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Optimizing Remote Operations Support Using an Effective Real-Time Model for Improved Drilling Performance

Seth Robert, William Fiffick, Drew Davis, and Robert Guillory, Canrig Drilling Technology; Joshua Myers, Nabors Drilling Solutions; Chakra Mandava, Nabors Corporate Services

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Abstract

The wider use of robotics, remote controls, real-time remote monitoring systems, artificial intelligence, and other techniques are setting new standards of performance. The exciting culmination of these engineering and technological efforts have given us "The Rig of the Future".

However, how should we develop and manage the support systems to leverage this modern drilling technology? Do we have the people, processes, tools, and infrastructure needed to successfully apply these technologies?

The following case study reviews key elements necessary to support modern drilling, including: Real-Time Operations Centers, competent field service technicians, custom software applications, new processes and drilling performance technology. Properly applying these systems enhances drilling operations, ultimately leading to better drilling performance with decreasing non-productive time (NPT). The synergies between remote support, field operations, drilling technology, and other critical components are discussed in detail. This case study describes how the Real-Time Operations Center concept was conceived and developed. These support systems optimize field service performance by leveraging remote equipment condition monitoring, automating alerts, providing real-time rig data, and remotely interfacing key systems to improve the overall reliability of drilling operations.

As a result, many issues can be corrected remotely, decreasing average resolution times, resulting in better customer satisfaction ratings.

We discuss the necessary support processes, roles, and responsibilities. By leveraging the "Internet of Things", we achieve greater efficiencies. Augmenting the conventional roles for Field Service Technicians and other supporting functions adds additional value and efficiency. Working together, these distinct disciplines coordinate and mesh key responsibilities resulting in an "ecosystem" to support drilling operations.

While some struggle to provide systematic, comprehensive service and support models, a template of best practices has been developed and validated. This details remote operations centers, enhanced equipment technology, enhanced software applications, as well as enhanced employee development practices (for the

necessary team of competent field service technicians). This model drives best-in-class drilling performance and is what "drilling rig of the future" looks like today.

Market & Technical Challenges

In the recent past (time period from 2013 to 2017), demand for drilling rigs has decreased by as much as 62%, ranging from a high of 3,736 rigs to a low of just 1,407 active drilling rigs worldwide (https://ycharts.com/indicators/total_world_rotary_rigs). Considering the challenging business climate over the last few years, there has been an urgent need to become more efficient. Some drilling contractors have seen their operating day rates reduced by as much as 50% (http://blogs.platts.com/2017/08/21/us-land-rig-drilling/)! Given these market pressures, many drillers struggle to remain profitable. Concurrently, there is a need to demonstrate competitive advantages through better operational performance and enhancing value for the operator. So, how do drilling contractors remain profitable while increasing value? How can these new business models be scaled and remain sustainable?

When E&P operators consider contracting drilling rigs, there may be a variety of benchmarks considered. For the purposes of this case study, we will focus on the drive to decrease downtime.

E&P Operators will always be looking at overall drilling performance. How much footage can a particular rig drill? What are the costs involved in drilling that footage? There are many leading indicators to consider, such as downtime. How can a drilling contractor reduce overall downtime rate without adding too much expense to their repair and maintenance cost? How can a driller keep costs to reasonable levels while improving overall productive time?

One way to decrease downtime could be to hire more maintenance people to support the rigs. By having more technicians, electricians, and mechanics available, response times might be much quicker. However, having additional people could dramatically increase overhead costs. Given the market conditions, increasing this field staff might not be the best option.

Another option might be to reduce downtime by having the ‘right’ parts on location. But, who would decide what the ‘right’ parts are to have on location? Would it be practical to have spare capital equipment available on each drilling location as a backup? Having sufficient spare capital equipment on site is likely not scalable nor profitable. Drillers must look for other ways to drive efficiencies.

A Comprehensive Solution

When tracking the key performance indicators (such as downtime performance) we look at the leading indicators. (i.e. How to reduce the overall downtime or, more importantly, to determine how to prevent the downtime altogether.)

‘Smart’ Drilling Equipment

Could today's drilling equipment be ‘smart’ enough to communicate issues *before* the point of failure? Over the last few years, ‘smart’ technology has advanced. Automated alarms and various communication platforms can alert key stakeholders (at the appropriate times) when equipment is sensing conditions that *could* lead to failure if it is not addressed immediately.

