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Optimism in Defence Estimating A Class Reference Guide

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15th September 2015



Major Capital Projects

Australian Air Warfare Destroyer



Ship	Original delivery	Revised estimate
Ship 1	December 2014	June 2017
Ship 2	March 2016	September 2018
Ship 3	June 2017	March 2020
Summary cost overrun approx. £590m		

A400M



Expected Cost (£m)	Actual Cost (£m)	Variance (£m)
2,238	2,752	514

Channel Tunnel



Expected Cost (£m)	Actual Cost (£m)	Variance (£m)
2,584	4650	2,066

Construction schedule delay – 1 Year

Sydney Opera House



Expected Cost (£m)	Actual Cost (£m)	Variance (£m)
3.5	102	98.5

Schedule delivery delay – 10 Years

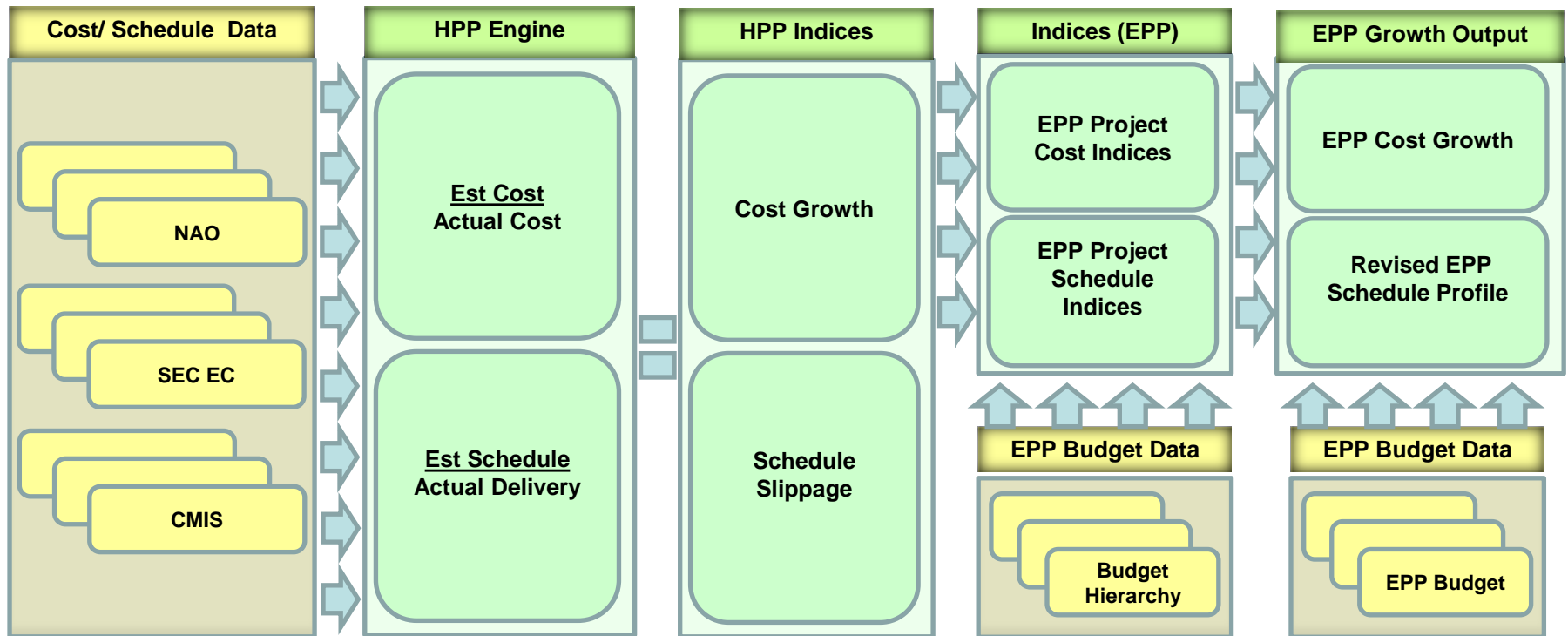
How Good Are We At Estimating?

