

Wellscope™

Growing demand for highly-predictive pioneering oil and gas tool for improved well performance



Better prediction, better production from every angle.

3D modelling technology routinely used in Formula One and aeronautics, applied to the oil and gas industry, results in more accurate appraisal of development prospects, well planning and prediction of true well and field value.

Accurate modelling of fluid flow in oil and gas well projects is especially demanding when economic and environmental considerations overlay with the increasing complexity of reservoirs and wells. Regardless of well type (horizontal, vertical, deviated) or project phase, with today's leading edge hardware and software solutions it's possible to make better decisions about what wells will do, what they won't do and how to design them to optimise their performance.

Recognising the growing need for better predictive tools to drive improved outcomes, Senergy developed Wellscope™ in 2009. Wellscope™ is a process that uses Computational Fluid Dynamics (CFD) to enable detailed modelling of fluids in wells and the surrounding reservoirs. CFD is the study of the dynamics of things that flow. Complex laboratory tests and processes are used in the Wellscope™ approach to capture individual hydraulic fracture perforations, true fracture geometry and actual fluid behaviour within a well.

Wellscope™ is a departure from standard analytical and nodal solutions. Other solutions on market overlook the real cross flow between reservoir layers and the flow of fluids through and along the entire well length. Instead they rely on trying to fit core, physical layer and well data - gathered from tests and logs - into general analytical solutions. In its three years in market, Wellscope's 3D models have delivered more accurate information about formation damage, fracture placement, completion options, cross and mass flow, inflow and well performance than traditional analytical solutions.

Wellscope™ has been used in more than 30 projects for some of the world's leading oil and gas projects across UK, Western and Eastern Europe, Scandinavia and Asia. LR Senergy's clients recognise that near wellbore fluid flow modelling using CFD will become standard industry practise with many commenting, **"why don't we do this on every well?"**

GAS

OIL

WATER

Wellscope™ models have a track record of being highly accurate. They allow operators to predict the impact of gas, water and other materials on well performance. The ability to model various scenarios consistently leads to better decision making within the project economics for the well design.

Benefits

The Wellscope™ team can engage clients at any phase of a project. Wellscope™ conducts a series of laboratory tests to produce the final models and recommendations. Oil and gas engagements over the past 5 years are building a reputation for Wellscope™ as a revolution in well test simulation and analysis. Understanding how the well is going to flow and reducing the subsurface uncertainties has delivered broad benefits including:

- Measurement of well performance within 5% of that predicted
- In 90% of cases clients were able to diagnose issues that were not identifiable without Wellscope™
- More rigorous decision making on field development planning, well completion and design
- Enhanced well recovery / increased reserves per well
- Risk mitigation against potential breakthrough of unwelcome water or gas
- Improved cost effectiveness – optimised well unloading procedure to remove drilling fluids from a well and achieve the most productive well possible
- Prediction of increased productivity and reserves through innovative drilling procedures in a fractured carbonate reservoir
- Improved resource allocation and more focused operations by reliably predicting true well and field value.

IN THE FUTURE

Before the end of 2015 Wellscope™ will be deployed to assess: sand and particle transport and control, core retrieval, erosion control, inflow control device and inflow control valve value prediction, well clean-up, well start-up and wellbore strengthening.

In the field

Recent use case studies



REAL TIME WELLSCOPE™

1. Real time Wellscope™ modelling within a five day constraint using log data acquired during drilling identifies optimum position of fracture and results in 20% well productivity improvement.



FORECASTING

1. West of Shetland development assesses impact of formation damage based on return permeability results from different reservoir drill in fluids. Model shows that well flow back in injectors has negligible impact on injectivity. Predictions using Wellscope™ ultimately result in cost savings of £5 million per well.



PRODUCTION POTENTIAL

1. Talisman Energy understands the flow dynamics and production potential of Gyda field wells and uses results to inform decisions and completion choices.

2. A “world top ten by reserves” operator increases a number of its wells’ recoverable reserves by 15% (80,000 barrels) as a result of Wellscope™ simulations.

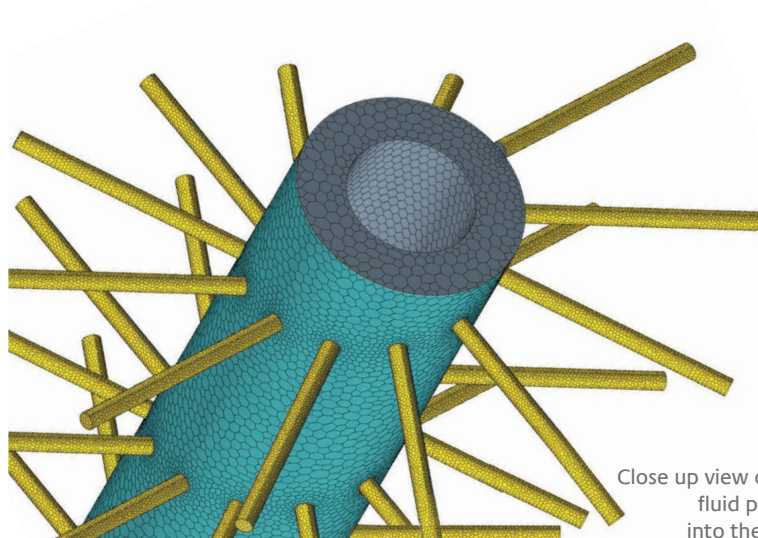


PLANNING AT START-UP PHASE

1. Numerical modelling of completion fluid removal from horizontal section (applying drawdown conditions and formation failure around sand control screens) used in North Sea. Additional pressure drop predicted reduces gas productivity by 25%. Wellscope™ enables well start-up procedure to avoid loss of this 25%.

