

# Educating Subsea Workforce of Tomorrow: Global Subsea University Alliance

Prof Ekaterina Pavlovskaja  
University of Aberdeen  
e.pavlovskaja@abdn.ac.uk



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# The Global Subsea University Alliance

*Partners in Advancing Subsea Engineering Through Research and Education*



Director:  
Prof. Ekaterina Pavlovskaja



UNIVERSITY  
OF ABERDEEN



HØGSKOLEN  
I BERGEN  
BERGEN UNIVERSITY COLLEGE



UNIVERSITY of HOUSTON  
CULLEN COLLEGE of ENGINEERING



UNIVERSIDADE FEDERAL  
DO RIO DE JANEIRO



NUS  
National University  
of Singapore



Curtin University

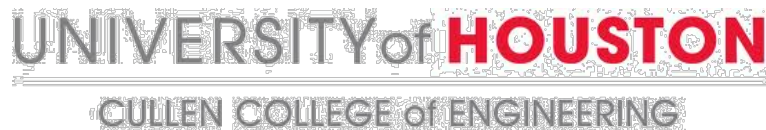
# Important partner similarities

## Initiation of Global Subsea Engineering Curricula

- Our Universities have Solid Industrial Partners
- Our Universities are Good Listeners
- Our Universities are Entrepreneurial and Agile



## Preexisting Individual Subsea Programs



# Genesis of the Partnership

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- Energy is the 21<sup>st</sup> Century Engineering Grand Challenge
- Energy solutions exist in ultra deepwater locations
- Our cities serve as home to the same O&G Companies
- O&G Engineering has no borders
- Governmental regulations require continued education
- Universities are trying to reach beyond our silos and utilize complementary key competence and infrastructure

# Voice of the O&G Companies

## *Top Rated Subsea Specific Items*

- Flow Assurance
- Low External Temperatures
- HPHT O&G Production
- Ultra-Long Distance Tiebacks in Severe Environments
- Corrosive Environment
- Reliability and Integrity of Complex Systems

## *Top Rated Engineering Specific Items*

- Engineering Efficiency
- Systems Engineering and Integration
- Fault Tolerant Design
- 30 Year Operational Life
- Autonomous and Intelligent Operation

# Defining a Core Subsea Engineering Education

## Core Curriculum Definition Process

- Voice of the Customer (O&G Companies)
- Benchmark partners' individual curriculum
- Synthesize findings into a common core subsea engineering curriculum
- Final review among partners and our advisory boards
- Implement the Global Subsea Curriculum

# Core Subsea Curriculum

## Core Courses

Flow Assurance

Materials &  
Corrosion

Subsea Systems

## Associated Courses

Pipeline Design

Riser Design

Computational  
Subsea Engr

## Selected Supporting Courses

Multiphase Flow

Heat Transfer

Fluid Dynamics

Mechanics

Reliability

Safety

# Course Inventory Among Partners

Course Name	UH	NUS	Curtin	Aberdeen	UFRJ	BUC
Flow Assurance	X	X	X	X	X	X
Materials and Corrosion	X	X	X	X	X	X
Pipeline Design	X	X	X	X	X	
Riser Design	X	X	X	X	X	X
Subsea Controls and Systems Integration	X	X	X	X		X
Subsea Construction & Operational Support		X		X		
Subsea Processing and Artificial Lift	X		X		X	
BOP Design	X					
Subsea Computational Methods	X				X	



# The Global Subsea University Alliance

## Education Goals

- Implement the Core Subsea Engineering Curriculum
- Enable International Course and Curriculum Sharing among the Alliance Partners
  - On-line streaming, MOOCs
  - Student exchange
- Host Workshops and Software Training
- Recruit other universities to provide a subsea engineering education.

# The Global Subsea University Alliance

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## Research Goals

- Establish international subsea research facilities available to the Alliance Partners
- Perform pre-competitive research among the Alliance partners.
- Build qualification and testing facilities coupled to workforce development.
- Faculty mobility



# Bergen University College

## **Expert competence areas:**

- Materials and Structural Integrity
- Condition Monitoring
- Multiphase Flow Measurement and Assurance

## **Key infrastructure and laboratories:**

- Ship model tank
- Multiphase Flow Loops (CMR and Univ. Bergen)
- Structural Integrity Test Laboratories (incl. DNV)

## **Important local partners in addition to industry:**

- GCE Subsea, University of Bergen, NTNU, CMR, Subsea Valley, TeknoVest, CCB and other OG supply bases



## **Expert competence areas:**

- Multiphase Flow Measurement and Assurance
- Subsea infrastructure (particularly ROV/AUV)
- Corrosion
- 3-Phase core flooding
- IFT and injectivity analysis
- Drilling engineering
- Subsea vibration and temperature sensors
- Composite pipes.

