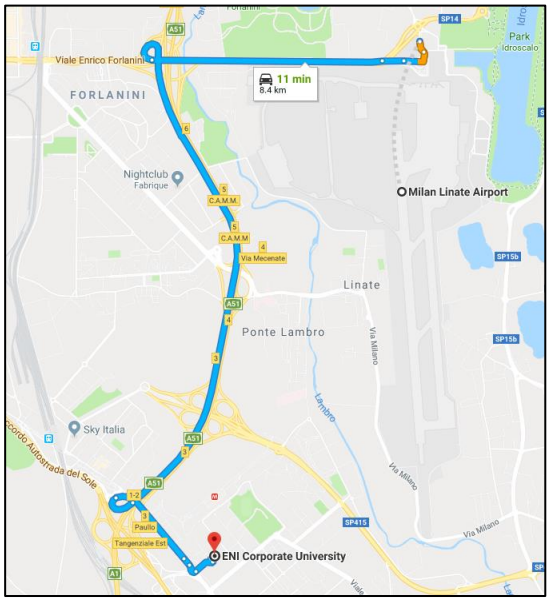
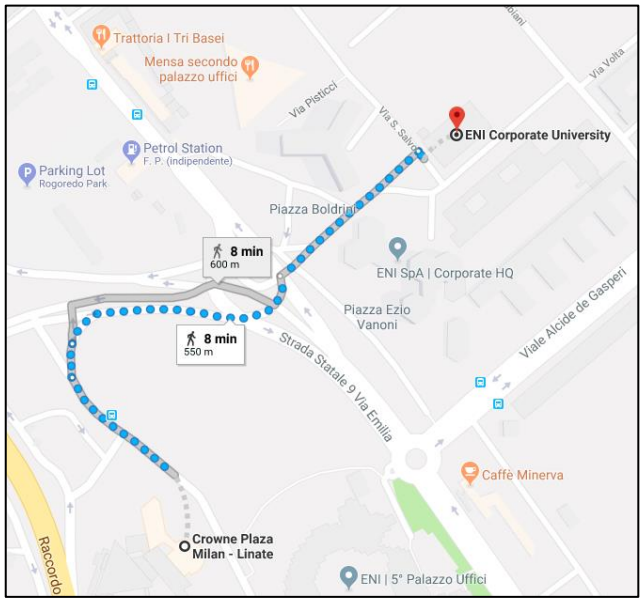
Geomechanics Initiative Meeting

Topic:	**Challenges in Wellbore Stability**
Guest presentation:	**Digitized Uncertainty Handling of Pore Pressure and Mud-Weight Window Ahead of Bit; Example North Sea - SINTEF**
Date:	Thursday 21st and Friday 22nd June 2018
Time:	09:30 to 17:10 Thursday 09:30 to 12.30 Friday
Host:	Eni SpA
Location:	Eni Corporate University, Alabastro Room, Via San Salvo 1, 20097 San Donato Milanese, Milan, Italy
Contact:	Francesca Tate/ Dawn Dukes, OTM Consulting, Great Burgh, Yew Tree Bottom Road, Epsom, KT18 5XT, UK +44 (0)1372 631950 francesca.tate@otmconsulting.com dawn.dukes@otmconsulting.com
Directions:	The meeting location is approximately 10-15 minutes' drive from Milan Linate Airport, or 50 minutes from Malpensa Airport. Eni's office is walking distance from nearby hotels. There is no parking available on site.





Thursday 21st June 2018			
Arrival with tea/ coffee			*09:30*
1	Welcome and safety briefing	Eni	10:00
2	Introduction to Geomechanics Initiative	Francesca Tate, OTM	10:10
3	Challenges in wellbore stabilities	Pamela Tempone, Eni	10:30
4	Data acquisition for geomechanics - a multidisciplinary approach	Clive Sirju, Nexen	11:30
Lunch			*12:30*
5	Global review of borehole stability challenges; field location vs age of field	Mark Davison, Shell	13:30
6	Digitized uncertainty handling of pore pressure and mud-weight window ahead of bit; example North Sea	Ane Lothe, SINTEF	14:30
Tea/ coffee			*15:30*
7	Facilitated discussion stemming from key points brought out during guest presentation	All, led by OTM	16:00
8	Meeting wrap up	Francesca Tate, OTM	17:00
End of day			*17:10*
Attendees are invited to attend a non-hosted group dinner at nearby Osterietta			*19:00*

