

Abstract

- The government budget in the United Kingdom (UK) is too large to be managed as a whole; therefore it is divided into departments of state by HM Treasury. The Ministry of Defence (MOD) is one such department, but even this is too large to control, hence it is allocated to programmes and those are broken down into projects. At this level the funding lines are estimated, forecast and monitored.
- The big picture is needed to ensure that the individual budget lines do not exceed the overall funding available. QinetiQ has been working on the big picture and generating the UK MOD total budget to establish the portfolio picture. This has utilised both micro and macro parametric cost modelling to their best advantage. This paper will explore the cost modelling techniques applied for the in-service capabilities and the future capabilities.
- Establishing the UK defence budget is the first step, after this the real fun begins. We are able to ask question such as; how can the portfolio view be used to influence industry strategy? What are the capability gaps? Is the portfolio balanced? How do we consider balance of investment decisions? What are the cost drivers? And many more.
- This paper will use the UK MOD as an exemplar, but the process will be equally applicable to any nation or governments.

Portfolio analysis: estimating the UK defence Budget

Dale Shermon | QinetiQ Fellow & Managing Consultant

ICEAA Professional Development & Training Workshop
Phoenix - June 2018

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QINETIQ

Agenda

-
- 1 QinetiQ and Advisory Services

 - 2 Portfolio analysis

 - 3 Budget Structure

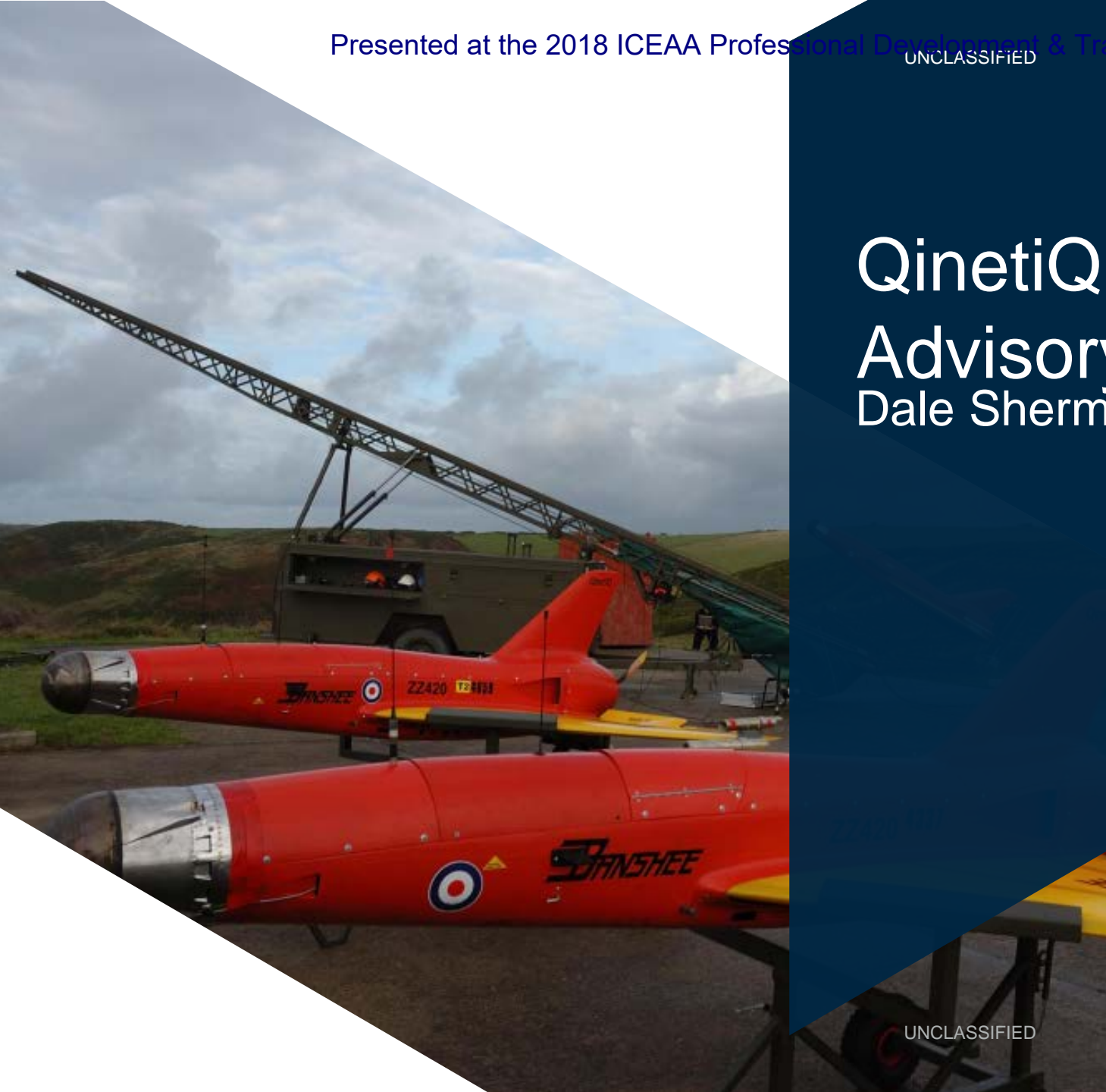
 - 4 Case study – UK Defence Budget

 - 5 Summary

Caveat – all figures and analysis are for presentation purposes only and will require review and scrutiny prior to use!

QinetiQ and Advisory Services

Dale Shermon | QinetiQ Fellow



Our vision and strategy

“The chosen partner around the world for mission-critical solutions,
innovating for our customers’ advantage”



UK

Lead and modernise the UK Defence Test and Evaluation enterprise, by working in partnership with Government and Prime contractors



International

Build an international company that delivers value to our customers by developing our home markets, creating new home markets and exporting



Innovation

Invest in and apply our core competence for customer advantage in defence and commercial markets

QinetiQ Advisory services

Diagnose

- A range of products and tools designed to assist customer in understanding and defining the **problem**, identifying weaknesses, risks and gaps and highlighting strengths.

Analyse

- Impartial and robust **analysis** of the evidence, assumptions, data and factors surrounding an issue to optimise customer's evidence-based decision making

Advise

- Delivery of knowledge and expert advice by providing key specialists and subject matter experts to support customers in the **conduct** of specific tasks

Support

- Provision of training, mentoring, coaching to **transfer** skills or the provision of skilled or expert staff to enable customer to deliver a task successfully.

QinetiQ Advisory services

Australian Force Structure Review

- Application of high level cost estimating methodology to review budgets and generate independent cost estimates (ICE)



CDM Cost Challenge

- Review of the budget of the top UK MOD projects to align budget with requirements for the Chief of Defence Material (CDM).



CCG Fleet Review

- Created a robust audit trail and evidence for a revised Fleet Renewal Plan (FRP) 2017 across 119 vessels in 43 home ports of the Canadian Coast Guard (CCG)



Portfolio analysis

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Portfolio Analysis - definitions

- **Commerce:**

- An analysis of elements of a company's product mix to determine the optimum allocation of its resources. Two most common measures used in a portfolio analysis are market growth rate and relative market share.

- **Securities:**

- An analysis of an investment portfolio relative to an idealized balance of holdings, used as means of optimizing allocation.

- **Defence:**

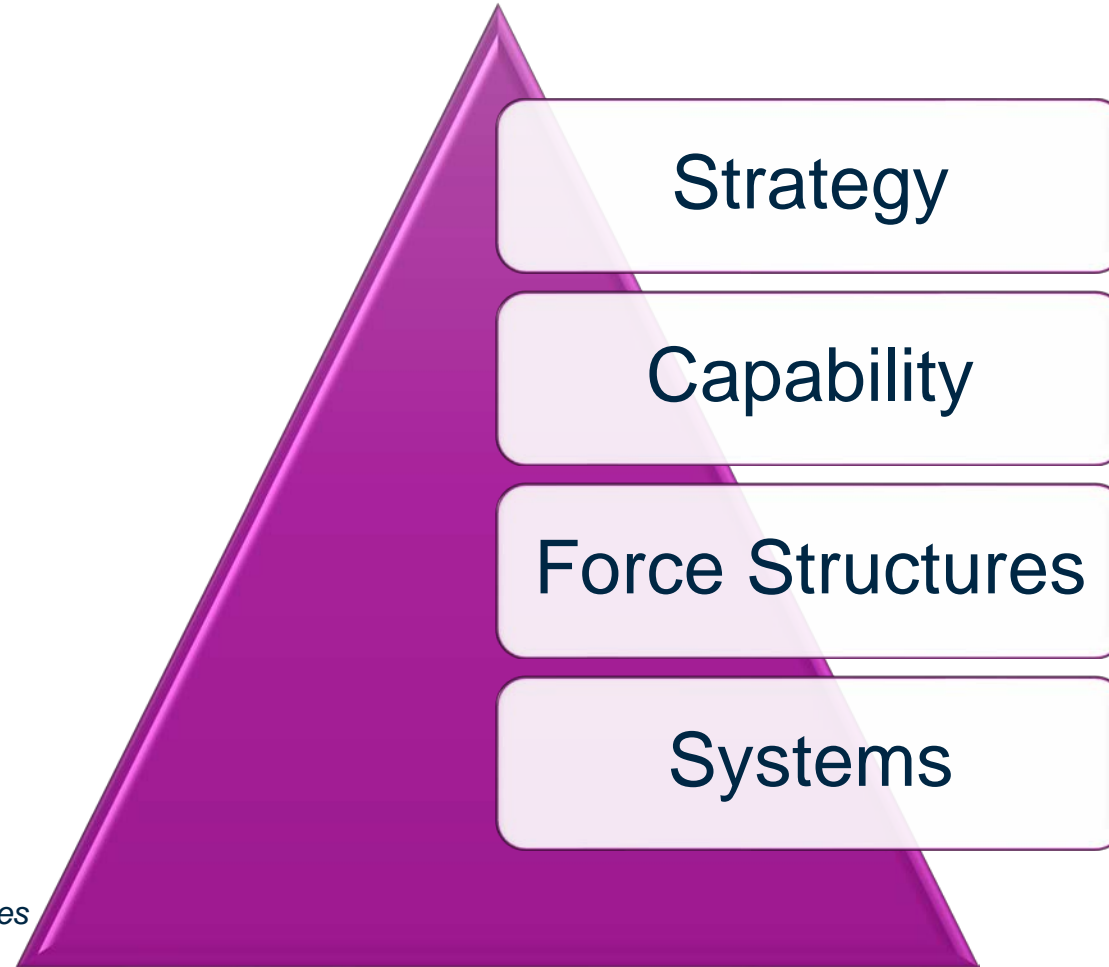
- The application of modelling, analysis and supplier insight, to understand the financial impact of a change in the composition of the portfolio or decisions on a strategic investment or divestment.