Real-Time Operations Centers

A modern Real-Time Operations Center needs to be more than just a ‘call center’ where issues are reported. Real-Time Operations Centers must have the ability to track the overall performance of the rig, understand the maintenance conditions, as well as the status of the equipment. An effective Operations Center is not only able to review issues, but, to *resolve* issues, as well as to prioritize maintenance requests. Smart equipment and custom software applications are key.

Modern Real-Time Operations Centers track rig performance through key performance indicators (KPIs). These KPIs also include internal performance measures such as agent availability and remote resolution rates.

Specialized Custom Software Applications

Software Applications today understand 'predictive' as opposed to 'reactive' analytics. These applications assist us by scaling maintenance practices. The applications gather sufficient information, to suggest crucial maintenance by *anticipating* the threshold of possible failures. Otherwise, maintenance operations are usually performed on a rigid, conventional schedule (therefore, performing maintenance that might not necessarily be needed at that time, such as oil changes based on hours in use versus quality sampling and analytics).

The Enhanced Roles and Competencies of Modern Field Service Technicians

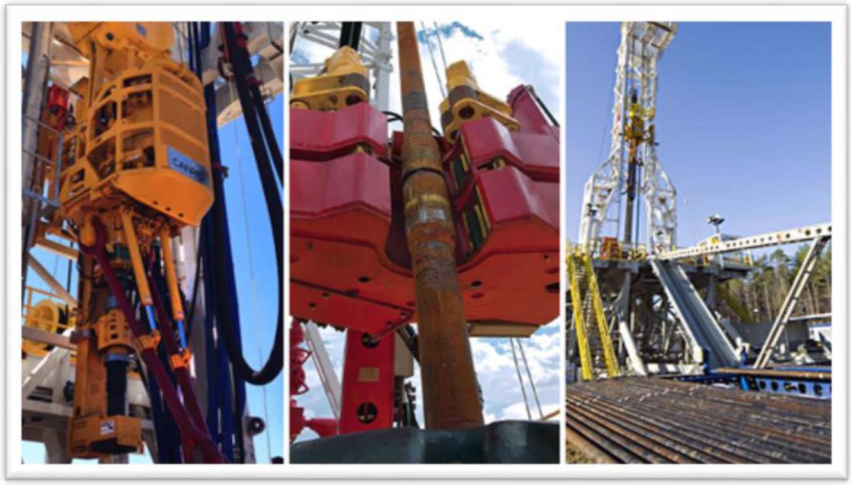
Modern Field Service Technicians effectively utilize information as well as capitalize on the efficiencies gained by a Real-Time Operations Center. Technicians become more efficient through accessing richer systems. By leveraging smart equipment (software that communicates more detailed information about equipment condition, as well as built-in escalation processes, expedited through a real-time command center) field service technicians are able to perform maintenance more quickly and effectively. This allows for reduced time troubleshooting by a technician on location and the potential to identify needed parts ahead of dispatch.

Equipment

The Imperative to Decrease NPT. Engineers and equipment designers are always looking for better ways to add additional value. Whether it be through automation, using software & programming, or through advancements in equipment reliability, the drilling industry continues to be performance driven. We measure equipment reliability by tracking downtime. Drilling contractors and operators look for equipment that exhibits the least amount of downtime, as well as general ease of maintenance.

Recent design enhancements provide the ability to monitor drilling equipment remotely through the 'Internet of Things'. In the past, it was all too common for crucial equipment to be inoperable until a service technician arrived or rig hands disassembled and replaced. (In addition, depending on the remoteness of the location, this could mean many hours of downtime.)

Remote Access Capabilities. With modern day technology, service companies can "remote in" to drilling equipment, looking at current faults (with historian data available) to quickly troubleshoot equipment issues from great distances.



Picture 1—Drilling Equipment with Remote Monitoring Capability

Having the ability to solve issues remotely ultimately improves equipment performance by identifying issues without the need for on-site technical resources. As a result, we have seen significant reductions in downtime within the last 5 years (year by year), ultimately driving a record downtime performance in 2016, despite economic conditions. The chart below shows a 50% reduction in downtime recorded with company products from 2012 to 2016.

