

OFFSHORE RIG SOLUTIONS
Products and Systems
Designed for Enhanced
Reliability



AADE
Emerging Technologies Meeting
October 17, 2013

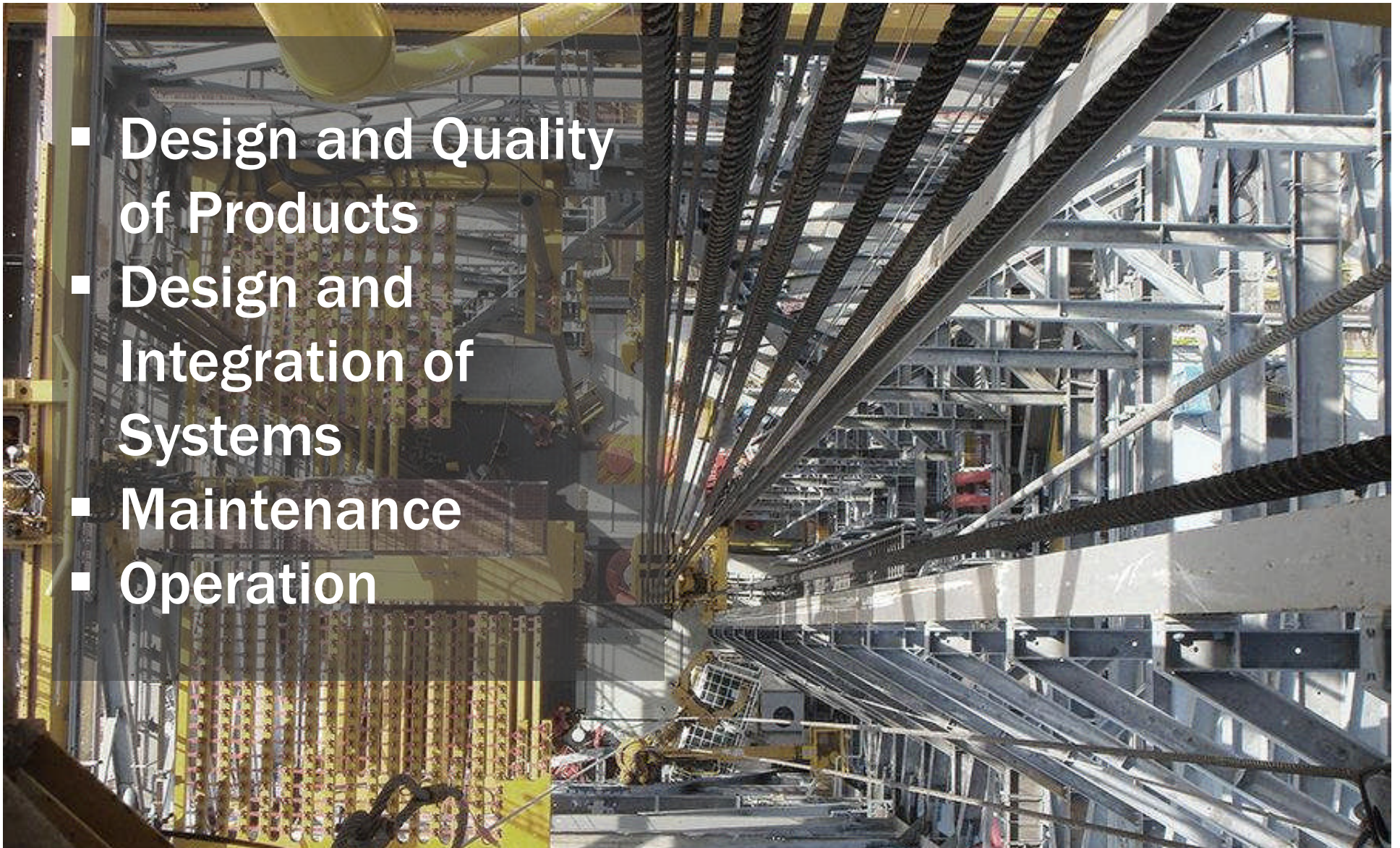
What Does Reliability Mean?



