

# **AGENDA ITEM IA: INNOVATION, DIGITALISATION AND AUTOMATION**

**ASSOCIATION OF CARIBBEAN STATES (ACS)**

**2<sup>ND</sup> COURSE ON MARITIME PORT UPGRADE FOR EXECUTIVES OF THE  
GREATER CARIBBEAN  
(VIRTUAL MEETING)**

ACS Secretariat, Port of Spain, Republic of Trinidad and Tobago

March 23<sup>rd</sup>, 2021



Innovation, digitisation and automation in the  
marine industry



# Our Offering



Provider of wide range of marine services with an ability to integrate



# Business Segments



## Portfolio of Services: **Offshore**, **Port Services** and **Cargo Transport**



- Offshore support
- Wind farm installation and maintenance
- Subsea
- Emergency response



- Towage
- Pilotage
- Mooring
- Environmental services



- Energy construction support
- Transport of minerals
- Transport of agricultural products

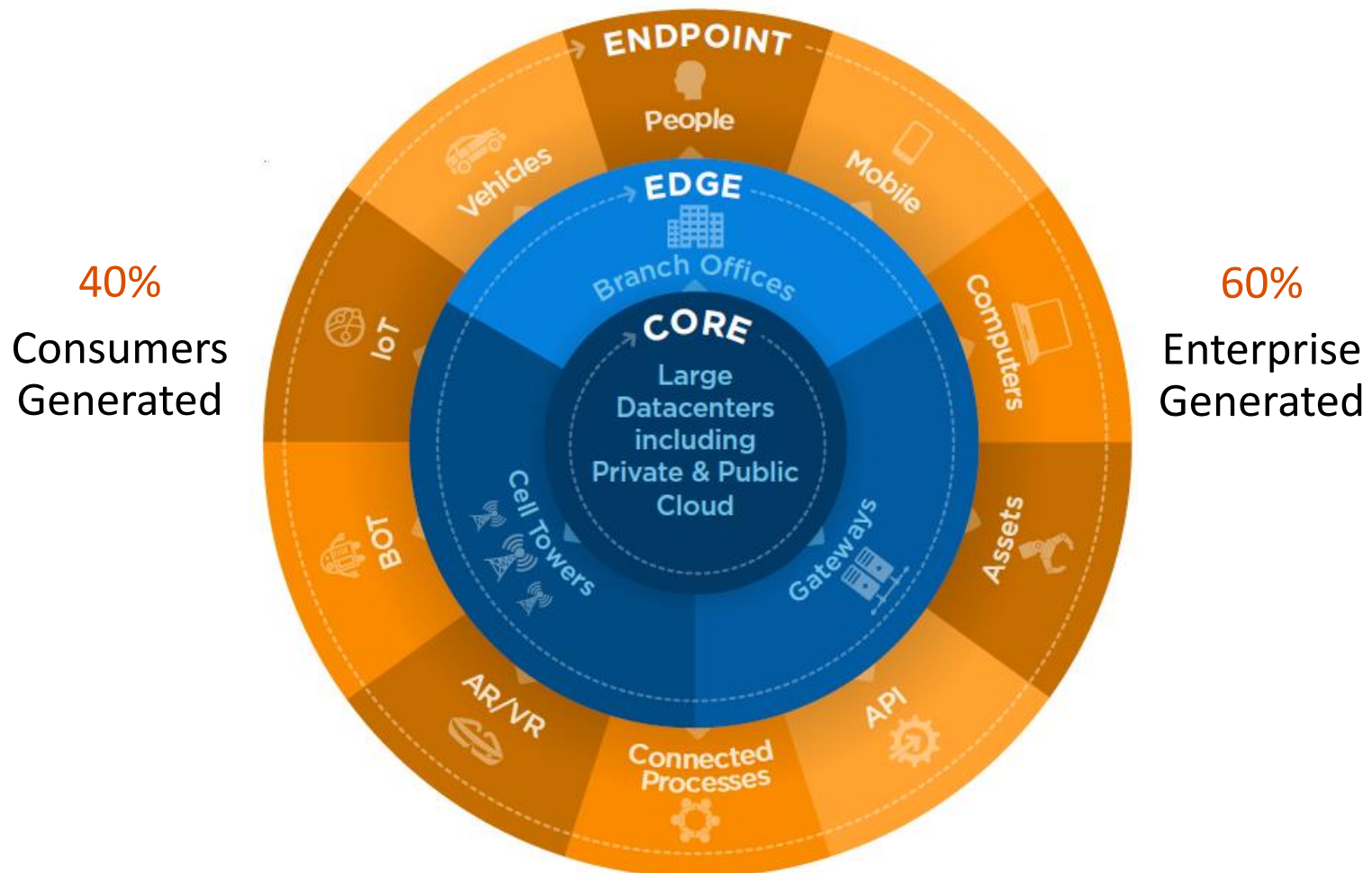
Other services (e.g. Government marine services) will remain in the portfolio but with less investment focus

# Digital – A Part of Daily Lives

Faster, more informed decision-making



# Global Datasphere in 2025



Est. 175,000,000,000,000,000,000,000 (10<sup>21</sup>) Bytes  
of data generated



# P&OML: an Illustrative Business Case



## Creating a digital strategy

**P&OML Vision: To be the champion provider of marine, port service and cargo transport solutions to the global offshore industry.**

### Digital Business Value

Operational Excellence	Cost Management	Customer Satisfaction	People and Talent	Fleet, Assets and ROA	Sales
<ul style="list-style-type: none"><li>• 5% lower fuel costs</li><li>• 0.5-1% reduction in operations cost</li><li>• 27% reduction in maintenance costs</li></ul>	<ul style="list-style-type: none"><li>• 25-25% reduction in the TCO finance function</li></ul>	<ul style="list-style-type: none"><li>• 20-25% lower call center cost</li><li>• 20-30% lower time to resolution</li><li>• 20-25% higher 24/7 availability</li></ul>	<ul style="list-style-type: none"><li>• 1-3% higher revenue per employee</li><li>• 2-3% higher employee satisfaction</li><li>• 25% increase in productivity</li></ul>	<ul style="list-style-type: none"><li>• 10-15% higher asset uptime</li><li>• Reduce maintenance cost by 13%</li></ul>	<ul style="list-style-type: none"><li>• 3-5% lower cost of acquisition</li><li>• 7-12% higher conversion</li></ul>

