



Energy | Aerospace & Defense

Pipeline Engineering

Online Pigging Tool Management System



CIRCOR Business Overview

Design, develop, manufacture and sell flow control products and solutions for Energy (Oil & Gas and Power) and Aerospace markets

2015 Sales:	\$656 Million
Employees:	~2,500

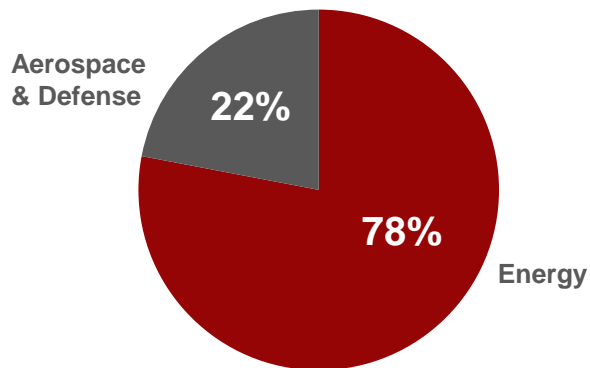
Energy



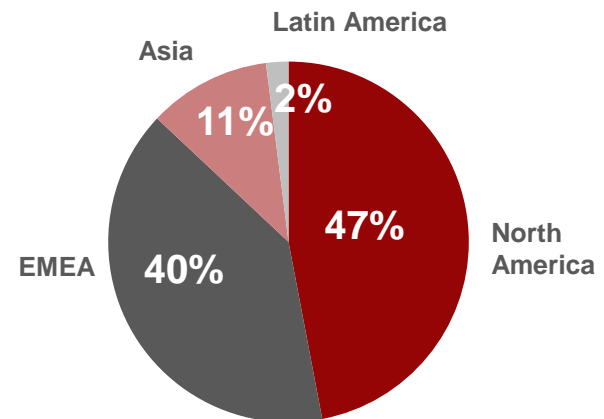
Aerospace & Defense



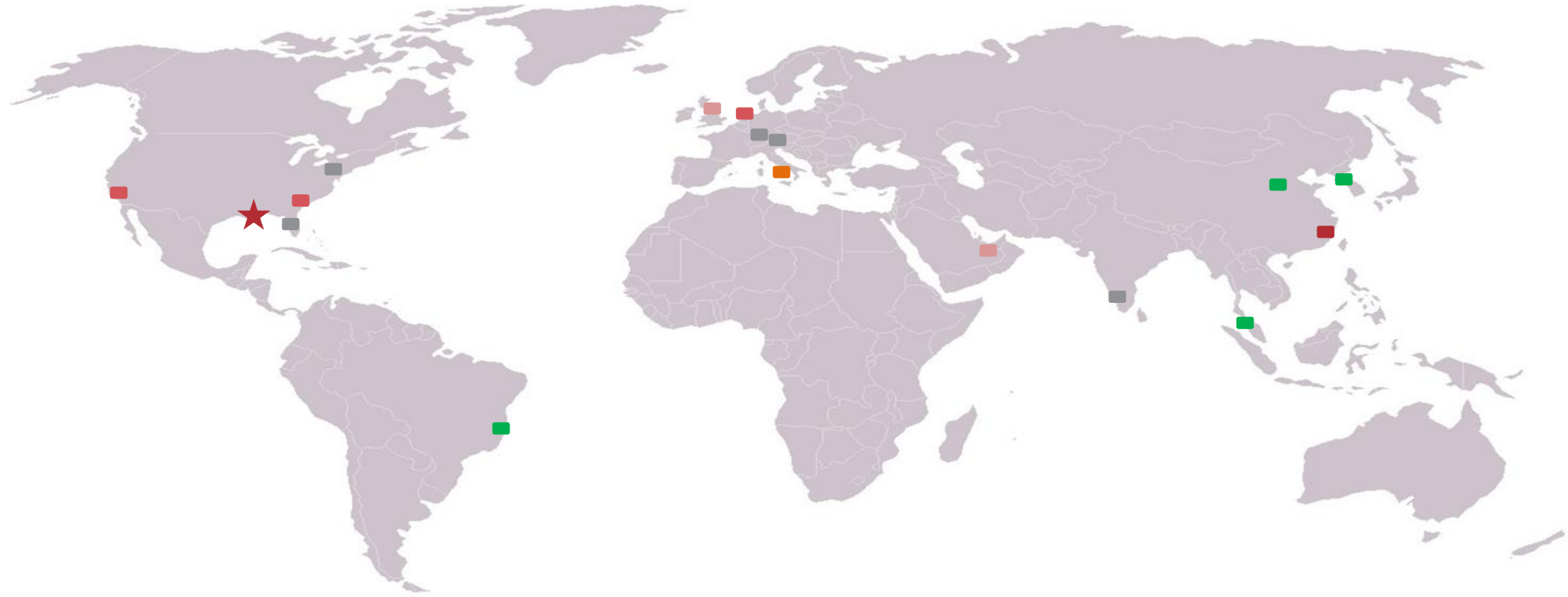
Sales by Industry



Sales by Geography



CIRCOR Energy Facilities



★ - CIRCOR Energy HQ

- | | |
|---|--------------------------------|
| ■ - Distributed Valves | ■ - Engineered Valves |
| ■ - Control Valves | ■ - Instrumentation & Sampling |
| ■ - Pipeline Engineering
(2 bases within UK) | ■ - Regional Sales Office |

Pipeline Engineering Overview

- Founded in 1969
- Acquired by Circor International in 2009
- Worldwide operational capability
- Head Office and manufacturing / fabrication in Richmond UK, plus manufacturing facilities in the Middle East
- Service Centres in UK (Aberdeen) and Middle East (Dubai)
- Regional offices in Houston, Dubai, Asia PAC and Mainland Europe
- Current UK staff total - 70