	Proportion of Projects above the 50% confidence level estimate	Proportion of Projects above the 90% confidence level estimate	Proportion of Projects outside the 10%,50% & 90% confidence level envelope.	Sample Size
Expectation	50%	10%	60%	
Assessment Phase Duration	94%	69%	69%	48 Projects
Assessment Phase Cost	53%	Not Available*	Not Available*	45 Projects
D&M Phase Duration	62%	43%	53%	150 Projects
D&M Phase Cost	48%	35%	42%	83 Projects

- Approving at 50% confidence means we should expect around half of projects going over their approval, and about a 10th of projects breaching their 90%.
- Far more projects than anticipated exceed their forecast of duration and cost, made at the relevant approval points.

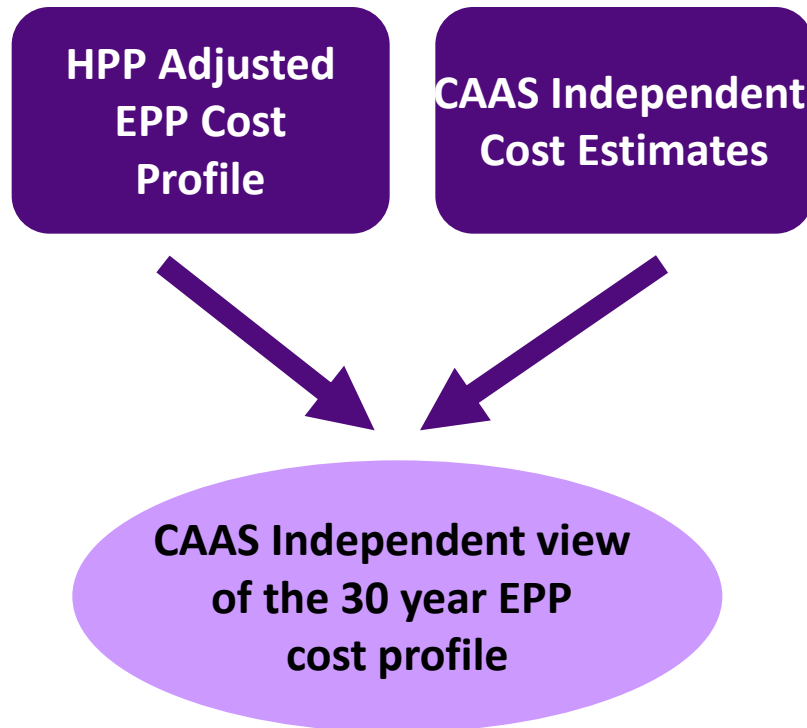
No data is held for the 10% and 90% confidence level estimates at Initial Gate.

Understanding Project Performance – Historic Project Performance (HPP) Model



The models primary intention is to generate and average indices to shape the outputs.
The functional interface can allow for a more detailed analysis if needed.

HPP – How We Use the Tool



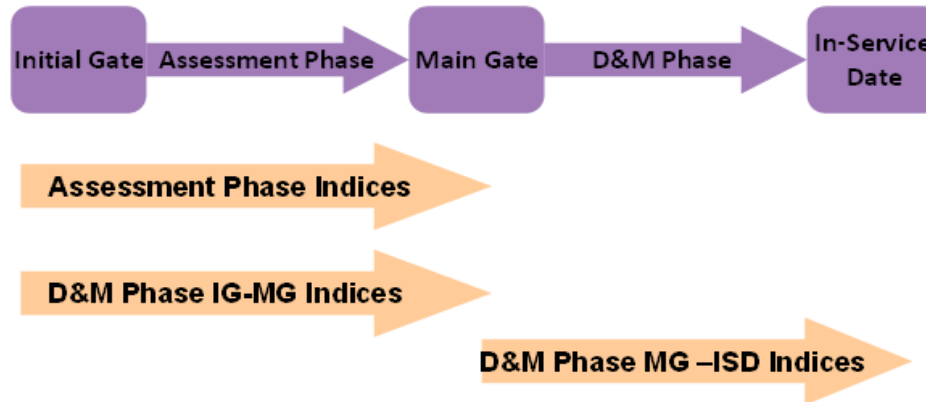
- The model is currently used to provide an understanding of historic equipment project performance and to produce a forecast cost profile for projects where there is no CAAS Independent Cost Estimate (ICE).
- The CAAS ICEs and the HPP model outputs are combined to produce a CAAS Independent view of the Equipment Procurement Programme (EPP) Cost profile over the next 30 years.
- The variance between the CAAS forecasted EPP cost profile and the MoD budget has been used annually to inform the NAO review of the Equipment Programme Affordability.

