TFD GROUP

TOOLS FOR DECISION

Supportability Audit
Needles in the Haystack

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17 July 2018

TFD's Mission

To optimise the cost and availability of supporting complex equipment systems or fleets that require maintenance

"Remember, the one thing that you should turn your mind to at all times is to increase the power of men and materiel, without increasing either."

Marshal of the RAF, Lord Trenchard
Inaugural Address to the RAF Staff College, 1922

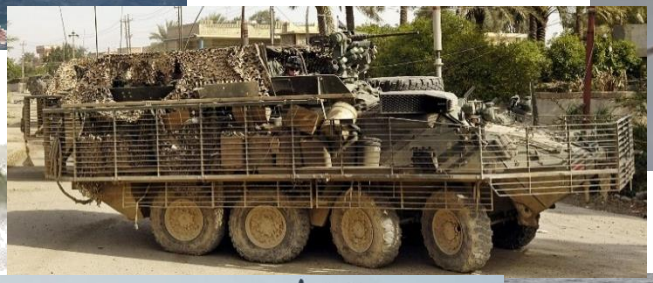
Do More with Less

Smarter Ownership

TFD GROUP
TOOLS FOR DECISION

Customers & Programs







Most major aerospace and defence companies across the world have TFD licenses

RAF Chinook CH47 Case Study

During Afghanistan & Iraq conflicts, severe pressure for greater output from RAF Chinook fleet for more flying hours (FH) on operations and for training.

RAF achieving 65 FH per aircraft per month on operations but only 40 FH in training compared with about 200 FH for civilian operators. Even setting aside obvious differences in the environment, considerable room for improvement.

Question - How to increase fleet flying from 12,500 FH to 16,500 FH, 18,500 FH and, eventually, to 21,000 FH?

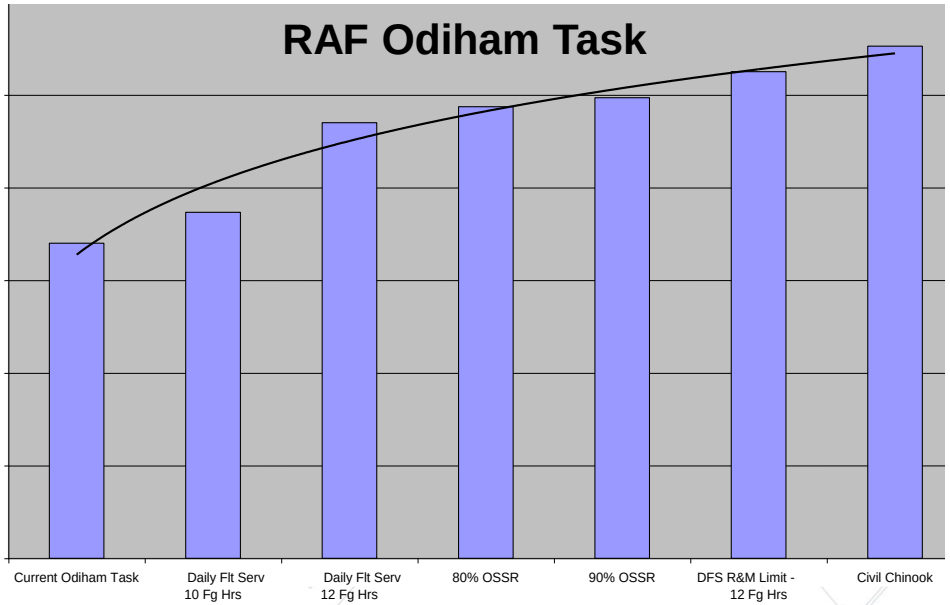
Method - **Supportability Audit**:

- Structured diagnostic interviews
- Data capture and analysis
- Build a model to test hypotheses
- Construct a coherent action plan

Work took 3-6 months

Conclusion:

Potential for 39% more FHs



RAF Merlin Mk3/3A (EH101) Case Study

RAF Merlin Force only achieving 60% of flying task, without any complication of operations in Afghanistan.

62% fleet unserviceability with 38% awaiting resources.

- Manpower 17.9%
- Spares 12.8%
- Info 4.4%
- Crew 2.0%
- Weather 0.5%
- Tools & Test 0.4%

Shortage of resources impeding management efficiency

Question - How to increase fleet achievement to achieve annual task?

Method - Supportability Audit:

- Structured diagnostic interviews
- Data capture and analysis
- Build a model to test hypotheses
- Construct a coherent action plan

Conclusion
Potential for 32% more FHs AND 13% more Serviceable aircraft

6 Interconnected Improvement Themes

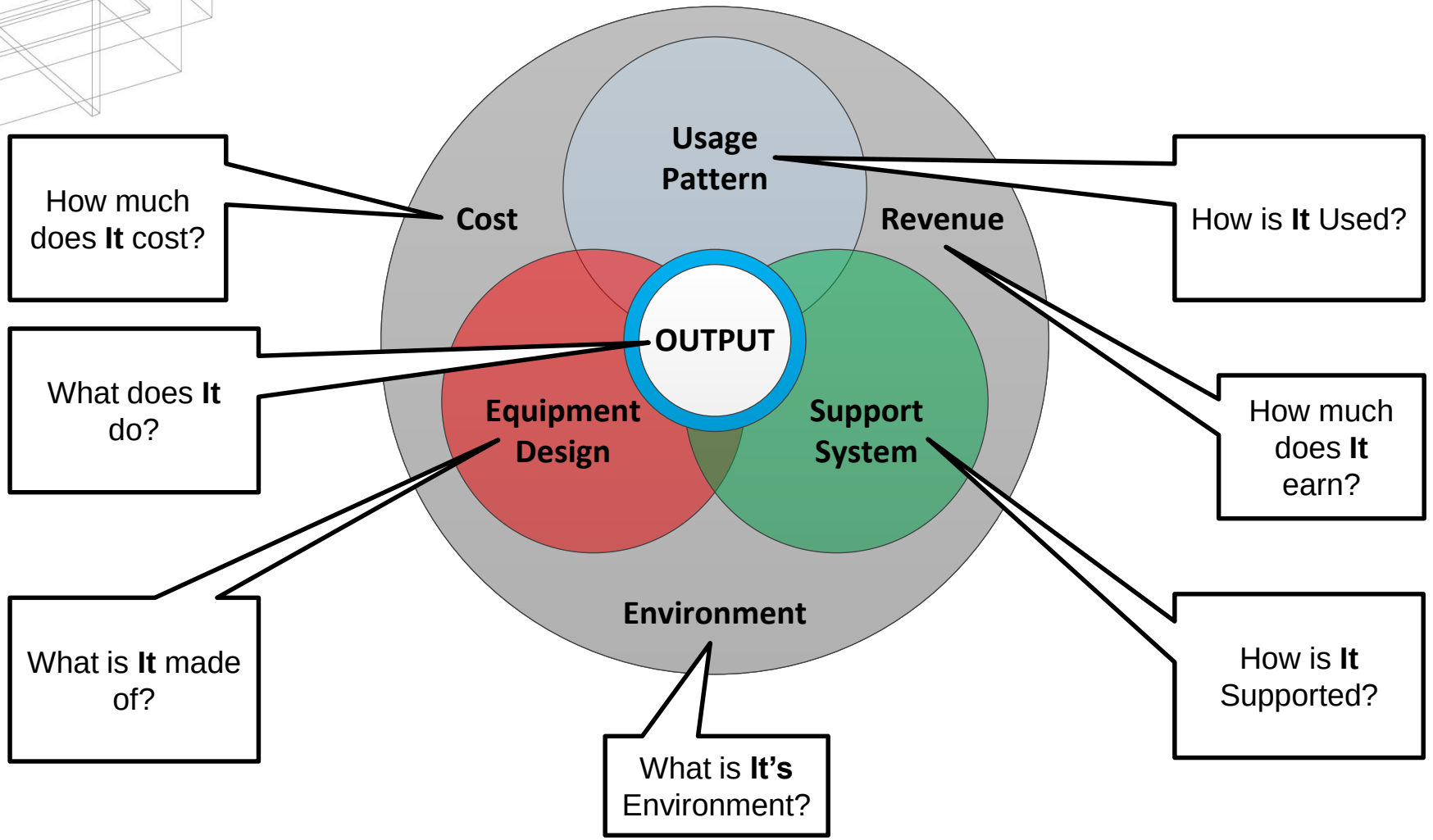
- Plans & Commercial management - too many disparate and incoherent contracts
- Maintenance policy
  - Implement Chinook RCM review from 2400 FH Major cycle to 3600 FH
  - Adopt continuous operations flying pattern & servicing policy
- Critical Items Review
  - Reduce AOG, Back Orders and Cannibalisation
  - Drive down ‘U/S’ stock value - £32M - £25M in 3 months
- Spares optimisation
  - Review spares holdings by location and establish Working Asset Levels
  - ‘Out of Scope’ spares – 33% of BOM outside Boeing TLCS contract
- Data exploitation – use of HUMS data
- Diagnosis support – improved technical publications and UFCM procedure