### Enabling Technologies

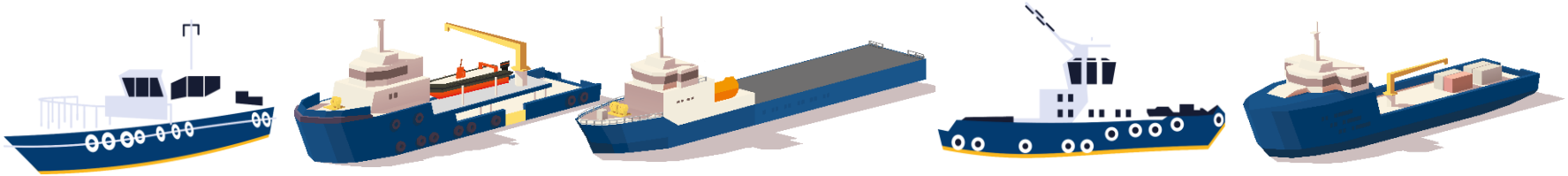
Mobile Technology, Social Platform,  
Cloud for Supply Chain, Big Data,  
IoT, Advanced Analytics,  
Augmented Reality, Digital Authentication,  
Cognitive Computing, Nanotechnology,  
3D Printing, Wearable technology,  
Mobile Asset Optimization, Robotics  
Autonomous Vehicles and Drones

# Connecting A Diverse Fleet



A unified approach to doing more with our resources

## P&OML Fleet +400 Vessels



Maintenance

Dry dockings

Procurement

QHSSE

Document Management

Fleet-wide data related to KPIs is captured through suite of systems

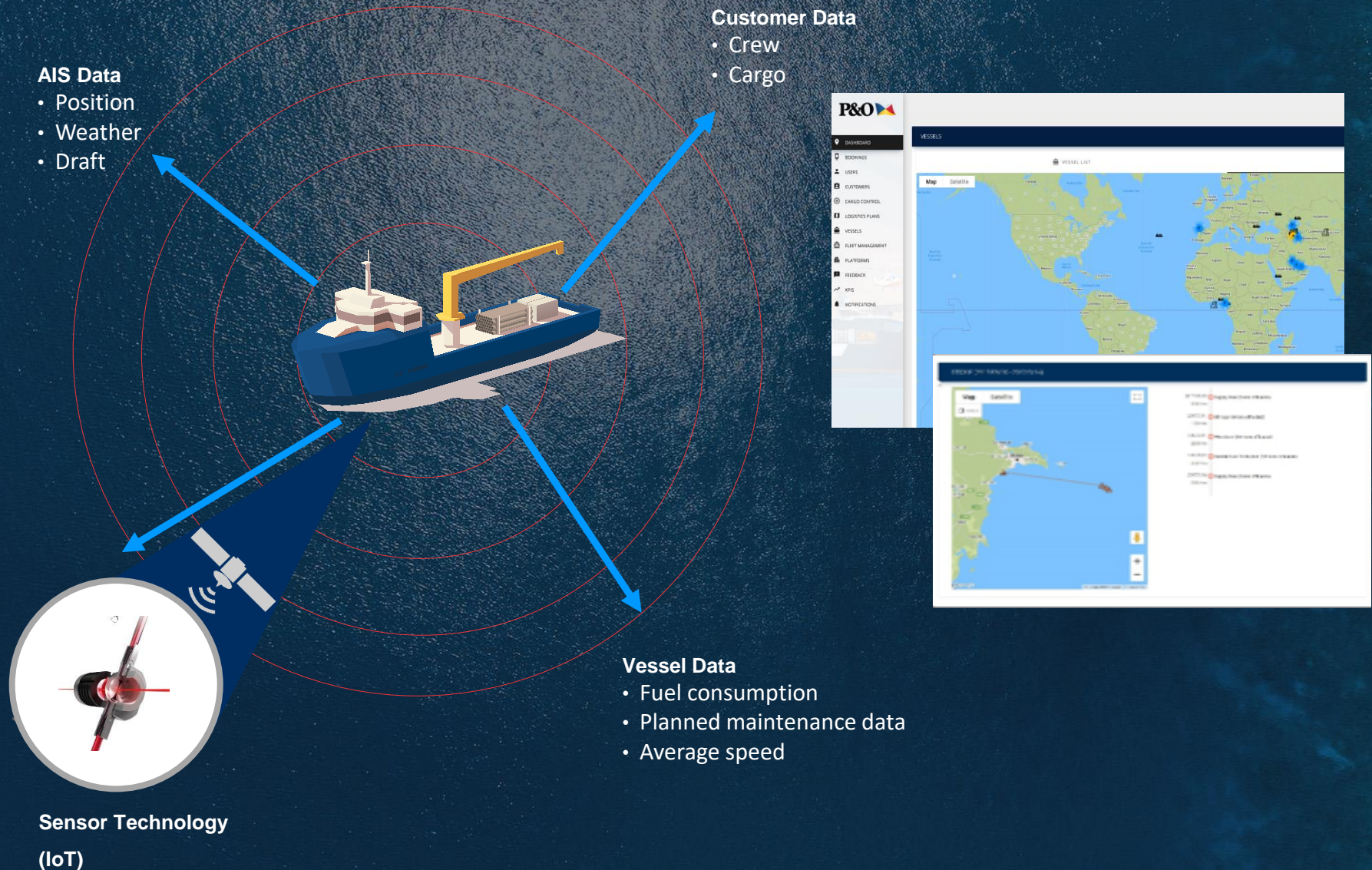
## Integrated management system

Data autonomously creates a dashboard for benchmarking activities and more informed decision-making closer to offshore and our clients

