMSCFD of gas. This is the first offshore development of gas production in Venezuela.

REFERENCES

[1] Technip. Tree Installation Procedure,
document N°. TF027337-000-CP-3865-0813, 2012.