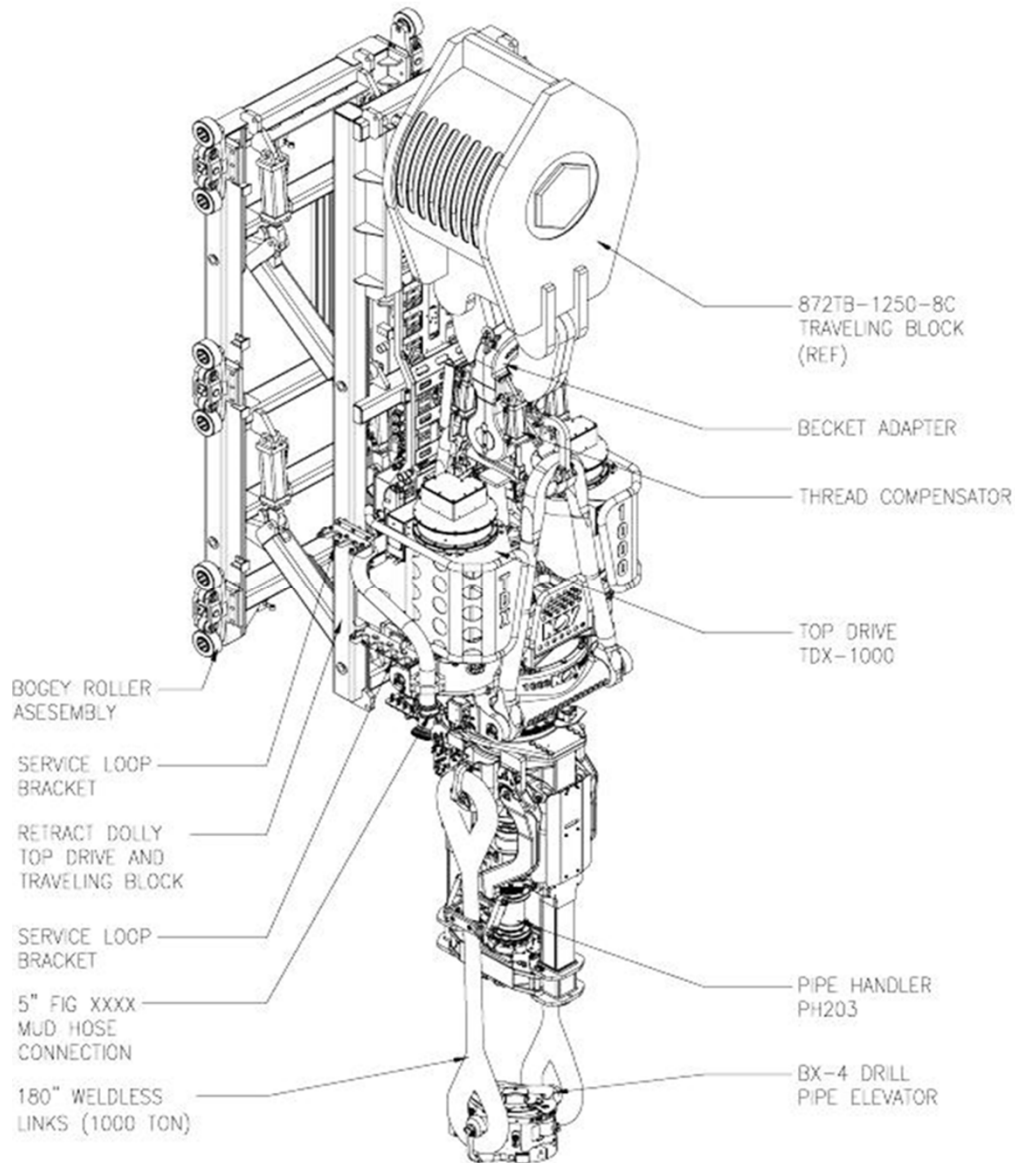
- Uptime / Availability
- Management of Downtime
- Prevention of Surprises
- Consistency
- Confidence

What Affects Reliability?

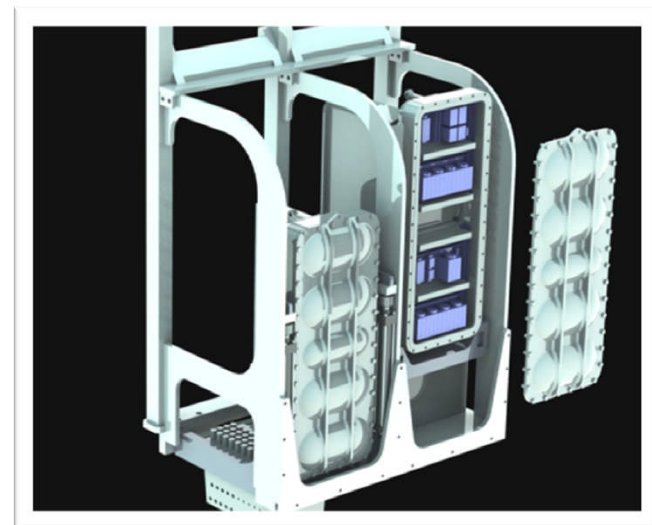
- Design and Quality of Products
- Design and Integration of Systems
- Maintenance
- Operation



Design Themes



- Modularity
- Redundant Systems
- Simplification
- Elimination (or mitigation) of failure modes
- Reduced/Planned/Optimized Maintenance



Drilling Equipment

- **TDX Technology and Benefits**

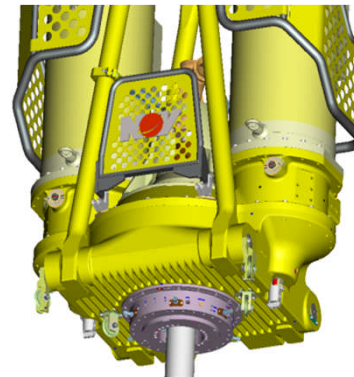
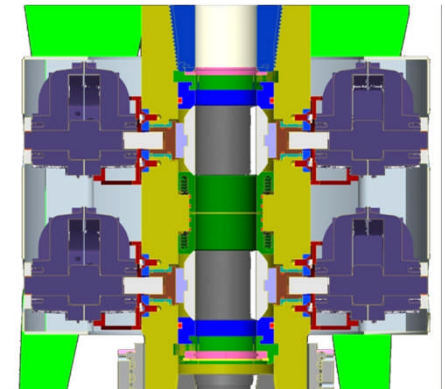
- **Redundancy**
 - **Full Motor Dual Redundancy**
 - Benefit – Can Still Drill Effectively on One Motor
 - Approximately 75,000 lbs.ft Intermittent and 52,500 lbs.ft Continuous on One Motor

 - **Dual Drive Redundancy**
 - Benefit – As Above, Can Still Drill Effectively on One VFD

 - **Dual Valve Upper IBOP**
 - Benefit – No Unplanned Downtime due to IBOP Washout