Data

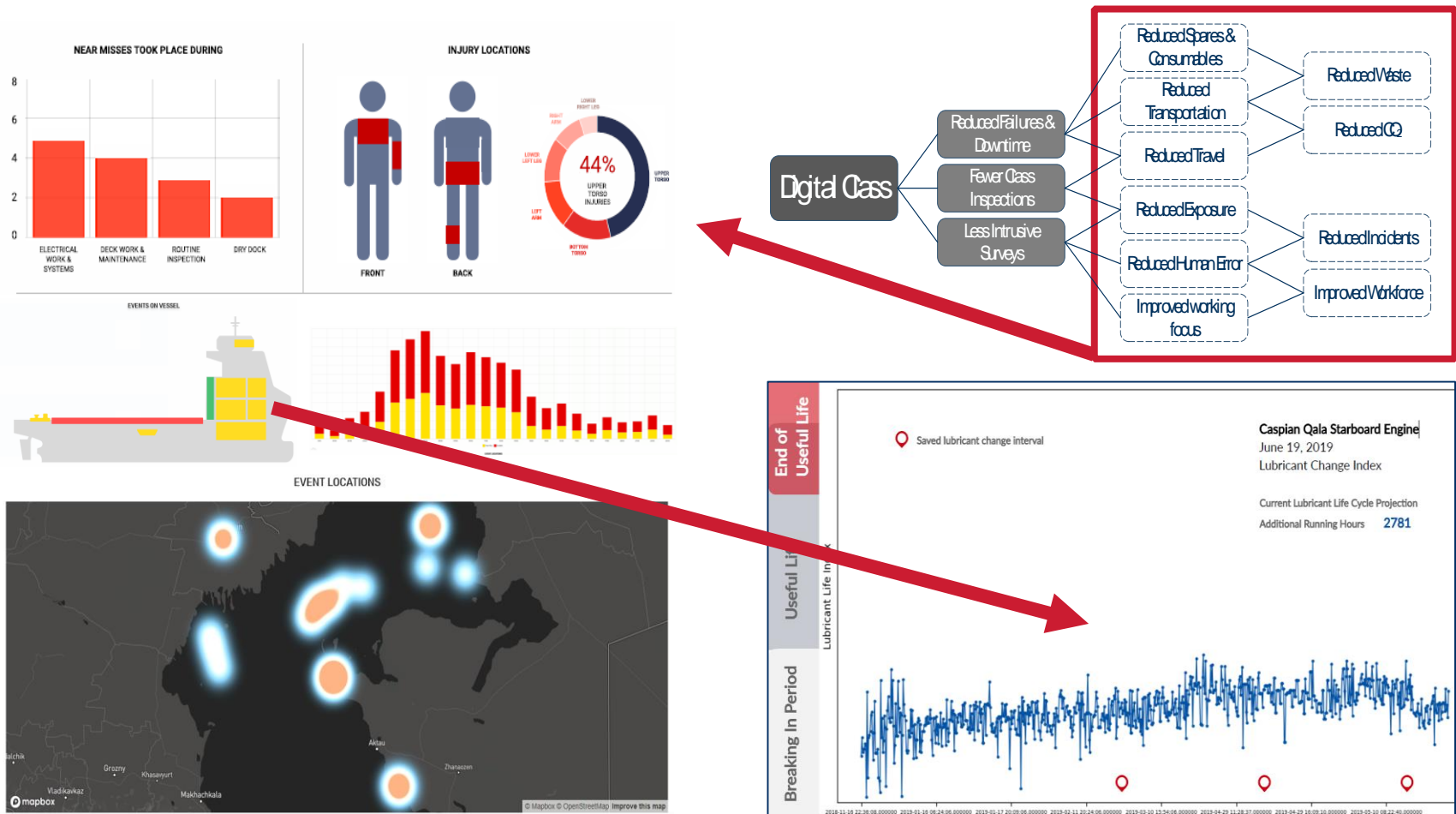


# A Connected Future



# Marine Analytics

Using data it is possible to unlock the value allowing analytics to better shape decisions





# BI and Analytics



## Enhancing transparency, accountability and engagement

- Power BI compiles automated dashboard using real time data (from NSE, MVV app etc.)
- KPIs clearly defined/displayed
- Encourages lateral learning and continuous improvement
- Use data to identify trends
- Better understanding of data to make business decisions

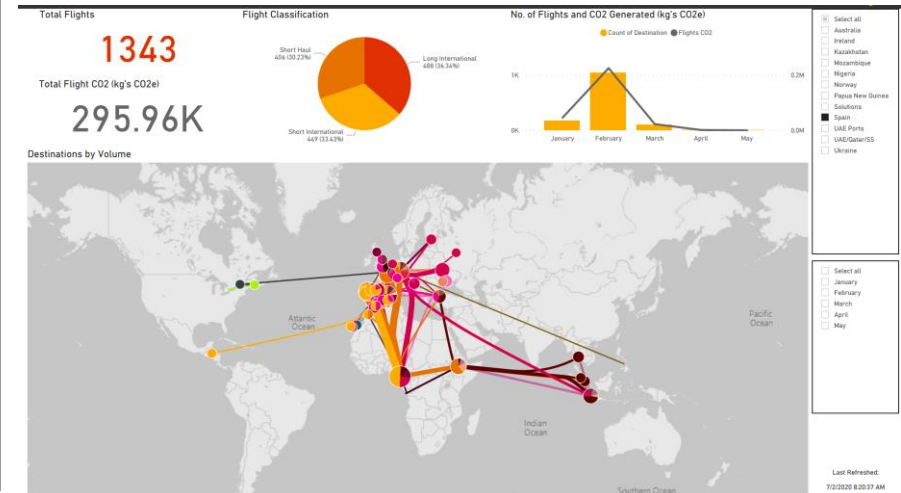
VESSEL	DATE	BESTSPEED COUNT	BESTSPEED HOURS	BESTECONOMY COUNT	BESTECONOMY HOURS	DISTANCE KM	SPEED KNOTS	TRAVEL HOURS	IDLE HOURS	VOLUME LTR
Baki	07/04/2020					43.8	3.4	4.7	19.3	1,590.6
Caspian Challenger	07/04/2020					34.0	3.4	5.4	18.6	22,028.0
Caspian Endeavour	07/04/2020					44.7	4.4	5.0	19.0	23,826.3
Caspian Power	07/04/2020					24.5	0.0	4.5	19.5	32,411.4
Caspian Pride	07/04/2020			2	5.2	110.2	7.6	8.0	16.0	6,204.8
Caspian Protector	07/04/2020					38.5	3.6	2.1	21.9	1,822.2
Caspian Provider	07/04/2020			1	6.5	130.5	7.8	9.1	14.9	5,196.3
Caspian Qala	07/04/2020			1	9.7	160.5	8.7	9.9	14.1	7,033.6
Caspian Server	07/04/2020			2	13.0	217.4	8.3	14.1	9.9	8,099.7
Caspian Supplier	07/04/2020			2	8.9	146.3	8.3	9.5	14.5	6,514.2
Caspian Voyager	07/04/2020			1	1.0	30.4	7.6	2.3	21.7	10,616.2
Citadel	07/04/2020					16.9	4.8	1.7	22.3	6,491.9
Fortress	07/04/2020					31	3.6	0.3	23.7	2,626.0
Topaz Dignity	07/04/2020					0.0	0.0	0.0	24.0	1,073.7
Topaz Captain	07/04/2020					384.8	8.7	24.0	0.0	10,201.6

