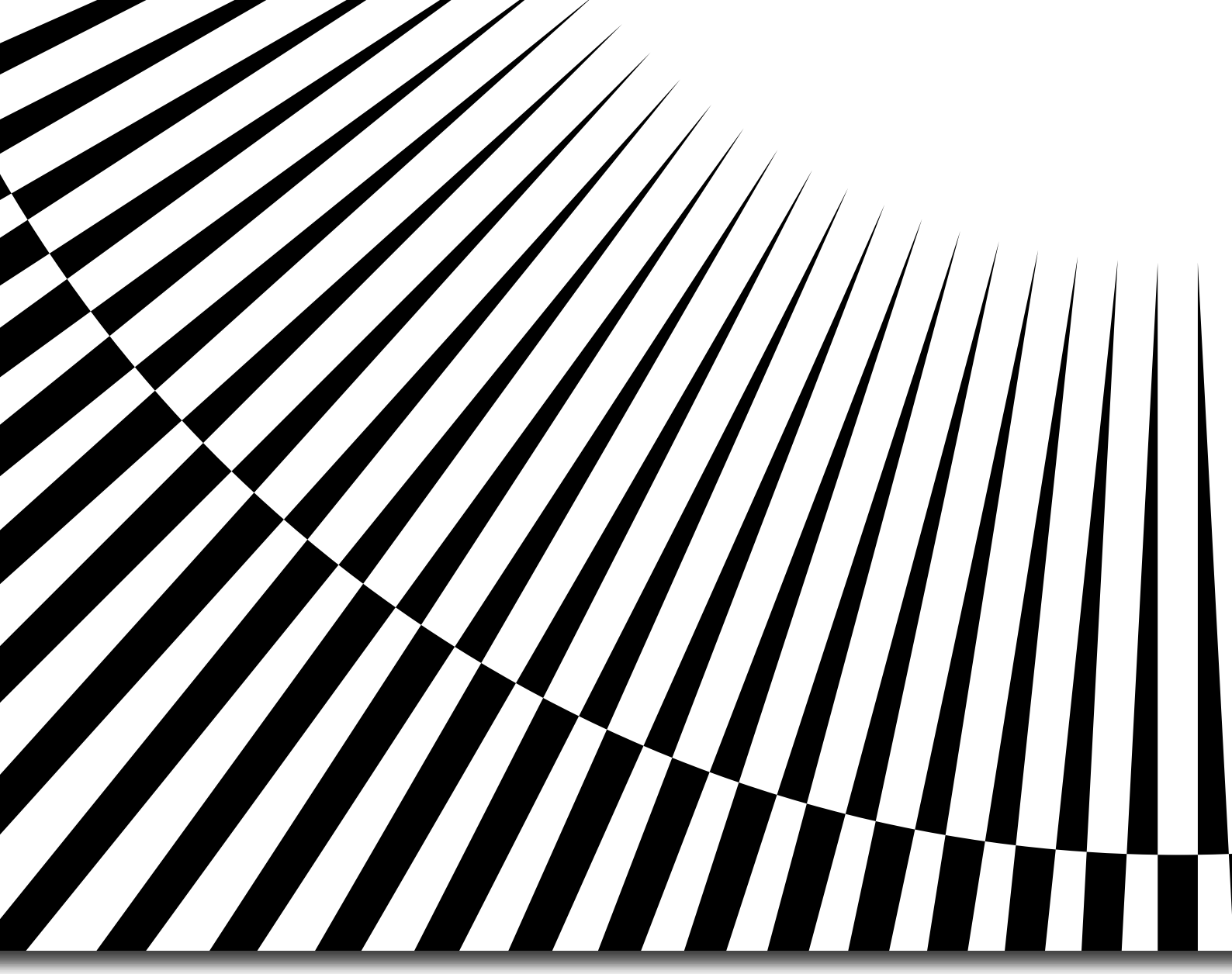
We are a global oilfield service company that specialises in drilling services and well services because we believe that specialists do the job best. Our experience drives our difference in our constant search for new ways to deliver better wells. We listen to our customers to provide straightforward solutions to help them produce more oil and gas. We are craftsmen, who take pride in our work and do what we promise. **We are Archer, the well company.**

