



OTC 18669

## J-Lay and Steep S-Lay: Complementary Tools for Ultradeep Water

Dominique Perinet and Ian Frazer, Acergy

Copyright 2007, Offshore Technology Conference

This paper was prepared for presentation at the 2007 Offshore Technology Conference held in Houston, Texas, U.S.A., 30 April–3 May 2007.

This paper was selected for presentation by an OTC Program Committee following review of information contained in an abstract submitted by the author(s). Contents of the paper, as presented, have not been reviewed by the Offshore Technology Conference and are subject to correction by the author(s). The material, as presented, does not necessarily reflect any position of the Offshore Technology Conference, its officers, or members. Papers presented at OTC are subject to publication review by Sponsor Society Committees of the Offshore Technology Conference. Electronic reproduction, distribution, or storage of any part of this paper for commercial purposes without the written consent of the Offshore Technology Conference is prohibited. Permission to reproduce in print is restricted to an abstract of not more than 300 words; illustrations may not be copied. The abstract must contain conspicuous acknowledgment of where and by whom the paper was presented. Write Librarian, OTC, P.O. Box 833836, Richardson, TX 75083-3836, U.S.A., fax 01-972-952-9435.

### Abstract

The pipelines are major components of the oil and gas production. With Ultra deep water development, the increasing of assisted recovery and zero-flare policy, pipelines specifications are much more elaborate: fatigue resistance due to cyclical operational loads and frequent shutdowns, thermal insulation for flow assurance purpose. They are often short and associated with many singularities, termination or inline structures. The design of pipelines must take into account walking and buckling, lay out in congested areas, sometimes with geohazards issues. The paper will expose the design of the different pipelines and associated components and describe how the contractors have met these challenges, improved the laying efficiency with using the J-lay method or the steep S-lay, which is adapted from conventional laying method continuously improved since the seventies with a deep water application resulting from the revisited strain criteria on the laying ramp.

The S-lay methods are much more appropriate from the pipeline fabrication point of view, and appear as a better option for the laying of relative long lines such as gas trunk line or long tie back. The J lay method appears as a natural configuration from the catenary point of view and is much more appropriate to the installation of in line structures.

The paper will illustrate with practical applications that these two methods are not opposed but are complementary tools and have each their own domain of excellence in the production and recovery of the hydrocarbon resources.

### Introduction

The driving phenomena for deep water pipelines have drastically evolved over the last ten years with the development of deep water fields. The key driver for the design of the field layout and the flowlines is undoubtedly the flow assurance of multiphase fluids. This has led to a significant increase of insulated flowlines, which has had a great impact on the overall behavior of pipelines on the sea

bed. The use of wet insulation materials such as polypropylene and polyurethane has resulted in a general reduction in the submerged weight of production flowlines, this in combination with the very soft soil conditions found in deep water locations has led to the significant increase in pipeline movements induced by pressure and temperature of the internal fluids. These movements known as pipe walking and lateral buckling have been the subject of much discussion within the offshore pipeline industry in recent years /1/, /2/, /3/, /4/. The details of these phenomena are not discussed in this paper, however the influence they have on the installation methods used for deep water pipelines will be addressed.

The field layout selected for a particular offshore development has a significant influence on the pipelines and in particular the installation techniques. In deep water fields, which are dominated by subsea wells, the field layout tends to be very different from those selected for more conventional water depths. In the past pipelines tended to be relatively simple inter-platform links or links between the field and the shore, now in deep water the flowlines tend to be very much more complex, with the need for end termination structures and several midline structures including valves and tees to facilitate tie-in of additional wells into the main flowline systems. These structures can be relatively large and need to be installed together with the pipelines, greatly influencing the complexity of the offshore pipelay operations.

The inclusion of all these subsea structures (PLEM, PLET, midline tee, etc) into pipelines has been a major feature in new pipeline systems in recent years. As a result pipeline installation operations are no longer a pure pipelay activity but also involve the handling and lowering of these structures which is becoming a major part of the operation. As a result the overall efficiency of pipelay operations is not simply related to the rate at which the vessel can lay pipe, but a combination of the lay rate together with the efficiency of the vessel to install structures as part of the pipeline. As a result all currently available pipelay techniques have a place in the deep water market, with no one dominating the complete picture. This paper will explore the potential for S-Lay as well as J-Lay to be effectively employed for both deep and ultra deep water field developments.

### Deep Water Pipelines

In general offshore pipelines can be divided into the following types :-

- In field flowlines, including production and injection flowlines. The pipes of these networks are fitted with singularities and structures as described here above