### Self-Verification Program 2020: Home

Showing: July 2020

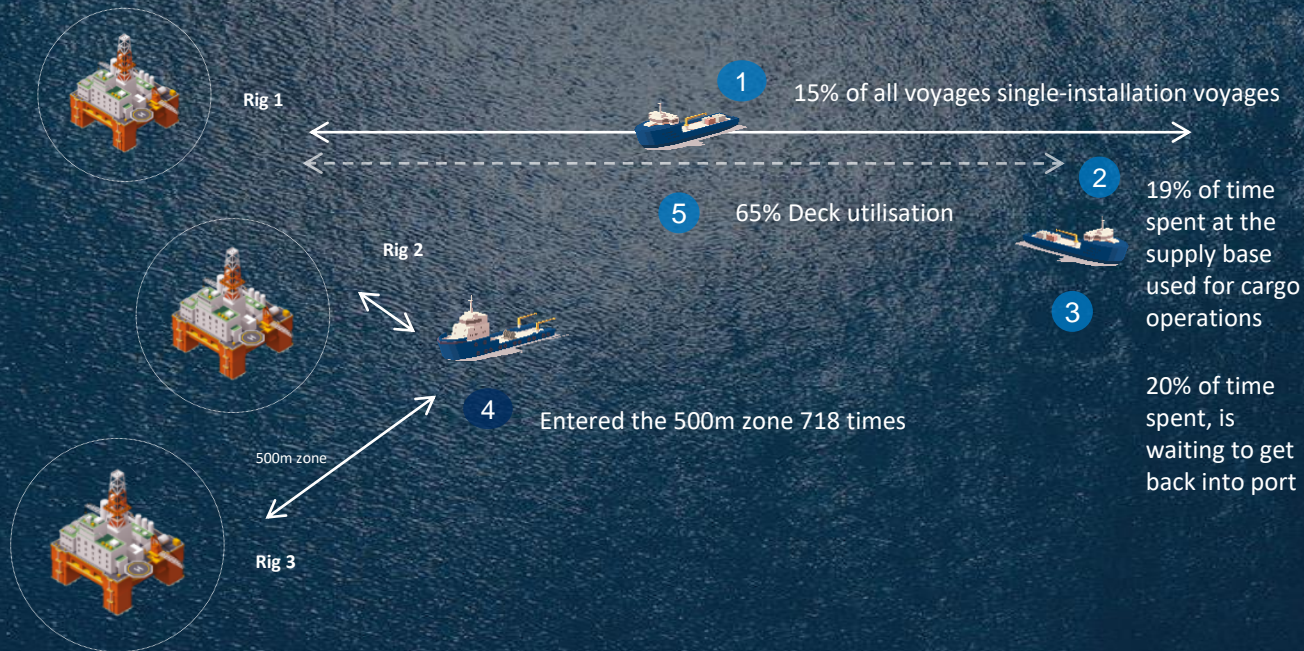


KPI TYPE	Level Name	Overall Statutory Comp.	Outstand Critical Equip. PM	Outstand Monthly PM	Critical / Priority Defects	Internal Vessel Audits	QVQ Insp. Find.	QVQ DVPQ Validity	Internal Vessel Staff	Retention Key Share Mgmt.	Retention Findings & NCIO's	Inc. Mgmt.	Defects Overdue	SOP	MMP	MVR	LLR	PO Receipt Ratio	Expenditure Processing	Total
ALL	GROUP				2.75	3.45	4.50	3.25	3.00	3.00	3.04	3.75	3.14	3.00	3.00	3.00	3.00	3.00	3.00	2.12
Show	REGION				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
Multiple selections	AFRICA				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
Month	AMERICAS				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
Jul-20	AUSTRALIA/PHG				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
Region	CASPIAN				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
All	EUROPE				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
Team/BU	MENA				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
All	TENGOZ				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
Vessel	TEAM				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
All	ANGOLA				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
Build Rev: 4.0	AUSTRALIA				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
Last refreshed on: July 05, 2020 09:35 AM O.	AZERBAIJAN1				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	AZERBAIJAN2				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	CYPRUS				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	IRELAND				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	KAZAKHSTAN				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	MADAGASCAR				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	MOROCCO				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	NIGERIA				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	NORWAY				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	PARAGUAY				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	PERU				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	QATAR, UAE & TURKEY				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	ROMANIA				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	RUSSIA				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	SAUDI				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	TENGOZ				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
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	TURKMENISTAN				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	UAE PORTS				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	UK				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28
	UKRAINE				2.80	2.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.28