 - **Oil Filtration Redundancy**
 - Dual Lube Pumps and Filtration Paths

 - **Lower Shaft “Back Seal” Providing Secondary Seal**
 - Benefit – Easily Switch to Secondary Seal in Seconds. No Downtime



Drilling Equipment

- **TDX Technology and Benefits**
- **Maintainability**
 - **PH-150 Dual-Ball Upper IBOP**
 - Benefit – No Unplanned Downtime due to IBOP Wash Out
 - **Simple Flooded Gear Box Design**
 - Benefit – No Spray Bars to Get Clogged
 - **IBOP QuickLock Sub Locks**
 - Direct Mechanical Locking of IBOP and Subs on Main Shaft
 - **Built In Diagnostic and Optional CBM**
 - Benefit – Quick Diagnostics and Option for Predictive and Condition Based Maintenance. Detect a Problem Before it's a Downtime Failure.
 - **NOV Mechanical Washpipe System**
 - Benefit – Vastly Improved Uptime for Washpipe.
 - **Quick Disconnect Motor Couplings**
 - Benefit – Very Quick and Safely Switched Single M



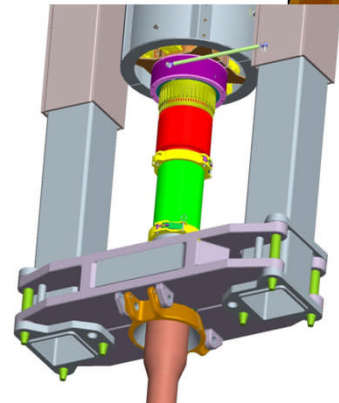
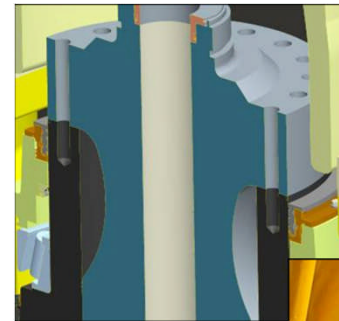
Drilling Equipment

- **TDX Technology (Continued)**

- **Modularity**
 - **Externally Removable Main Shaft**
 - Benefit – Shaft can be removed without gear-box strip down. Vastly Reduced Overhaul Time.

 - **Quick Disconnect Motor Couplings**
 - Benefit – Very Quick (minutes) Removal of Motor From Drive Train

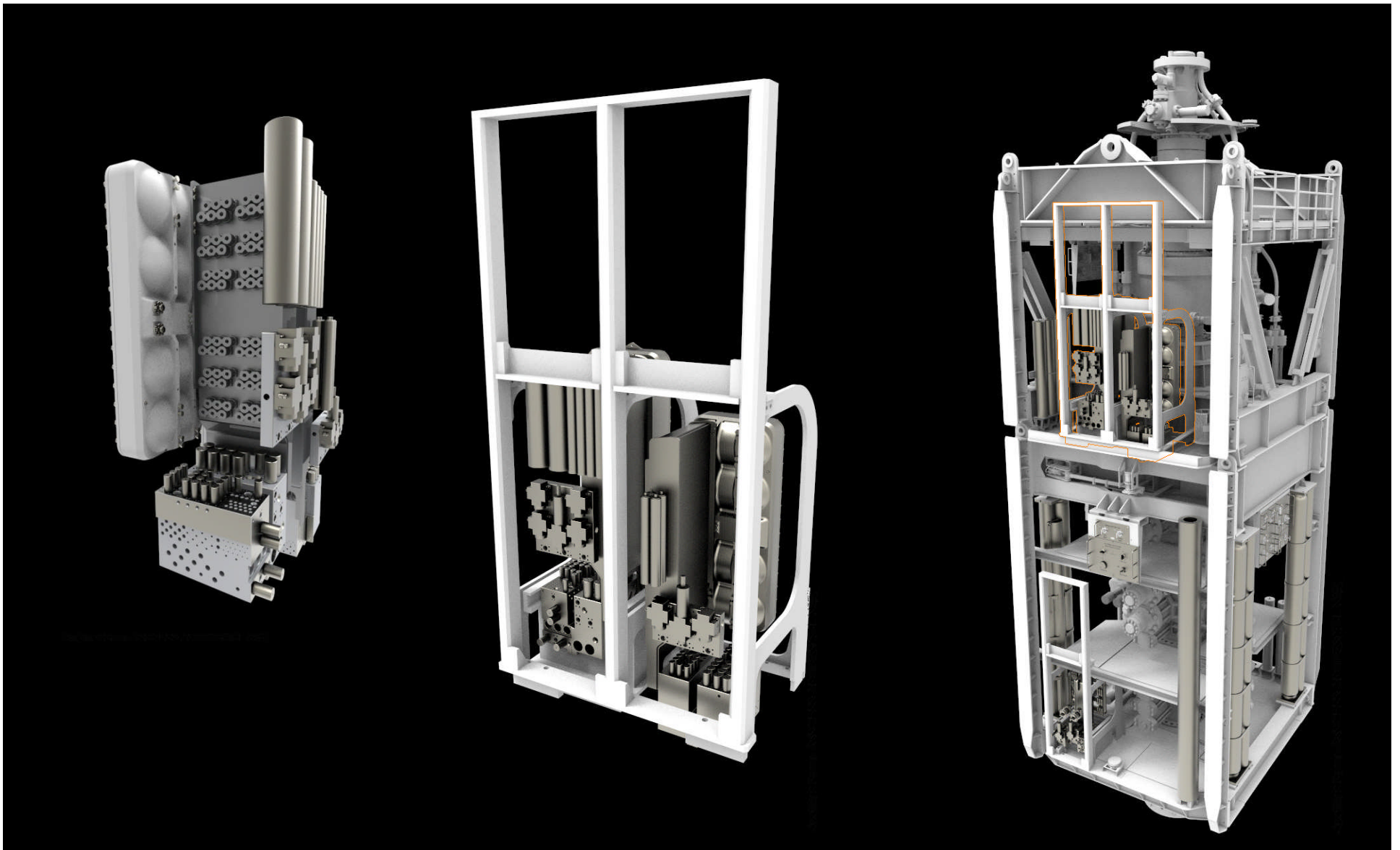
 - **PH-150 Pipe Handling System**
 - Benefit – Quick Change Stabbing Guides
 - Benefit – Swing Clear IBOP / Sub Handling System. Safe, and Non Manual Labor Intensive for Removing IBOP and Subs
 - Benefit – PH 150 Easily Removed for Maintenance



