

# Curriculum Vitae;

## Ken Watson

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### Personal Profile

I am currently the Senior 3D Modelling Specialist for the Rock Properties Group, Energy Consulting, in Lloyd's Register. Joining Senergy, which later became part of the Lloyd's Register group, I was primarily tasked with assisting Geomechanics colleagues with near wellbore Finite Element Analysis (FEA) problems, such as sand risk in both wellbores and perforations. The 3D modelling skills in Computer Aided Draughting (CAD) I had acquired over many years were then directed towards building geometry for our Wellscope™ colleagues. Wellscope is a Computational Fluid Dynamics (CFD) process which considers fluid flow coming from deep in a reservoir, passing through any type of completion from any vendor and then to surface. What makes Wellscope unique is that accurate geometry is used throughout, for the reservoir (kilometres in size) and the completion (details are millimetres in size), so that the driving force for fluids is simply physics and not prescribed data!

I have been involved in many aspects of oil industry draughting and design since 1985.

Out with work I am involved with many different groups dealing with a variety of items.

I am an active member of the Portlethen Moss Conservation Group, who look after a small remnant of raised bog, since 2006. A "sister" project to this is the Portlethen Community Woodland. In 2007 a farmer's field was turned over to the group so a woodland area could be created.

I was also part of the steering group that guided and helped a recognised artist create the "Discover North Kincardine" map between 2015 to 2017. This map detailed many walks and things to see all over our area and was posted through more than 4,000 letterboxes in our town and nearby villages.

Within the town where I live, I was part of the small steering group that created Portlethen's Edibles Trail in 2017/18. Three Edible's Trails were created; Inverbervie, Portlethen and St Cyrus.

I am the chairperson for the Portlethen Paths Development Group, created 2019, who assist Aberdeenshire Council with Paths and Open Spaces within our community.

Over recent years I have helped with the Portlethen Gala, mainly manual labour; setting up stalls etc.

Over the years I have developed several websites for some of the local projects and groups I have been involved with. Another local interest website that I developed was specifically geared towards visitors to our area, showing photographs and giving information about scenic areas, walking routes and businesses. Further websites have been for relatives, such as one for my brother's Architecture business and one giving information about Brechin Cathedral for my mother-in-law.

I am also the chairperson of the civilian committee for our local Air Cadet Squadron, 865 (Portlethen).

Away from Portlethen, I have been involved with the Aberdeen and District Badminton League for many years, both as a player, since the early 80's, and being on the league committee. I created the first league website in 1996, which after one year, to see if anyone was interested in it, was passed to the league for their use and upkeep. The website then came back to me in 2007 for administration and maintenance, and, at that same time, I became the scorecard secretary for the league.

I am a keen photographer, with an interest in many different subjects, but especially of flora and fauna.

I am married, with two children, I have a full, clean, driving license and my date of birth is 6<sup>th</sup> Jul'65.

Further information and some recommendations, can be found here: [www.linkedin.com/in/ken-watson-3d](http://www.linkedin.com/in/ken-watson-3d)

## Key Skills and Software Expertise

Computer Aided Draughting (CAD) since 1985 – including AutoCAD 2D and the very early days of 3D

3D CAD Solid Modelling since 2000 – IDEAS SDRC, PTC ProEngineer and PTC Creo Parametric

Finite Element Analysis (FEA) since 2006 - Abaqus

## Career Summary - Current Employment

**Apr' 2012 – Present**

**Lloyd's Register, Senergy from 2012 to 2016 (~7,000 employees)  
Senior 3D Modelling Specialist**

- Wellbore and Perforation stability and sanding prediction using FEA (Geomechanics)
- Creating complex 3D geometry in CAD for using in Wellscope™ (CFD)
- Investigation of “dropped objects” within a well using FEA
- Investigation of crush resistance of stacked tubulars using FEA
- Using FEA, mimic Shear Rams closing on a Tubular

Initially employed as a subject expert in 3D FEA, specifically for complex models including both the wellbore and perforation in the same model. These simulations were used to predict stability and sanding.

