CASE STUDY:
1003/05

PRODUCT:
RETROFIT PARAGON SYSTEM

DATE:
AUGUST 2022

RETROFIT
9 YEARS ON

LOCATION:
NORTH SEA

SERVICE:
Well Test Evaluation

BENEFITS:

Resurrected real-time bottom hole data

Replaced failed permanent gauge system

12% increased production

Improved understanding of water injection pressure limits

METROL®
APPLIED INTELLIGENCE

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PRODUCT: RETROFIT PARAGON SYSTEM

TO MAINTAIN RESERVOIR PERFORMANCE AND OPTIMISE PRODUCTION, THE BOTTOM-HOLE FLOWING CONDITIONS NEED TO BE MONITORED CLOSELY.

DOWNHOLE PRESSURE AND TEMPERATURE GAUGES PROVIDED SURVEILLANCE INFORMATION ON RESERVOIR CONDITIONS, ALLOWING INJECTION RATES TO BE ADJUSTED IN ADJACENT WELLS AND INCREASING PRODUCTION FLOW RATES FROM THE WELL.

CHALLENGE

In 2008, a live producing well in the North Sea was being monitored by a cabled permanent downhole gauge which failed prematurely. With only a single gauge, the client was without decisive surveillance bottom-hole pressure and temperature data. As the well had an expected production life of 15 years, a retrofit gauge system was deemed vital.

While it would have been possible to replace the defunct gauge, this required pulling the entire completion and subsea tree. This client wanted an equal gauge and telemetry system to be installed, without pulling the completion, and during the annual workover in 3 months' time.

Metrol were requested to design a bespoke carrier system for a slimline gauge carrier and telemetry stations. The gauges and telemetry would require fast design and interface with 3rd party large bore gauge hangers. In addition, Metrol's subsea telemetry equipment had to be aligned to the existing subsea tree architecture.

The Metrol Retrofit Paragon gauge was installed using electric line, at 2,281mMD, approximately 8m above the existing failed downhole gauge. A series of telemetry stations complete with temperature sensors were installed up the production tubing, with one repeater half way up the well having a second pressure gauge.

METHOD

DELIVERY CRITERIA

- To install a replacement gauge system which would provide a long term data stream during the production life cycle of the well, from high resolution data at a location close to the original permanent downhole gauge.
- To provide a system that could be installed without pulling the upper completion and subsea tree.
- To deliver a full subsea and downhole system within a 3 month lead time.
- To install the replacement monitoring units using wireline rather than a tubing conveyed system.
- To interface with industry standard large bore extension gauge hangers.
- To ensure all operations are carried out in a safe and efficient manner.

Fig 1. Metrol internal gauge carriers and repeater stations.

Fig 2. Metrol wireless system test through expandable hanger.

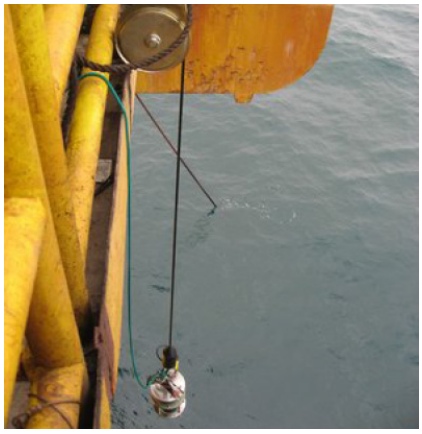

Fig 3. Deploying surface sonar

METHOD CONT...

PROCEDURE:

- The replacement was installed within the designated work package on time, budget and with zero incidents.
- Data acquisition was initiated as soon as the gauge station was set, with real time monitoring confirming that the gauge was operational.
- Data transmission from each subsequent setting of Metrol's tool stations was verified during installation.
- Full data transmission was live as soon as the Metrol subsea equipment was installed using an ROV.
- The bottom-hole pressure and well bore temperature data on installation was transmitted to the client on location.
- Client has regularly downloaded the well data on a bi-annual basis since installation.

The bespoke system included:

> High accuracy, long term, downhole pressure gauges coupled with wireless processors attached to 3rd party expansion hangers.

> Modular gauge and relay stations with precise positioning features to align within production bore.

> Wirelessly enabled debris cap for subsea production tree

> Surface sonar interrogation package deployed from the client vessel.

> The Metrol Data Centre provides the client with access to the long term data.