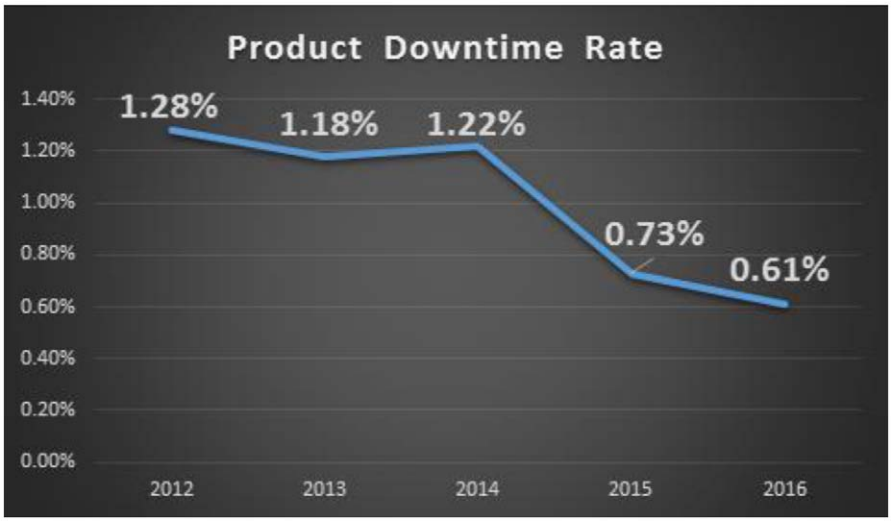


Chart 1—Product Downtime Rate 2012-2016

System Alerts and Escalation. Using integrated sensors, equipment reports system alerts, informing key stakeholders of system issues via the *Internet of Things*. System alerts help to escalate issues prior to a point of failure, leading to improved performance.

Not only does the system identify issues, but also, it can escalate issues (as requested, per the owner of the equipment). System alerts can be programmed to report on-site and/or (depending on the service level agreement) can escalate communications to email, phone calls, or immediate dispatch. By automating the escalation processes, response times can be further reduced.

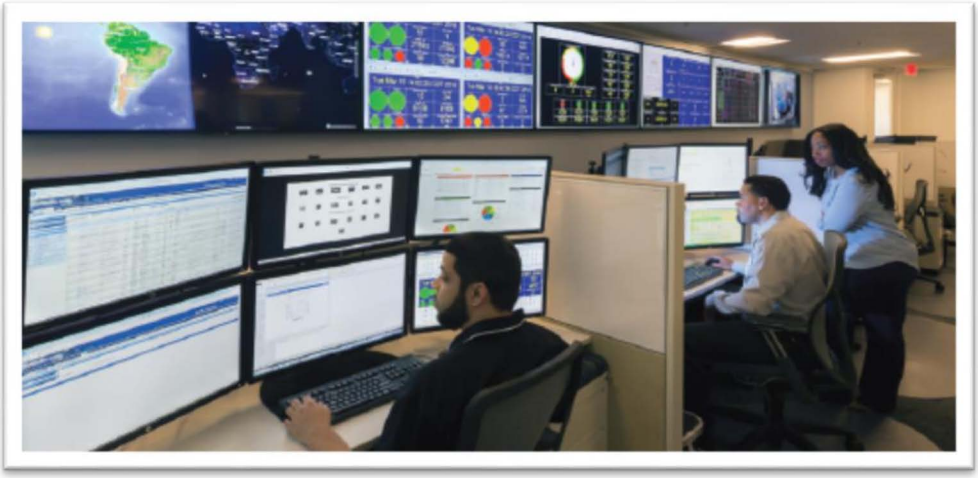
Real-Time Operations Center

Evolution of the Real-Time Operations Center. As drilling operations have evolved, so has the concept and scope of the Real-Time Operations Center. In 2007, the 'Support Center' (as it was referred to back then) became a central point where customers called in and requested technicians. Although issues were always captured in a database, efficiencies were not realized from data coming in. The data gathered was archived to track time served as a placeholder for document storage for on-site services that were provided.

As years passed, the scope of work expanded as well as the need for increased technical competencies. Advances in drilling rig technology allow support technicians to easily access the rig interface remotely. Having the ability to remotely "see" the rig interface enhances opportunities to immediately review operations data, driving even more opportunities to resolve issues remotely.

As equipment designs continue to improve, remote support further evolves. New levels of support opportunities have been identified. As technician's skills improved, greater percentages of issues are being solved "just like being there".