As these complex 3D models were produced, it became obvious that even more complex 3D geometry could be created, but then used specifically for the department's Wellscope offering. Although Wellscope considers a whole reservoir, being kilometres in size, it also considers the tiniest detail within the completion, millimetres in size. Therefore, accurate 3D geometry is key to the initial part of this process.

Recent Wellscope projects include:

- Comparing the relative performance of Sand Screens (stand-alone versus Inflow Control and by different completion vendors) in a large multi-layered reservoir.
- Taking original Piping ISO drawings and converting them into a full 3D Model for the purpose of analysing wall shear stress in CFD, for how corrosion inhibitor performs.
- Taking an original, hand drawn, component manufacturing drawing for a Xmas Tree Valve Block and converting it into a full 3D Model for the purpose of analysing wall shear stress in CFD, for how corrosion inhibitor performs.

A requirement, by a different group within the company, for a Mud Mat was initiated. The basis was adapting several different, but industry recognised, designs into one unique new style. This involved creating the 3D Model and Manufacturing Drawings as well as performing FEA work on the new style to ensure it was fit for purpose.

Whilst at Lloyd's Register I have been part of the Technical Advisory Group (TAG) for the Sand Management Network (SMN). This would typically involve assisting the committee in the assessment, ranking and selection of presentations for meetings which were held on a quarterly basis in Aberdeen.

The company also got involved with the local “Corporate Decathlon”, where colleagues took part in ten different sports over the year, competing against similar companies based in Aberdeen. Over different years I was a team captain, for Badminton, the vice-captain for the company one year, as well as being the team photographer attending each event.

## Career Summary – Previous Employment

### **Dec' 2000 to Apr' 2012**      **Weatherford International Ltd. (~40,000 employees)** **3D Modelling Specialist and 3D Design Analyst**

- Introduction to “true” 3D solid modelling within a large oil industry equipment vendor
- Parts and assemblies were designed wholly in 3D, then 2D manufacturing drawings were created
- Graphics, papers and presentations were created for conferences and marketing
- Introduction to FEA
- Using 3D CAD and FEA assistance was given for the design and manufacture of a new product size

Initially employed as the departments first ever dedicated 3D Modeller, using IDEAS SDRC software. Models were produced for R&D tools, the designs coming from personal ideas and the engineers. Within 1-1/2 years the company changed CAD software to Pro-Engineer, a relatively simple change, but assistance was offered to any colleagues that struggled to cope with the change. There was more involvement with the draughting side at this stage, for new tools, equipment and for sustaining activities. The main product for the department was Expandable Sand Screens (ESS) and their Expansion Tools.

At very short notice, in 2006, an ANSYS FEA course was attended. However, the department didn't take up the use of that particular software. In late 2006 Abaqus FEA training was received and this was the software that the department chose to continue with. FEA was used on new styles of the ESS product, investigating ease of expansion and looking at different scenarios which may be seen downhole, such as crush or collapse. Essentially, the product was required to be easy to expand but strong enough to resist collapse, which should be counter-intuitive.

Graphics were produced for magazines, both trade and in-house. Technical papers were created and presented based on Expandable Sand Screens. These were mainly for the annual customer conference of the company that provides the FEA software. Posters were also prepared and produced for showing at SPE led conferences, such as the Sand Management Forum.

FEA highlights would include a couple of projects where the department was able to considerably reduce project time and costs by utilising FEA.

- One size of ESS was investigated to increase collapse resistance. By running five separate scenarios, a prime option was chosen to go forward with to fabricate and test.
- A client had a new feature request for ESS. Engineers came up with ten different designs and these were all analysed. The two best options were manufactured and tested.