Metrics continuously evolve to ensure relevancy to business performance

# Offshore Logistics where the value can be unlocked



SHOREBASE

30% less vessels employed

- Do more with same asset base
- Increase in ROCE

35% reduction in delivery time

- Less inventory
- Reduction of rental cost of equipment

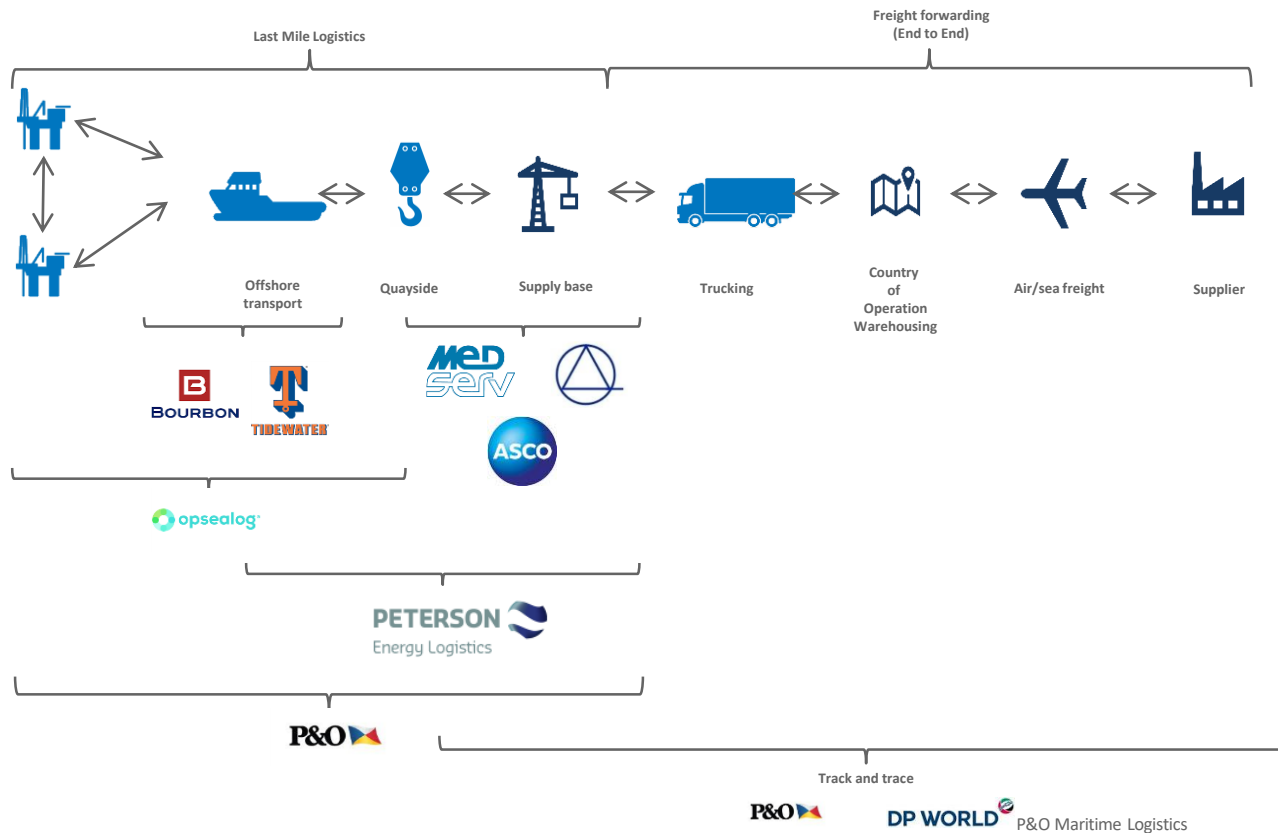
40% reduction in distance travelled

- 40% less fuel
- Fewer assets

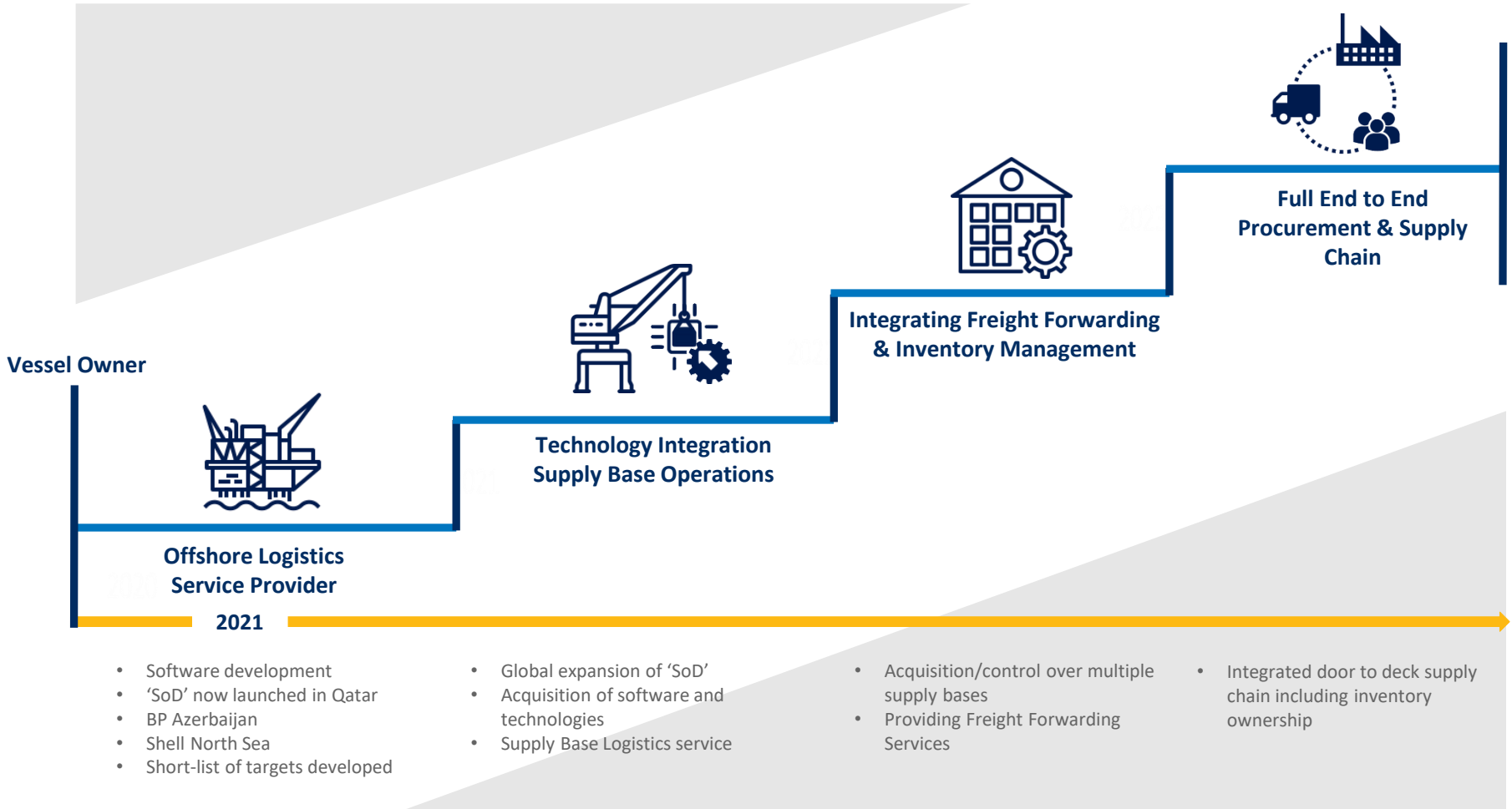


# Last Mile Logistics

Presents an opportunity to unlock value in a largely uncontested market space



# Gradual build-out of capabilities and scope driving towards an integrated offshore logistics service provider, and beyond



