



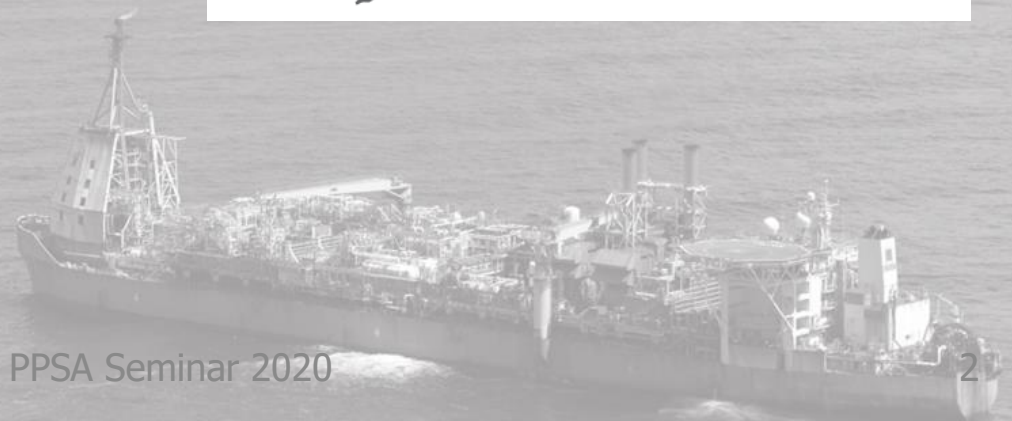
PIPELINE LIFE EXTENSION USING CUSTOM BUILT INSPECTION TOOLS

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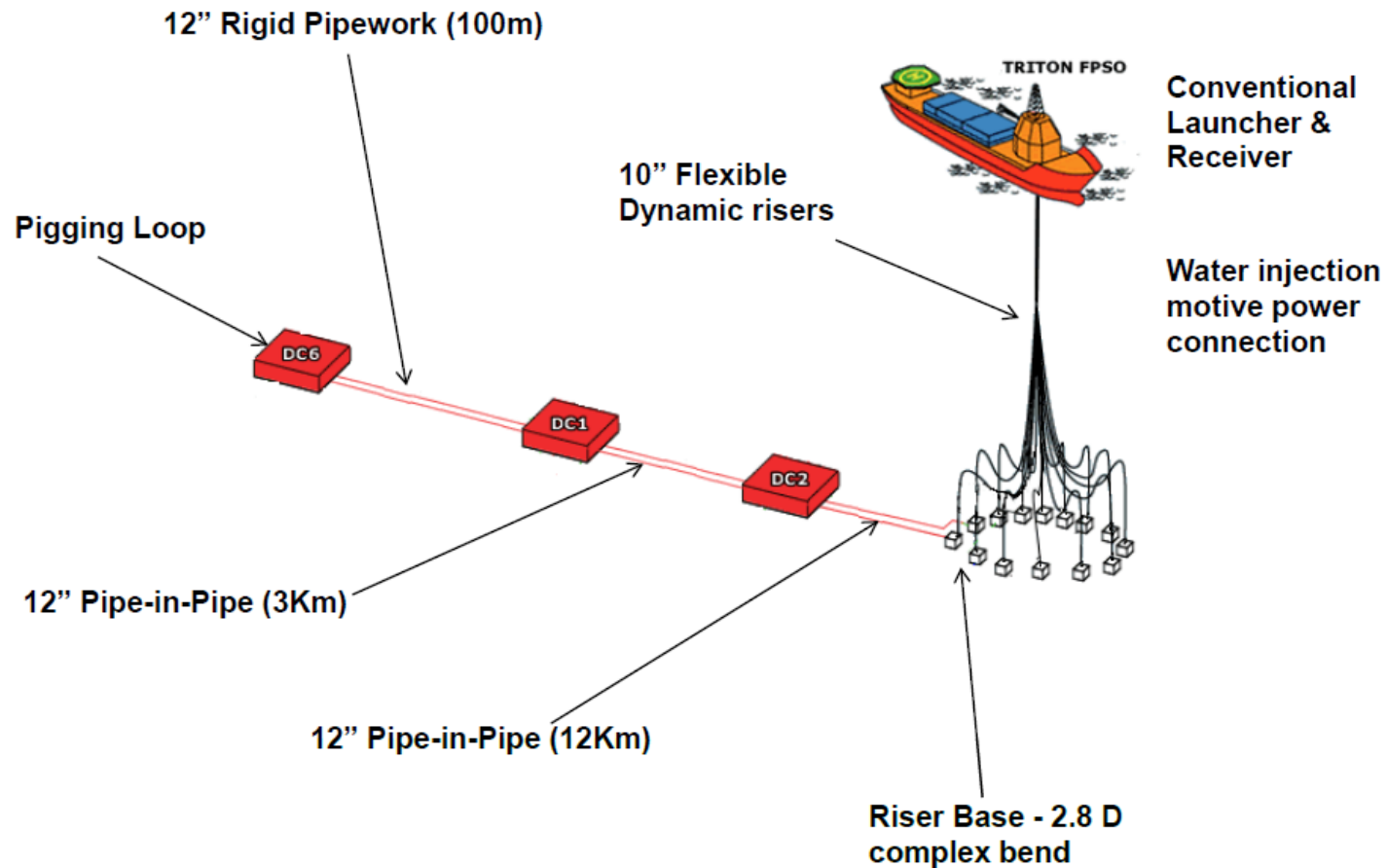
Sales & Operations Department