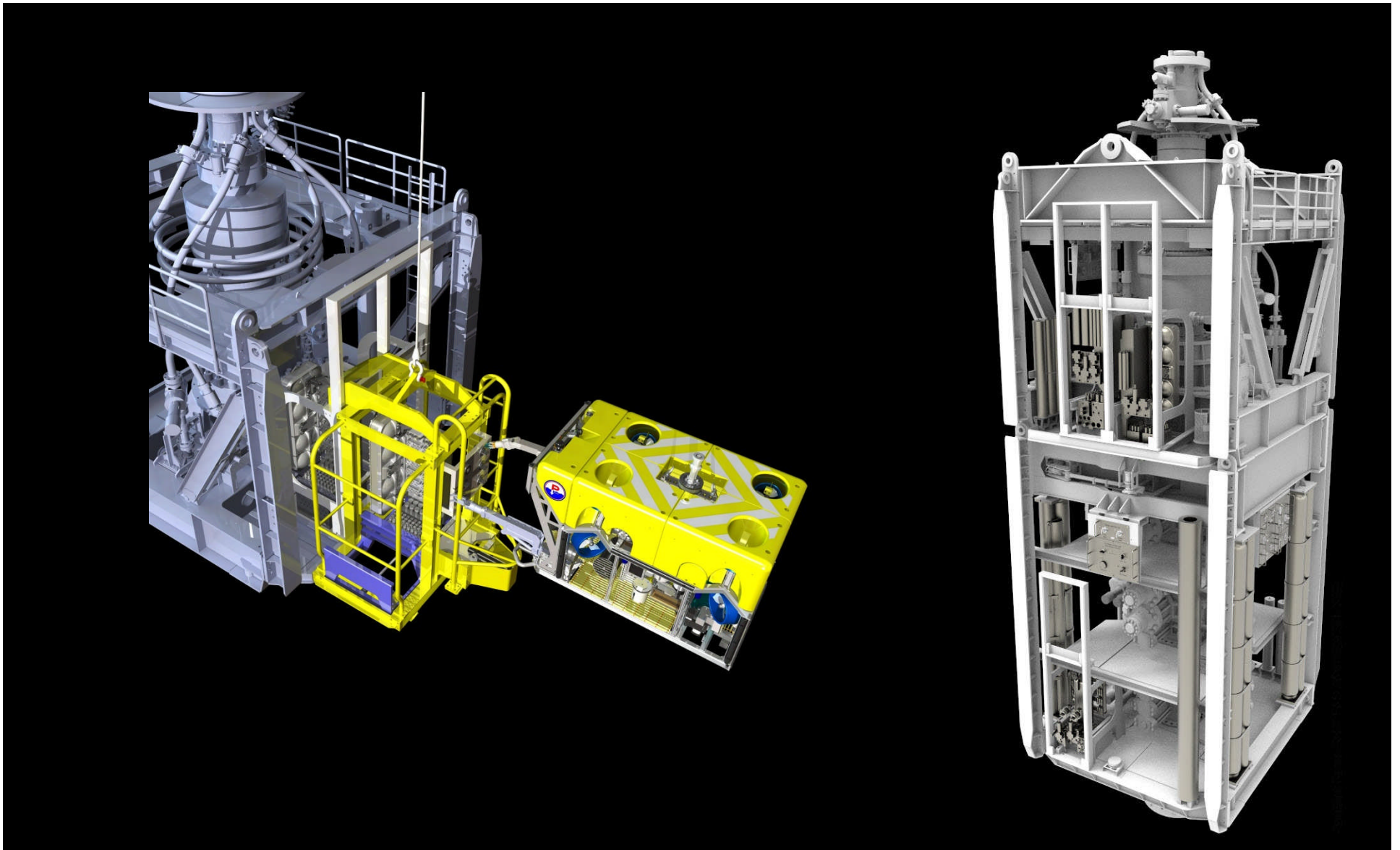
Choke and Kill Stab



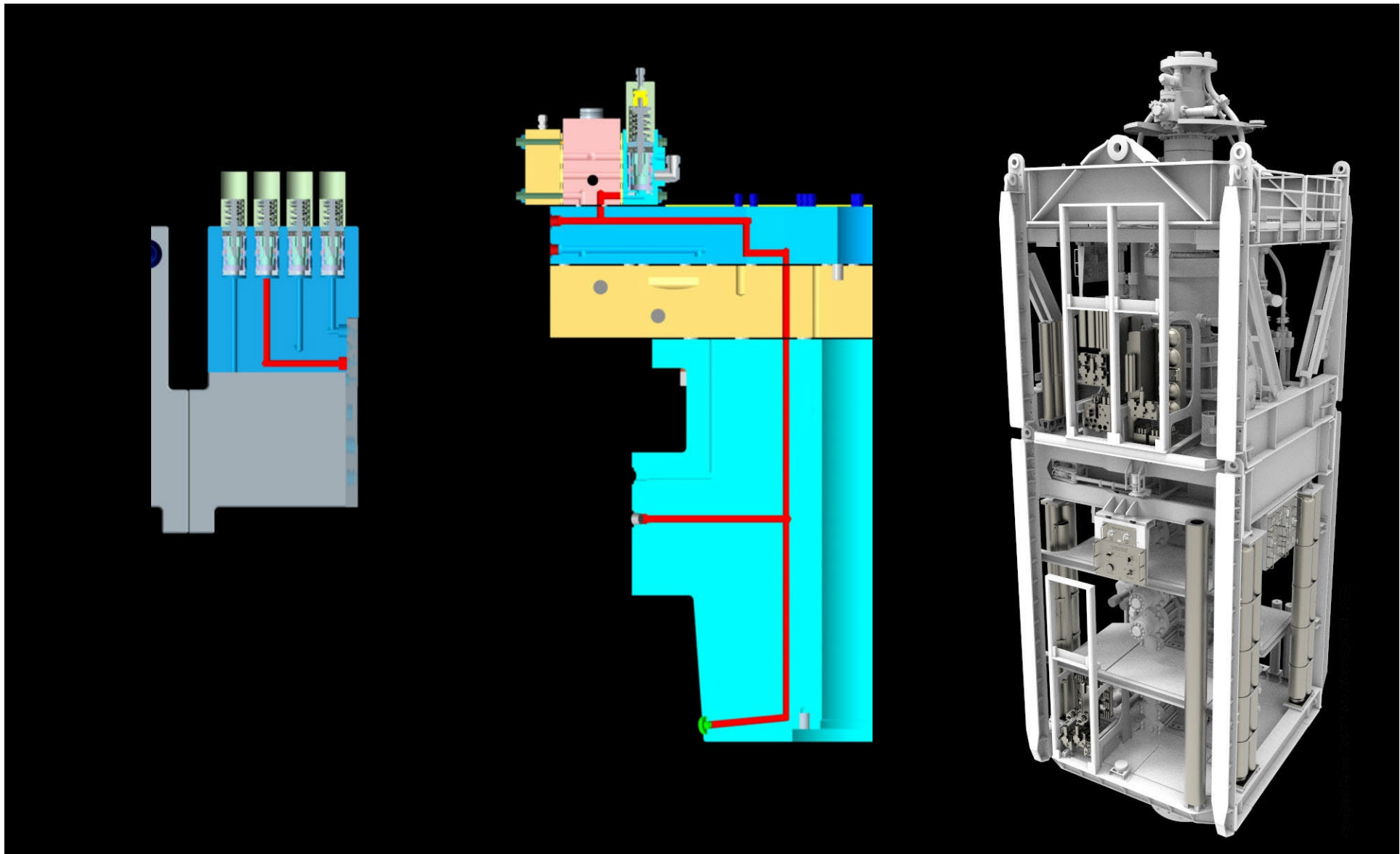
RCX Controls



RCX Controls



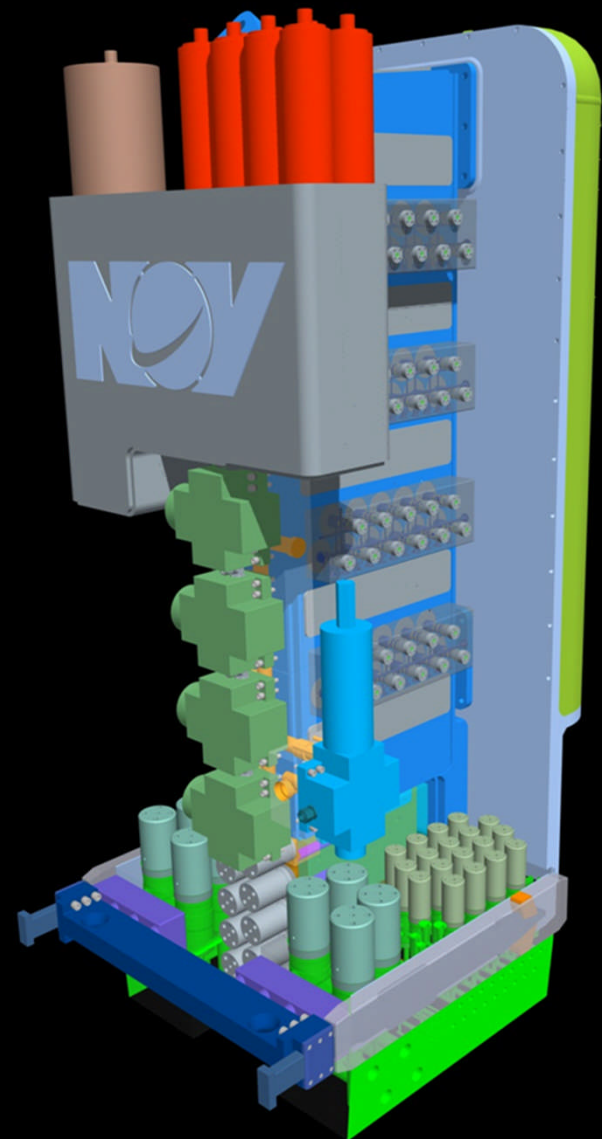
RCX Controls



Next Gen Pod

Reduced Leak Paths

- Visible from ROV
- Smaller/Lighter
- Retrievable
- Fewer Function Requirements
- Existing Known Components – Different Packaging





