John Crane Asset Management Solutions (JCAMS)

Sasol - Improving Plant Availability whilst Reducing Total Cost of Ownership

31st May 2021

William Herbert Heinrich Safety pyramid rule of thumb

The safety pyramid illustrates how an at – risk behavior can easily escalate to become a lost time injury or even a fatality

!The only place we have control over the outcome is at the bottom of the pyramid, when we choose to do, or allow, an at-risk behavior,

Agenda

1. Introduction to JCAMS
2. Defining Reliability & Availability
3. Reducing Total Cost of Ownership while Improving Availability & Reliability
4. How CBM can Reduce Costs and Improve Availability & Reliability
5. How a robust Inventory System can Reduce Costs and Improve Availability
6. Case Studies
7. Summary

Introductions

Gareth Boyd:

- Regional Business Development Manager – EMEA
- 14 years experience in global petrochemical sector
- MEA experience **-** 5 years MEA experience – previously based in Abu Dhabi, UAE, worked on projects in RSA, Botswana, Algeria.

Mike Judd:

- Technical Authority
- Background – Asset Management, Reliability, Maintenance, Condition Monitoring, Software, and Electrical / Electronics Engineering
- >35 years experience in oil and gas, refining, power generation, defence, transportation across the complete asset lifecycle
- MEA experience **–** Petrofac Sharjah, UAE, Qatar, Kuwait, Iraq, North & West Africa.

Introduction to John Crane Asset Management Solutions (JCAMS)

Gareth Boyd

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a smiths company

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c.23,000
PEOPLE

50+
COUNTRIES

c.170
YEARS

£2,498m
REVENUE

- JOHN CRANE
- SMITHS MEDICAL
- SMITHS DETECTION
- SMITHS INTERCONNECT
- FLEX-TEK
- ASSET MANAGEMENT SOLUTIONS

£945m
2019 REVENUE

c.6,100
COLLEAGUES

c.80
COLLEAGUES

4
COUNTRIES

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What JCAMS does

We are the Asset Management Solutions business of John Crane, providing reliability, maintenance, inventory and asset health management services across a client's entire plant

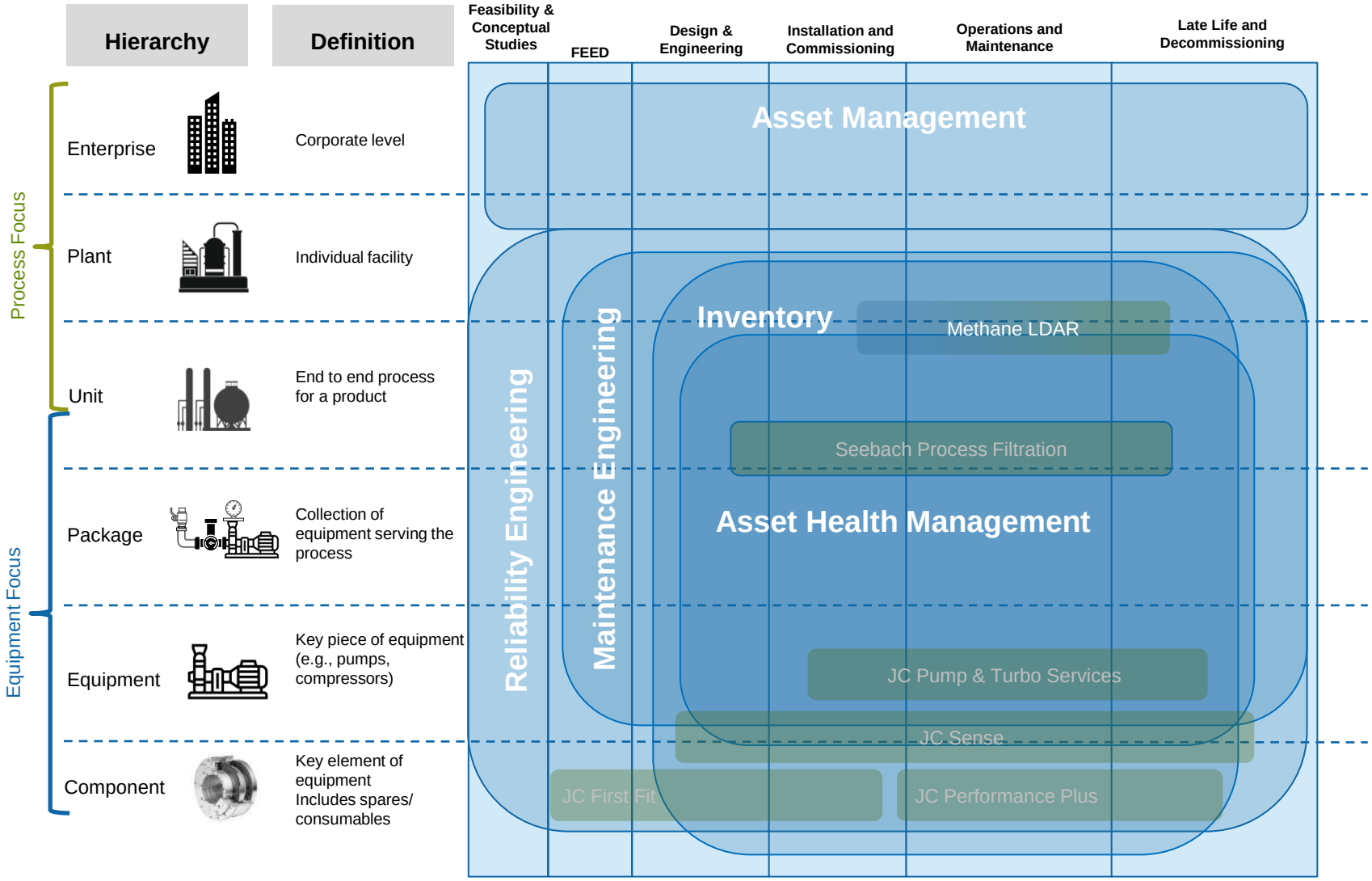
*We support our customers improve **equipment reliability and availability** by implementation of our data driven programs, through a combination of our consultancy, services and technology solutions.*

- Asset Management
- Reliability
- Inventory
- Maintenance
- Integrity
- Asset Health Management

Our Markets

- Oil & Gas
- Petrochemical
- Power & Water
- Pharmaceutical
- Pulp & Paper
- EPC
- Pipelines
- FPSO

