

The mission of the Fingerboard Reliability Task Group is to improve the safety and efficiency of drill floor operations by promoting improvements in the reliability and performance of Fingerboards and related products provided by Fingerboard original equipment manufacturers.

Summary:

This meeting has been set up for an industry group discussion of IADC members' interests in the fingerboard/latch reliability across our industry. The following Drilling Contractors participated in the meeting.

Noble Drilling
Transocean
SeaDrill
EnSCO
Diamond Offshore
Rowan
Pacific Drilling
Atwood

As a result of the meetings the following deliverables were to be met:

Deliverables:

1. **Identify the failure modes in fingerboard latches. Completed**
 - a. Cylinder Failures due to contamination
 - b. Latch Hinge Tolerances too small – corrosion build up causing latches to stick – No lubrication points on the latch
 - c. Air Quality – difference in systems as some have lubricators and others do not
 - d. Collision – No positive feedback/visual confirmation
2. **Improve the reliability of the fingerboard latches through redesign. Completed**
 - a. **NOV - US boards**, the latch & cylinder redesign efforts are the following:
 - To keep contamination out of the rod bushing
 - To minimize the effect of contamination
 - A solution to enable grease/lubricate the latch hinge mechanism
 - PIB 1000012204-PIN - PRS Fingerboard Latch Assembly Upgrade
 - NOV has developed a new cylinder with the following design improvements:
 - Rod wiper and an improved rod seal with an integrated secondary wiper for additional contamination prevention
 - Rod seal was relocated above the rod bushing to protect the bushing from contaminants
 - Synthetic rod bushing was implemented which is less prone to contamination than the sintered bronze of the previous design

- Stainless steel rod end cap that is more corrosion-resistant
 - Cross-drilled rod instead of rod clevis and screw for ease of assembly
 - Closed loop exhaust air on the piston end of the cylinder thus eliminating the possibility of contamination entering through the piston end vent port
- b. **NOV - Norway boards**, the latch & cylinder redesign efforts are the following:
- Redesign of venting to help mitigate blockage
 - To minimize the effect of external contamination
 - Increase stroke length to ease set up
 - A solution to enable grease/lubricate the latch hinge mechanism
 - PIB 1000012078-PIN - Cylinder upgrade for HydraRacker Fingerboard Latch Assemblies
 - NOV has developed a new cylinder with the following design improvements:
 - **Closed loop exhaust air** on the piston-end of the cylinder, including quick exhaust, thus eliminating the possibility of contamination entering through the piston-end vent port
 - **Extended cylinder stroke** for ease of correct installation of cylinder
 - **New cylinder pre-grease** with enhanced characteristics for hydrocarbons, to reduce the risk of the internal cylinder lubricant drying out
 - **Rod wiper/scrapper** and an **improved rod seal** with an integrated **secondary wiper** for additional contamination prevention
 - **Synthetic rod bushing**, which is less prone to contamination than the sintered bronze bushing
 - Improved **piston material** and **double piston seal**

c. Below is a list of the Product Bulletins to address issues that were identified

Issues	Norway Fingerboards		Orange Fingerboard	
	Bulletin Number	Description	Bulletin Number	Description
Lubrication Setting Recommendation	94692404 -PIB 6/29/2016	Recommend lubrication setting for systems with lubricators	1000011892-PIB 12/7/2016	Method of Setting Lubricator for PRS Fingerboards
Air Supply	94692404 -PIB 6/29/2016	Instrument Air Supply Quality Requirements	1000011892-PIB 12/7/2016	air cleanliness requirements
	94816768-PIN 9/20/2016	Multi-Stage filtration system for both boards	94816768-PIN 9/20/2016	Multi-Stage filtration system for both boards
Control Software Upgrade	94806970-PIN 8/17/2016	HydraRacker upgrade to grip head close sequence	N/A	
Secondary Retention	9469356-PIN 8/26/2016	Latch Safety Wire Upgrade Kit	N/A	

Incorrect Torque Impact on Binding	N/A		1000011814-PIB 10/7/2016	Advise cylinder rod binding due to incorrect torqueing of cylinder nut, and provide the recommended procedure
No lubrication points on the latch	1000011892-PIN 2/6/2016	Kits to Add Grease Fittings to Fingerboard Latches	1000011892-PIN 2/6/2016	Kits to Add Grease Fittings to Fingerboard Latches
Latch Re-Design	1000012078 11/10/2017	Improved Fingerboard Latch Cylinder design	1000012204-PIN 8/28/2017	Improved PRS Fingerboard Latch Cylinder design

3. **Determine a service life for fingerboard latches. Completed**

- a. NOV – US boards – Testing concluded 46,000+ Latch cycles with:
 - No failures recorded during testing
 - Contamination did influence Cylinder performance
- b. NOV – Norway Boards - Testing concluded 86,000+ Latch cycles with:
 - No failures recorded during testing
 - Contamination did influence Cylinder performance
 - Testing of the effect of adding lubrication to the air system still ongoing

4. **Provide solutions for positive feedback for latch position. Completed**

- a. We have been presented with two technologies: 1) Shape recognition/Video Analytics; and 2) Instrument/Wireless Sensor Solution
- b. **NOV Vision Systems** - The pilot system consists of four cameras mounted on two HydraRackers for detection of two angular position states of latches in the fingerboard; open, closed.
- c. **Salunda – Wireless Latchhawk System** consists of individual latch wireless sensors, router wireless gateways, and HMI at/near the Drillers Chair. Advantages are:
 - Accelerometer Technology
 - Real time latch position feedback
 - Rapid installation, no disassembly required
 - No cable on fingerboard
 - Wireless comm. between gateways
 - Retrofit to all latch variants, including new latch designs
 - Ease of replacement
 - Visual confirmation/warning of anomalies with LED.
 - Battery Life – 5 years
 - Condition Monitoring Capabilities
- d. **Rice Electronics** – the system consists of individual latch wireless sensors, router wireless gateways, and HMI at/near the Drillers Chair. Advantages are:
 - Accelerometer Technology
 - Real time latch position feedback
 - Rapid installation, minimum disassembly required
 - No cable on fingerboard

- Wireless comm. between gateways
- Retrofit to all latch variants, including new latch designs
- Ease of replacement
- Battery Life – 5 years
- Condition Monitoring Capabilities/Data Logging Storage

Conclusion:

Due to the Fingerboard Reliability Task Group analysis- multiple solutions have been identified to improve the reliability of the operations that involve and surround the Fingerboard through the following:

- Re-Design of the Latch Cylinder
- Latch Position Feedback
- Improved lubrication points for maintaining performance

It was agreed by the participating Drilling Contractors to postpone further meetings until the identified solutions can be implemented and vetted in the field. Whenever new information/lessons learned surfaces, then the task group can initiate another meeting to discuss.