Source: <http://www.businessdictionary.com/definition/portfolio-analysis.html>

http://www.scaf.org.uk/library/prespaper/2016_02/Cost%20Assurance%20and%20Analysis%20Service-Mark%20Wright,%20CAAS.pdf

Portfolio Structure in defence

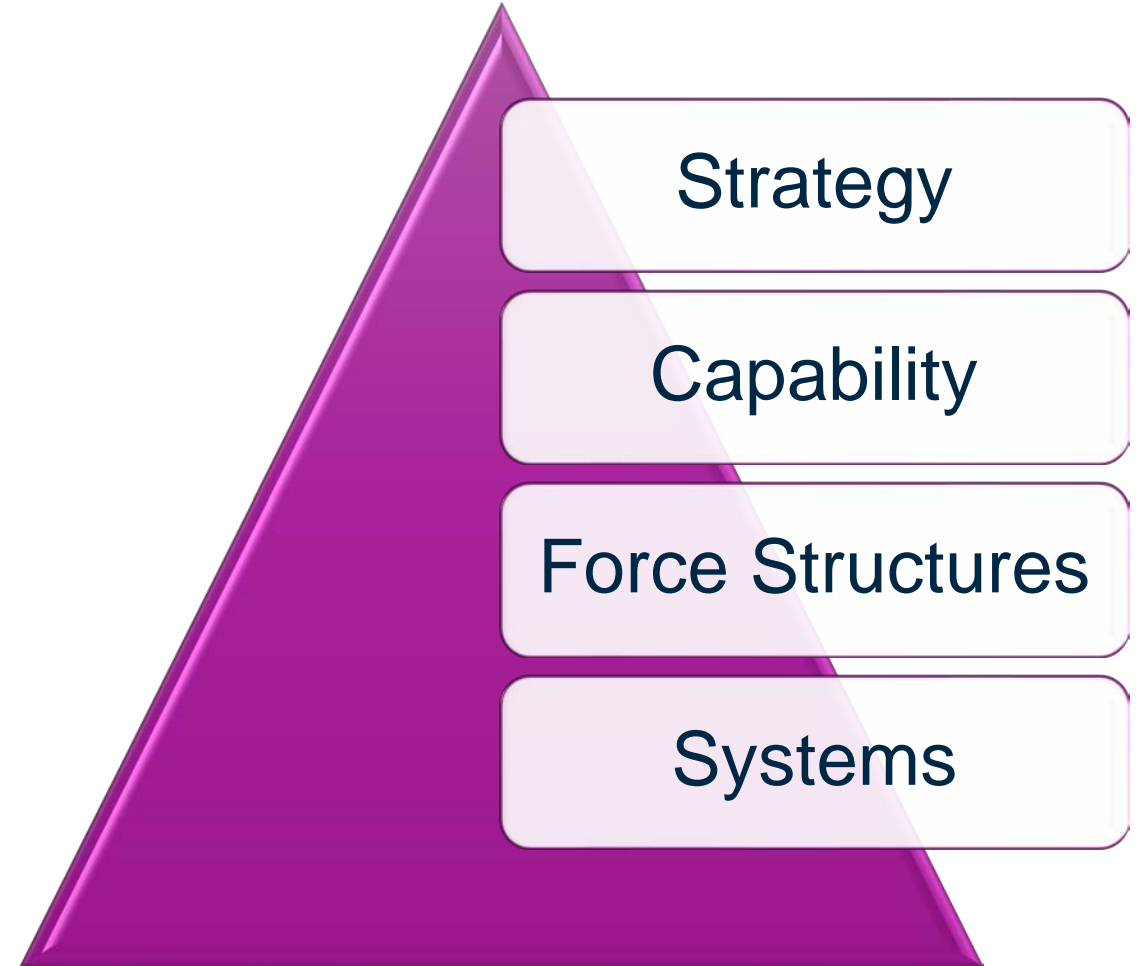


Source: Centre for Defence Acquisition, Cranfield University, Innovative UK Approaches to Acquisition Management, dated May 2009

Portfolio problems

- Defence budgets are constantly **under pressure** to achieve Value for Money (VfM)
- There is a constant need to **demonstrate affordability** of the acquisitions being made.
- Decision makers are required to **juggle the needs** of the service personnel with the budget provided by the government
- Affordability occurs at many levels of the portfolio:
 - Strategic – What does the Government want to achieved?
 - Capability – How will it generate the outcome of effect desired?
 - Force Structure – Who are the single services or joint organisations delivering the capability?
 - Systems – Where are the systems being acquired?

Source: Centre for Defence Acquisition, Cranfield University, Innovative UK Approaches to Acquisition Management, dated May 2009



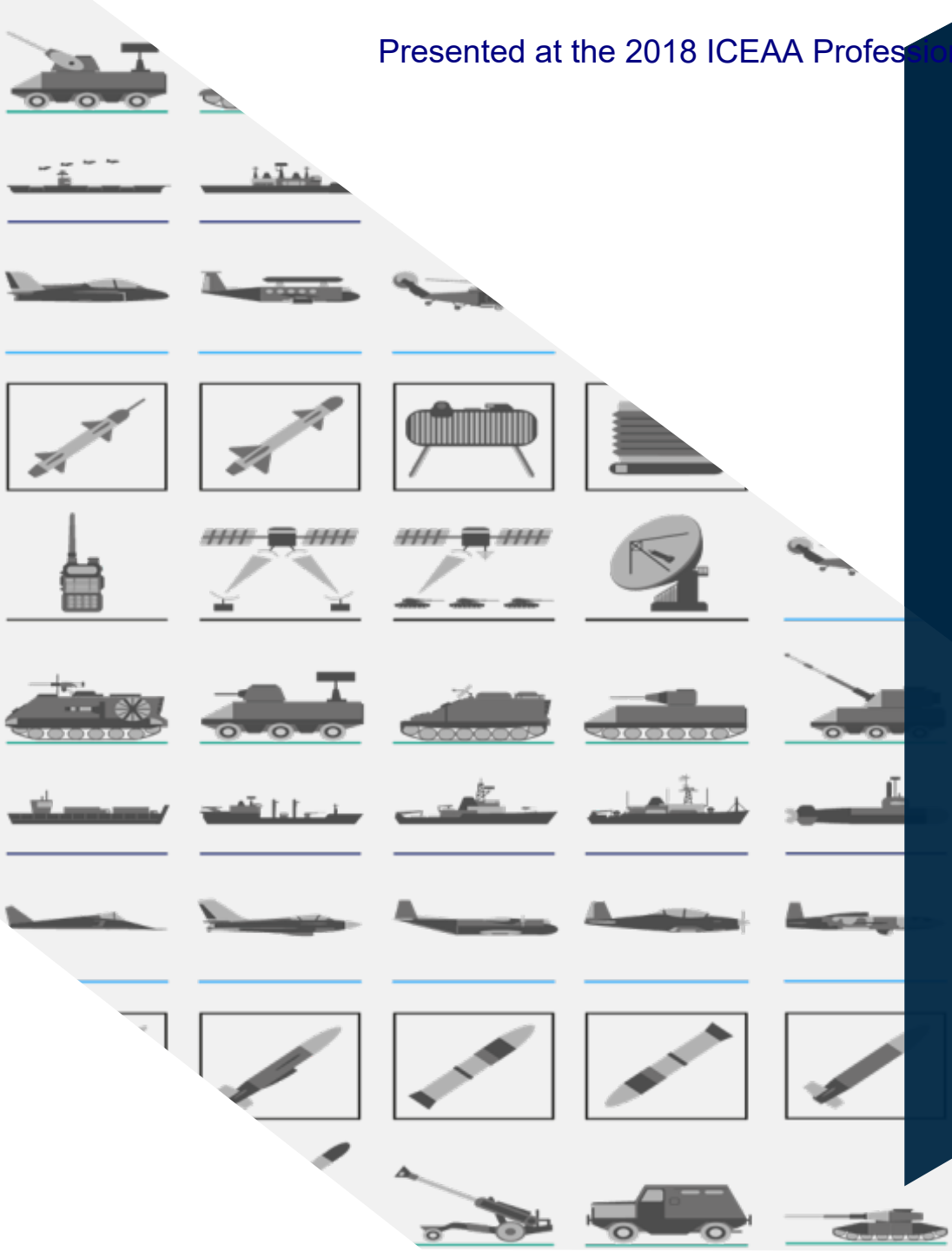
Project, Programmes and Portfolios

- **Project level analysis** will only deal exclusively with low level issues and decisions regarding a single project.
 - The **focus** is seeking to deliver and support a system to time, budget and performance.
- **Programme level analysis** will consider the issues and decisions across an enterprise or business sector.
 - The **focus** is seeking to maintain an industry sector with the facilities, resources and supply chain capable of delivering systems of systems (SoS) through the provision of a uniform or constantly growing demand.
- **Portfolio level** the mission capability will fluctuate with some force elements becoming obsolete and proving unreliable while others are being commissioned into service with ‘infant mortality’ issues.
 - The **focus** is providing the nation with a defence force which will be able to execute the will of the government.
- Throughout this structure the analysis of **costs, schedule, risks and decisions** need to be made at the appropriate level