# Prevention of Catastrophic Loss

## Why deploy a digital solution



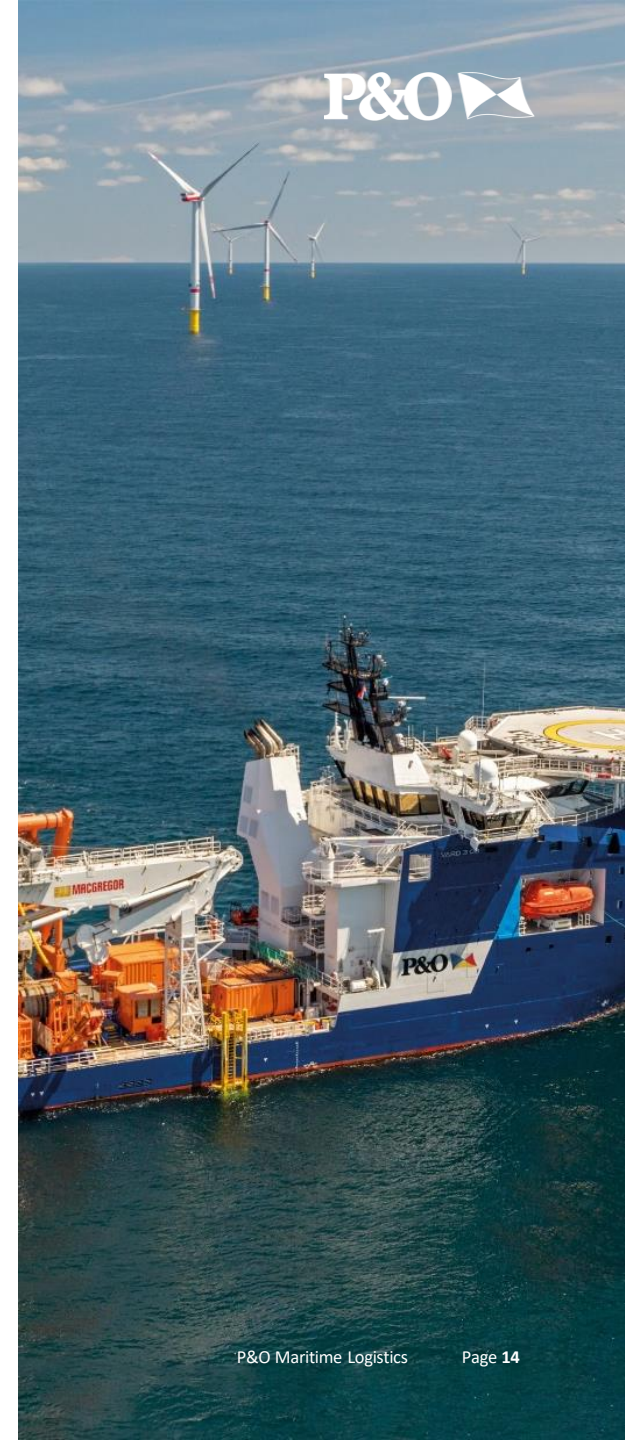
Background

- In June 2018, a connecting rod went through the engine block of a marine ship
- Early root cause analysis findings traced the problem to previously undetected water contamination
- Manual sampling, specifically for water ingress to this engine, had been taking place for several weeks prior to this catastrophic failure (through local contractors)
- The manual sampling indicated no issues



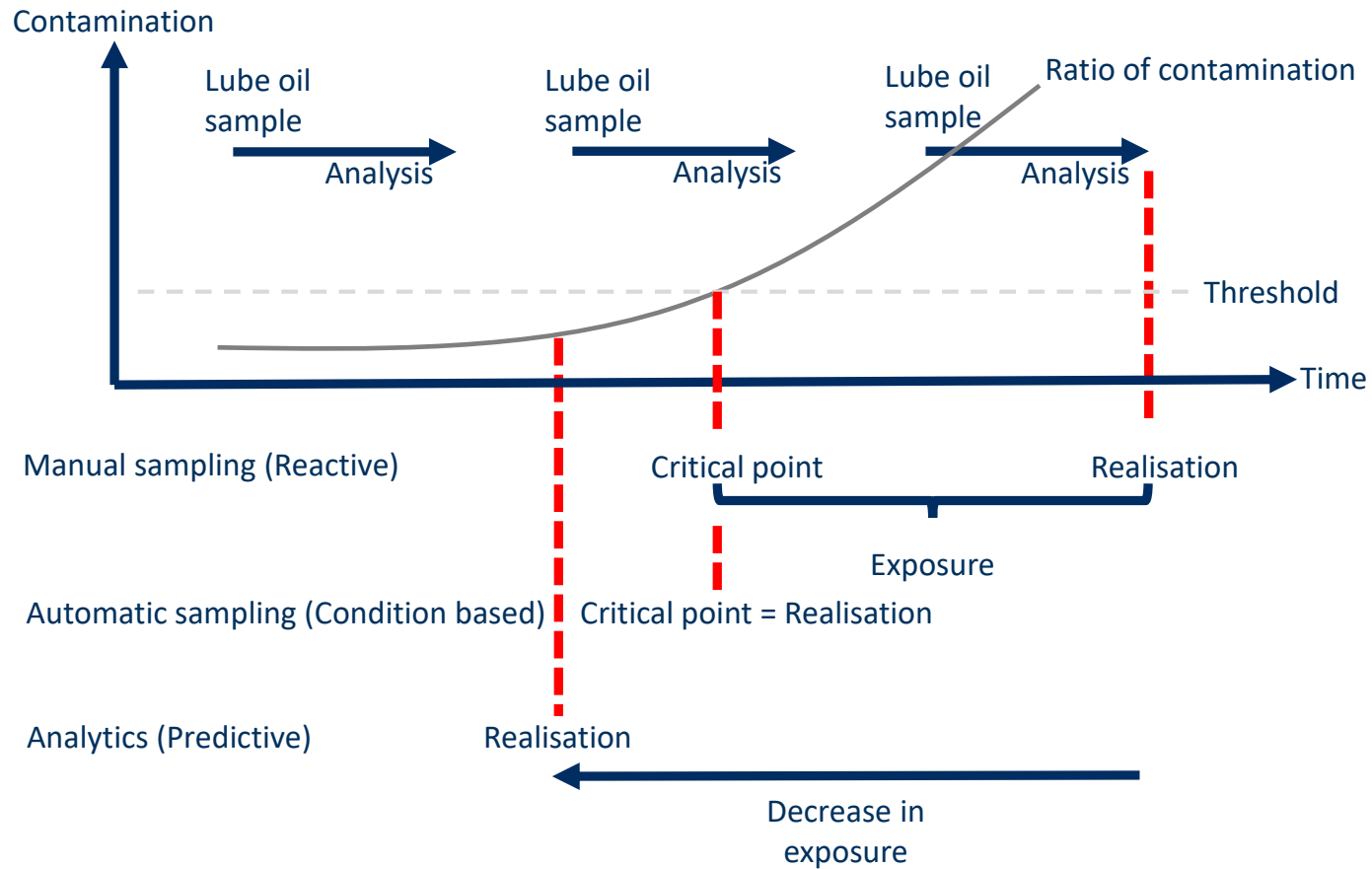
Cost of Failure

- \$400K - Cost to purchase a new engine
- \$150K - Cost to expedite shipment of the new engine
- 10 –20 days of lost utilization
- Replacement Process:
- The new engine will be flown to the ship
- On arrival, the engine will have to be completely taken apart to get the components into the ship
- The engine will then have to be reassembled, piece by piece, inside the ship
- Extensive redundancy protocols will then take place



