
EXPRO

Brown Field Monitoring and Optimization using Modern and Robust Techniques

Mohamed Raafat – Account Manager

Bio

Expro Bio

Expro is the visionary full cycle energy services expert offering novel, insightful solutions, dependable competency and award-winning safety.

Combining innovative, future-facing technology with high-quality data across well construction, well flow management and production, subsea well access and well integrity and intervention, we have a reputation for extraordinary performance that keeps your operations running smoothly.

Speaker Bio

Mohamed Raafat – Account Manger
Mohamed is a Petroleum Engineer with +9 years of experience, he has joined Expro in 2014 as Well Testing Field Engineer then held the positions of:

- Application Engineer
- Operation Support Engineer
- Technical Sales Engineer
- Acumen Product Line Champion

Currently he is managing some key accounts of Expro Egypt in Well Testing, DST, TCP, and Well Interventions and Integrity.

Brown Field Monitoring and Optimization using Modern and Robust Techniques

Agenda

- Brown Field Characteristics
- Brown Field Monitoring and Surveillance techniques
- Expro Metering solutions suite
- Sonar Meter and Flared Gas Measurement
- Selected Case Studies

Brown Fields Characteristics

Brown fields are characterized by having unconventional or depleted reservoirs producing either heavy oil, sour fluids or from tight pays.

A major key point is the increase of the produced associated gas and water breakthrough introduce a new problem of production lines and facilities bottlenecking.

These specs put field surveillance a priority to early detect issues before it adds up affecting the whole field production and integrity

Having upstream and midstream facilities designed to handle and monitor specific range of fluids amounts; with production parameters and composition change in mature or brown fields, these facilities can’t efficiently handle or monitor the new production parameters.

Brown Fields Monitoring and Surveillance Techniques

Conventional well testing is reliable and accurate however the pace of data requirement can't be achieved using conventional well testing.

The new techniques of production surveillance provide flexibility and pace by allowing multiple spots testing in short time with high accuracy.

The flexibility of the new techniques coming from the small footprint, reduced workforce and reduced logistics handling depending on the application.

Expro has the capability of providing several monitoring and measurement techniques including the conventional, unconventional, and new technologies which can be retrofitted and customized according to the application of interest.

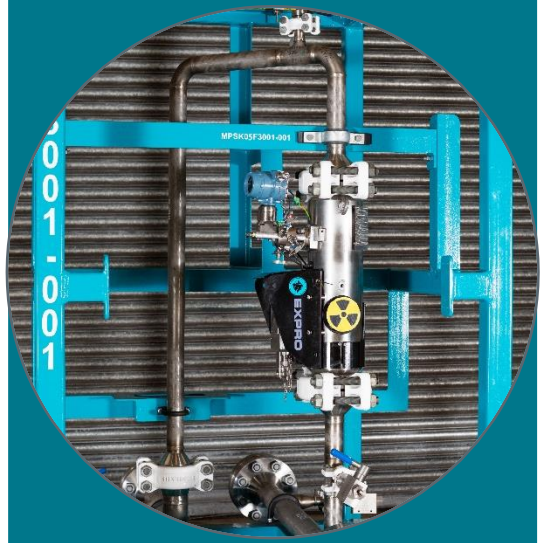
"Data surveillance and acquisition are very crucial for mature field development. Surface facilities de-bottlenecking is adding considerable positive value for the hydrocarbon recoveries"

Expro metering solutions suite

SONAR

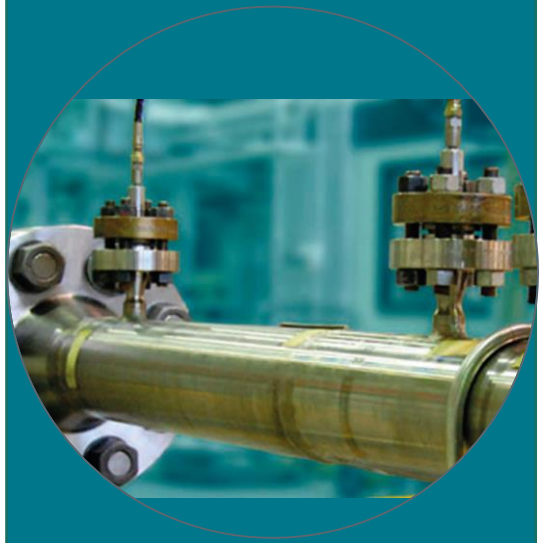
Clamp on/non intrusive
Low impact ops
Remote locations
Single/multiphase

