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Optimism Bias

Time for a new approach?



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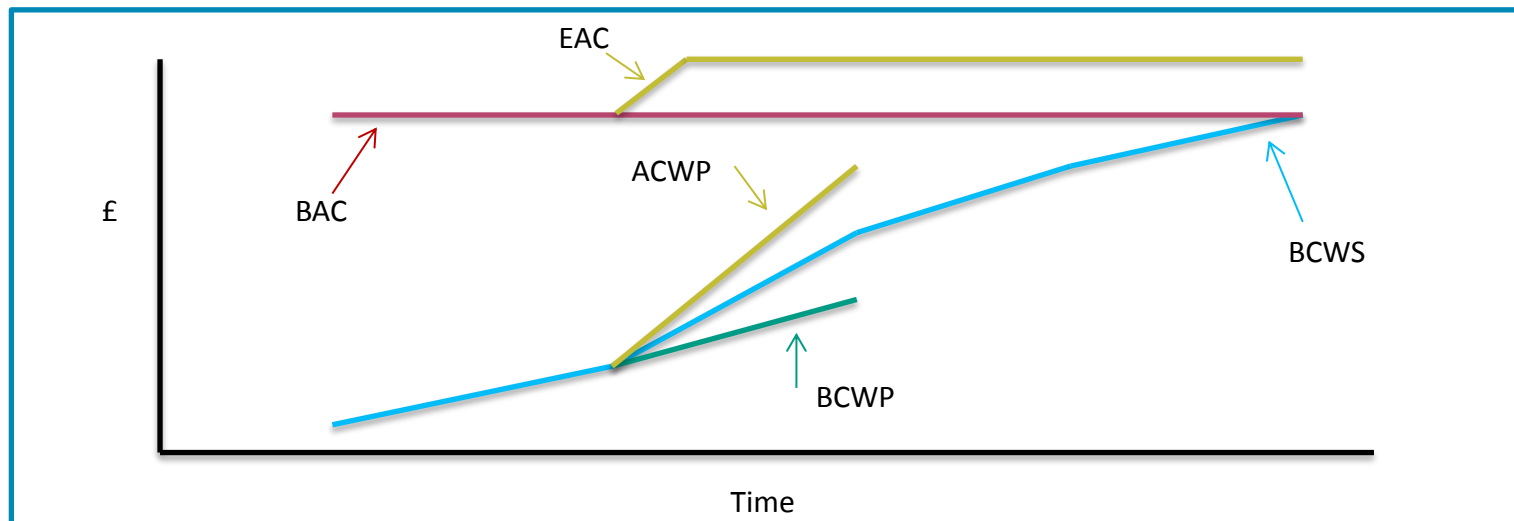
EVM and Project Controls



EVM and Project Controls

- Earned Value Management (EVM) is a project management technique for measuring project performance and progress.
- The essential features of EVM are:
 - A valuation of planned work or **project baseline** (the budgeted cost of work scheduled BCWS)
 - Pre-defined performance metrics to quantify the accomplishment of work (the budgeted cost of work performed BCWP)
 - Tracking of actual costs incurred throughout the project life (Actual cost of work performed ACWP)

HOW CAN WE TRACK A PROJECT'S PERFORMANCE WITHOUT UNDERSTANDING OUR BASELINE?



Optimism Bias



Optimism Bias – What is it?

“There is a demonstrated, systematic tendency for project appraisers to be overly optimistic. This is a worldwide phenomenon that affects both the private and public sectors.” (Flyvbjerg, 2002)

- Weinstein (1980) defined Optimism Bias (OB) as “peoples’ tendency to predict better outcomes than actually happen.” The same can be said for project managers and estimators, who tend to believe that they can deliver a project to much more difficult timescales and budgets than the reality would allow.
- HM Treasury’s Green Book mandates that project appraisers should make explicit adjustments on schedule and cost, for both capital and operating projects, to redress this tendency.

The logo for QinetiQ, featuring the company name in a blue, sans-serif font.