Pipeline Engineering Aberdeen Service Centre

- PE Aberdeen currently has a 5,000 sq.ft Facility
- Workshop to suit Extensive Pig Refurbishment Work Scopes
- Provide Engineering Support for Pipeline Operators
- Pigging Tool Management of over 400 Pigs
- Over 250 Pig Mobilisations each Year
- Long Term Contracts with EnQuest, Fairfield, MOUK, Nexen, Shell, TAQA & TOTAL.
- Global PECAT Product Line Support
- Supporting ILI companies in Aberdeen

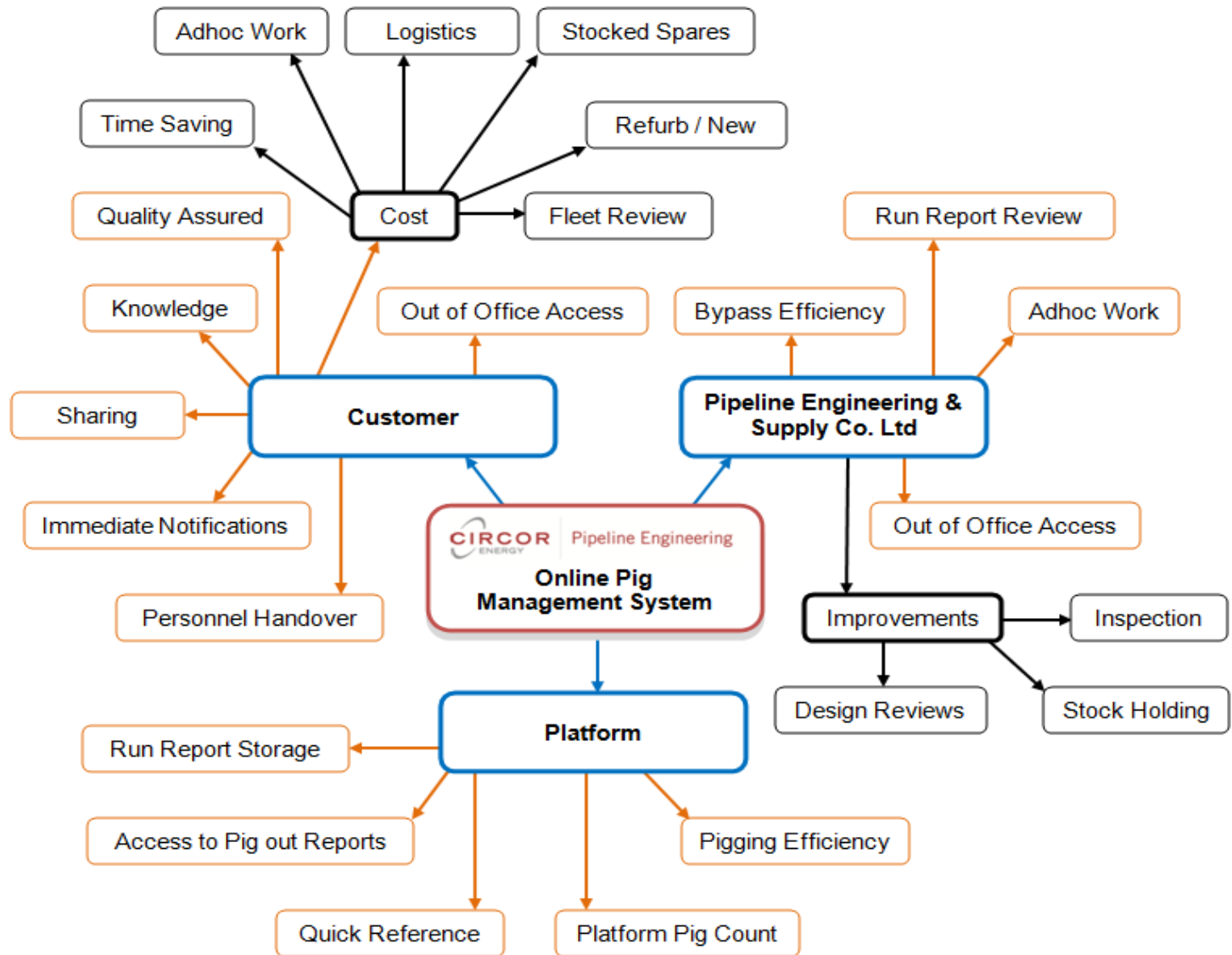


Pigging Tool Fleet Management

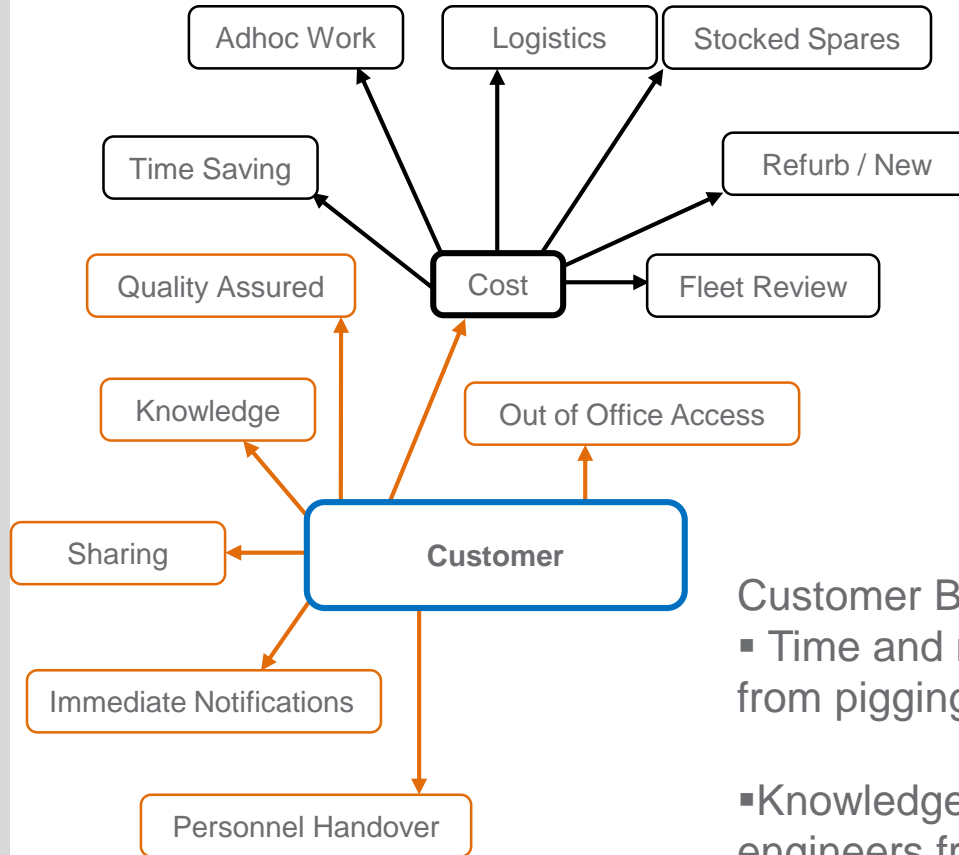
- Initial Pig Fleet Assessment
- Optimization of Customers Pigging Tool Fleet
 - Improve cleaning effectiveness, reduce customer annual costs, streamline pig fleet, reduced risk of stalled / stuck pigging tool
- Pig Refurbishment Activities
 - Stripping, inspecting, painting, refurbishment & testing.
