The PSIG two (2) day Pipeline Simulation Short Course (PSSC) will be held May 14 – 15, 2018. Please visit the PSIG (Conference) website to register online. The cost of the course is $1500.00 US ($500.00 US for students) and includes the conference admission as well. Sign up early as the PSSC is limited to 30 participants (including a maximum of 5 students).

PSSC Agenda

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

LECTURER BIOGRAPHIES

**Dr. Jon Barley**

Jon Barley is Director of Simulation Technology at Emerson - Energy Solutions, now part of Emerson Automation. He began his career in the oil and gas industry in 1989 at the BP Research Centre in Sunbury developing 3D reservoir simulators for modelling enhanced oil recovery. In 1992 he joined Energy Solutions International (formerly Scientific Software–Intercomp) working in the Pipeline and Facilities division. During his time with ESI he has worked on fluid property and simulation software, delivered on-line real time pipeline management systems, undertaken various pipeline engineering consulting studies and provided internal and external training and support on all aspects of pipeline simulation.

Jon received a Bachelor’s degree in Mathematics from the University of York in 1985 and a PhD in Computational Fluid Dynamics from the University of Reading in 1989. He is a Chartered Mathematician through the Institute of Mathematics and its Applications and holds the position of Vice Chairman of the board of the Pipeline Simulation Interest Group.

**Dr. Jason Modisette**

Jason Modisette is Chief Scientist at ATMOS International, Inc. in Anaheim, California. He has been developing pipeline software since 1997, including online and offline models, optimizers, leak detection systems, and other applications for both gas and liquid pipelines.

Jason received a B.S. in Physics from the California Institute of Technology in 1992 and an MS and PhD in Physics from Rice University in 1995 and 1997. He is a member of the board of the Pipeline Simulation Interest Group.

**Dr. Ivor Ellul**

Ivor Ellul began his career in the oil and gas industry in West Germany, as a design engineer on pipeline, storage tank, and refinery systems. After specializing in the modeling of multiphase flow in pipelines, he worked for a number of years in the area of numerical modeling of single and multiphase pipelines under steady-state and transient conditions. He has been involved in various pipeline simulation studies for clients worldwide.

Ivor is industry lecturer to the Petroleum Engineering Department of Imperial College, London where he lectures the MS course on pipeline and process engineering. He served as an advisor on the board of the Faculty of Petroleum Engineering of the University of Houston. He presides as chairman of the board of the Pipeline Simulation Interest Group and as Past Chair of the SPE Gulf Coast Section. Ivor is a Chartered Engineer in the United Kingdom and a registered Professional Engineer in the state of Texas. Ivor received a BS in Mechanical Engineering from the University of Malta, and MS and PhD degrees in Petroleum Engineering from Imperial College, London.

**Ed Nicholas**

Ed Nicholas has been designing, implementing, and supporting real time pipeline modeling applications for 35 years. He managed simulation development at CRC Bethany, Real Time Systems, and Scientific Software-Intercomp before branching out as Nicholas Simulation Services in 1995. He led the development of and currently provides primary support for the leak detection system of the Trans-Alaska Pipeline. His primary clients have been Koch Industries, PRCI, Sacramento Municipal Utility District, Alyeska Pipeline Services Company and Enbridge Pipelines. Ed received a BS in physics and mathematics from Houston Baptist University and a MS in applied physics from the California Institute of Technology.
COURSE CONTENT

Fluid Properties – Dr. Jon Barley

1. Introduction
   Basic Definitions
   Fluid Property Expressions
   Density and Relative Density
   Viscosity
   Heat Capacity
   Heating Value
   The Phase Diagram

2. Gas
   Gas on the Phase Diagram
   Ideal Gas Laws
   Real Gases
   Real Gas Density
   Defining a Gas Mixture
   Empirical Methods of Predicting Real Gas Densities
   Empirical Methods of Predicting Real Gas Viscosity
   Empirical Methods of Predicting Real Gas Specific Heat Capacities

3. Liquid
   Liquid on the Phase Diagram
   General Properties of Liquids
   Liquid Density
   Empirical Methods of Predicting Liquid Densities
   Empirical Methods for Determining Liquid Specific Heat Capacity
   Viscosity
   Non-Newtonian Fluids
   Liquid Mixing