Modelling as an Enabler

- Take a **Total System** view
- Evaluate ‘what-ifs’ without ‘experimenting’ on the ‘real-world’ business
- Balance task and resources to outcomes: Resources; Facilities; and People
- Identify critical constraints
- Identify and quantify best changes to make

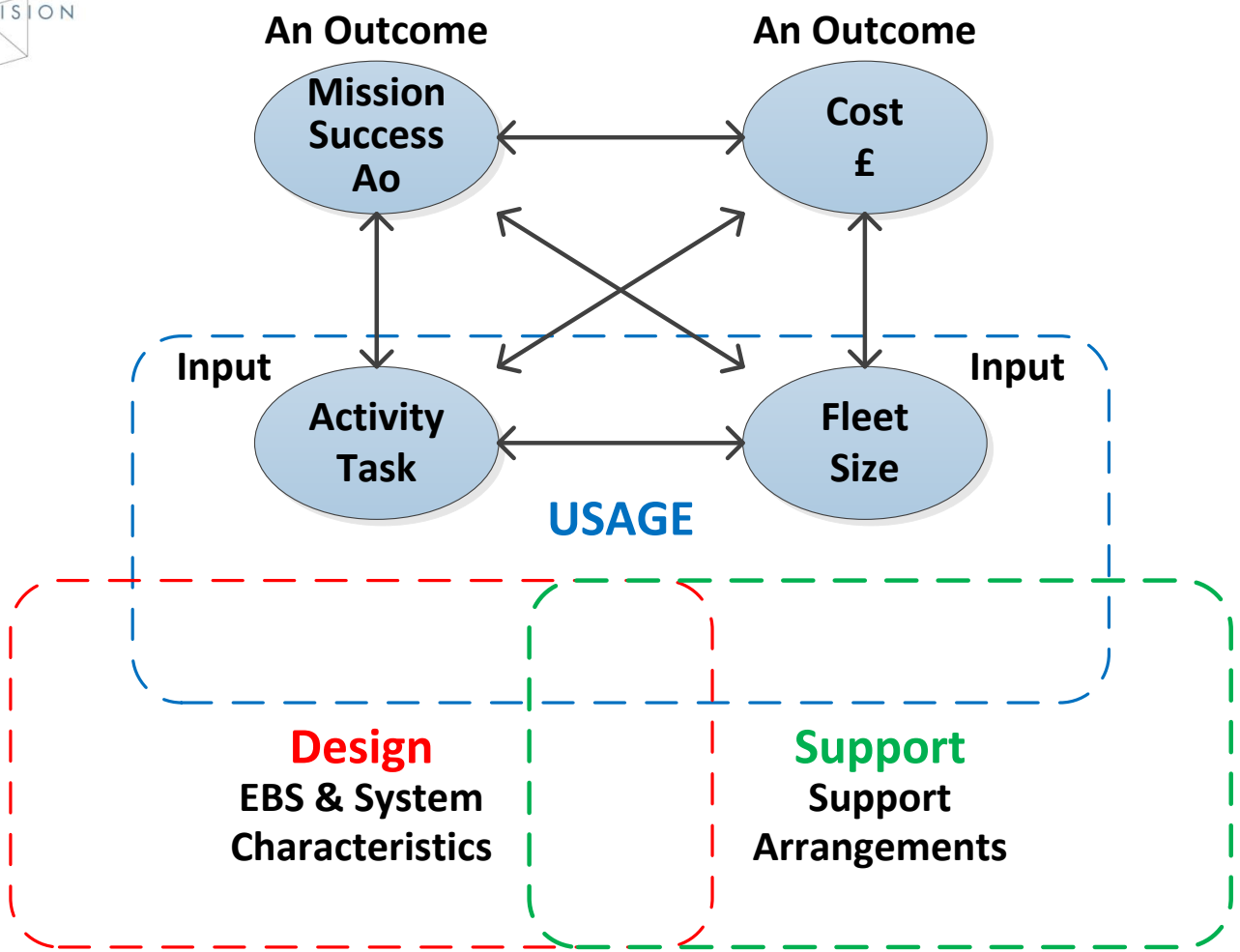
But rather than ask the people, why not *ask the Digital Twin?*

The Total System



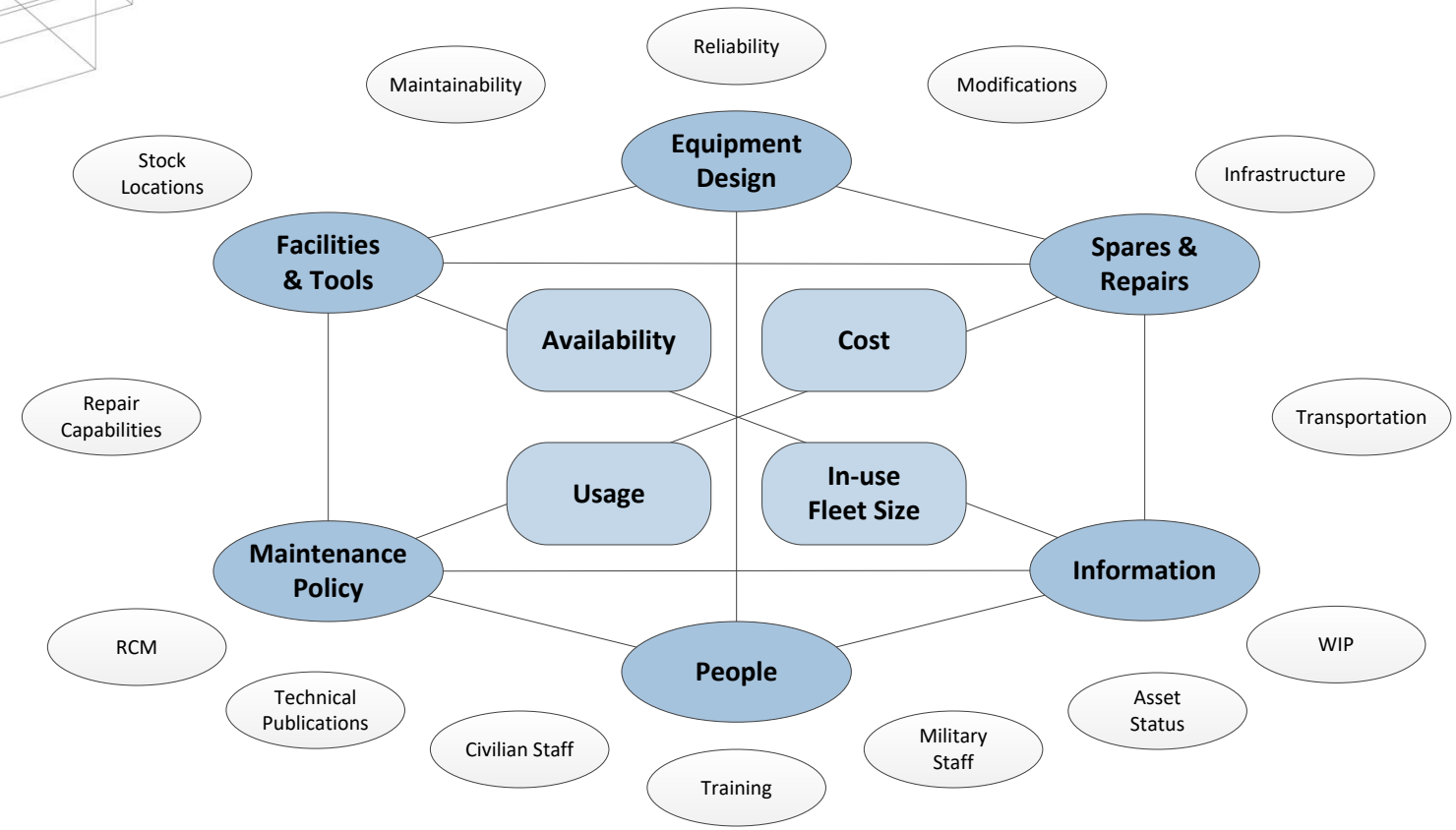
How does **It** all work as a Total System?