- Pigging Equipment Tracking.
- Support Customer with Pipeline Pigging Expertise & Assessments
- Large Pig Spares Stocking Levels held in Aberdeen
- Replacement Spares Manufactured in Richmond
- Certification Management
- Weekly & Monthly Customer Reporting
- New Online Pigging Tool Management System



Online Pigging Tool Management System



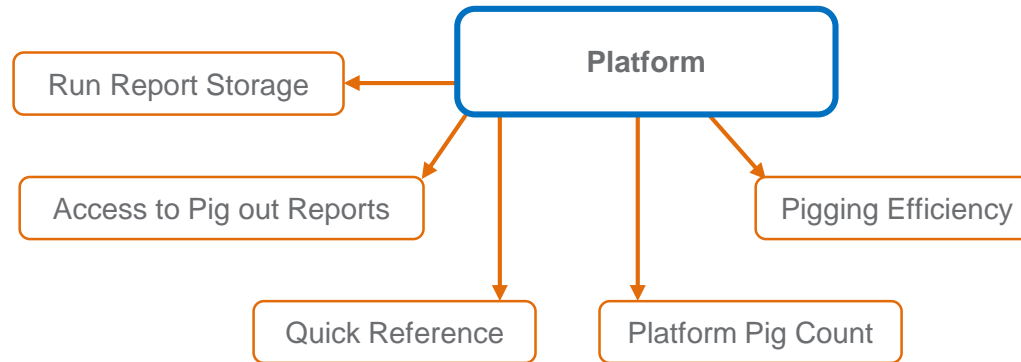
Customer Benefits



Customer Benefits & Savings:

- Time and money saved sourcing up to date from pigging contractor.
- Knowledge shared between platform engineers from one location.
- Access to historical records.
- Reduced risk
- Out of office access.

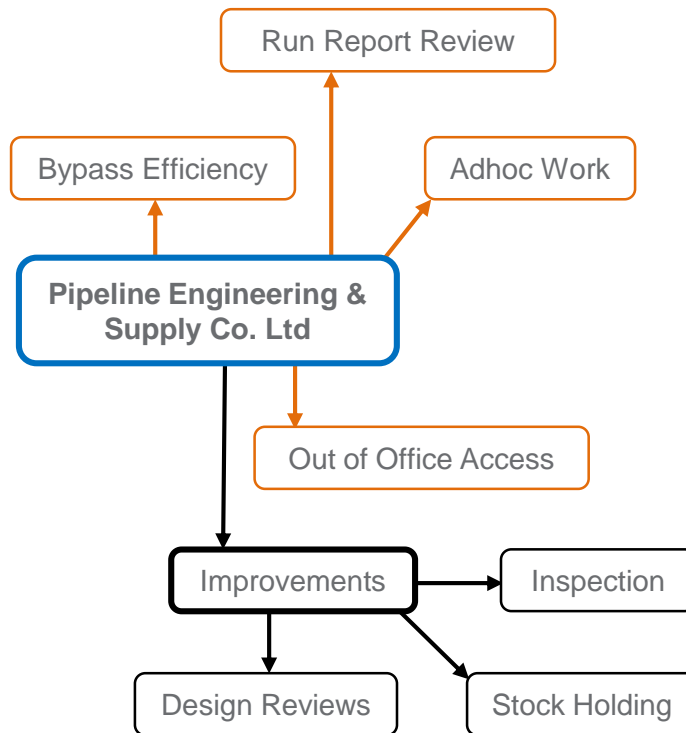
Platform Benefits



Platform Benefits & Savings:

- Reduced risk of stuck pigs.
- Reduced risk of lost pigs.
- Full access to pig certification.
- Optimisation pig runs.