HPP Source Specifics

- The HPP model was used to develop cost growth and schedule indices for the following project characteristics:

Characteristic	Categories
Category	A, B, C
Operating Centre	Ships, Submarines, Land Equipment, Helicopters, Combat Air, Air Support, ISTAR, ISS
Equipment Type	Rotary Wing, Ships, C4ISR, Ammo/Weapons, Submarines, Fixed Wing, Support, Vehicles
Contract Type	Firm, Fixed, Other
Procurement Route	UK Competition, Non-Competitive, International Competitive, Other
FLC	Navy, Joint Forces Command, Army, Air-force, D Strategy & Programmes

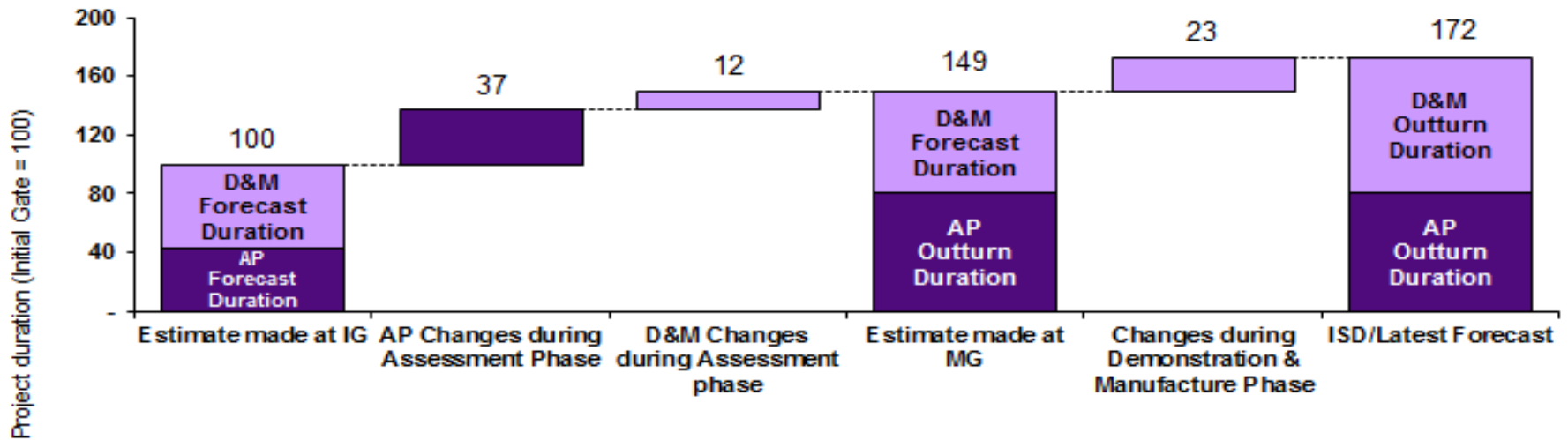
HPP Model Calculations Method



- The HPP model generates three indices for both average schedule and cost growth.
- The Demonstration & Manufacture (D&M) phase is split into two indices. The first index compares estimates at Initial Gate (IG) and Main Gate (MG) and the second compares the estimate at MG to In-Service Date (ISD).
- As per the original “*Review of Acquisition for the Secretary of State for Defence - An Independent Report, 2009*” analysis, the cost growth index between MG and ISD is based on unit cost and takes into account requirement changes.
- Indices are factored dependent on progression of CADMID cycle.

