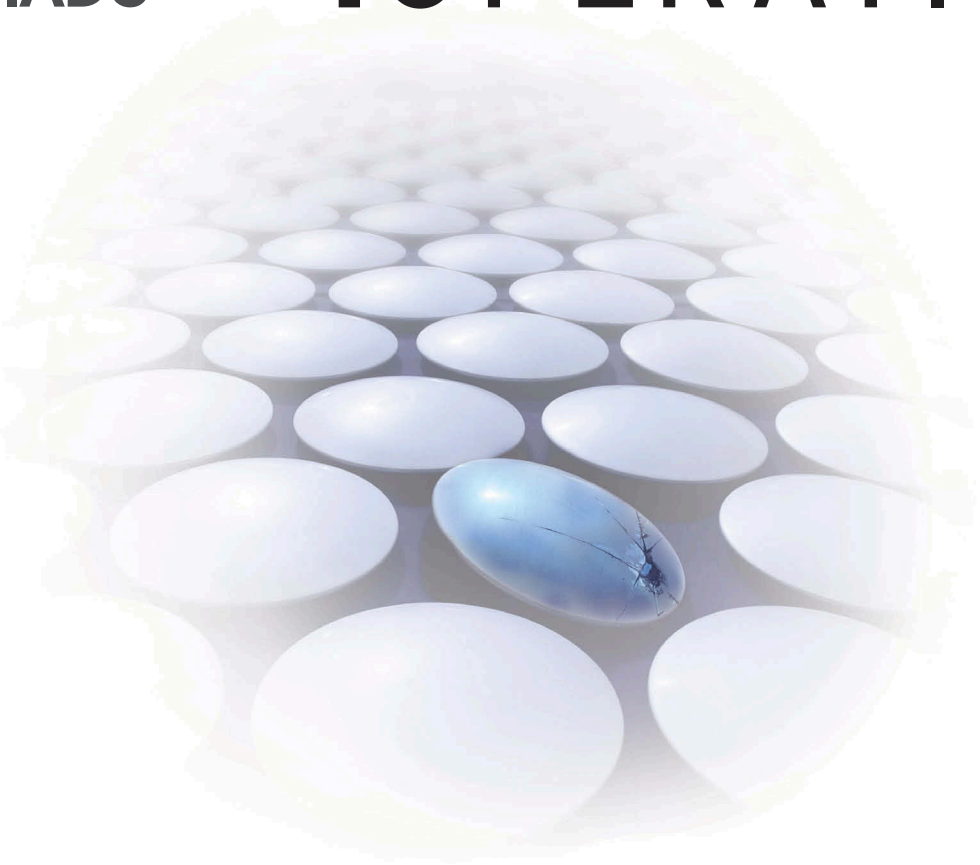
DRILLING CONTRACTOR ANTHOLOGY SERIES

ASSET INTEGRITY FOR DRILLING OPERATIONS

IADC™



Asset Integrity for Drilling Operations
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Preface

By Steve Colville, IADC President & CEO

Asset integrity and reliability is the most fundamental and possibly the most challenging aspect of the drilling industry's business. Asset integrity is defined as the ability of an asset to perform its required function effectively and efficiently while protecting health, safety and the environment. It is the means of ensuring that the people, systems, processes and resources that deliver integrity are in place, in use and will perform when required, over the entire lifecycle of an asset.

It is a topic that remains of considerable interest to the regulatory groups that make up the International Regulators Forum (IRF). In December 2007, this group convened in Miami, Fla., to focus attention on asset management and safety in the offshore industry. They were challenged by IADC to publicize their perspective on asset management and did so in a series of articles that appeared in Drilling Contractor throughout 2008 and 2009. These articles, plus other asset integrity-related articles that have been published in Drilling Contractor, are re-formatted for this publication. They are intended to promote further interest and encourage dialogue and action in addressing the variety of concerns raised by the regulatory authorities.

At IADC, we share the IRF's interest in the topic of asset integrity. We continuously engage with government policy makers, regulators and producers to sensibly influence new policies, to advocate better regulatory practices to enable drilling contractors to perform to their best and to give stewardship to the values of our industry. This active leadership creates trust and gives the space for us to improve reliability and asset integrity in our rigs, people and equipment. Working together, IADC's members are developing and creating the solutions to industry's needs that will propel us forward to a successful future.

About IADC: The International Association of Drilling Contractors

Since 1940, the International Association of Drilling Contractors (IADC) has exclusively represented the worldwide oil and gas drilling industry. Membership is open to any company involved in oil and gas exploration, drilling or production, well servicing, oilfield manufacturing or other rig-site services. IADC's vision is for the drilling industry to be recognized for its vital role in enabling the global economy and its high standards of safety, environmental stewardship and operational efficiency. Its mission is to catalyze improved performance for the drilling industry.