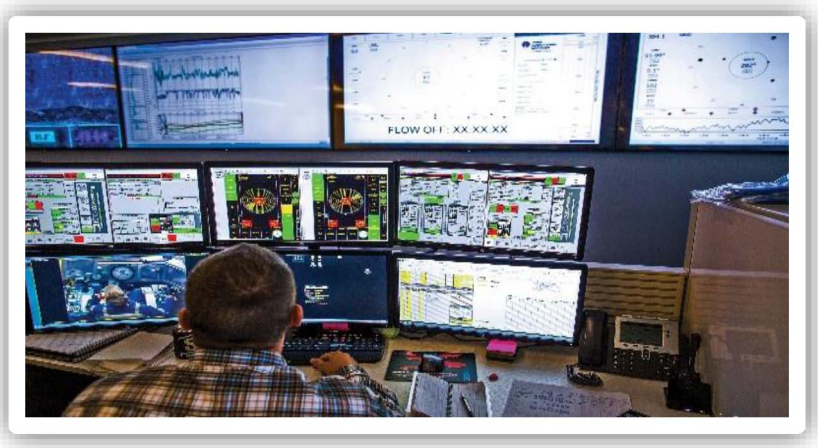
Back in 2007, the Support Center was staffed by as many as 15 support technicians. By 2017, the Real-Time Operations Center increased staffing to over 75 support positions. Many KPIs are tracked in the Real-Time Operations Center (such as total issues reported, issues resolved remotely, response time, and first time resolution rates).



Picture 2—2017 Real-Time Operations Center

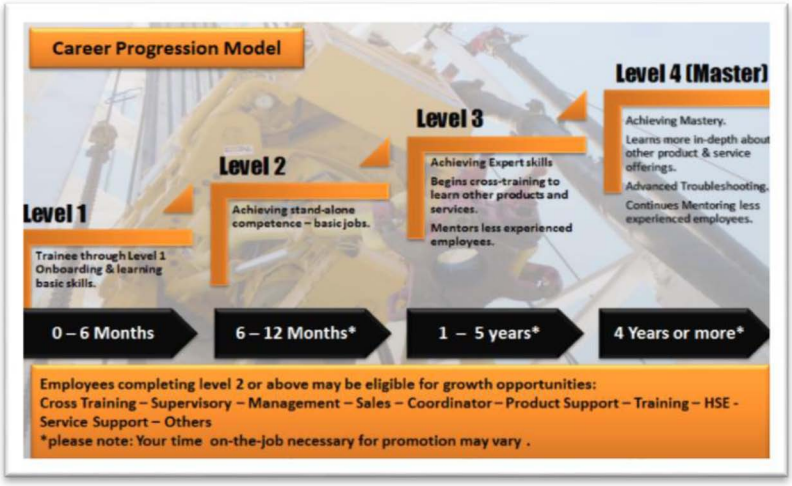
Enhancing the Role of the Support Technician. In the past, the Support Center was only able to cover a few product lines, though still supporting rigs 24-hours a day. Back then, the Support Technician's scope of work was to provide basic assistance to expedite dispatching field technicians, and, if possible, they *might* assist in troubleshooting. As remote communications improved, the skill set of support technicians expanded. As additional product lines were added, the idea of 'Real-Time Operations Support' became a reality.

By 2010, the Real-Time Operations Center staffing increased to over 44 Support Technicians supporting as many as 5 product lines. Within a few years, the support center was scaled to support over 2,000 calls a month. The staff for the Real-Time Operations tripled as well as the need to further develop their skills and competencies.



Picture 3—Real-Time Operations Center Rig Equipment Technician

Competency Assurance Management System. Through 2012, the company initiated a project to develop a Competency Assurance Management System (CAMS). CAMS specified the competencies necessary within a position. Ultimately, CAMS created individual development plans for every Technician. As a result, short-term as well as long-term progression plans are developed, tracked, and managed. Training plans, as well as career paths, have been initiated leading to higher levels of technical competency.



Picture 4—CAMS Progression Model

As expected, within the first few years, average competency level for technicians became a key leading indicator to overall improved customer satisfaction, further improving remote resolution rates.

Enhanced Escalation and Communication. The Real-Time Operations Center has become the central point of communication for field operations and maintenance. This key centralized group, serves as an 'expeditor' to a host of resources. For example, when a technician (local or remote rig support) needs technical documentation (i.e. including schematics, technical data, manuals, etc.) the Real-Time Operations center can quickly access and distribute that information. Work instructions can be easily accessed as critical information for each job that is captured. The real-time operations center can access historical information as well as maintenance histories for particular rigs and specific rig equipment. When appropriate, the Real-Time Operations center can bring in additional resources such as subject matter experts, Product Specialists,

Mechanical Engineers, Electrical Engineers, and Software Engineers, as needed. By having access to all of these resources, we are able to deliver crucial information directly to the field.