Key Finding 1 - The average MOD project significantly exceeds its time approval

Growth in Project Duration

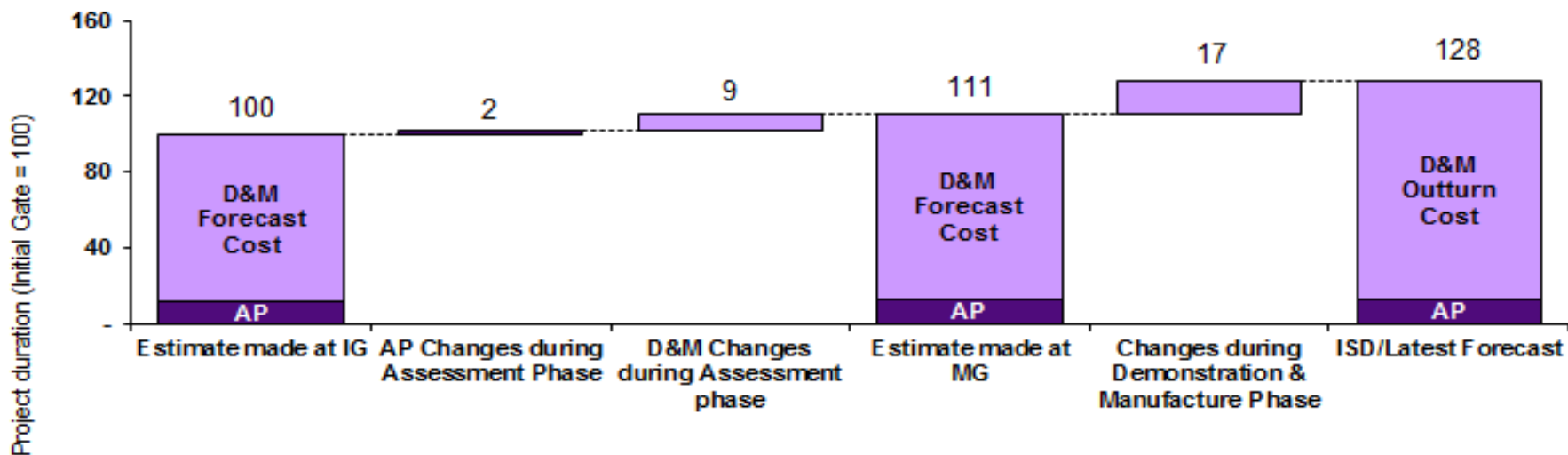


Duration Growth Category	Samples
Assessment Phase	49
Demonstration and Manufacture	55
Main Gate to In-Service Date	151

Growth estimates derived from NAO, Sec EC & CMIS statistics from 1999 – 2015. Samples utilised following model data validation and user manual exclusions.

Key Finding 2 - The average MOD project significantly exceeds its cost approval

Growth in Project Cost



Cost Growth Category	Samples
Assessment Phase	44
Demonstration and Manufacture	57
Main Gate to In-Service Date	83

Growth estimates derived from NAO, Sec EC & CMIS statistics from 1999 – 2015. Samples utilised following model data validation and user manual exclusions.

Comparison to the Defence Acquisition Report (October 2009)

	2009 Defence Acquisition Report	2014 Optimism Bias Phase Analysis	Variance
Schedule Slippage	81%	72%	-9pp
Cost Growth	42%	28%	-14pp

- The method for calculating the schedule slippage and cost growth indices is consistent with the method used for the HPP analysis in the Review of Acquisition for the Secretary of State for Defence (October 2009).
- In addition to the projects used for the Defence Acquisition Report, the Optimism Bias Phase analysis also includes projects that have completed their assessment and D&M phases since 2009 to 2014. The average schedule slippage and cost growth are both lower between IG and MG, and MG to ISD.



Can We Afford the Equipment Procurement Programme?

Budget Cycle	PT Forecast/£Bn	CAAS ROT/ £Bn	Var £Bn	Var %	EPP Contingency £Bn
PR12 Stage 1	79.5	92.0	12.5	15.7%	N/A
ABC13 QRPC1	63.6	67.9	4.3	6.8%	4.7
ABC14 QRPC3	67.9	71.2	3.2	4.7%	4.6

- The reduction in the contingency reflects better estimating and improved project performance.
- This analysis excludes the MoD Support Budget.
- ROT represents the Realistic Outturn outputs produced through CAAS Independent Cost Estimates.