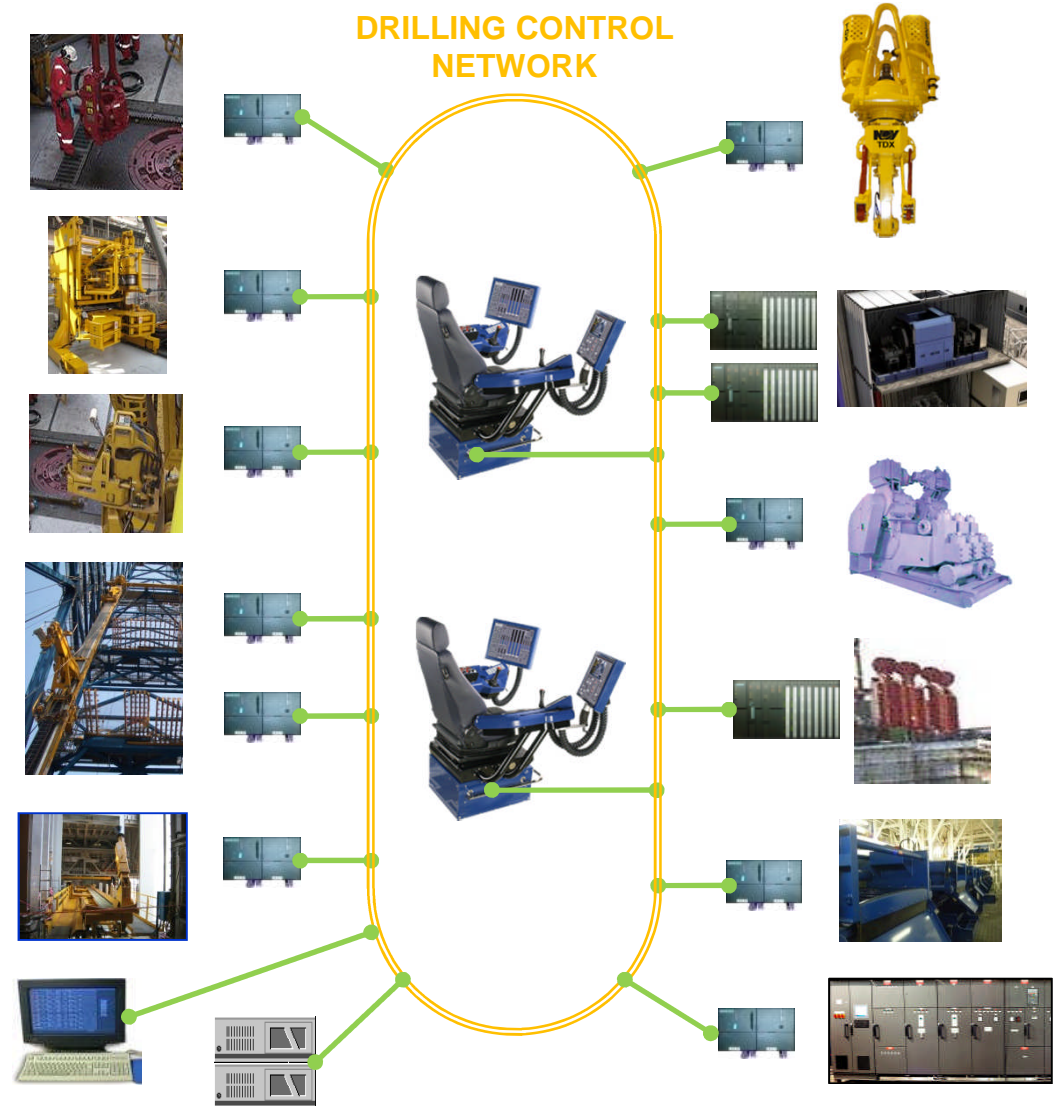
**Real Time
Remote Monitor
Proactive Data
Automated Reporting**