Pipeline Engineering Benefits



PE Benefits & Savings:

- Full control of component quality
- Access to historical data
- Assess pig run reports to aid continuous improvement
- Potential to broaden scope to pig traps.

Customer Specific Dashboard – Recent Activity

The screenshot shows the CIRCOR Energy dashboard with a navigation bar at the top containing 'HOME', 'WORKSPACES', 'FAVORITES', 'SEARCH', 'SUPPORT', and 'SIGN OUT'. The user 'Benjamin Sturges' is logged in. The main content area is titled 'Recent Activity' and lists several actions:

- Barry Ritchie downloaded the TAQA Bratani Ltd - Equipment Register.XLS File (554 KB) from the TAQA Workspace. (October 17, 2016 01:06 PM)
- Barry Ritchie viewed the TAQA Bratani Ltd - Equipment Register.XLS File (554 KB) in the TAQA Workspace. (October 17, 2016 01:06 PM)
- Barry Ritchie viewed the 05. RT497 2016.06.21 Refurbishment.pdf File (137 KB) in the TAQA Workspace. (October 17, 2016 12:57 PM)
- Barry Ritchie viewed the 01. RT500 2013.06.07 Refurbishment.pdf File (134 KB) in the TAQA Workspace. (October 17, 2016 12:56 PM)
- Benjamin Sturges viewed the 06. RT519 07.14.2016 Refurbishment.pdf File (19 KB) in the TAQA Workspace. (October 17, 2016 12:53 PM)
- Barry Ritchie changed the name from 23.05.2016 to 13.05.2016 for the 13.05.2016 Folder in the TAQA Workspace. (October 17, 2016 10:45 AM)
- Barry Ritchie uploaded the S36943-002 2016 TAQA Bratani Ltd Pig Fleet Review Rev.0.pdf File (734 KB) to the TAQA Workspace. (October 17, 2016 10:45 AM)
- Barry Ritchie created the 23.05.2016 Folder in the TAQA Workspace. (October 17, 2016 10:44 AM)

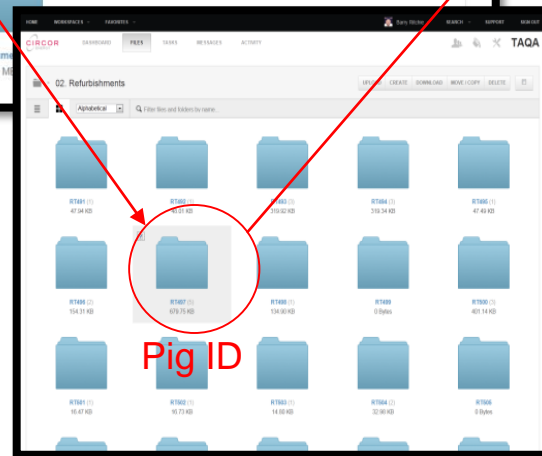
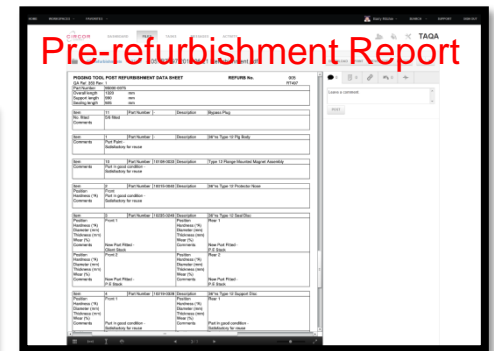
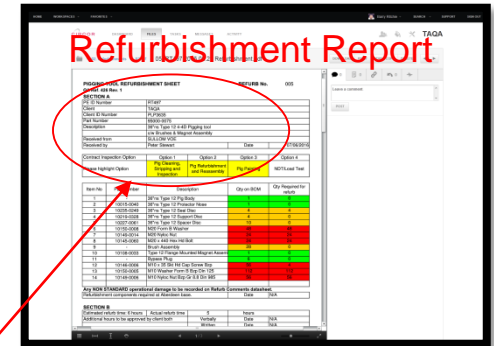
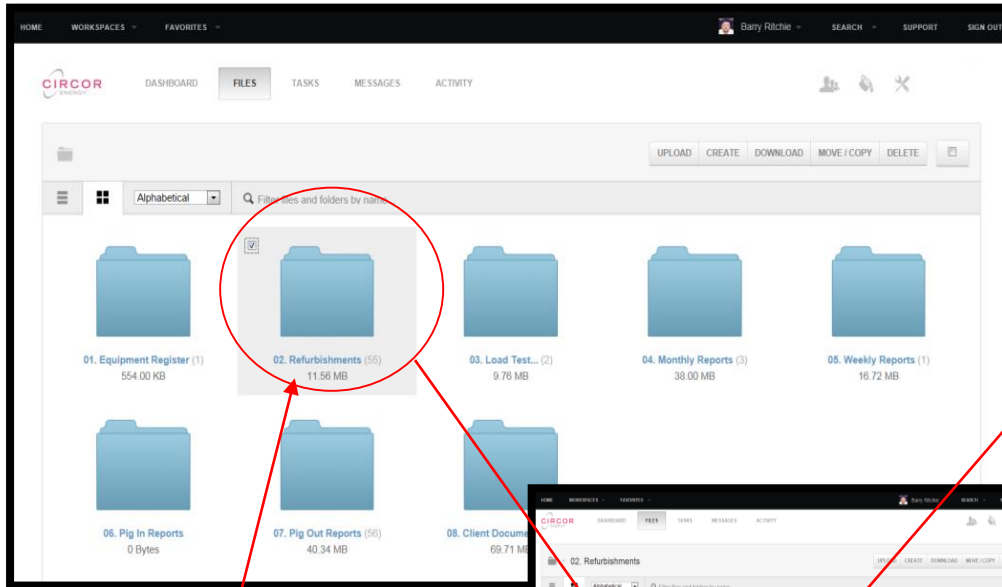
On the right side of the dashboard, there is a 'LINKS' section with 'CIRCOR Pipeline Engineering Website', 'PECAT Introduction Video', and 'ROC - Quick Open Closure Video'. Below that is a 'USERS' section listing 'Barry Ritchie'. A red arrow points from the 'PECAT Introduction Video' link to a video player window in the bottom right corner.