HM TREASURY

THE GREEN BOOK



Bottom Up Approach

- **Baseline**
 - The planned activities required to achieve the project with known impact
 - 100% probability x certain expenditure/schedule
- **Uncertainty**
 - Implies that expenditure or cost driver cannot be assigned precisely
 - Maximum, Most Likely and Minimum assessment of expenditure/schedule
- **Risk**
 - Implies there is a probability assigned with an event occurring
 - E.g. 50% probability x Max, Most Likely and Min assessment of expenditure/schedule
- **The distinction is frequently ignored**



Optimism Bias – How is it used?

- Mott MacDonald produced a study, “Review of Large Public Procurement in the UK”, into the size and causes of cost and time overruns in past project in 2002.
- The outcome was a set of recommended adjustment ranges for specific project types.
- The upper bounds are a starting point for producing an adjustment to a cost/schedule estimate.

Project Type	Optimism Bias (%)			
	Works Duration		Capital Expenditure	
	Upper	Lower	Upper	Lower
Standard Buildings	4	1	24	2
Non-standard Buildings	39	2	51	4
Standard Civil Engineering	20	1	44	3
Non-standard Civil Engineering	25	3	66	6
Equipment/Development	54	10	200	10
Outsourcing	N/A	N/A	41	0

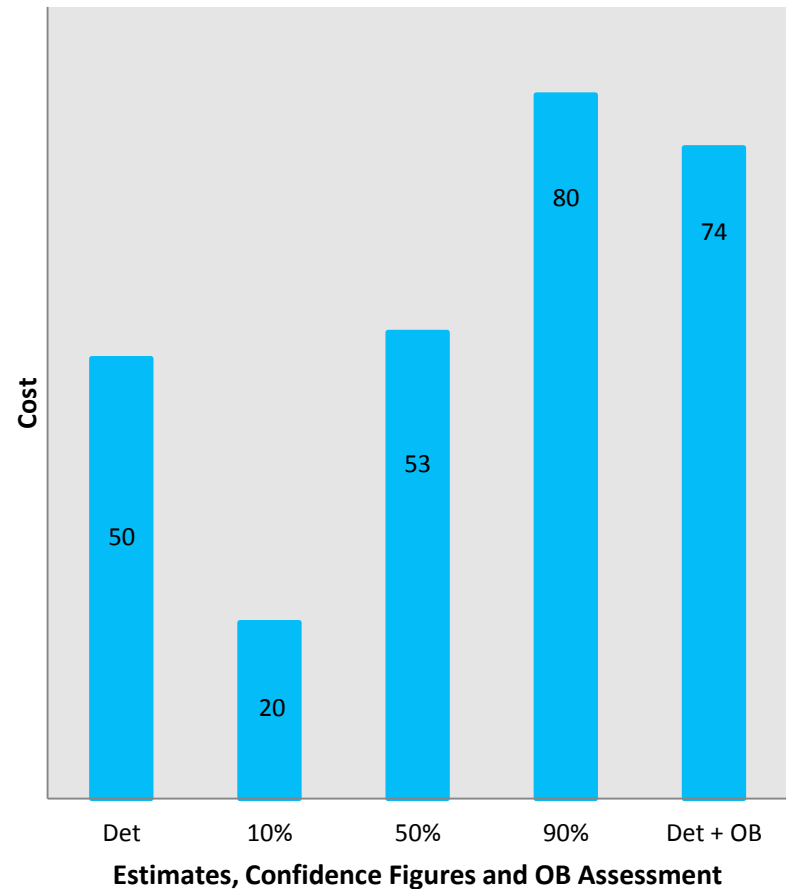
Upper Bound Optimism Bias (%)		Equipment / Development	
		54	200
		Works Duration	Capital Expenditure
Contributory Factors to Upper Bound Optimism Bias (%)		Equipment / Development	
Procurement	Complexity of contract structure	13	7
	Late Contractor involvement in design		7
	Poor contractor capabilities	11	4
	Information management		5
Project specific	Design complexity		10
	Degree of innovation	20	17
	Environmental Impact	9	
Client Specific	Inadequacy of Business Case	20	18
	Project Management team		5
	Poor project intelligence	4	4
External influences	Legislation / Regulations	4	5
	Technology	19	18

- Depending upon the project type, the upper bound can be reduced by mitigating the contributory factors to account for the effect of risk management and project management processes