Full Plant Reliability Support



Defining Reliability & Availability

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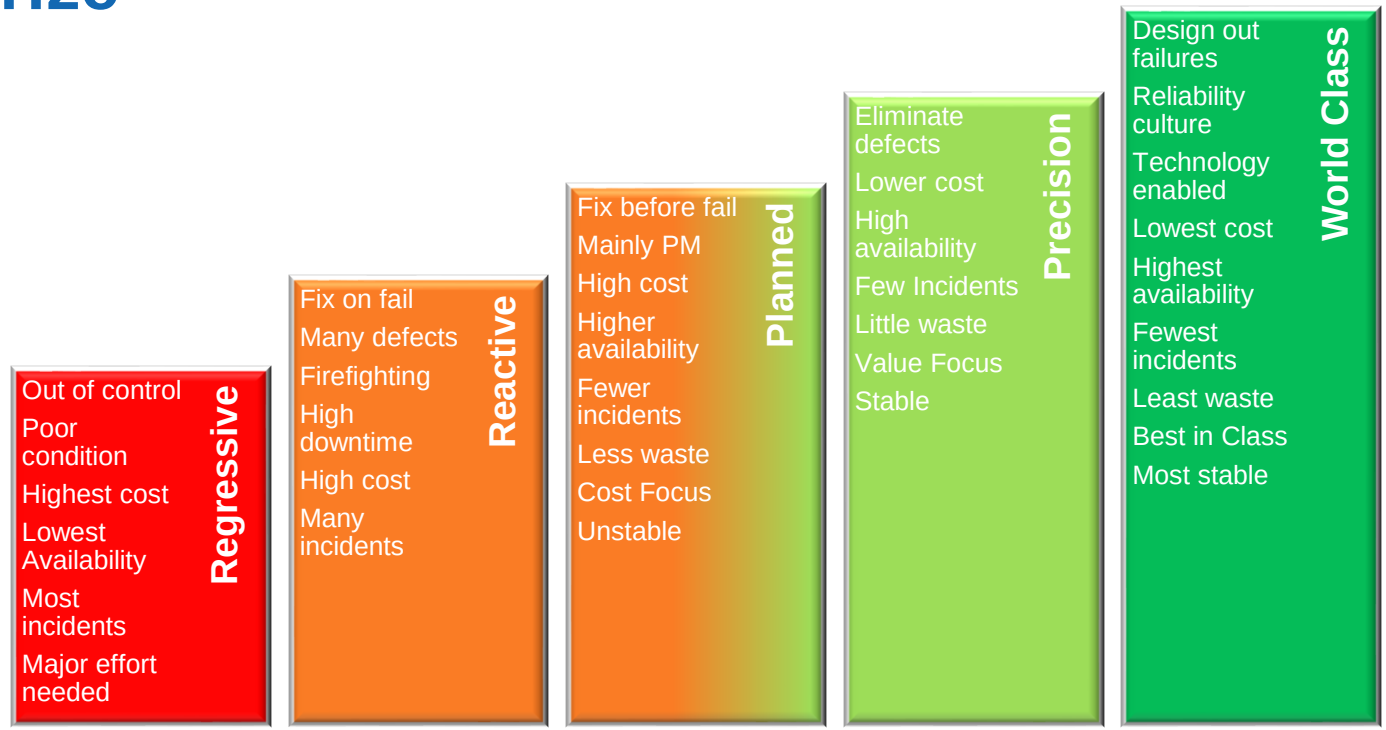
The Prize

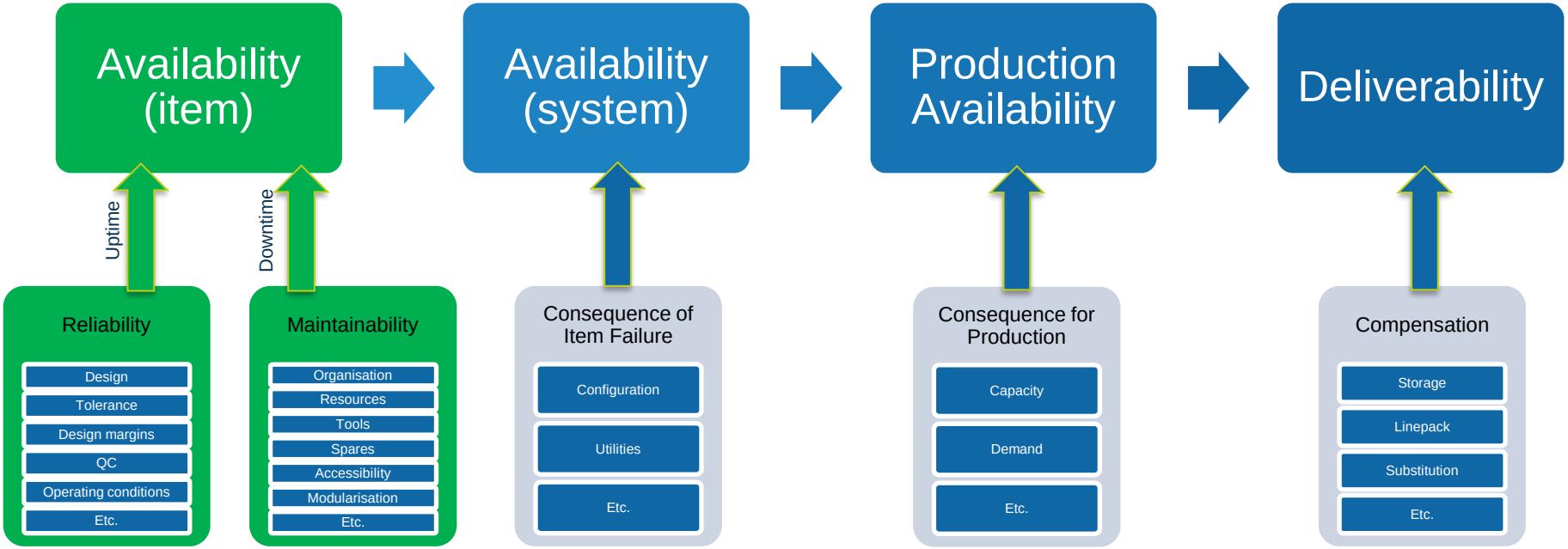


Credit: Winston P. Ledet (Dupont, Manufacturing Game), Terrence O'Hanlon (ReliabilityWeb)

- **20% - 45% reduction** in lifecycle costs
- **5% improvement** (e.g. 82% - 87%) in asset availability
- **20% - 60% reduction** in MRO inventory
- Improved Safety & Environmental performance

Reliability Defined

The probability that an item will continue to perform its intended function without failure for a specified period of time under stated conditions



ISO 20815 – Production Assurance and Reliability Management

Reliability Centred Maintenance

Described by Nowlam and Heap in 1978 and further developed by John Moubray

1. What are the functions and associated performance standards of the asset in its present operating context?
2. In what ways does it fail to fulfill its functions?
3. What causes each functional failure?
4. What happens when each failure occurs?
5. In what way does each failure matter?
6. What can be done to predict or prevent each failure?
7. What should be done if a suitable proactive task cannot be found?