archerwell.com

Archer
The well company

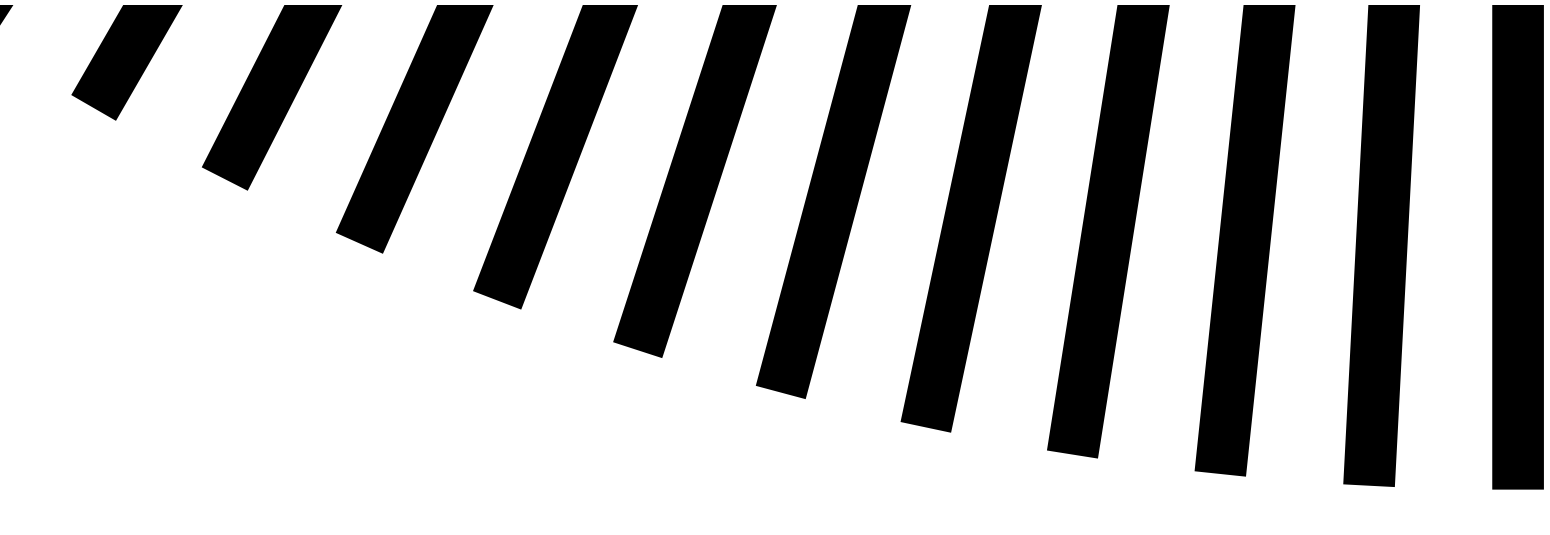
Space Brochure R01/2011



Captured by SPACE

3D perspective on well performance

Archer
The well company



Your well revealed with startling detail and clarity. High definition, 3D ultrasound imaging through oil, water or gas. Greater understanding. Better decisions. Improved well performance.

The SPACE series
Reveal more, understand more

SPACE takes downhole imaging into another dimension. A combination of high-definition ultrasound technology and the most powerful data processing algorithms delivers true 3D visualisations of astonishing resolution and clarity.

The SPACE system can be configured to look along the wellbore or sideways. There are no moving parts to wear out, deform or malfunction; no protrusions to catch on obstructions; no optical components to smear or cloud. It requires no light to function and works equally effectively in oil, gas and water.

The first releases in the SPACE series are now available:

SPACE/20™
Visualising the well in 3D – detailed investigation of conditions, assemblies and components

SPACE/20M™
Measuring the well in 3D – adding sub-millimetre accurate measurements in three dimensions

SPACE overcomes the limitations of previous-generation technologies, enabling decision makers to act with complete confidence.

Managing well performance
The role and value of SPACE

Wells rely on thousands of individual components to function effectively and productively. Hostile subsurface conditions hasten the inevitable progress of wear, corrosion, deformation and component failure.

Managing performance in such a complex and ever-changing system – to improve output and minimise operating costs whilst ensuring human and environmental safety – is always a challenge. Increasing numbers of ageing wells, the greater complexity of some newer wells and the need to operate in more extreme environments all add to the difficulties.

