Drilling and Advanced Rig Technology (ART) Training Simulators

Mechanised Pipe-Handling, Cyber Drilling and Well Control Training

with optional Offshore Crane Operations
Modern Cyber rigs today are supplied with operator chairs, joysticks and touchscreen interfaces in air-conditioned driller's cabins. These very modern Drilling and Advanced Rig Technology (ART) rigs include complex drilling packages that are either semi or fully automated and are run by intelligent computer software systems. Making connections and drilling are no longer the straightforward tasks that they were 10 years ago. With integrated rig control, anti-collision and zone management systems, the driller and assistant driller need skill sets that enable them to review, interpret and act on a large volume of data that is presented in front of them.

The DrillSIM M-600 (single chair) and DrillSIM M-6000 (two or more chairs) solutions are the widely accepted industry tools that enable Drilling Contractors and Operators to fully train and verify the skills needed by a modern day driller. The 6x series units can model any number of cyber rigs (on the same simulator) by using an interchangeable plug and play pannier system. The simulators enhance safety performance and assist with reducing the all-important non-productive time (NPT).

Key Features

- Highly-realistic training environment
- Accurate 3d models of rig and pipe-handling equipment
- Downhole math models fully integrated
  - realistic HMI responses / data fed back to the driller
  - well control (IADC WellCAP/IWCF), stuck pipe etc.
- Multiple rig packages on one simulator
  - Ability to emulate equipment from any vendor
  - Experience with all major rig control systems
- Different simulator environments depending on needs
  - Large-scale projection, classroom or containerised
  - Integrate with DrillSIM-5000 manifolds, BOPs etc.
- Drilling Systems offers the complete solution
  - 10+ years experience in delivering ART simulators
  - does not rely on third-parties for ongoing support
  - Remote support via VPN links

Benefits

- Train in safety
  - no risk to personnel, assets or the environment
- Recreate rig specific models
- Recreate scenarios and downhole conditions
- Reduce the learning curve
- Increase confidence of the driller and AD
- Reduce the reliance of “On-the-Rig Mentors” and OJT
- Rig crew training and team problem solving
  - Gap analysis in crew knowledge
- Provides an independent competency assessment tool
Simulator Environments

The simulator can be installed in several different simulator environments, depending on the training needs and budgets. For impressive and high impact, the large warehouse scale solution is the way forward, incorporating a replica doghouse and a multi-screen projection solution. The optional multi-LCD visualisation wall takes this one step further.

Where space is restricted or the client requires a multi-functional simulator, the classroom based LCD version is the unit of choice. The systems feature several HD LCDs, positioned in front of the driller. Two or more of these chairs can be linked together, recreating a modern-day doghouse environment. Incorporating a third main view, down between the legs of the operator enables the simulator to be used for Offshore Crane Operating training using the KraneSIM software.

Where Drilling Contractors operate in the global market and mobilise their rigs for new contracts, the classroom based simulators can be fitted into custom designed 40ft containers, enabling the training simulator to move with the rig. Equally, for new-build projects, the simulator can move from the Shipyard to an Operations base once the rig is commissioned. The containers can include all the necessary world-voltage equipment and HVAC items enabling the container to be moved to any location in the world.

Rig Designs and Drilling Packages

Through a unique design process, Drilling Systems has adopted a “plug-and-play” pannier technology, that allows multiple rig designs / drilling equipment to be run on a single simulator. Within a matter of minutes, an Instructor can switch from teaching on a dual-activity drillship to a semi-automated jackup by replacing the plug-and-play panniers and restarting the simulator in a different rig mode. In addition to the different controls, the Company has emulated a wide range of drilling equipment (roughnecks, top drives, rackers et) and their respective integrated control systems, zone management etc. All this from a single simulator provider.
**Functionality**

The DrillSIM simulators are more than just basic pipe-handling simulators, teaching how to move a piece of pipe from A to B. The emulated systems recreate all the zone management and anti-collision interfaces, ensuring the driller and assistant driller take ownership and configure the relevant piece of equipment before using it in earnest.

