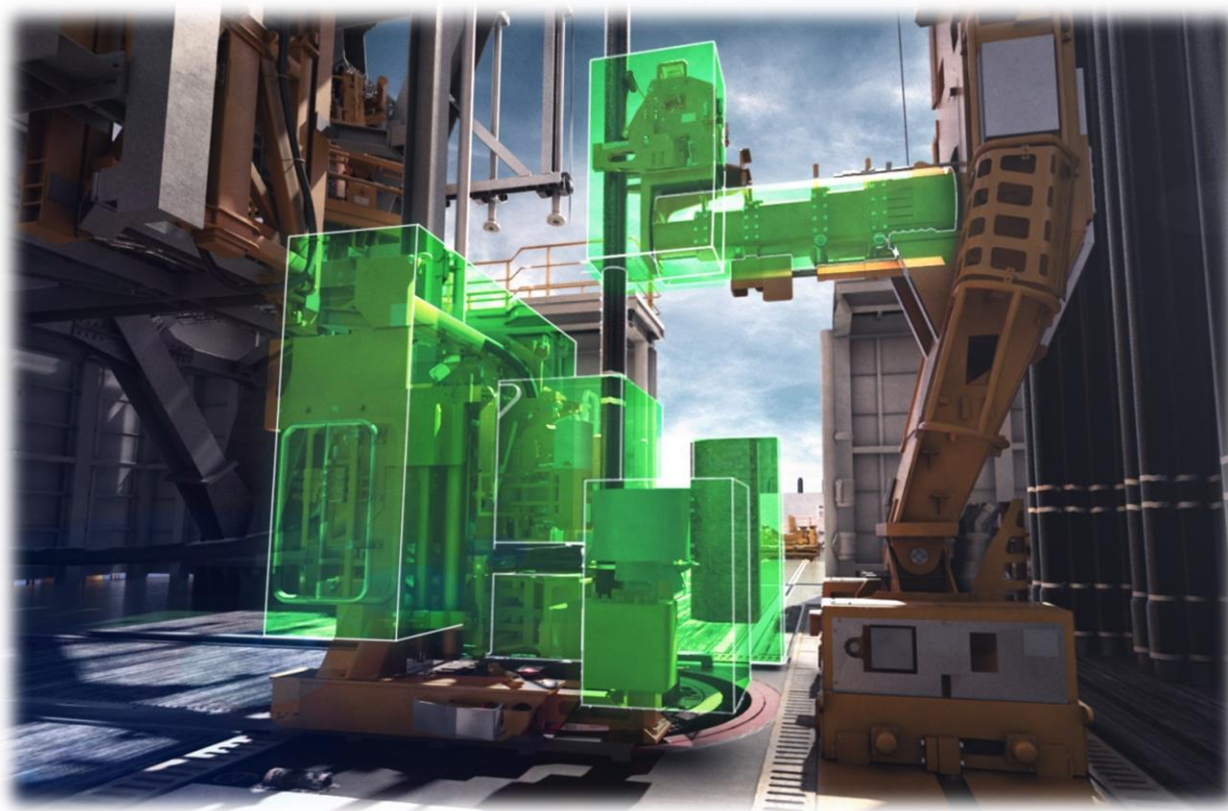


ACS – Anti Collision System

National Oilwell Varco provides Anti Collision System (ACS) functionality for integrated drilling control systems. The system increases personnel safety and uptime by preventing drill floor machines from colliding.

The drilling equipment packages become increasingly complex. In response to these technological changes, NOV presents **Anti Collision System with ACS viewer**.

The main ACS system is hosted on the Smart Machine Integrator PLC and handles all critical ACS functionality.



ACS VIEWER:

The ACS viewer is hosted on the Smart Machine Integrator Server providing visualization, logging and playback.

The unit (viewer) visualizes how the Anti Collision System works using accurate 3D animations, transparent or translucent ACS boxes, and vectors indicating distances between the machines.

These features make it easy to understand the ACS and see the machine boundaries the way the ACS sees them. This saves a significant amount of time during commissioning, testing and troubleshooting.