Global survey reveals 38% of wells underperform

A recent independent survey revealed 38% of wells globally were underperforming. 2 in 10 involved issues with safety systems and other control systems. 6 in 10 relate to tubular, corrosion and scale issues.

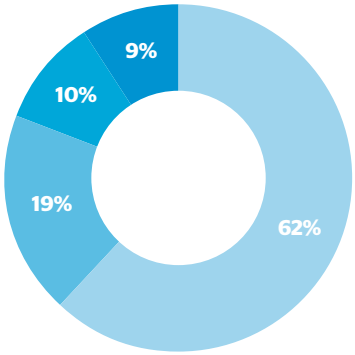
To maximise production and recovery, whilst minimising health, safety and environment (HSE) hazards and cost of extraction, it is essential that managers have access to reliable diagnostic resources able to deliver clear, unambiguous information.

Legacy technologies simply cannot supply this information with the depth, definition or clarity required by decision makers.

Archer's SPACE technology can.

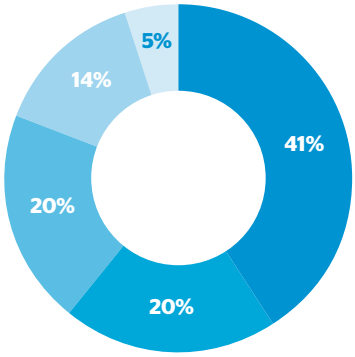
Global well performance analysis

Underperforming wells



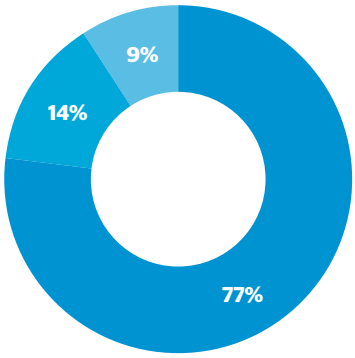
- Permanently shut-in
- Temporarily shut-in
- Operating under dispensation
- Operating normally

Well performance failures



- Tubulars
- Safety and other control systems
- Annular integrity & zonal isolation
- Corrosion
- Scale

Well performance challenges



- Gathering & analysing data
- Competency
- Equipment availability

[1] OTM Consulting 2009. Data shows percentage of well affected by well performance issues and impact. Global averages developed from OTM's internal market models for all oil and gas wells. Issue fractions were weighted by number of wells per region.

[2] OTM Consulting & Archer market survey 2010. Data shows the relative distribution of failures affecting well performance encountered by survey participants. Based on global industry sample of 20 well performance experts.

[3] SPE North Sea Well integrity forum, Nov 2009 & Drilling Engineering Association (DEA) Europe, March 2010. Data compares main challenges faced by operators in managing well performance.

The application of SPACE
3D ultrasound in action

The ability of SPACE to provide 'see for yourself' 3D ultrasound visualisations of well geometries, components, assemblies and obstructions is invaluable.

SPACE also offers the ability to take high precision measurements in all three dimensions. This allows accurate assessment of current dimensions, diameters, areas and volumes as well as comparisons with original data – facilitating change over time reviews and the ability to check whether critical components remain within or are beyond acceptable tolerances.

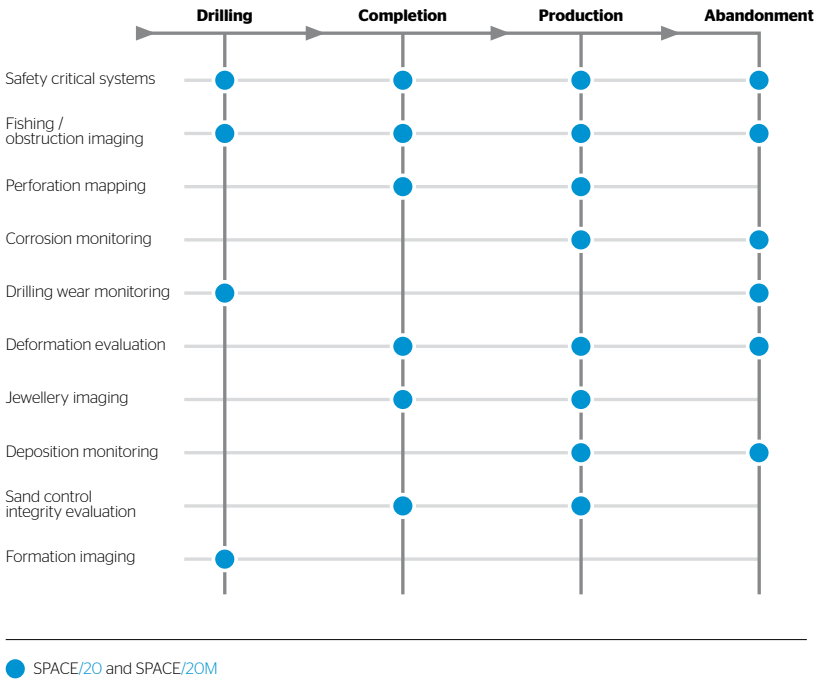
Beyond the limits of legacy technologies