About IRF: The International Regulators Forum

The International Regulators Forum (IRF) is a group of ten regulators of health and safety in the offshore upstream oil and gas industry. It exists to drive forward improvements in health and safety in the sector through collaboration in joint programmes, and through sharing information.

IRF participants are:

- National Offshore Petroleum Safety and Environmental Management Authority, Australia (NOPSEMA)
- Petroleum Safety Authority, Norway (PSA)
- US Bureau of Safety and Environmental Enforcement (BSEE)
- Danish Working Environment Authority (WEA)
- National Hydrocarbons Commission, Mexico (CNH)
- New Zealand Department of Labor (DOL)
- Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) and Canada-Nova Scotia Offshore Petroleum Board (CNSOPB)
- Brazilian Natitonal Petroleum Agency (ANP)
- The Health and Safety Executive, Great Britain (HSE)
- State Supervision of Mines, the Netherlands (SSM)

ASSET INTEGRITY FOR DRILLING OPERATIONS

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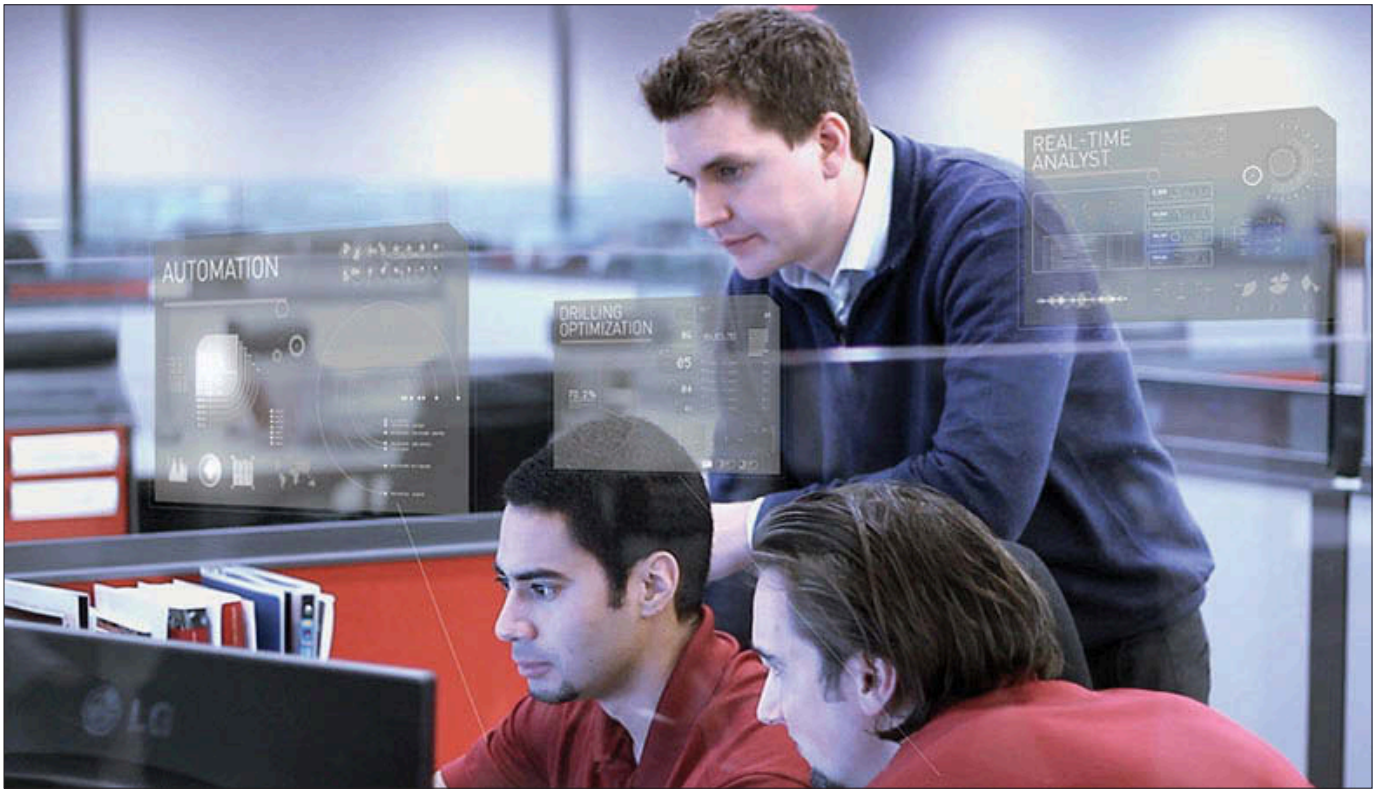
ENSURING RELIABILITY, AND PROVING IT

Industry addresses asset integrity through data-driven programs, focus on human factors, enhanced documentation

By Linda Hsieh, Managing Editor with reporting by Jesse Maldonado, Associate Editor



NOV's eHawk Performance Monitoring service provides remote monitoring capabilities and advisory services for critical assets on rigs, such as engines, top drives, mud pumps and drawworks.