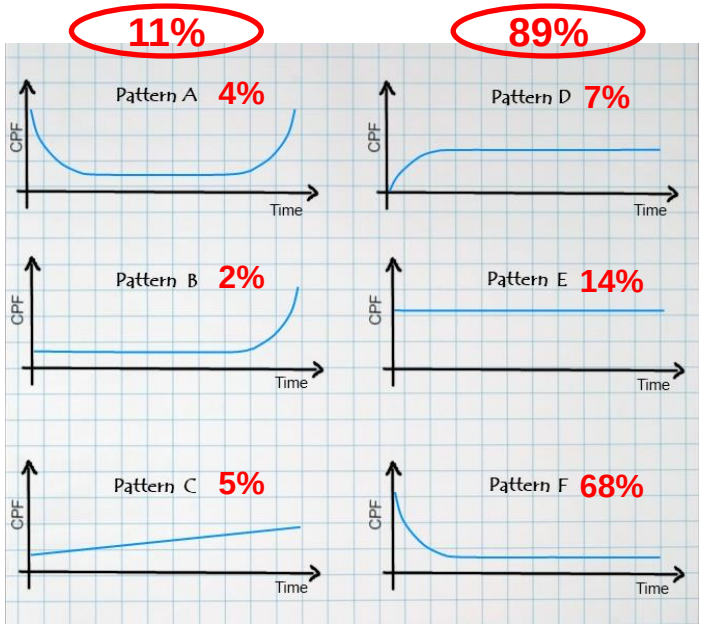
Technically feasible and economically viable response

Proactive Task

- Scheduled restoration
- Scheduled discard
- On condition
- Failure finding task
- Combination of tasks

Default Actions

- Redesign
- Run to failure



Reducing Total Cost of Ownership While Improving Reliability & Availability

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What Now?

Regressive

Survival Techniques

1. Decommission facility
2. Reduce facility throughput
3. Sell the facility to an organisation with the resources to restore sustainable performance
4. Increase resources deal with failures
5. Improve planning, scheduling, procurement, work management processes
6. Lower standards of performance expected

Reactive

Pursue Planned Domain

1. Understand that that the status quo is no longer acceptable.
2. Maintenance based upon RCM principles
3. Optimise work identification, planning, scheduling and work execution management.
4. Requires strong organisational structure and succession planning
5. Liable to revert back to reactive domain
6. Pursue precision domain

Planned

Pursue Precision Domain

1. Strong leadership
2. Strong business case
3. Establish culture of defect elimination
4. Empower workforce to make decisions
5. Maintenance based upon RCM principles
6. Typically requires 12 – 18 month implementation programme

Establishing Effective Maintenance

Corrective Maintenance

Create optimised PM programme

Plan

Schedule

Execute

Report

Analyse

Improve

All stages optimised for effective performance

Identify and classify assets

Assess asset criticality

Determine failure characteristics

Select mitigating measures

Create PM programme

Align to outage schedule

Optimise resource profile

RCM principles apply

Accelerate using maintenance templates

All stages optimised for effective performance

Our Approach – 6 Step Improvement Methodology

- Establish **client goals** and threats to those goals.
- **Review and assess** available information.
- Recommend way ahead.
- **Prioritise and plan** in line with goals.
- Establish combined team, including facility personnel.

- **Fast Track Inventory** Optimisation.
- **Removal / Deferral** of non-value adding & non-urgent activities.
- **Identification & rectification** of bad actors.
- **Extend** maintenance intervals.
- **Shut down, isolate** and preserve redundant equipment.

- Longer term actions to **improve reliability, maintenance, integrity** and inventory performance.
- Longer timescale and/or more resource than short term improvements.

- **Develop a reliability culture**, defect identification and elimination.
- Optimisation of processes, work identification, planning, scheduling, close out, reporting and improvement.

This approach can be applied to focus on **early cost savings** for the following categories without unduly impacting longer term objectives.

How CBM can Reduce Costs and Improve Availability & Reliability

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What are CBM and CM?

- **Strategy or mindset** in which assets are maintained based on condition, rather than time or operating hours

Condition Based Maintenance (CBM)

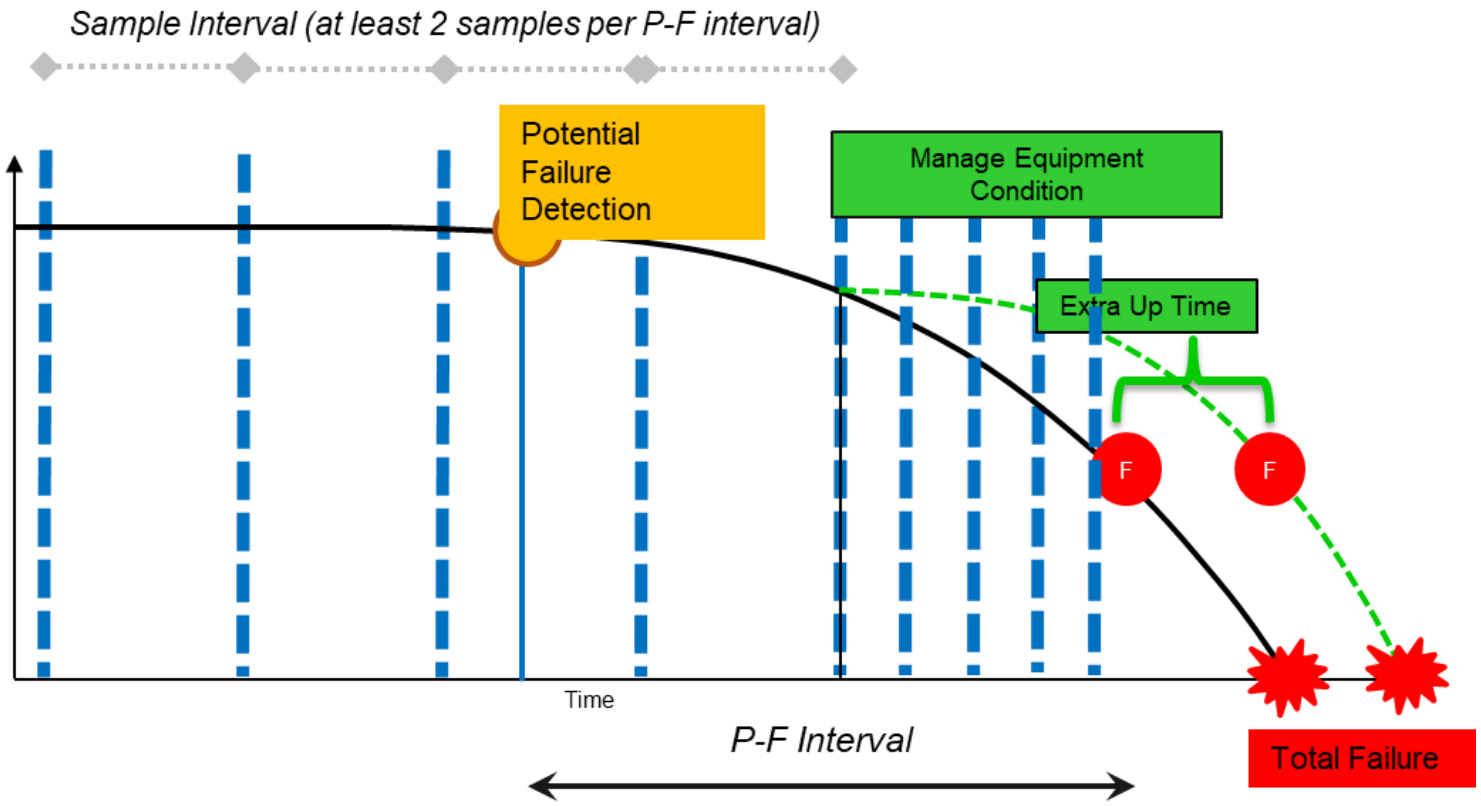
- **Activities** undertaken to determine the condition of an asset

