DEEP HOLE DRILLER

AN ATLAS COPCO PUBLICATION FOR THE DRILLING PROFESSIONAL - NO. 1 / 2010

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Atlas Copco

EDITORIAL

When looking through this issue of Deep Hole Driller you will come across a number of innovations of special interest for the oil and gas industry. At Atlas Copco we strive to create innovative products for tangible benefits in every industry we serve. The oil and gas market is no different.

This year we earned American Petroleum Institute 4F certification on the Predator Drilling System, which offers fast setup time and enhanced safety features. The new pipe handling options and upgrades for the RD20 drill rig offer greater safety. Additionally, we recently launched two new DrillAir compressor models, the XRVO 1550 open frame compressor and the XRYS 1260 compressor (510 psi). Now we offer even higher capacities and higher discharge pressures, resulting in a higher productivity when drilling. In combination with the Hurricane booster range, we offer complete air packages up to 5,000 psi.

The innovation continues with the introduction of the ATEX certified ZoneAir XATS 1020 compressor for Zone 2 hazardous area (Class1, Div 2). This portable compressor is robustly built into a specifically adapted DNV offshore container and includes the latest ATEX technologies for safe operation.

Even last year, when the entire industry suffered from the global downturn, Atlas Copco never stopped developing new products. We're working hard to make our industry successful and sustainable. We look forward to seeing you at the Offshore Technology Conference in Houston or at the Global Petroleum Show in Calgary.

Stephan Kuhn
President, Atlas Copco
Compressor Technique

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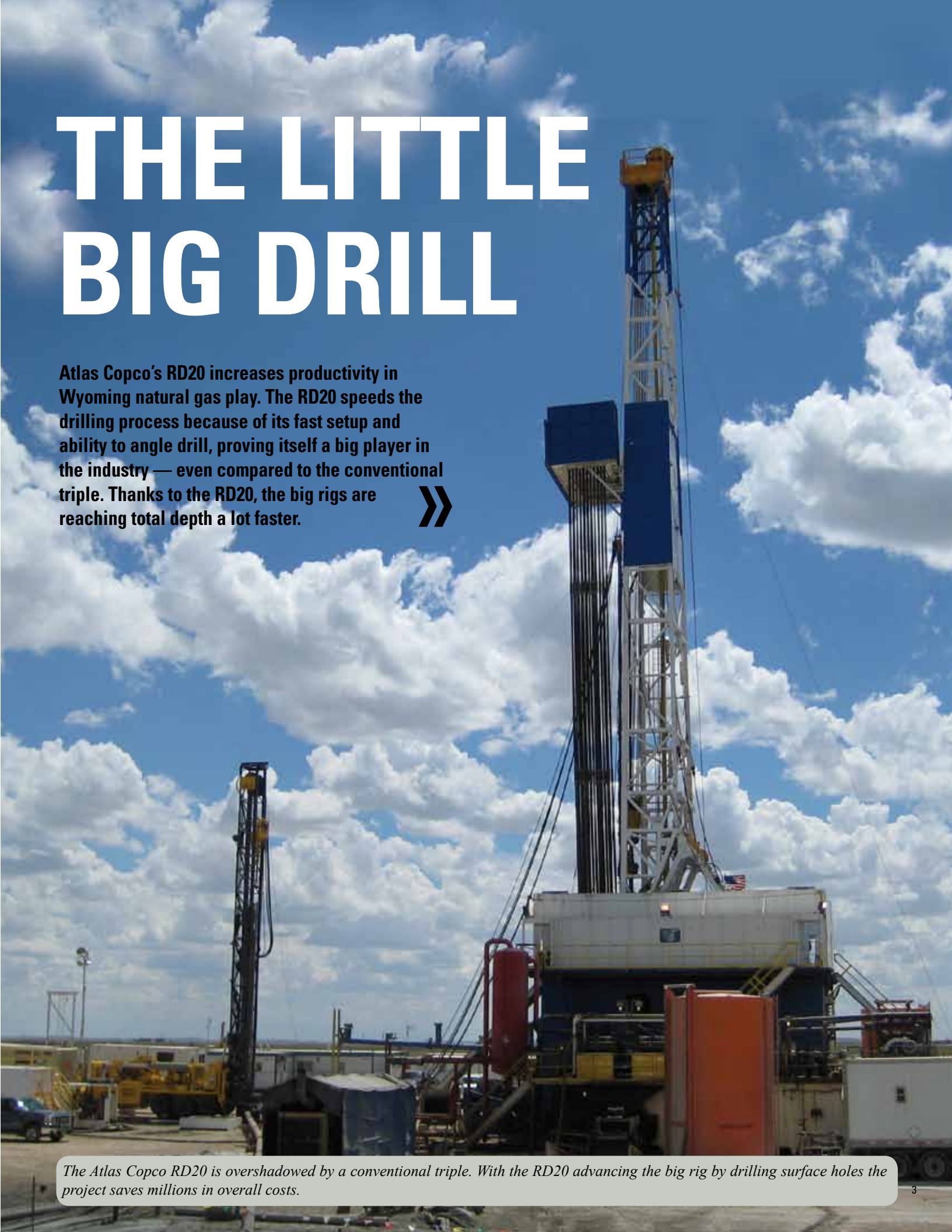
Atlas Copco

THE LITTLE BIG DRILL

Atlas Copco's RD20 increases productivity in Wyoming natural gas play. The RD20 speeds the drilling process because of its fast setup and ability to angle drill, proving itself a big player in the industry — even compared to the conventional triple. Thanks to the RD20, the big rigs are reaching total depth a lot faster.



The Atlas Copco RD20 is overshadowed by a conventional triple. With the RD20 advancing the big rig by drilling surface holes the project saves millions in overall costs.

Gas wells in western Wyoming are great producers with average gas output of 10 to 15 million cubic feet per day. The global average is .05 to 1 MCF.

From Left, Keith Engelman, Atlas Copco's Rocky Mountain region deep hole drill sales manager and store manager; Zane White, president of White Mountain Operating; Derek Anderson, Atlas Copco national oil & gas manager; Jeff Ferguson, operations manager for White Mountain Operating.

In western Wyoming, at 7,000 feet above sea level, there is a mesa of consolidated rock that holds gas in fissures in the formation. Unlike other formations, where the body of gas rests in softer formations capped off from the surface, this is tight in the rock. Drilling gas wells closer together allows drill crews to save time, while maximizing the gas recovery. Atlas Copco's RD20 also helps speed the process because of its fast setup and ability to angle drill at a much shallower depth than big conventional rigs.

Another big advantage of placing wells close together is that it minimizes the impact on the environment. A conventional drill site would require 6 acres per drilled well. By putting 36 wells on one 40-acre site, the overall drilling footprint is greatly decreased. This means more than 150 acres are retained for animal habitat.

Discovered in the 1970s, the gas near Pinedale, Wyoming, proved difficult to recover. The formation held the gas so tightly that fracking only sealed up the formation tighter. In recent years with improved technology that includes directional drilling and the use of high-pressure epoxy sands that are "tougher" to hold the formations open, the natural gas is not only more accessible, but the wells produce at a much higher rate than the average well.

