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The Cost Capability Trade Off Model: Forecasting the Optimum Performance within Budgetary Constraints

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Agenda

1. **Problem Space**
2. **The Model**
3. **Numerical Results**
4. **Future Work**

Complex Asset Management's Forecasting Questions.

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Complex Asset Management's Forecasting Questions.

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Can we afford to build them?

Complex Asset Management's Forecasting Questions.

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Can we afford to run them?

Budgetary constraints on Complex Defence Assets

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Ministry of Defence's £8bn bill to scrap planes, ships and tanks

THE true extent of the Ministry of Defence's spending review was laid bare yesterday as it emerged military mandarins "wrote off" £8billion of equipment and assets.

By: Marco Giannangeli
Published: Sun, August 18, 2013

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The estimated cost for the early withdrawal of the Harrier Fleet is £1.29bn

EXPRESS Home of the Daily and Sunday Express

The Cause?

Austerity: The Background

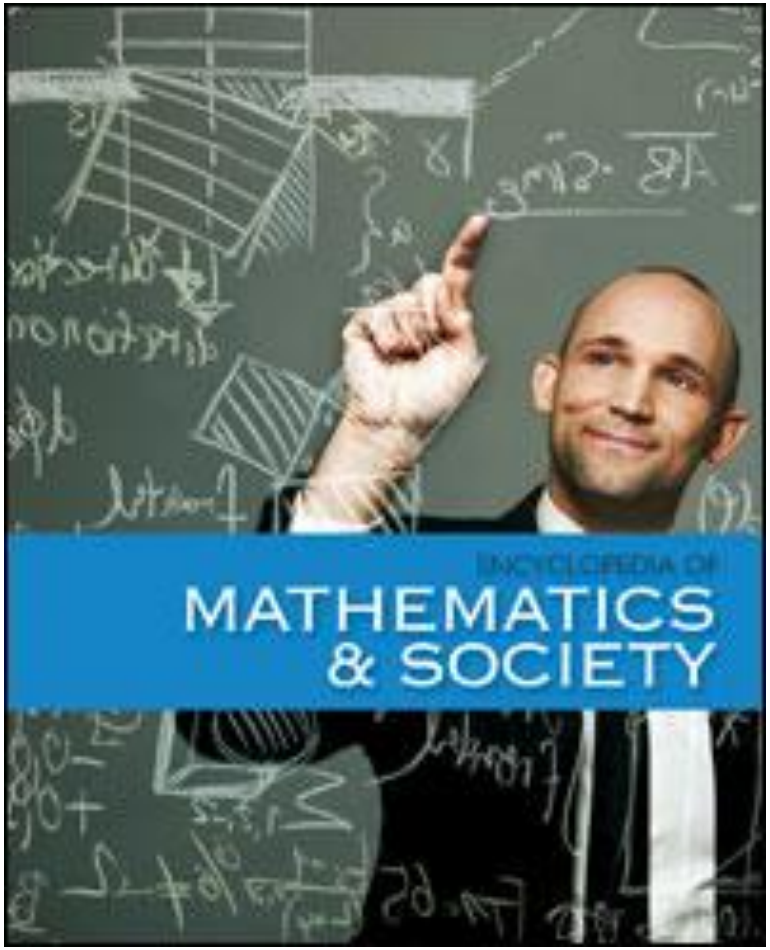
In time of austerity, many public and private owned businesses are faced with providing a capability under the conditions of budgetary constraints. The question is how can an business entity forecast what they can and can't do under such circumstances.

What lessons can be learned from Forecasting in the Defence Supportability Engineering.

Forecast solution how to survive austerity?

The Cost Capability Trade Off Model

The Cost Capability Trade Off Model is a **Hybrid Model of Non-Linear Regression, Optimisation, Monte-Carlo Simulation and Design of Experiment** in order to forecast the optimum performance within budgetary constraints.



