Flow Assurance for O&G Production System

Maximise Overall Production Through Effective and Reliable Flow Management

PetroSync Distinguished Instructor

Mr. Paul Fairhurst
Managing Director, Fairhurst Flow Assurance Solutions Ltd
Director of Flow Assurance, Cranfield University

- Over 30 years of international oil and gas industry experience
- Specialize in flow assurance, hydraulic design, multiphase flows and thermal management
- Senior Flow Assurance Engineer, BP London, Houston and Bogota (1989 - 2010)
- Chairman of the Imperial College Transient Multiphase Flow JIP, (1981-1989)
- Former Committee Member for the SPE Flow Assurance Forum Series

Course Objectives

- UNDERSTAND the systematic concept of flow assurance and phase behaviour of multiphase flow
- IDENTIFY the challenges and PROVIDE the solutions to flow assurance in pipeline system
- APPLY competently the fundamental principles of fluid mechanics, heat and mass transfer to analyse typical flow assurance systems
- DESIGN basic flow assurance system and efficient operability
- LEARN various system analysis software applications to improve flow assurance in production
- GAIN knowledge in subsea separation and boosting, multiphase metering and production equipment

Specially Designed for

- Production Engineer
- Flow Assurance Engineer
- Pipeline Engineer
- Material Engineer
- Consultant
- Contractor
- Service Provider
- Equipment Supplier
- Researchers
- Managers

The course will be of particular interest to engineers in oil and gas exploration, production and operating companies, consultants, contractors, service providers and equipment suppliers involved in design and operation. In addition, it useful for researchers or managers who wish to understand the technical issues to aid in their decision making.
Flow assurance is a key component in the design and operation of offshore production facilities. As conventional oil reserves decline, companies are developing unconventional fields with complex fluid properties. All these factors mean that flow assurance plays an increasingly important role in the oil and gas industry and employers are frequently seeking skilled engineers in this field. This is particularly true as the industry goes to deepwater, deeper wells and higher temperature and pressure reservoirs.

This course will be cover the fundamentals of flow assurance and the phase behaviour of multiphase flow. Delegates will have an in-depth understanding of the systematic concept of flow assurance. Delegates will also learn the flow phenomena that can help to avoid problems such as hydrate formation, pressure waves, or high viscosity liquid flow failure.

Furthermore, this course will cover potential challenges to pipeline operation including: surge, hydrate formation, wax deposition, multiphase fluids, and slugging. The causes of these issues, design solutions and subsea operational will be an integral part of the course. After the course, delegates will be able apply competently the fundamental principles of fluid mechanics, heat and mass transfer to analyse typical flow assurance system. In addition, delegates will understand the elements of an operability report for subsea production facilities. Theories will be presented along with practical exercise on situational cases in application of the course.

**Course Overview**

Flow assurance is a key component in the design and operation of offshore production facilities. As conventional oil reserves decline, companies are developing unconventional fields with complex fluid properties. All these factors mean that flow assurance plays an increasingly important role in the oil and gas industry and employers are frequently seeking skilled engineers in this field. This is particularly true as the industry goes to deepwater, deeper wells and higher temperature and pressure reservoirs.

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**Course Content**

**Day One: Fundamentals of Flow Assurance**

**Introduction of the Course**

**Flow Assurance**
- The flow assurance environment
- Multiphase pipeline hydraulics
- Production chemistry issues
- Engineering the future

**Fundamentals of Multiphase Flow**
- Definitions
- Flow Pattern prediction
- Pipeline sizing (1), maximum and minimum velocity constraints

**Phase Behaviour & Physical Properties**
- Compositional models, equations of state and phase diagrams
- Black oil models, definition of properties

**Class Exercise: Magnus flow pattern determination**

**IN-HOUSE SOLUTIONS**

Save Cost • Improve Performance • Reduce Risk

Petrosync understands that in current economic climate, getting an excellent return on your training investment is critical. This training can be conducted exclusively for your organization. The course can be tailored to meet your specific needs at your preferred location and time. We will meet you anywhere around the globe.

If you like to know more about this program, please contact Jerry Tay (Conference Director) on +65 6415 4502 or email jerry.t@petrosync.com
Day Two: Flow Assurance for Pipeline System

Production Chemistry
- Properties of oil and condensate reservoir fluids
- Fluid Sampling

Oil & Gas Pipeline Design
- Pipeline sizing (2)
- Thermal management
- Design for wax
- Design for hydrates
- High viscosity issues
- Solids transport
- Pigging

Slugging Flows (1)
- Hydrodynamic slugging description and modelling
- CFD comparisons with hydrodynamic slug flow data

Slugging Flows (2)
- Terrain induced slug flow
- Severe slugging
- Forces due to slugging
- Piping layout
- Slug catcher design