A SPACE scan produces rich data to feed through our range of bespoke processing modules. The power and flexibility of this combination enables SPACE to far exceed the physical and performance limits of legacy technologies – and to successfully undertake tasks not previously possible: perforation mapping, sand control integrity investigation and component-level diagnostics of safety critical devices.

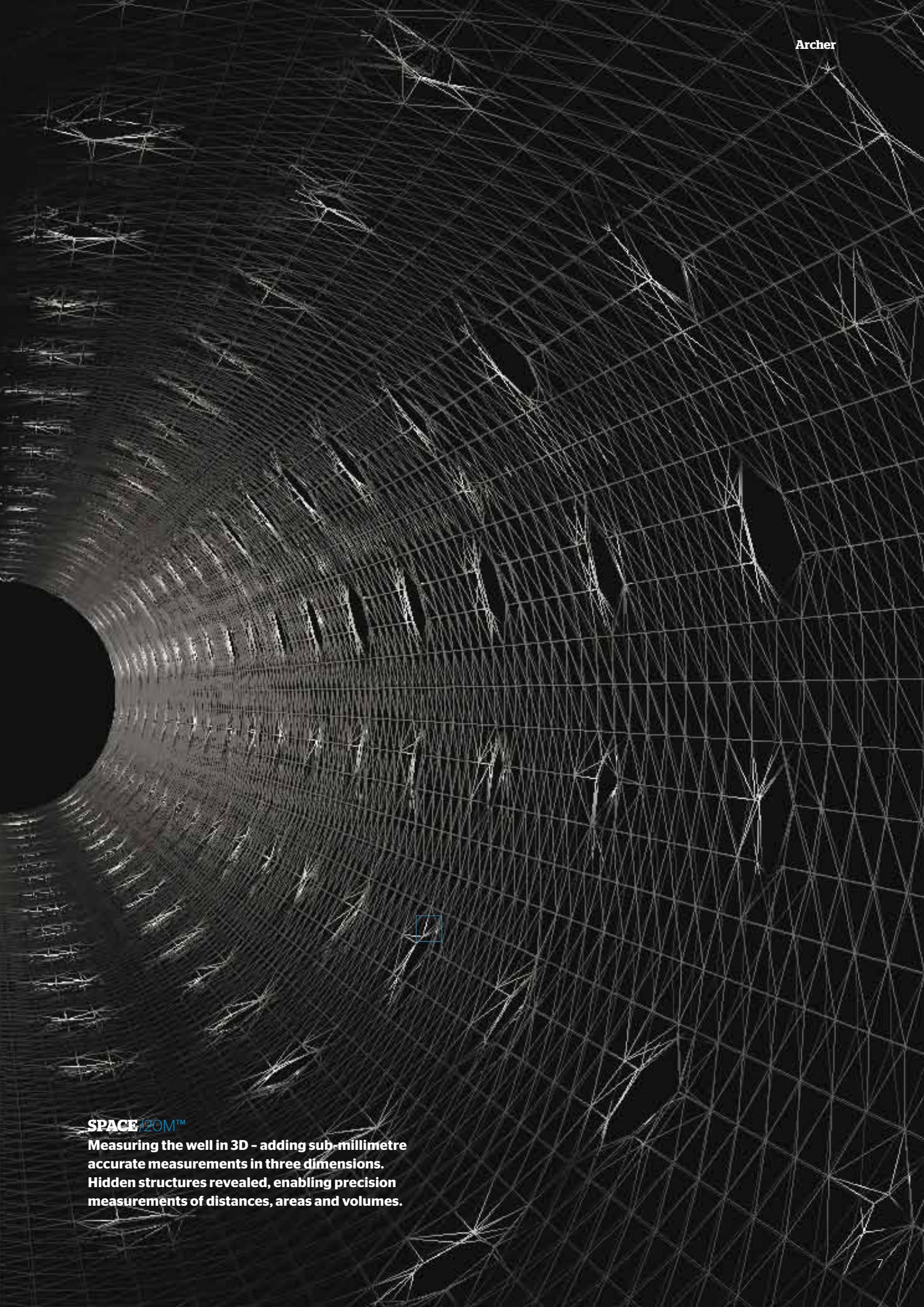
SPACE is a category-defining use of ultrasound technology, drawing on 20 years of front-line industry experience and a decade of development work by our technical team. The first outcome was the global launch of our Point system of ultrasound well integrity diagnostics – proven in over 1000 well deployments to date. SPACE not only builds on that great heritage, its capabilities provide the perfect complement for Point.