**Rig Crew Training**
- Surface equipment
  - Tool ownership and configuration
- Tubular handling
  - Drillpipe, HWDP, tubing, casing, riser
  - Stand building, connections, tripping pipe
  - BOP landing
- Human Machine Interface (HMI) operations
  - Drilling data, alarm setting etc
  - CCTV control
  - Zone management awareness
  - E-stops
- Downhole reactions
- Testing and verification of rig operating procedures
- Routine well programmes
- Emergency response scenarios
  - LMRP disconnect
- Drill the well on the simulator (DWOS)
  - with offshore and onshore personnel
- Practice and mitigate operational risks
- Troubleshooting with rig technicians

**Additional Training**
- Drilling Competency Assessments
- IADC WellCAP and IWCF well control accreditation
- IADC WellCAP plus
- Stuckpipe
- Wellbore Cleaning Problems
- Extended Reach Drilling (ERD)
- Through Tubing Rotary Drilling (TTRD)
- Managed Pressure Drilling
- Graduate Drilling Engineers
- Real-time Operations Centres (RTOC) team training

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*The power of simulator training*

*I hear and I forget.*
*I see and I remember.*
*I do and I understand.*

*Confucius, Chinese philosopher & reformer, (551 BC - 479 BC)*
High Impact

If physical space and budget is not restricted, then the DrillSIM-6000 Warehouse scale configuration is the premier solution. Walking into the simulator room immediately focuses your attention to the task in hand, namely to learn and appreciate the complexity of modern-day drilling rigs. A mixture of high-performance computer equipment, bright projection systems and the advanced 3D graphics deliver the wow factor to any training programme. This fact will not be overlooked by your Marketing Department as they promote the services of your company, whether you work for a drilling contractor, service company, training school or University.

Typical Warehouse configuration
• Replica doghouse
• Large 4 screen visual projection systems
• Projection view up the derrick
• 8m / 25 ft ceiling heights
• Dual chair configuration - Driller and AD
• Plug-and-play pannier system for different rig packages
• Instructor Station - monitoring and control
• HMI repeater views
• CCTV views
• Supported Flooring

Optional Items
• Third/Fourth operator chairs
• Well Control consoles
  • BOPs, Diverters, Manifolds, Remote Choke
• Managed Pressure Drilling
• Visualisation walls
  • split views of deviated wells, downhole tools
• Links to Real-Time Operation Centres (RTOCs)
**Powerful, yet compact**

Where the large scale projection-based solutions are not appropriate, using large high-definition (HD) LCDs delivers an equally impressive training environment. These industrial LCD solutions require a smaller footprint and will generally fit within existing training facilities. Each chair has its own independent visual world creating the greatest flexibility in training options.

For drilling training only, two large LCDs (typically 65”/70”) provide the main views and are complemented by two smaller side views (40” screens). By adding a third main screen, positioned below the operators feet, the simulator can be also used for crane operator training.

**Typical Classroom configurations**
- Large high-definition industrial LCD panels
- Dual main views - drilling training
- Triple main views - drilling and crane op training
- Twin side screens for peripheral vision
- Supporting frameworks
- 3m / 10 ft ceiling heights
- Single (driller) or Dual (with AD) chair configurations
- Plug-and-play pannier system for different rig packages
- Instructor Station - monitoring and control
- HMI repeater views
- CCTV views
- Supported Flooring

**Classroom options**
- Integrates with a range of well control hardware

**Crane Training Options**
- Generic or crane specific plug and play panniers
- Pedestal, knuckle boom, box boom, gantry cranes
- Any offshore installation design / layout
- Variable weather conditions
- Comprehensive selection of malfunctions
- Déjà vu for session review
- Fully integrate with competency assessments
Any place, any time

For clients requiring a flexible solution that can be moved to different locations, or for those without the required training centre facilities to house a warehouse or classroom based ART simulator, then the containerised DrillSIM-6000/600 solutions are the preferred choice.

The containerised DrillSIM units, effectively house the classroom based DrillSIM-600 (single chair) or DrillSIM-6000 (dual chair) systems, featuring the large industrial LCD panels. The hardware and computer equipment is modified with vibration mounts making it suitable for regular shipment.