Budget Structure

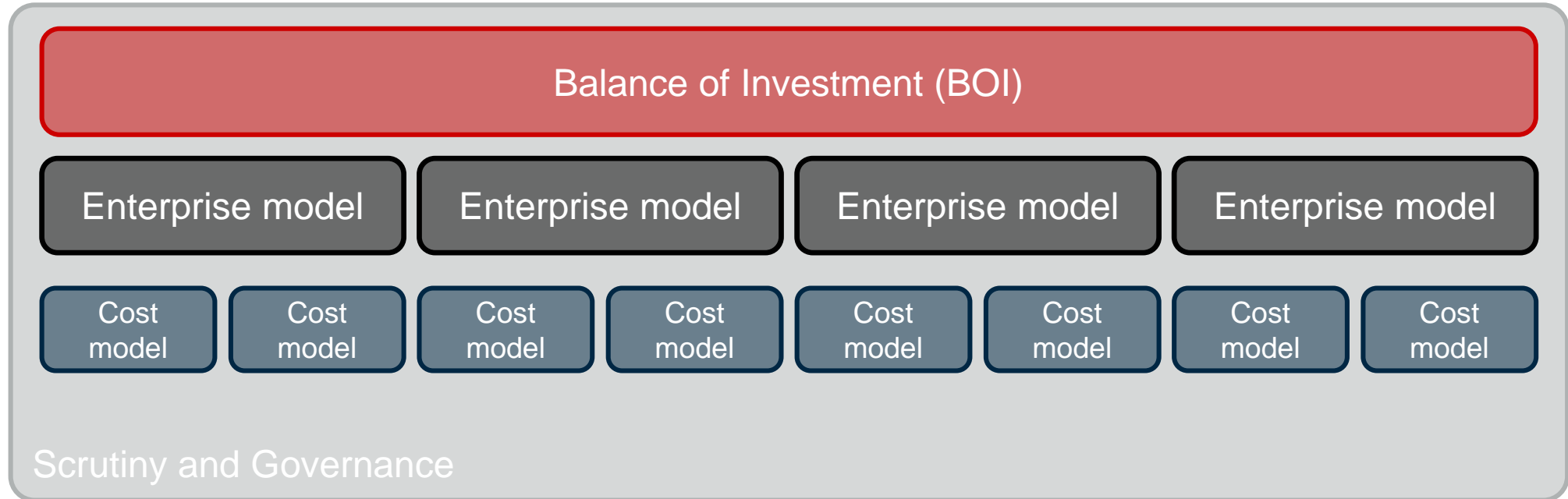
Dale Shermon | QinetiQ Fellow



Defence Budgets



Cost modelling approach



Applying macro-parametrics

- The projects will be a large variety of systems that can reuse a macro-parametric model.
- The platforms or systems will vary depending upon the value of the input parameter that is used to establish the performance, design, technology year and so forth.



Case study – UK Defence

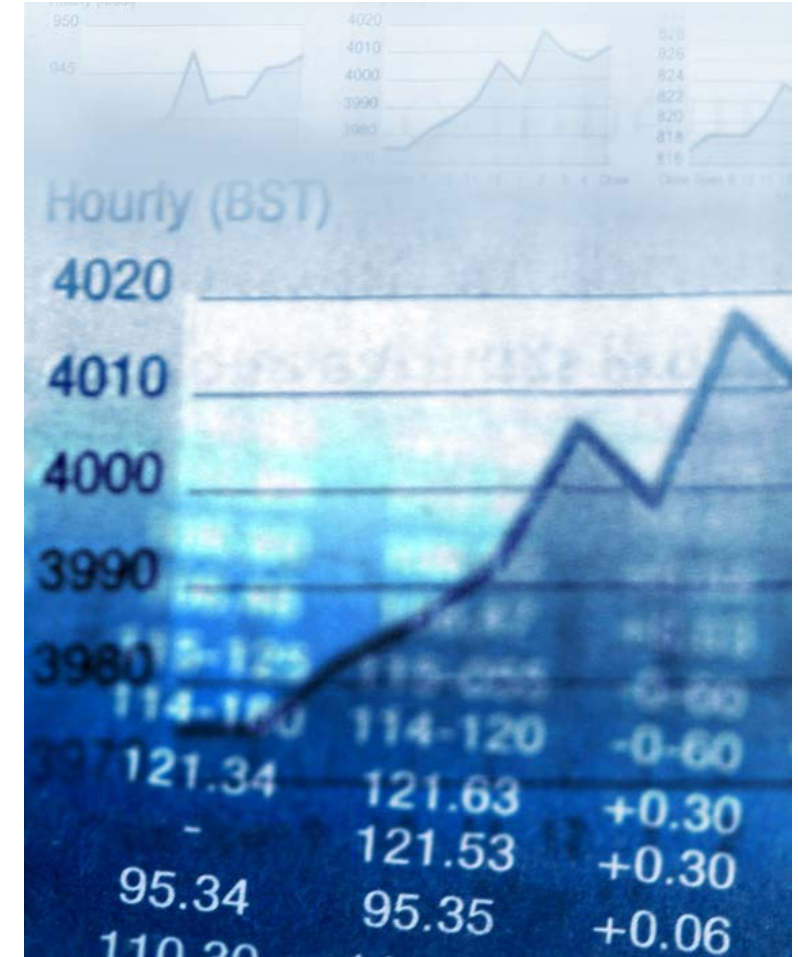
budget

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macro-economic view of defence

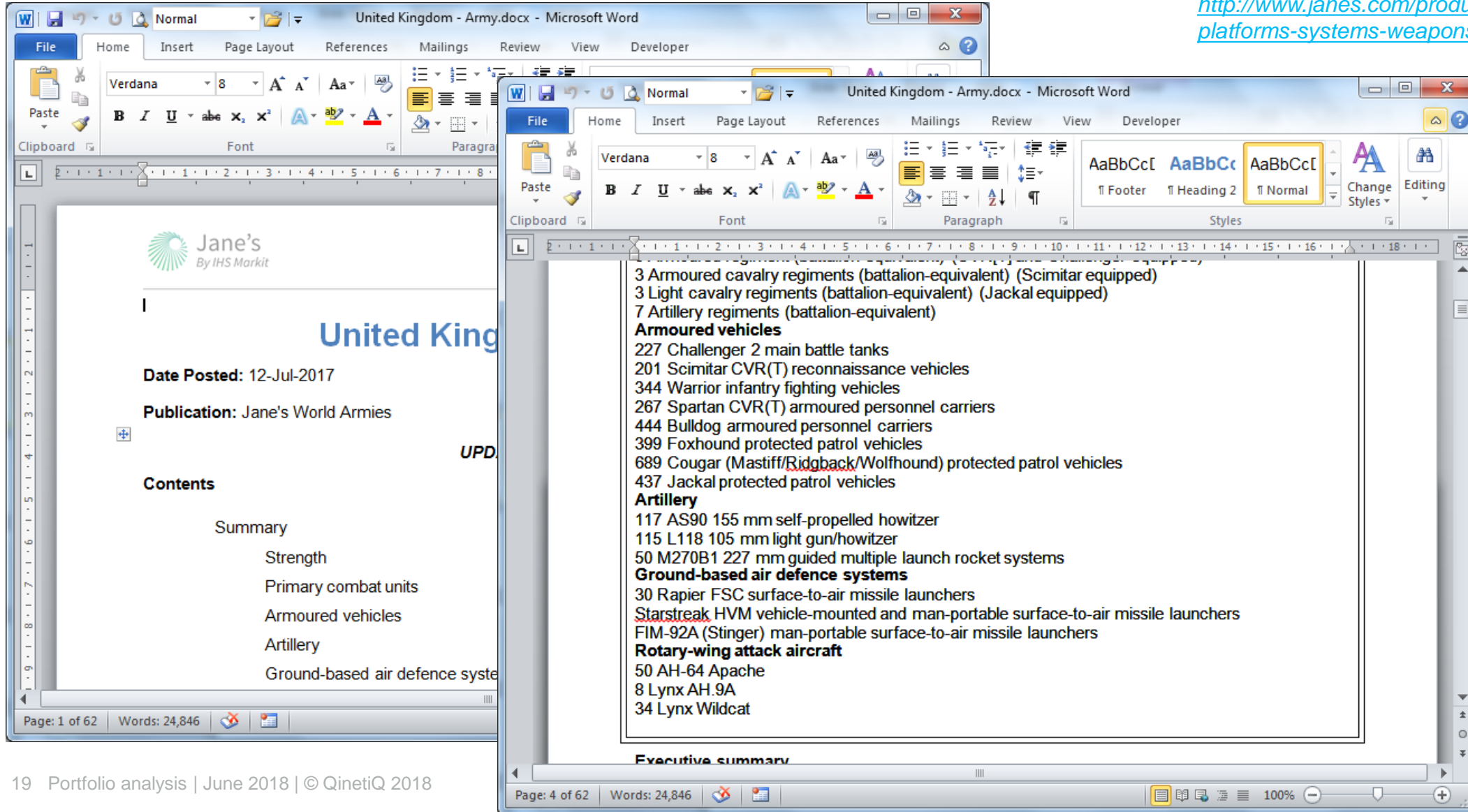
- A **rigorous process** of analysis is necessary to support the acquisition of any capability either in the public or private sector.
- Shareholders and taxpayers are **not amused** when funds are squandered on unnecessary or frivolous purchases.
- The process described here is an example of a defence acquisition process that would **withstand subsequent scrutiny**.
- Stress test the **cost drivers** and potential areas of over heating in the budget across the whole of DE&S.