Day Three: Hydrates and Wax

Hydrates and Wax
- Description of hydrates and consequences of formation
- Hydrate control methods
- Testing for hydrates
- Description of wax and consequences of deposition
- Rheology of waxes
- Pipeline cooldown and gel re-start
- Testing for waxes

Case Study:
- Girassol case study
- Thermal management
- Operating procedures
- Hydrate remediation

Scale, Asphaltines and Napthenates
- Scale types, testing and scale management
- Occurrence of asphaltines, laboratory testing and prediction
- Properties of napthenates and mitigation

Gas/Condensate Pipeline Design
- Pipeline sizing
- Liquid inventory management
- Influence of water

PROGRAM SCHEDULE

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>08:00 – 09:00</td>
<td>Registration (Day I)</td>
</tr>
<tr>
<td>09:00 – 11:00</td>
<td>Session I</td>
</tr>
<tr>
<td>11:00 – 11:15</td>
<td>Refreshment &amp; Networking Session I</td>
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<tr>
<td>11:15 – 13:00</td>
<td>Session II</td>
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<td>13:00 – 14:00</td>
<td>Lunch</td>
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<td>14:00 – 15:30</td>
<td>Session III</td>
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<tr>
<td>15:30 – 15:45</td>
<td>Refreshment &amp; Networking Session II</td>
</tr>
<tr>
<td>15:45 – 17:00</td>
<td>Session IV</td>
</tr>
<tr>
<td>17:00</td>
<td>End of Day</td>
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HYBRID TRAINING SOLUTIONS
FOCUSED TRAINING • REDUCED COST • ENHANCED RESULTS
Over the years, there has been a growing demand for hybrid training programs. It is an excellent option to maximize your training dollar for your specific training needs. We make it possible to run a training program that is customized to your training needs at a fraction of an in-house budget! If you like to know more about this program, please contact us on +65 6415 4500 or email general@petrosync.com
**Day Four: System Analysis and Software Application**

**System Analysis & PipeSim Software**
- Components of pressure loss
- System design
- Optimisation
- PipeSim software demonstration

**Maximus Software Demonstration**
- Description of Maximus software
- Building a pipeline layout model in Maximus
- Case studies

**Transient Flows**
- Occurrence of transient flows
- Examples of ramp-ups, severe slugging, pigging, blowdown and cooldowns/warm-up

**Class Exercise**
- Pompano flowrate ramp-up
- Determine theoretical ramp-up surge
- Slug catcher sizing

**Day Five: Flow Assurance for Subsea Development**

**OLGA Software Demonstration**
- Modelling in OLGA
- Case studies

**Subsea Separation and Boosting**
- Managing system energy
- Multiphase pump types
- Experience with multiphase boosting
- Description of subsea separation technologies
- Experience with subsea separation

**Multiphase Metering**
- Why we measure production rates
- Advantages of multiphase metering
- The technical challenges
- The terms and definitions
- The technology status

**Subsea Wells and Completions**
- Tree configurations and equipment
- Well and completion configurations
- Subsea drilling and installation
- Corrosion and corrosion control
- Erosion, erosion/corrosion, design for erosion
- New technology

**Subsea Production Equipment**
- Why choose subsea systems?
- What is a subsea system
- Designing a subsea system
- Subsea wells
- Manifolds and tie-ins
- Flowlines and risers
- Maintenance. Intervention and abandonment
- New technologies and the future

**IN-HOUSE SOLUTIONS**

**SAVE COST • IMPROVE PERFORMANCE • REDUCE RISK**

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Paul Fairhurst is the managing director of his own oil and gas consultancy company which was formed in March 2011. His principal focus is on Flow Assurance at an advanced stage providing reviews and guidance to Flow Assurance studies base on his 33 years of experience and expertise in Flow Assurance design tools and projects. His expertise covers all aspects of upstream oil and gas project execution from concept selection, FEED, to detailed design and construction.

Before starting his own consultancy company, Paul Fairhurst was a Senior Flow Assurance Engineer for 21 years at BP Exploration. He is a leading expert in hydraulic design, multiphase flows and thermal management. As a senior flow assurance engineer, he managed the multiphase flow R&D programme for BP worldwide by providing input to QPR’s. He authored BP guidance documents on Design Issues for Deepwater Development and also the BP Multiphase Flow Design Manual. Additionally, he guided the BP software requirements on transient multiphase flow simulation and produced a white paper on new-generation software tools. Paul also managed a validation suite for testing commercial software products and was involved in numerous field trials and data analysis activities, primarily related to slugging flows. He undertook numerous technical studies for BP and professionally represented the company at partner meetings and peer reviews. He was the manager of the BP Multiphase Flow R&D program. Paul was involved in technical service work as well, where he was responsible for all BP’s work using the new breed of commercial transient multiphase flow simulators PLAC, OLGA, PeTra and TACITE including testing and validation studies.