SPACE through life of well

SPACE is a powerful and comprehensive life of well resource. It has application through the entire length of well and from the first drilling operation to beyond the last drop of production.



SPACE/20™
Visualising the well in 3D – detailed investigation of conditions, assemblies and components. Tubular and perforation geometries displayed in high-definition 3D.



SPACE/2OM™
Measuring the well in 3D – adding sub-millimetre accurate measurements in three dimensions. Hidden structures revealed, enabling precision measurements of distances, areas and volumes.

SPACE/20
Visualising the well in 3D

SPACE/20 uses ultrasound technology to produce high definition, 3D visualisations of conditions, assemblies and their components in the wellbore – through oil, water or gas and at any depth or well orientation.

There is no need to change well fluids or chemically condition the well as with optical devices. The 'true' 3D output enables renders to be viewed from any angle – displaying surfaces even direct visual examination downhole could never reveal. With a smooth profile the scanner is far less likely to become stuck in the wellbore. And with no moving parts to fail, there is much reduced possibility of the mechanical failure that affects many legacy technologies.

At the heart of the value of SPACE is the extraordinarily rich data captured from around 225,000 data points every second. Processed at high speed, this information is transmitted to surface via e-line, to be viewed and captured as video or as 3D renders.

The quality and definition of the output from SPACE/20 is invaluable in supporting decisions that require the certainty of unambiguous visual evidence.

Key benefits

- No need to change or chemically condition well fluids
- Information is presented in 3D for accurate visual analysis of downhole geometry
- 3D renders can be viewed from any direction
- No moving parts
- Slim, smooth profile minimises risk of hang-up or inspection damage
- Unambiguous information

Typical applications

Production enhancement

Full 360° coverage for detailed inspection of wellbore surfaces:

- Perforations, screens and inflow control devices
- Inspection of sliding sleeves, side pockets and valves

Safety and integrity

Imaging individual components within complex assemblies:

- Safety valves, blowout preventers, wellheads and trees
- Identify corrosion, erosion and wear

Remediation

Capture images beyond obstructions and through deposits like scale, wax or hydrates:

- Diagnosis of wellbore restrictions and blockages
- Fishing

SPACE/20M
Measuring the well in 3D

SPACE/20M offers all the features and benefits of SPACE/20 but with the added ability to collect and deliver measurements of wellbore, assemblies and their components.

The combination of sub-millimetre accuracy and detailed 3D modelling also allows linear dimensions to be further processed, to reveal key area and volume information.

Measurement is an invaluable addition to the information available to operators and is enabled through a range of enhanced SPACE/20M sensor control, data processing and analysis modules.

When measurement data is collected over time, rate of change can also be assessed. This will reveal detailed information on wear, deformation, corrosion, pressure handling and tolerance limit changes critical to maximising and sustaining well performance.

SPACE/20M provides operators with a unique resource: a means of determining the exact nature and severity of well integrity and performance issues – and predicting failure points. This provides the information needed to select, with confidence, the most cost-effective methods and timings when applying remedial action. And the tipping points where well maintenance costs exceed profitability.

SPACE/20M also provides operators with unambiguous proof to demonstrate compliance with local or international regulations and corporate responsibility for health, safety and the environment.