MPFM



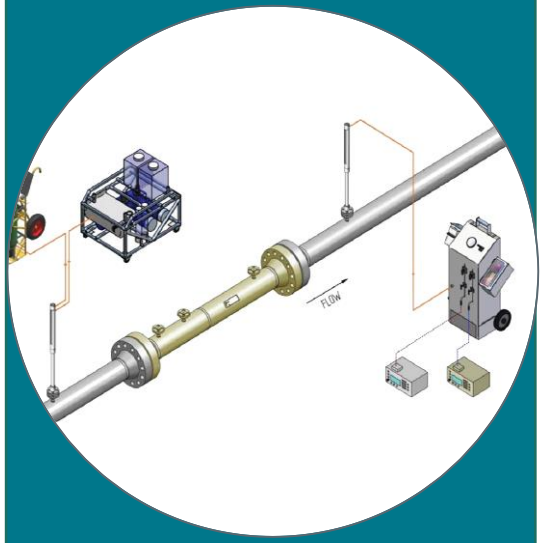
Fluid fraction measurement
Portable
Configurable
Multiphase

Wet Gas



Gas condensate
10% liquid loading
Continuous metering
Fixed or portable

Value add measurements



MultiTrace- phase verification
PVT sampling

Full suite of measurement techniques and capabilities

Core applications

Surveillance

Wellhead surveillance

- Oil and Gas/Gas Condensate wells
- Water and Gas Injection

Production optimisation

- Gas lifted wells
- ESP wells

Well remediation

Pre and Post Intervention

- Stimulation
- Reperforation

Facility adaptation

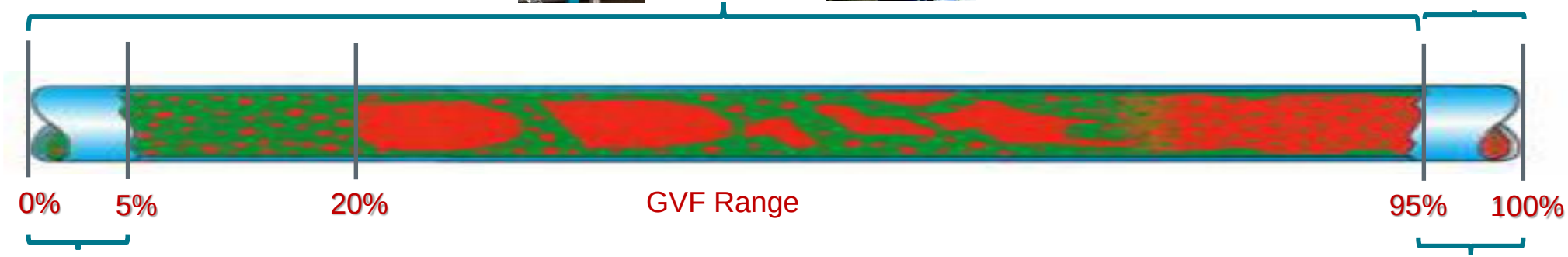
- Fuel gas optimization
- Separator Outlets assessment
- Flared gas measurement