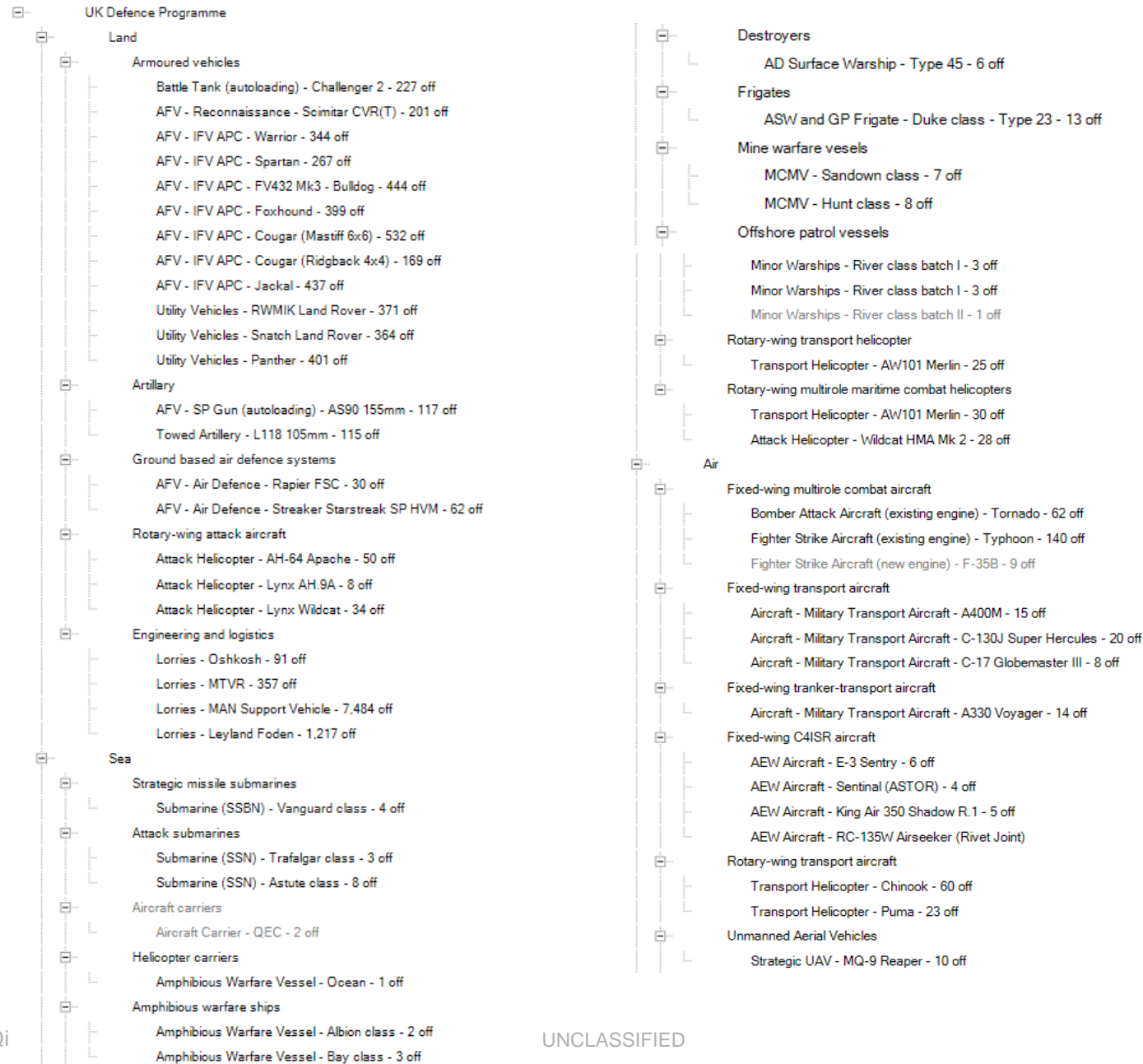
Portfolio view

Source:

<http://www.janes.com/products/military-platforms-systems-weapons>



Force Structure



Project - top-level input parameters

Product Breakdown Structure

- 1 UK Defence Programme
 - 2 Land
 - 3 Armoured vehicles
 - 4 **Battle Tank (autoloading) - Challenger 2 - 227 off**
 - 5 AFV - Reconnaissance - Scimitar CVR(T) - 201 off
 - 6 AFV - IFV APC - Wamor - 344 off
 - 7 AFV - IFV APC - Spartan - 267 off
 - 8 AFV - IFV APC - FV432 Mk3 - Bulldog - 444 off
 - 9 AFV - IFV APC - Foxhound - 399 off
 - 10 AFV - IFV APC - Cougar (Mastiff 6x6) - 532 off
 - 11 AFV - IFV APC - Cougar (Ridgback 4x4) - 169 off
 - 12 AFV - IFV APC - Jackal - 437 off
 - 13 Utility Vehicles - RWMIK Land Rover - 371 off
 - 14 Utility Vehicles - Snatch Land Rover - 364 off
 - 15 Utility Vehicles - Panther - 401 off
 - 16 Artillery
 - 17 AFV - SP Gun (autoloading) - AS90 155mm - 117 off
 - 18 Towed Artillery - L118 105mm - 115 off
 - 19 Ground based air defence systems
 - 20 AFV - Air Defence - Rapier FSC - 30 off
 - 21 AFV - Air Defence - Streaker Starstreak SP HVM - 62 off
 - 22 Rotary-wing attack aircraft
 - 23 Attack Helicopter - AH-64 Apache - 50 off
 - 24 Attack Helicopter - Lynx AH.9A - 8 off
 - 25 Attack Helicopter - Lynx Wildcat - 34 off

Input Sheet

Battle Tank (autoloading) - Challenger 2 - 227 off

Cost: £1,292,151,261 1.41% Labor Requirement: 0.00 hours
 Project Cost: £91,876,589,270 Project Labor Requirement: 0.00 hours

Phase Set: A <Inherited> Worksheet Set: In-service only

	Value	Pessimistic	Optimistic	Units	Spread
1 Start Date	Budget start = 01/04/2017				
2 Performance Data					
3 Combat Mass	62,500.00	62,500.00	62,500.00	kg	
4 Calibre of Main Gun	120.00	120.00	120.00	mm	
5 Design Data					
6 Engine Power	1,200.00	1,200.00	1,200.00	SHP	
7 Technology Standard					
8 Year	1989	1989	1989		
9 Programme Data					
10 Number of Participating Nations	1.00				
11 Percentage to be included in the estimate of Development	Zero In-service = 0.00			%	
12 Percentage to be included in estimate of Production Invest...	Zero In-service = 0.00			%	
13 Number of additional variants to be developed	0				
14 Development Status	In-Service				
15 Production Quantity (including all variants)	386				
16 Production Rate	50.00			Units Per Year	
17 Crew Data					
18 Number of Officers	1	1	1		

PRICE TruePlanning 16.0 - [20180226 - UK Defence Programme.tppj]

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Product Breakdown Structure

- 1 UK Defence Programme
- 2 Land
- 3 Armoured vehicles
- 4 Battle Tank (autoloading) - Challenger 2 - 227 off
- 5 AFV - Reconnaissance - Scimitar CVR(T) - 201 off
- 6 AFV - IFV APC - Warrior - 344 off
- 7 AFV - IFV APC - Spartan - 267 off

Input Sheet

Battle Tank (autoloading) - Challenger 2 - 227 off

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5 Design Data	1,200.00	1,200.00	1,200.00	SHP	
	1989	1989	1989		
	1.00				
Rate of Development	Zero In-service = 0.00			%	
of Production Invest...	Zero In-service = 0.00			%	
Developed	0				
	In-Service				
(ts)	386				
	50.00			Units Per Year	
	1	1	1		

Challenger 2.docx - Microsoft Word

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Jane's
By IHS Markit

Challenger 2

Date Posted: 05-Jul-2017

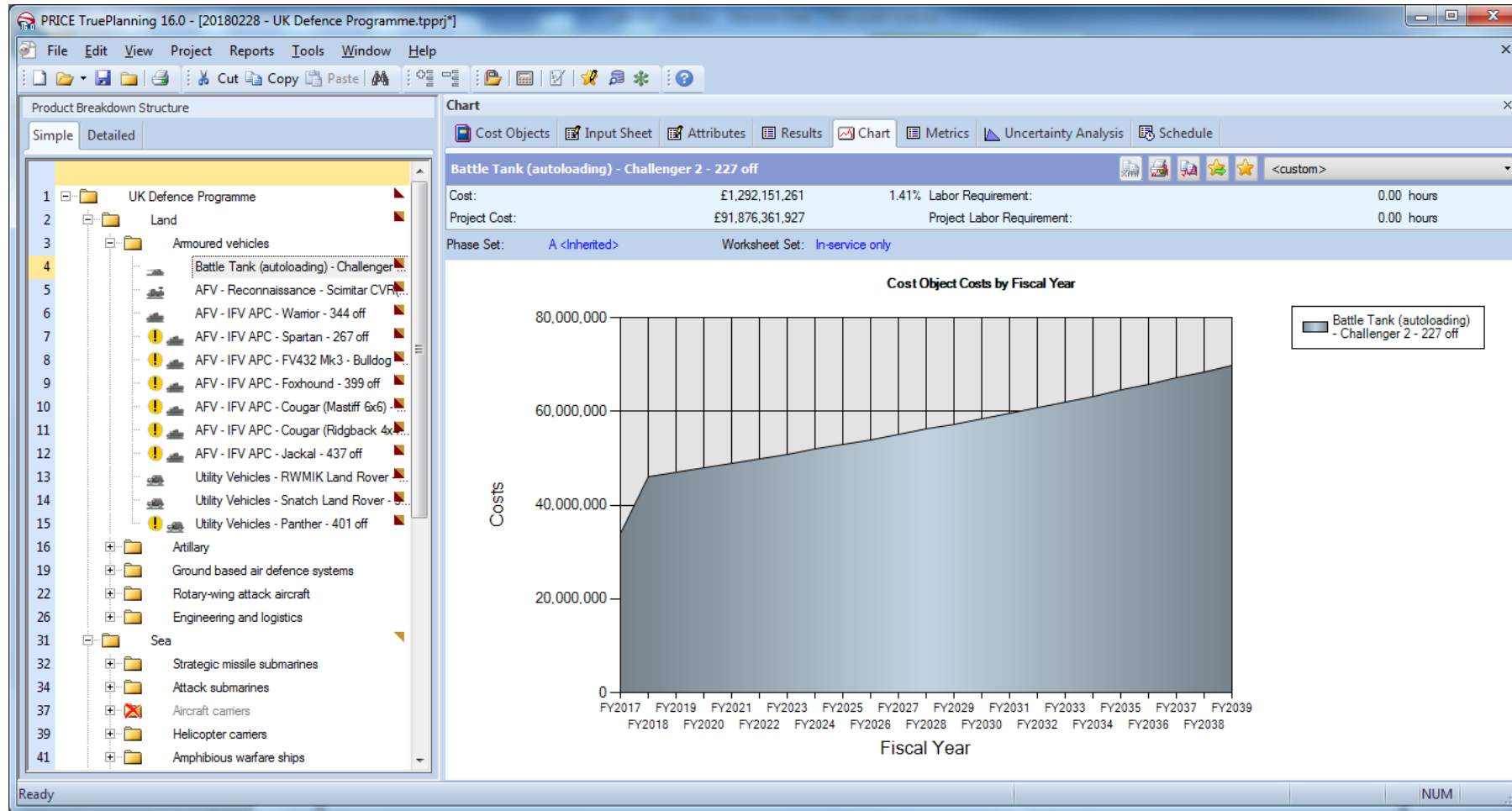
Publication: Land Warfare Platforms: Armoured Fighting Vehicles

