A new world of surveying

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Similarities between Oil/Gas Technology and Brain Surgery

Wellbore Drilling Versus Deep Brain Stimuli (DBS)
Personal Background (Slide 2a)

- **Education**
  - **MSc:** Satellite navigation and GPS
  - **PhD:** Wellbore position uncertainty
Personal Background (Slide 2b)

• Education
  – MSc: Satellite navigation and GPS
  – PhD: Wellbore position uncertainty

• Work experience
  – Project manager Norwegian Hydrographic Service
  – Development manager Gyrodata Inc.
Personal Background (Slide 2c)

• **Education**
  – MSc: Satellite navigation and GPS
  – PhD: Wellbore position uncertainty

• **Work experience**
  – Project manager Norwegian Hydrographic Service
  – Development manager Gyrodata Inc.

• **Health**
  – Diagnosed with Parkinson’s Disease 2002
  – DBS operation 2012
Job objectives – (Slide 3a)

• **Wellbore Drilling**
  – To safely drill a hole from the surface (or the sea bottom) to a predefined underground target for exploration- or production purposes
Job objectives – (Slide 3b)

• Wellbore Drilling
  – To safely drill a hole from the surface (or the sea bottom) to a predefined underground target for exploration- or production purposes

• DBS-operation (Deep Brain Stimulation)
  – To safely drill two holes through the scull and to push electrodes toward targets deep in the core of the brain to improve the life quality of patients with Parkinson’s etc.
Targets (Slide 4a)

Wellbore drilling
Targets – (Slide 4b)

Wellbore drilling

DBS
Target size

Distance – (Slide 5a)

Wellbore drilling

- Wellbore length
  - 1 to 15 km (Typical 2 km)

- Penetration length
  - 8 to 12 cm (Typical 10 cm)

DBS
Target size
Distance – (Slide 5b)

Wellbore drilling

- Wellbore length
  - 1 to 15 km (Typical 2 km)

- Typical target size
  - Hz: 100m X 100m
  - V: 1m
    (Average 67m)

DBS

- Penetration length
  - 8 to 12 cm ( Typical 10 cm)

- Target size
  - About the size of a piece of rice
    6mm X 2mm X 1mm
    (Average 3mm)
Target size
Distance – (Slide 5c)

Wellbore drilling

• Wellbore length
  – 1 to 15 km (Typical 2 km)

• Typical target size
  – Hz: 100m X 100m
  – V: 1m
    (Average 67m)

• Relative difference
  – For 2 km wellbores
    1D; 67 : 2000

DBS

• Penetration length
  – 8 to 12 cm (Typical 10 cm)

• Target size
  – About the size of a piece of rice
    5mm X 2mm X 1mm
    (Average 3mm)

• Relative difference
  – For 10 cm penetration
    1D; 0.3 : 10
Target size
Distance – (Slide 5d)

Wellbore drilling

- Wellbore length
  - 1 to 15 km (Typical 2 km)

- Typical target size
  - Hz: 100m X 100m
  - V: 1m
    (Average 67m)

- Relative difference
  - For 2 km wellbores
    1D; 67 : 2000 = 3 : 100

DBS

- Penetration length
  - 8 to 12 cm (Typical 10 cm)

- Target size
  - About the size of a piece of rice
    5mm X 2mm X 1mm
    (Average 3mm)

- Relative difference
  - For 10 cm penetration
    1D; 0.3 : 10 = 3 : 100

⇒ About the same relative precision demand for both cases
Other Similarities – (Slide 6a)

- Both tasks can be divided into three closely linked project/job phases
  - Initial phase
    Establishing common references for explorations/underground drilling and for pre investigations/brain operation
  - Drilling/operation phase
  - Production/stimulation phase
Other Similarities – (Slide 6b)

• Both tasks can be divided into three closely linked project/job phases
  – Initial phase
    (Establishing common references for explorations/underground drilling and for pre investigations/brain operation)
  – Drilling/operation phase
  – Production/stimulation phase

• The principal project phases may even be divided into closely linked sub groups
Other Similarities – (Slide 6c)

• Both tasks can be divided into three closely linked project/job phases
  – Initial phase
    Establishing common references for explorations/underground drilling and for pre investigations/brain operation
  – Drilling/operation phase
  – Production/stimulation phase

• The principal project phases may even be divided into closely linked sub groups

• Most of these tasks are dangerous and may result in fatal accidents
  – Especially if safety precautions are not in place or are neglected
Other Similarities – (Slide 6d)

• Both tasks can be divided into three closely linked project/job phases
  – Initial phase
    Establishing common references for explorations/underground drilling and for pre investigations/brain operation
  – Drilling/operation phase
  – Production/stimulation phase

• The principal project phases may even be divided into closely linked sub groups

• Most of these tasks are dangerous and may result in fatal accidents
  – Especially if safety precautions are not in place or are neglected

Shall now look at each of the three project phases and see that even more similarities are present
Project Phase 1
Major tasks 1 – (Slide 7a)

Oil and gas industry
• Exploration/preparation
  – 3D imaging (Seismic) including ship navigation

DBS surgery
• Investigations/preparation
  – Mounting of reference frame on the scull
Project Phase 1
Major tasks 1 – (Slide 7b)

Oil and gas industry

- Exploration/preparation
  - 3D imaging (Seismic) including ship navigation
  - Orientation of drill rig relative to seismic