ACS Viewer Functions

- 3D visualization of derrick equipment
- Visualizes machine boundary boxes
- Shortest-distance-vectors
- Playback function

ACS Viewer Benefits

- Reduces time needed on Commissioning
- Reduces downtime by simplifying trouble shooting processes
- Simplifies testing of ACS for upgrades and periodic maintenance
- Step change away from “black box” ACS systems
- Real time monitoring of ACS functionality

CONTROLS:

- ACS on the Smart Machine Integrator PLC
- ACS Viewer on the Smart Machine Integrator Server

SPECIFICATIONS:

ACS Content

- Anti Collision Software — Dynamic stop positions and stop commands
- HMI interface — ACS matrix and operator messages
- Override functionality — Release and Ignore key-switches
- ACS Viewer

Additions/Options

- Well Center (main, aux)
- Off Drill floor setback
- Safe Entrance (MMC interface)

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 **NATIONAL OILWELL VARCO**

ACS – Anti Collision System

HOW DOES THE ACS WORK?

The ACS aggregates a world state of the drill floor based on current position, movement vectors and stop lengths of the equipment. Virtual boxes or cylinders are created around the parts of the machines.

During normal operation the ACS works in the background coordinating limits of movement. This is not noticeable for the operator. When a potential collision is detected ACS sends a message to the operator.

The ACS is a complex system with good safety margins. It still provides enough room for flexible machine movements and efficient operation, while increasing personnel and machine safety.

ACS FUNCTIONS

- Prevents collisions between drill floor machinery
- Provides dynamic stop positions
- Prevents equipment from starting unsafe movement
- Raised floor saver
- Prevent machines from entering well zone when in Active Heave Compensation (AHC) mode

OVERRIDE FUNCTIONS

- **Ignore: key switch in LER** — override so drillfloor can run when one machine has a «measurement not healthy» alarm. Machine is invisible to other machines in ACS.
- **Release: key switch in LER** — override so a machine can run independent of ACS stop signals

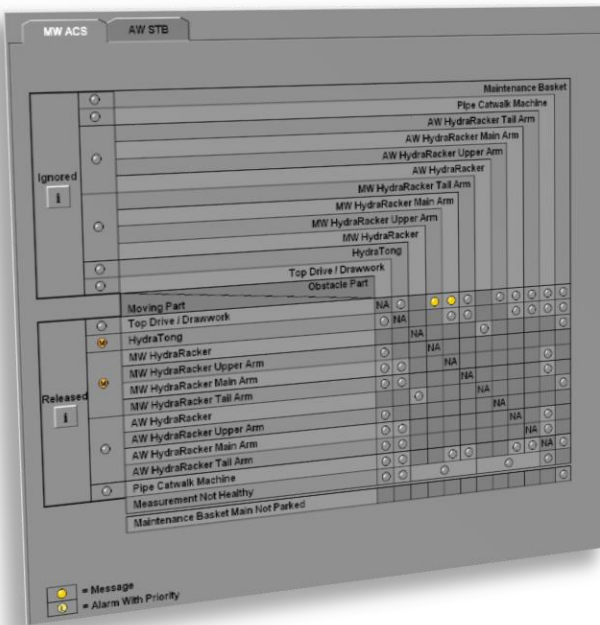
HMI FUNCTIONS

- **Operator messages:** top of left screen
- **Yellow LED at ACS screen display:** indicating prevented collision
- **Measurement Not Healthy:** alarm for each machine



ACS SCENARIOS

- During trip in, the Top Drive (TD) is lowered after taking over the drill string. The HydraRacker (HR) is still in Well Center. **With ACS, the drawworks is prevented from lowering TD into HR. TD will stop above HR arm, and can not be further lowered until HR has retracted.**
- During commissioning the Pick Up Elevator (PUE) must be mounted first on one pipe racker, then on the other. **With ACS Viewer the PUE model can be transferred from the first test to the other reducing physical connection time and working at heights.**
- The rig experiences frequent ACS stops while handing over pipe from catwalk to pickup elevator. **NOV remote support accesses the ACS viewer to get an overview of the drill floor and solves the problem by moving catwalk target.**



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