UPDATED

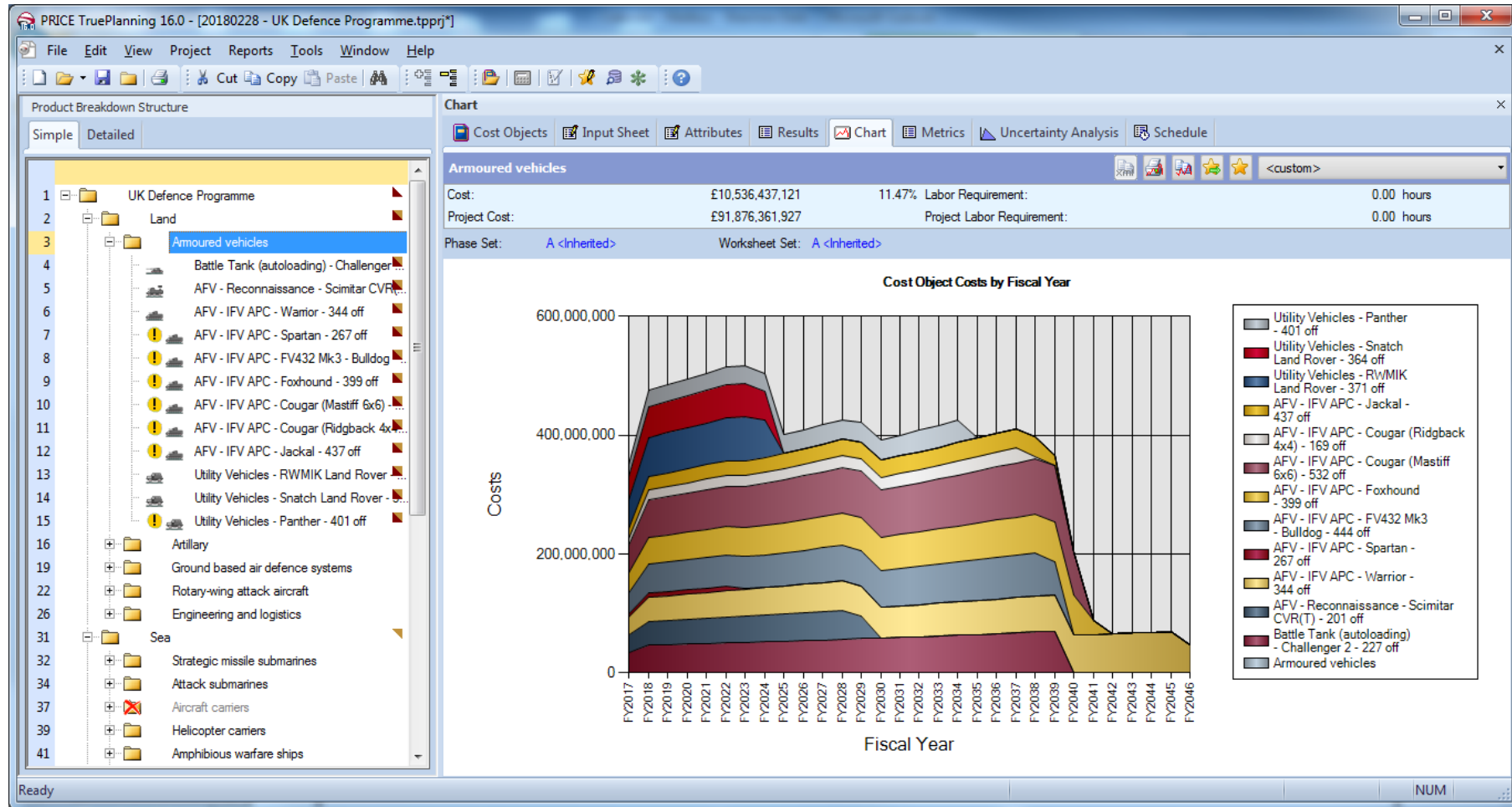
standar	-	62500 kg (137788 lb) (62.5 t)	57300 kg (126324 lb) (57.3 t)	64500 kg (142198 lb) (64.5 t)	62000 kg (136686 lb) (62.0 t)
combat:	62500 kg (137788 lb) (62.5 t)	74480 kg (164200 lb) (74.5 t) (Dorchester armour kit dependent)	-	-	-
Mobility					
Configuration					
running	tracked	tracked	tracked	tracked	tracked

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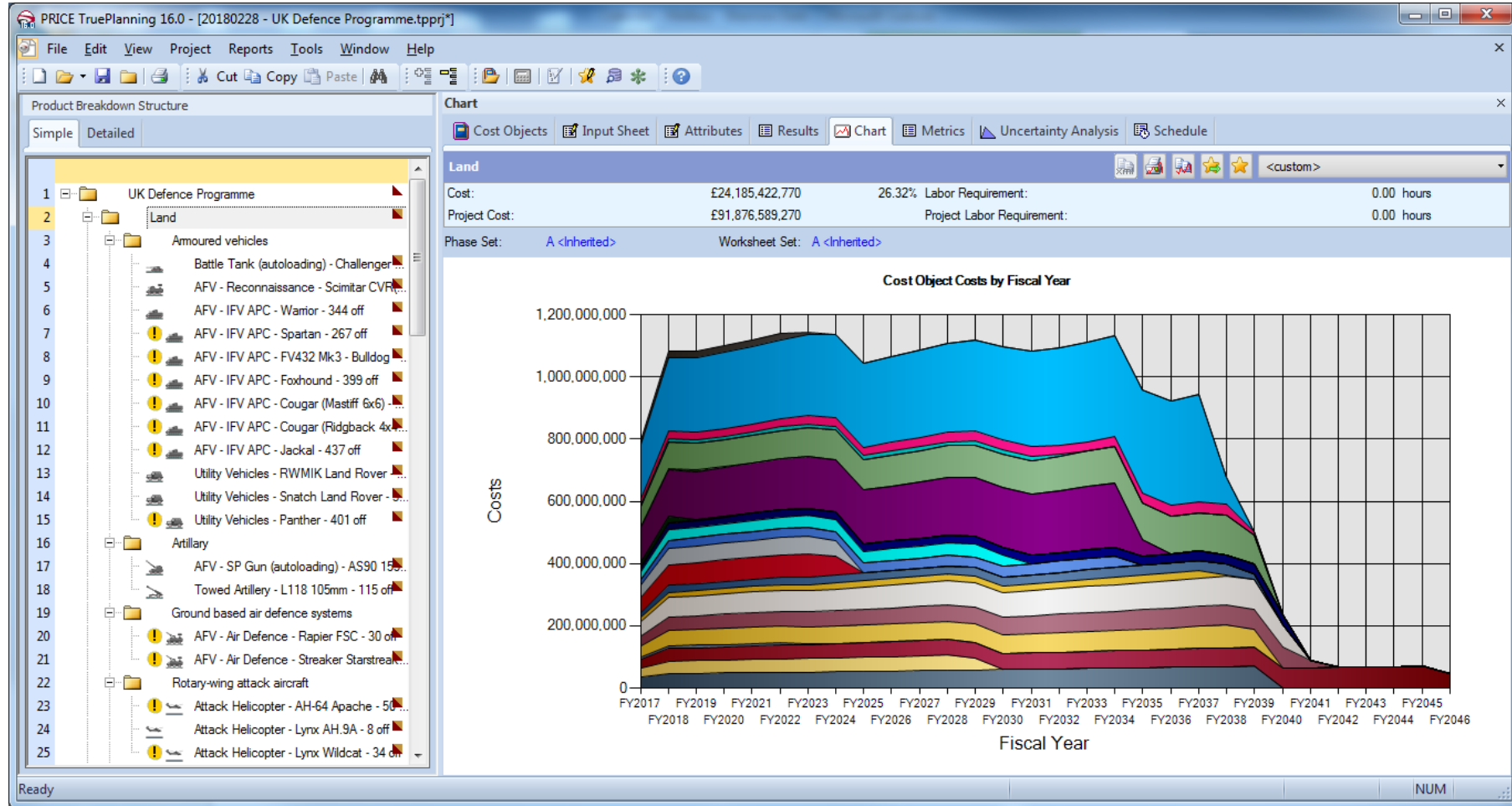
Land Programme - Challenger 2 project