Typical Container configurations
- 40ft high-cube container
  - Plant zone with power and AC condenser units
  - Computer zone with industrial computer racks
  - Racks mounted on special vibration mounts
  - Emergency exits and lighting
  - Large high-definition LCDs visual systems
    - Dual main views - drilling training
    - Twin side screens for peripheral vision
    - LCD supporting frameworks
  - Single (driller) or Dual (with AD) chair configurations
  - Plug-and-play pannier system for different rig packages
  - Instructor Station - monitoring and control
  - HMI repeater views
  - CCTV views

Container options
- 45 ft High Cube Container (not all ports accept 45ft)
- World voltage
- Ultra-harsh weather conditions
- Triple main views - drilling and crane op training
- Wall mounted BOP and Diverter control stations
- Desk area for 4 students (for single chair solutions)
Standard Scope of Simulation

**Circulating System**
- Mud Properties
- Density, Yield Point & Plastic Viscosity
- Density Tracking through annulus
- Solids Control Equipment
- Trip & Strip Tanks

**BOP and Well Control System**
- Choke & Standpipe Manifolds
- Manual Choke, Remote Choke & Bypass lines
- Choke inlet and isolation valves
- Surface BOP (a 13 1/8", 10,000 psi stack)
- Drill String Valves (Float, IBOP & Safety Valves)
- Subsea BOP (a 18 3/4", 10,000 psi stack)
- Maximum water depth of 10,000ft
- Accurate modelling of accumulator behaviour
- Subsea Diverters
- Booster line, riser, choke and kill lines

**Equipment and Operational Malfunctions**
- Hoisting System Malfunctions
- Power System Malfunctions
- Rig Instrumentation Malfunctions
- Control Malfunctions
- Gauge Malfunctions

**Downhole Effects**
- Maximum geological column of 30,000ft
- Rock Strength & Abrasiveness
- Formation Fluid type & Permeability
- Wells of varying annular geometry
- Multiple Casing & tubing strings
- Leak Off Testing
- Bottom Hole Effects
- Hole Cleaning
- Differential Pressure
- Annular Velocity
- Downhole Problems
- Bit washout, Drill String washout, Bit Bailing, Drilling on junk, Pipe Twist-off, Stuck Pipe
- Sloughing, Differential Sticking
- Fluid Flow & Pressure Loss
- Multiple Kicks
- Kick Influx Density
- Reservoir Drawdown & Stabilisation
- Gas Expansion & migration
- Underground Blowout
- Dynamic Pressures during well control
- Lost Circulation

**Well Control**
- Kicks while Drilling
- Kicks while Tripping
- Stripping
- Kicks while out of hole
- Kicks while running casing or liners
- Driller’s Method of well control
- Volumetric method of well control
- Wait and Weight method of well control
- Concurrent method of well control
- Low Choke method of well control
- Bull heading

**Additional Functionality**
- BOP Landing
- LMRP Disconnect

Common Features

**DrillSIM Infrastructure Software**
- 1/O task and database managers
- Instructor Station
- Student Station
- Sound software
- Remote VPN support PC software
- Remote VPN support webcam software
- Downhole Math Models - Surface
- Downhole Math Models - Subsea
- MPD Interface software
- Déjà vu data record and playback

**Computer Racks**
- Typically one rack per chair
- Industrial rack mounted PCs
- Main views
- Camera views including CCTV systems
- Sound Effects and simulation computer
- Instructor Station & flyaround
- Student Station
- Human Machine Interface (HMI) front screens
- Spare PC, pre-loaded with all applications
- Pull-out KVM
- Session power switches
- Sequential start-up module
- 24 port network hub / switch
- Power distribution, cooling fans

**Instructor Zone**
- Instructor Desk
- Instructor Control - dual 19" LCDs
- Instructor Fly around - 19" LCD, joystick
- HMI repeater views
  - dual LCDs per Driller and AD chairs
- A4 colour laser printer
- VoIP telephone
- Access to technical support team
- VPN Webcam

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