# IoT Journey

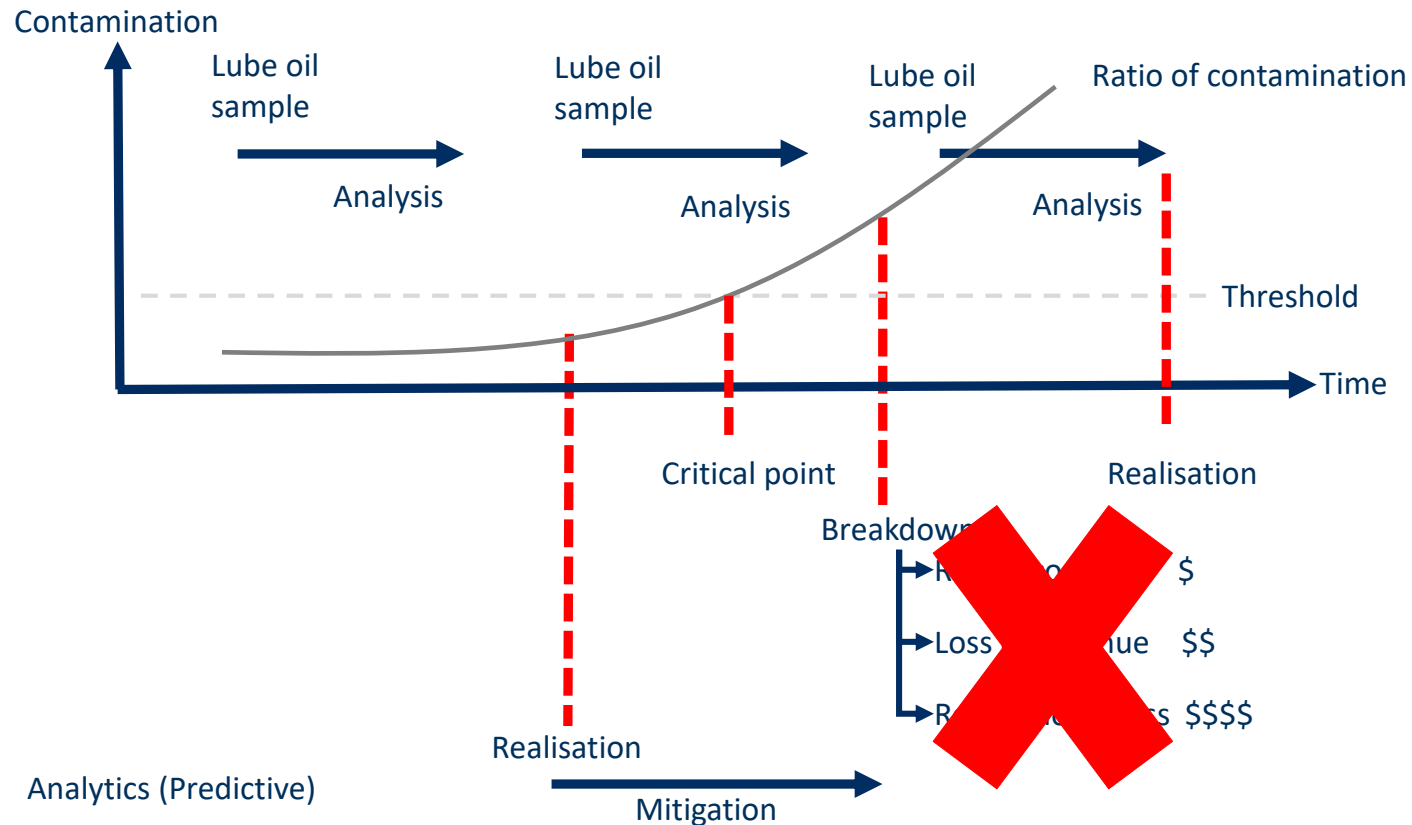
Enables change of maintenance model from reactive to predictive