By placing multiple well heads on one pad just 10 feet to 16 feet (3 to 4.8 meters) apart, it's possible to put dozens of wells in a small footprint. "We have drilled as many as 36 wells on one pad," says Zane White, owner of White Mountain Drilling.

At one time, a particular play had more than 40 big conventional rigs working in the area. Today that number is just over 20. White Mountain operates two RD20 rigs to advance the drilling operation ahead of the conventional rigs. By drilling the surface hole in the 1,700-foot (518-meter) range, White's fleet allows the big rig the ability to get to total depth faster. Wells in the area will ultimately go to 14,000- to 15,000-foot (4,267- to 4600-meter) depths.

The big advantage

Because a conventional drill needs pipe to add weight to the drill string, and the RD20 has hydraulic pull down, standard is 30,000 pounds (13.6 metric tons). A mud motor requires down pressure of 30,000 lbs of force to turn. Although White

Count the stacks, each represents a well on a pad. These separator units remove the gas from the water coming from the well.

> We speed up the development of a pad enough that the customer can get one more well done in the same time.

Zane White, president of White Mountain Drilling

has added 10,000 pounds (4.5 metric tons) with additional hydraulics, the well drilled by an RD20 can begin to angle off from vertical sooner, or more shallow than a conventional rig. This becomes critical when placing multiple well heads on such a small footprint.

A conventional rig wouldn't be able to turn until it reaches 300 feet (91 meters); an RD20 can begin to angle from vertical at 80 feet (24 meters). "We kick off from the surface at an angle; this little rig can do it from the beginning," emphasized White.

This is a huge advantage to maximize well production. By setting the surface casing with the RD20, White's drills increase overall well completion time. "We speed up the development of a pad enough that the customer can get one more well done in the same time," says White. "We may cost a bit more per drilled foot, but at $3 to $4 million per completed well, we ultimately save the company money and time."

From the surface

When White's crew begins on the site, he preps the site and drills the mouse and rat holes if needed. His crews then begin drilling the surface holes. The area is covered with 50 to 100 feet (15 to 30 meters) of glacial till and overburden. When beginning the hole with the RD20, the crew can choose to go with DTH hammer drilling or tricone. "We can make it happen with the tricone, but if we hit a boulder, which is very common, it is easy to change out to hammer drilling," says White.

White Mountain uses a 14¾ tricone bit to start the hole. "We started here on total air using auxiliary compressors when the water got too much [at one time the work was all vertical drilling]. Today everything is on fluid and mud motors for directional drilling," says White.

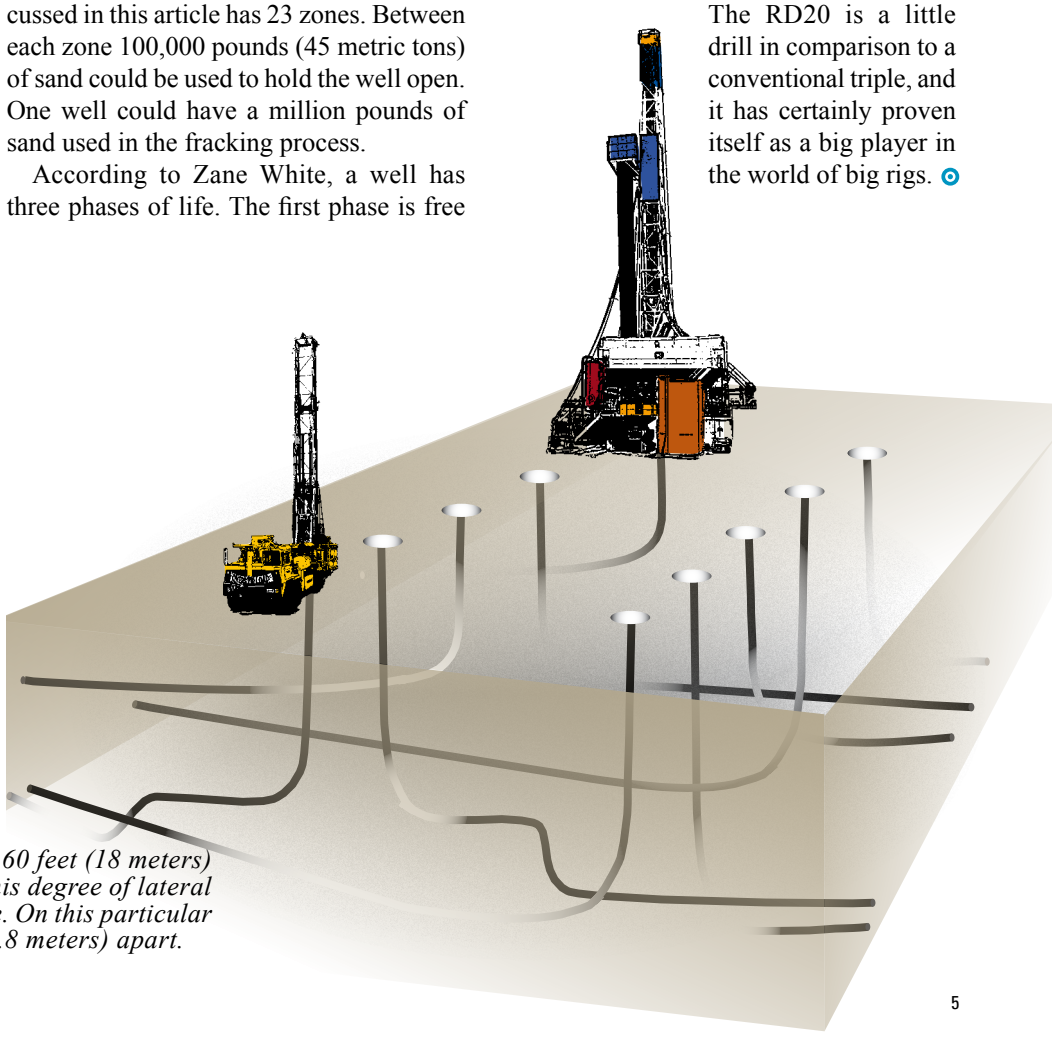
White's crew completes a well when they set the casing. Another contractor will come and concrete the well, making it ready for the conventional rig to "walk" over the prepared surface well. The conventional rig will continue with long pipe to total depth.

Production Rates

A well that's drilled to depth can have multiple frac zones. The well on the job site discussed in this article has 23 zones. Between each zone 100,000 pounds (45 metric tons) of sand could be used to hold the well open. One well could have a million pounds of sand used in the fracking process.

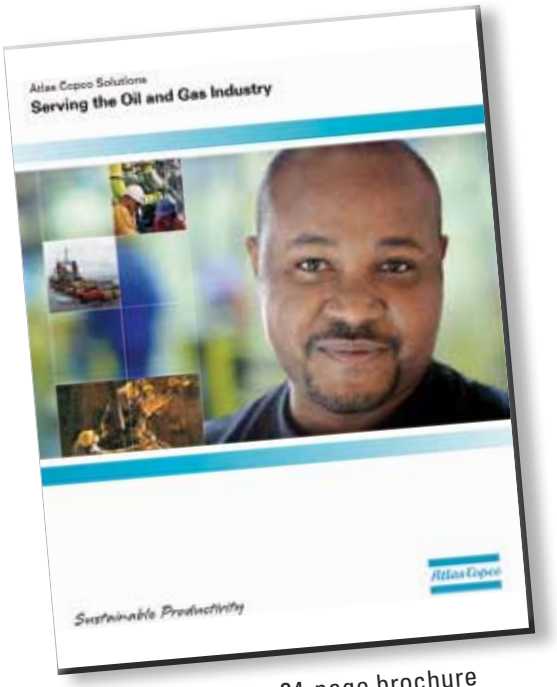
According to Zane White, a well has three phases of life. The first phase is free flowing under natural pressure. The second phase involves water flooding to force hanging oil or gas from the zone. The third phase is CO_2 injection. The global average is 0.5 to 1 million MCF per day. This play on the mesa of Wyoming that covers about 60 by 50 miles in area produces as much as 30 million MCF a day with little water. The average is 9 million MCF per day.