### **May 2000 to Dec' 2000**      **Rigserv Ltd. (~20 employees)** **CAD Operator and Procurement**

- Enhancing 3D CAD skills with more “solid” looking items
- Procurement of goods from suppliers

Taken on as per previous employment (Jan'97 – Jan'00) to cover all drawing requirements for the company, but now also responsible for procurement and materials sourcing and pricing for projects.

### **Jan' 2000 to May 2000**      **Unemployed** (downturn in oil industry related work)

- Using a different version of 2D AutoCAD

During this short period, and to keep my hand in, some occasional CAD work was undertaken, on an ad hoc basis, for a very small and local, water industry related, company using AutoCAD LT 97. This work consisted of system one-line diagrams, panel general arrangements etc. Some basic Web Authoring assistance was given to the company.

## Career Summary – Previous Employment

### **Jan' 1997 to Jan' 2000      Rigserv Ltd. (~20 employees)** **CAD Operator**

- Enhancing 3D CAD skills with more “solid” looking items
- Supervisor, issuing work to colleagues
- Procurement of goods from suppliers
- Assisting with creating office documents etc.

Employed as the senior design CAD operator, using AutoCAD 12, there was responsibility for producing all drawings for the company. The drawings were as per the previous employment with the company, from proposal to as built, including electrical, general arrangement, construction, hydraulic, pneumatic etc. but now with a heavier emphasis being placed on 3D line of sight studies for ensuring that all major equipment on a drillfloor could be seen from each position within a Driller's Cabin. Drilling Instrumentation, Driller's Consoles and Driller's Cabins were the main product of the company.

Further responsibilities, included issuing work to the workshop, being involved in hands on work within the workshop and purchasing goods and materials for the company. This meant having direct contact with suppliers and clients. Various forms and documents for proposals and projects were produced, such as bill of materials, cable schedules and document transmittals using Excel, PowerPoint, Word, Paintshop Pro, CorelDraw and other image manipulation tools. Simple “help” documents that aided the office staff in using their PC's more efficiently were created. Brochures and designs for “freebies”, such as T-shirts, mugs and paperweights, at times of exhibitions, were also prepared, as well as the exhibition stand layout. Also, at the time of Offshore Europe, aid was given to help set out the stand, take it down, as well as being an exhibitor representing the company.

Other responsibilities were producing scale panels for electrical gauges. This involved both pen work and the application of Letraset. Minor hand changes to drawings were also carried out.

During slack periods, skills were enhanced by also producing numerous 3D “solid” drawings of day to day items, which was quite an achievement considering the early version of AutoCAD.

Made redundant in January 2000 due to the down turn in North Sea work.

### **Mar' 1995 to Jan' 1997      Brumac Engineering Ltd. (~50 employees)** **CAD Operator**

- Producing all CAD materials for several engineers and technicians within an engineering company
- Producing as supplied drawings on-site (a docked semi-sub)
- Graphics for SCADA systems
- Assisting with quality systems

Employed as the sole CAD operator, using AutoCAD 12, and responsible for producing all drawings for three engineers and several system/field technicians. Each engineer would be working on different projects so work had to be prioritised and produced to tight schedules. Drawings were mainly for local water authorities, such as panel arrangements, electrical schematics etc., but a period of time was spent in Europort, Rotterdam, producing as supplied drawings on site for the company's Stirling office. Typical drawings were of cable tray and sensor installation. This involved some surveying and climbing around the inside of rig legs (docked semi-sub) to see them in-situ.

As well as the CAD work, graphics for SCADA systems were produced. Some quality system issues were undertaken, such as backing up all the office computers, ensuring equipment was sent for calibration on time and logging / tagging in-coming software and hardware.

## Career Summary – Previous Employment

### **Aug' 1988 to Mar' 1995      Rigserv Ltd. (~20 employees)** **CAD Operator**

- Introduction to design and manufacture within a small independent oil related supplier
- Introduction to very basic 3D CAD
- Producing marketing materials
- Organising social club activities

Initially employed as one of three CAD operators using AutoCAD 2.6 a full range of drawings were produced, from initial proposal, through revisions to final as built. These would include everything from “one-line” diagrams for the whole instrumentation system to construction, general arrangement, electrical, hydraulic and pneumatic.