Application – HMS Queen Elizabeth

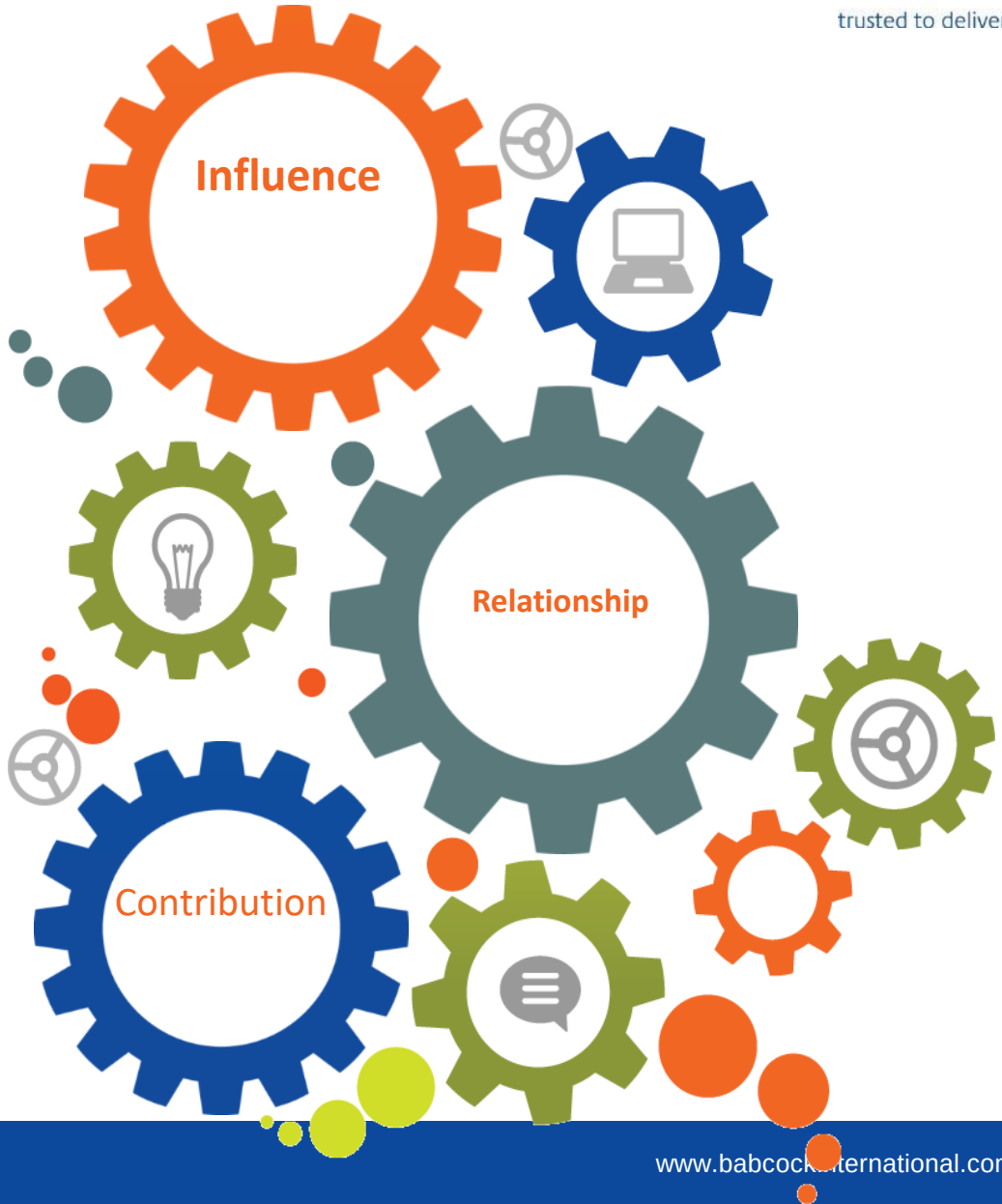
Past budget versus Future forecast

Logical Argument: Foundation

Building on top of a Through Life Cost Model

Logical Argument: Conversion

Cost to Capability



The Cost Capability Trade Off Model

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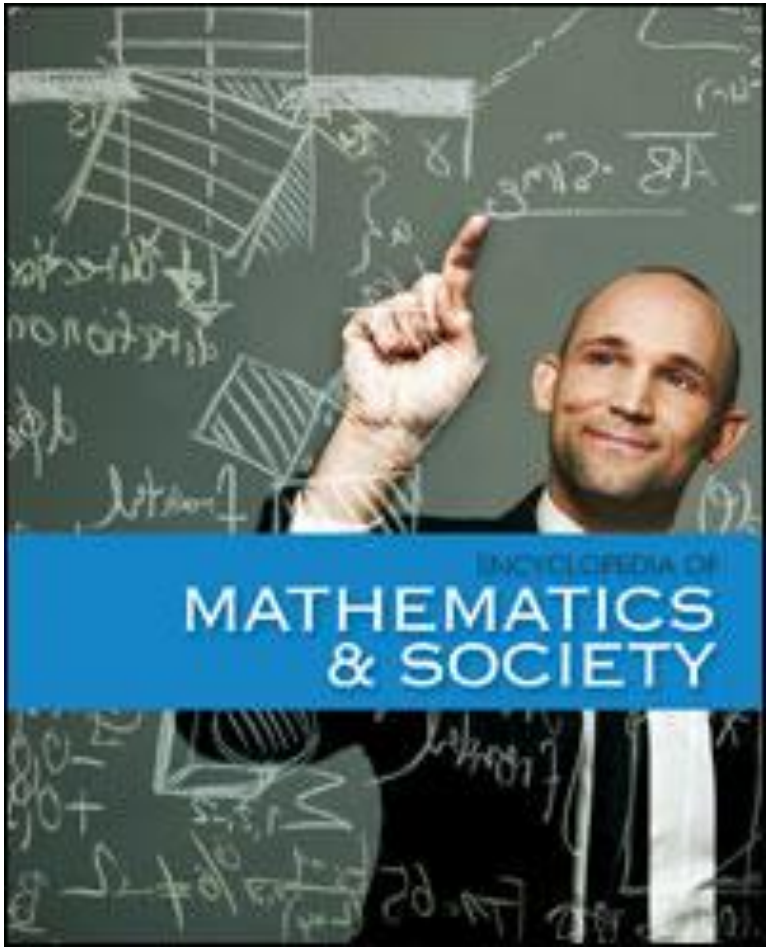
Demonstration

A guess will always be replaced by a guess but a logical argument evolves.



Options Comparison of Trade-Off

