

# Terra Nova Offshore Opportunity



Beyond today's standards.\*





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**Innovation, it has been said, is the ability to see change as an opportunity, rather than a threat.**

When the Terra Nova Floating Production Storage and Offloading (FPSO) vessel was commissioned it offered an assortment of attractive capabilities for its owners over the expected 15-17 year life of the Terra Nova reservoir. They had an open mind to innovative thinking.

FPSO vessels are gaining interest from companies around the globe. One of the key advantages they offer is a relatively rapid commissioning process. Often an FPSO can be ready within two years, or around half the time it takes to construct and equip a traditional production platform. The Terra Nova structure is one of the largest FPSO vessels ever built, at a length of 292.2 metres and a width of 45.5 metres. In fact it's about the size of three football fields laid end to end and it stands more than 18 storeys high. This immense size is put to good use as the Terra Nova FPSO can store 960,000 barrels of oil and provide accommodations for up to 80 personnel during production operations, with plans to expand capacity to 120 beds.

There are also advantages when operating in production areas that lay in deeper water. These fields, such as the ones off the coasts of Eastern Canada, West Africa and Brazil, present installation and operational challenges that would be more significant problems for conventional platforms. As a result, fields that might be considered economically marginal can be developed with FPSOs. Another benefit of an FPSO compared to a platform is that in areas prone to icebergs, the FPSO – equipped with a quick-disconnect turret system – can propel itself away from the wellhead under its own power and avoid collision and/or an environmental disaster.

But there are challenges associated with FPSOs. The conditions are harsh for the operating equipment. On-board turbines are expected to run essentially non-stop in high seas. Heavy wave action can make every maintenance task that much more difficult. Percy Delaney is a Mechanical Maintenance Engineer with the Terra Nova consortium. He points out that “the Terra Nova FPSO is



*The Terra Nova FPSO is designed to hook up to the reservoir.*

designed to remain on location for years at a time. It is also designed to withstand severe storms, known as 100 year storms.”

For the uninitiated, a 100 year storm refers to a storm event of such magnitude that it would be expected to be equalled or exceeded only once in one hundred years. This obviously has implications for maintenance routines. As Delaney explains, “We’ve already experienced a 90th percentile storm, followed by 2 additional significant storms within one week. On one occasion we observed 14 metre waves washing over the main deck.” Typical conditions are harsh, compounded by extreme cold, high winds and fog as well as seasonal ice and icebergs.”

**On-board turbines are expected to run essentially non-stop in high seas.**

The Terra Nova hull was constructed in Korea with the various modules that add functionality being sourced from all over the world. The final assembly was done in Bull Arm, Newfoundland. Among the components that made up the Terra Nova FPSO were a pair of Thomassen/General Electric PG6561B Frame 6B Heavy

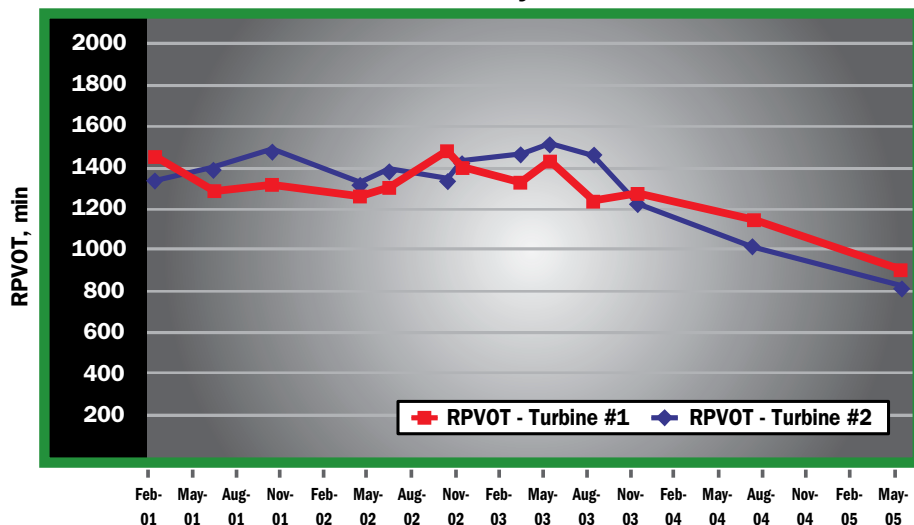
Duty Gas Turbines that are used for power generation. These turbines employ a geared speed reduction system. In this type of application, the lubricant has to do double duty, lubricating both the turbine bearings and gears. Consequently, this is a challenge for any lubricant because the requirements for gear lubrication are different than those of the turbine shaft bearings.

According to Delaney, use of large frame turbines off shore is uncommon. Compared to the more prevalent aero-derivative turbines, frame units enjoy extended operating life but they need to

additive system containing an anti-wear additive and he was pretty sure that we had a solution.”