The Total System View



System Availability and Cost are driven by the interaction of Usage, Design and Support

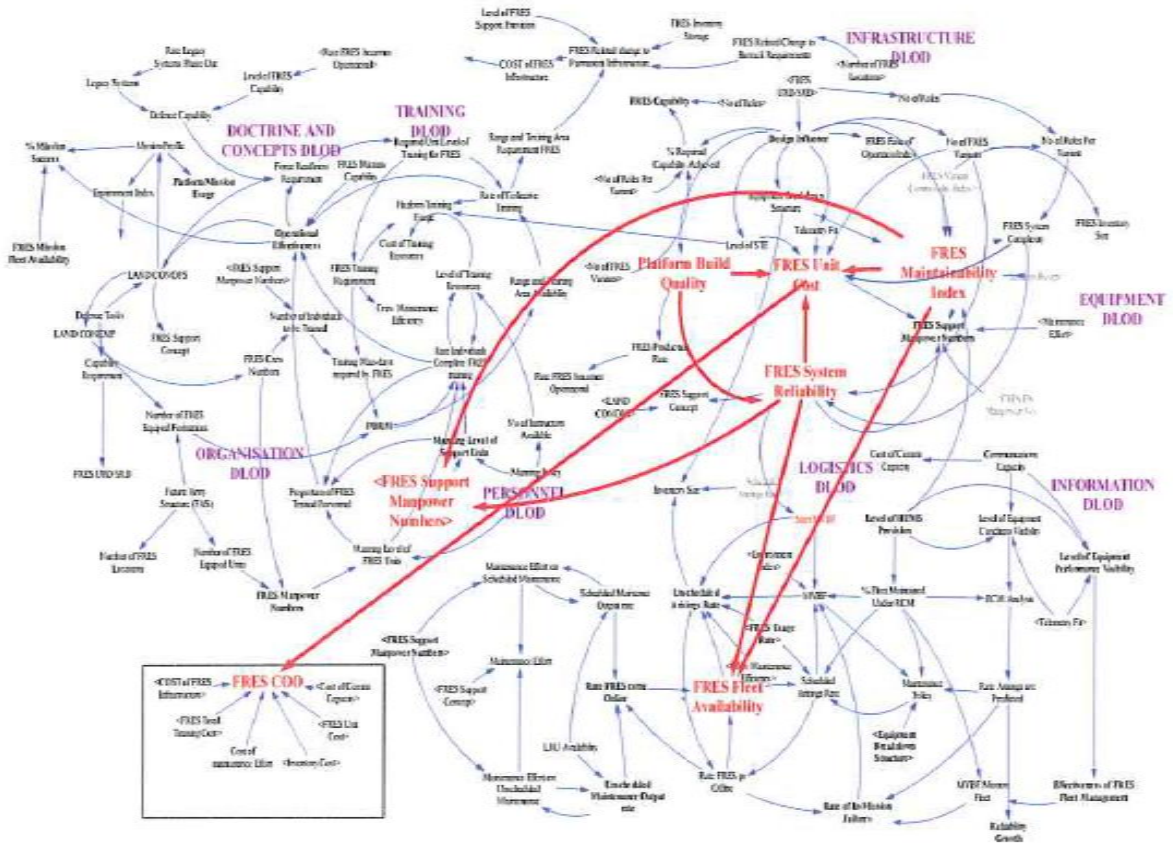
Interactions of Support Disciplines



Support activities are complex, interconnected and must be tuned to avoid unintended outcomes

It is critical to handle the complex interaction of all these activities

A Typical Support System



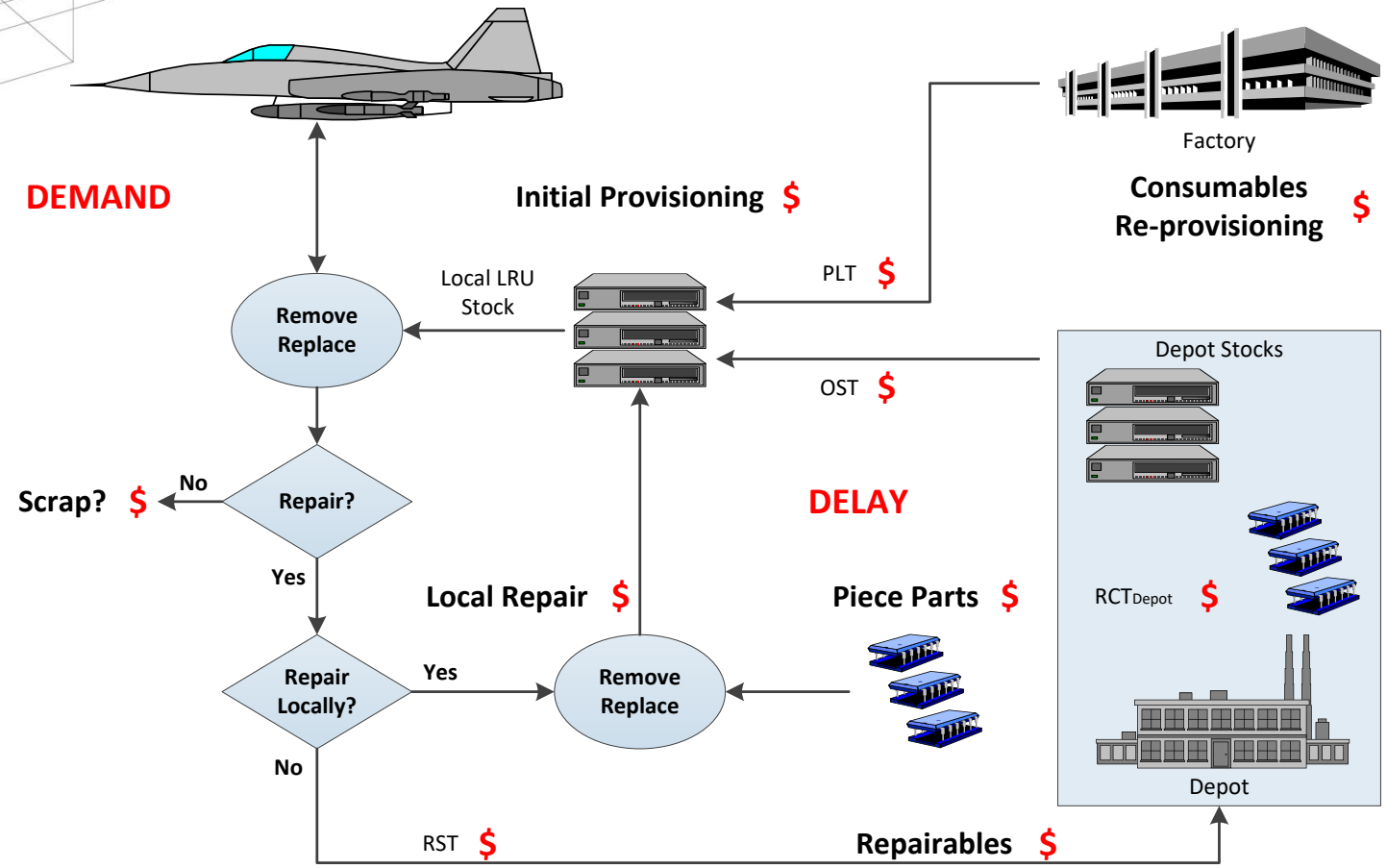
Support interactions are complex and cannot be independently quantified