"I'm not aware of other gas plays like this. Most are unconsolidated whereas this rock is like granite – all the way to the bottom," says White. The formation has had much to do with the RD20's advantage at mesa, but it's the increase in productivity that has really proven the RD20's worth. The RD20 is a little drill in comparison to a conventional triple, and it has certainly proven itself as a big player in the world of big rigs.



The RD20 can begin to kick off in a direction just 80 feet from the surface. Currently White Mountain is drilling at 4 degrees at 1,500 feet (457 meters) which puts the well 60 feet (18 meters) away from the surface hole at 1,500 feet. This degree of lateral varies by pad and is planned well in advance. On this particular footprint, the holes are 10 to 16 feet (3 to 4.8 meters) apart.

Serving the Oil and Gas Industry



Receive this free 24-page brochure about Atlas Copco oil and gas products by contacting moira.ploof@us.atlascopco.com.

Atlas Copco is a world leader for solutions that generate sustainable productivity in your industrial applications. Built on more than 130 years of experience and knowhow, our products and services range from compressed air and gas equipment, generators, construction and mining equipment, industrial tools and assembly systems to all related parts and services, as well as industrial rental.

What sets Atlas Copco apart as a company? Most of all, it is our conviction that our own success is directly linked to the success of our customers.

This is why we always go the extra mile to provide the best possible know-how and technology to help our customers grow, produce and succeed.

There is a unique way of achieving this goal – we simply call it the Atlas Copco Way. It is based on our company values: constant innovation and interaction with our customers, and a commitment to the highest standards in safety, quality and efficiency.

These values are the foundation that continue to help us achieve sustainable productivity for our customers – and the environment – around the world.

With a comprehensive product offering, Atlas Copco is a trusted partner to the oil and gas industry. We provide reliable equipment for many challenging applications along the entire oil and gas value chain.

We know our business – and we know yours. When we work with our customers, we have one goal in mind: sustainable productivity.

Based on our company's early roots in drilling technology, we have built our expertise and expanded our portfolio over decades of research and development and customer interaction. We have grown to become a premier, reliable end-to-end partner for the oil and gas industry.

From the well all the way to the downstream, Atlas Copco provides reliable equipment for the industry's entire application range. Our unique global service presence provides local assistance for customer applications with parts and service, as well as comprehensive Customer Support Plans.

BENEFITS OF WORKING WITH ATLAS COPCO:

- World leading player in air / gas compression and purification
- More than 130 years of experience
- Presence in more than 160 markets
- Extensive global service network
- No compromises on component quality
- Highly-trained personnel
- Complete range of solutions and services

WE HAVE PRODUCTS FOR YOUR APPLICATION:

- Exploration & Production
- Transportation
- Refinery & Petrochemical
- Distribution & Power Generation

Atlas Copco launches new industry web site www.atlascopco.com/oilandgas

Atlas Copo's new site is a gateway to information on the oil and gas industry. See the site for videos, useful Atlas Copco links, oil and gas news, application stories, product information and more.

See us at:

OFFSHORE TECHNOLOGY CONFERENCE

• OTC Show, 2010
May 3–6
Houston, Texas, USA
Atlas Copco Booth 9441

GLOBAL PETROLEUM SHOW &CONFERENCE

• GPS, 2010
June 8–10
Calgary, Alberta, Canada
Atlas Copco Booth 1456

Predator Earns API Certification

The drill operates with one man on the platform. All drilling functions and handling of pipe is done from the driller's station.

American Petroleum Institute

•**The Predator** employs a substructure, giving it the look and feel of bigger units. The substructure is one of three distinct rig components, which include the carrier-mounted self-transportable drill rig, and the pipehandling skate system.The substructure features a wired control box with back up manual valves. The five-axle rig is backed onto the substructure using a self-contained hydraulic motor. Rig operators use a control box to lower railings and raise the substructure and mast.

Rig up takes 45 minutes to an hour for the three main pieces and can be done in four to six hours when all ancillary systems, such as air or mud packages, pipe cassettes, toolhouses etc. are involved. The substructure functions not only as a sub-base for drilling operations, but contains options like piping for mud and air drilling packages, a water injection pump, and an integrated computer/PLC.

After several years of planning, testing and documenting, the Predator, a new generation drilling system for the oil and gas industry from Atlas Copco Drilling Solutions (ADS), has achieved API 4F certification from the American Petroleum Institute.

The American Petroleum Institute (API) represents all aspects of America's oil and natural gas industry. Its nearly 400 corporate members include major oil suppliers to equipment and supply manufacturers like Atlas Copco.

The API Monogram Program verifies that manufacturers are operating in compliance with industry standards. API also offers licensing programs for nearly 200 additional specifications. In the case of the Predator, ADS has obtained API 4F licensing for the Predator's hoisting capabilities.

"We have licensed the actual specification for the Predator's mast and the substructure," said Jim Bowrey, Quality Standards manager with Atlas Copco. "What this means is we have now been audited and conform to API requirements, which include very strenuous safety factors beyond typical mechanical design safety standards. The safety factors in the Predator's design, and the fact that this design has been tested and validated, show that we meet or exceed standard design requirements."

Achieving these API certifications has been a long and involved process that really began during the Predator's design phase. "When we started to design the Predator, we knew we were going to go for an API specification," said Shane Lein, product manager, Oil & Gas Drilling Rigs. "We did some homework up front to ensure the Predator would meet all aspects of API's 4F licensing program."

> "We will have one of the few rigs in this particular class that will be certified."
>
> **Shane Lein**,
> product manager, Oil & Gas Drilling Rigs

The actual certification process has taken about two years and has included everyone from vendors to Atlas Copco employees in the Garland, Texas, manufacturing facility. Any vendor that supplies a part that goes into the Predator in the areas of license such as the mast must also meet API requirements.

"We must have records, documentation and traceability on materials, as well as the people working on these parts," said Bowrey. "Everything must be current. All of this information will have to be maintained and serialized for each Predator we manufacture. Anytime API wants evidence that we've met all of our requirements, or if the customer has questions, we can go back and trace every single item that applies to this license."

Lein added that the entire Predator team, starting with the designers, also had to meet API requirements. "We had specific parameters we had to meet and specific documentation we had to produce or obtain for our personnel. For example, all of our welders had to be qualified in AWS welding procedures."