Addressing Optimism Bias in Defence Contract Estimating



Ministry
of Defence

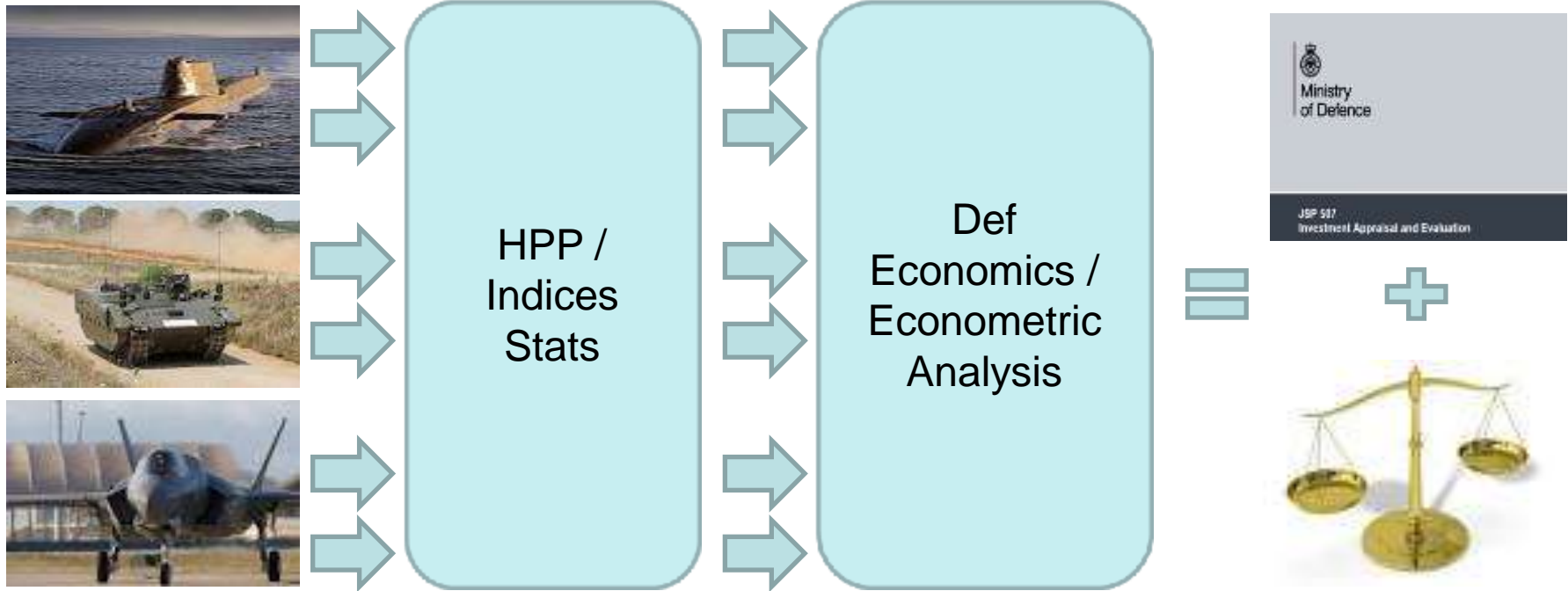
JSP 507
Investment Appraisal and Evaluation



Current Application of Optimism Bias adjustments in MOD

- For small projects (Category D) or where the project is at an early stage of development, OB should be applied as an explicit adjustment to a single point estimate.
- For medium and large (Category A, B or C) projects OB calculations should be used to provide an independent sanity check of the project's 10%, 50% and 90% confidence level cost and schedule estimates.

Improving the Optimism Bias Tool and Guidance



Worked Example on how the new OB data & tool is likely to be used

- Optimism Bias adjustments will be based on project characteristics across the Operating Centres, including whether a project is collaborative, internationally competed, non-competitive or UK competition, and whether they are Firm, Fixed or TCIF contracts. All of these different facets will affect the Optimism Bias index
- So for example a non-competitive firm price project in Helicopters Operating Centre will have a 22% OB index whereas a non-competitive firm price project in the Combat Air Operating Centre will have an OB index of 11%. A reference table with all the possible permutations of the index will be produced, so that the most relevant one can be applied.

Optimism Bias Key Findings

- Project performance varied based on procurement route, equipment type, contract type, customer & operating centre.
- Project size (measured by value, or length) is not a significant determinant of overrun.
- A positive association was observed between schedule slippage and cost growth for all indices.
- No significant correlation was observed between the estimated quantity of equipment to be procured and the cost of the D&M phase.

Next Steps

1. Update Guidance (Such as JSP 507)



2. Expand HPP Scope of analysis
(In-Service Support)



3. Encourage wider collaboration



Conclusions

- CAAS work to update the original Historic Project Performance model and expand the supporting dataset has provided the basis for the collaboration with Defence Economics, to revise the Optimism Bias approach.
- With a much improved Optimism Bias process, based on a relevant project dataset, the Department should be able to improve its estimating to reduce the number of projects that breach the 50% confidence limit at approvals.

Questions

Questions?

Cost Assurance and Analysis Service

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