ON THE ISSUE OF INSPECTING CHALLENGING PIPELINES

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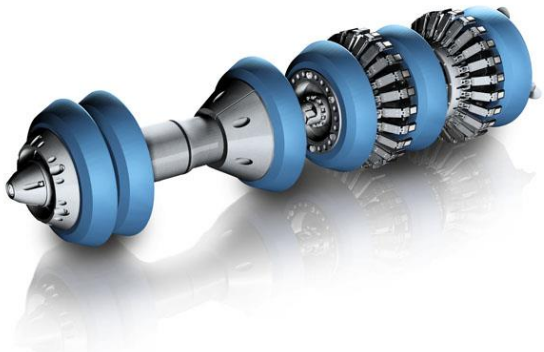
INTRODUCTION

- There are appr. 4 million kilometers of oil & gas transmission pipelines globally.
- Roughly 40% of these lines are considered „non-piggable“
- In addition there is a large number of pipelines upstream that require regular inspection.

What does „piggable“ mean?

„PIGGABLE“

- In-Line Inspection (ILI) of pipelines is well-proven, widely used and in parts of the world even prescriptive
- ILI is performed for metal loss, crack, geometry and leak detection
- The mission is to provide accurate, reliable and consistent data for integrity assessment and fitness-for-purpose investigations



A pipeline is considered „piggable“ if it can be inspected with an ILI tool, without the need to modify the tool or the pipeline

„PIGGABLE“ VS. „UNPIGGABLE“

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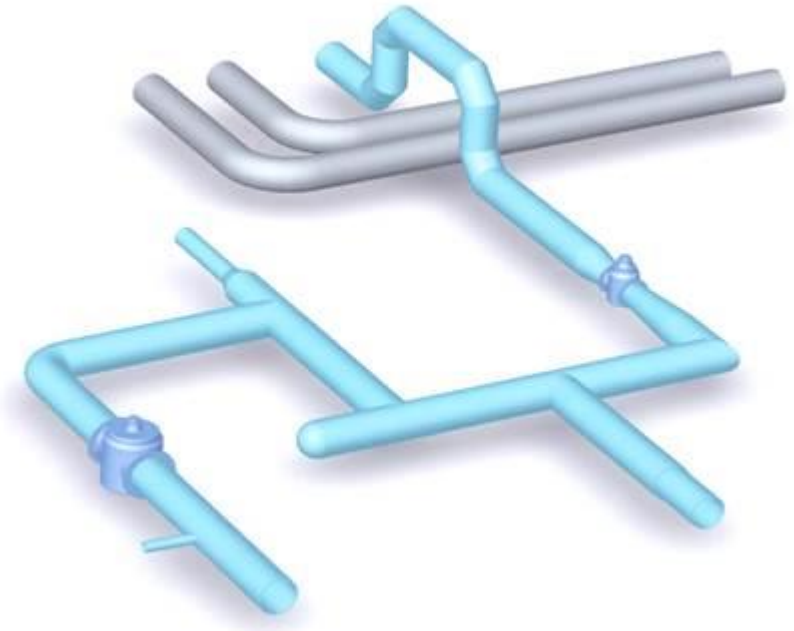
„UNPIGGABLE“ ISSUES

- **Accessability**
- **Negotiability**
- **Propulsion**



These issues remain:

Flaw types: metal loss, cracks, geometric anomalies

POD, POI – issues of data quality, data management

THE TOOL BOX APPROACH

- Technology
- Tailor Made Processes and Procedures
- Expertise and Experience

ACCESSIBILITY

- Hot tapping
- Pig launch valves
- Temporary or permanent launcher
- Spool piece
- Bi-directional operation

NEGOTIABILITY

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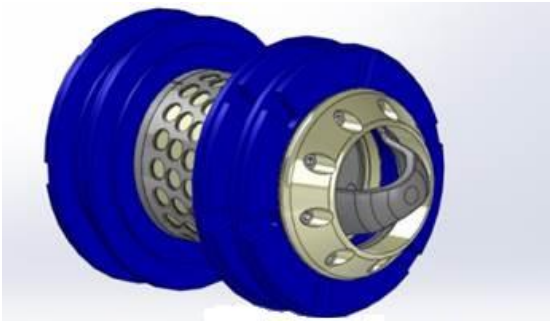
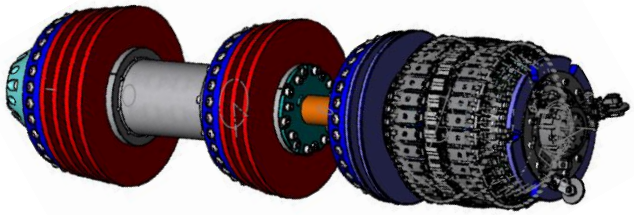
- Uni-directional