Major Event Coordination. In cases where a rig is 'down', the Real-Time Operations center acts as the central point of communication. Through clearly defined processes (and escalations), a Major Event Coordinator is able to identify key stakeholders, capture critical documentation, distribute information as necessary, ultimately reducing resolution times for major events.

This proven model to manage Major Events has improved communications across multiple groups, clearly identifying subject matter experts and stakeholders as needed. Getting the *right* people involved, at the *right* time, reduces the amount of re-work performed. Following the Major Event process provides a clearer picture of the issues, leading us to better analysis of root causes and capturing *lessons learned*. As a result of implementing the Major Event process, we have seen a drastic reduction on the percentage of downtime events lasting over 12 hours. As seen in the chart below, the Major Event process quickly saw results in the percentage of major events that were greater than 12 hours.

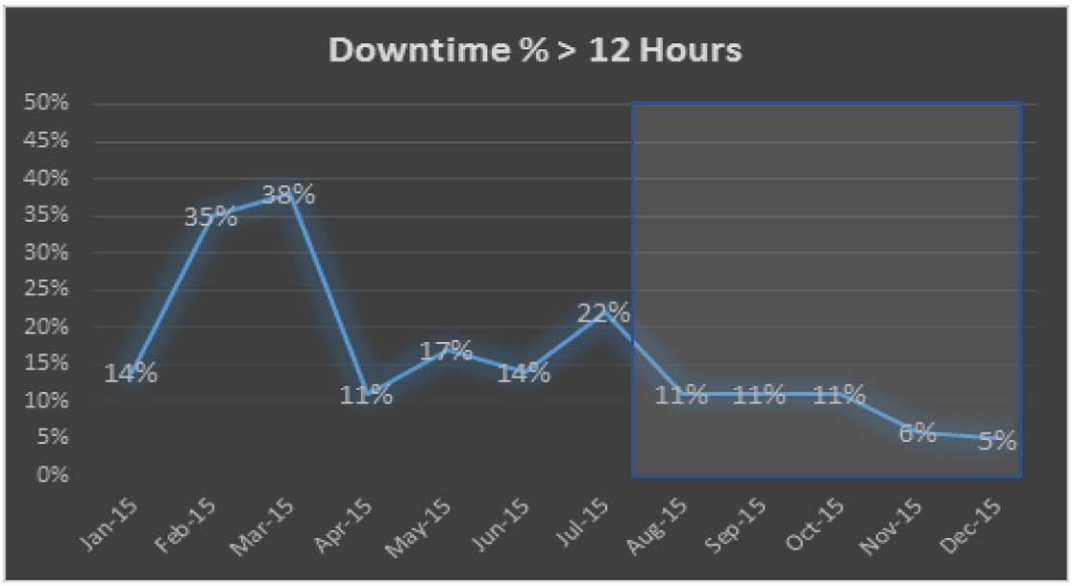


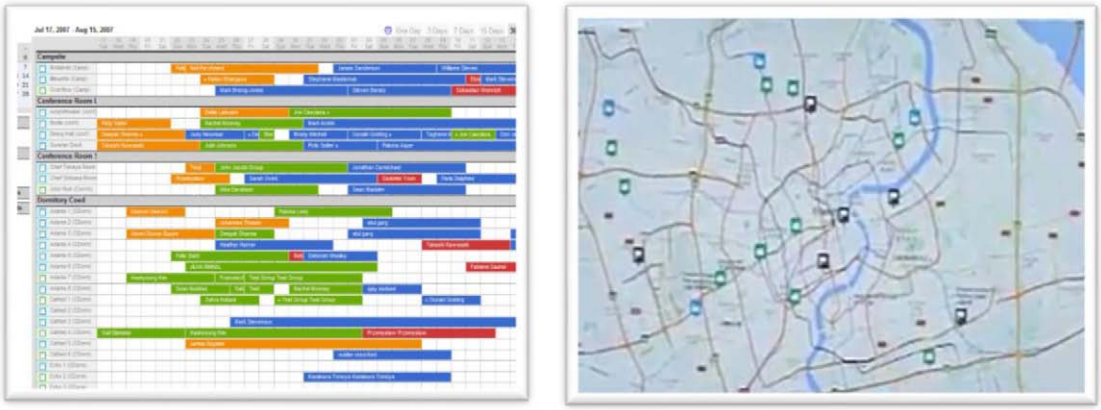
Chart 2—Downtime Percentage Less Than 12 Hours