Optimism Bias – Local Application

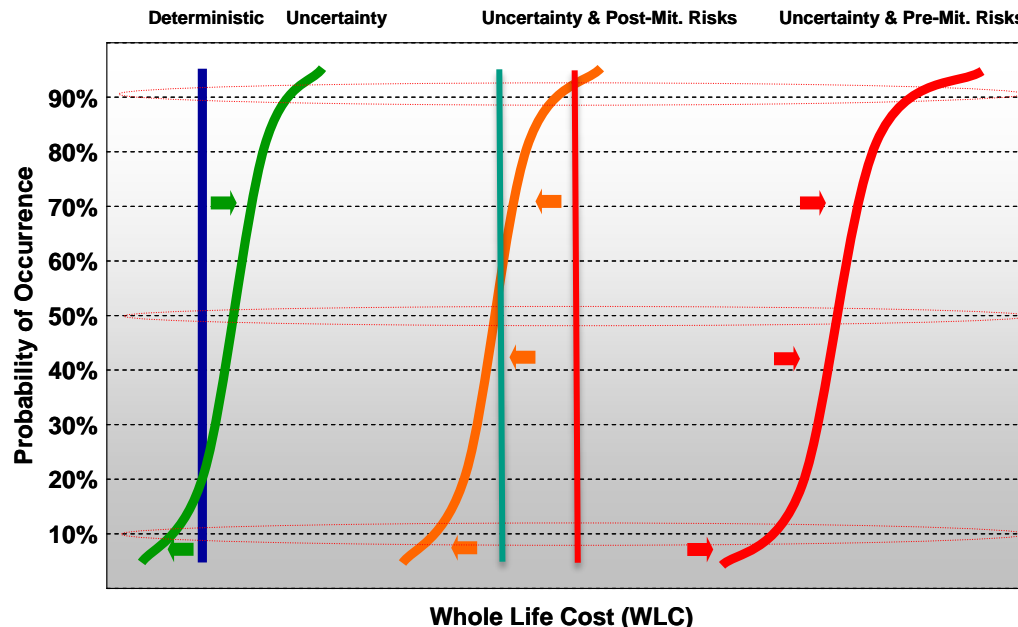
- **TOP DOWN ASSESSMENT**
- The Mott MacDonald study identified various contributing factors to Optimism Bias.
- As seen previously, each has a different contribution and the extent to which each factor is assessed to be mitigated is the amount which the OB factor is reduced:
- **For example – Deterministic estimate of £50M**
- Equipment procurement Upper Bound = 200%
- Project believe that most factors are mitigated except the complexity of contract (7%), lack of contractor involvement in design (7%) and the complexity of the design (14%).
- As percent of upper bound = 24%
- Optimism Bias factor = $24\% \times 200\% = 48\%$
- **Det + OB = $50m + (50 \times 48\%) = 74M$**

Cost Optimism Bias Assessment £M



Optimism Bias – applicability in Defence projects

- Joint Service Publication (JSP) 507 requires that Optimism Bias be used as “an independent top down sanity check of risk which is then compared to the existing calculation of confidence figures using a bottom up approach.”
- On medium to large projects – The OB adjusted cost figure should equate to the expected value cost estimate. If the OB adjusted figure is closer to, or exceeds the 90% confidence value, it implies insufficient consideration to an aspect of risk.





Optimism Bias – Applicability in Defence projects

- **Note that the comparison of the OB adjusted figure against the 90% confidence value is NOT a pass/fail situation**
- **The OB calculation is a far cruder assessment and the 90% confidence value may have been well assessed**
- **Defence Economics within the MOD “reserve the right to increase the level of OB where the evidence for mitigating the contributory factors to OB is not compelling enough.”**
- **For smaller projects (Category D or smaller value Category C projects) – OB can be used as the explicit risk adjustment to the deterministic baseline cost in the absence of detailed risks and three point estimates of uncertainty.**