As it Happens Updates, Highlighting Actions Completed by Individuals to Project Documentation.

Updates with Additional PE Technical Data

The video player shows a red circular device with a gauge, labeled 'PECAT™ Pipeline Cleanliness Assessment Tool'. The video title is 'PECAT - Pipeline Cleanliness Assessment' and it has 110,006 views. The video was published on 22 Apr 2013. The description states: 'PECAT™ is a pigging based inspection tool developed by Pipeline Engineering primarily to measure how clean a pipeline is, particularly prior to high resolution inline inspection and the decommissioning of pipelines. Using state of the art unique sensor and data logging technology, in one pigging run, the PECAT™ tool can measure location and quantity of debris in the pipeline, as well as record the other parameters, such as ovality (elong), temperature and differential pressure. While the PECAT™ pipeline cleanliness assessment tool is normally used prior to high resolution inline inspection and the decommissioning of pipelines, it can also be used as part of ongoing pigging campaigns in operational pipelines to ensure deposit build-up in the pipeline is kept under control.' The video is categorized under 'Science & Technology' and has a 'Standard YouTube Licence'.

Customer Specific – Pigging Tool Documentation



Pig ID

Refurbishment Details



Easy & Quick Access to All Project Documentation

Full Data History Logged in One Location

All Platform, Responsible Engineer & Pigging Support Team Can Have Access

30/07/2016 Pipeline Engineering Aberdeen Service Centre Pig Refurbishment Register										
Week No: 30 Fairfield Energy Limited										
PE ID No	NPS (inches)	Tool Description	Refurbishment Part No.	Location	Refurbishment Status	Receipt Date	Despatch Date	Pipeline	Load Test Date	New Load Test Due Date
RT700	24	24"ns Type 12 2-2D Pig c/w Circular Brushes & Magnet Spacer	35000-0060	PE Aberdeen	NOT Refurbished	07/06/2016		PL005 - Dunlin - Cormorant A	25/03/2016	24/09/2016
RT701	24	24"ns Type 12 4-3D Pig c/w Magnet Spacer	35000-0126	Dunlin			08/07/2016	PL005 - Dunlin - Cormorant A	25/03/2016	24/09/2016
RT702	24	24"ns Type 12 4-2D Pig c/w Circular Brushes & Magnet Spacer	35000-0198	PE Aberdeen	Refurbished	27/11/2015		PL005 - Dunlin - Cormorant A	23/03/2016	22/09/2016
RT703	24	24"ns Type 12 4-2D Pig c/w Circular Brushes	35000-0061	PE Aberdeen	NOT Refurbished	21/07/2016		PL005 - Dunlin - Cormorant A	25/03/2016	24/09/2016
RT704	24	24"ns Type 12 4-2D Pig c/w Circular Brushes & Magnet Spacer	35000-0198	PE Aberdeen	Refurbished	27/11/2015		PL005 - Dunlin - Cormorant A	23/03/2016	22/09/2016
RT705	24	24"ns Type 12 2-4D Pig c/w Magnet Spacer	35000-0063	PE Aberdeen	Refurbished	21/02/2014		PL005 - Dunlin - Cormorant A		
RT706	24	24"ns Type 12 2-4D Pig c/w Magnet Spacer	35000-0064	PE Aberdeen	Refurbished	21/02/2014		PL005 - Dunlin - Cormorant A		
RT707	24	24"ns Type 14 4CC Pig c/w Tracker Housing & Magnetic Spacer	35000-0063	PE Aberdeen	Refurbished	05/05/2016		PL005 - Dunlin - Cormorant A	25/03/2016	24/09/2016
RT708	24	24"ns Type 14 4CC Pig c/w Tracker Housing & Magnetic Spacer	35000-0063	Dunlin			24/06/2016	PL005 - Dunlin - Cormorant A	25/03/2016	24/09/2016
RT709	24	24"ns Type 12 2-4D Pig c/w Triangular Brushes, Magnet Spacer & Facility For Tracker	35000-0108	Dunlin			14/04/2016	PL005 - Dunlin - Cormorant A	15/03/2016	14/09/2016
RT710	24	24"ns Type 12 2-4D Pig c/w Triangular Brushes, Magnet Spacer & Facility For Tracker	35000-0108	Dunlin			27/07/2016	PL005 - Dunlin - Cormorant A	15/03/2016	14/09/2016
RT711	24	24"ns Type 12 2-4D Pig c/w Triangular Brushes, Magnet Spacer & Facility For Tracker	35000-0108	Dunlin			27/07/2016	PL005 - Dunlin - Cormorant A	15/03/2016	14/09/2016
RT712	24	24"ns Type 12 2-4D Pig c/w Magnets, Facility For Tracker & Gauge Plate	35000-0103	PE Aberdeen	NOT Refurbished	07/06/2016		PL005 - Dunlin - Cormorant A	18/04/2016	17/10/2016
RT713	24	24"ns Type 12 De-Scaling Pig c/w De-Scaling Cups, Support Discs & Seal Discs & Mag	35000-0068	Dunlin			14/04/2016	PL005 - Dunlin - Cormorant A	15/03/2016	14/09/2016
RT714	24	24"ns Type 12 De-Scaling Pig c/w De-Scaling Cups, Support Discs & Seal Discs & Mag	35000-0068	Dunlin			14/04/2016	PL005 - Dunlin - Cormorant A	15/03/2016	14/09/2016
RT715	24	24"ns Type 12 4-2D Pig c/w Gauge Plate						PL005 - Dunlin - Cormorant A		
RT716	24	24"ns Type 12 2-3D Pig c/w Gauge Plate & Magnet Spacer						PL005 - Dunlin - Cormorant A	10/01/2015	03/07/2015
RT717	24	24"ns Type 12 2-2D Pig c/w Circular Brushes & Magnet Spacer						PL005 - Dunlin - Cormorant A	25/03/2016	24/09/2016
RT718	24	24"ns Type 12 2-4D Pig c/w Magnets						PL005 - Dunlin - Cormorant A	16/03/2016	15/09/2016
RT719	24	24"ns Type 12 2-4D Pig c/w Magnets						PL005 - Dunlin - Cormorant A	16/03/2016	15/09/2016
RT720	24	24"ns Type 12 2-4D Pig c/w Jetting Head						PL005 - Dunlin - Cormorant A	19/05/2014	18/11/2014
RT726	24	24"ns Type 12 2-4D Pig c/w Brushes & Magnet Spacer						PL005 - Dunlin - Cormorant A	15/03/2016	14/09/2016
RT727	24	24"ns Type 12 2-4D Pig c/w Spring Arm Mounted Brushes & Magnet Spacer						PL005 - Dunlin - Cormorant A	05/04/2016	04/10/2016

