ELECTROPROJECT SOFT TORQUE

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Topics

- Short introduction of Electroproject
- Stick Slip characterization
- How to mitigate Stick Slip from surface
- EPST Controls Hardware
- EPST Projects
- EPST performance Reports

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GDF SUEZ businesses are structured around six business lines:
• five active in energy,
• one active in environment.

Energy Services
- Management of urban networks in and outside France.
- Management of industrial and tertiary electrical installations.
- Global multitechnical offers.

Cofely Experts b.v.
Large contractor in
The Netherlands and Belgium

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EPST Electroproject Softtorque

Main Markets

- Industrie
- Water
- Heave and Transport
- Marine and Off-shore
- HVAC
- Rollecoasters
- Industrial Components
- Service and Maintenance

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Stick Slip fundamentals

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Stick Slip fundamentals

Cyclic, heavy torsional vibrations

- 3-10 second period
- BHA comes to a complete stop in “stick phase”
- BHA accelerates up to 5x surface speed in “slip phase”
- Reduced ROP, heavy vibrations down hole motor failures, bit damage
- Can occurs 50% of on bottom time (!)
Stick-slip is a **threshold phenomenon**; i.e.

- Value of the threshold is difficult to predict and increases with:
  - Increasing MD
  - Increasing WOB
  - Reduced DP size
Example of threshold character of stick-slip

- RPM is stepped from 130 to 150
- Stick-slip completely disappears
How to mitigate Stick Slip from surface

Surface torque

Down hole RPM

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Stick Slip mitigation

Achieved by changing the drive controls
Could be software or electronics
Tuning is required:
“Cf” and “Kf”

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How to mitigate Stick Slip from surface

- Example of stick-slip mitigation with EPST
- RPM variations
- Torque steady
EPST Tuning

“Cf” and “Kf”

- Drill pipe stiffness
- BHA inertia
EPST Tuning

- Manually input of Kf and Cf (MHI Home screen).

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- Calculation with integrated BHA and drill string configuration.

EPST BHA/drill pipe entry screen

Cf / Kf spreadsheet

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EPST Autotune

- First in the world. While drilling identification of softtorque tuning parameters
- Only software update for EPST controller.
EPST Electroproject Softtorque

EPST Autotune

SoftTorque Operating Envelope from simulation
AutoTune test - Rig 79 Harmel-8 8 3/8” hole @ 3606m

Threshold speed
STRS Contribution

"Auto Tune"
Shell tuning steer
Used during drilling

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What does Stick Slip mitigation brings?

- **SOFT TORQUE REDUCES THRESHOLD RPM**
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EPST Controls Hardware

HMI Control panel

EPST Control cabinet

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**EPST Controls Hardware**

- HMI (Control panel)
- Ethernet
- PLC Controller
- Profibus 1
- EPST Controller
- Profibus 2
- VFD
- Actual speed (digital encoder feedback)
- Motor
- Gearbox

**EPST System overview**

- Drill String and Bottom Hole Assembly

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# Projects

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</table>
What brings ElectroProject SoftTorque to the table:

- Well proved SoftTorque system.
- Designed to be embedded in all electrical TD’s
- AutoTune functionality
- Advance SoftTorque EPST
- Valuable information for operations
Performance Results

Results: Noble Hans Deul

- NAM
- Jackup, North Sea
- Electroproject STRS
- 12 ¼" section
- 2450–5550 m
- 60° inclination
- PDC bit
- 5 ½" DP

www.softtorque.com
Hans Deul Record Run

- Well K15-FK-106, 12¼” section drilled in 1 bit run from 1466 m to 5001m AHRT
- Steering required at beginning (42°-55°) and end (55°-50°)
- High WOB used in Rogenstein (30 MT vs. 22MT), lower RPM to reduce shocks due to whirl
- STRS prevented onset of stick-slip at lower speed 140 rpm
- Average ROP = 30.2 m/hr
- 11.8 days ahead of base plan, 21.9 days ahead of AFE50/50