Drilling Control System

- Drilling Control Network
- Operator Workstations

- Drilling Instrumentation
- Data Servers

- Machine Control Systems (PLC)
- Variable Speed Drive System

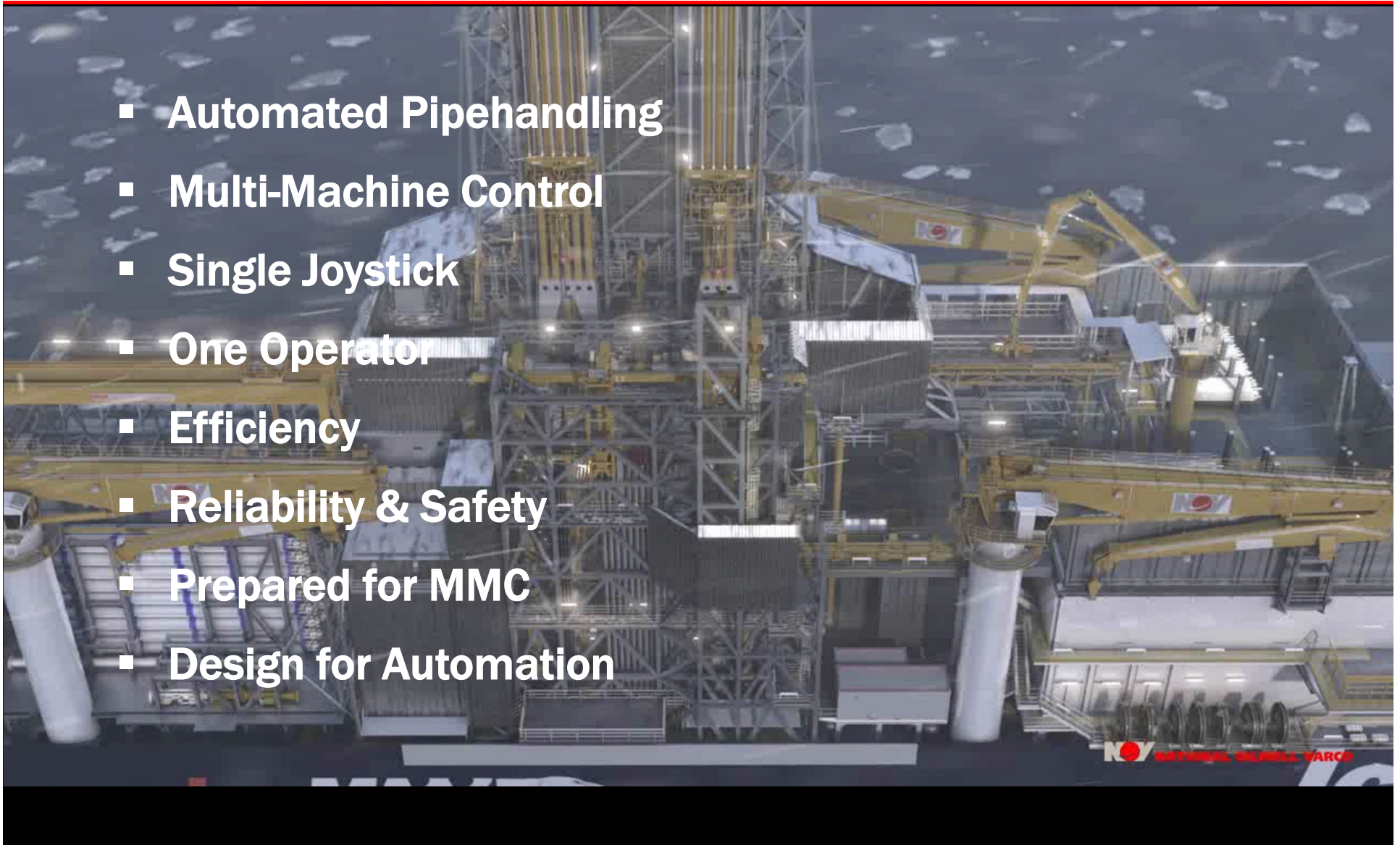


Rig Specific HIL Simulation

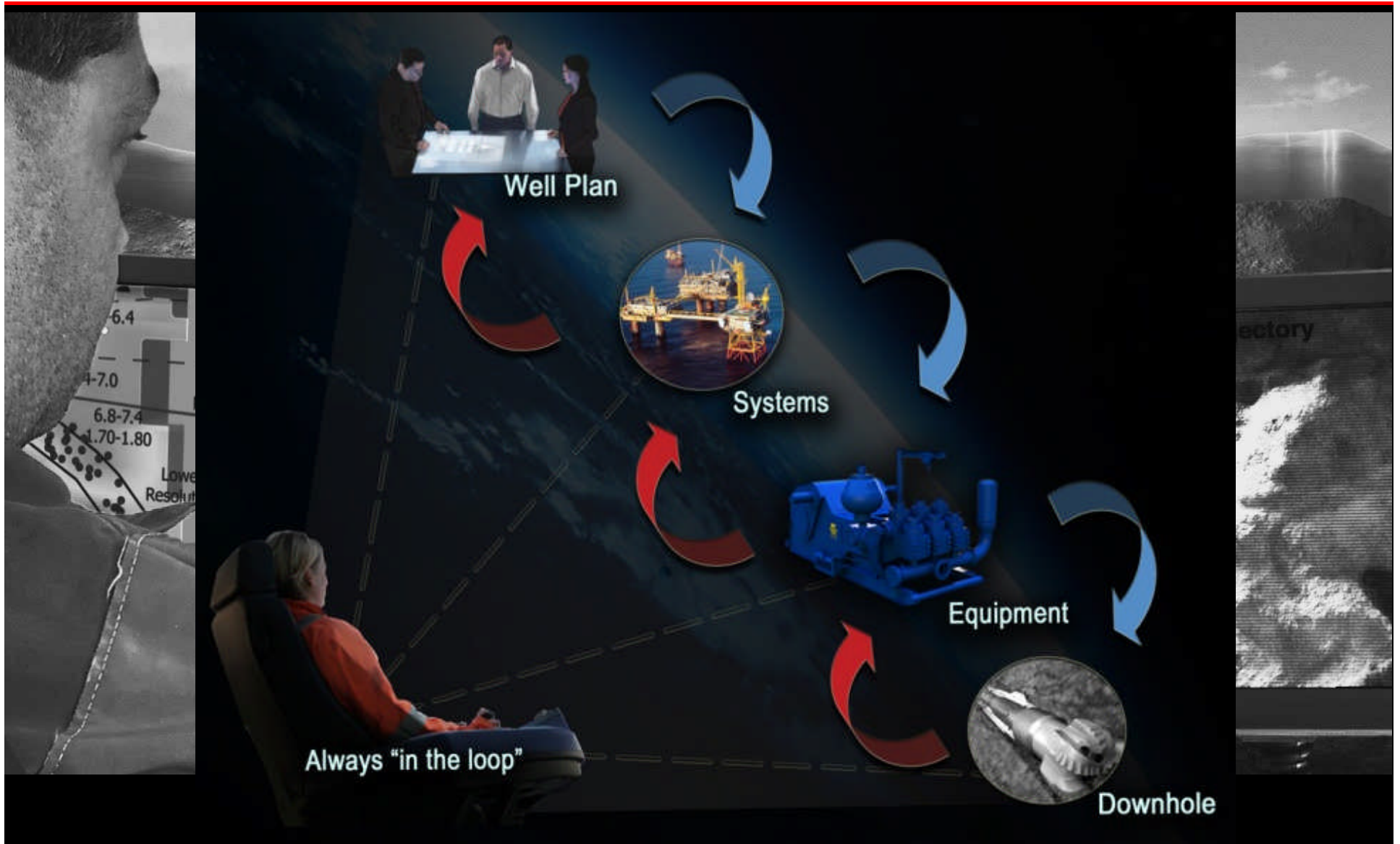
- Simulation Environment
- Three Dimensional Visualization
- Actual 3D Computer Models
- Actual Control Software
- More Exhaustive Testing
- Knowledgeable Equipment Experts
- Prior to Commissioning
- Use for Rig Specific Training