GUILLEMOT WEST (GW) FIELD

Field Data	Guillemot West	Guillemot North-West
Location	UK Central North Sea, UK Blocks 21/29a, 21/25, 21/30, 21/29b Approx 14km NW of Triton	UK Central North Sea, UK Block 21/24 Approx 14 km NW of Triton
Water depth	290ft (87m)	290ft (87m)
First Production	March 2000	March 2000
Recovery	Natural depletion	Natural depletion
Field Life	10 years	10 years
Wells	3 production wells	7 production wells
Drill Sites	2	2
Manifolds	2 x 6 slot manifolds	
Pipelines	2 x 12in Production 1 x 4in Gas Lift Approx 12km + 3km long back to FPSO	Part of Guillemot West Infrastructure



2 x 12" PL1652 / PL1653 PRODUCTION PIPELINE LOOP



CHALLENGE FOR IN-LINE INSPECTION

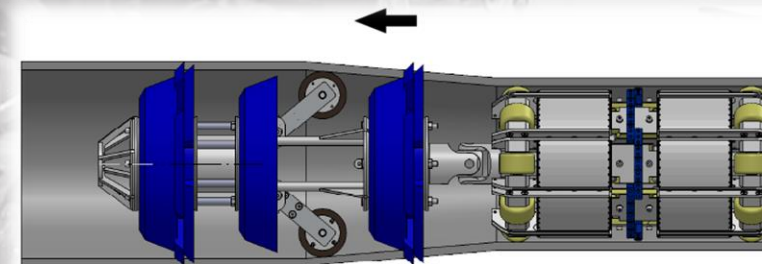
The inspection route contains some features that pose problems for cleaning, gauging and intelligent inspection tools. It was therefore essential that the proposed tools would be capable of navigating the following obstacles without getting stuck:

- Lines had not been inspected since commissioning in year 2000.
- Internal diameters ranging from 253 mm – 304.8 mm
 - Transitions Flex (253 mm)
 - Flexible pipe (304.80 mm) (installed after 2013 execution)
 - Riser base (273.1 mm)
 - Tie in spool (285.7 mm)
 - Pipeline (297.7 mm)
- 10" flexible riser: Concern over mechanical damage to dynamic riser carcass
- Pipe-in-Pipe (PIP) Pipeline 12"; API 5L X65; wall thickness 13.1 mm
- Carrier Pipeline 18"; API 5L, X60, wall thickness 11.1 mm
- Coating: 55.55 mm SPU foam in annulus
- Complex riser base bends (2.8 D)
- Debris location and extent unknown but some history of sand production

ENGINEERING AND TESTING PHASE

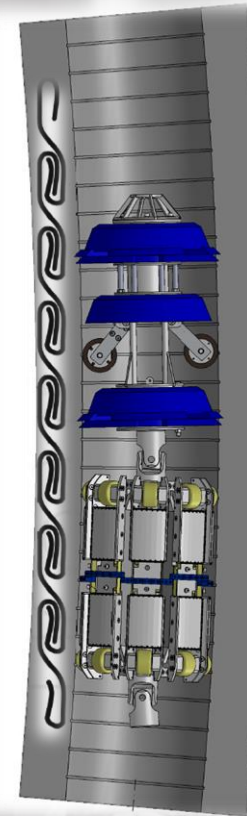
- **Dual diameter capability**

Pipeline ID range	245 to 310mm
One axial diameter reduction to	245mm
Min ID in min bend radius:	265mm
Max. Ø barred offtake:	full bore
Max. Ø unbarred offtake:	8"
Wall thickness range	15mm