Within one-year responsibilities expanded to training and supervising up to 5 other draughtsmen.

With newer versions of AutoCAD being introduced, a personal decision was made to start learning about the very basic 3D capabilities within 2D AutoCAD. Very basic 3D elements were introduced to general arrangement drawings, which enhanced these drawings by adding Isometric views. As the 3D capabilities of the software were improved, Line of Sight drawings, from the Driller's viewpoint to the Rotary Table and Derrick were possible. Throughout this employment there was constant contact with the other heads of department and the general manager.

Other responsibilities included producing brochures and colour slides, for marketing and proposals, as well as the running of the small social club, which involved, as examples, organising trips to go skiing, ice-skating, 10 pin Bowling, etc.

### **Oct' 1985 to Aug' 1988      Engineering Surveys Reproduction Ltd. (~50 employees)** **CAD Operator**

- Introduction to CAD and Draughting within a drawing office dealing with the oil industry
- Typesetting
- Training colleagues in software
- Producing computer programmes

Employed as the sole CAD operator (in a large, traditional, drawing office) using Robocom 1500E software on an Apple IIE computer. Initially the work only consisted of Process Loop Diagrams (for an oil major), but the work quickly expanded as the company became aware of the possibilities, to include Battery Layouts, Navigational Aids etc. This work meant being in contact with clients on a day to day basis. Another service provided was visiting client premises, measuring up and producing “virtual” office floor plans fitted out with seats, desks etc. The CAD work was also done at the premises of an oil major using RoboCAD IV software on an IBM PS2 computer.

As well as CAD there was the operation of the computerised phototypesetter, Compugraphic MCS-8208, for all colleagues. In addition, training was given to personnel in the use of the Typesetter and CAD software as well as occasionally participating in manual (cartographic) draughting on a drawing board.

Based on a personal interest in computer programming, a bespoke AppleSoft Basic program was written to illustrate, to the company's head office, the percentage productive work, sick time etc. for the office, wholly based on input of the weekly office timesheets for each colleague. The output was plotted colour graphs which were posted to our head office in London.

## Publications

Industry Technical Papers where I am listed as co-author – Society of Petroleum Engineers (SPE)

**Formation Loading and Deformation of Expandable Sand Screens, SPE 143941**, Presented at the SPE European Formation Damage Conference, Noordwijk, The Netherlands, 7-10 June 2011

**Complex Completion Design and Inflow Prediction Enabled by Detailed Numerical Well Modelling, SPE 168149**, Presented at the SPE International Symposium and Exhibition on Formation Damage Control, Lafayette, Louisiana, USA, 26-28 February 2014

**The Use of Computational Fluid Dynamics to Troubleshoot Excessive Metal Loss in a Carbon Steel Flowline: A Case History, SPE 169640**, Presented at the SPE International Oilfield Corrosion Conference, Aberdeen, United Kingdom, 12-13 May 2014

**Understanding Perforation Geometry Influence on Flow Performance Using CFD, SPE 174194**. Presented at the SPE European Formation Damage Conference and Exhibition held in Budapest, Hungary, 3-5 June 2015

**Upscaling Laboratory Formation Damage Test Data, SPE 199268**. Presented at the SPE International Conference and Exhibition on Formation Damage Control, Lafayette, Louisiana, USA, 19-21 February 2020

Papers presented at Abaqus Finite Element Analysis (FEA) Users Conferences

**FEA Modelling of Expandable Sand Screens**, Presented at the Abaqus Users Conference, Newport, Rhode Island, USA, 19-22 May 2008

**FEA Modelling of Expandable Sand Screens Interactions with Rock Formations**, Presented at the Simulia Customer Conference, London, United Kingdom, 18-21 May 2009