Wellscope™ Highlights

- Supersedes 30-year-old technology being used today
- Reduces reliance on skin factor
- Proven results across varied well scenarios
- Three international patents granted
- Nominated for innovations award at ONS in 2010
- Wellscope™ delivers 3D models of a prospective well with a current capability of 500 million cells. Can show thousands of cells on the hydraulic fracture face (some previous models have just one cell to represent the fracture face).



Close up view of reservoir fluid perforations into the formation

CLIENT USE CASE

“Standard modelling techniques could not model our proposed complex recompletion. **LR Senergy’s Wellscope** process helped us evaluate both the optimum perforation strategy and the viability of a challenging and expensive workover recompletion. Detailed numerical two phase fluid modelling of the well inflow helped us understand and predict the performance of the well.

Wellscope CFD modelling resolved the industry gap between coarse scale numerical simulation and analytical snapshot wellbore models. Improved well inflow performance predictions helped us make the right multimillion dollar decision.”

Barry Goodin, Senior Exploitation Engineer, Vermilion Oil & Gas



PRODUCTIVITY OPTIMISATION

1. Model built in real time based on MWD data pin points optimum position for hydraulic fracture.
2. Based on the anticipated reservoir quality and the planned well geometry (open hole with perforations) a major North Sea operator accurately predicts well performance. Results: Wellscope™ prediction = 6,500 bopd (from 3284mDft), well maximum rate = 5,633 bopd (from 2662mDft).



WELL PERFORMANCE

1. An operator in South East Asia maps inflow characteristics, permeability sensitivity and completion options in a vertical well (inc. base case, formation damage, hydraulic fracture placement).
2. Potential productivity from different drilling techniques for increased well recovery. Results: UBD drilling = 464m³/day, MPD drilling = 365m³/day, conventional drilling = 290m³/day.



HAZARDOUS MATERIAL ASSESSMENT RISK MITIGATION

1. Operator models fluid leak-off from the well to the reservoir with long term shut in to measure estimated residence time of corrosive fluid in a well with sand screens.



RISK MITIGATION

1. Clients partner with Wellscope™ for mechanical modelling of failing wellbores, gas well clean-up and modelling the crushed zone around perforation tunnels.

Evolution

Wellscope™ is a game changer that overcomes the commonplace reliance on gross simplification of complex well properties that could not be modelled until now. This form of modelling has garnered momentum since the Wellscope™ development team first recognised that predictive solutions for enhanced well recovery could be achieved using Computational Fluid Dynamics (CFD).

“Bolsters LR Senergy’s reputation as a high performance knowledge and diversified services partner for oil, gas and renewables. Wellscope™ is an innovative example of our team driving the economic imperative to do things differently.”

James McCallum, LR Senergy CEO

How does it work?

- The Wellscope™ team gathers data required to build a model of the reservoir and the planned or existing well geometry
- Additional restrictions such as formation damage, sand screens, ICDs, packers and fractures, are identified and constructed in 3D
- CAD model imported into selected CFD software and base case and any sensitivities solved for single, two or three phase flow
- Mass flow, velocity, temperature change and flow distribution extracted from solved model as required.

Learn more

For a demonstration, pricing and proof of concept (POC) or to discover the many ways Wellscope™ can lead to enhanced well recovery contact wellscope@lr-senergy.com or call +44 1224 213 440

To read Wellscope technical papers including: The Extinction of Skin, 2012 (SPE 151 807), visit <http://www.onepetro.org/mslib/servlet/onepetroreview?id=SPE-151807-MS>



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WELLSCOPE™ EVOLUTION TIMELINE

2008

- **September:** LR Senergy Production Technology and Formation Integrity teams conceived Wellscope™
- Wellscope™ uses CFD to model fluid behaviour in wells assisting its first client with damage impact prediction

2009

- **October:** filed UK patent

2010

- **May:** filed US patent
- **August:** nominated for innovations award at ONS
- **October:** nominated for ICOTA technology award

2011

- First 20 million cell model constructed

2012

- First use of Wellscope™ for reservoir scale gas coning prediction

2013

- Passed 500 million cell mark
- Modelled mesh screens and detail of wells with ICDs, screens and significant length with two phase flow
- Access to high performance computing becomes routine thereby removing any obstacles to the widespread use of Wellscope™

2014

- Published SPE paper on use of CFD for corrosion inhibitor effectiveness prediction
- Joined Danish research OPTION project (through LR Copenhagen)
- US patent granted

2015

- Two UK patents granted
- Nominated for ADIPEC innovation and technology award