TOTAL EXPLORATION IN PAPUA NEW GUINEA

EXPLORATION OPTIMIZATION THROUGH TECHNOLOGY AND INNOVATION

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TOPICS ADDRESSED:

(1) Total position in PNG
(2) Leverage of global technical, operational experience and innovation
(3) Recent exploration efforts and near term focus

- PRESENCE IN PNG AND FOOTHILLS EXPERIENCE
- PRL15 EXPLORATION POTENTIAL
- PRL15 RECENT EXPLORATION HIGHLIGHTS
- OPTIMISATION & DERISKING IN THE FOOTHILLS
- TOTAL TECHNOLOGY IMPLICATION
- R&D FOR NEAR-TERM APPLICATION
TOTAL PRESENCE IN PNG
EXPLORATION POSITION

- Committed to long term sustainable E&P presence & optimal future development of resources in PNG’s unique environment

- Growing presence in PNG onshore & offshore full E&P cycle: 31,200 km² (Op.) and 4,165 km² (Non-Op.)

- PRL 15 Operatorship since August 2015
  - Total 40% - OilSearch 23% - ExxonMobil 37%
  - Elk-Antelope appraisal program completed

- Leveraging global experience, onshore to ultra deep offshore:
  - Technological innovation & expertise
  - Development & project execution capability

- Continued active exploration & maturation program:
  - Airborne GraviMag in transition zone
  - Onshore 2D and MT
  - 3D surveys planned in near future in the offshore
TOTAL FOOTHILLS EXPERIENCE
EXPERTISE & TECHNOLOGY

- Committed Partnerships
  - Forging committed Joint Ventures
  - Collaboration with all stakeholders

- Actively unlocking the significant resource potential of the foothills via an optimized exploration program
  - Data capture and integration
  - Technical Excellence & Technological implication
  - Optimizing technological experience and expertise

- Significant foothills, onshore and complex imaging experience
  - Bolivia
    - 26 wells over 4 structures (3 discoveries).
    - 1300km 2D, 500 km2 3D & MT: ~1800km2
    - Current Production: 220kBbls/D (100%)
  - Columbia
    - Historic position on Cusiana / Cupiagua (disc. 1990-91), 3 Discoveries, 3D Dev & development wells
    - Tangara: Sparse 3D (~500km2) & 1 well
    - Iskana: 1 well
    - Niscota: 2D 400km 4 wells leading to Huron discovery with production start-up due in 2017.
Located in a **structurally unique syntax domain**. Transition between Papuan and Aure Fold Belts.
- Influence of NE-SW Aure regional inherited structural trend (Australian Craton, previous transform zones)
- Structural complexity requires **integration of all available data sources to ensure optimal prospect de-risking**
Aure Fold Belt has a high historical technical success rate but carbonate reservoir quality predictability remains complex.

Main play risks & uncertainties:
- Reservoir quality/productivity
  - associated with depositional environment
- Prospect imagery and geometric definition

Past exploration only based on surface geology and sparse seismic data of limited quality (fold and offset)

New technologies and data coverage will enable more successful and cost-effective exploration.
Acquisition completed in Oct. 2018, without accident (delegated to OilSearch)

Operational and HSE challenges:
- Located in Papuan Thrust and Fold Belt, dense tropical rainforest with significant topographic relief (5m to 450m)
- Taking benefit from acquisition synergy & historic operators experience

Pushing further acquisition parameters onshore PNG, with smallest source interval ever acquired on PRL15 on production basis
- **Very large increase in seismic coverage and seismic fold** leading to improved imaging
- **2018 acquisition as an opportunity to test line parameters for future acquisition optimization:**
  - Multiple sources to determine optimum shooting design: half source interval & smaller/shallower explosive loads
  - Expected enhancement of S/N: less ground-roll vs. Higher energy
  - Overburden characterization improvement in area of complex static correction

![Source pattern diagram]

**PRL15 acquisition parameters**

- **2005:**
  - Source: 1kg, 3m
  - Receiver: 120m

- **2007:**
  - Source: 1kg, 3m
  - Receiver: 120m

- **2009:**
  - Source: 15m, 120m
  - Receiver: 12.5m

- **2014:**
  - Source: 1kg, 3m
  - Receiver: 120m

- **2018:**
  - Source: 1kg, 3m
  - Receiver: 15m

- **2018 Test parameters:**
  - Source: 1kg, 3m
  - Receiver: 120m

- **2021:**
  - Source: 1kg, 3m
  - Receiver: 120m

**Production vs. Tested**
Non-seismic methods constantly used as additional information to seismic
- Onshore acreage fully covered by AGG data
- 34 new MT stations acquired along with 2018 seismic acquisition, leading to improved coverage over PRL15
- From 2D & 3D unconstrained inversion towards 3D joint constrained inversion focused on prospectivity derisking
**TOTAL EXPLORATION ONSHORE PNG**

**SURFACE DATA AND MODELLING**

- **Additional surface data** acquisition over the recent years
  - Field work & surface geology to better constraint our structural models
  - LIDAR surveys as a support for operation planning
- **Reduce risk & uncertainties in our geological models** through structural modeling, 3D restoration (Move3D) to displacement estimates and paleo-bathymetry reconstruction

![Surface and sub-surface data Constraints](image)

*Structure model hypothesis*

*2D Forward modeling*

*Paleo-Bathymetry reconstruction*

*Mechanical modeling*
TOTAL TECHNOLOGY IMPLICATION
INTEGRATION & EXPERTISE

● **>> Ongoing Onshore PNG Exploration Effort through use of experience and technology for optimal and cost effective de-risking**

● **Continuous operations and new data acquisition**
  - Regional AGG
  - LIDAR survey
  - PRL15 2D seismic & MT acquisition

● **Constant integration using advanced techniques**
  - Field work and surface geology, 3D restoration and Structural modeling
  - From seismic to Shot based Interpretative imaging
  - Passive seismic

● **R&D focus on near term industrial application**
  - Developing & testing new imagery technology (PSDM, FWI…)
  - METIS (Multiphysics Exploration Technologies Integrated System) project

● **Dedicated facilities & in-house expertise**
  - Technological center and laboratories
  - Pangea High performance computation center
Use of latest's techniques such as Full Waveform Inversion (FWI) to improve resolution of velocity model

FWI tested as an automatic tool to discriminate between different structural models and derisk carbonate facies and extension
TOTAL R&D FOR NEAR-TERM APPLICATION

METIS (MULTIPHYSICS EXPLORATION TECHNOLOGIES INTEGRATED SYSTEM)

INDUSTRIAL PILOT

- Objectives:
  - Acquiring 3D High Density seismic data in hard-to-access onshore areas…
  - … while ensuring high quality image, low HSE & environmental footprint, at acceptable cost

- Four technical cornerstones:
  - Optimizing survey design
  - Automating operations from the air
  - Real-Time Processing & Interpretation
  - Eco-Friendly materials

- Phase I pilot in Papua New Guinea – Q4 2017
  - Early de-risking of the project’s fundamentals
  - Successful and paving the way for an accelerated project’s development

>> Towards Phase II pilot in 2019… and targeting industrial pilot in 2021 with 100 km² 3D
Total position Onshore PNG:
- Continue progressing with Papua LNG project: Near term FEED, followed by FID
- Advancing exploration for additional resources capture and gas aggregation
- Optimal derisking with current integration of newly acquired 2D seismic and MT program for additional prospect maturation on PRL15

In offshore PNG, advancing and optimizing our exploration program in an attractive exploration position
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