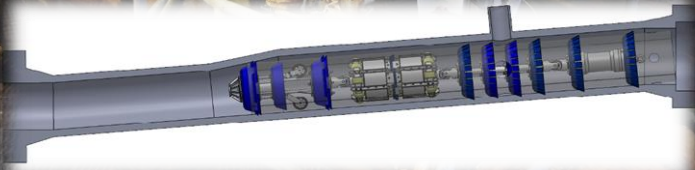
ENGINEERING AND TESTING PHASE

- **Traversing the flexible hoses**
ID 253mm x 215m long flexible risers
ID 304.8mm x 3085m long flexible pipe section (after 2013)

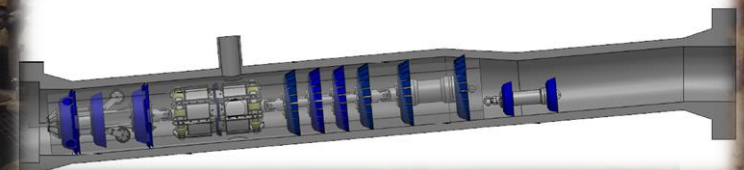


ENGINEERING AND TESTING PHASE

- Trap assessment and tool configuration



Launcher Q-101:
Barrel length: 1850mm
Reducer length: 356mm
Nominal length: 800mm

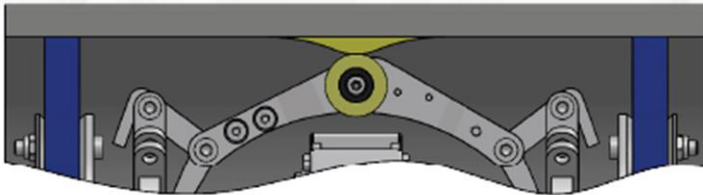


Receiver Q-102:
Barrel length: 1850mm
Reducer length: 356mm
Nominal length: 800mm

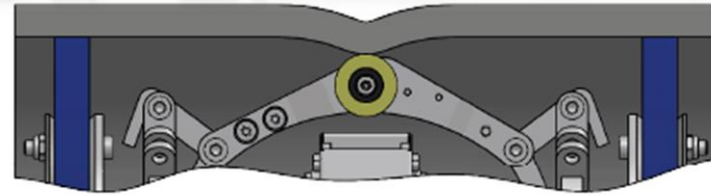
ENGINEERING AND TESTING PHASE

- **GEO+:** Remaining pipeline debris – sand, scale, wax

debris



dent



Volume of hard sediment remaining in a 6" crude line measured and mapped by GEO+



FACTORY ACCEPTANCE TESTING (FAT) 2013



- 12" Test spool (WT 12.5mm 298.9mm) with artificial defects
- 12" Spool (WT 15.4mm 293.1mm bore; 25mm – 273.9mm bore)
- 10" Spool (WT 7.5mm - 258mm bore)
- 12" 2.4D 45° BTB bend combination (WT 12.5mm)
- 12" 2.4D 180° bend (WT 12.5mm)

OFFSHORE EXECUTION 2013 / 2019

Progress Meeting every 2 weeks with Dana Petroleum Contractors

- Cleaning Contractor
- Pumping Contractor
- Inspection Contractor – 3P Services
- Construction Contractor

Pipeline Loop Preparation

Take pipeline out of service and fill with the inspection medium seawater

Pre-Inspection Cleaning

Gel Pigs & Gel Slug Train, Foam Pigs, Hard Body cleaning tools (from low to high aggressive cleaning properties), Gauge Plate Tool

GEO+ INSPECTION

- Geometric Inspection
- Debris Mapping
- Bi-directional tool configuration (2013 only)
- Confirmation if min ID
- "Go" – "No Go" decision for MFL



Receive of bi-directional GEO+ inspection tool in 2013 execution

MFL INSPECTION

- MFL Metal loss Inspection
- Unidirectional tool configuration
- Constant tool speed $\sim 0.5\text{m/s}$
- Run time: ~ 16 hours



