RADAR

Advanced riser inspection

Riser Inspec

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Risers – the pipes connecting a wellhead at the bottom of the sea with an installation on the surface – have to function in one of our planet's most challenging environments. Reliability is everything. Detecting flaws externally by conventional means, however, is time-consuming and costly. RADAR[™] (Riser Active Data Acquisition Recorder) is an inspection tool that scans the walls and welds of risers for flaws from the inside and transmits the data in real time for analysis.

RADA

DAR

Besides working much faster and being easier to use than traditional inspection methods, RADAR can be employed in almost every location. Offshore drilling contractors also benefit by being able to track and inventory specific riser sections, allowing safer and more efficient deployment.

Riser Inspection

Viser Active Data Acquisition Recorder

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RADAR[™] was developed to address the oil and gas industry's need for an efficient, safe and cost-effective method of internal inspection for drilling and production risers, choke and kill lines, as well as other metal pipes. Among other advantages, RADAR dispenses with the special handling or external preparation associated with traditional inspection methods.

The system uses real-time data acquisition and analysis to identify defects based on specific rejection criteria, to determine the location, orientation, type and size of reportable flaws, to present the data meaningfully, and to video-record the condition of the pipe's interior.

Currently, two configurations are available: a large-diameter tool for scanning drilling and production risers and other large-diameter pipe bodies **I**, and a small-

Using these two tools, pipes with diameters ranging from 3 inches to 24 inches

diameter tool for choke and kill lines and other smalldiameter pipes.

robotics tool, designed to inspect pipe wall thickness and weld quality by means of real-time data acquisition and analysis.

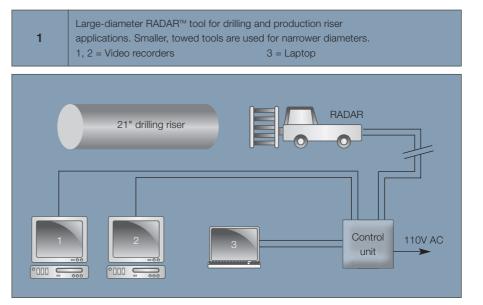
RADAR[™] is a fully automated

can be inspected. RADAR is a joint development of ABB Vetco Gray and

Global Automated Systems, and the service has been in use since late 2001. One of

RADAR's most important advantages is its portability, which enables it to be





pipe yards, remote dockside facilities, customers' facilities, offshore rigs. The equipment, which can be handled by a two-man team, can be used anywhere where compressed air, water and electricity are available. By bringing in a third technician, dimensional and other non-destructive examinations can also be performed to provide a complete field inspection service.

used almost anywhere. Locations where

it has already been employed include

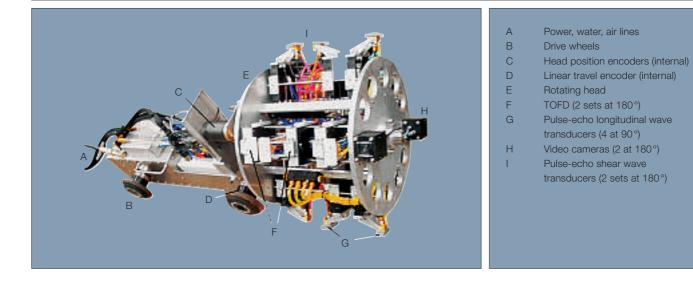
RADAR[™] speeds up inspections

The conventional approach is to take the riser from the rig, transport it to a pipe yard or dockside facility, remove the external lines and coatings, and then inspect it externally. This procedure then has to be reversed to return the riser to service - all in all, a costly and time-consuming process. An internal inspection with RADAR has the primary advantage that it eliminates all special handling, stripping or external preparation of the pipe. The inspection itself is performed in a third of the time needed with the conventional method. This, plus the fact that inspections can be performed almost anywhere, results in a significant saving in both time and money. Using RADAR, an average of six flanged 90-feet (27 m) long sections of a typical 21-inch riser can be inspected in 24 hours, assuming a data acquisition frequency of

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Large-diameter RADAR scanning tool

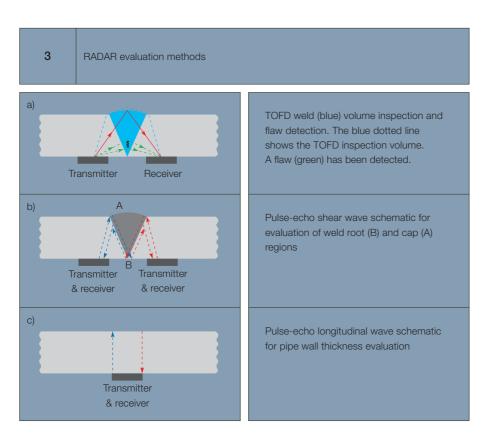
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2-foot (60 cm) intervals, plus girth welds at the end connections.