Their relationships are critical and the system must be optimally tuned

A *Wicked Problem* that cannot be solved top-down

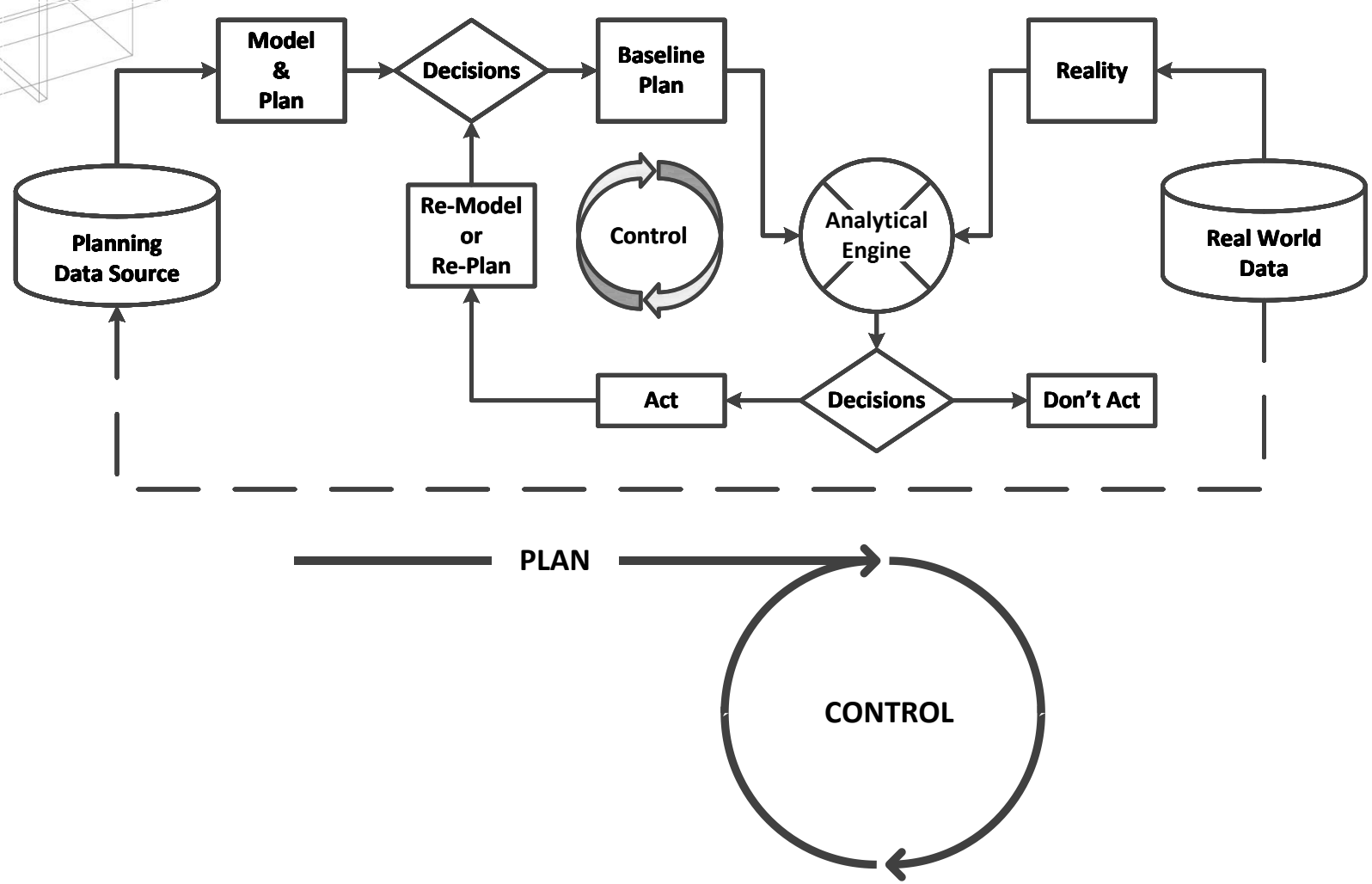
Supportability Audit is bottom-up interrogation of the Digital Twin

A Simple Logistic System



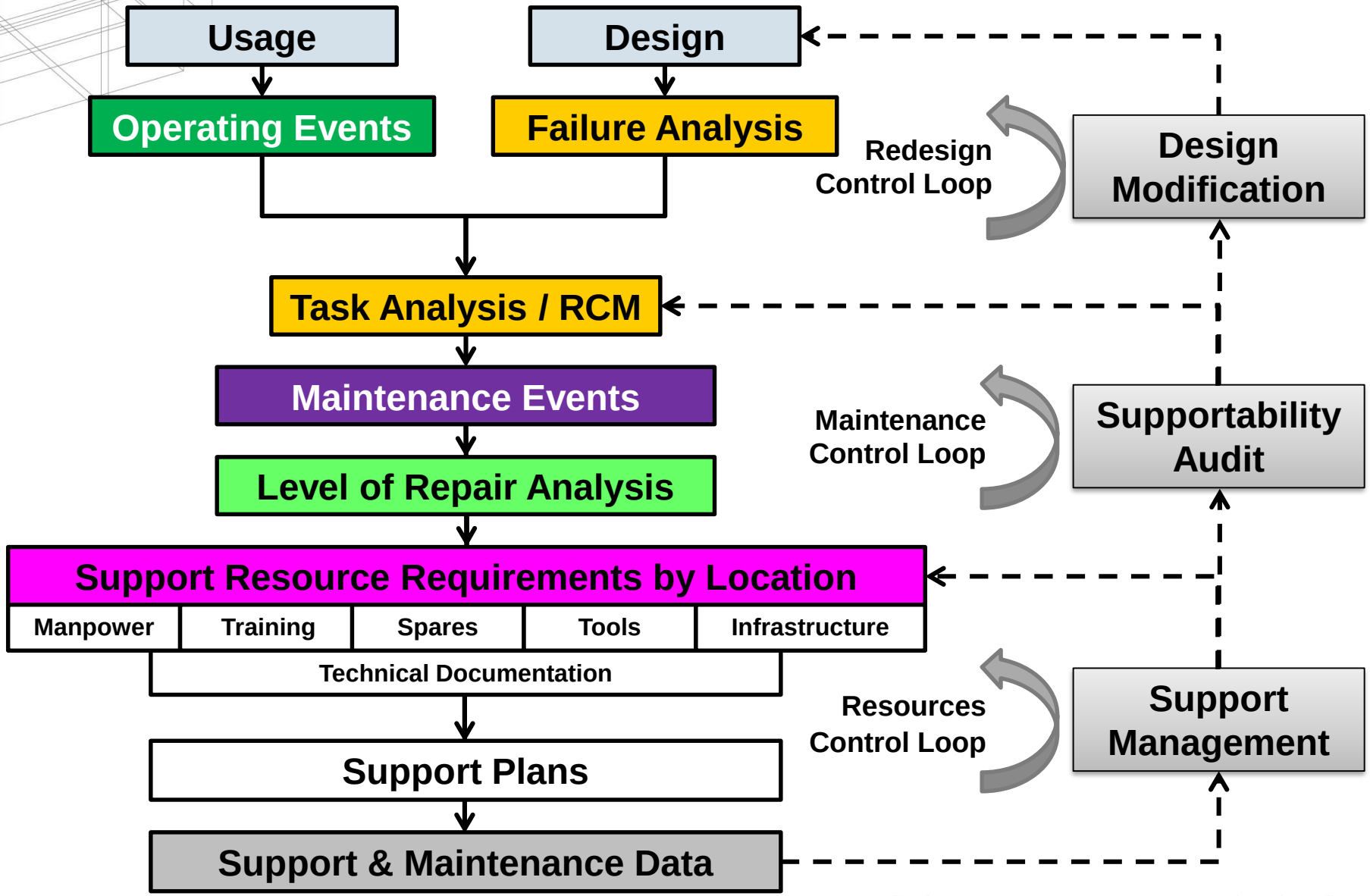
The rate and pattern of *Use* drives *Activities* at various *locations*
Each Activity at each location takes *time* and *resources* which ***Cost***
Activities and *Delays* determine ***Availability***