Operating Envelope

MPFM 2600

PassiveSONAR

ActiveSONAR



ActiveSONAR

Wet Gas Meter

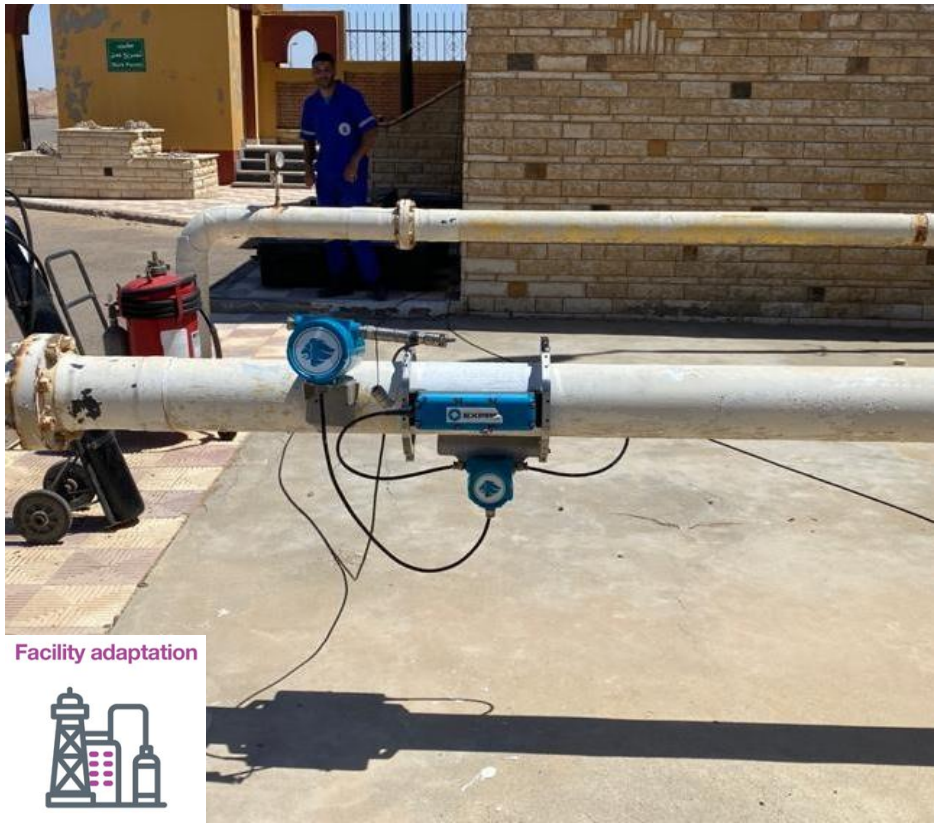
Full suite of measurement techniques and capabilities

Acumen

Non-intrusive solution for in-line ultrasonic meter verification

Customer challenges:

- General Petroleum Company (GPC) had concerns about their actual fuel gas consumption from the natural gas supply line provided by the distributor to their oil plant. They believed the in-line ultrasonic meter for custody transfer was reading higher and as a result, they were paying an estimated $40K per month for gas they do not consume
- GPC needed to measure the gas flow rate within a reliable accuracy range without stopping or diverting the gas flow
- A replacement in-line ultrasonic meter for custody transfer was believed to be required to assure the reliability of the distributor flow rates and the customer wanted to verify the functionality before any additional CAPEX investment • An intrusive measurement device would require stopping or diverting the gas flow which could result in the partial shutdown of the facility • Expro were approached to provide an optimal and robust non-intrusive measurement solution to verify the gas flow rates



Expro excellence:

- Expro supplied a 4-inch and 6-inch clamp-on ActiveSONAR supported by a metering technician to measure multiple branches on the natural gas supply line from the distributor to GPC's plant
- The flowlines were insulated with a thick layer of polyethylene (PE) which could not be removed and therefore Expro provided a specifically designed adaptor to ensure a robust meter installation
- Data was provided over an 8-hour test period simultaneously on both branches
- The operation was performed with a very small footprint and required a minimal crew to operate and no power generators were used

Value to the client:

- GPC received a non-intrusive solution with no disruption to supply
- The customer was also able to verify the distributor rates provided by the in-line ultrasonic meter and was able to precisely spot check the gas consumption without any shutdown or disruption
- Expro's non-intrusive solution proved that the inline ultrasonic meter was functioning properly and saved GPC the cost of purchasing a replacement custody transfer meter or calibration of the existing one

Acumen

Assistance in improving field management

Customer challenges:

- The operator is one of the largest hydrocarbon producing joint ventures (JV) in Egypt. The operator has various black oil onshore and offshore fields located in the Gulf of Suez
- These fields are mature and the customer continues to maximise production while minimising capital investment in the assets
- The customer wanted access to a reliable non-intrusive flow metering solution across all process conditions without any facility modifications in order to facilitate inline metering where no existing metering was available. A specific project was reservoir injectivity performance assist with pressure support management
- The customer wanted to optimise gas-lift measurements, monitor water injection to the reservoir at the wellhead and facilities whilst determining the surface flow line network capacity

Expro excellence:

- Traditional testing methods were not feasible in terms of operational efficiency as well as costs due to the requirement of flow line shut-in and space constraints on the platforms
- Our ActiveSONAR flow meters were deployed to the facilities both on and offshore in a range of sizes from 2-inch to 24-inch
- Work was performed efficiently across a large number of locations without disruption to ongoing production activities
- 46 tests were carried out over a six week period with up to two tests being successfully performed each day (12 hour shifts)

Value to the client:

- Small footprint and operational efficiency allowed same flow lines to be tested at different locations for a better understanding of subsea pipeline network and detection of potential leakage subsea
- OPEX vs CAPEX by avoiding permanent facility modifications
- Portable power supply and pressure/temperature gauges allowed operation to be independent of platform utilities
- The reporting of preliminary data was within 24 hours and delivery of the final report within 72 hours on average
- The availability of injection data will allow for improvement of reservoir field management, validate assumptions for reservoir simulation, and flow performance models

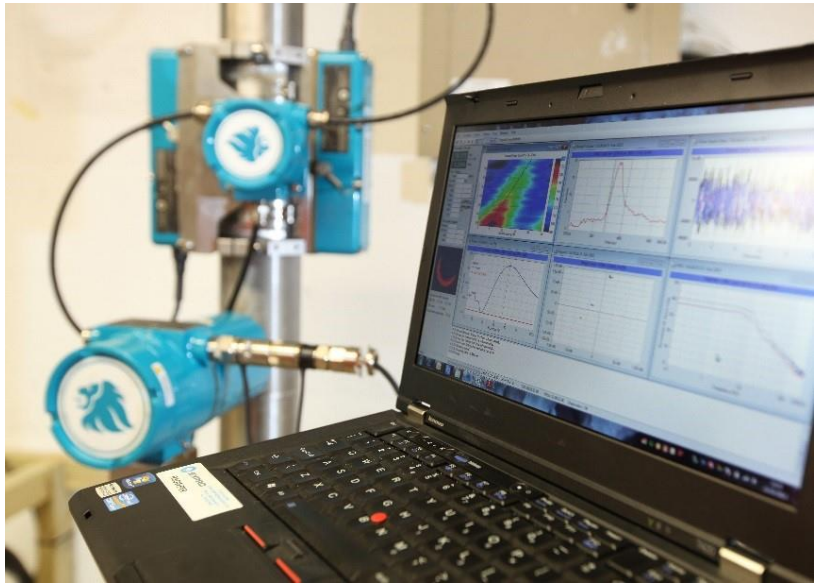
Sonar Meter and Flared Gas Measurement

One of the key challenges in Brownfields is the increased amount of flared gas due to exceeding facilities design rates of gas with the increased associated gas production.

Expro has deployed Sonar Meter to qualitatively and quantitively assess the amount of flared gas which will be future basis for optimization and recovery plans.

Expro successfully completed multiple flared gas measurement campaigns inside and outside Egypt and helped the operators to assess their current situation and put future feasible plans for recovery.

Flared gas measurement is part of Expro “Citizen of the world” campaign of achieving net zero CO2e emissions by 2050, this is inline with COP27 objectives.