Key	Description
Equipment OUT of PE Aberdeen & OUT of / Unknown Certification	
Equipment OUT of PE Aberdeen & IN Certification	
Equipment IN PE Aberdeen	
RTXXX	Equipment IN PE Aberdeen & Ready For Despatch
Scrapped / Guaranteed / Missing Equipment	
External Storage	



Case Study 1 - Pig Fleet Optimisation

Customer Request:

PE was requested to review the current pig fleets for all North Sea assets to optimise fleet and reduce annual costs.

PE Step 1 – Fleet Streamlining:

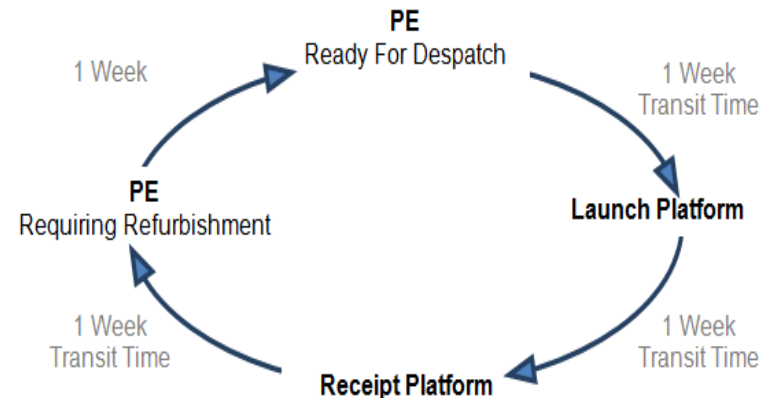
Loading data into online management system.

Review of stocked pigs against current / future pigging plans and logistical cycle involved with a pig run and refurbishment activities.

Result:

Reduction in operational pig fleet by 55% resulting in large annual savings to the customer.

- Reduction to storage costs
- Reduction to spares costs
- Reduction in certification costs



Case Study 1 - Pig Fleet Optimisation

PE Step 2 - Parts Optimisation:

The OEM bristle brushes were utilised but are primary for short distance and light debris removal as they clog easily in waxy lines.



The brushes were replaced with clipped type brushes as they're better suited for both hard and soft wax removal.

PE also replaced some circular brushes with spring arm mounted brushes for longer distance brushing requirements.

Result:

PE improved cleaning effectiveness by removing up to 35% more medium-firm hard wax....*less pigging runs required, improved ILI first run success.*