Optimism Bias – Limitations of its applicability

- **The Mott MacDonald study is limited on the number of Defence procurement projects included within the sample**
 - 2 procurement projects
 - Telecommunications network
 - Faslane Shiplift
 - Not typical defence procurement equipment, typically one off longer term assets
- **Application locally within Defence uses subjective criteria for assessment of mitigation factors**
- **The impact of contribution factors on the OB Upper Bound % is hard to justify on such a limited sample**
- *As discussed in the Green Book, it is recommended that these adjustments be based on data from past projects or similar projects elsewhere, and adjusted for the unique characteristics of the project in hand. In the absence of a more specific evidence base, departments are encouraged to collect data to inform future estimates of optimism, and in the meantime use the best available data. **Supplementary Green Book Guidance***
- **Positive steps seen in CAAS Historic Project Performance tool for Procurement. Development of an equivalent for Support?**

Alternative Approaches





Alternative Approaches – NAO Major Projects Reports

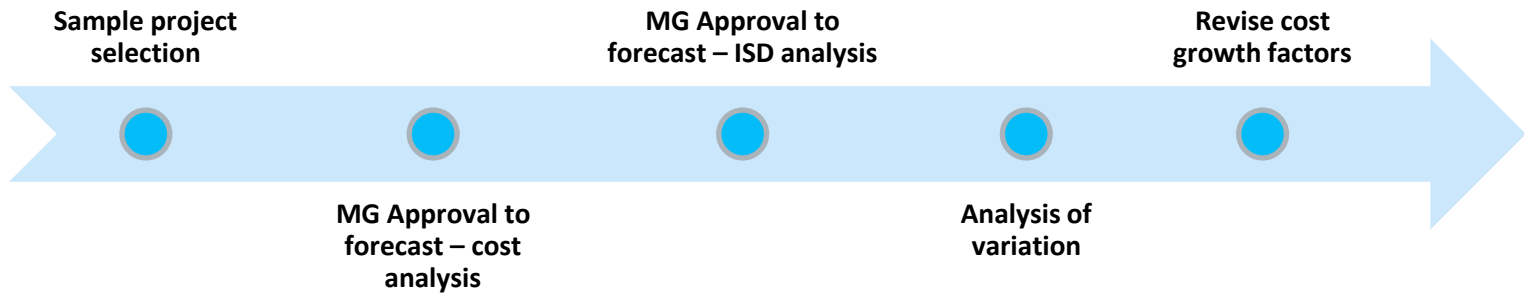
- Revise Mott MacDonald project risk areas using data on project cost growth from NAO MPR.
- Revise causes of cost growth (contributory factors), and develop new dataset specific to Defence.
- DSTL (2011) making progress
- Inherent pitfalls within this dataset.

Cost of the Demonstration and Manufacture Phase

Project/Increment Title	Budgeted For Cost (£m)	Forecast Cost (£m)	Variation (+/- £m)	In-Year Variation (+/- £m)
A400M	2498	3268	+770	+163
Total (£m)	2498	3268	+770	+163

A400M

Date	Variation (£m)	Category	Reason for Variation
March 2012	-8	Procurement Processes	A reduction due to repricing.
March 2012	-10	Technical Factors	Reduced Defensive Aids hardware device procurement following the drawdown of other aircraft platforms in the 2010 Strategic Defence and Security Review.
March 2012	-5	Technical Factors	Changes to Integration contingency
March 2012	+1	Technical Factors	Increased cost of OCCAR management Agency
March 2012	+7	Technical Factors	Revised costing for assumed set up costs for the A400M training facility including increased VAT £5M





Alternative Approaches – “Sources of Weapon System Cost Growth”

- Although MM study compares itself with other studies undertaken within the UK, there is no international comparison.
- Bolten et al (2008)¹ undertook a similar cost assessment in the US sponsored by the US Air Force, the project sample focusing solely upon 36 major defense acquisition programs.
- Output similar to Mott MacDonald but with different growth categories and % contribution.
- OB tool could be developed based on this to sense check against Mott MacDonald, and a similar approach undertaken to refresh the dataset underpinning the UK tool.
- ¹ Bolten, Joseph G., Robert S. Leonard, Mark V. Arena, Obaid Younossi and Jerry M. Sollinger. Sources of Weapon System Cost Growth: Analysis of 35 Major Defense Acquisition Programs. Santa Monica, CA: RAND Corporation, 2008. <http://www.rand.org/pubs/monographs/MG670>.