- **Understanding uncertainty**
- **Feasible options are not all equal**
- **Each option has a probability of not exceeding the budget**
- **Case Study Option A versus Option K.**

Option A

COST CAPABILITY TRADE OFF MODEL
TARGET OPTIMISATION

1. Baseline Cost	£4,255,638
2. Percentage Reduction	20.00%
3. Target Cost	£3,404,511

Summary
Run
Relationship

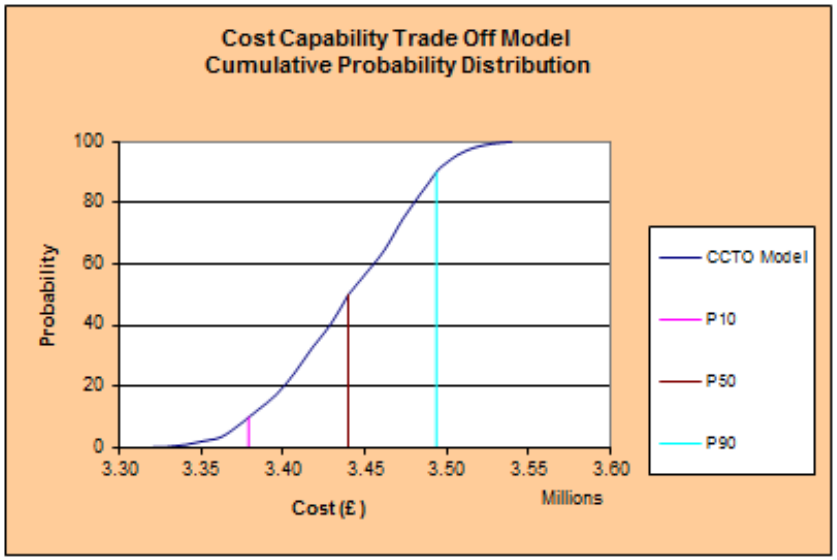
4. Performance Lever Feasibility Lowest Limit	Availability	Readiness	Usage
	50.0%	70.0%	60.0%