The Planning & Control Turbocharger

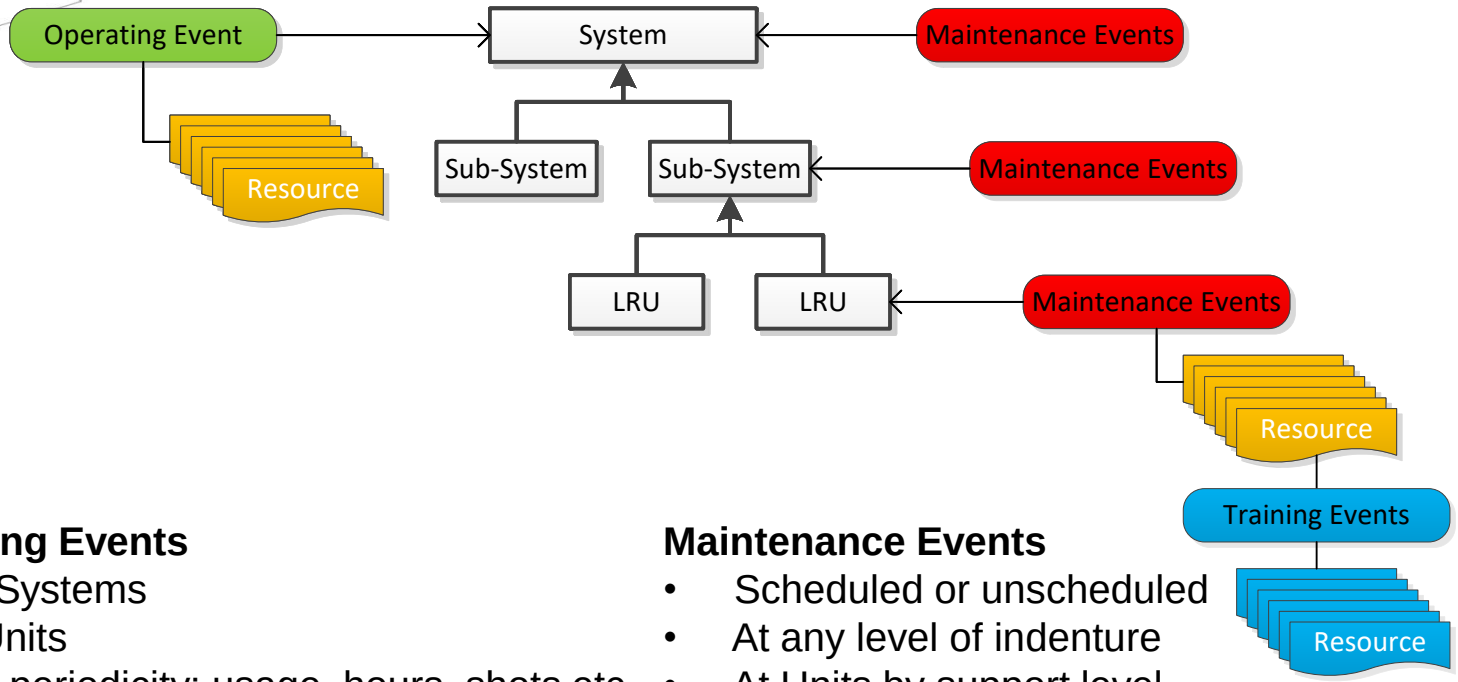


Achieving AFFORDABLE AVAILABILITY requires PLANNING and CONTROL

Integrated Support
Planning & Control



Life Cycle Costing
Operating & Maintenance Events

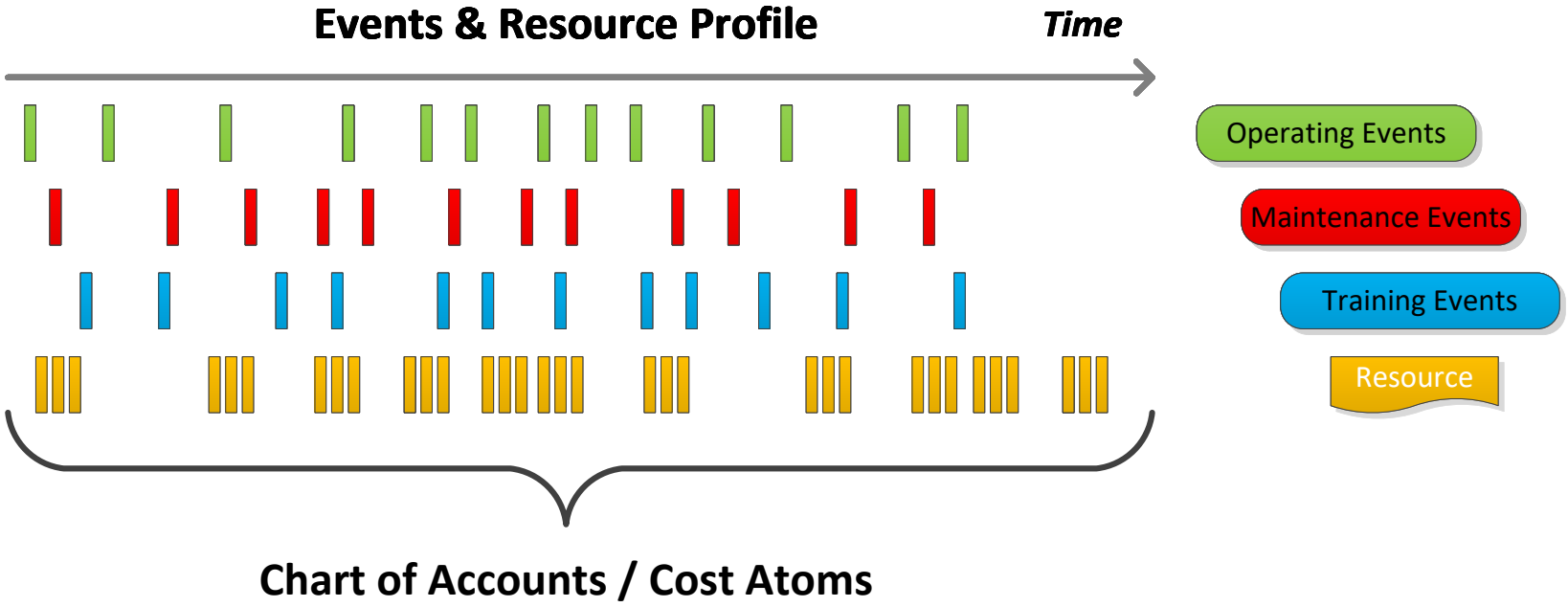


Operating Events

- On Systems
- At Units
- At a periodicity: usage, hours, shots etc
- Consumes Resources
- In a Quantity
- With a certain probability
- For a time
- At a cost defined by the resource