Condition Monitoring (CM)

Benefits

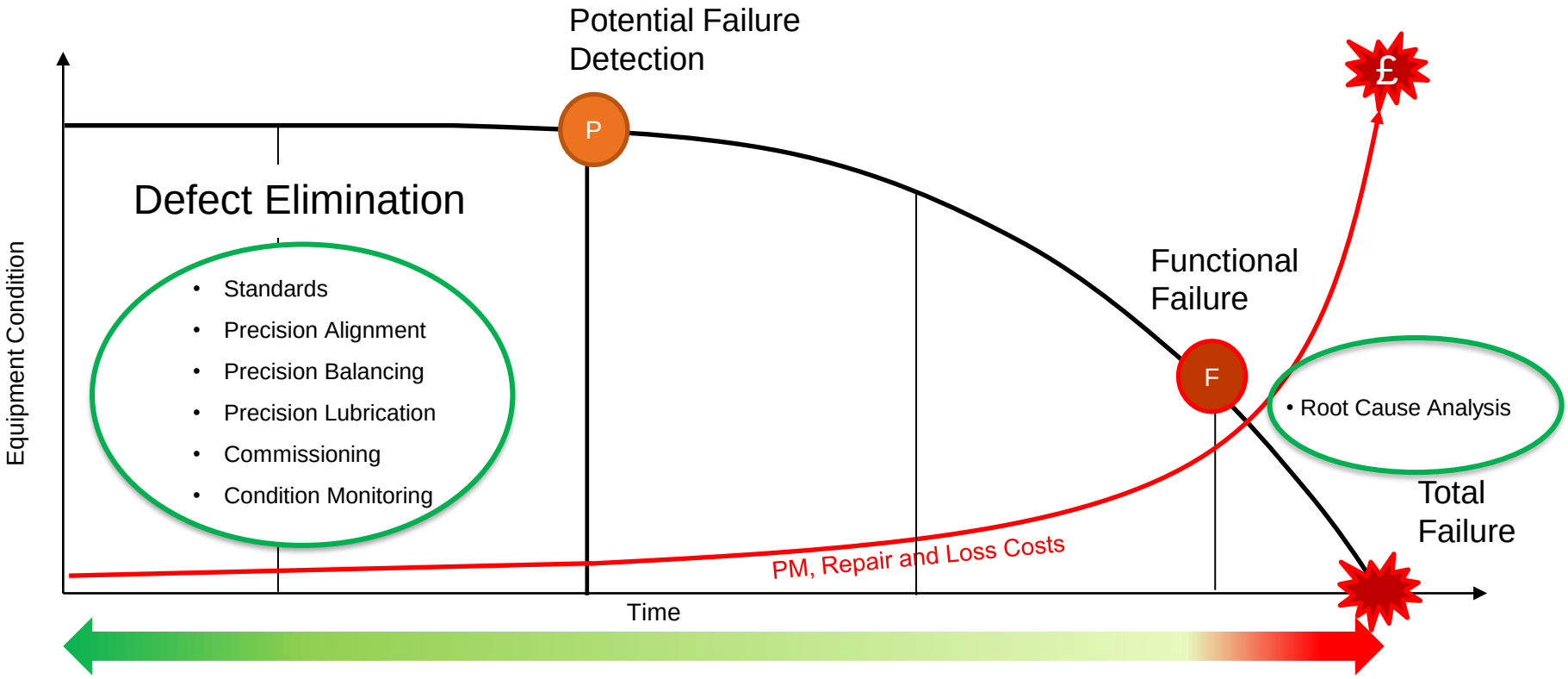
1. Where technically feasible and economically viable, CBM strategy has the lowest lifecycle cost
2. Provides assurance that operations can be continued safely
3. Helps identify and eliminate the underlying causes of defects leading to functional failure
4. Provides assurance that defect causes are not reoccurring
5. May allow reduction in inventory
6. Detects the onset of failure early, reducing the costs of corrective action and reducing operational impacts
7. May allow an asset owner to reduce insurance premiums

Optimum Monitoring Interval



- Early detection improves outcomes
  - Allows action to extend life
  - Early warning
  - Increases availability
  - Reduces cost
- Reduce interval to track fault progression
  - Eliminate surprises
  - Maximise schedule flexibility