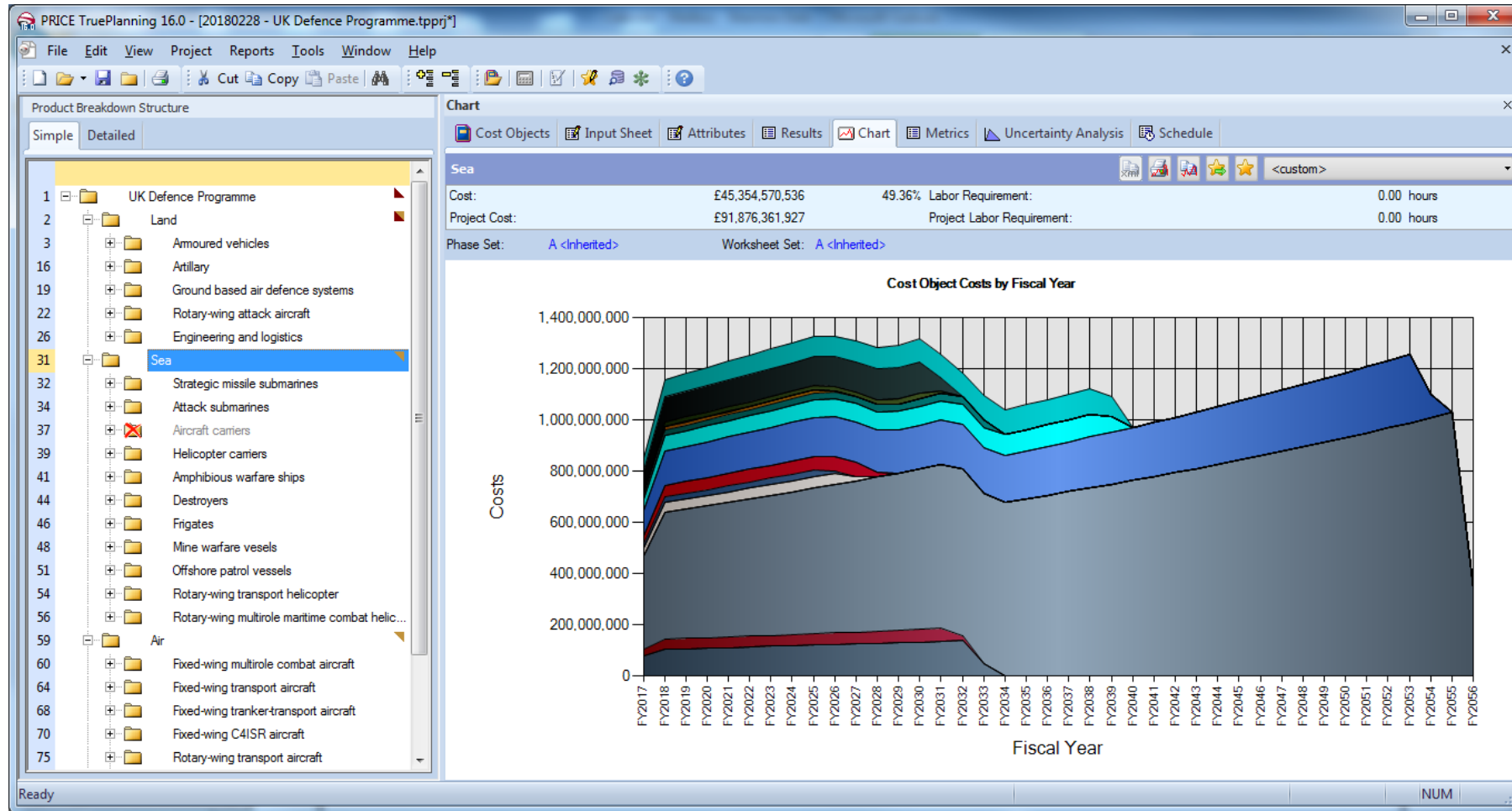
Land Programme – Armoured Vehicles



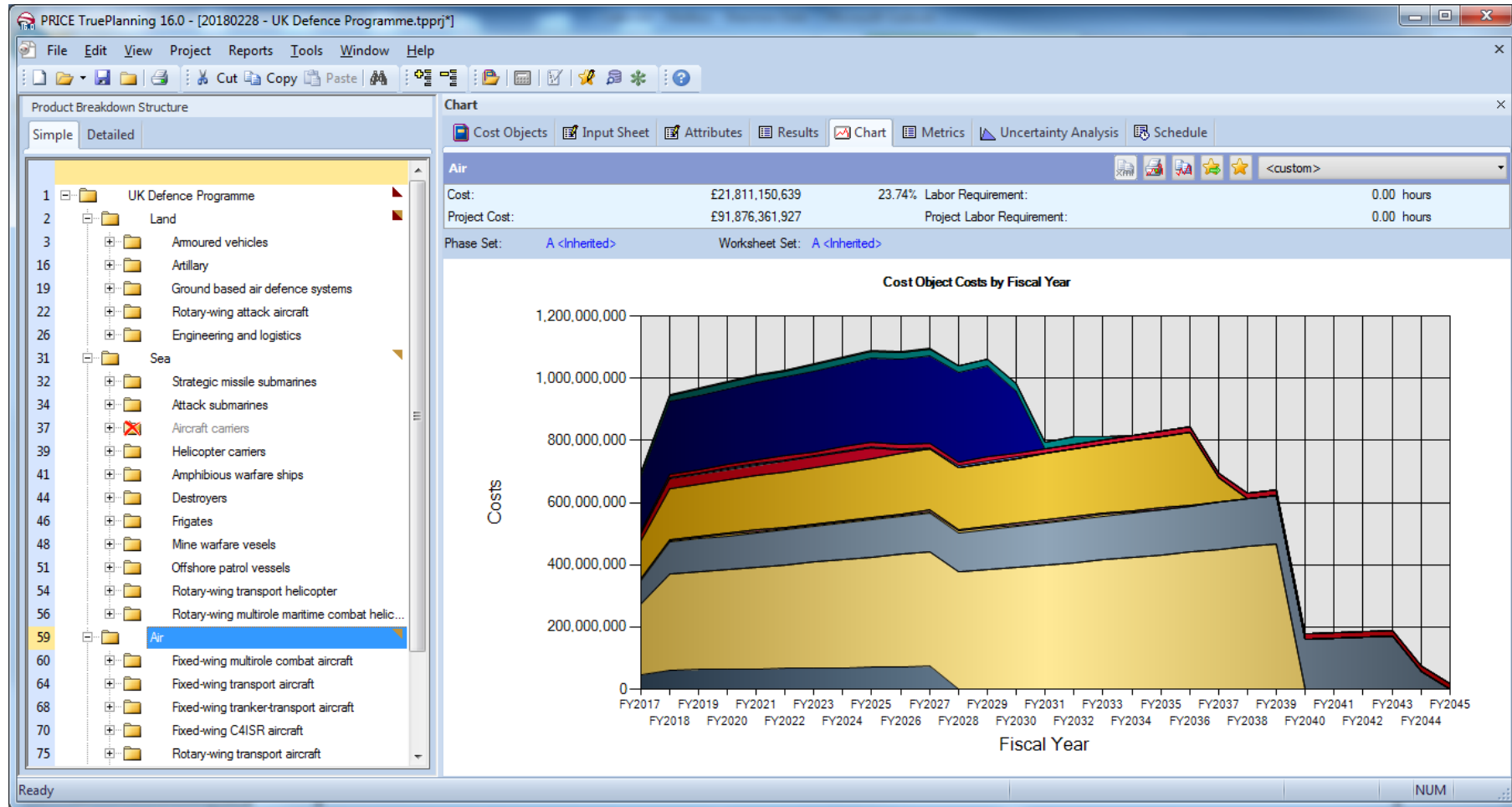
Land programme



Maritime programme

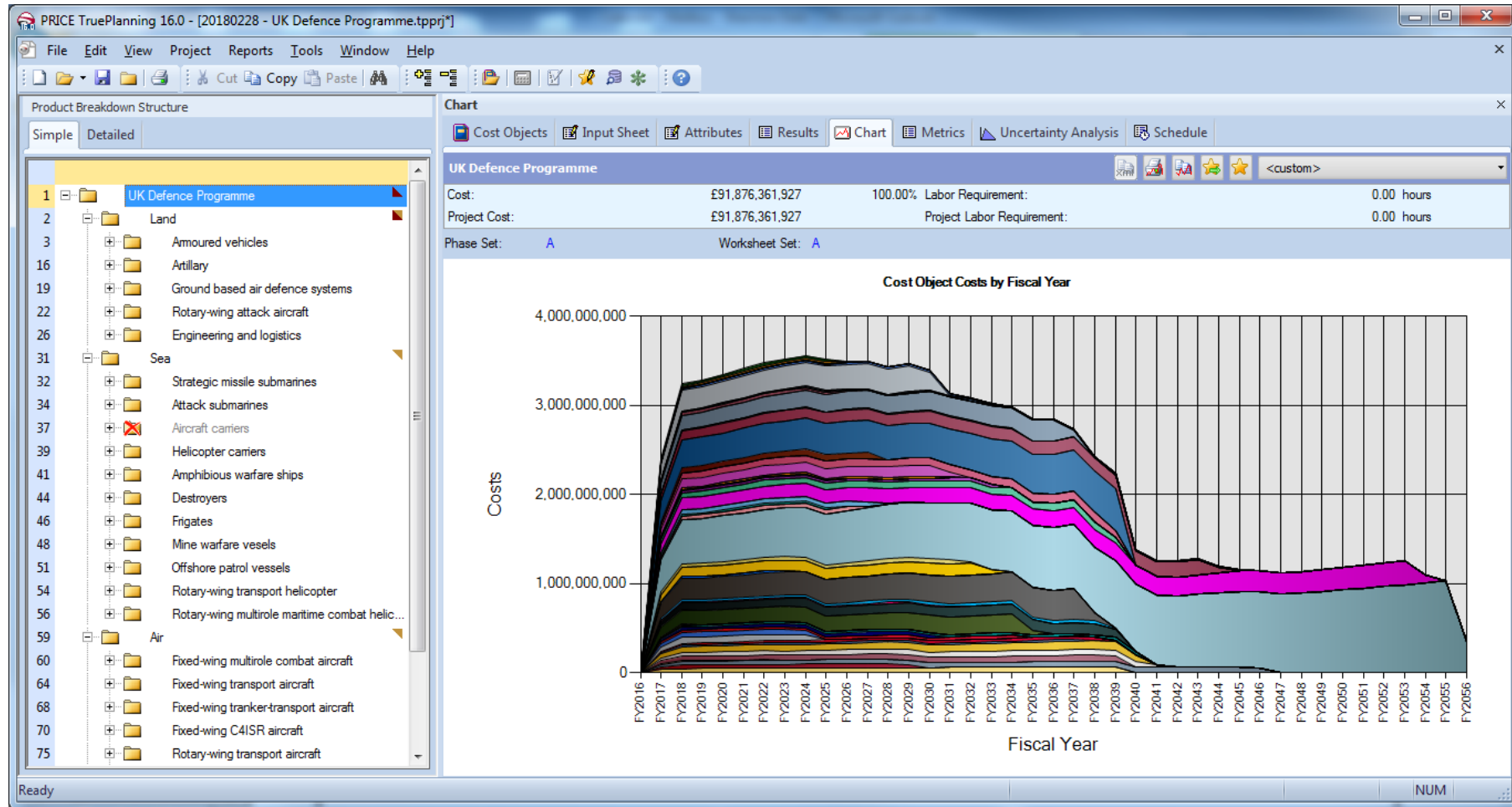


Air Programme



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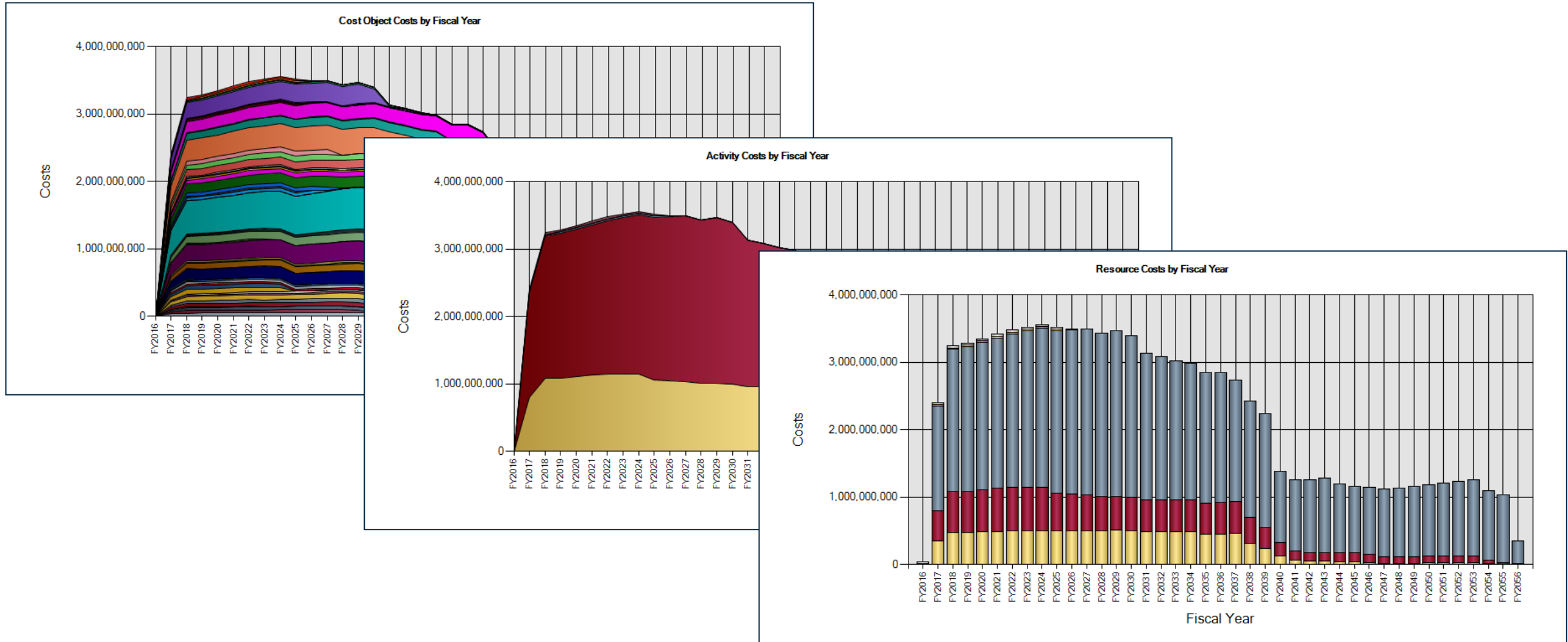