Maintenance Events

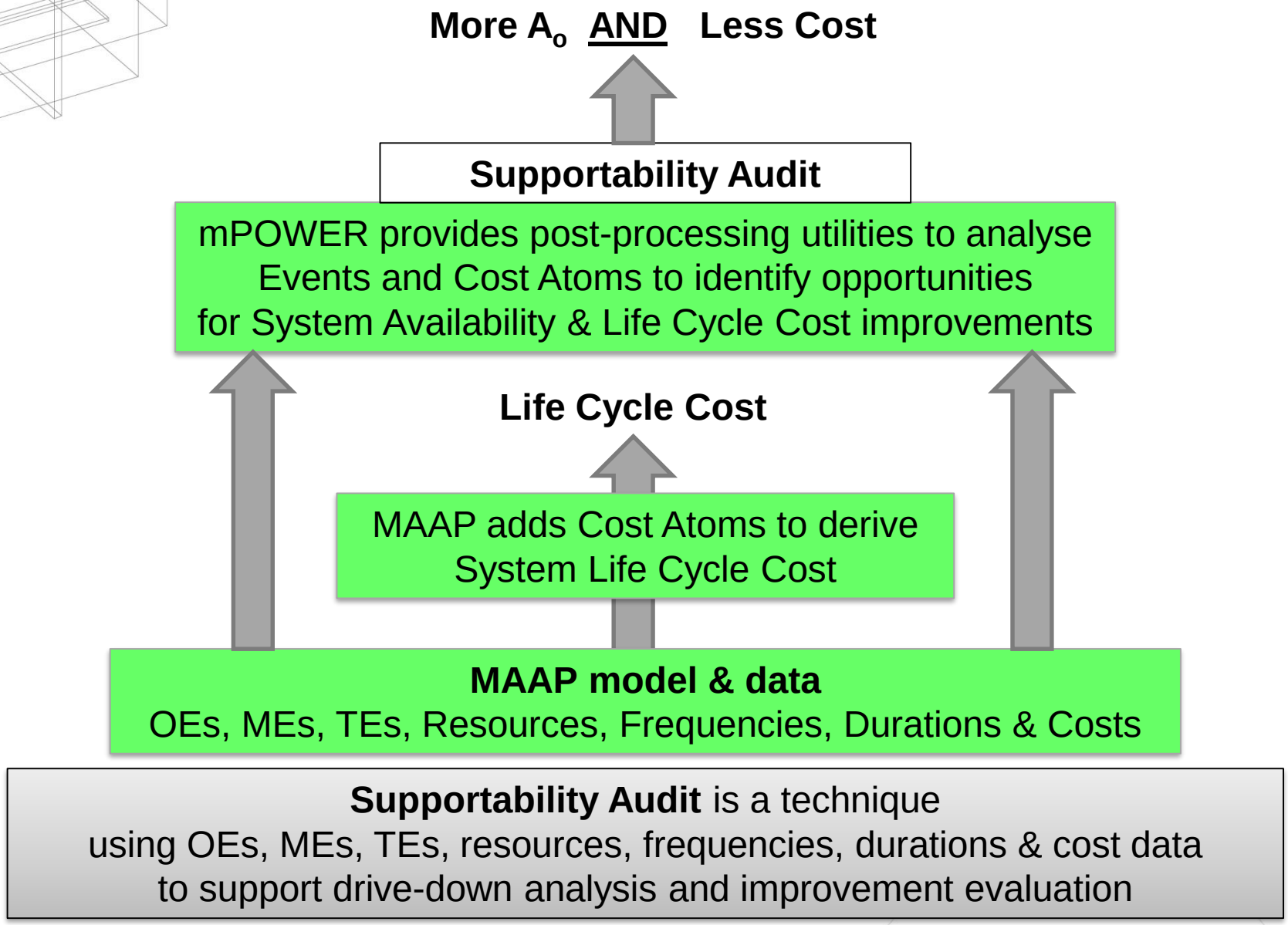
- Scheduled or unscheduled
- At any level of indenture
- At Units by support level
- Consumes Resources
- In a Quantity
- With a certain probability
- For a time
- At a cost defined by the resource



TFD MAAP

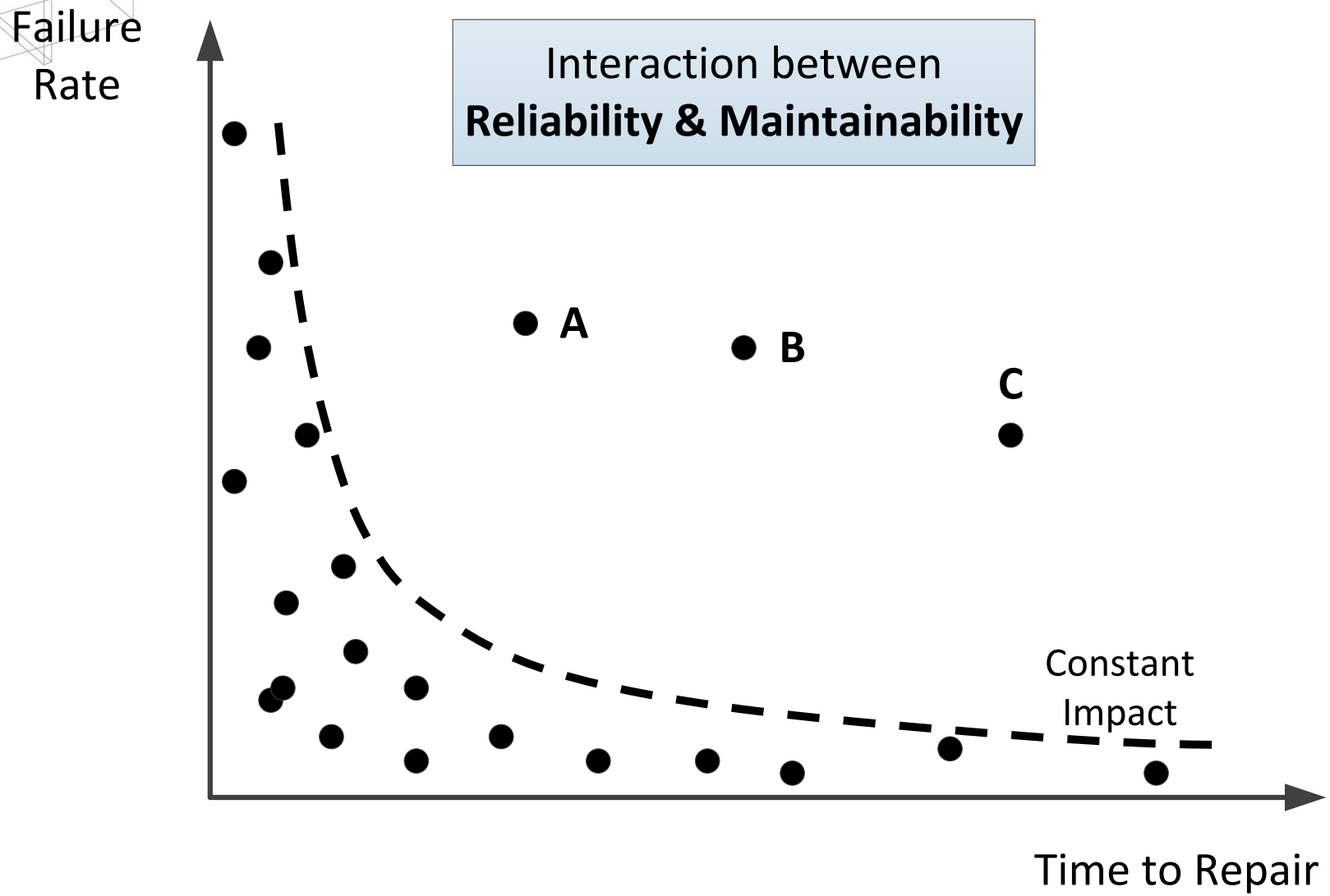
An event-driven, activity-based 'adding engine' of 'cost atoms' to derive LCC
It handles automatically all the complex interactions of support

