

Coriolis Timeline – 1994 - 2025



Department for Business, Energy & Industrial Strategy

National Engineering Laboratory

FUNDED BY BEIS

Impacts

Underpins density measurements in offshore oil & gas sector (replacing densitometers)

Improved measurement uncertainty under high temperature and pressure conditions reducing financial exposure

Supports extraction of heavy oil from fields which previously faced challenges due to high viscosities

Supports implementation of appropriate technologies for new cleaner fuel applications



Coriolis ISO 10790

National Engineering Laboratory participated in the creation of the ISO standard 10790: Measurement of fluid flow in closed conduits - Guidance to the selection, installation and use of Coriolis flowmeters

Coriolis Calibration techniques

National Engineering Laboratory took part in lab intercomparison researching comparing multiple calibration techniques. The effects of fluid temperature & fluid properties on meter calibration results were also researched

Application to Gas Flows

National Engineering Laboratory researched the performance of Coriolis flowmeters in gas use at a range of pressures. This work provided traceable data at elevated gas pressures that was disseminated to industry

Two Phase Flow Studies

Research targeted air entrainment in fuel bunkering applications. Data collected by National Engineering Laboratory was used as the foundation for standards in fuel bunkering in Singapore. Work was further extended using large (8") meters

Industry Guidance Note

Research established that installation and set-up had a significant effect on measurement accuracy. National Engineering Laboratory produced a guidance document for industry

UK National Standards Oil Facility Upgrade to Evaluate Coriolis Flow Meters at High Viscosities

Changes made to reflect industry need to ensure accurate reference measurement in higher viscosities flows

Carbon Capture and Storage

Use of Coriolis meters for measurement of CO2 density and flow in carbon capture and storage applications

Coriolis Diagnostics Explored

Aim was to look at using extensive diagnostic tools and data such as drive gain, tube frequency and amplitude to improve measurement accuracy

Coriolis Multiphase Flow Research

Meters were evaluated with correlations derived for three phase flow. This was one of the first such experiments performed in a traceable laboratory

Small Bore Meters at High Pressure

Provided vital data on small Coriolis meters operating at high liquid pressures. Meters were being used in applications for chemical dosing with little known data available

Upgrade of Multiphase Flow Loop Densitometers

Changing the densitometers on the liquid lines of the multiphase flow loop to Coriolis meters in order to improve accuracy and increase monitoring of impurities. This has been enabled by improvements in Coriolis technology to greatly increase density measurement accuracy

A Review of Coriolis Meter Performance at Elevated Temperature and Pressure Conditions

To improve the knowledge of industry, National Engineering Laboratory will publish a review of Coriolis meter performance when calibrated at elevated conditions at National Engineering Laboratory's EPAT facility

Coriolis Devices Used as Liquid Reference Meters on Advanced Multiphase Facility

Coriolis meters are used as reference devices for the first time at National Engineering Laboratory. This advancement which allows mass and volume flow, as well as density measurement, from a single device, and is enabled by traceability to National Engineering Laboratory's EPAT facility covering the high temperatures and pressures required

Further Research on New Coriolis Densitometer Devices

Using National Engineering Laboratory's liquid densitometer calibration facility to conduct research into the robustness and reliability of this new design as it becomes more widely used in place of traditional densitometers

Supporting the hydrogen economy

Development of calibration facilities and understanding of the process parameters effecting uncertainty when using Coriolis flow meters for high pressure hydrogen

High pressure, pulsed flow

Development of Coriolis metering technology and associated calibration facilities for high pressure, pulsed flow applications in diesel engine fuel injectors

Pressure Effects on Coriolis Flow Meters

Flow programme project to collect definitive data on the effect of pressure on Coriolis flow meters with a view to revising ISO 10790

New Generation Signal Processing Research (PRISM)

Collaboration with Oxford University where the advances in experimental signal processing techniques (PRISM) are to be researched. (Crossover with Density roadmap)

Digital and Data

Collaborative project to examine new signal processing techniques and big data approaches as applied to Coriolis flow meters

Coriolis ISO 10790 Revision

National Engineering Laboratory helped review the ISO 10790 when up for revision

Two Phase Flow Research with Vertical Installations of Coriolis Meters

Research in vertical flow concluded an effect on Density. Conditions were simulated from a Oil production platform and validated against field data

Cryogenic Mass Flow Metering

Research conducted with the objective of establishing standards for Cryogenic flow measurement for UK Department of Trade. Calibrations performed on liquid nitrogen at -193°C provided a unique data set on technology performance at these temperatures

Application to Non-Newtonian Flows

Research aimed at understanding technology performance in other process industries specifically looking at Coriolis meter performance in Non-Newtonian fluids

Temperature, Pressure and Viscosity Effects JIP

Collaborative project with three manufacturers to examine the influence of process conditions on Coriolis flow meters. As a result the UK regulator (OGA) updated guidelines to state that meters must be calibrated under conditions as close as possible to those they would see when in service. It was also highlighted that a facility with the capability to do such calibrations did not exist, paving the way for National Engineering Laboratory's EPAT facility.

Coriolis Two Phase Flow Research

Research using diagnostic data provided a correction method for the presence of gas in liquid flow to improve measurement accuracy

Improvement in National Standards Infrastructure

To reflect industry need to have reference measurements at operating conditions, BEIS & National Engineering Laboratory developed Elevated Pressure & Temperature (EPAT) facilities

EPAT UKAS Accreditation

National Engineering Laboratory facility receives UKAS accreditation for calibrations up to 100 bar and 80°C. This provides industry with confidence in the facility, as such, a significant proportion of Coriolis flow meters used in the North Sea are now calibrated at National Engineering Laboratory

New Generation Densitometer (Coriolis Design)

Liquid densitometer facility used to validate performance of new generation densitometer (Coriolis design). Research from EngD contributes to providing manufacturer with a unique dataset that clearly shows operating capability of the device

Knowledge Transfer

- Guidance document on using Coriolis meters in high viscosity, low Reynolds fluids
- Best practice guide for the use of Coriolis flowmeters
- Installation & set-up of Coriolis meters (Update)

Coriolis ISO 10790 Revision

National Engineering Laboratory lobby for revision of Coriolis ISO standard to include National Engineering Laboratory research into Reynolds number, pressure, viscosity and temperature effects. This will provide end users with definitive guidance on the use of Coriolis meters

Increasing sensor densities on Coriolis meter

Potential collaborations to look at the benefits of increasing sensor densities on Coriolis tubes to allow more accurate measurement

Ambient Effects - Future Work

Using new algorithm from EngD research to partner with multiple meter manufacturers and further research activities

Multiphase JIP

Potential JIP using National Engineering Laboratory's Advanced Multiphase Facility to examine the use of Coriolis meters for multiphase flows

- STANDARDS AND INDUSTRY GUIDANCE
- INTERNAL RESEARCH
- CAPABILITY DEVELOPMENT
- COLLABORATIVE WORK WITH EXTERNAL PARTNERS
- JOINT INDUSTRY PROJECTS (JIP's)