Irvine remembers, “Tech Services was looking for an EP turbine product. We had been a couple of years in development with TURBOFLO\* EP 32 at the time. We knew that Thomassen had some concerns about “EP” turbine fluids. The industry had seen problems with varnishing in a similar application in the North Sea. The lube oil coolers had developed a buildup of varnish after only 18 months, while using a competitor product. This led to excessively

**RPVOT - Tested by ASTM D2272**



*The Rotating Pressure Vessel Oxidation Test (RPVOT) is commonly used to measure the oxidative resistance or stability of fresh turbine oils and is also used to monitor the remaining oxidative life of turbine oils in used oil analysis. With TURBOFLO EP 32, the RPVOT values for both turbines have remained consistently high over the duration of the field trial, demonstrating excellent stability.*

**Petro-Canada relied on its core strengths, an intensive data monitoring process combined with a highly collaborative customer relationship.**

be repaired on-site. The combination of confined, hazardous spaces and sea-state limits on the maintenance cranes makes repairs challenging, so reliability is critical.

Nick Finelli is a Technical Service Advisor with Petro-Canada. He recalls the first contact with the turbine manufacturer’s representative. “He was pretty cautious. We had no history with Thomassen. These turbines aren’t sitting on a plant floor. On the ocean, a turbine failure can be catastrophic.” Finelli continues, “We didn’t have a commercial oil that matched their spec, but I talked to our Engineering Manager, Doug Irvine. He felt that we already had a good product that utilized our ultra-pure base oils and unique

high lubricant temperatures and an eventual 25% decrease in power before a shutdown was necessary to clean the coolers.”

In order to convince Thomassen, Petro-Canada relied on its core strengths, an intensive data monitoring process combined with a highly collaborative customer relationship. After all, the proof is in the testing and this product would be field tested in three phases: At Shore (hook-up, commissioning and takeover of systems); In Shore (sea trials in Trinity Bay); and Off Shore (at the Grand Banks on the Terra Nova oil field). “It’s very important to get an opportunity to field test because there’s never a full correlation between bench and field trials,” Irvine says. Field tests provide the best validation possible for an engineer. The initial fill was done in April of 2000 and the commissioning phase ended in January of 2002.

Nick Finelli was present for the initial fill. In fact he was a regular visitor to Bull Arm as the FPSO took shape. “I was there one week out of every five, for eighteen months,” he recalls, “and two or three days were spent right on the FPSO. My job was to act as a liaison between our distributor and the First Fills Engineer for Terra Nova.”

## Petro-Canada's TURBOFLO EP formulation is ideal for modern heavy-duty gas turbines.

Over the course of commissioning, the equipment received monthly lubricant analyses. Physical and chemical properties including viscosity, additive level and oxidative stability remained constant throughout this period of time.



Developing a product like TURBOFLO EP requires a company to listen carefully to the requirements of both its customers and the industry and be committed for the long haul. "Turbine oils have a long development cycle," Irvine points out, "from idea to testing to screening prototypes. For example the Turbine Oil Stability Test (TOST) alone is run for over 10,000 hours. That's why it's so important to anticipate industry needs. This project really highlighted the need to see the big picture."

## Reliability is the hallmark of Petro-Canada lubricants such as TURBOFLO EP.

Vittoria Lopopolo is also an Engineering Product Specialist with Petro-Canada. She points out that the high quality, severely hydrocracked/hydrotreated base stocks that Petro-Canada manufactures perform extremely well in this application. "Additives are used to boost the inherent properties of the base stocks," she notes. "The synergistic combination used in Petro-Canada's TURBOFLO EP formulation allows these products to exhibit properties such as excellent oxidation and thermal stability, anti-wear protection, corrosion inhibition as well as exceptional water and air separation. This makes them ideal for modern heavy-duty gas turbines."