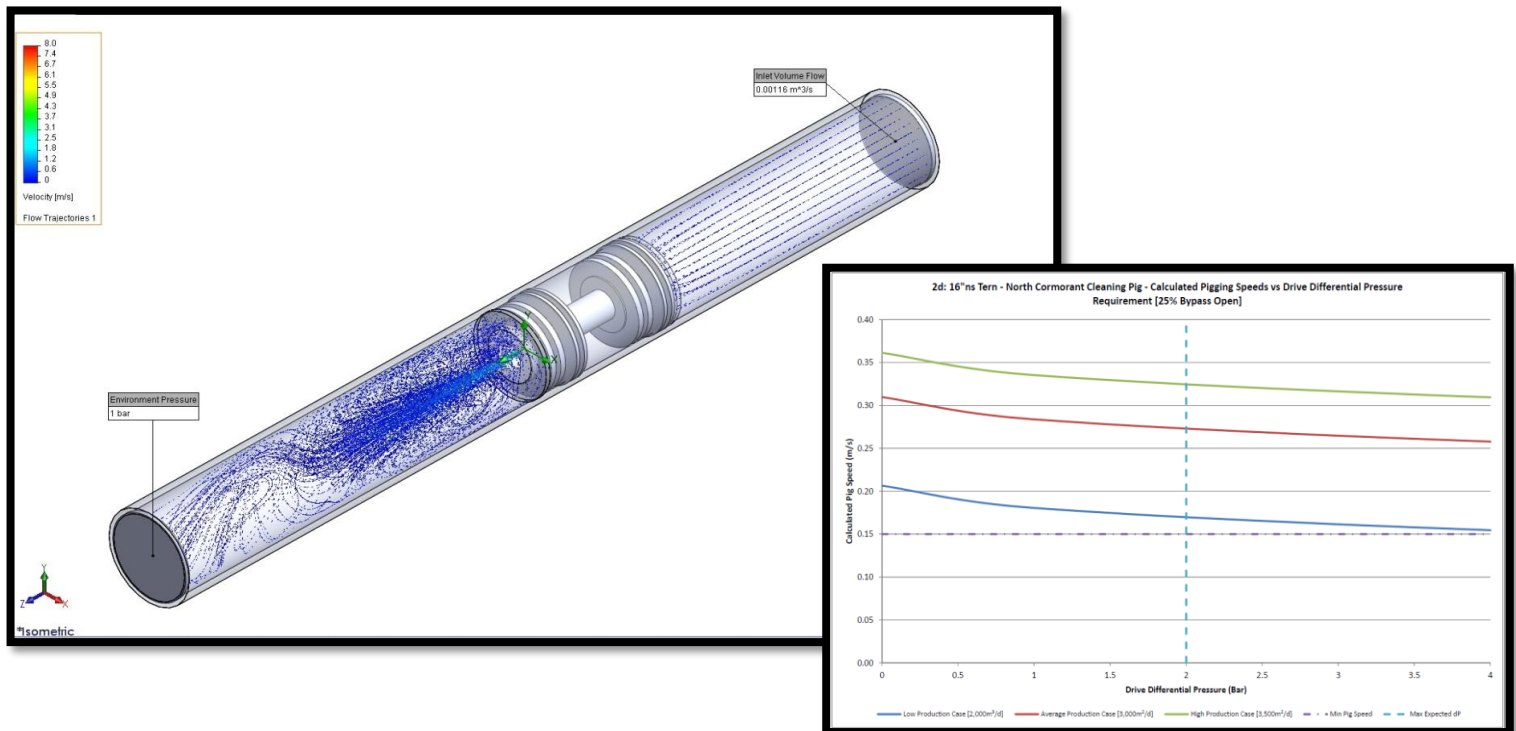
Case Study 1 - Pig Fleet Optimisation

PE Step 3 - Bypass Optimisation:

PE carried out a CFD (computational fluid dynamics) study focussing on the bypass flow through the pig within the pipeline. The study identified differing bypass port arrangements present on the pigging tools to confirm the optimal configuration for each pig type.

Result:

Increase from 25% to 100% bypass for improved cleaning performance.

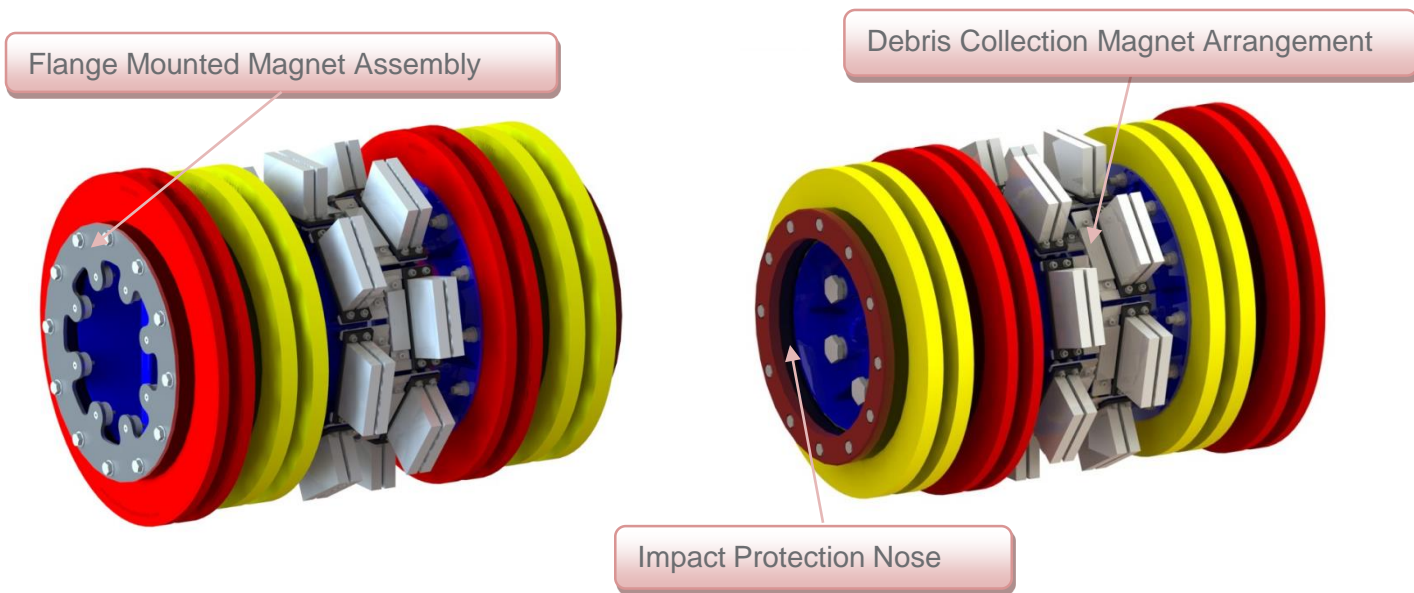


Case Study 1 - Pig Fleet Optimisation

PE Step 4 – Design Upgrade:

Utilise current pig manufactures pig design to include:

- debris collection and
- non-intrusive communications
- additional front end impact protection



Result:

PE upgraded the pigging tool to include debris collection, pig signalling and impact protection from ***bespoke design upgrades.***

Case Study 2 – Fleet Suitability Assessment

Customer Request:

PE was requested to assess, standardise and optimise the customer's pig fleet which consisted of pigging tools from various manufacturers.