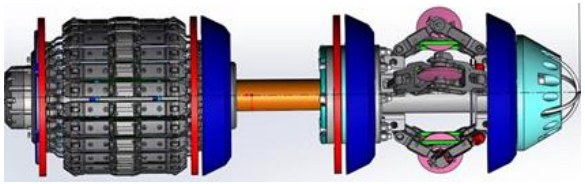
- Bi-directional



- Low friction



- Ultra compact

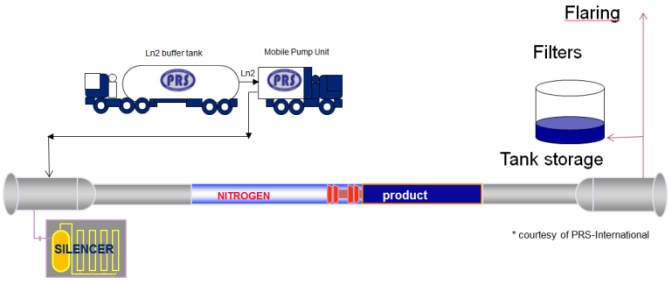


- Multi – diameter

PROPULSION

- Medium propelled

- Nitrogen/ Air



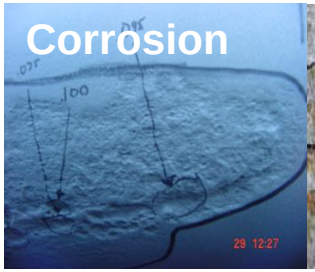
- Batching

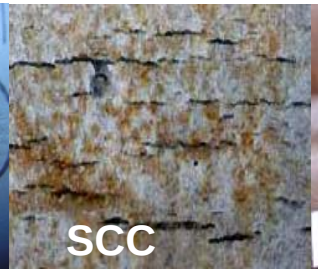
- Self-Propulsion

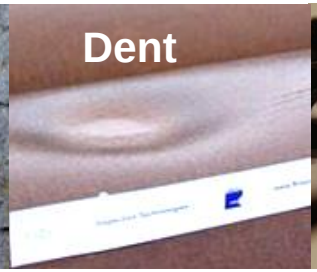
- Cable operated

MEASUREMENT TECHNOLOGIES

- MFL – Magnetic Flux Leakage
- UT – Ultrasonic Technology
- EC – Eddy Current
- EMAT – Electro-Magnetic Acoustic Transducer
- …







CASE STUDY: JET FUEL LINE FEEDER LINE

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The Challenge:

- 6“ fuel line, length 1300 m
- Wall thickness: 4.5 to 5.6 mm
- No launching or receiving traps installed
- Access only possible from one end
- Tight miter bends in the line
- No digging possible
- Low operational pressure during inspection
- No interference of aircraft movement tolerable

CASE STUDY: JET FUEL LINE FEEDER LINE

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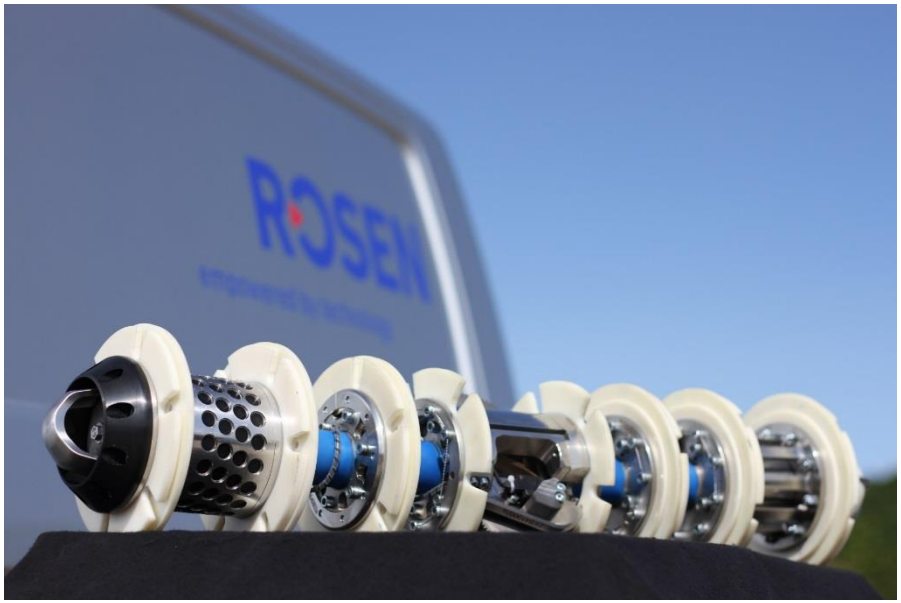
The Solution:

- Small diameter UT inspection tool
- BiDi capability
- Mechanical design of tool allows negotiation of mitre bends
- Tool capable of negotiating 1D bends
- Tailor made and specialized procedures



CASE STUDY: JET FUEL LINE FEEDER LINE

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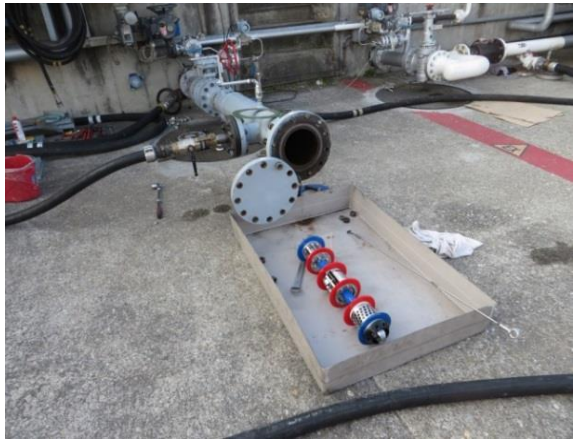
The Benefit:

- Reliable inspection of line providing high resolution UT data
- Zero disturbance to normal airport operations and aircraft movement
- Cost saving by avoiding any digging
- No line modifications required
- Inspection using medium transported in line – jet fuel
- Risk minimization due to Bi-Di design of tool



CASE STUDY – MULTI-PHASE OIL LINE

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The Challenge:

- Inspection of 10“ multi-phase flow lines
- Multiple lines between 1 and 10 km long
- Hard to clean
- Medium at elevated temperature
- High water cut
- No possibility to install launchers & receivers
- Only access possible via 3-port valve

CASE STUDY – MULTI-PHASE OIL LINE

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Valves are 3 port ball valves that are used in pipelines that require frequent maintenance pigging. They can also be used to run short ILI tools – if available!

CASE STUDY – MULTI-PHASE OIL LINE

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The Solution:

- Specially designed BiDi MFL tool, that can be launched and received via 3-port valve
- Tailor made procedures
- Tool can operate in LF/LP conditions
- Specialized tool tracking equipment

CASE STUDY – MULTI-PHASE OIL LINE




CASE STUDY – MULTI-PHASE OIL LINE

The Benefit

- **Cost effective**

No impact on operation, no pipeline modifications no need to liquid fill the line or for pumps, hydro test can be avoided

- **State-of-the-art inspection quality**

Same performance as high resolution uni-directional MFL tools

- **Light weight and easy to handle**

No need for cranes, less manpower

- **Flexible operation**

Online inspection - less dependent on production planning

- **Safe and reliable**

Robust and proven MFL technology that only requires moderate cleaning

CASE STUDY – LOADING LINE

The Challenge:

Offloading pipeline at a MBM (Multi Buoy Mooring), from PLEM (Pipeline End Manifold) to beach head area, no pig traps and previous UT inspection was unsuccessful due to questionable data.

Size: 20”

Length: 1800 mtr

Product: Jet Fuel / Gasoline

CASE STUDY – LOADING LINE

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The Challenge (continued):

The line cannot be inspected with conventional tools because of

- No traps
- Subsea entry
- Pressure limit of 6.5 kg/cm2 (6.4 bar) during inspection

Boundary conditions

- No interference with offloading operations
- Risk to be minimized
- Full inspection coverage
- Eliminate possibilities of contamination to the ocean during the submarine activities of disconnecting hoses and installation of launching spool at PLEM
- Send only clean product to storage tank