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ActiveSONAR contributes to “zero flaring” gas compression

Customer challenges:

- A customer in the Middle East required four gas compression packages
- Flow rate measurements and diagnostics are essential for multiple separator gas outlets in the customer’s process facility for compressor design sizing and fulfilling their “zero flaring” gas compression project

Expro Excellence:

- Expro proposed a non-intrusive clamp-on ActiveSONAR meter
- Different sizes 4in, 6in and 8in were installed on high pressure and low-pressure separators across the customer’s process facility
- Real-time flow rate data was provided covering a wide range from 1500-27000 Sm3/d
- SONAR meter diagnostics indicated unstable flow that correlated with upstream operations
- SONAR meters were also able to qualitatively identify liquid carryover and the presence of wetness in certain separator gas outlets

Value to the client:

- The customer received an integrated solution with SONAR meters and multiple Expro product lines
- Provided insight into liquid carryover in the gas tree which could have potentially led to inefficient compression and equipment damage
- Provided the customer with additional separator stream to unload the liquid and optimise facility throughput before the installation of compressors
- Non-intrusive measurements ensured proper design sizing for the compressors and helped achieve “zero flaring” gas compression
- The customer could certify that their process plants were running at maximum efficiency

Acumen

Contribution to a zero flare campaign in Nigeria

Customer challenges:

- As a signatory to the zero routine flaring commitment agreement by oil and gas producers, Nigeria is enforcing stricter regulations with more severe penalties on operating companies failing to meet zero flaring requirements
- To commercialise the associated gas being flared an accurate, portable metering system was required to determine the most economical method to modify facilities to process the gas
- Expro was asked to measure the gas flared on all flow stations where little or no metering was installed or available

Expro excellence:

- Expro during the flare measurement project installed metering on all the flare lines on each flow station to ascertain the total amount of gas which was flared on each flow station on a daily basis
- Various meter sizes were installed on multiple measurement locations with minimal footprint and no disruption to production
- Flare measurements have been carried out on high pressure low pressure separators and flow lines. The pipe sizes ranged between 6" and 24"

Value to the client:

- Operating company was able to accurately report flare gas and reduce penalties
- The customer implemented process upgrades to further minimise the requirement to flare
- The operator also identified a potential variation in a new wells GOR that initiated remedial intervention

Acumen

Optimisation of gas lift network performance

Customer challenges:

- Artificial lift (gas lift) optimisation for an unmanned platform in a mature field in the North Sea
- The customer was calculating gas lift injection rates based on the choke size, with no actual volumetric measurement
- Expro was approached to confirm the validity of the calculated gas lift injection rates for well performance modelling
- The customer wanted to inject gas at different rates by adjusting the choke size to verify if the produced oil rates were optimised by observing Tubing Head Pressure (THP) and the oil rate

Expro excellence:

- Expro mobilised one field technician and one meter set to complete the operation, highlighting how compact, flexible and how easily mobilised our system is
- Expro performed a surveillance campaign moving a 2-inch ActiveSONAR meter to test 6 different gas lift injection lines
- The injection choke sizes were adjusted from 100% to 25% to determine the optimal gas lift rate

Value to the client:

- Each well was successfully tested within a 24-hour period, including rig up, multi-rate choke test and rig down
- SONAR meter diagnostics **indicated unstable gas flow** in all 6 lines at the higher choke settings. This insight confirmed there was **insufficient** gas supply leading to suboptimal performance of the injection network and associated loss of net oil production
- SONAR meter diagnostics indicated that there was **wetness in the lift gas system** which prompted the customer to perform maintenance on the upstream dehydration plant
- 5 of the 6 wells were successfully tested at multi rates. One well had a change in choke size, but this did not yield any change in gas lift rates or associated production rates which indicated that the **choke was non-functional** and prompted the customer to perform maintenance
- Expro was able to optimise production improving overall oil production, identify plant issues and assist the customer with improving gas lift modelling

Well Flow Management | Acumen

Mature gas field, North Sea – Spirit Energy (Centrica), SPE-171712

Customer challenges:

- Monitoring wellhead production rates on 44 wells across 6 platforms in a mature and declining gas field
- Most wells suffering with water breakthrough and salt build-up
- Legacy wellhead Venturi meters out of range and in disrepair

Expro Excellence:

- Initial wellhead surveillance campaign using clamp-on sonar meters
- Subsequent permanent meter installation on each well
- Meters directly integrated into existing SCADA system