4. General Compositional Fluids
   General Equations of State
   Cubic Equations of State
   Virial Equations of State

5. Fluid Property Calculators & Simulation
   Accuracy
   Formulation
   Computational Effort
   Improving Performance?

6. Vapor-Liquid Equilibrium

Pipeline Flow Equations - Dr. Jason Modisette

1. Introduction
   The Bernoulli Equation
   Enthalpy
   Applying the Bernoulli Equation to a pipe

2. Conservation Laws
   General Form
   Mass Conservation
   Momentum Conservation

3. Energy Conservation
   Kinetic Energy
   Gravitational Potential Energy
   Intermolecular Forces and the Joule-Thomson Effect

4. Friction
   Viscosity and Stress
   Laminar Flow
   Turbulent Flow
   The Moody Diagram
   Friction Factor Forms
   The Smooth-pipe/Rough-pipe Transition
   Modeling the Laminar-Turbulent Transition

5. Pipe Expansion

6. The Thermal Environment
   Steady-State Conduction
   Transient Conduction with Cylindrical Symmetry
   Convection Effects

7. Batches and Composition Changes

8. Numerical Methods
   Direct Integration of Steady State
   Method of Characteristics
   Finite Difference Method
   i. Explicit, Implicit and Semi-Implicit Methods
   ii. Choice of Boundary Conditions
   iii. Handling the Nonlinearities
   iv. Single Network Model vs. Independent Leg Models
Multiphase Flow in Pipelines – Dr. Ivor Ellul

1. The Challenge of Multiphase Flow
   - Empirical Methods
   - Flow Regime Determination
   - Pressure Drop Calculation

2. The Mechanistic Formulation
   - Introduction
   - Flow Regime
   - Liquid Holdup and Pressure Gradient

3. The Formulation of the Transient Two-Phase Equations
   - Formulation Process
   - Physical Models
   - The Two-Fluid Model
   - Conservation Equations
   - Closure Relations

4. Two-Phase Flow Regime Description
   - Separated Flow
   - Distributed Flow

5. Flow Assurance
   - Chemical Deposition
   - Thermo-hydraulic Challenges
   - Design Integration

6. Applications

Real-Time Systems and Leak Detection – Ed Nicholas

1. Some Working Examples
   - Pig and Commodity Tracking
   - Hydraulic Analysis
   - Water Balancing
   - Leak Detection

2. A Review of Limiting Uncertainties - Physics Always Wins/Data is Never as Good as you Want it to Be
   - Fluid Properties
   - Temperature and Properties of Pipeline Surroundings
   - Measurement Factors

3. Real Time Pipeline Modeling Paradigms

4. Dealing with Bad and Missing Data

5. Leak detection
   - Overview of Leak Detection Approaches Fundamentals
   - What Performance Can One Expect?
     i. The False Security of the Normal Distribution
     ii. API 1149 Usefulness and Limitations
     iii. What do Flow Meter Accuracy Specs Really Mean
     iv. Estimating Real World Performance
   - False Alarms – the Causes and Cures

6. Smarter Time Systems
   - Building on the Basics
   - Looking at all of the Data Together
   - Systems that Learn from the Data
   - Expert Systems

7. Recommendations, Conclusions and Reflections
The PSSC starts promptly each day at 8:30 AM. See the table below for schedule details. It is highly recommended to arrive at 8:00 AM to get prepared for the session.

Lunch and coffee breaks are provided.

**PSSC AGENDA**

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<tr>
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<td>12:30 pm – 3:30 pm</td>
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| **May 15**        |                                                 |                 |
| Dr. Ivor Ellul    | Multiphase Flow in Pipelines                    | 8:30 am - 11:30 am |
| Ed Nicholas       | Real-Time Systems and Leak Detection            | 12:30 pm – 3:30 pm |

The PSSC will be held at the same hotel as the PSIG conference – [Stein Eriksen Lodge](https://www.psig.org).

**Questions?**

For additional questions regarding the PSSC, please contact [Dr. Ivor Ellul](mailto:Dr.IvorEllul) or [Dr. Jon Barley](mailto:Dr.JonBarley).

For additional information about PSIG, please visit the PSIG website at [https://www.psig.org](https://www.psig.org) or contact the PSIG Registrar, [Melissa Debevc](mailto:MelissaDebevc).