Receive of MFL inspection tool in 2013 (left) and 2019 (right)

UT INSPECTION

- Supporting ILI to MFL inspection
- Unidirectional tool configuration
- Constant tool speed $\sim 0.6\text{m/s}$
- Run time: ~ 15 hours



UT Inspection tool after run in 2019

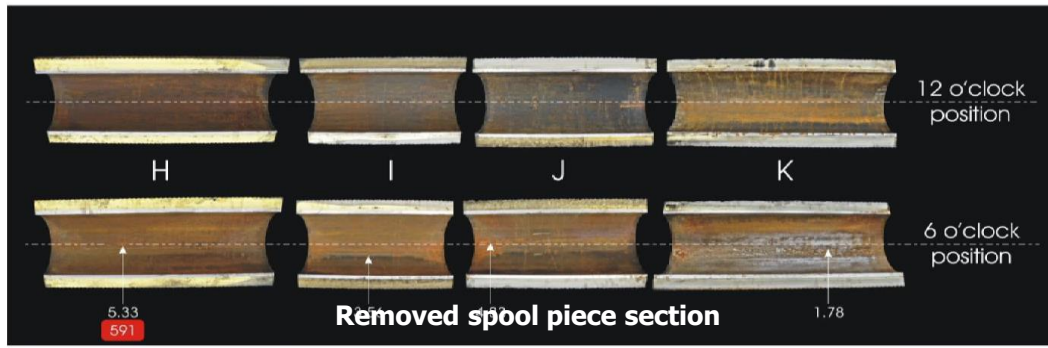
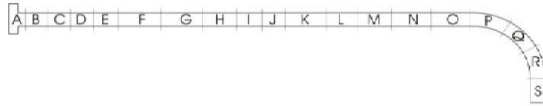
2019 Field Execution - Intelligent Inspection Operation concluded after 6 days (July 28, 2019 – August 01, 2019) with delivery of the site report at Aug 02, 2019.

DATA ANALYSIS

- Preliminary Report delivered 2 weeks post inspection site report
- Final Report delivered 8 weeks post inspection site report
- Corrosion Growth Consideration Report delivered 10 weeks post inspection site report (only 2019)

FIELD INVESTIGATION AFTER 2013 ILI

After detailed review of the ILI report in 2013 a rigid pipe section was replaced by a new 12" flexible piping. A part of the removed pipe section was deeply investigated. A spool where severe spots of corrosion were reported was examined using different measuring methods.



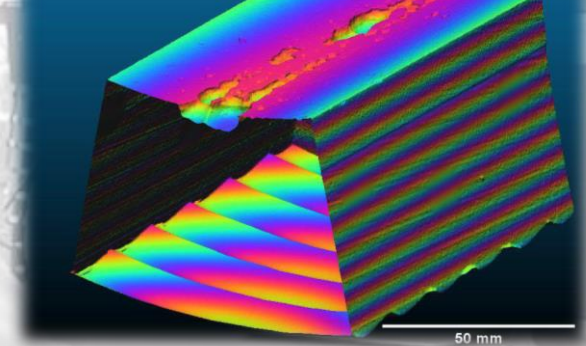
FIELD INVESTIGATION AFTER 2013 ILI

Identified pit depth were measured by:

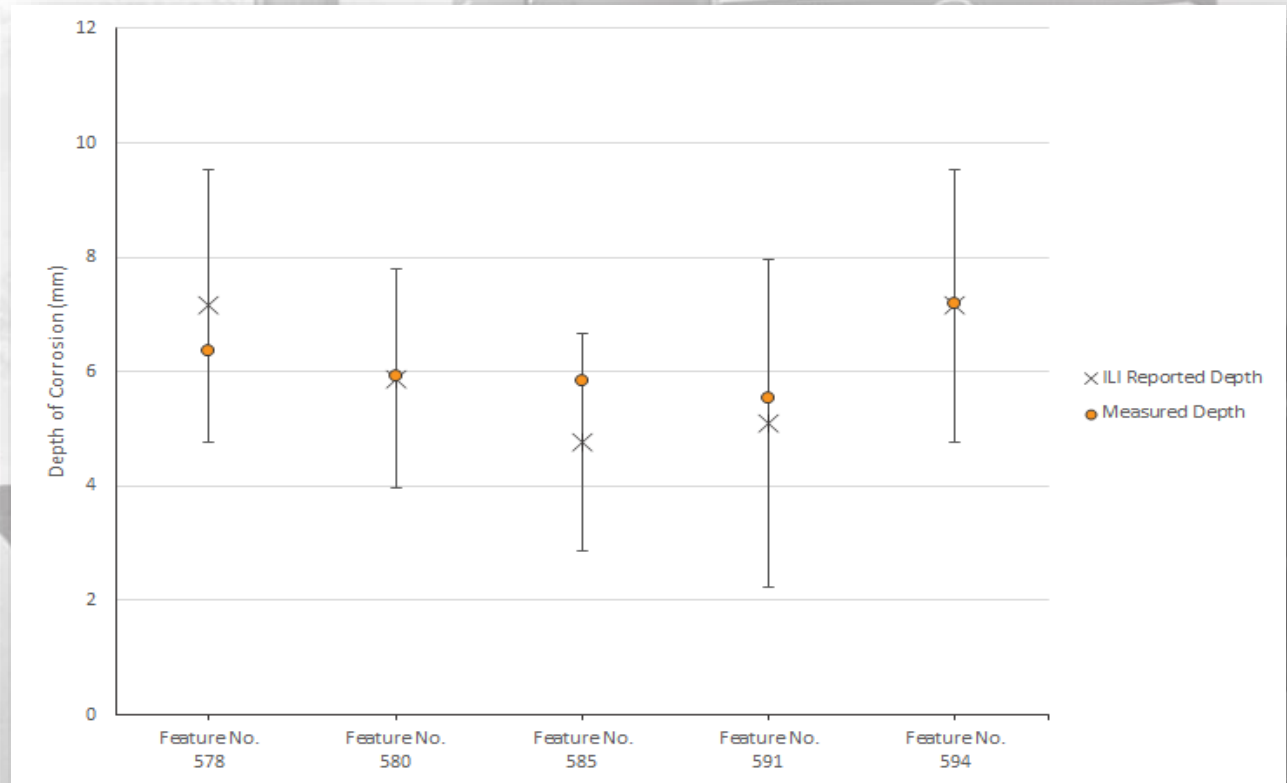
- Pit depth gauge (initial)
- Pit depth gauge (cleaned)
- 3D laser Scan
- Metallographic sections



Virtual cross section through UT indication



FIELD INVESTIGATION AFTER 2013 ILI



Comparison reported depth vs. measured depth

Conclusion

A never before inspected flowline loop included many obstacles and was previously considered as un-inspectable. During a design and test phase, custom made and flexible ILI tools were built and submitted to factory acceptance demonstration tests with reference to a safe tool navigation and measuring performance.

2013 offshore execution were successfully performed and made the pipeline loop inspectable. Results provided from a GEO+ inspection supported the examination of the pipeline cleanliness condition. Further a MFL inspection determined the integrity status of the pipeline for the first time since pipeline installation. The basis for a calculation of the remaining life time and measures to extend the pipelines life time were provided within the final inspection report.

A repeat of the ILI campaign was executed in 2019 where all the special measures taken in 2013 had meanwhile become routine. The advanced ILI performance allowed determination of the current pipeline integrity status. This information was the basis to calculate a new, extended design life and keep the line in operation.

THANK YOU FOR JOINING THIS PRESENTATION!

Reference:

- [1] Pigging Contractor Scope of Work; Petro Canada UK Limited; 15/03/10
- [2] Final Acceptance Test Report; 3P Services GmbH & Co. KG; 24/09/13
- [3] Final Report, 3P Services GmbH & Co. KG, 16/12/13
- [4] Examination of P2 Spoolpiece - Greater Guillemot Area PL1653; Intertek; 08/12/15
- [5] Review of GGA P2 Spoolpiece Dissection; Origin Integrity Management; 07/06/16
- [6] GGA In-Line Inspection Campaign – Scope of Work; Dana Petroleum; 18/01/19
- [7] Factory Acceptance Test Report; 3P Services GmbH & Co. KG 05/07/19
- [8] Guillemot West, Pipeline Pigging Project, Overall Procedure for Operations 2019 – Procedure; Dana Petroleum; 09/07/19
- [9] Final Report, 3P Services GmbH & Co. KG, 30/09/19
- [10] Source: <https://www.dana-petroleum.com>