Supercharge CBM – Prevention is Better Than Cure

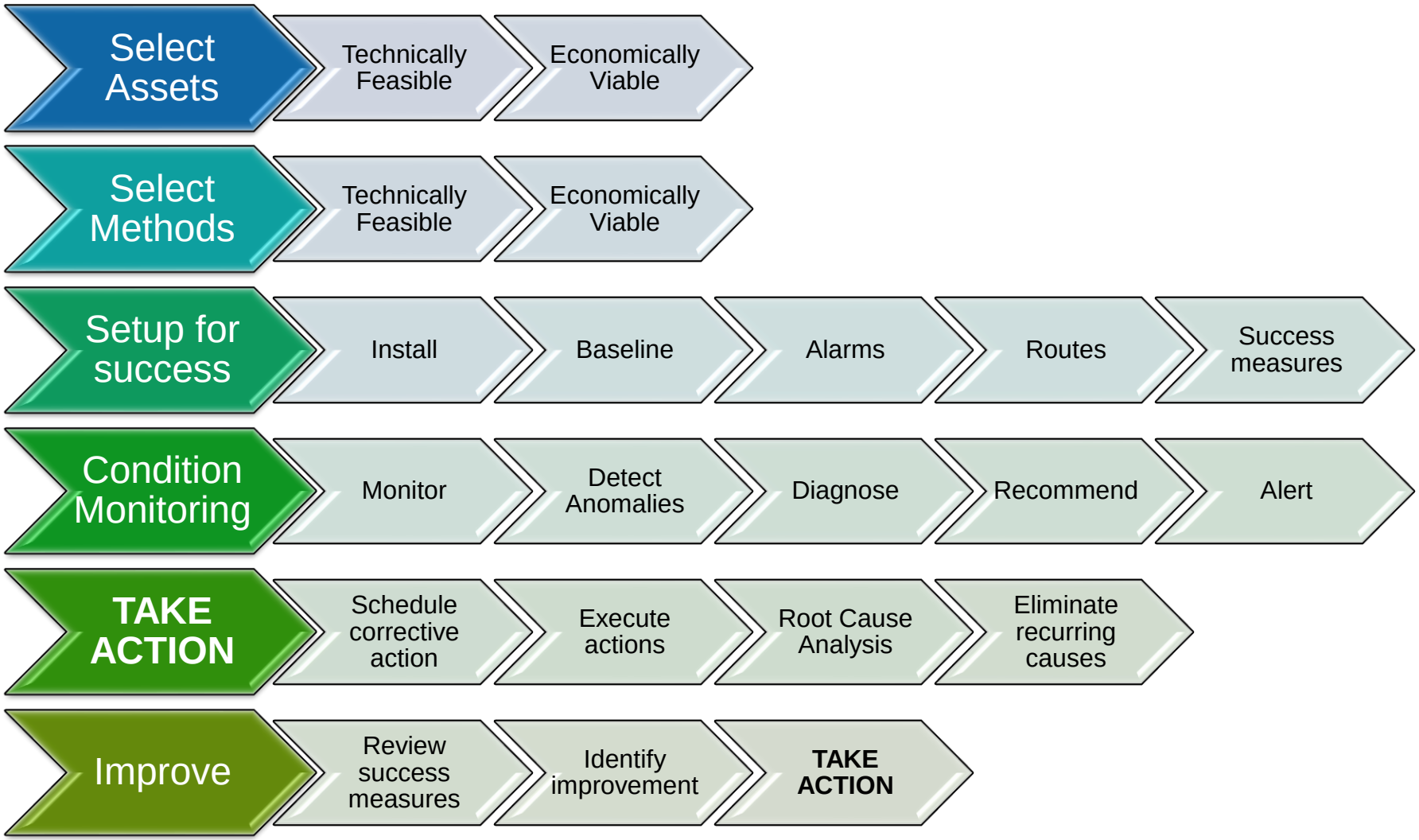


Focus Efforts Here:
Proactive Defect Elimination

To Reduce Impact Here:
Reactive Maintenance

Increase monitoring after startup to ensure correct operation and to reduce 'infant mortality'

What Makes CBM Successful?



How CM Improves Reliability, Availability & Cost

- Support Precision Maintenance
  - Monitor post commissioning
  - Monitor post intervention
- Eliminate repeat failures
  - Identify common causes
  - Monitor for recurrence

Increase Reliability

- Identify faults early
- Repair only when needed
- Minimise repair scope
- Schedule action when impact is low

Increase Availability

- Support precision maintenance
- Eliminate repeat failures
- Identify faults early
- Repair only when needed
- Minimise repair scope
- Schedule action when cost is low

Reduce Cost

How a Robust Inventory System can Reduce costs and improve availability

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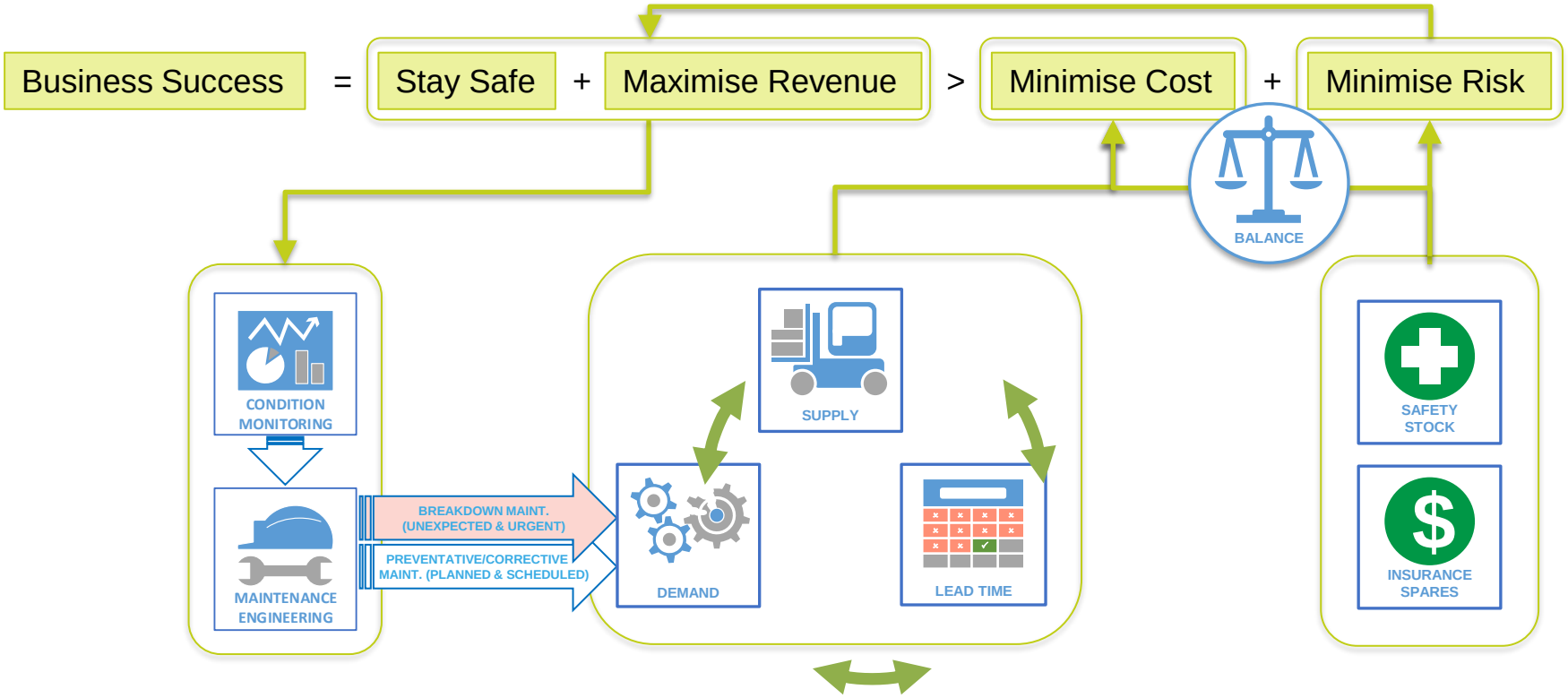
Importance of MRO inventory