Working with Specialized Software Applications

Asset Management Software Applications. Our asset management software applications help us better manage capital equipment in the field. These software applications track the maintenance (scheduled or unscheduled) required for each piece of equipment. By deploying the tracking software, equipment owners can view the entire life cycle of the asset: from initial delivery, to routine maintenance performed from a daily interval, to the point of recertification. Also, the Asset Management Applications track all unscheduled maintenance and equipment issues. Equipment work histories generated can be useful as a diagnostic tool for both ongoing repair work and in determining failure modes for future prevention actions.

Field Service Software Applications. Our field Service Software applications track the entire lifecycle of each service request. Asset data are derived from the Asset Management software applications, populating each service request. Throughout the life of the service request, the Real-Time Operations Technician uses this software to track service level agreements, ensuring compliance to those agreements. The Field Service Software applications captures critical KPI data. All appropriate information for the service request is stored in a central depository, accessible by all appropriate stakeholders. Crucial data is always accessible via document tracking, improving close out processes within each service request.

By gathering the pertinent information, (along with field service technician's information) the system *understands* the customer requirements. Competency requirements are analyzed to determine which technicians are available *and* would be the best match to solve a particular issue. The Field Service system will *understand* the parts requirements, helping locate the required parts. The Field Service system gathers this information, and, based on the scheduling module, offers recommendations for each service request. Automating logistical processes helps drive efficiencies, making the most of available resources. The Field Service system helps prioritize service requests reducing response lags, improving utilization rates for technicians, as well as reducing overall resolution times by having the *right* technicians doing the *right* jobs.

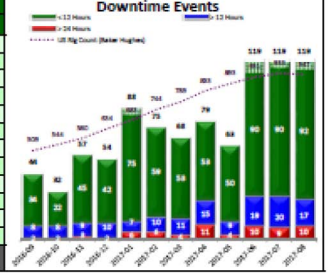


Picture 6—Resource Schedule and Locator for Field Service Technicians

Key Performance Indicators. The Real-Time Operations Technician utilizes these integrated software applications to manage the customer service cycle as efficiently as possible. By employing these processes, we are improving many key performance indicators. These key performance indicators break down in the following categories: Remote Resolution, Total Call Volumes, Calls On Hold Time, Agent Availability, and more as needed.

Total Events (Service & Troubleshooting)												
			Troubleshooting Events									
					Event Resolution							
					Remotely		Dispatched			Outliers (Events >24 hrs)		
Service & Rentals Activity	Total	% by Prod Line	Total	% of Total Events	Total	% of Trbl Events	Total	% of Trbl Events	Avg Event Time	Total	% of Disp Events	Avg w/o Outliers
Top Drive	405	10%	198	49%	92	46%	106	54%	12:14	9	8.5%	8:13
Catwalk	448	11%	127	28%	38	30%	89	70%	11:27	4	4.5%	9:23
Wrench	201	5%	120	60%	40	33%	80	67%	11:08	1	1.3%	10:00
Instrumentation	2109	54%	1215	58%	1068	88%	147	12%	10:09	5	3.4%	8:46
PH/DC	664	17%	369	56%	207	56%	162	44%	10:52	8	4.9%	9:11
Other	107	3%	61	57%	29	48%	32	52%	16:22	6	18.8%	8:53
Total	3934	100%	2090		1474	71%	616	29%	11:20	33	5.4%	9:03

Downtime Events								
Month	Total Events	> 24 Hours		> 12 Hours		< 12 Hours		Downtime Events
		#	%	#	%	#	%	
2016-09	44	2	5%	8	18%	34	77%	
2016-10	32	2	6%	8	25%	22	69%	
2016-11	57	3	5%	9	16%	45	79%	
2016-12	54	2	4%	10	19%	42	78%	
2017-01	88	6	7%	7	8%	75	85%	
2017-02	75	6	8%	10	13%	59	79%	
2017-03	68	4	6%	11	16%	53	78%	
2017-04	79	11	14%	15	19%	53	67%	
2017-05	63	4	6%	9	14%	50	79%	
2017-06	119	10	8%	19	16%	90	76%	
2017-07	119	9	8%	20	17%	90	76%	
2017-08	119	10	8%	17	14%	92	77%	
YTD Total	917	69	8%	143	16%	705	77%	