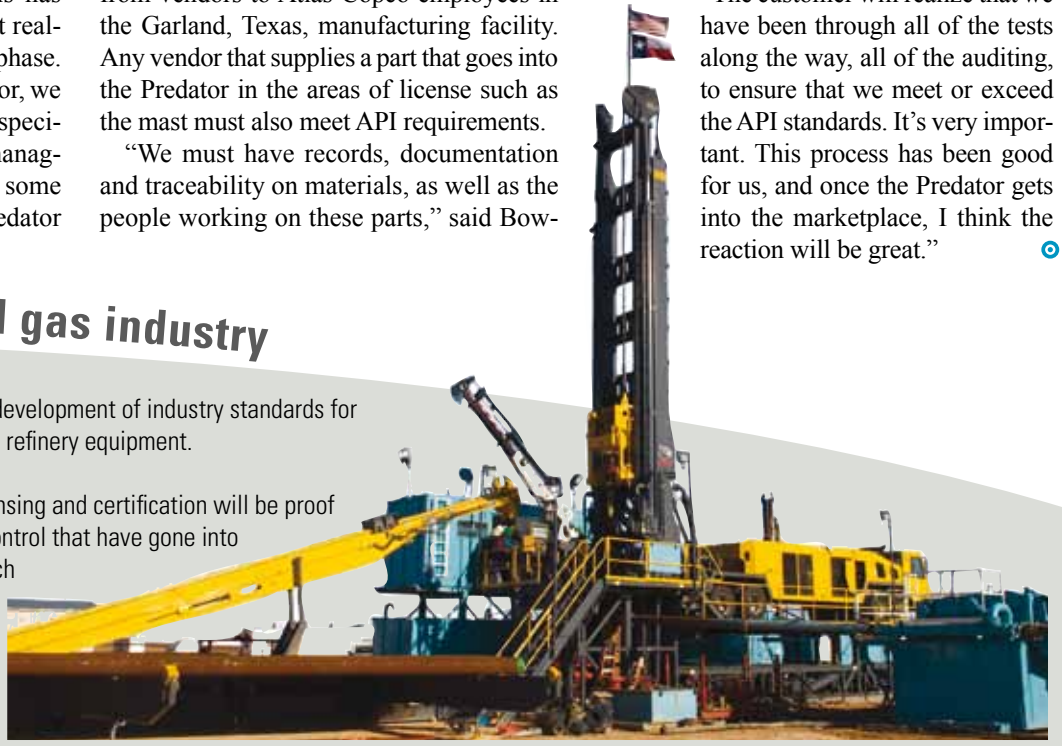
At this time, the Predator is the only ADS product that is obtaining API Monogram certification. The Predator is still undergoing field testing, but production is scheduled to begin in the next couple of months. "In terms of achieving this license, we have been able to time it perfectly so the very first production unit will be able to receive the API Monogram stamp," said Bowrey.

"We will have one of the few rigs in this particular class that will be certified," said Lein. "It's going to give us a competitive advantage, especially when we start selling into the conventional oilfield markets."

"It will be very clear to customers that this licensed brand that we'll apply to the Predator has a special meaning," said Bowrey. "The customer will realize that we have been through all of the tests along the way, all of the auditing, to ensure that we meet or exceed the API standards. It's very important. This process has been good for us, and once the Predator gets into the marketplace, I think the reaction will be great."

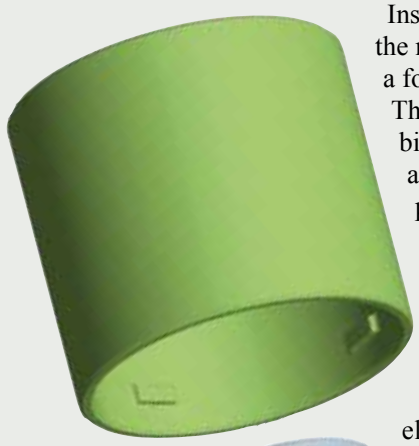
represents the oil and gas industry

- As part of its mission, API has led the development of industry standards for manufacturers of production, drilling and refinery equipment.
- For future Predator customers, API licensing and certification will be proof of the rigorous procedures and quality control that have gone into the development and manufacture of each Predator Drilling System.
- **The Predator** is still undergoing field testing, with production scheduled to begin in the next couple of months.



New Secoroc One-Piece Retrieval System for the Oil and Gas Industry

The new Secoroc 8-inch, one-piece retrieval system by Atlas Copco simplifies and improves on its predecessor by eliminating the retaining ring and dowel pin, resulting in a more robust system for the oil and gas market.



Instead of a retaining ring and dowel pin, the new patented design is comprised of a four lug system on the retrieval sleeve. These lugs correspond with grooves in the bit head. Once the lugs and grooves are in alignment, the bit is rotated to lock it into place.

"The retrieval system decreases the amount of time spent tripping the hole should a bit shank, and in gas drilling time is of the essence," said Mike Millsaps, Product Specialist, Atlas Copco DTH equipment. "By simplifying the design and eliminating parts, there are fewer issues that can arise with it, making it a better system all the way around."

The 8-inch system is available with two different retrieval sleeves to accommodate the QL/TD80 hammers or TD85 hammers. The bit number indicates which sleeve is packaged with the bit. Current QL and TD retrieval hammers or standard hammers can be converted to use the new one piece system by simply changing the chuck body.

Atlas Copco currently offers the Secoroc one-piece retrieval system for its 6-inch hammer class, and is expanding the concept for additional hammer sizes.

The new Secoroc 8-inch, one-piece retrieval system will make its official debut at the **2010 Offshore Technology Conference** in Houston, Texas.

New Assignments at Atlas Copco Cover Oil and Gas Products

Torbjorn Redaelli, President – Atlas Copco Construction Mining Technique USA LLC, has announced that Ron Boyd has left his current position as Business Line Manager for Rock Drilling Tools (RDT) to take on a new assignment as Project Manager for Atlas Copco's oil and gas RDT products.

Ron Boyd

In this capacity, Boyd will initially focus on developing and executing a strategic two-year plan, better positioning Atlas Copco within the North American oil and gas drilling market and identifying new growth opportunities both domestically and globally.

Gene Mattila

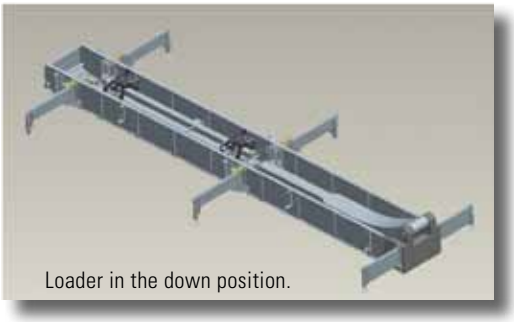
Boyd will work directly for the Grand Prairie Product Company within Atlas Copco's RDT division in Grand Prairie, Texas.

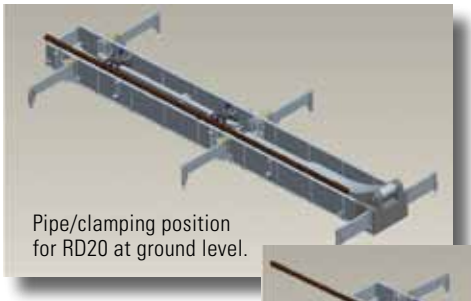
"Ron's hard work and devoted efforts in his various prior positions within CMT USA have been an important part of the company's success," said Redaelli. "We wish him the best of luck in his new and challenging assignment."

