TFD Europe

Q. Why Use VMetric?

A. To Develop optimum spares scales to meet fleet availability targets

You should you use ***VMetric*** when you need to:

- Develop optimum spares scales to meet fleet availability targets
- Identify inadequate or expensive spares recommendations
- Be sure of achieving target fill rate or availability levels

VMetric – The Inventory Optimisation Tool

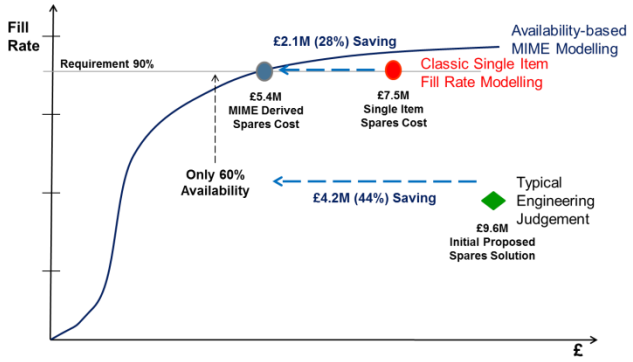
The aim of spares provisioning is to choose the spares that maximise Operational Availability (Ao) for an affordable cost, or minimises the cost for a required Ao. To preserve system availability, the spares stock must be sufficient to cover the time taken to replenish the stock with a serviceable item. The main drivers are the failure rates, the repair turn-round times, if appropriate, and both the purchase and repair costs. Reducing repair turn-round times will minimise the need to hold spares to stock the pipeline.

Spares Optimisation Approaches

There are 3 typical approaches to calculate stocks.

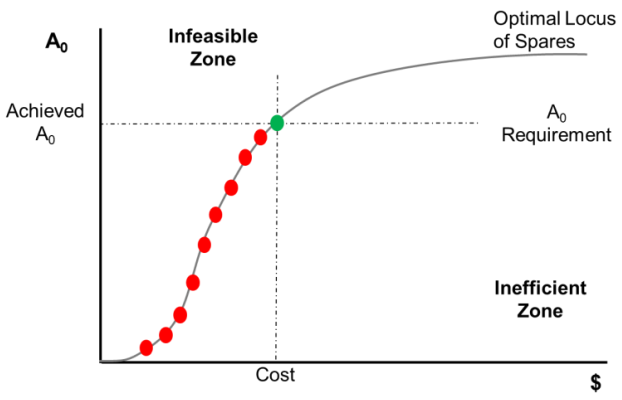
- Engineering judgement based on previous experience. This approach is often flawed leading to shortfalls or expensive stock holdings.
- Single Item Modelling works at the item level treating each part independently. Typical measures of performance are Off-the-Shelf and Overall Satisfaction Rates which, in effect, describe the confidence of having a specific part available when required. These measures are also called Fill Rates. This approach can be described colloquially as “Happy Shelves”.
- System-based modelling works at system level addressing all parts simultaneously with overall system availability the key performance metric. By choosing to hold the spare with the largest impact on system availability, at a cost, the overall risk or shortage is reduced for the overall system. Multi-Indenture Multi-Echelon (MIME) modelling incorporates these principles for complex environments where spares are required at multiple locations, with partial or full repairs at various levels. This approach can be described colloquially as “Happy Systems”.

Over many years, Engineering Judgement has proven to be the least effective and most expensive approach. Single Item Modelling for each item is better but for a given availability level System-based Modelling typically produces scales that are 25-30% cheaper as illustrated below from recent MOD data.