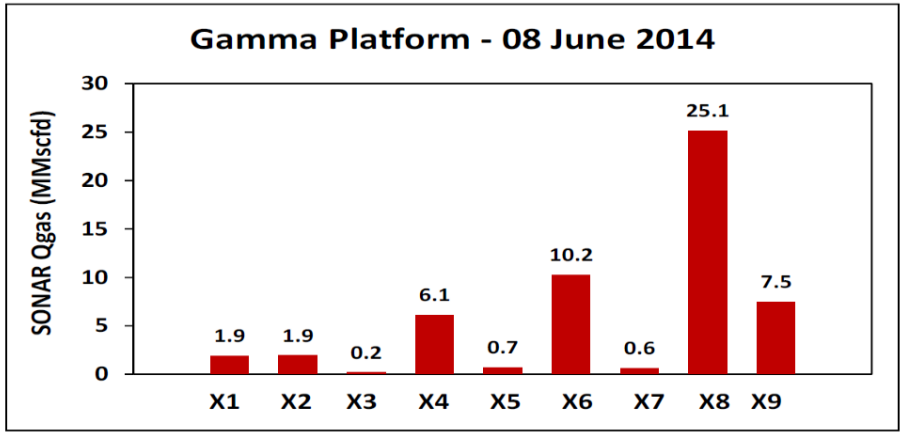


Figure 5: Individual Well Production Gamma Platform – Jun 2014

SONAR meter is currently being used for production allocation for all wells, when previously it was done by WHP and WHT trending.

Value to customer:

Wellhead Monitoring

- High resolution well production allocation data
- Identify underperforming wells and liquid loading behavior

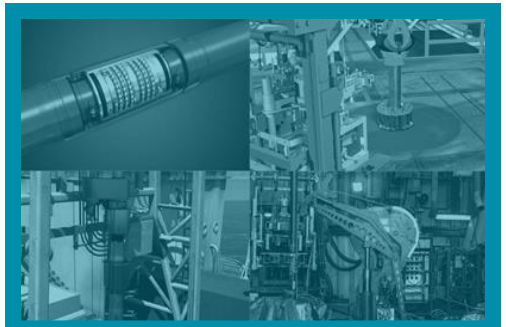
Well Intervention

- Optimized well shut-in cycles
- Prioritise interventions
- Assess pre- and post-intervention well performance

Reservoir Management

- Increased peak production rates
- Better reservoir management
- Prolonged field life

Capabilities across the Well Lifecycle

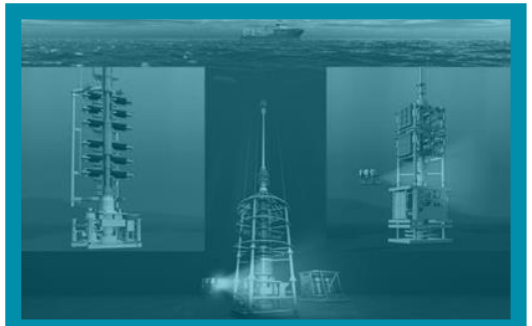


Well Construction

- Completion Technologies
- Casing Technologies
- Cementing Technologies
- Downhole Service Tools
- Drilling Technologies
- Conductor Driving & Slot Recovery
- Tubular Products & Services

Well Flow Management

- Well Testing
- Drill Stem Testing (DST)
- Tubing Conveyed Perforating (TCP)
- Fluid Sampling & Analysis
- Pipeline and Flarestack Services
- Permanent Downhole Monitoring (PDM)
- Metering Solutions
- Water Treatment
- Offshore Production Units
- Enhancement Systems
- Facility Upgrades
- Operations & Maintenance
- Wireless Well Solutions



Subsea Well Access

- Subsea Test Tree Assembly (SSTTA)
- BOP Spacer / Spanner Joint Assembly (BOPSJ)
- Open Water Intervention Riser System (OWIRS)
- Light Well Intervention (LWI)
- Riserless Subsea Well Intervention System (RSWIS)
- Hydraulic Intervention System (HIS)

Well Intervention and Integrity

- Mechanical Slickline
- Cased Hole Services
- CoilHose™
- Octopoda™ Intelligent Intervention
- Petroleum Engineering Solutions
- SafeWells®
- Distributed Fiber Optic Sensing (DFOS)

Presentation end

Thank you