PE Step 1 – Analysis:

Full dimensional analysis was completed to identify each tool's suitability and cleaning effectiveness.

Pig ID	Pig Sealing disc OD (mm)	% Min ID	% Nominal ID	% Max ID	Pig Support Disc OD	% Min ID	% Nominal ID	% Max ID	Pig Cup OD	% Min ID	% Nominal ID	% Max ID	Pig Circular Brush OD	% Min ID	% Nominal ID	% Max ID
Priority 1 Refurbished Pigs																
RT717	625	114%	108%	106%	576	105%	100%	97%	N/A				585	107%	101%	99%
RT700	620	113%	107%	105%	576	105%	100%	97%	N/A				585	107%	101%	99%
RT713	620	113%	107%	105%	576	105%	100%	97%	605	110%	105%	102%	N/A			
RT703	610	111%	106%	103%	576	105%	100%	97%	N/A				585	107%	101%	99%
RT719	615	112%	106%	104%	576	105%	100%	97%	N/A				N/A			
Priority 2 Refurbished Pigs																
RT704	610	111%	106%	103%	576	105%	100%	97%	N/A				585	107%	101%	99%
RT705	615	112%	106%	104%	576	105%	100%	97%	N/A				N/A			
RT706	615	112%	106%	104%	578	105%	100%	98%	N/A				N/A			
RT707	-				N/A				585	107%	101%	99%	N/A			
RT716	615	112%	106%	104%	572	104%	99%	97%	N/A				N/A			
RT720	615	112%	106%	104%	572	104%	99%	97%	N/A				N/A			

- Full tool fleet analysis conducted
- Compared to optimum dimensions
- Items in purple oversized and corrected.

Case Study 2 - Pig Fleet Assessment

Action:

All cleaning pig discs refitted with optimal specification dimensions and manufactured by PE.

Now to prove the cleaning pigs effectiveness...run PECAT.

Benefits:

- Capability of comparing pig run results to analyse cleaning effectiveness.
- Generate enhanced cleaning capabilities.
- Reduction in spares costs from heavy wear due to discs being oversized.
- Reduction in pig parts stocking levels.
- Reduced change of a stalled or stuck pig.

Cleaning Effectiveness Assessment:

PECAT was added to the cleaning programme to measure the debris quantity and confirm suitability for ILI campaign.



Case Study 2 - Pig Fleet Assessment

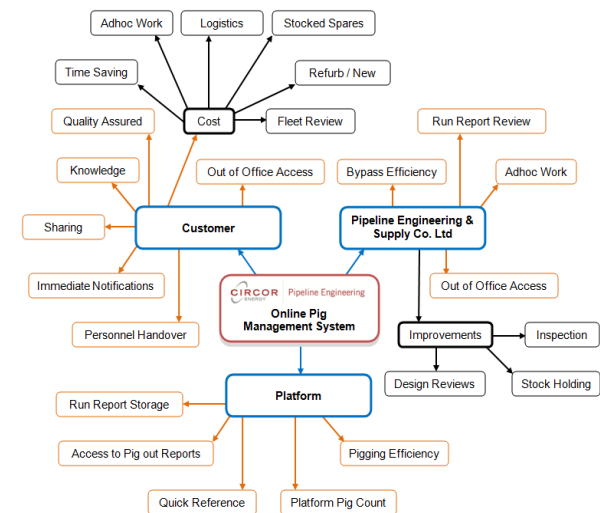
The table and graphs show a summary of the 7.1 million readings that were taken during the individual assessment:

Start Distance (km)	End Distance (km)	Mean Depth (mm)	Estimated Volume (m ³)	Comments
0.135	1	0.48	0.755	From bottom of Riser
1	2	0.45	0.826	
2	3	0.42	0.758	
3	4	0.40	0.735	
4	5	0.50	0.917	Highest volume of wax identified
5	6	0.36	0.658	
6	7	0.29	0.520	
7	8	0.30	0.549	
8	9	0.31	0.562	
9	10	0.31	0.559	
10	11	0.30	0.549	
11	12	0.29	0.527	
12	13	0.28	0.502	
13	14	0.27	0.492	
14	15	0.27	0.487	
15	16	0.25	0.452	
16	17	0.28	0.510	
17	18	0.32	0.574	
18	19	0.28	0.506	
19	20	0.29	0.530	
20	21	0.28	0.515	
21	22	0.27	0.499	
22	23	0.26	0.480	
23	24	0.27	0.486	Suspected corrosion point
24	25	0.27	0.492	
25	26	0.28	0.515	
26	27	0.29	0.532	
27	28	0.31	0.562	
28	29	0.32	0.579	
29	30	0.32	0.587	
30	31	0.33	0.603	
31	32	0.36	0.651	Suspected dent KP31.58
32	33	0.43	0.775	
33	34	0.38	0.684	
34	End	0.52	0.048	To bottom of Riser

- Cleaning campaign undertaken.
- PECAT run to confirm effectiveness.
- Wax quantity along the pipeline measured.
- Confirmed acceptable for ILI run.

Fleet Management & Bespoke Customer Portal Benefit Summary

- Enhance cleaning effectiveness.
- Reduce the chance of a stuck pig.
- Reduce pigging tools.
- Reduce pigging spare materials.
- Reduce project cost.
- Reduce project time.
- Improve shared knowledge.



Q&A

- Any questions?

Case Study 2 - Pig Fleet Assessment