As a result of this change, Gene Mattila has left his position as Business Line Manager for Geotechnical Drilling and Exploration (GDE) products and taken on the position as Business Line Manager for Atlas Copco's RDT products.

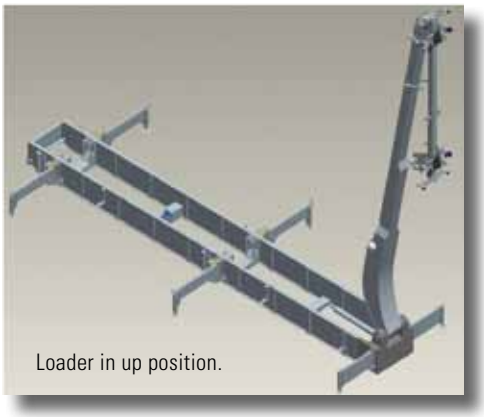
"With his broad expertise and senior status in the U.S. construction and mining business, along with his proven leadership skills and ability to deliver results, Gene is uniquely suited to take on this challenge," said Redaelli.

Atlas Copco Releases New Automatic Pipe Loader for RD20 Drill Rig


Loader in the down position.


Pipe/clamping position for RD20 at ground level.


Pipe/clamping position for RD20 on 10-foot substructure.


Loader in up position.

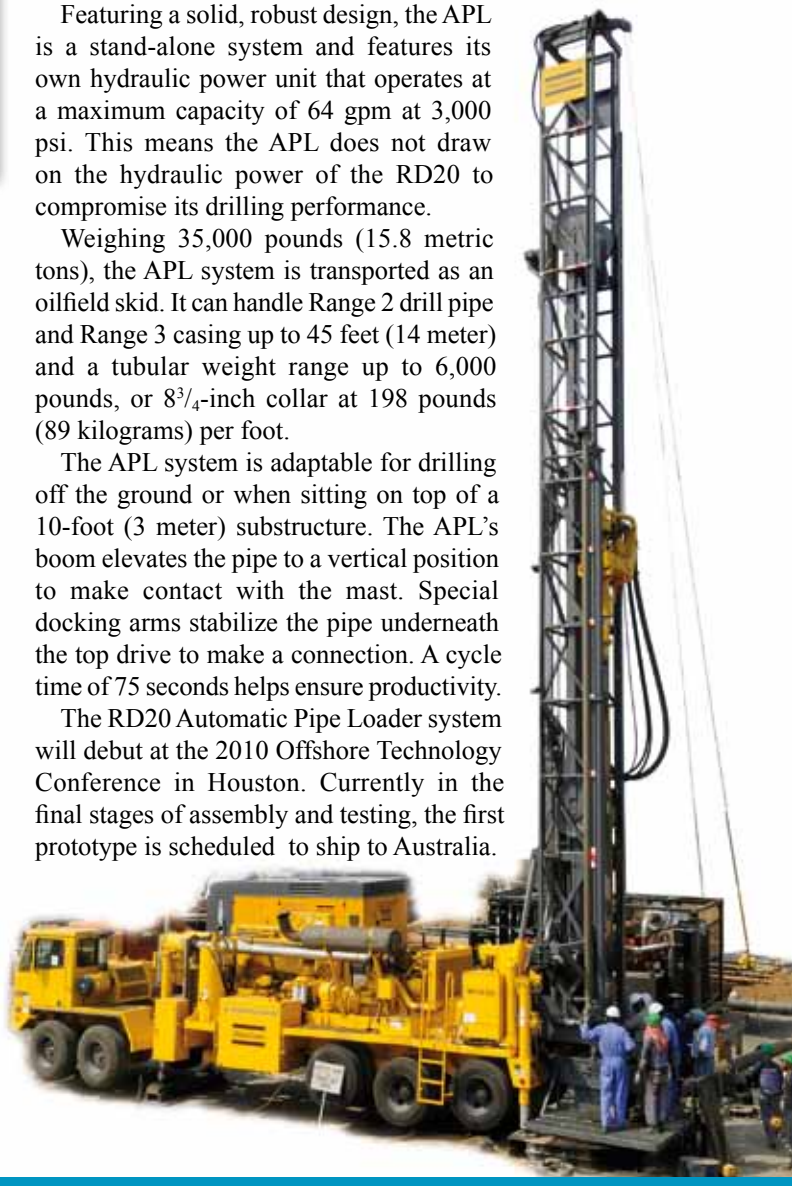
Safety is always a concern on a drill site. As a result, Atlas Copco has developed an Automatic Pipe Loader (APL) system for its RD20 mobile rotary drill rig. Designed for hands-free pipe handling, the APL system can be used with standard RD20 pipe, as well as other types of oilfield or external upset pipe ranging from 3½ inches OD to 13 3/8 inches OD. It is designed to work with any RD20 Range 3 model, and in some cases with earlier Range 2 models.

Featuring a solid, robust design, the APL is a stand-alone system and features its own hydraulic power unit that operates at a maximum capacity of 64 gpm at 3,000 psi. This means the APL does not draw on the hydraulic power of the RD20 to compromise its drilling performance.

Weighing 35,000 pounds (15.8 metric tons), the APL system is transported as an oilfield skid. It can handle Range 2 drill pipe and Range 3 casing up to 45 feet (14 meter) and a tubular weight range up to 6,000 pounds, or 8 3/4-inch collar at 198 pounds (89 kilograms) per foot.

The APL system is adaptable for drilling off the ground or when sitting on top of a 10-foot (3 meter) substructure. The APL's boom elevates the pipe to a vertical position to make contact with the mast. Special docking arms stabilize the pipe underneath the top drive to make a connection. A cycle time of 75 seconds helps ensure productivity.

The RD20 Automatic Pipe Loader system will debut at the 2010 Offshore Technology Conference in Houston. Currently in the final stages of assembly and testing, the first prototype is scheduled to ship to Australia.



Automatic Pipe Handler System — RD20

Technical Specifications

Weight	35,000 pounds (16 metric tons)
Length	605 inches (50.4 feet/15 meter)
Height	56.25 inches (142 cm)
Width	102 inches (259 cm)
Width-operational mode	247 inches (627 cm)

Pipe Handling

Tubular Diameter Range: 3 1/2 inches to 13 3/8 inches

Tubular Length Range: Range 2 Drill Pipe/Range 3 casing — designed for 45 feet

Tubular Weight Range: 6,000 pounds (8 3/4 inch collar at lbs/ft)

Hydraulic Requirement (max.): 64 gpm at 3,000 psi, based on collar

Cycle time: 75 seconds

STANDARD FEATURES ON B-7 41/1000

- Automatic load/unload
- Booster bypass manifold
- Precooler and aftercooler
- Suction scrubber tank
- Four-point lifting
- Heavy-duty skid
- 24 volt DC starting and operating system
- Suction and discharge safety relief valves
- Full function instrument panel monitoring all pressures, temperatures and controls with full protection shutdown and fault indicators.