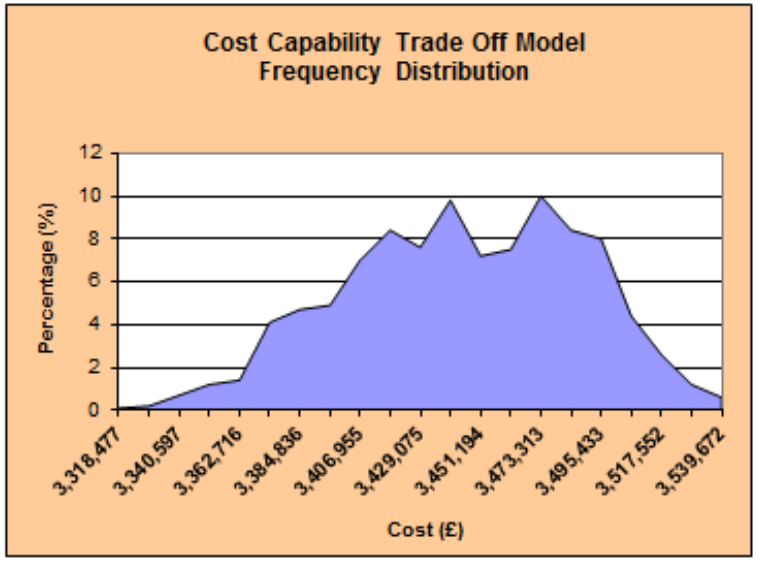
Options	Availability	Readiness	Usage
A	67.5%	89.7%	81.8%
	No Solution	94.8%	63.3%
C	90.2%	75.8%	87.2%
D	73.4%	83.6%	74.3%
	57.5%	No Solution	88.2%
F	96.4%	75.4%	81.2%
	54.5%	No Solution	90.3%
H	70.1%	85.3%	78.5%
	74.6%	76.2%	No Solution
	66.5%	72.9%	No Solution
	79.5%	75.1%	No Solution
	96.4%	72.9%	No Solution
	Choose Option		Transfer

3 Dimensional

Option A

COST CAPABILITY TRADE OFF MODEL





10% Probability - cost will be less than	**£3,379,188**
50% Probability - cost will be less than	**£3,440,021**
90% Probability - cost will be less than	**£3,493,774**
Baseline Costs*	**£4,255,638**
Target cost	**£3,404,511**
Probability - Target cost achieved	**22.75%**

Summary

3 Point Estimate

Recalc Target Prob.

Option K

COST CAPABILITY TRADE OFF MODEL
TARGET OPTIMISATION

1. Baseline Cost	£4,255,638
2. Percentage Reduction	20.00%
3. Target Cost	£3,404,511

Summary
Run
Relationship

4. Performance Lever Feasibility Lowest Limit

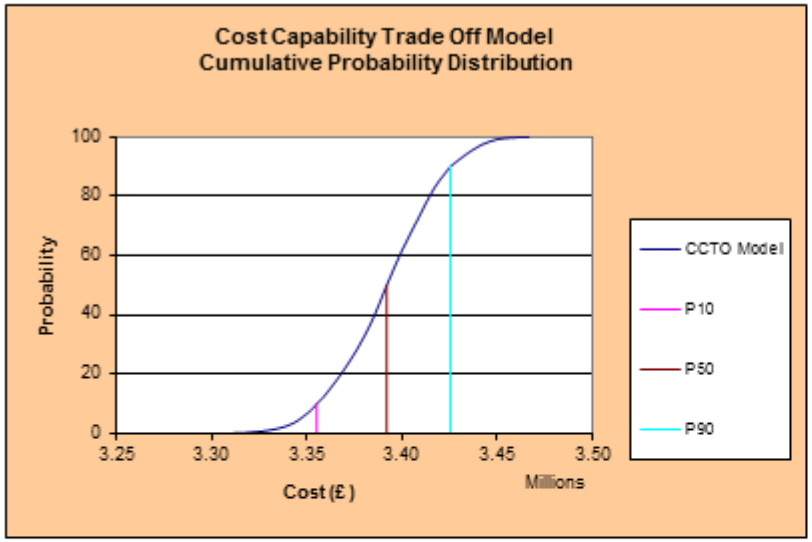
Availability	Readiness	Usage
50.0%	70.0%	60.0%