Picture 7—Key Performance Indicators

Evolution of Field Service Technicians

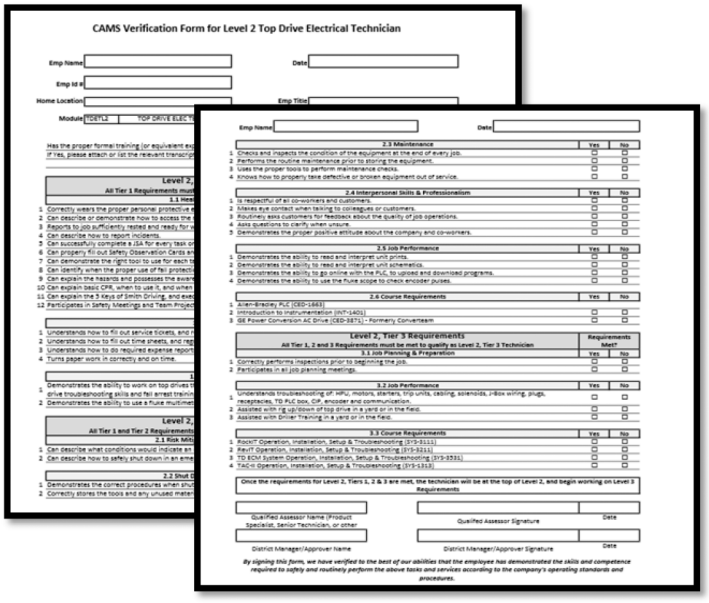
"Mechanics & Electricians". In the recent past, it was customary to have two categories for Field Service Technicians - "Electrical" or "Mechanical". For Electricians, troubleshooting the older (more conventional) equipment meant taking voltage readings (utilizing basic test equipment to see if power was getting *to* the equipment) or using those readings to determine whether the electrical equipment (itself) had failed. For Mechanics, the focus was swapping broken parts, rebuilding and overhauling equipment.

However, as the equipment designs advanced, so did the technical requirements. By 2009, specific (OEM) training became mandatory to work on top drives, automated catwalks, and automated floor wrenches. As drilling rig technology continued to advance, skilled technicians required further cross training on multiple rig types (i.e. conventional rigs, SCR Rigs and AC technology, etc.)

By 2015, things were changing again. Older technologies were being phased out in favor of newer technology. The conditions required improved efficiencies and technicians were expected to cross-train on multiple product lines. These increasing demands meant new skill sets were necessary. Technicians must have more advanced training to help them learn the skills necessary to succeed.

Competency Assurance Management System (CAMS). The CAMS program (launched in 2012) specified the training required to keep pace with emerging industry requirements. CAMS created career paths for Field Service Technicians, identifying technical requirements to support their assessed training gaps. CAMS provides a personal training program focused on short term and long-term goals.

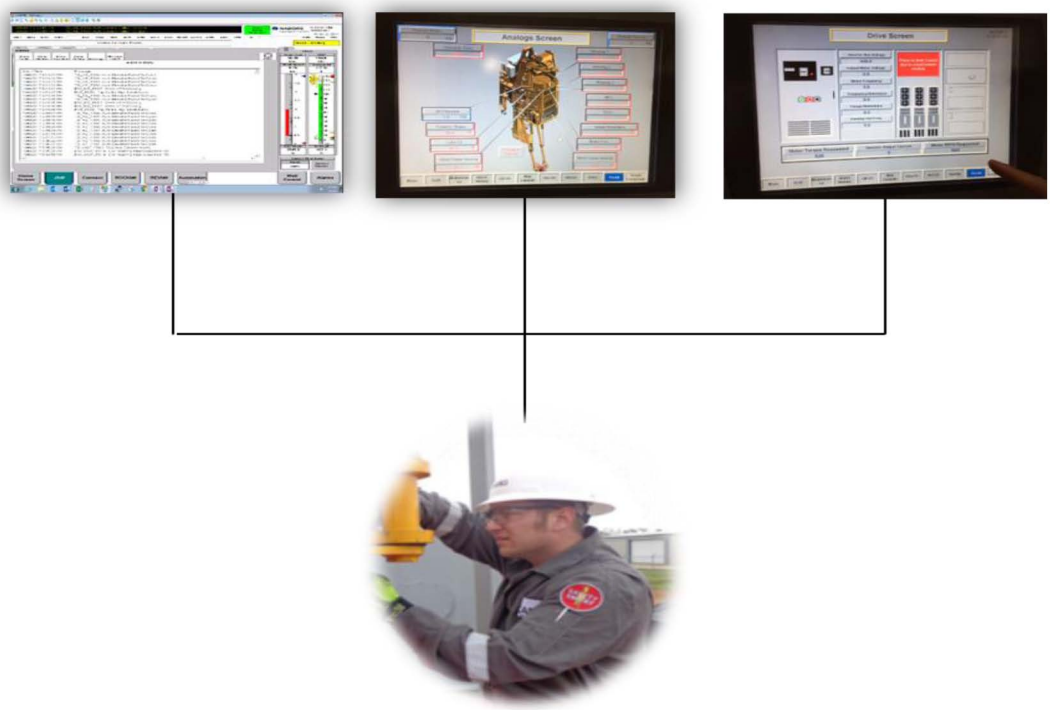
With CAMS, the company formally assesses technicians based on standard competency levels. The technicians are assessed through trained assessors in the product line in which they are assessing. An example of a CAMS Competence Verification form is pictured below.