Cost Growth, by RAND Category (mean for 35 mature programs)

Category	Development Cost Growth (%)	Procurement Cost Growth (%)	Total Cost Growth (%)
Errors	19.6	14.7	14.6
Cost estimate	18.0	8.4	10.1
Schedule estimate	1.0	0.9	0.9
Technical issues	0.6	5.4	3.5
Decisions	30.7	57.4	41.6
Requirements	17.5	9.5	12.9
Affordability	-1.9	-0.5	-1.3
Quantity	4.3	40.8	21.9
Schedule	6.0	10.0	8.9
Inter- or intraprogram transfers	4.8	-2.4	-0.7
Financial	1.0	1.8	1.4
Exchange rate	0.1	0.1	0.1
Inflation	0.9	1.7	1.3
Miscellaneous	5.2	1.4	2.4
Error correction	-0.5	-0.3	-0.4
Unidentified	-0.3	-0.3	-0.4
External events	6.0	2.1	3.1
Total	56.5	75.4	60.0

Pessimism Bias

Pessimism Bias

- Contrary to Optimism Bias is the theory of Pessimism Bias.
- Not masses of literature.
- Concept that it is *an effect which people exaggerate the likelihood that negative things will happen to them.*

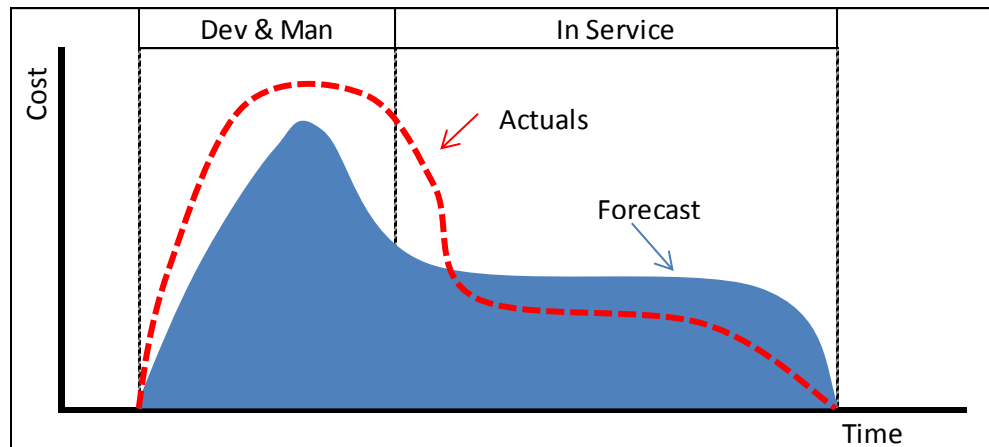
HOW DOES THIS RELATE TO DEFENCE EQUIPMENT?



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Pessimism Bias in the context of Defence contracts

- **Development** of defence equipment is widely accepted to be inherently optimistic, with more than 50% of contracts overrunning on cost and/or schedule
- What about **operating and support costs**?
- Do we as cost estimators err too much on the side of caution?
- Is it a given that support costs are subject to so much uncertainty that projects are disproportionately funded?





Pessimism Bias – Contributory Factors

- **Lack of application of lessons learnt?**
- **Emphasis on procurement costs?**
- **Are operating and support costs too far in the future at the concept phase to assess robustly?**
- **Should we actually be thinking that a newer platform will be inherently less expensive given technological advances?**
- **Should we be rebalancing affordability forecasts to ensure a smoother cost profile and to reduce under/overspend?**



Conclusions

- **EVM requires a robust baseline cost and schedule**
- **There exists high levels of optimism in project estimates arising from underestimating project costs and duration or overstating benefits.**
- **MOD are aware and attempt to reconcile this by using Mott MacDonald study output.**
- **Key issues relate to its applicability in Defence**
- **Whilst useful as a tool, the dataset and recommended ranges require refreshing to meet demands of defence procurement projects.**
- **Should we consider the inverse for support costs (?) and if so, contribute to redressing the budgetary imbalance**

Any Questions?



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