**Saved millions of €**
Middle East

- Middle East
- BATCH DRILLING
- ELECTROPROJECT EPST
- ~40 % ROP IMPROVEMENT SINCE EPST; compared against best offset
- REDUCED BIT DAMAGE

www.softtorque.com
Performance Results

Noble Hans Deul North Sea

- ELIMINATED STICK-SLIP VIBRATIONS
- REDUCED FAILURES
- INCREASED ROP 10%

www.softtorque.com
The impact of Soft Torque Technology on Drilling Performance

Mike Lukyanov  
Well Engineer

Odion Ikhajiagbe  
Well Engineer
Conclusions:

- Stick slip is damaging both for equipment and for cores
- STRS aided Qatar Shell in:
  - Reducing stick slip by 40%
  - Increasing ROP by 30%
  - Reducing bit wear
  - Good quality cores
- STRS is easy to implement and has shown good results
Pearl Wells Application:

ROP (ft/hr)

Well A: Av. 59.5 ft/hr
Well B:...
Well C:...
Well D:...
Well E:...
Well F:...
Well G: Av. 77.2 ft/hr
Well H:...
Well I:...
Well J:...
Well K:...
Well L:...
Pearl Wells Application:

Av. 59.5 ft/hr

ROP

Av. 77.2 ft/hr
Pearl Wells Application:

- Improvements in bit performance were observed
- Less bit wear and more footage drilled per bit
- IADC bit dull grading was used and same crew applied it
- Weighted average with respect to footage drilled was taken

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<tr>
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<th>Bit Wear</th>
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<tr>
<td></td>
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<td>Inner Teeth</td>
<td>Outer Teeth</td>
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<td>feet/bit</td>
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<td>With-Out STRS</td>
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<td>1.5</td>
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<td>With STRS</td>
<td>2567.6</td>
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<td>% Improvement</td>
<td>8.2</td>
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EPST Controls Hardware

SYSTEM ADVANTAGES

1. The EPST system is designed to be easily implemented in modern drive systems.
2. The EPST controller is a stand-alone and a RIG specific \( \mu \)-processor-based controller.
3. It can operate without any interface with the RIG controls.
4. No changes are needed in the existing RIG controls.
5. Implementation can be completed within hours. Down time is reduced to an absolute minimum. The average down time while commissioning is one hour.
6. EPST can be switched ‘ON’ or ‘OFF’ on demand by using the high resolution touch screen without limiting TD control abilities.
7. EPST includes a high resolution touch screen. Independent of the RIG control capabilities, the state-of-the-art visualisation equipment presents real time data to identify down hole drill behaviour.
8. EPST includes WITS communication.
9. EPST includes state-of-the-art data logging.

www.softtorque.com
THE POWER OF SIMULATION

The performance of Soft Torque systems depends strongly on the VFD’s or SCR’s configuration that is implemented.

Electroproject has 75 years of experience with VFD and SCR controls. This knowledge, combined with a great understanding of drill string behaviour, is used to create an EPST simulation tool. While engineering ElectroProject can determine the expected performance of EPST and guarantee successful implementation.
THE POWER OF HIGH RESOLUTION DATA

EPST includes state-of-the-art data logging technology. The EPST system stores high resolution 400 Hz data from 250 parameters. This data is organised and stored for later use.

This tool is used to verify the performance of the TD and can even be used as an event recorder to determine the cause of problems while drilling.
SoftTorque end-user and major directional drilling service company testimonial

Ensign Energy Rig 951, Shell GABON - 2012

Subject: RE: Soft Torque system
Here we go.

We just proceeded to a test and drilled 2m with the Soft Torque off, and the results are awesome. We kept parameters constants during this test, and we carry on drilling at all times. After a connection, 13m were drilled (from 1404 to 1417m), with the Soft Torque running, and S/S remains steady at average 30.

Turned the Soft Torque off at 1417m, and drilled an additional 2m down to 1419m. Stick-Slip immediately picked up to severe levels at 170 (Surface RPM at 80). Turned the Soft Torque on with a finger click on the tactile screen, on the fly, and S/S back to steady low levels around 30. Same improvement seen on surface torque and surface RPM.

Looks magical!

Here attached is a graph of the test. If we can have such a system running on all the rigs, tools reliability will make a giant step.

Regards, Rene
Thanks for your attention!

Questions?

Angel Catena

acatena@electroproject.nl

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