**Cyclic Loading of a Rock Mass for Underground Gas Storage Applications**, Presented at the Simulia Customer Conference, Providence, Rhode Island, USA, 24-27 May 2010

**The use of FEA in sand screen design cuts costs and accelerates development**, Presented at the Simulia Customer Conference, Barcelona, Spain, 16-19 May 2011

Presentations at local Abaqus Finite Element Analysis (FEA) Users Conferences

**A short history of our Abaqus experiences**, Presented at the Simulia Energy User Forum, Mercure Ardoe House Hotel, Aberdeen, 28<sup>th</sup> April 2010

**Sand Screen developments using Abaqus to Cut Time and Costs**, Presented at the Simulia Energy Seminar, Mercure Ardoe House Hotel, Aberdeen, 20<sup>th</sup> April 2011

Presentations and Posters at the SPE European Sand Management Forum

**Numerical Analysis of Expanded Slotted Tubulars**, Poster at the 3rd SPE European Sand Management Forum, Mercure Ardoe House Hotel, Aberdeen, March 2008

**Cyclic Loading of a Rock Mass f/ Underground Gas Storage Application**, Presentation at the 4th SPE European Sand Management Forum, AECC, March 2010

**Numerical Modelling capabilities within Weatherford International Ltd., CFD and FEA**, Poster at the 4th SPE European Sand Management Forum, AECC, March 2010

Presentations at the Sand Management Network (SMN)

**ICD simulations using Computational Fluid Dynamics**, Presented at the SMN Technology Forum, AECC, November 2013

## Education

**1977 to 1983**

### **Hazlehead Academy Aberdeen**

- 6 x Higher Grade Passes
  - Maths (A)
  - Technical Drawing (A)
  - Physics (B)
  - Metalwork (B)
  - English (C)
  - Engineering Science II (Pass)
  
- 2 x CSYS Passes
  - Maths Paper II (B)
  - Maths Paper IV (D)

**1988 to 1989**

### **Aberdeen Technical College Aberdeen**

- Scotvec National Certificate
  - Computer Aided Draughting (Pass)

## Training Courses

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|-----------------------|--|
| <i>August 2001</i>    | PTC, ProEngineer Foundation Course   |
| <i>August 2001</i>    | PTC, ProEngineer Drawing for Designers   |
| <i>September 2001</i> | PTC, ProEngineer Advanced Custom Training                                      |
| <i>January 2002</i>   | Weatherford, Introduction to Adobe Acrobat                                     |
| <i>February 2002</i>  | PTC, ProMechanica Structure Training   |
| <i>August 2004</i>    | Continuum, Project Management for Practitioners                                |
| <i>May 2006</i>       | Onsite Training Services, Banksman/Slinger incorporating Overhead Gantry Crane |
| <i>May 2006</i>       | Wilde, ANSYS Workbench Simulation V10  |
| <i>December 2006</i>  | Abaqus, Introduction to Abaqus   |
| <i>October 2007</i>   | Scottish Training Consultants, Setting Priorities & Keeping Organised          |
| <i>December 2007</i>  | Simulia, Metal Inelasticity in Abaqus  |
| <i>December 2007</i>  | Simulia, Analysis of Geotechnical Problems with Abaqus                         |
| <i>April 2008</i>     | Simulia, Substructures and Submodelling with Abaqus                            |
| <i>April 2008</i>     | Simulia, Abaqus/Explicit: Advanced Topics                                      |
| <i>August 2008</i>    | Evolve, Business Report Writing  |
| <i>March 2009</i>     | CD Adapco, Introduction to CFD (Star CCM+)                                     |
| <i>February 2011</i>  | Simulia, Introduction to Abaqus/CFD  |
| <i>August 2013</i>    | CD Adapco, Introduction to CFD (Star CCM+)                                     |

## Referees

If required, names and contact details for referees can be provided.

## Professional Membership

Society of Petroleum Engineers (member number 3361111)