From reliability-centered maintenance programs to integrated sensors to advanced risk modeling, the drilling industry is dedicating more resources than ever to ensuring the integrity of its assets. However, in this post-Macondo world, simply doing the work is oftentimes not enough anymore. We're now increasingly being asked – by operators as well as regulators – to provide evidence of when the work was done, who did it and if that person was qualified, and how that person conducted the work.

Diamond Offshore, for example, has significantly amped up its efforts around documentation when it comes to equipment maintenance. "There's a lot more emphasis on contractors doing their work as their company's management system says they are going to do. Operators want to be able to see maintenance records and proof of certifications. They want to ensure we are doing what we say we are doing and not just pencil-whipping it," Frank Breland, Manager of Planned Maintenance for Diamond Offshore, said.

At the same time, increasing equipment complexity is putting stress on what companies require of their personnel. This continues to push the development and adoption of data-driven maintenance processes that incorporate sensor-collected data, understanding of failure modes and real-time monitoring. The drilling industry has historically been skeptical of technologies, like sensors, believing that having more sensors means less reliability. Now, that mindset is changing, Ashe Menon, Director of Asset Management

for National Oilwell Varco (NOV), said. "Since we are drilling deeper wells and the equipment is working so much harder, we really need these extra capabilities to identify trouble spots before they fail. This is the way the industry is going."

Nevertheless, the industry recognizes that no matter how sophisticated the equipment gets, it can't function without competent people. As more complex systems are used to manage more complex assets and operational objectives, companies are recognizing that they need to focus, too, on the human interface. "It is important to look at how people interpret data," Pieter van Asten, Business Concepts Manager for Lloyd's Register Energy – Drilling (LRED), said. "That is very challenging and can be of greater importance than equipment failure because it's not black and white. There's a lot of grey in between."

Reliability-centered maintenance

Back in 2010, Ensco kicked off a more robust reliability-centered maintenance (RCM) program, focusing initially on pipe-handling equipment. "Reliability-centered maintenance is a very methodical way in which we analyze the failure modes of a particular piece of equipment and how we can prevent those failure modes. The ultimate goal is ensuring the integrity of our assets," Sachin Mehra, Ensco VP of Asset Management, said.

This comprehensive process begins by establishing a multidisciplinary team that includes not just drilling contractor personnel but also the OEM. A five-day session, facilitated by a third-party company, is then held where team members come together to discuss all possible failure methods for a particular piece of equipment and brainstorm solutions for failure prevention. "These sessions don't have to be five days – they could be three days or eight days, depending on the complexity of the equipment," Mr Mehra said. Regardless the length of the sessions, a significant amount of information is generated through these discussions, and it could take months to further analyze that information and turn it into action items.

At this point, Mr Mehra stressed, it's critical that the drilling contractor follows through by implementing those action items on its rigs. "You only get the real benefit of the RCM study if you implement changes in operations and maintenance. Those changes could be many things – an alternate equipment component, a redesign of a component to increase reliability, or perhaps the way that equipment is maintained or operated."

This means a company must be prepared to make the RCM program a long-term investment where payoff may not be immediate. "Sometimes, in order to see the results of a particular RCM study, it could take a year or more depending on what the equipment is," Mr Mehra said. Taking the long-term view has paid off for Ensco since the program kicked off just four years ago. One of the first RCM studies Ensco did focused on the bridge racker for the ENSCO 8500 Series rigs. Since that study was done and action items were implemented, the average annual downtime for each 8500 Series bridge racker has been reduced by nearly 95%, Mr Mehra explained.

The Ensco DS-6 drillship is working for BP in Angola under a five-year contract. Under its reliability-centered maintenance program, Ensco completed several studies on BOP control systems in 2012. The company is now implementing learnings and action items from those studies across its drillship fleet.

This result was possible because Ensco knew it could leverage the improvements that came out of one RCM study across all of its 8500 Series rigs – one reason the company picked this particular piece of equipment to study in the first place. "The cost of the RCM was spread over seven rigs, and the benefits we gained have benefitted all seven rigs," he said.

In 2011, after Ensco added a significant drillship fleet through the Pride International acquisition, Ensco realized it needed to pivot the focus of its RCM efforts to subsea BOPs and, in particular, BOP control systems. An enhanced RCM study, completed in 2012 on this equipment, is being implemented across the company's drillship fleet. So far, on just three drillships, Ensco has been able to reduce downtime related to this equipment by nearly 70%, Mr Mehra said. The company is aiming for further improvement as it continues to analyze downtime statistics and fine-tune its RCM strategy.

Collaboration with OEMs will be particularly important in that effort, he continued. "Equipment design and quality control is a big issue. If you look at Ensco's asset integrity philosophy, we want to get to a point where the equipment is designed such that it is inherently reliable," Mr Mehra said. "The industry is still doing