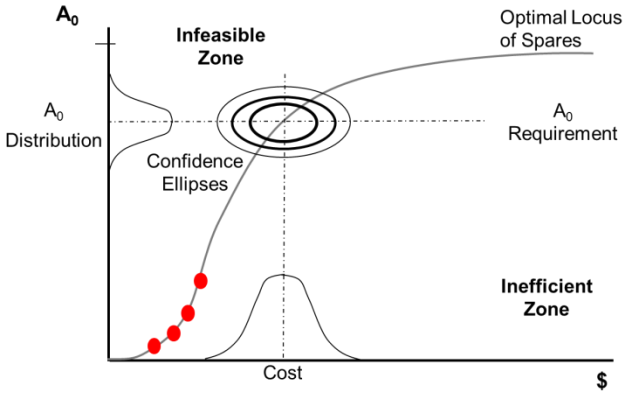
Marginal Analysis

Marginal analysis is a mathematical technique to optimise spares selection. The diagram below illustrates the technique. Provision of spare parts improves system availability by reducing the probability that a spare is not available when required. The contribution to availability is a function of the part’s failure rate and the time for it to be repaired, and of course all parts have specific procurement and repair costs. Selecting the part which most increases availability for least cost is the most cost effective. But once a part has been provisioned, the contribution to availability from another one must be recalculated, and the next selection made. Repeating this process will lead to a series of individual part choices that form an optimal locus of spares to achieve system availability for a specific cost until the requirement is met. By definition, it is infeasible to achieve more availability than the optimal locus while any other choice is sub-optimal, inefficient and wasteful.

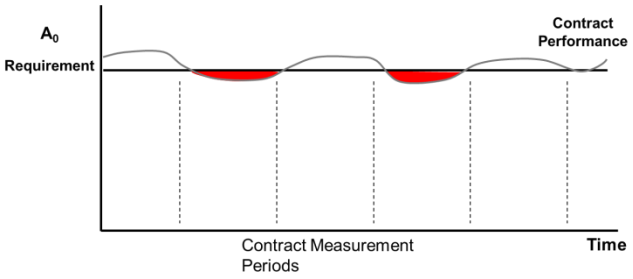


Confidence Limits

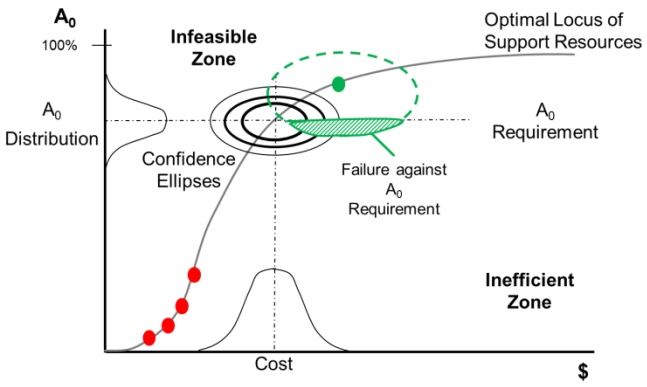
The achieved availability is based upon mean data but failures are inherently stochastic with some statistical variation. Likewise, the cost elements may in practice be subject to some variability. This can be thought of as ellipses of confidence about the mean point as illustrated below.



On average over the long term, the spares package will meet the requirement. But the solution will fail to meet the required availability for 50% of the time. As spares performance is usually measured over shorter periods, excess performance in one period will not offset under-performance in others and this will lead to contract penalties.



VMetric handles this issue automatically. If the requirement is to meet a minimum availability level for more than X% of time, the availability target is increased to reduce the commercial risk as illustrated below.



This approach does not require use of a separate simulation tool to evaluate performance of an optimum spares package in the required scenario.

Non-Cost Optimisation

Normally, spares packages are optimised for cost since cost is normally the principal constraint when procuring initial spares packages.

However, there may be other metrics against which to optimise in special circumstances. If storage space is the dominant constraint, as for example in submarines, spares should be optimised using the packed volume of each spare. ***VMetric*** is able to use a shadow currency, such as m^3, as the base for optimisation. Alternatively, if the constraint is weight as for example in a Fly-Away pack of aircraft spares, the shadow currency could be Kilograms.

Non Steady State Scenarios

VMetric, like all current spares optimisation tools, takes a steady state view and assumes long-term scenarios which remain unchanged forever. But in the real world, the situation always changes as basing, activity levels, support arrangements, even system configuration evolve.

In a best attempt to address this issue, users of steady-state tools split scenarios into multiple time-slices, chain together a sequence of runs for each fixed condition, and load results from the last run as inputs to the next. As the volume of change increases, complexity, workload, time and error probability all grow exponentially. For changing scenarios, TFD's ***Tempo*** tool is more appropriate.

VMetric minimise spares inventory costs

VMetric is the pre-eminent spares optimisation in the world to:

- Generate optimum spares scales to meet fleet availability targets
- Identify inadequate or expensive spares recommendations
- Ensure achievement of target fill rate or system availability levels
- Optimise spares packages against constraints other than cost

VMetric - The Pre-eminent Inventory Optimisation Tool