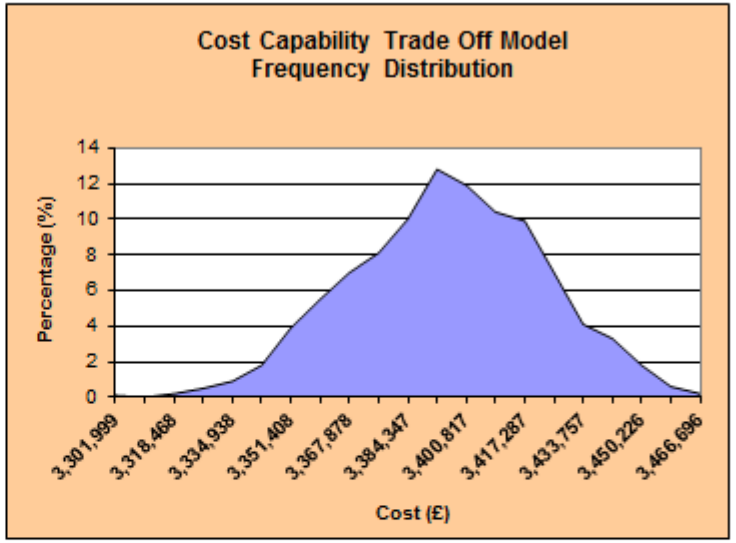
Options	Availability	Readiness	Usage
A	64.5%	99.1%	87.8%
B	68.0%	87.8%	85.0%
C	98.1%	86.2%	67.4%
D	67.2%	93.3%	75.3%
E	80.6%	94.2%	68.3%
	62.4%	No Solution	83.2%
G	70.2%	84.8%	96.6%
	56.2%	No Solution	68.3%
	51.4%	93.6%	No Solution
	76.6%	75.1%	No Solution
K	90.9%	89.1%	68.1%
L	79.4%	83.4%	72.5%
	Choose Option		Transfer

3 Dimensional

Option K

COST CAPABILITY TRADE OFF MODEL





10% Probability - cost will be less than	**£3,355,301**
50% Probability - cost will be less than	**£3,392,068**
90% Probability - cost will be less than	**£3,425,522**
Baseline Costs*	**£4,255,638**
Target cost	**£3,404,511**
Probability - Target cost achieved	**67.36%**

