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## Development of a Pipeline Management System for an Ultradeepwater Long-Distance Subsea Tieback in the Gulf of Mexico

Aditya Singh, Total E&P USA; Neeraj Zambare, Kongsberg Process Simulation; and Magnus F. Brostrøm, Kongsberg Maritime

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### Abstract

The Canyon Express Pipeline System produces three gas fields in the deep (6200-7200 feet) Mississippi Canyon under different operating regimes and varying production rates from multiple zone completions. A real-time Pipeline Management System (PMS) was developed for the Canyon Express Pipeline System to provide enhanced capabilities for reservoir and production monitoring, early detection of potential production upsets, and production planning.

PMS is a self-learning dynamic model. Topsides process simulator, D-SPICE™, was integrated with the multi-phase pipeline simulator, OLGA2000®, to develop the PMS. A stable interface allows high-fidelity simulations for subsea pipelines together with topsides facilities.

The PMS consists of a real-time and a planning simulator. The real-time simulator has a live read-only satellite (microwave) link from the platform Master Control System (MCS) via OPC (OLE for Process Control) to get all the available measurements. Current real-time condition of the PMS can be transferred to the planning simulator for off-line planning simulations. Look-ahead scenarios can be run on the real-time simulator which displays trends of possible future process problems.

Speed of up to 30 times real time is achievable in Look-ahead and Planning modes. A web server linked via OPC to the real-time simulator allows any authorized user to monitor the system from the World Wide Web using a standard web browser.

The PMS model scope covers the subsea wells, flow lines, inlet high-pressure (HP) separators, low-pressure (LP)

separator, export gas compressors, slug tank, gas buyback and pigging. The real-time and look-ahead modes are used to monitor operations throughout the process, from the subsea wells to gas sales. Functionalities include: detection of water break-through in subsea wells, detection of scale buildup, monitoring of hydrate margins, methanol injection optimization, liquid holdup monitoring, dynamic flow metering for flow allocation, detection of blockage in the flow line, early detection of equipment failure, etc. The planning simulator is used for detailed diagnosis of problems, analyzing “what if” scenarios, developing operating procedures and planning critical operations.

The enhanced monitoring, look-ahead and planning capabilities provided by the real time tools can significantly reduce production downtimes and intervention costs, and increase the ultimate recoveries of deepwater fields. Real-time production management tools are essential for managing the challenges associated with deepwater operations.

### Introduction

The Canyon Express transportation system consists of two 12-inch flow lines running parallel from Camden Hills through Aconcagua and Kings Peak to the Canyon Station Platform, located approximately forty miles north of the northernmost Kings Peak well. Production from the fields is gas with some condensate and formation water. The wells are tied together in a “daisy-chain” arrangement. Refer to Figure 1 Canyon Express Infrastructure

When the PMS was developed, there were 4 producing wells on the east flow line and four producing wells on the west flow line:

East Flow line:

- 2 Camden Hills wells (CH 1, CH 2)
- 2 Aconcagua wells (AC 3, AC 4)

West Flow line:

- 2 Aconcagua wells (AC 1, AC 2)
- 2 Kings Peak wells (KP 1, KP 2)

The two flow lines are loop connected at the ends but are isolated from one another with a subsea isolation valve located just upstream of MC305-1. Each flow line is designed for