New Hurricane booster makes the most of space

Atlas Copco's Hurricane model B7-41/1000 booster incorporates advanced technologies, application flexibility and exclusive size and weight advantages. Driven by a Caterpillar C7 Tier 3 diesel engine, the B7-41/1000 features a four-cylinder single-stage booster block. With 350 psi of suction pressure, the Hurricane B7-41/1000 model has a capacity of 2,400 scfm at a maximum discharge of 1,000 psi.

The use of a six-cylinder, turbo-charged drive engine allows for increased flows and pressures for improved borehole drilling. Like all Atlas Copco boosters, the Hurricane B7-41/1000 provides a better penetration rate, cooler bit temperatures and longer bit life.

Smaller and lighter – yet still packing as much power as larger competitive units – the Hurricane B7-41/1000 has a solid lineup of standard features.

Optional features include an automatic scrubber tank drain, stainless steel cooler tubes and a cold weather kit. Other options, capacities and pressures are available so that Hurricane boosters can be customized to fit your needs.

Atlas Copco's Hurricane booster line offers capacities ranging from 500-4,500 scfm up to 5,000 psi to meet the demands of oil and gas air/foam drilling, nitrogen generation, pipeline services, and water well and geothermal drilling. With a tradition of quality and innovative engineering, Hurricane booster compressors have earned a solid foothold in the worldwide market of air and gas compression.

Atlas Copco's new ZoneAir XATS 1020 containerized portable compressor:

As a world leader in innovation and technology, Atlas Copco introduces the ZoneAir XATS 1020, an ATEX certified containerized portable compressor for the oil and gas industry. With a capacity of 1020 cfm at 150 psi (10.3 bar), the ZoneAir XATS 1020 provides energy efficient performance in numerous applications.

The ZoneAir XATS 1020 is typically found on offshore platforms and vessels for painting and sandblasting, gas flaring, well testing and enhanced oil recovery. As a long-term investment, the ZoneAir XATS 1020 offers a low cost of ownership with simplified maintenance and a 180-gallon stainless steel fuel tank for eight hours of operation at full load, which results in increased uptime.

The ZoneAir XATS 1020 is ideal for seasonal or temporary oil and gas applications. Its containerized housing and forklift slots make it easier to transport and stack for flexibility and versatility on site.

The ZoneAir XATS 1020 is driven by a Cummins QSM 11 Tier 3 compliant engine and includes the new C190 screw element from Atlas Copco.

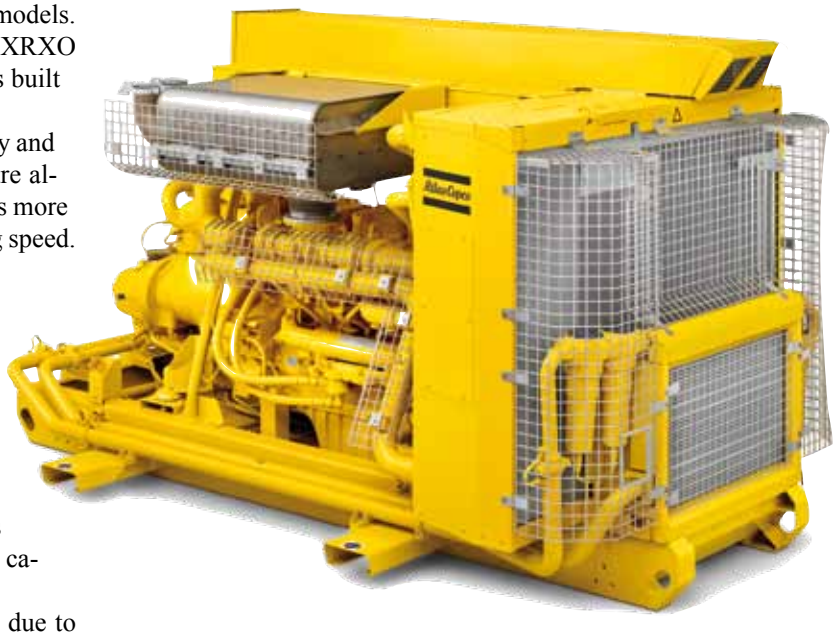
Atlas Copco Launches DrillAir Open Unit

Atlas Copco's Portable Air Division completes its DrillAir range with the new Open Unit compressor, available in two models. The XRVO 1550 delivers 1550 cfm at 365 psi, and the XRXO 1400 delivers 1400 cfm at 435 psi. The DrillAir Open Unit is built for productivity, reliability and easy maintenance.

The new dedicated open unit design delivers higher capacity and higher pressure effectively and efficiently. The higher pressure allows for faster drilling, while the higher flow removes cuttings more efficiently. Increased productivity is then gained by increasing speed.

Fuel consumption is optimized with the exclusive FuelXpert™ system. Conventional systems are based on pneumatically controlled engine speed and air inlet without accounting for fuel economy. These systems have focused on the stabilization of the regulating system, but have not looked at the optimal fuel consumption at each load. FuelXpert, via the engine electronic control module, regulates speed and air inlet with a view to optimizing fuel consumption for each working condition. Important when the air demand is lower than the capacity required, the system ensures the right capacity for the application.

The DrillAir Open Unit also offers longer component life due to Oiltronix™ technology. This electronic controlled oil temperature system extends the lifetime of air-ends, compressor components, oil and the oil separator. It also reduces or eliminates condensate (water) in the oil system. Additionally, and not insignificantly – Oiltronix technology reduces the average oil temperature, prevents overheating and increases safety.



The DrillAir Open Unit is available with a choice of a push fan or a pull fan. This option, along with the unit's ease of transport and installation, makes these units ideal for specialist applications and allows for greater flexibility in the integration with OEM configurations.

Gas detection system guarantees safe operation; no need for flame arrestors

The engine features flameproof Pyroban components such as an inlet shutdown valve, inlet flame trap, Exd. alternator and battery system, water-cooled exhaust gas cooler, spark arrestor and engine safety control system.

The ZoneAir XATS 1020 also includes Pyroban's 3GP gas detection system. The 3GP system is a reliable and proactive gas detection system that guarantees safe operation in a hazardous area. It eliminates the need for exhaust flame arrestors and the related daily maintenance, which increases uptime.

The ZoneAir XATS 1020 is housed in a 15-foot DNV container and is fully ATEX 94/9/EC certified for Zone 2 (Class 1, Division 2) hazardous area operation. There is a single service side for easy accessibility. Routine maintenance is simplified with heavy duty air filters, a fuel pre-filter with water separator, easily accessible genuine oil filters and central drains to remove liquids.

Other features include an air starter with air reservoirs; external fuel filling and manual fuel cut-off valve; two emergency stops on the opposite sides of the container; a platform shutdown system; and a user-friendly control panel protected by a lockable stainless steel cover.

HARD ROCK ISLAND

Texas drilling company looks to the Atlas Copco TH60 as the latest in rig technology to get it through various formations

Taylor Virdell (far right) stands with his crew in front of the company's new TH60, (from right) driller Caleb Virdell, driller Lynn Hoy, and helper Cole Weinheimer, .

> "I really like how clean and wide open the deck is on this rig — it's so uncluttered.
>
> **Taylor Virdell Jr.**

Virdell Drilling Inc. is an example of a company that has adapted as technology has evolved to take advantage of the latest tooling. Many drillers who have been around a while can relate to this family's story – and appreciate how far modern hard rock drilling has come.