Friday 22nd June 2018			
Arrival with tea/ coffee			*09:30*
1	Day two welcome	Francesca Tate, OTM	09:45
2	Tyra collaborative drilling study a few lessons	Frederic Bourgeois, Total	10:00
3	Preventing and managing geomechanically related drilling issues: theory and practice	Tibor Toth, Bertrand Cuesta, Wintershall	11:00
4	Final thoughts and meeting wrap up - Plan and topics for 2018 / 2019 - Member update	All, led by OTM	12:00
End of day			*12:30*
Attendees are invited to attend a non-hosted group lunch at nearby Sotto Sopra			*13:10*

Challenges in Wellbore Stability

How can I mitigate wellbore stability issues to improve drilling performance & increase casing/cementing efficiency?

Preventing significant wellbore instability during drilling is one of the main and recognised objectives of the Geomechanics community. Geomechanics practitioners try to summarise in one optimal mud weight window subsurface uncertainties coming from various sources: i.e. regional tectonics, under constrained local stress distributions, missing data for mechanical stratigraphy interpretation, ambiguous drilling events used for model calibrations, etc. On the top of these, cross-disciplinary communication issues can contribute to the challenge of sharing wellbore stability risks and influence the well planning and design to improve drilling performance.

The aim of the meeting is to discuss which methodologies are applied and when, who determines which approach is the most applicable and how the predicted collapse pressure are calibrated and shared with the rest of the organisation. Some specific questions regarding processes and modelling for wellbore stability are the following:

The Manager's Point of View:

a) Who's doing what? (pore pressure, in-situ stress estimation, borehole collapse pressure, rock properties, real time monitoring)
b) Where in the organisation does this fall? G&G or Drilling?
c) With which skillset/ certification?
d) KPI management: Who owns the KPIs to track efficiency and effectiveness? 100% drilling or 100% G&G or a combination of the two?
e) How good are we in predicting borehole collapse pressure?
f) Do you have in-house tools or third parties? Who owns it?
g) People & communication: How do you efficiently communicate WBS risks? Your experience of pros and cons of sitting in G&G/ Drilling.

The Geomechanics Practitioner's Point of View:

a) Let's start with definitions: What is your definition of stable well and optimal mud weight window?
b) How do you define the high/ worst case? 90deg allowable breakout? Or the probabilistic P90?
c) Which approach is preferred (the Fit for Purpose Geomechanics: Simple Versus Complex Approaches). How many fields have you worked where:
    i. Mohr-coulomb/ modified lade is sufficient for WBS modelling
    ii. A Quantitative Risk Analysis (QRA) is sufficient and helps the planning
    iii. The weak bedding plane modelling is required
    iv. A 3D mechanical model is required
    v. A complex finite element modelling is required
d) The range of geomechanics issues is wide and interfaces with many other disciplines (e.g., petrophysics, geophysics, production geology, drilling, production and reservoir engineering). How and when do you start integrating input from other disciplines in the modelling? Or when are you called into the game to explain issues that cannot be explained in other ways?
e) How easy is it for you to get the data you need? Do your organisation's procedures help with Data Requirement and Acquisition for well planning and monitoring?
f) Field Cases – Learning from success and failure: Let's discuss about calibrating models with field/well/lab data, and the pros and cons of analytical versus numerical models. How all these have helped optimising well placement/ planning and improving drilling performance?

Abstracts

1. Eni – Challenges in wellbore stabilities

Following the results of the Geomechanics Survey undertaken by OTM Consulting at the end of 2016 and the questions proposed in the call for abstract of this event, we would like to spend some time of the presentation in sharing Eni experience on how we embed the wellbore stability process into the well planning and monitoring of our wells.

At the end of this general discussion, we are going to present a case study where we show how our internal tool helped us interpret drilling events and calibrate our wellbore stability model and well plan, minimizing drilling risks and costs

2. Nexen – Data Acquisition for Geomechanics- a multidisciplinary approach

Data acquisition activities involve a substantial capital expenditure each year. Our companies base major investment decisions on the data acquired to:

- Demonstrate the existence of potential field development prospects.
- Appraise field development opportunities to optimise development concepts.
- De-risk field development activities.
- Optimise field production.