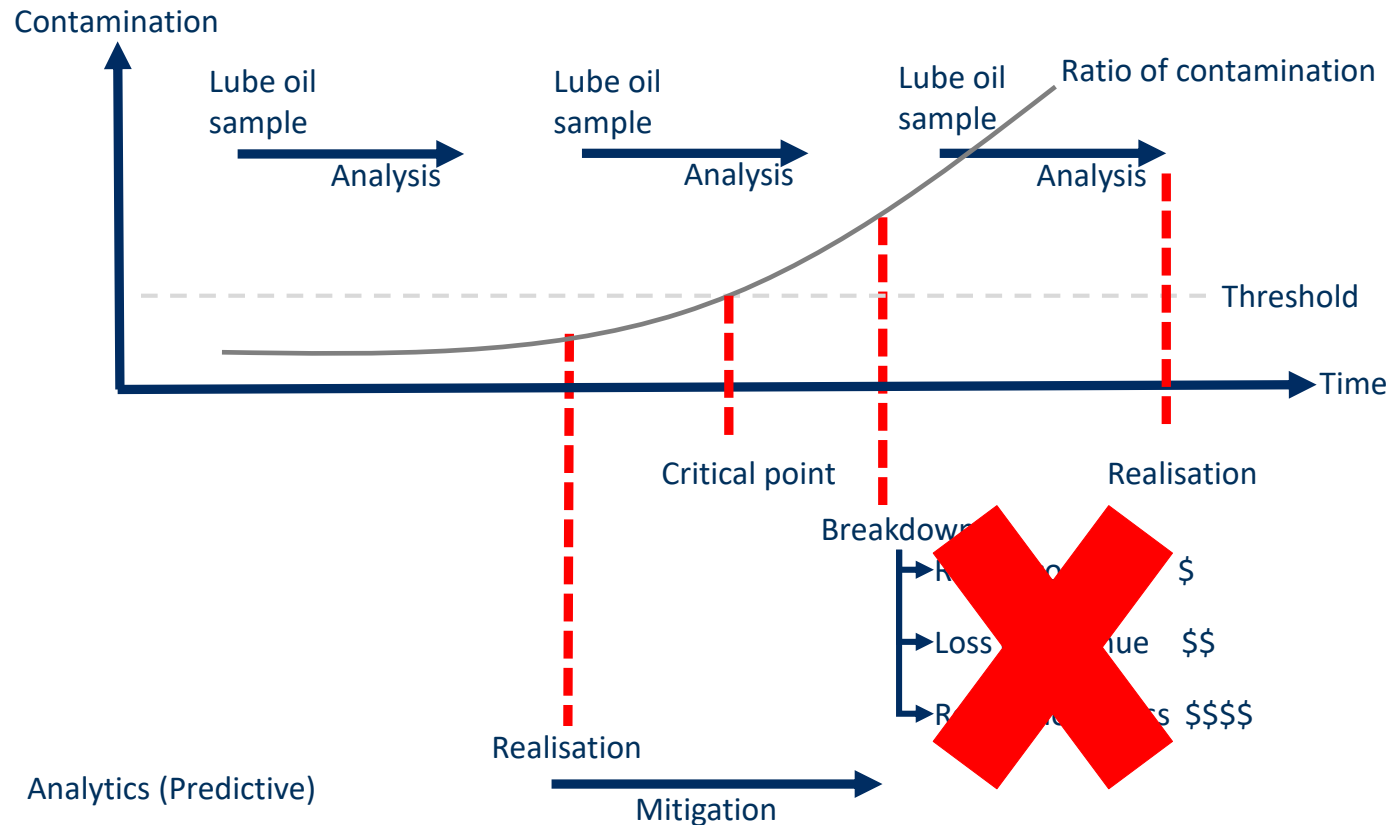
# IoT Journey

Enables change of maintenance model from reactive to predictive



# IoT Journey

Enables change of maintenance model from reactive to predictive



# Measurement Parameters

## Oil Life Cycle – Performance Optimization

By using VitalyX this enables us to ensure that the lube oil operates within its life cycle sweet spot. Not changed before it becomes optimal, and not after it becomes a risk to the asset

## Water Dilution

Water can induce base oil oxidation, severely compromise additives, and interfere with oil film production, causing severe damage to an asset.

## Soot

Excessive soot can lead to many issues, including increased viscosity, lower combustion efficiency and increased wear of key components.

## Glycol

Glycol contamination can result in wear rates 10 times greater than water contamination alone, and can also be an indication of severe asset failure.

## Fuel Dilution

Fuel dilution dilutes the concentration of oil additives, in turn diluting their effectiveness, as well as being an indication of internal leakage.

## SaltWater Dilution

Saltwater can cause significantly more issues than water. In most applications, the presence of saltwater indicates a compromised seal. Even a small amount of highly saline water can lead to catastrophic failure.

## TBN

TBN is an important indicator of a lubricant's health and can be used to estimate where the lubricant is in its life cycle. The TBN determines oil's ability to neutralize acids that are produced during use.

## TAN Index

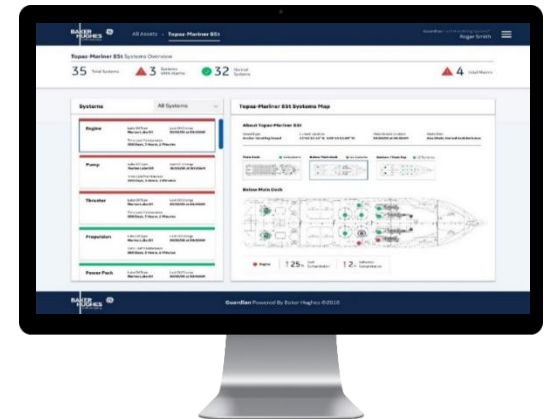
As oil is used, it becomes contaminated with acids, resulting in the base number dropping over time. As a result, TAN compliments TBN in tracking the remaining useful life of oil.

## Viscosity

Viscosity is an important indicator of a lubricant's ability to protect a system from wear and tear.

## Metallic Particles

Microscopic metallic particles can lead to catastrophic failures in systems such as generators, engines or gearboxes. BHGE's lubricant monitoring platform provides context, predictive models based on the specific application.



## Temperature

Due to the fluid's dielectric properties change with temperature, it is important that the Sensor Bank incorporates temperature measurement.

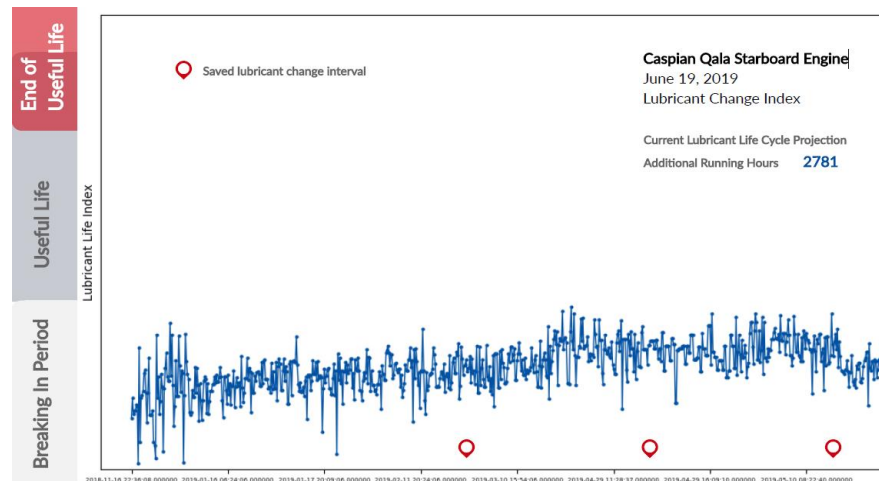
## Density & Dielectric

Density and Dielectric sensing will be performed using a single mechanical resonant sensor with capacitance measurement. This device is well known with an established range of capabilities.

# Extension of Lubrication Oil Change

## Lubrication Oil Useful Remaining Life Analysis

- This process is used to measure the current position in an oil's life cycle, and predict its remaining useful life
- The benefits to operators of this predictive analysis cannot be overstated



- Cost Savings of Condition Based Monitoring
- Moving to a condition based oil intervention schedule reduces costs of:
  - New lube oil
  - Disposal of old lube oil
  - Cost of labour for the change
  - Downtime caused by intervention

## Lubrication Oil Performance Optimisation

- Current practices determine time based maintenance on lubrication oil interventions
- The majority of the time, the lubrication oil change is performed:
  - Before it is necessary (40% of the time)
  - Before the oil reaches its 'breaking in' or optimal performance level





Thank You