After looking at the black and white photos dropped by the drill site by family patriarch Taylor Virdell Sr., Taylor Virdell Jr., current head of the family business, reminisced with his father about the days when Taylor Sr. and the Virdell family elders, great grandfather James Sr. and grandfather James Jr., would drill sun up to sun down penetrating just 12 feet (3.6 meters) in the hard rock with cable-tool rigs. Back in those days they drilled an 8-inch (20 cm) hole just because the heavier tooling got better penetration than lighter bits.

Virdell Drilling has been serving Central Texas since 1900. Central Texas has a lot of fast-drilling limestone with good fragmentation and water flow, but not in the Llano area near Fredericksburg, which is at the heart of Virdell Drilling's working territory.

Today the man at the controls of the company's new Atlas Copco TH60 is the fifth-generation family driller, Caleb Virdell. The Precambrian metamorphic formation near Llano contains hard abrasive granite, chert, gneiss and quartz. Caleb can hammer drill 12 feet (3.6 meters) in roughly 15 minutes – the depth that took his forefathers a full day to reach.

The Virdell family's rig technology has evolved from cable tools to top head rotary drives and so has the family's way of servicing rigs. Just as most vehicles today need a technician to spot issues, Virdell says, "I'm not an electrician or computer technician. Venture and Atlas Copco have been real good for us. We are with Atlas Copco today because of our relationship with Venture and their dependable support system. If we need anything we can call Venture and they are here right away."

The company also works with Venture to support their tooling needs. The company purchases new Atlas Copco Secoroc Fusion DHD60 down-the-hole hammers, and also works with Venture to turn over the hammer casing and other hammer servicing.

Each well in this area is developed open-hole to depth with a 6-inch DTH hammer. It's finished with an $8^{3}/_{4}$-inch surface hole and 6-inch PVC casing sealed in place. To do this, the crew drills to depth with the 6-inch hammer then goes back in the hole with an $8^{3}/_{4}$-inch hole reaming bit on »

Caleb Virdell achieves great penetration rates with the TH60.

Taylor Virdell seals the casing with bentonite. Heavy rains have made it difficult to reach some drill locations. Without portable fiberglass mats the rig buried to the axles.

a 6-inch hammer. Regulations require the hole must be sealed from surface contaminants to 25 feet (7.6 meters). Once the hole is reamed and cased to the required depth, the crew goes back in with the 6-inch hammer and drills another few feet to remove all cuttings that have fallen to the bottom. Then they thoroughly flush the hole, giving the customer clean water.

Virdell says 200 feet (61 meters) is as deep as they've been in this area and most wells won't go deeper than 160 feet (48 meters).

"We never know what the ground will be like in this area," says Virdell. He has seen both solid granite with no fissures and well fractured ground with ample water. Today the well is drilled in a slight depression in an open pasture. Virdell thinks this depression may offer the possibility of a broken up formation below.

This location was the choice of the customer, who had the site selected by a person using a divining rod, also called "witching." If no water was found Virdell had decided

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to try a spot about 50 yards (46 meters) up the hill where he had discovered "an obvious fault" and geologically upset ground with large broken rock exposed to the surface. Virdell says they have had lots of rain, which makes it hard to know if they will get a true look at where the ground water will flow in dry times.

Virdell says he would be happy with 2 to 3 gallons per minute (gpm) in this area. Many local residences use a tank to store groundwater because the flow rate is so low.

Choosing the right rig

This is the second Atlas Copco drill Virdell Drilling has run. The first was an Atlas Copco T3W purchased in 2006. After Virdell took a closer look at the features he needed the most, he decided on a TH60 for the most recent purchase. After years using a rig with a deck engine, Virdell says, "I really like how clean and wide open the deck is on this rig – it's so uncluttered." The TH60 is built on a Peterbilt 367 truck that features a 600 hp Cummins engine.

Enchanted Rock Region

- Cretaceous Limestone, 100 million years old
- Paleozoic Sedimentary, 450-600 million years old
- Precambrian Granite, 1 billion years old
- Precambrian metamorphic, oldest rock in the region

Enchanted Rock State Park is found in Llano County. The Enchanted Rock is the 425-foot- (130 meter) high exposed dome of the huge granite mass that solidified deep underground from molten rock about a billion years ago. The granite formation is surrounded by even older metamorphic rock formations.

Power is important for drilling, but also is necessary to navigate the terrain. This area is known as one of the most beautiful parts of Texas, which is also called Texas' Hill Country because of its often steep and continuously wavy landscape. "We can climb the hills around here and not even have to shift down. You just put it on cruise control. This is a real truck!" emphasizes Virdell.

Open deck space on the TH60 also helps keep the rig clean. Driving to well site locations for the company often includes moving through forested areas. Virdell says cleaning the mess from the deck of the T3W takes too much time and also adds time when servicing the components.

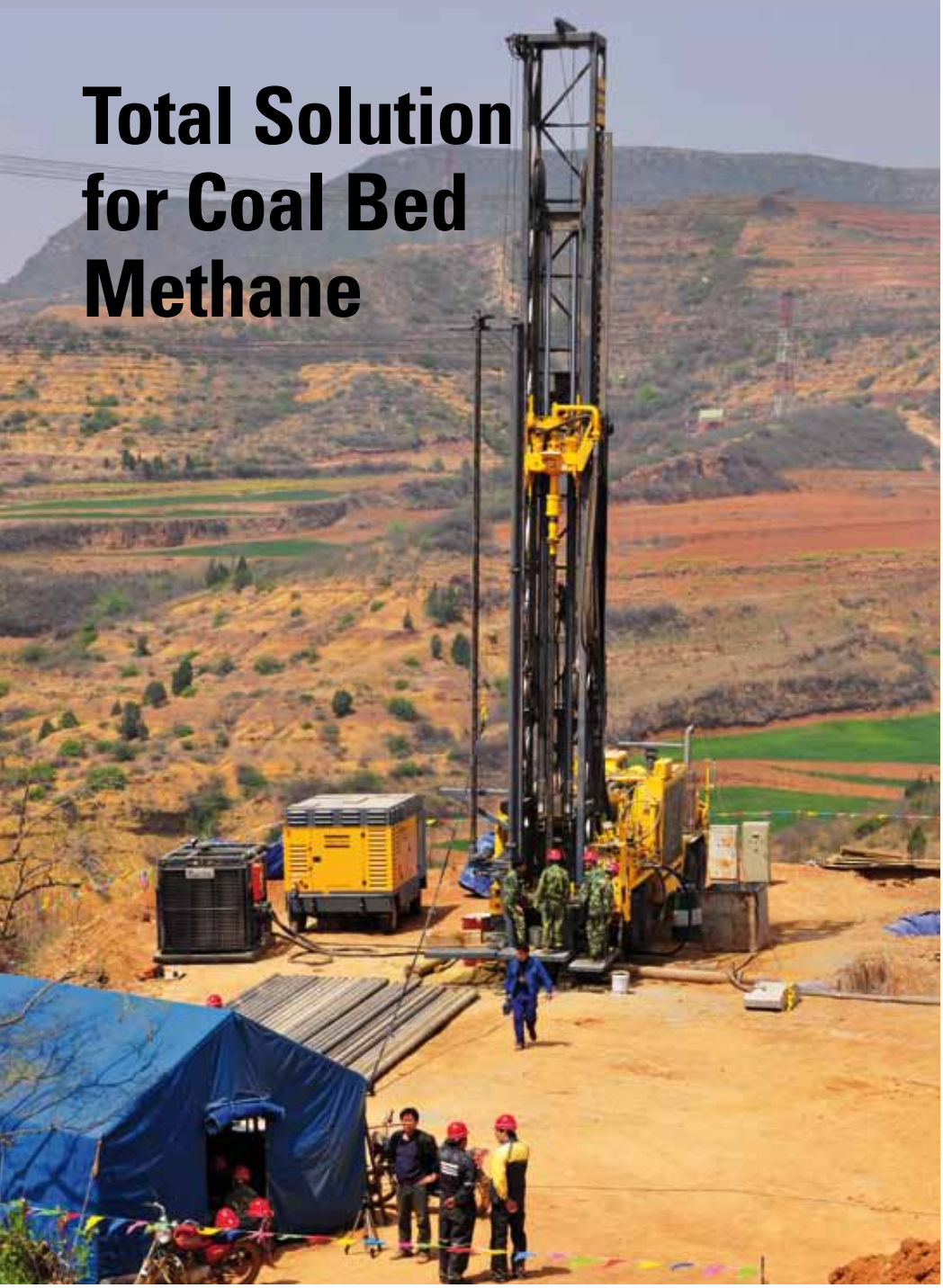
Although he changed some time ago, Virdell has used 4½-inch drill pipe in the past, but switched to 3½ inch and found it beneficial. In the past the company drilled more municipal wells that were larger diameters. Now that they consistently drill 6-inch wells, he thinks the 3 ½-inch pipe allows for better flushing of the annulus when gravel or larger chips come from the well. On the well discussed in this story, at 90 feet (27 meters) a heavily fractured zone produced cuttings over an inch in diameter.