Fig 4. Tree Cap c/w Metrol's Modem and SMM

RESULTS

- **For 6 years** the bottom hole pressure of a producing well has been monitored enabling water injection pressures in adjacent wells to be increased. The client has benefited from a corresponding 12% increase in overall production from the well as a direct result of this reservoir monitoring and analysis, see Fig 5.
- The client was able to reinstate bottom-hole data acquisition, and gained a real time wellbore thermal profile.
- Deployment of the Metrol Retrofit Paragon system on wire meant no need for any penetration or feed-throughs of the well controls and barriers. This negated the need to pull the upper completion, thereby reducing operational risk and saving days of rig time.
- The use of wireless telemetry during deployment of the Metrol system gave direct diagnostic feedback on the gauges' signal clarity at surface, so that the signal repeaters were then placed optimally to ensure long-term data relay reliability.
- Production well test data acquired in the first 3 months of the Metrol systems' daily sampled pressure and temperature data overlaid on other performance data (ie well chokes, tubing head pressure etc) enabled the recalibration of the well's performance design to improve production allocation.
- Metrol's e-line interrogation tool was modified to allow running of the electronic setting tool and operation on the same string.
- Costly well interventions are minimised by the Metrol Retrofit Paragon System being engineered to yield 6 continuous years data production.
- Metrol's retrofit telemetry system deployment in an operational well was a world first for the industry.

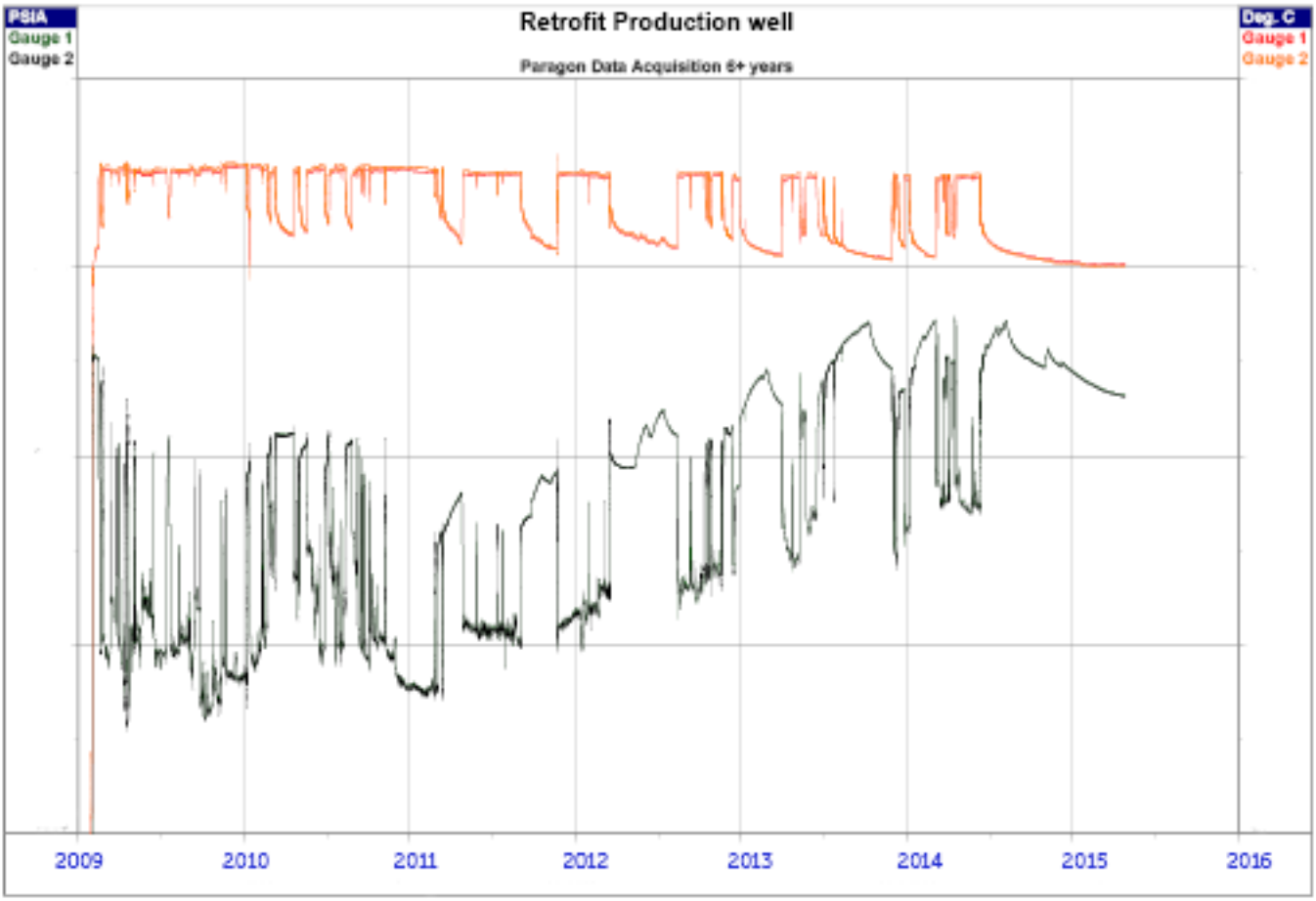

Fig 5.
Well data collected since the Metrol Retrofit Paragon system was installed.

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Howe Moss Place
Kirkhill Industrial Estate
Dyce, Aberdeen
AB21 0GS, Scotland, UK

T +44 (0)1224 772771
E sales@metrol.co.uk
www.metrol.co.uk