Our credibility as an operating company with our partners, and other stakeholders, is measured (directly and indirectly) by our ability to acquire the right data, in a safe, efficient and effective way. We need to make good quality decisions.

We have developed a toolbox we can use to:

- Gain clarity on well objectives by defining the Key Decision(s) that need to be made and to list the associated Key Activities (with time-scales).
- Review the Key Issues (i.e. risks and uncertainties) that need to be addressed through those Key Activities if the Key Decision(s) is to be made with confidence.
- Develop a blue-print for fit for purpose plan for well Data Acquisition Plan (e.g. data acquisition, processing and interpretation requirements) that focuses on addressing the Key Issues, and to prioritise actions by taking into account value of information concepts.
- Communicate the Data Acquisition Plan in a simple and clear way, to secure buy-in from all stakeholders including partners.

What this means for geomechanics is we have process to map out exactly what information we need to acquire at different stages of a project which meets stakeholder expectations. Examples such as density from surface, XLOT's vs FIT/LOT, sonic data for stress anisotropy, image logs etc.

3. Shell – Global Review of Borehole Stability Challenges; field location vs age of field

A recent survey was conducted of global Geomechanics team to evaluate the current BHS challenges in different basins where Shell is operating. These have been reviewed and ranked with many common themes present. However, there are some location specific challenges which are linked to subsurface setting as well as age of the field. These will be discussed and case studies presented.

Guest presentation – SINTEF – Digitized Uncertainty Handling of Pore Pressure and Mud-Weight Window Ahead of Bit; Example North Sea

Currently, drilling teams experience large uncertainties in prediction of pore pressure and wellbore stability, leading to extensive non-productive time due to unexpected events such as stuck pipe, mud losses and well control events. The best prediction tools available today are not automatically updated with real-time input, such that drilling-related decisions that require updated calculation lead to extensive need for experts to perform configuration, pre-studies, and follow up during operations.

We will show a workflow combining, pre-drill 3D pressure modelling with uncertainty, and the effect the uncertainty of the pore pressure will have on the mud-weight window. The wellbore stability model will be shown and mud weight window identified. The database needed for the workflow will be shown. Examples will be shown from the North Sea case studies.

4. Total – Tyra Collaborative drilling study a few lessons.

Fields in the Danish Central Graben provide considerable challenges for drilling, particularly when wells have a high inclination in the shales of the lower overburden. An integrated, collaborative approach to dealing with those challenges is likely to bring significant benefits. The ultimate aim is to combine a detailed characterisation of the subsurface conditions with the well design and with operational practices for drilling. The scope was designed to link several aspects that are clearly related but not often considered in detail during the same study.

The major tasks defined were:

- Analysis of the drilling events at key wells that exhibit a range of experiences
- Creation of 1D Mechanical Earth Models for several of the wells
- Calculation of downhole pressures and temperatures, not just for drilling but also during liner emplacement and cementing, followed by comparison with measured values and wellbore stability models
- Creation of a 3D Geomechanical Model, including the effect of pressure changes over time
- Analysis of the wellbore stability at each well using both the 1D and 3D models together

5. Wintershall – Preventing and managing geomechanically related drilling issues: theory and practice

In this presentation a method to better plan safe and efficient drilling is introduced. This method aims at building geomechanical models (1D or 3D) which remain consistent with the observations and various modelling works conducted earlier by other disciplines – e.g. geological model and petrophysical interpretation – while achieving a robust match to the field observations characterizing the stress tensor in 4D. However, applying such workflow in the scope of drilling planning and operation remains challenging. That is mostly due to a lack of coordination between the various stakeholders involved, but also because of a poor culture of operational management.

Attendees:

	Company	First Name	Last Name
1	Eni	Pamela	Tempone
2	Eni	Silvia	Haiz
3	Eni	Marco	Brignoli
4	Eni	Chibuzor	Onyia
5	Nexen	Clive	Sirju
6	OTM Consulting	Francesca	Tate
7	Shell	Mark	Davison
8	Total Danmark AS	Frederic	Bourgeois
9	Wintershall	Tibor	Toth
10	Wintershall	Bertrand	Cuesta

Guest presenter:

	Company	First Name	Last Name
1	SINTEF	Ane	Lothe