Key benefits

- Sub-millimetre accuracy measurements obtained in three dimensions
- Full 360° coverage of wellbore circumference
- Measure distances, areas and volumes for use with calculations or modelling
- Time-lapse comparisons for rate of change calculations

Typical applications

Production enhancement

Enable the scheduling and execution of activities to enhance production:

- Clean-up of wellbore restrictions and blockages
- Stimulation of perforations, screens and inflow control devices

Safety and integrity

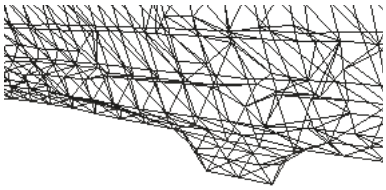
Enable compliance with local or international regulations for health, safety and the environment:

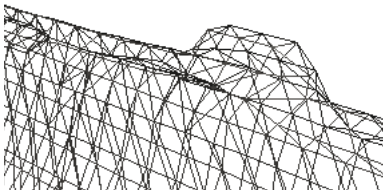
- Safety valves, blowout preventers, wellheads and trees
- Structural performance limits of tubings, casings and liners

Remediation

Obtain precision dimensions of downhole geometries to maximise success of remedial actions:

- Setting of straddles, patches, plugs or packers
- Fishing





Inside SPACE
Adding a new dimension to information

SPACE defines a new category of ultrasound scanning services. Its true 3D visualisations and sub-millimetre measurement capability give operators access to information second only to personal inspection.

With phased array scanning, SPACE is able to scan ahead and radially – to provide full wellbore coverage. It operates equally effectively in water, gas and oil. And the data obtained is processed downhole and transmitted to surface for real time imaging.

That data is information rich. Around 300 sensors are activated through multiple 360° sweeps every second, surveying 128 different focal lengths. This produces almost a quarter of a million data points to process into a true, three-dimensional image.

The high-definition image can be examined from every angle, so surfaces invisible to cameras or any other inspection tool can be explored. Even direct personal inspection – should that ever be possible – could not match this capability.

Benefits of phased array scanning

SPACE control systems permit the use of phased-array scanning, similar to the technology used for medical diagnosis.

The ability to focus beams at a range of defined distances from the scanning head offers great advantage when obtaining data for 3D visualisations of: the inner and outer surfaces of the pipe, every surface of complex assemblies and their components, past obstructions and through corrosion, scale waxes, asphaltenes and hydrates.

Adding measurement to 3D visualisations

Each service in the SPACE range identified by the suffix M features additional sensor control, data processing and analysis modules that enable sub-millimetre accurate measurements to be applied to the 3D image.

This option is invaluable when measuring degradation or change over time. There are many instances where the unambiguous evidence delivered is critical to safety or productivity decisions such as: assessing the performance of tubing, casings and liners; detailed assessment of safety systems and well control devices.

SPACE provides operators with information essential to improving well performance. The detail and clarity of the information delivered is unmatched by any existing technology. The ability to view surfaces invisible to any other inspection device is unique and the addition of accurate measurements in three dimensions is invaluable when assessing well changes over time.

The outcome is more accurate, timely and cost-effective remedial action; absolute proof of compliance with health, safety and environmental regulations; better performing wells and increased profitability.

SPACE system specification

Physical	Azimuthal	Forward
Max OD, in [mm]	3.0 [76.2]	3.2 [81.3]
Length[1], ft [m]	7.5 [2.3]	
Weight[1], lbs [kg]	88.5 [40.1]	
Environmental		
Max temperature, degF [degC]	220 [105]	
Max pressure, psi [Mpa]	5000 [34.5]	
Electrical		
Voltage, VDC	240	
Current, mA	200	
Functional		
Vertical resolution[2], in [mm]	0.12 [3.0]	
Radial resolution[2], in [mm]	0.04 [1.0]	
Viewing range, in [mm]	3.5 - 13.0 [89 - 330]	
Circumferential coverage, degrees	360	
Operational		
Recommended logging speed, ft/min [m/min]	0.3 - 15 [0.1 - 4.5]	
Logging mode	Real time	

1. Tool only. Typical toostring with centralisers and sinkerbars 23.5 ft [7.2 m], 250 lbm [113.4 kg]
2. At logging speed of 0.3 ft/min in water filled environment