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## Reservoir Management Challenges of the Terra Nova Offshore Field: Lessons Learned After 5 Years of Production

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### Abstract

The paper describes reservoir management challenges during the first 5 years of the production from the Terra Nova oil field, located offshore Newfoundland and Labrador, Canada. The purpose of the paper is to share lessons learned in the appraisal strategy, data monitoring, subsurface modeling and production management of this subsea/ floating, production, storage, offloading (FPSO) development. The material covers appraisal history, reservoir description, production history, reservoir monitoring, reservoir management, lessons learned and future challenges.

The paper will discuss the need for a balanced approach regarding development and delineation of the resources. Since there is no gas export from Terra Nova or any of the Grand Banks fields, surplus gas has to be re-injected. The Terra Nova depletion plan requires that the production from the water injection region and the gas flood regions be balanced for optimum pressure management. The relative richness of the injection gas from the Terra Nova production process has the potential to create miscible gas-oil conditions. We will discuss how slim tube experiments and compositional tracking of the fluids have demonstrated benefits to the oil recovery by operating the gasflood at a reasonable pressure. The Terra Nova field lies not only in a harsh environment but also in an immature, low infrastructure area. This has led to additional challenges regarding reservoir management and future development.

Production behavior and history matching have shown that seismically defined fault blocks are leaking rather than sealing. The presence of leaky faults is beneficial for oil recovery, but presents challenges for precise reservoir simulation modeling and history matching. Terra Nova has extensive amount of data from bottom hole pressure gauges,

wireline formation pressures (e.g. RFT/RCI), water cut trends GOR trends, gas tracers, etc. The paper discusses how these data have been integrated in the reservoir management process. Various history matching approaches will be discussed; both manual history matching and assisted techniques (experimental design).

This is to the best of our knowledge the first SPE paper from the Grand Banks oil province that describes integrated reservoir management challenges particular to this region.

### Introduction

The Terra Nova oil field is situated on the Grand Banks, about 350 km east-southeast of the city of St. John's in the Canadian province of Newfoundland and Labrador. The Terra Nova field is located in the Jeanne d'Arc basin 35 km southeast of the Hibernia oil field and 25 km southwest of the White Rose field (Figure 1). It is the second largest producing oil field in East Coast Canada.

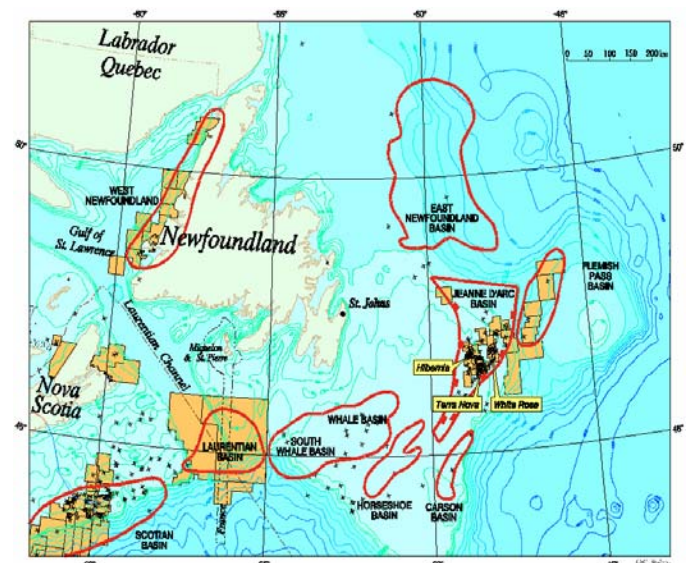


Figure 1: Location of the Terra Nova oil field

Terra Nova was discovered in 1984 at a water depth of 95 m. The oil reservoirs are located in the Upper Jurassic Jeanne d'Arc sandstone formation at depths of 3200-3600 m below sea level. After a successful initial appraisal campaign in