Macro-parametric cost model



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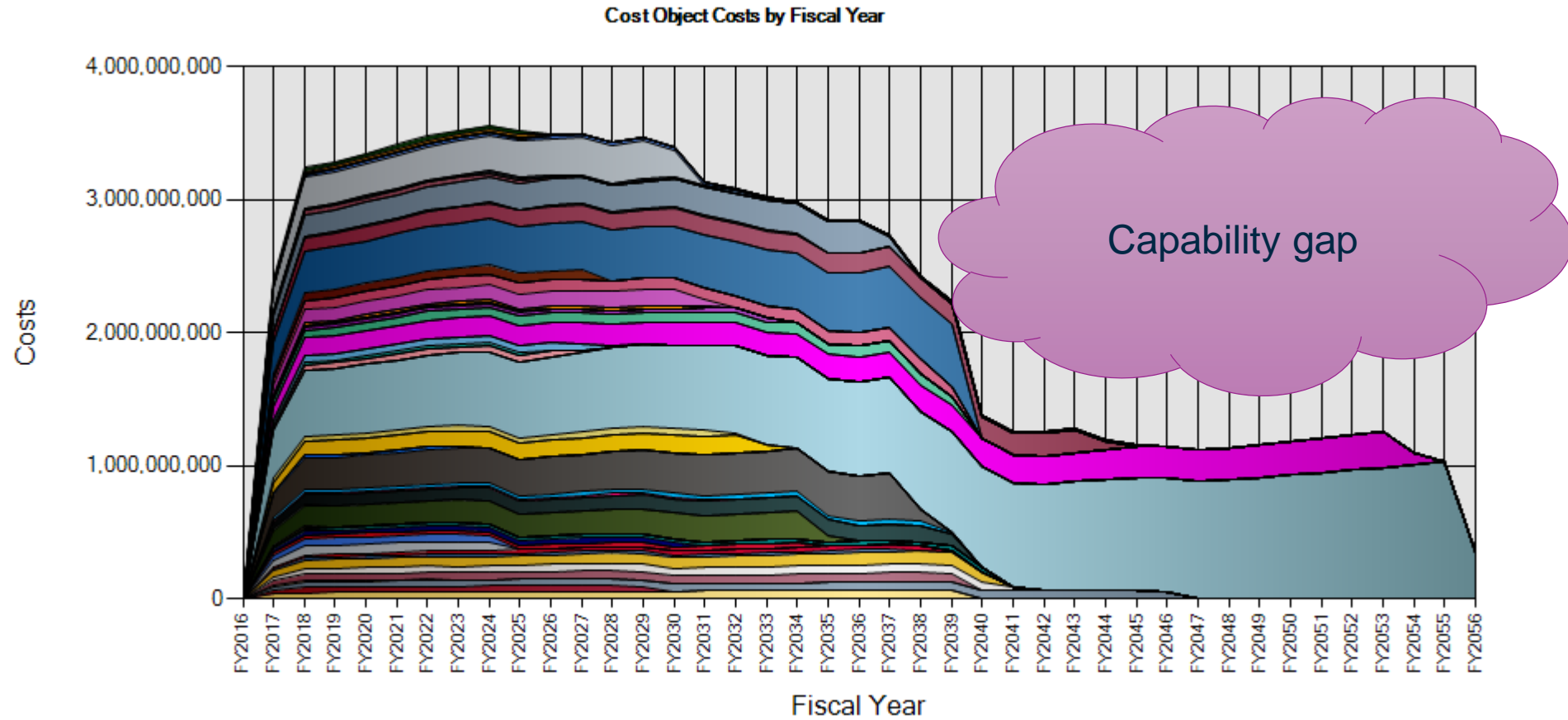
All operating and support – same data; multiple views



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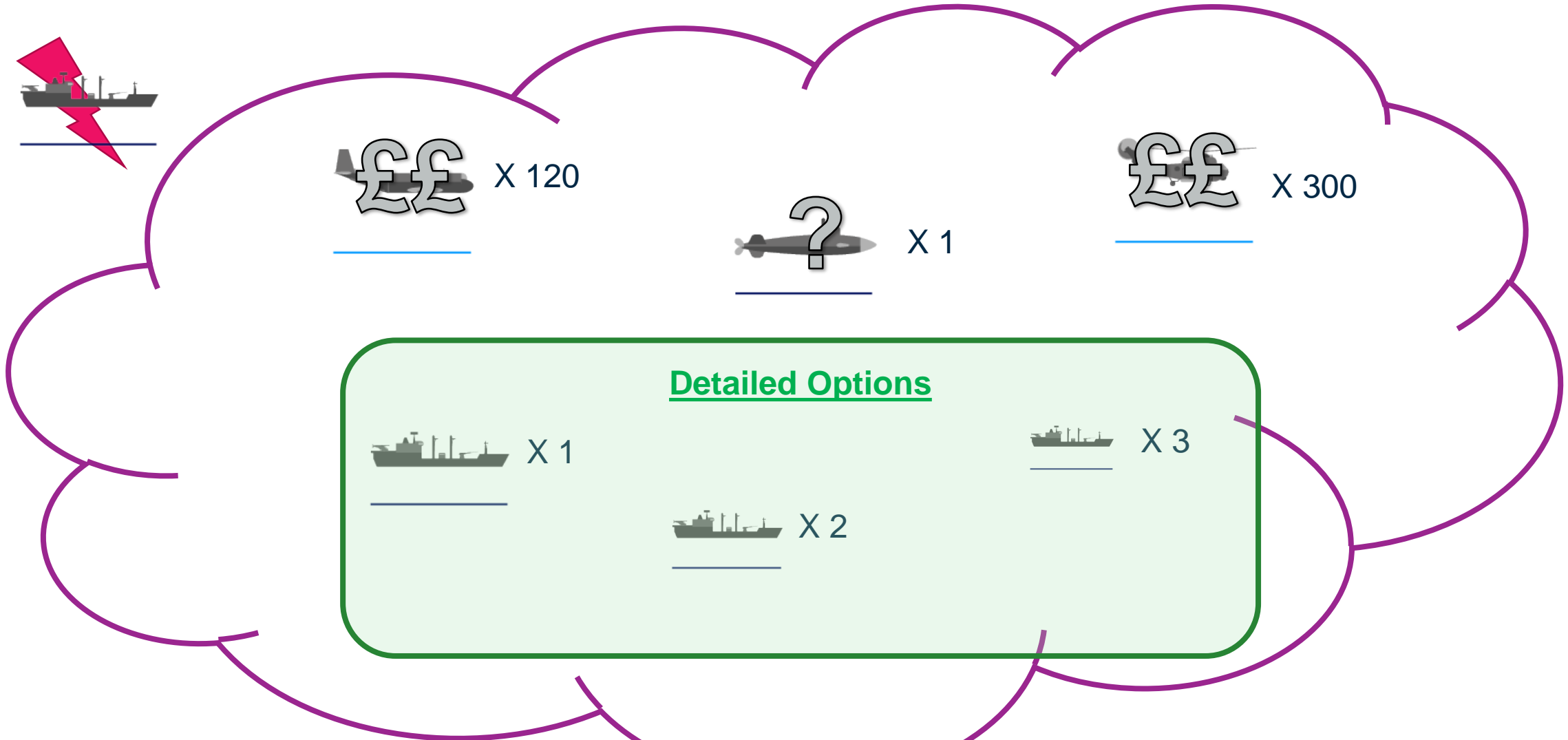
All operating and support