- Holding too little inventory risks increased downtime and reduced revenue
- Holding too much inventory leads to excessive costs
- Having the wrong spares adds risk and cost

Information Required to Optimise Stock Levels

1. Material Processes

- Stock/non-stock
- Rules
- Stock movement

2. Materials Data

- Type
- Material Master
- BOM

3. Maintenance Data

- Criticality
- Failures
- Material use

4. Warehouse

- Returns process
- Repair

5. Master Data

- Materials ID
- Vendors
- Classification

6. LORA

- Repair or replace

7. Outsourcing Strategy

- Vendor managed
- Consignment stock

8. Asset Analysis

- Status of Asset

9. Inventory

- Stock visibility / analysis
- Forecasting

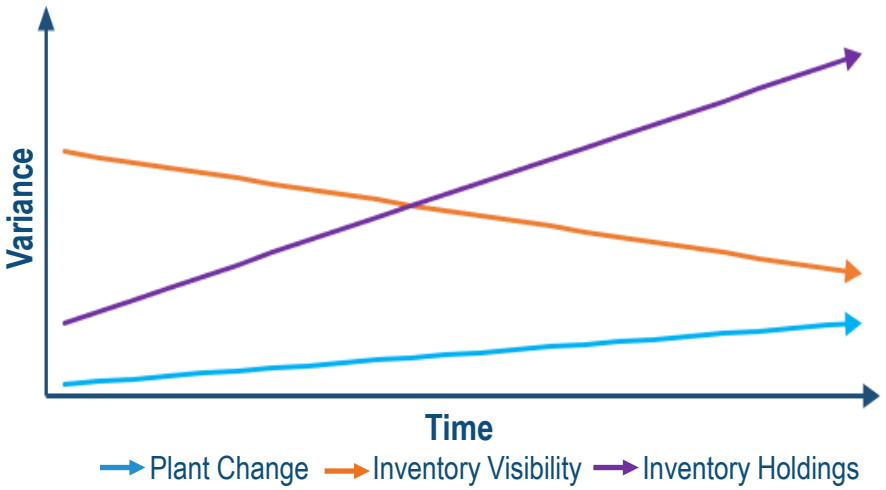
10. Strategies

- Inventory strategies

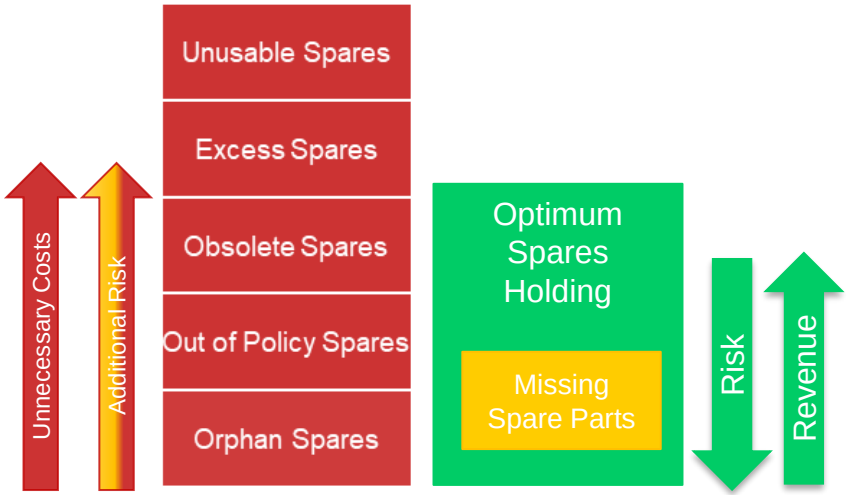
All elements of inventory management require accurate, up to date, consistent and controlled information

Establishing and controlling inventory processes and information is vital for managing inventory effectively

How Inventory Impacts Performance Over Time



- Inventory data is often a second thought at the project stage and starts off life in poor condition
- Change to the plant over time tends to further degrade data
- This gives poor visibility of the true inventory position, leading to excess inventory and increased risk
- This risks lower availability AND higher costs



- Poor visibility typically leads to **up to 60% excess inventory**
- Much excess inventory is not available for use
- Often critical spare parts are not held
- Our process drives the plant **back towards optimum spares holding.**

Typical Inventory Improvement Project

Our phased approach takes account of the current business environment by focussing on **early cost savings** without unduly impacting longer term objectives.

Maintenance – Deferral/removal of non-critical activities

Operations – Shutdown/isolation of redundant equipment

Materials – Justification to keep spares inventory

Cost reduction in **6 steps**

Goal Setting → Assessment → Prioritisation and Planning → Short Term Savings → Medium Term Savings → Longer Term Savings

Inventory holding can typically be **reduced by** between 20% and 60%

Cost of capital is around **10%**

Storage overheads are between **10%-20%**

Multiple stores can exponentially increase spares holding

Inventory Reduction Fast Track

FOCUS — Desktop review to select priority materials list

WORKSHOP — Frequent stakeholder workshops to ensure **rapid delivery of inventory reduction**.

WAREHOUSE — Warehouse walkdown with experienced team to identify anomalies

Detailed Review

DETAILED REVIEW — Detailed review of opportunities for improvements to inventory performance.

Culture and Process Change

CULTURE & PROCESS CHANGE — Govern and control business processes across the organisation and influence mindset changes to inventory

Spares Holding Optimisation Process

- Analyse the inventory material list.
- Cumulative value, looking at the highest value by volume.
- Known problems & issues.

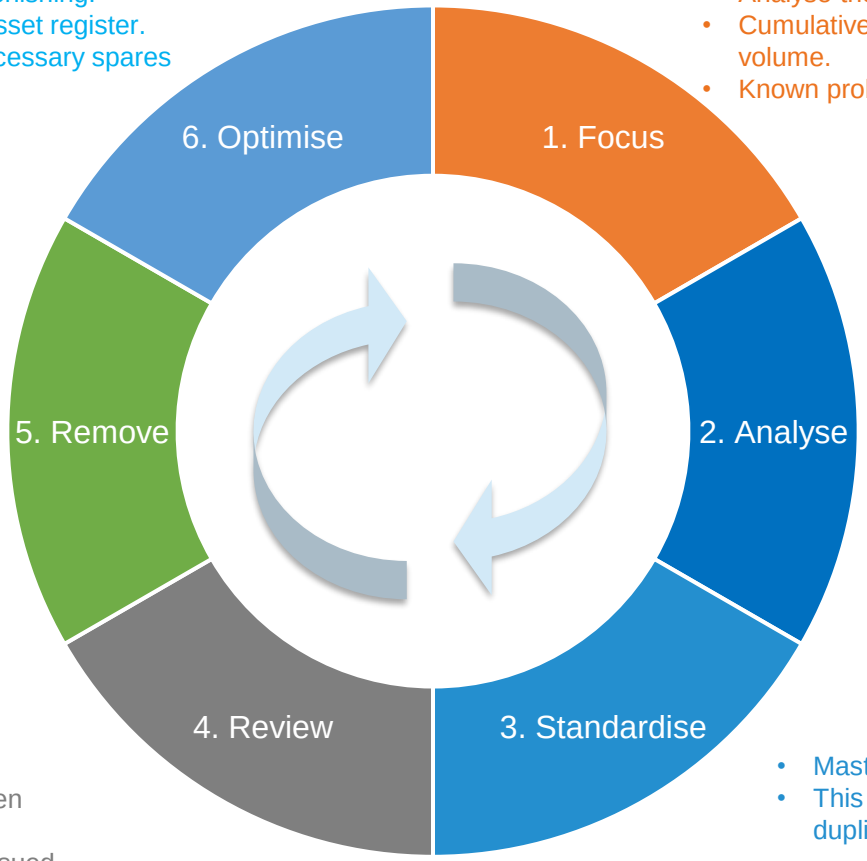
- Compare asset register, material, maintenance & warehouse data.
- Understand what assets require which spares & which are critical.