For Caleb Virdell, speed is the big advantage with the new TH60. He can trip from the hole much faster and the winch operates faster. His father Taylor agrees with that comment and adds idling while tripping – at a faster speed – also reduces fuel consumption. "Working faster at an idle, that's where you see fuel savings."

Today the well has reached 120 feet (36 meters) with the best flow coming from the fracture at 90 feet. The well produced 12 gpm after flushing the hole clean. Sampling the water, it showed 520 ppm of total dissolved solids. As a comparison, at 2,000 ppm Virdell says the water tastes salty. He says the lowest they've seen is 250 ppm, which is like rain water.

After 110 years Virdell Drilling has come a long way. Taylor wants to continue to provide the best service he can for his customers, which includes using the most advanced drills available.

Total Solution for Coal Bed Methane



ACCORDING TO SOME EXPERTS, COAL BED METHANE HAS MANY ADVANTAGES AND POTENTIAL USES.

- It contains nearly no sulfur and therefore results in minimal corrosion to related equipment;
- It generates few pollutants upon combustion;
- It combusts to give off a gaseous fertilizer that can enhance photosynthesis in plants; and
- It can reduce methane emissions and effectively alleviate the greenhouse effect.

Coal bed methane can be used to produce electricity, industrial fuel and residential fuel, and it can be liquefied for automobile fuel. Other uses include the production and synthesis of ammonia, formaldehyde, methanol and carbon black. With so many benefits and the world's current energy supplies decreasing, the prospect of large-scale development and use of coal bed methane as a highly efficient and clean source of energy has become very attractive.

In China, Shanxi province is a major coal producing area. The Qinshui basin, located in southern Shanxi province, is now a source of industrial development and production of coal bed methane with 1000 billion m^3 of gas reserves. At a moderate depth of 200-1000 m, the coal bed of Qinshui basin is high in gas content (19-26 m^3 per ton) and has good coal bed methane resources. Its stratum occurrence is smooth with few faults, and the coal bed has high cleat development (530-580 streaks/m) and penetration rate (0.5-1.0md) – good geological conditions for coal bed methane development.

One local company specializing in coal bed methane extraction, utilization, collection and transportation is Qinshui Lanyan Coalbed Methane Co., Ltd. ("Qinshui Lanyan"), a subsidiary under Jincheng Coal Mine Group. In 2008, Qinshui Lanyan purchased an Atlas Copco RD20 truck-mounted drill, which was matched with an Atlas Copco XRVS 476 portable air compressor.

Compared to a traditional domestically produced mast-type water 2000 drill rig, the Atlas Copco RD20 and XRVS 476 compressor combination drilled a 400-500 m well in five to six days, which was an increase in speed of 300 percent. Labor costs were reduced by two-thirds, resulting in an overall improvement in efficiency of 70 percent. More significantly, this drilling technique has had little impact on the environment, reduced the workload of the drillers and generated substantial economic benefits overall.

As a result, the company has purchased a second Atlas Copco truck-mounted drill and portable air compressor, and added a 1015-psi (70-bar) Hurricane booster for use in coal mines 700-800 m in depth or in situations where there are high volumes of underground water. So far, all the equipment has been transported and installed at Qinshui Lanyan's site and the first well has been completed.

China's "11th Five-Year Plan" clearly states that more efforts shall be made in scientific research, exploration and development of coal bed methane. In addition, preferential policies will be developed for related enterprises in terms of taxation and equipment investment so that the environmentally friendly industry of developing and utilizing coal bed methane can receive greater attention. It should come as no surprise, then, that more Atlas Copco equipment will soon be operating across the major oil and gas fields of China in the near future.

Atlas Copco commits to

Sustainable Productivity

To effectively communicate its efforts to ensure reliable, lasting results with the responsible use of human, natural and capital resources, Atlas Copco has launched a new brand promise – Committed to Sustainable Productivity. This new brand promise encompasses all Atlas Copco divisions and is effective immediately.

"With the new brand promise we can communicate that in addition to our ability to innovate for superior productivity, we are a very responsible company," said Annika Berglund, senior vice president – Corporate Communications. "Sustainability – thinking about what will last – has always been a part of our product innovation, customer service, diversity, safety, and environmental concerns."

For Atlas Copco, the concept of sustainable productivity includes more than just "green" or environmental issues. It refers to an entire set of corporate values that embraces a long-term view of commitment, interaction and innovation that improves product quality and productivity, while simultaneously benefiting Atlas Copco customers and the global community at large.

> "In today's corporate world, we as a company need to be open about what we stand for in order to attract the best people and assure our customers that we are a trustworthy business partner."
>
> **Ronnie Leten, Atlas Copco president and CEO**

"In today's corporate world, we as a company need to be open about what we stand for in order to attract the best people and assure our customers that we are a trustworthy business partner," said Ronnie Leten, Atlas Copco president and CEO. **To that end, Atlas Copco's commitment to sustainable productivity includes:**

- Reducing the impact of production on the environment;
- Promoting diversity amongst employees and management;
- Improving energy efficiency and reducing the cost of ownership;
- Supporting suppliers in implementing best practices;
- Having the most reliable products and services;
- Ensuring a consistently high competence level;
- Boosting health and productivity through better ergonomics;
- Focusing on health and safety in the workplace;
- Offering services that secure maximum availability;
- Innovating for continuous product development; and
- Acting for a better society around us.

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