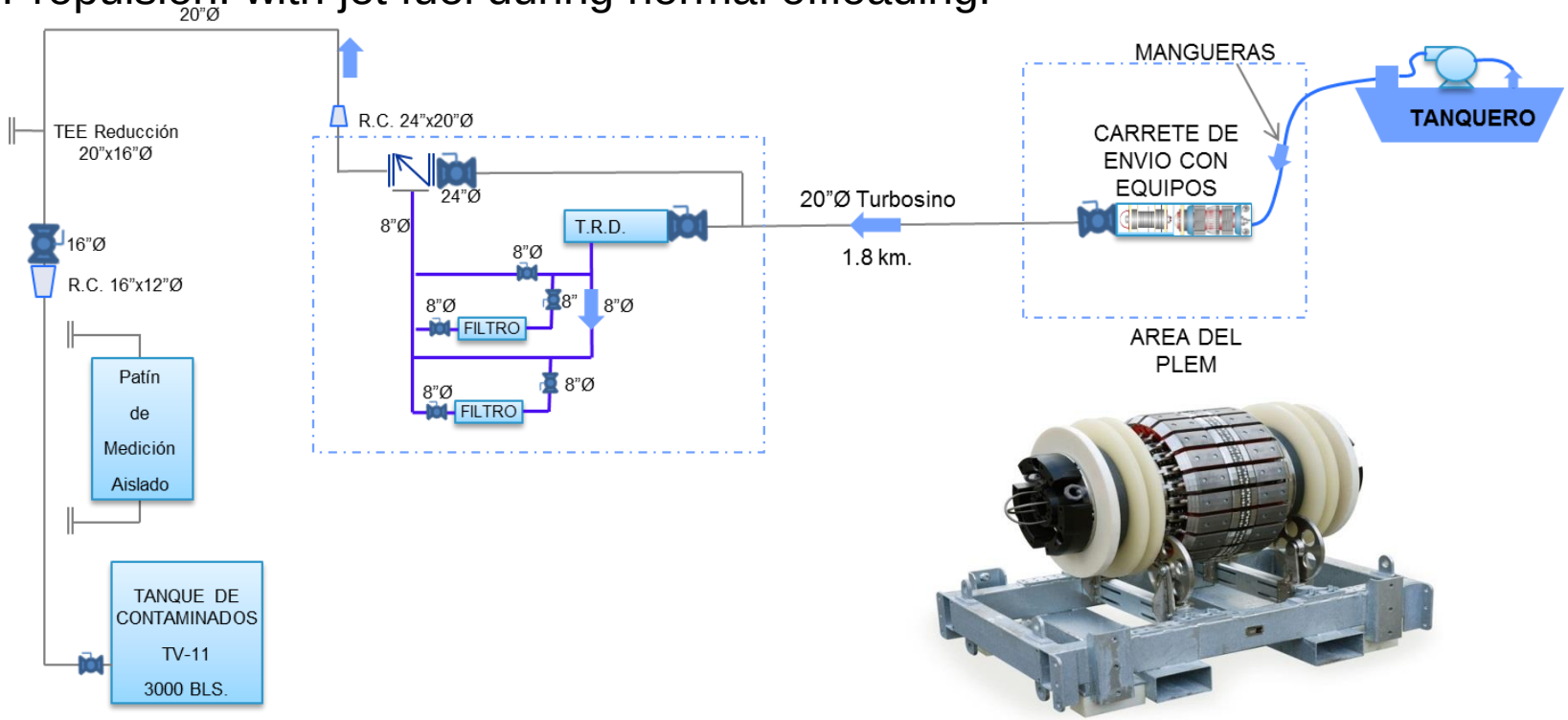
CASE STUDY – LOADING LINE

The Solution:

For this inspection ROSEN engineers selected a medium propelled low friction MFL inspection solution in combination with pre-inspection cleaning.

Pigging direction: from subsea PLEM to onshore beach head.

Propulsion: with jet fuel during normal offloading.



CASE STUDY – LOADING LINE

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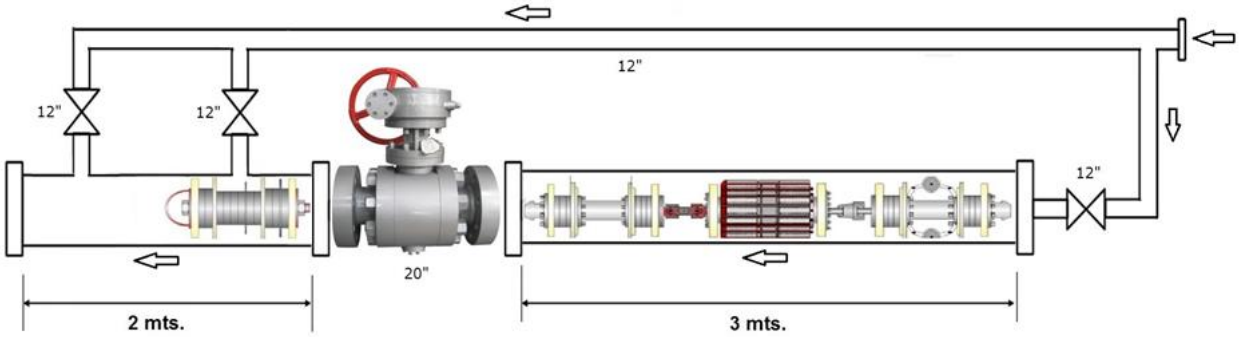
Launching trap design & construction



Design enables launching cleaning and MFL pig without intermediate spool recovery.

CASE STUDY – LOADING LINE

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Beach head with trap and filters installed

CASE STUDY – LOADING LINE

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Pre-loading of cleaning and MFL tool into launching spool

CASE STUDY – LOADING LINE

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The Benefit:

High resolution data collected for advanced Integrity Assessment

Successful procedures for complex operational conditions and a short time frame

Risk minimization and no impact on normal operations.

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