Supportability Audit
Interrogating the Digital Twin

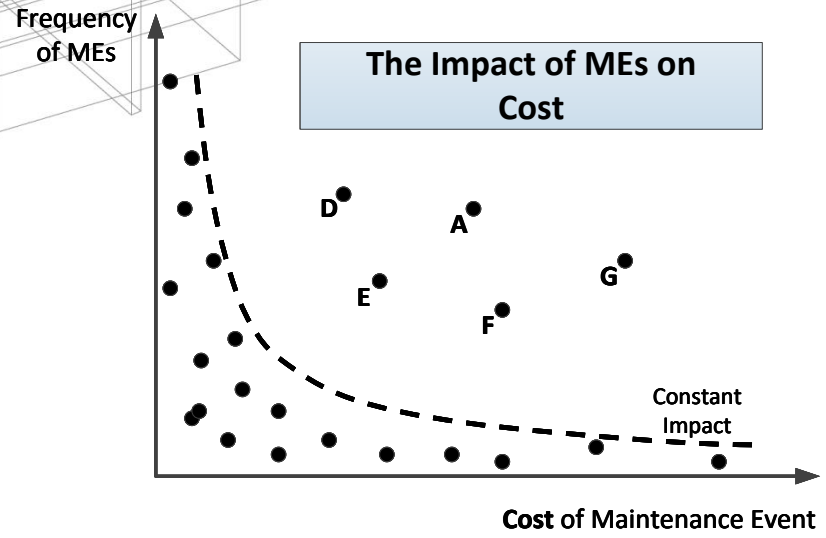


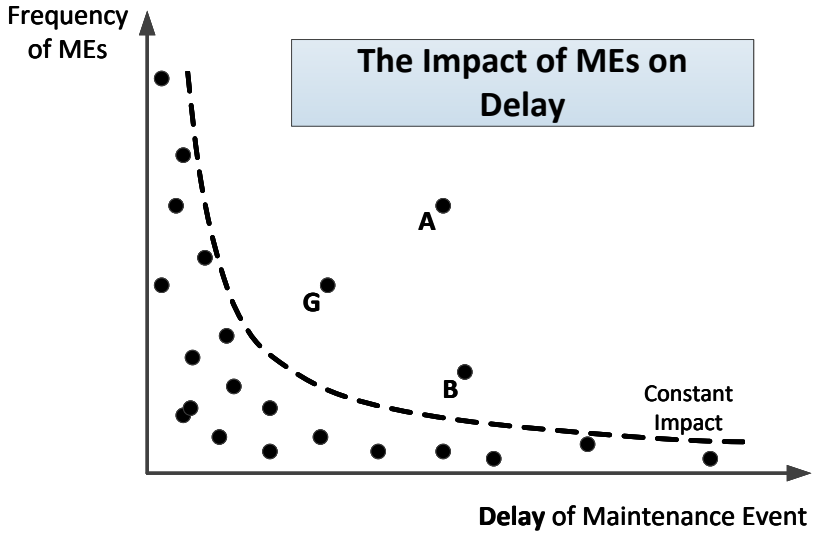
Supportability Audit is a technique
using OEs, MEs, TEs, resources, frequencies, durations & cost data
to support drive-down analysis and improvement evaluation

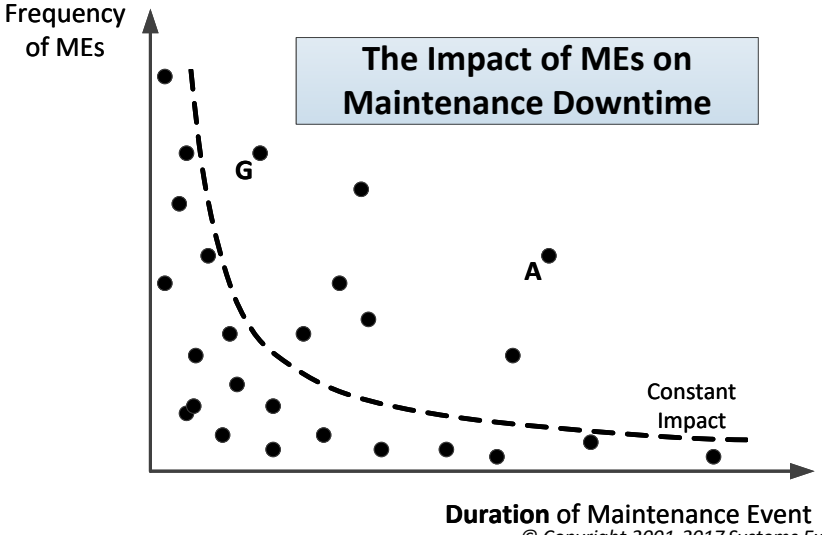
Supportability Audit
Identifying the Problems