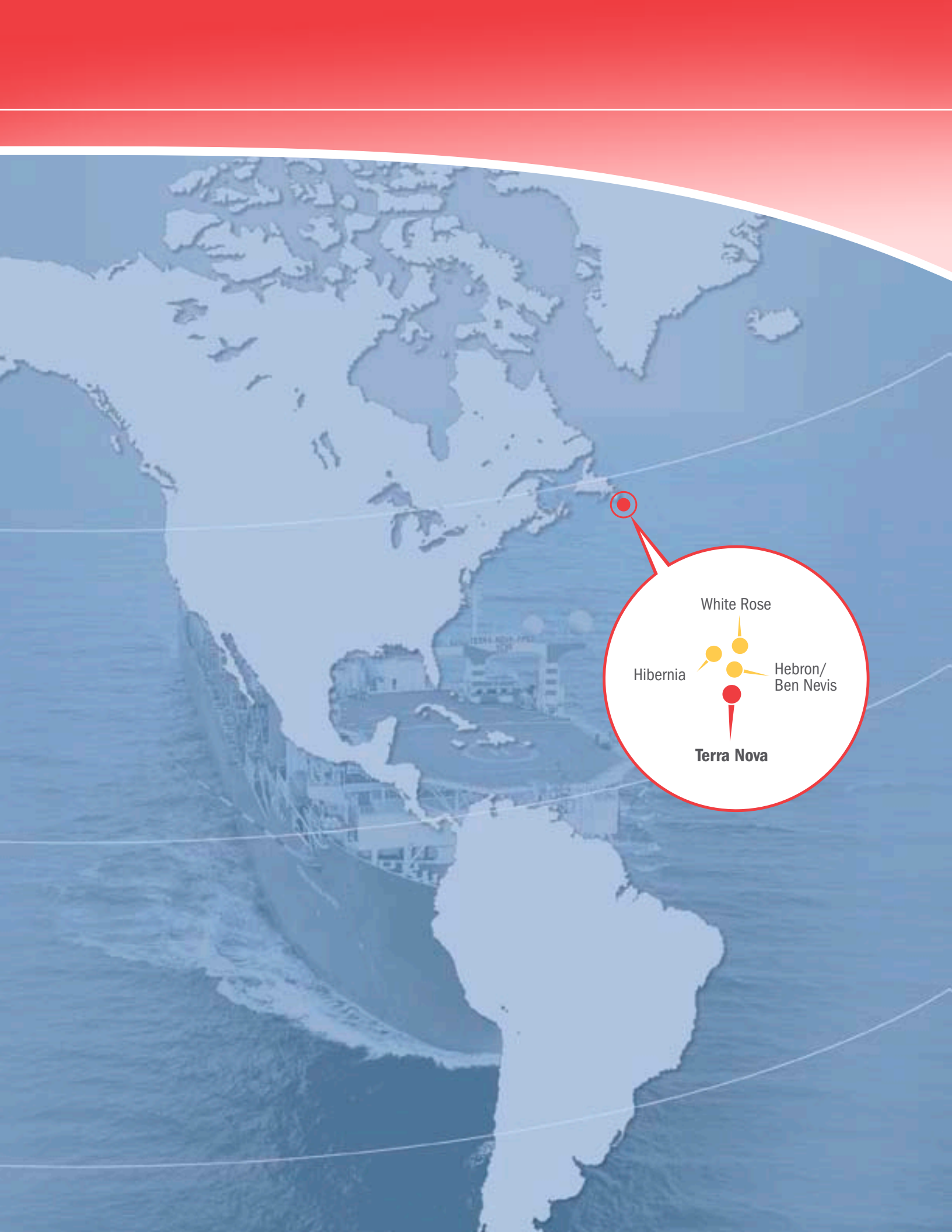
"Traditionally, turbine lubricants have been simple rust and oxidation inhibited products," points out Lopopolo, "but advances in output power-to-weight ratios, hotter operating temperatures and very low oil make up rates have increased the demands placed on turbine fluids, and necessitated more robust and sophisticated formulations."

Reliability is the hallmark of Petro-Canada lubricants, such as TURBOFLO EP, and it is a quality much appreciated by customers such as the Terra Nova consortium. Percy Delaney notes that "these turbines are 40 megawatt units. If we lose one, our output drops by 20,000 barrels a day. In addition we need the turbines to run the thrusters that stabilize the platform's location. That's why we require 97% availability of the turbines. A reliable power supply directly affects our bottom line."

"We're pleased with the results," declares Delaney. "In September (2005) we changed out the initial fill. We had a scheduled shutdown that presented a perfect opportunity. That was after about 28,000 fired hours of operation. I think you could say we got our use out of it." As an additional aside he mentions that the Thomassen maintenance personnel were favourably impressed by the trouble-free performance of the fluid.

The Terra Nova project stands as a testament to the Petro-Canada product development philosophy. By staying abreast of industry trends and being responsive to the needs of customers, the company continues to see change as an opportunity. Customers can therefore continue to focus on profitability, secure in the knowledge that Petro-Canada delivers Tangible Savings Solutions for their application.





White Rose

Hibernia

Hebron/  
Ben Nevis

Terra Nova

If you would like to know more about the Terra Nova project or TURBOFLO EP, please contact us at:

**Head Office:**  
**Petro-Canada Lubricants**  
**2310 Lakeshore Road West**  
**Mississauga, Ontario**  
**Canada L5J 1K2**



**Canada – West** ..... Phone 1-800-661-1199  
**– East (English)** ..... Phone 1-800-268-5850  
**(French)** ..... Phone 1-800-576-1686  
**Other Areas** ..... Phone (416) 730-2408  
**E-mail** ..... [lubecsr@petro-canada.ca](mailto:lubecsr@petro-canada.ca)  
**Internet** ..... [www.petro-canada.com](http://www.petro-canada.com)

**Petro-Canada America Lubricants**  
**980 North Michigan Avenue**  
**Suite 1400, #1431**  
**Chicago, Illinois**  
**USA 60611**

**Phone ....** 1-888-284-4572  
**Fax .....** (708) 246-8994  
**E-mail ....** [email@petro-canadaamerica.com](mailto:email@petro-canadaamerica.com)

**Petro-Canada Europe Lubricants**  
**The Manor, Haseley Business Centre**  
**Warwick, Warwickshire**  
**CV35 7LS**  
**United Kingdom**

**Phone .....** +44 (0) 2476-247294  
**Fax .....** +44 (0) 2476-247295  
**Internet.....** [www.petro-canada.co.uk](http://www.petro-canada.co.uk)

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