DBS surgery

- Investigations/preparation
  - Mounting of reference frame on the scull
  - 3D imaging (MRI) of the scull with the reference frame
Project Phase 1
Major tasks 1 – (Slide 7c)

Oil and gas industry
- Exploration/preparation
  - 3D imaging (Seismic) including ship navigation
  - Orientation of drill rig relative to seismic

DBS surgery
- Investigations/preparation
  - Mounting of reference frame on the scull
  - 3D imaging (MRI) of the scull with the reference frame
Project Phase 1
Major tasks 2 – (Slide 8a)

Oil and gas industry

- Exploration/preparation
  - 3D imaging (Seismic) including ship navigation
  - Orientation of drill rig relative to seismic

DBS surgery

- Investigations/preparation
  - 3D imaging (MRI) of the scull with the reference frame
  - Mounting of reference frame on the scull
Project Phase 1

Major tasks 2 – (Slide 8b)

Oil and gas industry

- Exploration/preparation
  - 3D imaging (Seismic) including ship navigation
  - Orientation of drill rig relative to seismic
  - “Creation” of a common coordinate system for both seismic and drilling

DBS surgery

- Investigations/preparation
  - 3D imaging (MRI) of the scull with the reference frame
  - Mounting of reference frame on the scull
  - “Creation” of a common coordinate system for both MRI pictures and operation
Project Phase 1
Dangers & consequences – (Slide 9a)

Oil and gas industry

• Mapping blunders
  – Use of wrong UTM zone etc.

DBS surgery

• Diagnosing blunders
  – Use of upside down MRI pictures

31V or 32V?
Project Phase 1
Dangers & consequences – (Slide 9b)

Oil and gas industry

- Mapping blunders
  - Use of wrong UTM zone etc.
- May lead to:
  - Bad decisions and large economical losses

DBS surgery

- Diagnosing blunders
  - Use of upside down MRI pictures
- May lead to:
  - Operation of left/right brain side based on other side’s info

31V or 32V?

Left or right?
Project Phase 2
Major tasks – (Slide 10a)

Oil and gas industry
• Drilling process
  – Conductor setting/drilling for largest casing diameter

DBS surgery
• Operation
  – Drilling two 14 mm holes through the scull
Project Phase 2
Major tasks – (Slide 10b)

Oil and gas industry

• Drilling process
  – Conductor setting/drilling for largest casing diameter
  – Intermediate under-ground wellbore drilling

DBS surgery

• Operation
  – Drilling two 14 mm holes through the scull
  – Running of electrodes into the brain
Project Phase 2
Major tasks – (Slide 10c)

Oil and gas industry

• Drilling process
  – Conductor setting/drilling for largest casing diameter
  – Intermediate under-ground wellbore drilling
  – Running of casing and wellbore completion

DBS surgery

• Operation
  – Drilling two 14 mm holes through the scull
  – Running of electrodes into the brain
  – Exchanging intermediate electrode with permanent
Project Phase 2.1
Dangers & consequences – (Slide 11a)

Oil and gas industry
• Drilling for the largest casing
  – Drilling into adjacent wellbore

DBS surgery
• Drilling through the scull
  – Drilling into the brain tissue
Project Phase 2.1
Dangers & consequences – (Slide 11b)

Oil and gas industry

- Drilling for the largest casing
  - Drilling into adjacent wellbore
- May lead to:
  - Blow-out/fatal accident

DBS surgery

- Drilling through the scull
  - Drilling into the brain tissue
- May lead to:
  - Severe brain damage - death
Project Phase 2.2
Dangers & consequences – (Slide 12b)

Oil and gas industry

• Intermediate under-ground wellbore drilling
  — Drilling into shallow gas pockets
• May lead to:
  — Exploding (or even sinking) platform/fatal accident

DBS surgery

• Running of electrodes deep into the brain
  — Punctuation of large blood vessel
• May lead to:
  — Brain bleeding/stroke (severe)
Project Phase 2.3
Dangers & consequences – (Slide 13a)

Oil and gas industry

• Running of casing and wellbore completion
  – Bad cementing/perforations

DBS surgery

• Exchanging intermediate electrode with permanent
  – Brain “movement”
Project Phase 2.3
Dangers & consequences – (Slide 13b)

Oil and gas industry

• Running of casing and wellbore completion
  – Bad cementing/perforations
• May lead to:
  – Interaction with non-reservoir wellbore sections
    • Loss of reservoir

DBS surgery

• Exchanging intermediate electrode with permanent
  – Brain “movement”
• May lead to:
  – Stimulation of other brain parts
    • Upside-down view
    • Depression etc.
Project Phase 3  
Major tasks – (Slide 14)

Oil and gas industry
• Production of oil and gas reserves
  – Maintenance of installation and wellbore

DBS surgery
• Permanent stimulation of the brain with voltage
  – Changing battery and DBS electronics maintenance
Project Phase 3
Dangers & consequences – (Slide 15a)

Oil and gas industry
- Maintenance of installation and wellbore
  - Failure to follow maintenance plan

DBS surgery
- Permanent stimulation of the brain with voltage
  - Missing maintenance plan
Oil and gas industry

- Maintenance of installation and wellbore
  - Failure to follow maintenance plan
- May lead to:
  - Major accidents
    - Exploding platforms

DBS surgery

- Permanent stimulation of the brain with voltage
  - Missing maintenance plan
- May lead to:
  - Unscheduled immediate stop in voltage supply
    - Parkinson “freezing”
This ends my presentation

Thank you for listening