- Master data cleansed to a structured format.
- This reduces excess inventory by identifying duplication and commonality across all data.

- Compare WO's & PO's to verify what components / spares have actually been consumed & at what frequency.
- Frequency of goods receipt – goods issued.

- Remove any excess, obsolete & duplicate stock from the inventory.
- Items for Consignment Stock or for Maintenance Provider.

- Optimise spares forecasting & replenishing.
- Compare spares consumption vs asset register.
- Reliability problem areas and unnecessary spares holdings.



Case Studies

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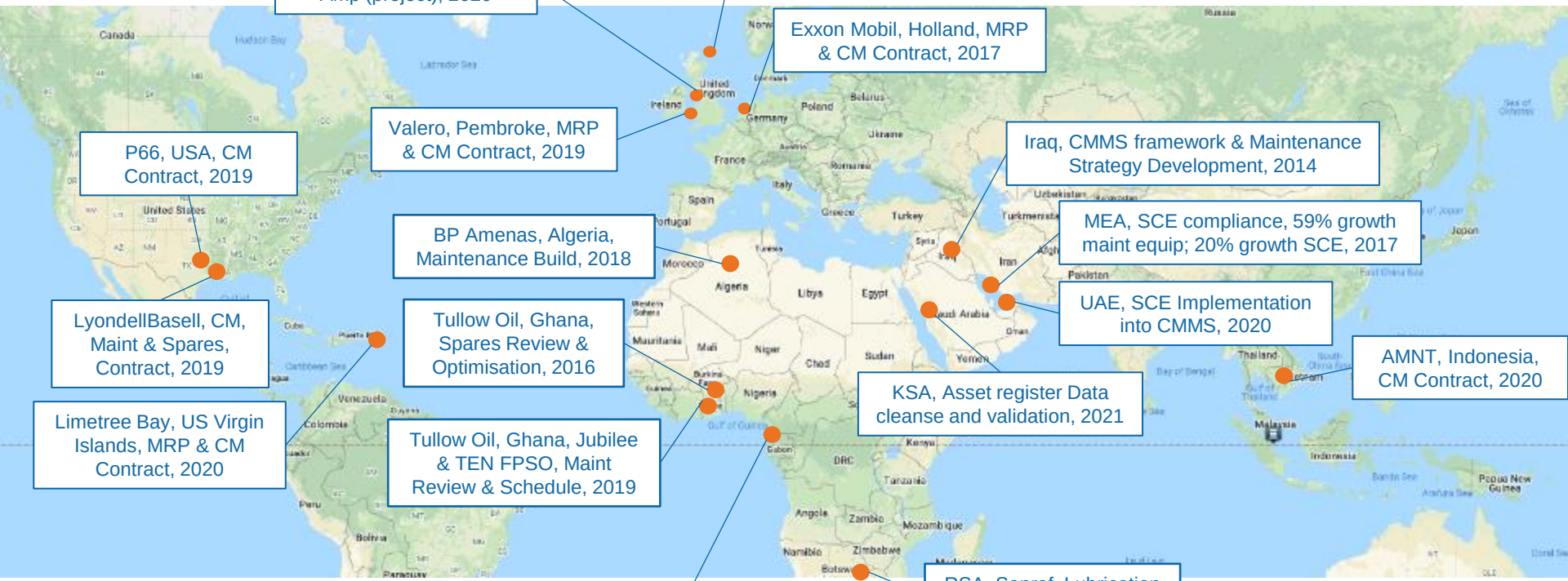
Recent Projects

JCAMS have delivered a range of Reliability, Maintenance, CM and Inventory projects across the world



Maintenance Data Optimisation

Operational Reliability Engineering

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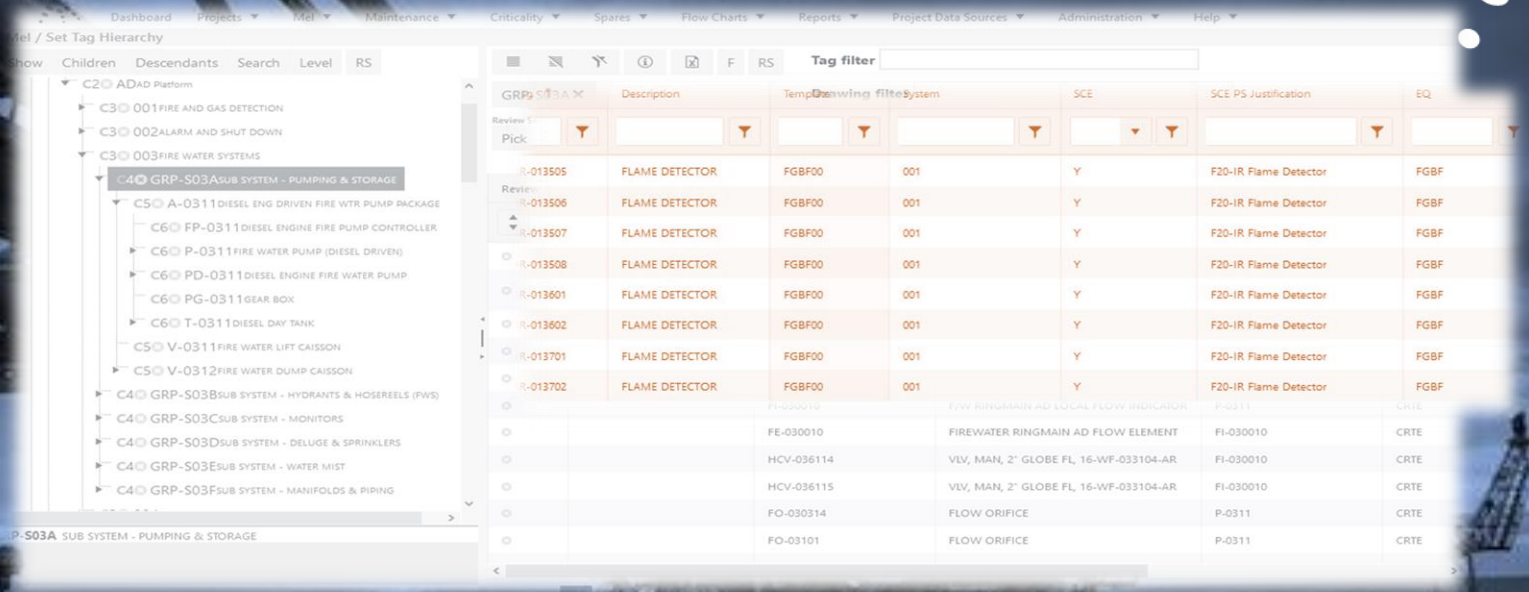