Picture 7—CAMS Verification Form

Field Troubleshooting Using Smart Equipment

Utilizing today's technology with smart equipment, Field Service Technicians can access current readings to better understand the operating conditions. These systems help technicians understand what the current equipment status is through reading faults and conditions. Technicians can view this data using on-site computers or remotely by accessing the Internet of Things (IoT).



Picture 8—Field Service Technician Using Equipment Data

Role and utilizing Real-Time Operations Center

Field Service Technicians on-site requiring additional support have the capability of using the Real-Time Operating Center to gain additional technical assistance. Technicians can ask Agents to help them access additional technical documentation such as work instructions, product bulletins, and schematics.

There are also times where Technicians may need to escalate troubleshooting events. The Real-Time Operations Center can escalate service issues to Master Level Technicians, Engineers and Software Programmers as needed.

Picture 9—Escalation Process from Field to Real-Time Operations Center

In cases where issues result in downtime, the Real-Time Operations Center serves as the central command post. Major Event Coordinators are assigned with the Real-Time Operations Center capturing and communicating all pertinent information regarding the event. The Major Event Coordinator captures the sequence of events, centralizes communication by multiple resources through one point of contact, managing the workflows and escalating communication as required.

The Organizational Structure

The organizational structure has evolved to optimize drilling performance. With smart drilling equipment, supporting roles are being enhanced, improving overall technical support. Key performance indicators that prove the effectiveness of this model include improved downtime performance and reduced cost to support. Watching these kinds of metrics is critical in all economic conditions, (especially as organizations strive to remain profitable regardless of commodity pricing).

The company has developed an "ecosystem" synergizing smart drilling equipment that has the ability to communicate through the Internet of Things and improving overall performance of the equipment. Available 24/7, The Remote Operations Center can resolve more issues with competent support. Supporting software communicates in a systematic environment automating and streamlining processes while simultaneously capturing key performance metrics to help drive business improvement.

Picture 10—Ecosystem for Enhanced Drilling Support

Conclusion

Recent advances in modern Drilling Technology have provided us with a powerful suite of interconnected tools. Much of the technology for the "Rig of the Future" was originally developed to build in greater efficiencies for stand-alone equipment and systems. However, as we combine these technologies, how do we derive the greatest synergistic benefits from those combinations?

After years of planning and development, a new "ecosystem" has been achieved. That ecosystem includes all of the the necessary support processes, roles, and responsibilities for Real-Time Operations Centers. By leveraging the "Internet of Things", greater efficiencies are realized. Conventional roles for Field

Service Technicians and other supporting functions were augmented, adding additional value and drilling efficiencies. As an ecosystem, these distinct disciplines combine key responsibilities, meeting emerging challenges to better support drilling operations.

The result is a template of best practices; Real-Time Operations Centers, enhanced equipment technology and custom software applications, as well as improved employee development practices necessary to train teams of competent field service technicians. This performance model drives best-in-class drilling performance making "the rig of the future" the rig of *today*.

Citations:

Contract volatility reins in US land rig day rate growth: Fuel for Thought. (2017, August 21). Retrieved December 01, 2017, from http://blogs.platts.com/2017/08/21/us-land-rig-drilling/

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