A fully automated tool

RADAR is a fully automated robotics inspection tool 2, designed to traverse the diameter of the pipe and inspect the pipe wall thickness and quality of the end-connection welds by means of realtime data acquisition and analysis. To this end RADAR uses two time-of-flight diffraction (TOFD) channels, four pulseecho shear wave transducers and four pulse-echo longitudinal wave transduc-



ers. A video record of the internal condition of the pipe is also made. Since the data are acquired and analyzed in real time, the inspectors are able to immediately identify any flaws, allowing repairs to be made before the pipe is returned to service.

Data acquisition and analysis

RADAR uses the TOFD channels to check the weld volume over the entire length of the welds. The two types of transducer – pulse-echo shear wave and pulse-echo longitudinal wave – are used to inspect and analyze the root and cap regions of the welds and to inspect the wall thickness along the length and circumference of the pipe, respectively.

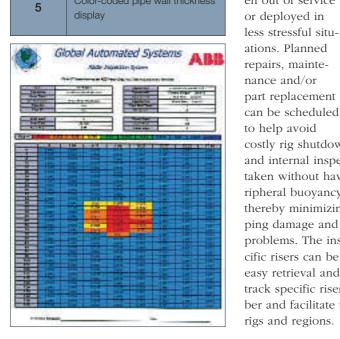
The head of the RADAR tool rotates 360 degrees while two TOFD transmitters, spaced 180 degrees apart, send ultrasonic sound energy into the material at an angle . Energy diffracted by a flaw in a weld is picked up by a set of two receivers, also 180 degrees apart. The system processes this data to calculate the outline of the flaw, which it subsequently displays as a B-scan . Using this method, RADAR can detect any weld flaw larger than 0.031". At the same time, RADAR produces a video record of the pipe's internal condition . Since the system relies on ultrasonic energy traveling through the material, the equipment has to be very accurately calibrated. Calibration standards and procedures have been developed for the system, and are performed prior to every job and at intervals no greater that five riser joints or 12 hours, whichever comes first

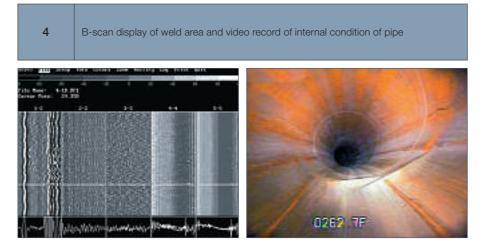
As already mentioned, pulse-echo shear wave transducers are used to inspect the root and cap regions of the welds 3b. The two transmitters and two receivers are spaced 180 degrees apart and, as the tool head rotates, inspect the entire weld along the circumference of the pipe.

The four pulse-echo longitudinal wave transducers are located near the front of the tool, spaced 90 degrees apart, and are used to evaluate the thickness of the pipe wall 30. Data is displayed in real time as a color-coded thickness map, showing both graphically and numerically any anomalies in the wall thickness 5.

The reporting criteria can be customized for each new application, giving the

Color-coded pipe wall thickness





analysis program the necessary flexibility to follow industry standards or alternative criteria based on customer or fitfor-purpose requirements.

Improving risk management

ABB's RADAR service can make an important contribution to the risk management program of offshore drilling contractors. Life-cycle wear data on drilling riser components can be measured against acceptable tolerances, helping to minimize risk by identifying mar-**RADAR** lets offshore ginal equipment that could be taken out of service or deployed in less stressful situations. Planned

operators minimize risk by identifying marginal equipment that could be taken out of service or deployed in less stressful situations.

The future of RADAR

This service is suitable for use worldwide, the current generation of RADAR tools having already been used in the Gulf of Mexico and South America. Recently, RADAR was also introduced to the North Sea market following the Offshore Northern Seas show in Stavanger, Norway, in September 2002.

To further improve this service, ABB is currently developing a new tool that

> will enable risers to be inspected while still in position. Dubbed RADAR-V (for vertical), it will be capable of inspecting drilling or production risers without having to pull them to the surface. Offshore operators and drilling contractors can expect a very considerable saving from RADAR-V. which

ABB expects to introduce to the market in late 2003.

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costly rig shutdowns due to failure, and internal inspections can be undertaken without having to remove peripheral buoyancy and auxiliary lines, thereby minimizing handling and shipping damage and potential corrosion problems. The inspection data of specific risers can be stored digitally for easy retrieval and used, for example, to track specific riser assets by serial number and facilitate their transfer between rigs and regions.