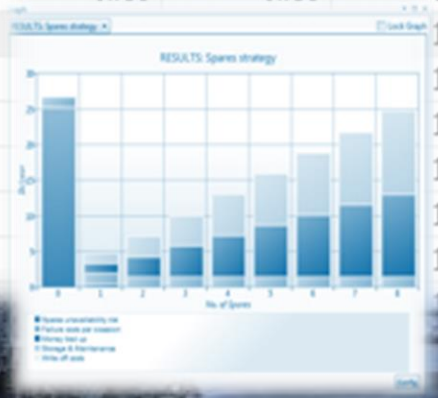
25% Reduction in annualised maintenance man hours

$1.6M USD in reduction in maintenance costs

Reduction in safety critical backlog

Critical Spares Analysis - *Materials Management*

Graph	No of spares	Service level	Spares unavailability downtime	Spares unavailability risk	Failure costs per occasion	Money tied up	Storage & Maintenance	Write-offs & depreciation	Total Impac
		%	%	$k/year	$k/year	$k/year	$k/year	$k/year	$k/year
☑	0	0	0.01	152.6	0	0	0	0	152.6
☑	1	97.89	0	1.872	0	0.798	0.798	0.987	4.454
☑	2	99.99	0	0	0			1.117	4.341
☑	3	100	0	0	0			1.126	5.98
☑	4	100	0	0	0			1.127	7.61
☑	5	100	0	0	0			1.127	9.239
☑	6	100	0	0	0			1.127	10.87
☑	7	100	0	0	0			1.127	12.5
☑	8	100	0	0	0			1.127	14.1



Critical spares reviewed for oil export upgrade

Inventory Optimisation Software utilised

$750K of capital freed up

Summary

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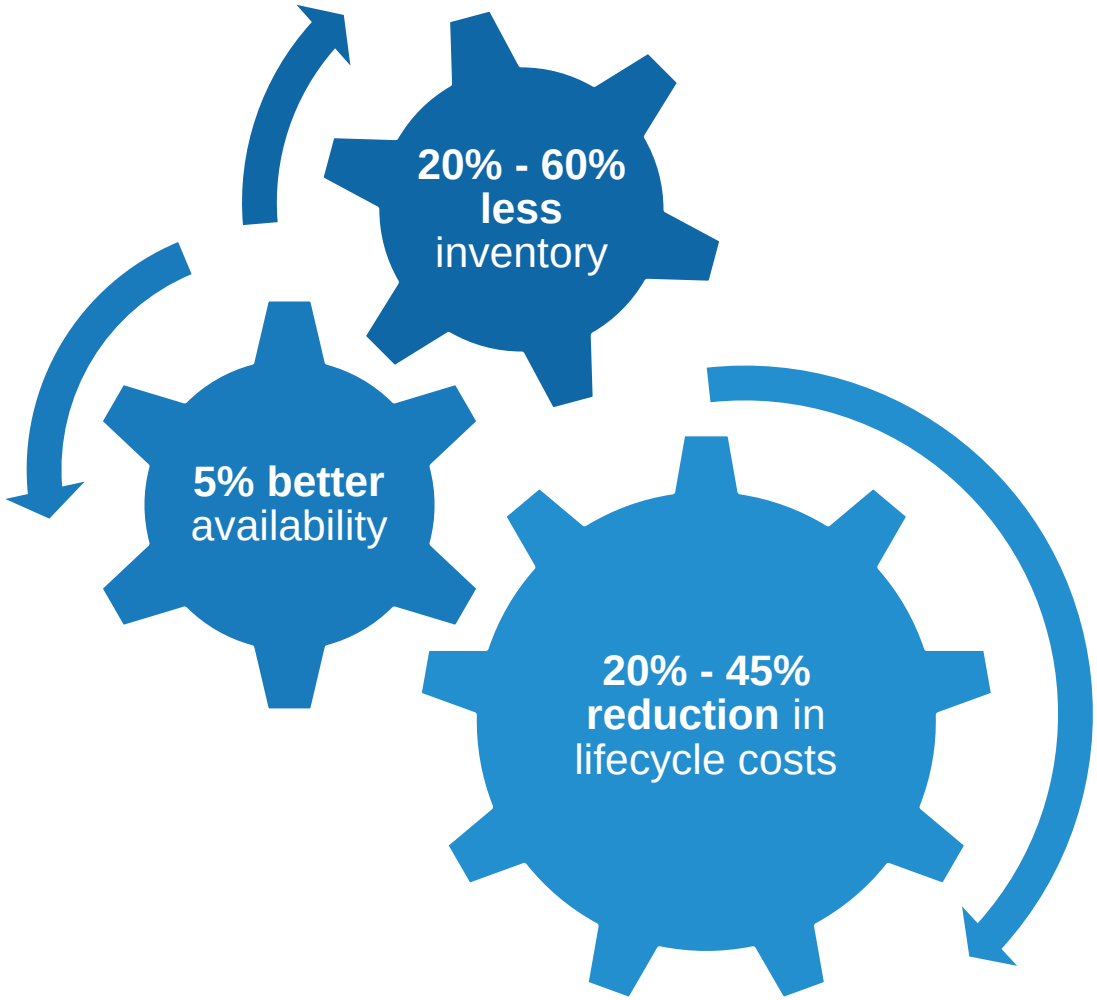
The Prize

Increased Reliability & Availability, Reduced Total Cost of Ownership, Continuous Improvement



1. **Reliability –** eliminate defects through Precision to reduce failures and cost
2. **Maintenance** - ensures correct amount of effort (money) is spent in areas where it adds value – criticality focused
3. **Condition Monitoring** is a key part of the maintenance strategy – Increasing availability and reducing costs by ensuring intervention only when necessary
4. **Inventory –** right spares at the right time and in the right condition maximises availability and minimises cost

Thank You

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