**PROFESSIONAL ACTIVITIES**
- Chairman of the Imperial College Transient Multiphase Flow JIP 1981 - 1989
- Former committee member for the SPE Flow Assurance Forum Series
- Member of Institute of Petroleum (now Energy Institute) and was on the advisory committee for the Design of Thermal Management Systems guidelines.
- Member of the Cranfield University Industrial Steering Committee of the Process Systems Engineering MSc Course.

**PUBLICATIONS**
Course Details
Title: FLOW ASSURANCE FOR OIL AND GAS PRODUCTION SYSTEM
Date: 11th May 2015 - 15th May 2015
Location: Bali, Indonesia

INVESTMENT PACKAGES

<table>
<thead>
<tr>
<th>Investment Package</th>
<th>Deadline</th>
<th>Price</th>
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<tbody>
<tr>
<td>Standard Price</td>
<td>8th MAY 2015</td>
<td>SGD $ 5,995</td>
</tr>
<tr>
<td>Early Bird Offer</td>
<td>10th APR 2015</td>
<td>SGD $ 5,795</td>
</tr>
<tr>
<td>Group Discount (3 or more)</td>
<td>8th MAY 2015</td>
<td>10% discount for groups of 3 registering from the same organization at the same time</td>
</tr>
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Group Discount is based on Standard Price
* To enjoy the promotion & discount offer, payment must be made before deadline
* For 7 or more delegates, please inquire for more attractive package.
* Prices include lunches, refreshments and materials. Promotion & discount cannot be combined with other promotional offers.
* Important: Please note that registration without payment will incur a SGD 200 administration fee.

DELEGATES DETAILS

1st Delegate Name __________________________________________
Direct Line Number: _______________________________________
Email: ____________________________________________________
Job Title: _________________________________________________
Department: ______________________________________________
Head of Department: _________________________________________

2nd Delegate Name __________________________________________
Direct Line Number: _______________________________________
Email: ____________________________________________________
Job Title: _________________________________________________
Department: ______________________________________________
Head of Department: _________________________________________

3rd Delegate Name __________________________________________
Direct Line Number: _______________________________________
Email: ____________________________________________________
Job Title: _________________________________________________
Department: ______________________________________________
Head of Department: _________________________________________

INVOICE DETAILS
Attention Invoice to:
Company: _____________________________
Address: _____________________________
Fax: ________________________________
Industry: ____________________________
Postcode: ____________________________
County: ______________________________
Email: ______________________________

Please note:
- Indicate if you have already registered by Phone Fax Email Web
- If you have not received an acknowledgement before the training, please call us to confirm your booking.

PAYMENT METHODS

By Credit Card: Please debit my credit card: □ Visa □ MasterCard □ AMEX □ Security Code: ____________
Card Number: _____________________________ Expiry Date: ________________
Name printed on card: ______________________

By Direct Transfer: Please quote invoice number(s) on remittance advice
PetroSync Global Pte Ltd Bank details:
Account Name: PetroSync Global Pte Ltd
Bank Name: DBS Bank Ltd
Bank Code: 7171 • Bank Swift Code: DBSSSGSGXXX • Branch code: 288
Account No.: • SGD: 2889018980 • USD: 0288002662016
Bank Address: 12 Marina Boulevard, Level 3, Marina Bay Financial Centre Tower 3, Singapore 019882
All bank charges to be borne by payer. Please ensure that PetroSync Global Pte Ltd receives the full invoiced amount.

I agree to PetroSync’s terms & conditions, payment terms and cancellation policy.

Authorized Signature: _____________________________

PAYMENT TERMS: Payment is due in full at the time of registration. Full payment is mandatory for event attendance.

TERMS AND CONDITIONS

DISCLAIMER
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CANCELLATION POLICY
You may substitute delegates at any time as long as reasonable advance notice is given to PetroSync. For any cancellation received in writing not less than fourteen (14) working days prior to the training course, you will receive credit voucher less a SGD 500 administration fee and any related bank or credit card charges.

Delegates who cancel less than fourteen (14) working days of the training course, or who do not attend the course, are liable to pay the full course fee and no refunds will be granted.

70% ATTENDANCE IS REQUIRED FOR ISSUANCE OF PETROSYNC’S CERTIFICATE.

CERTIFICATE OF ATTENDANCE

Payment Terms:
- For Payment by Direct Telegraphic Transfer, client has to bear both local and overseas bank charges.
- For credit card payment, there is additional 4% credit card processing fee.

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DETAILS

Please accept our apologies for mail or email that is incorrectly addressed. Please email us at registration@petrosync.com and inform us of any incorrect details. We will amend them accordingly.

CHARGES & FEE(s)
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Course Confirmation

Authorized Signature: _____________________________

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