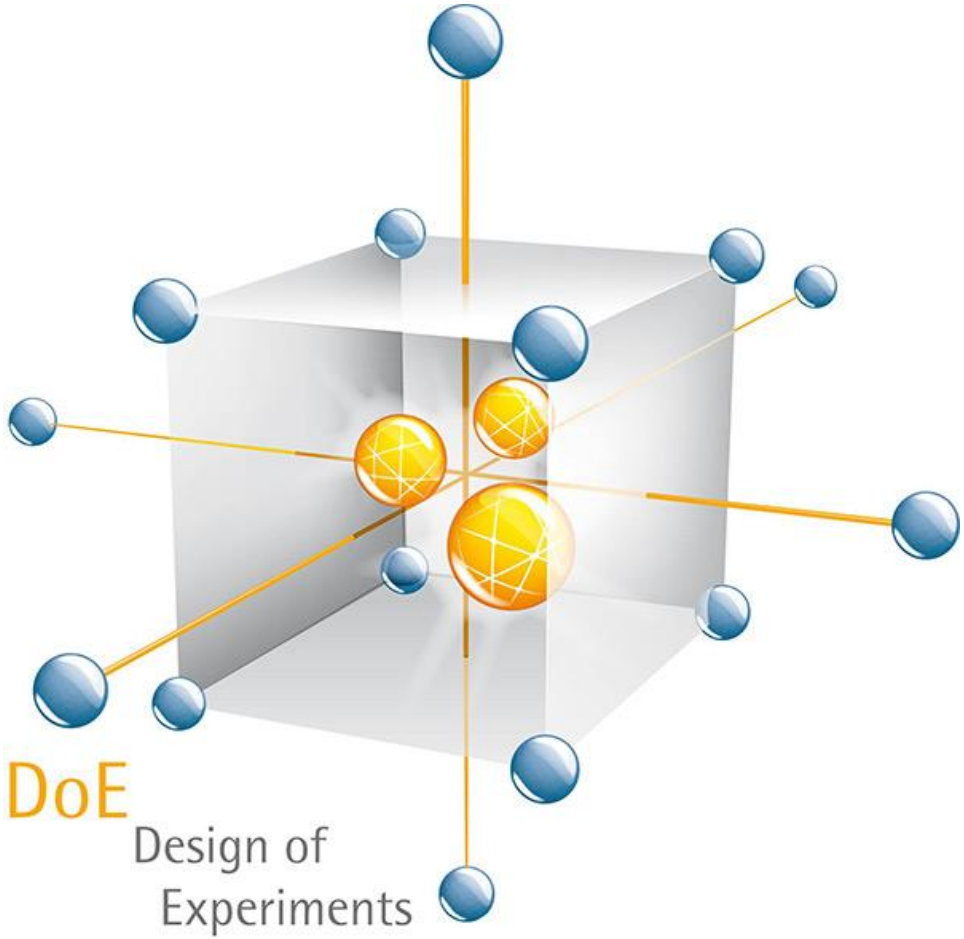
Summary

3 Point Estimate

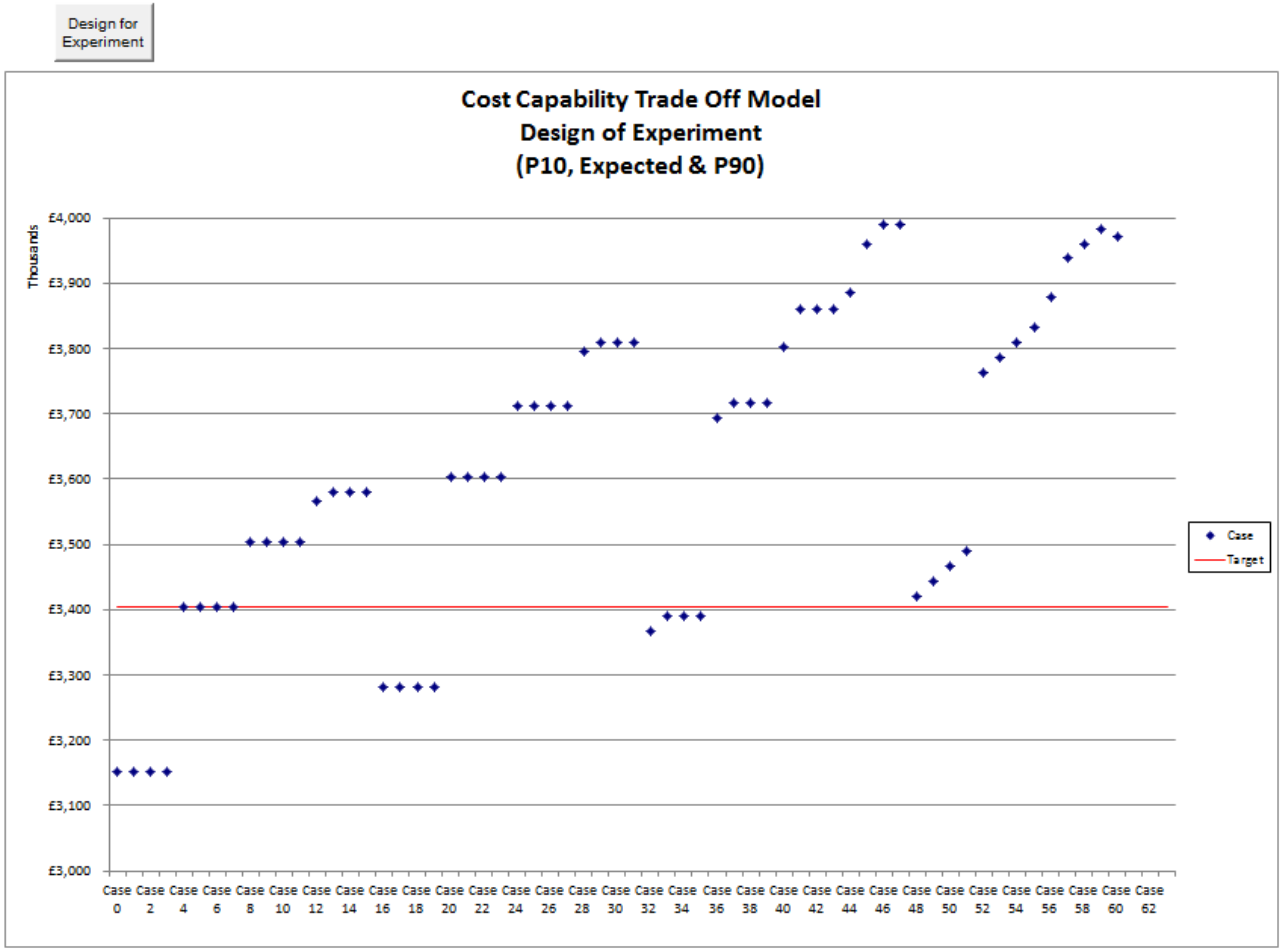
Recalc Target Prob.

