Cavern Charts A Graphical Technique for Evaluating the Maintenance Stagger in a Fleet of Aircraft

THE VALUE OF PERFORMANCE.

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Fleet Planning

Data-Lake Holistic Visualisation Innovation Machine-Learning Automation Tools Optimisation Maintenance-Stagger Stochastic-Modelling Forecasting

A Cavern Chart





What questions can Cavern Charts answer?

Why use a Cavern Chart?

- Simple
 - No complex mathematics required
 - No special software required
 - No large or difficult to obtain data sets required
 - Visual and intuitive results
- Fast
 - 3-4 hours from zero to hero
 - Compute time of a couple of minutes (in Excel)
- Deployable Now

Understanding the Problem

A definition of fleet stagger

Fleet stagger is the gradient of the dotted line (κ)

(Note: fleet stagger ≠ the goal line on a traditional stagger or aircraft flow chart)

The aircraft state, S_i at time t_i can will be 0 during maintenance checks and 1 when available.

Constructing a Cavern Chart One aircraft, four service types

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Constructing a Cavern Chart The whole fleet

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Therefore the number of aircraft in maintenance (M) is a function of maintenance duration (D), base interval (B), fleet stagger (k) and number of aircraft in the fleet (n).

A cavern chart shows how *M* will vary if values of *D*, *B*, *k* or *n* are altered.

To draw a cavern chart:

- Choose a variable to be altered.
- Calculate M for full maintenance cycle $(t_{k(n-1)} \text{ to } t_{k(n-1) + 8B})$ for each value of the variable and calculate the percentage of time with:
 - 0 aircraft in maintenance
 - 1 aircraft in maintenance
 - 2 aircraft in maintenance

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• Draw a stacked area chart of the calculated percentages.

Cavern Chart Example

• Fleet of 12 aircraft (*n*).

For the example fleet of 12 aircraft:

Cavern Charts are a simple graphical tool to assist answering:

- How many maintenance bays do I require?
- What is an optimal fleet stagger?
- What should the acquisition tempo of a new fleet be?
- How will changing rate of effort effect the fleet stagger?
- What happens if the duration of a maintenance check is changed?
- What is a good starting point for more advanced optimisation techniques?
- Cavern Charts are fast
- You can use them now