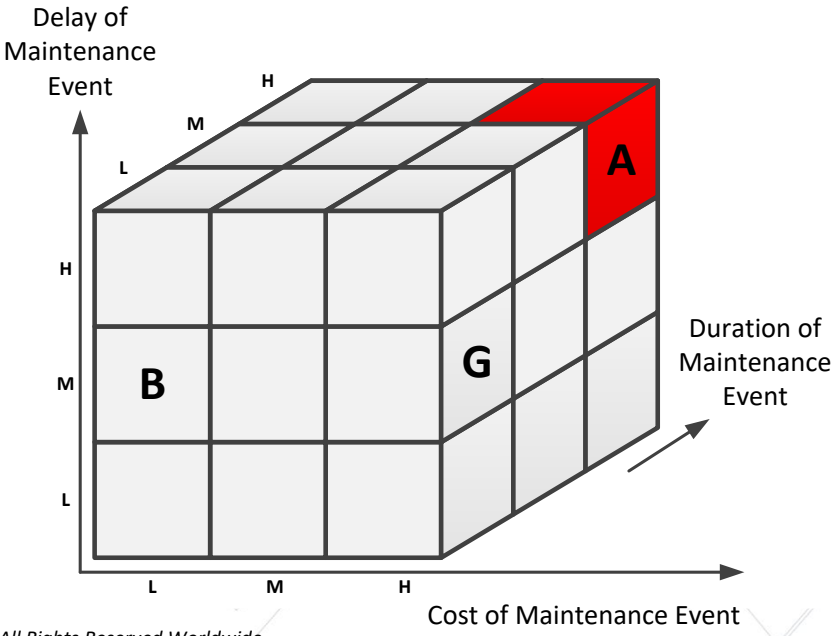


Supportability Audit
Identifying the Problems

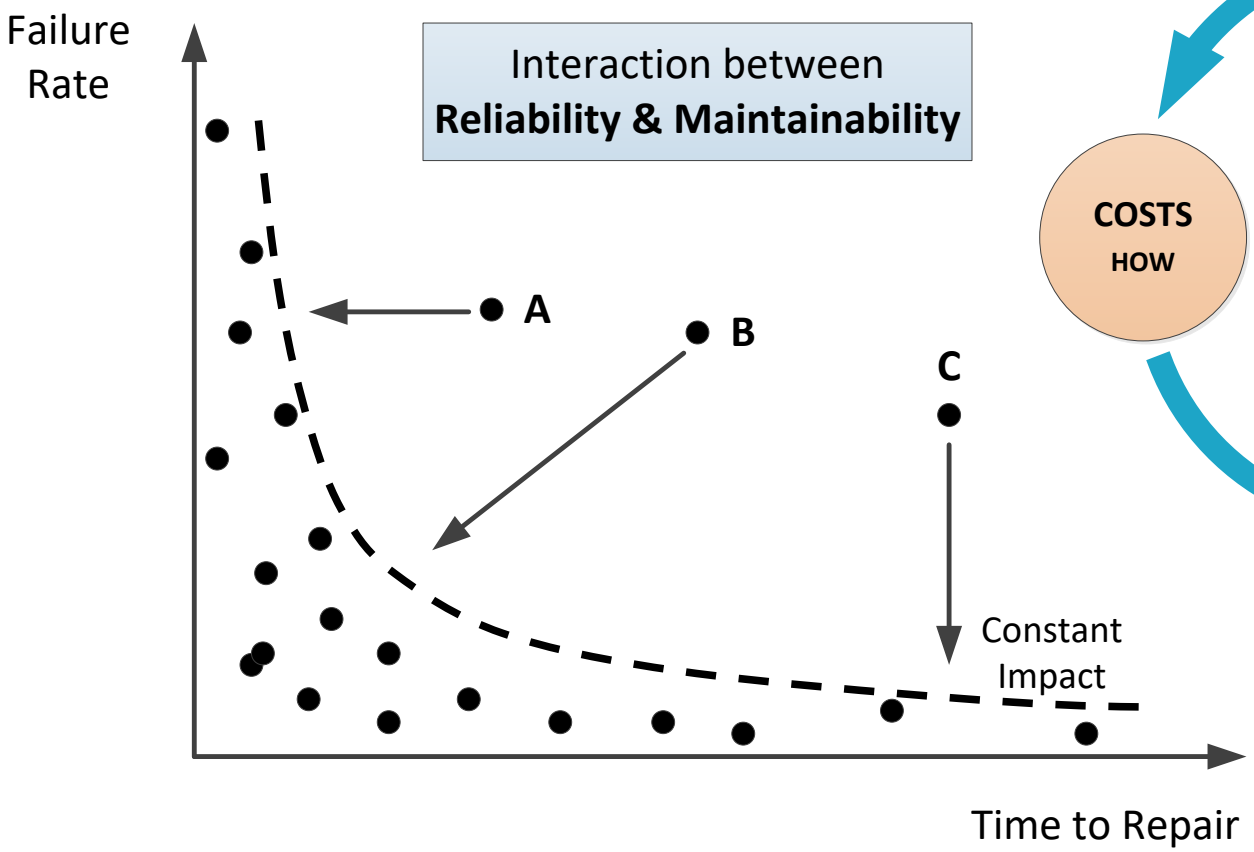


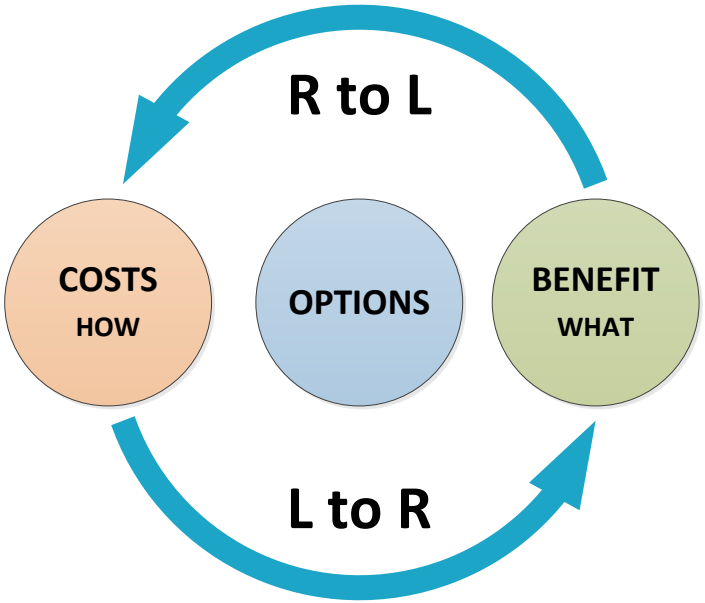






Supportability Audit
Quantifying the Benefits





Compare previous System LCC with assumed future System LCC to derive potential cost benefit

RAF Puma Mk1
Supportability Audit Case Study

RAF Puma Mk1 – Support Helicopter

Supportability Audit to identify potential support shortfalls and opportunities for improvement

- Number of aircraft on both 230 Sqn & 33 Sqn reduced by 3 aircraft but the total flying task was maintained at each unit; each aircraft flew more sorties
- Fleet operational availability (Ao) target increased from 75% to 80%
- Maintenance staff to receive either additional training, or maintenance procedures improved, to reduce maintenance task durations by 15%
- Suppliers to improve production lead times (PLTs) on first time demands by 15%
- Suppliers to deliver a price challenge of 15% challenge on purchase and repair prices
- RCM-based review of maintenance policy to reduce frequency of all unplanned corrective maintenance by 15%

Potential cost savings of £5.6M or 23% of annual costs

AND 5% increase in availability delivering same task with 6 fewer aircraft

Sweden Tgb 14/15
Supportability Audit Case Study

Tgb 14/15 – Utility Support Vehicle

Supportability Audit to identify potential support shortfalls and opportunities for improvement.

Tgb 14/15 is a fleet of 347 vehicles used only in training and fully supported by Mercedes. The basic Geländewagen is a very mature vehicle that has been in production for 36 years. More than 200,000 have been built.

- Vehicle utilisation was low and up to 70 vehicles could have been placed in storage reducing maintenance costs by 11% while meeting availability levels and driving an additional 2,750Km.
- Despite the maturity, issues were identified with:
  - Air filter – this was traced to incorrect item identification data which was driving excessive and wasteful procurement
  - Central locking system which was an acknowledged intermittent system fault. The Audit quantified the cost enabling FMV to press Mercedes for a solution.

Potential cost savings of £250K over 10 years - 2.7% of annual costs through reduced maintenance while meeting availability over more Km using 70 fewer vehicles

Sweden Tgb 360
Supportability Audit Case Study

Tgb 360 – Armoured Terrain Vehicle

Tgb 360 is a new fleet of 113 Armoured Fighting Vehicles of 4 variants built by Patria, supported by FMV and operating from 2 bases in Sweden.

As a new vehicle with little in-service data available, this SA set a modelling baseline while identifying current weaknesses and potential areas for improvement.

Issues identified included:

- Maintenance policy review by location and interval identified potential to reduce resources by 8% with a PM cost reduction of 2%.
- Data quality review revealed errors and omissions in the contractor's maintenance data that identified the risk of system under-performance and erroneous procurement.
- Major materiel cost drivers review identified the need and benefit of modifying 2 additional items.

Confirmed majority of key support metrics but identified annual cost savings of >2% on SEK 29M. Protected A_0 by identifying key data errors

SA is a powerful analytical technique that can find, assess and quantify the business case for significant support cost savings.

SA can be applied cost effectively to most, if not all, systems covering a wide range of environment, technology and maturity.

Extrapolating the benefits from these examples across Defence could make significant inroads into the cost of support.

SA requires a small investment to build the models.

A programme of SA projects will be better than self-funding.

Why not?

Supportability Audit - Interrogate the Digital Twin?

QUESTIONS?