Options Comparison of Trade-Off

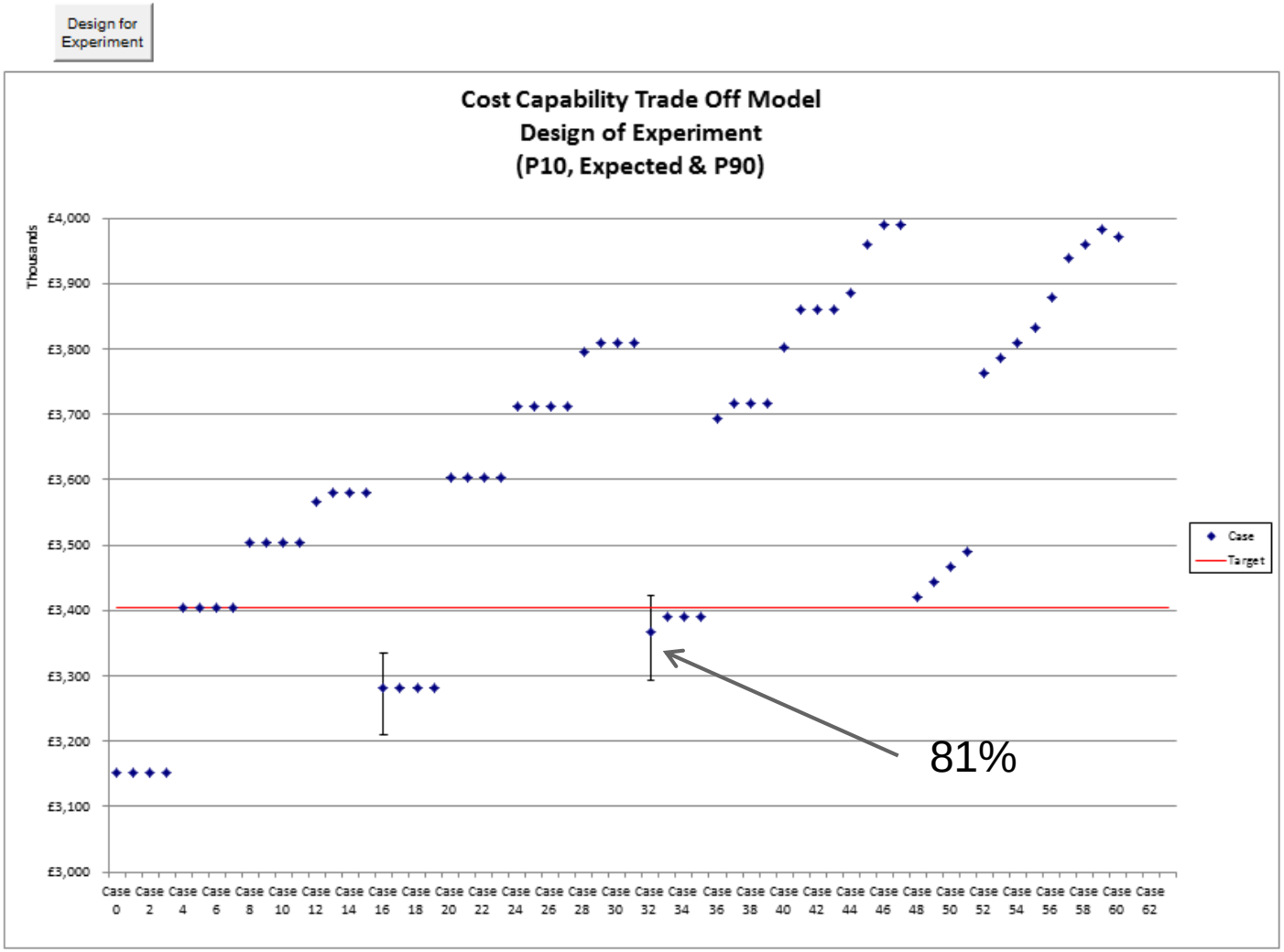
- **Use Design of Experiment to investigate options comparisons**



Design of Experiment



With Monte-Carlo Simulation



Queen names new Royal Navy Aircraft 14th July 2014

Summary

- **Austerity has the ability to cut short the Life of an Highly complex assets.**
- **For Forecasters working in supportability engineering, we have to work out ways of sustaining operation and performance under such budgetary constraints.**

Future Work

The Cost Capability Trade Off Model was built for such situations but theoretically has wider applications outside the Defence supportability engineering industry.

THANK YOU

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