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Business case - option space



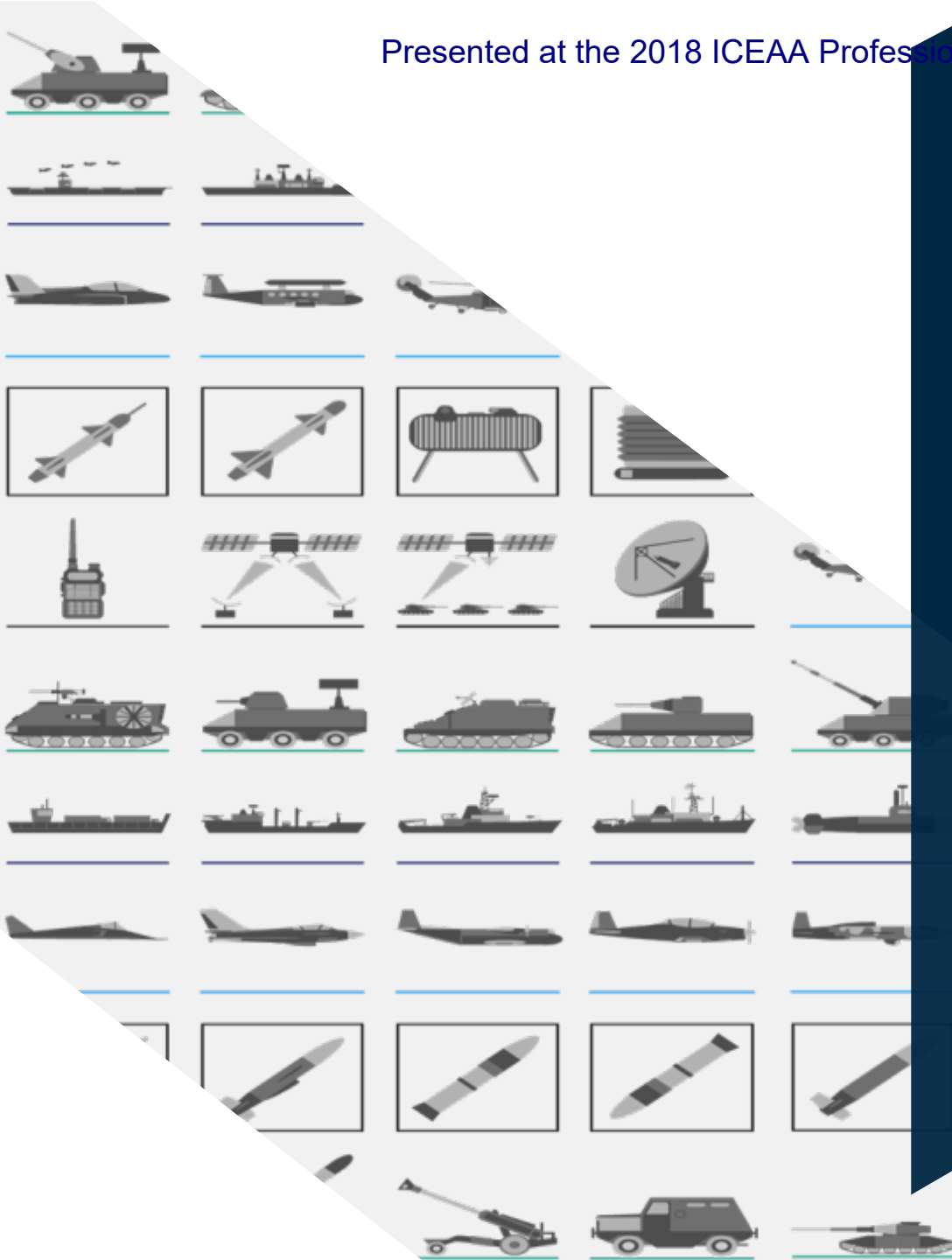
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Other questions

Query	Approach
How can the programme view be used to influence industry strategy?	<ul style="list-style-type: none"> Consider the Production schedules; are they serial or parallel Do they lend themselves to uniform production and labour demand.
Is the portfolio balanced?	<ul style="list-style-type: none"> Quick review of the budget for the land, sea and air
When does the next project need to be initiated?	<ul style="list-style-type: none"> From the capability gap determine the development and production schedule to complete at the out of service date of the obsolete capability
Is an Anglo-American acquisition a good idea?	<ul style="list-style-type: none"> Test the options of a single, two, three nation acquisition and the resulting funding levels
What is tradeable?	<ul style="list-style-type: none"> Consider all the options to replace a capability; not just like for like (a ship for a ship)
Is the programme optimised?	<ul style="list-style-type: none"> Establish if there are any unnecessary peaks or troughs in the budget
Who owns the programme budget?	<ul style="list-style-type: none"> Consider who in the organisation is best placed to control the projects in the programme.
What are the cost drivers?	<ul style="list-style-type: none"> Conduct sensitivity analysis on the input parameters to determine the significant influences
Do the project budgets exceed the government budget?	<ul style="list-style-type: none"> Review the overall portfolio level and compare it to the total voted budget from the government

Summary

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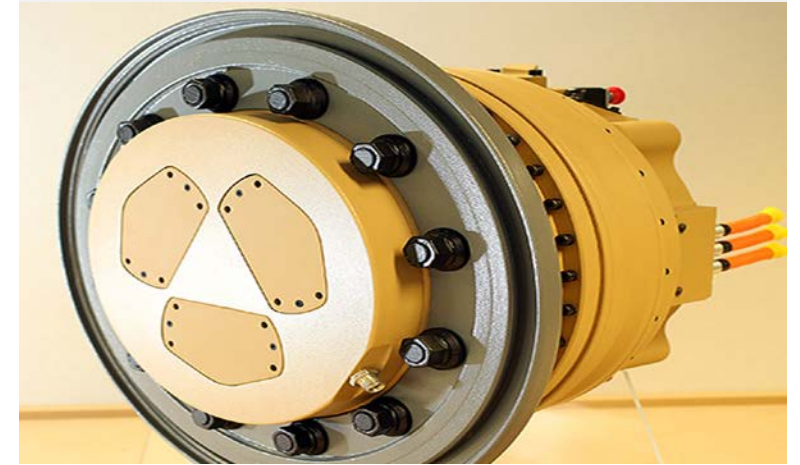


Analysis observations

- ✘ No calibration has been conducted or cross checks to verify the costs
- ✘ No attrition of fleet numbers have been considered
- ✘ No consideration of project specific risks
- ✓ As a first level ROM analysis the exercise can establish the portfolio picture
- ✓ This high level analysis directly links the input parameters to the output cost
- ✓ The analysis will provide ROM costs from first level assumptions
- ✓ Multiple views of the same information
- ✓ All the models are validated and verified
- ✓ Should result in a suitable capability mix relative to the perceived threat and within the budget
- ✓ The analysis assumptions and input parameters are recorded for future scrutiny and debate

Summary

- There is a need for portfolio analysis to enable a complete understanding of the current and future defence picture.
- Macro-parametric cost modelling lends itself to the quick and plentiful generation of operating and support costs.
- There is an ability to capture both the project details and the top-level budget constraints.
- Simple traceability and audit trail for scrutiny.



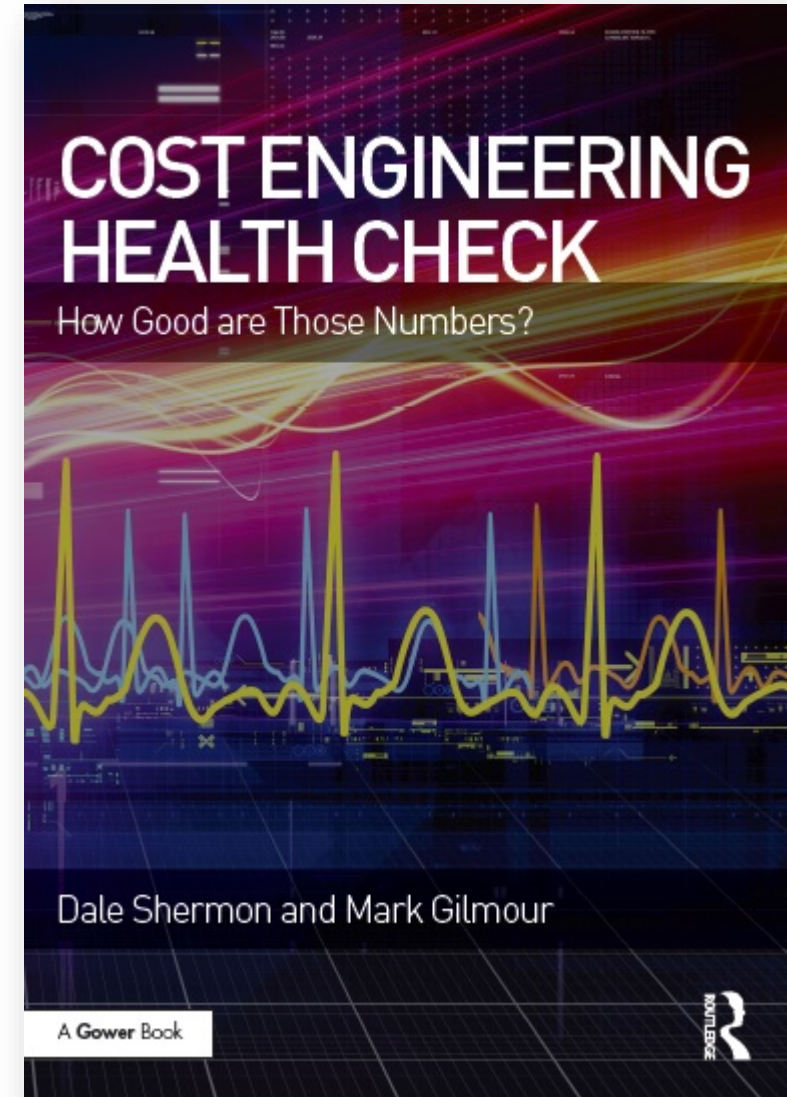
Any questions?

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