Rig Automation by Design

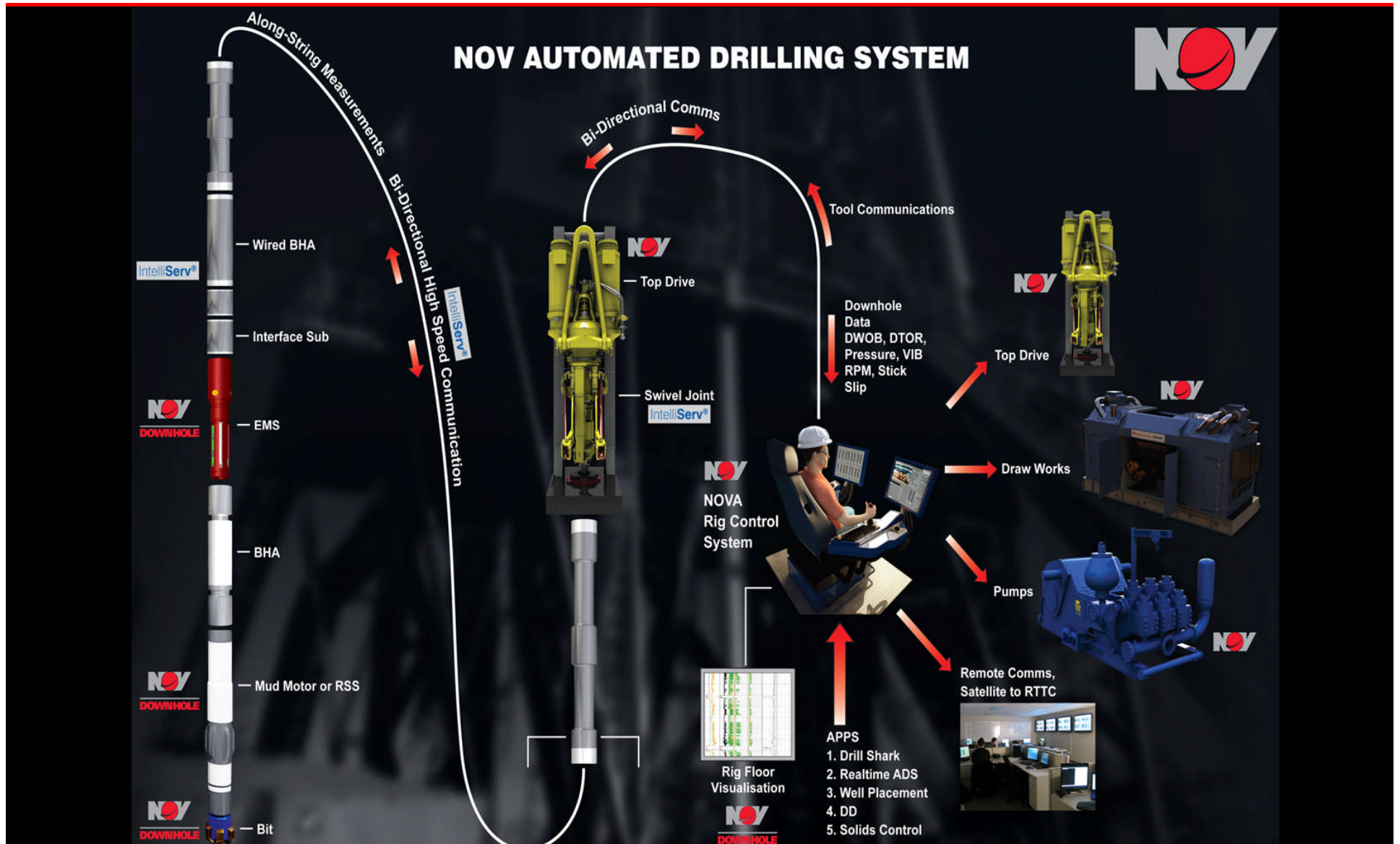
- Automated Pipehandling
- Multi-Machine Control
- Single Joystick
- One Operator
- Efficiency
- Reliability & Safety
- Prepared for MMC
- Design for Automation



Holistic Process Automation



Holistic Process Automation



Thank-you!

DISCOVERER INSPIRATION

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