## **Key infrastructure and laboratories:**

- Corrosion Centre
- National Geosequestration Centre
- 2-phase Flow Loops (liquid and gas)
- 3-Phase core flooding lab
- IFT analysis lab
- Materials testing/Marine Sciences Labs
- 2- CO2 injection test sites and experimental 3D seismic operations
- Pawsey supercomputer centre

## **Important local partners in addition to industry:**

- DnV, FMC, Shell, Woodside, BHPB, Intecsea, GE O&G, Baker Hughes, SUT, SEA, Technip, Chevron, Fugro, Henderson fabrication facility

## Expert competence areas:

- Multiphase Flow: Experimental Multiphase Flow Research, Empirical Multiphase Flow Modelling.
- Heavy Oil Multiphase Flow Research and Modelling.
- Development of Novel Offshore and Subsea Multiphase Equipment: Multiphase pumps, Multiphase Jet Pumps, Compact Separators, Produced Water Filtration Systems.
- Testing of Multiphase Flow Equipment: Multiphase Flow Meters, Multiphase Pumps, Compact Separators.

## Some Key infrastructure and laboratories:

- Three-Phase Oil-Water-Air Flow Loop
- Three-phase process separator and oil & water storage
- Heavy Oil Multiphase Flow Loop

## Expert competence areas:

- **Modeling:** Linear and Nonlinear System Identification; Physics Based Modeling, Online Adaptive Modeling, Automated Data-Driven Modeling, Dynamic Systems Analysis.
- **Automatic Control:** Linear and Nonlinear Feedback Control, Data-Driven Controller Identification, Feedforward Control, Multivariable Control Systems, and Adaptive Control.

## Subsea Engineering Experience:

- **Model Based Methods in**
  - Subsea Machine Diagnostics, Prognostics and Performance Monitoring; Multi-Phase Flow and Heat Transfer Modeling in Pipelines / Multi-Phase Fluid Pumps; Optimization and Analysis Led Design of Subsea Architectures; Fluid Power (Hydraulic) and Hydraulic Fracturing Modeling; Subsea Systems Integration
- **Automatic Control of**
  - Subsea Blowout Preventers; Multi-Phase Fluid Pumps and Electric Motors; Well and Manifold Multivariable Pressure and Flow Control; Dual Gradient Drilling; Autonomous ROV Tasks

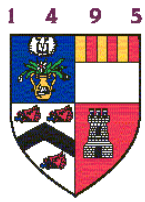


## Expert competence areas:

- Static and dynamic analysis of submarine risers and subsea pipes
- Experimental analysis of structures
- Integrity of intact and damaged onshore and offshore structures
- Inspection and monitoring of offshore structures; Risk based inspection of structures and equipment
- Maintenance and repair of offshore structures and equipment
- Reliability of, floating and submarine structures and systems
- Flow assurance
- Alternative materials (composites, intelligent materials, materials for high temperature high resistance steels, etc.)
- Artificial reefs
- Wave energy technologies

## Key infrastructure and laboratories:

- Subsea Technology Laboratory
  - Horizontal and vertical hyperbaric chambers, and thermal-hyperbaric chamber
  - Fatigue testing apparatus for rigid pipe welding joints
  - Flow loops for sensor calibration and simulation of different gas-liquid flow patterns
- Well Technology and Engineering Laboratory
  - True Triaxial cell
  - HP/HT Multiphase Flow Loop Test Facility
  - Drilling mud flow loop test bed
  - Virtual Drilling Rig Facility



# University of Aberdeen

## Subsea Technology Research Directions:

- Decommissioning (underwater laser cutting)
- Subsea Sensors and wireless networks
- High Voltage DC Networks
- Resonance Enhanced Drilling
- Composite Materials Modelling
- Fluid Structure Interaction Modelling
- Iceberg – soil - pipeline interaction studies

## Key infrastructure and laboratories:

- Fluid Open Channel and Oscillatory Flow Tunnel Facilities
- High Pressure-High Temperature (HPHT) Facility
- Resonance Enhanced Drilling and Drill String Dynamics Laboratories
- Optical Engineering and Power Electronics Laboratories
- Oceanlab



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Thank you

[www.subsea-alliance.org](http://www.subsea-alliance.org)