

Improving Realism: Combining Cost and Schedule Risk Analysis

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- Why is it important that cost estimates consider schedule?
- Why are current approaches (in MOD) inadequate?
- Potential options?
- Approaches used in CAAS
- Parting Thoughts

I will unashamedly be taking a MOD-centric viewpoint and recognise that the challenges and solutions applicable to other organisations may differ.



Why is it important to consider Delay?

Delay has a direct impact on military capability, and a significant impact on cost.

Delay

Direct Cost Growth

3.6 – 8.4% of Main Gate cost/year

Additional Costs

- Hidden Industry Costs;
- Urgent Operational Requirements (UORs);
- Run-on costs;
- Manning costs.

Slippage of cost Profile

MOD budgets are annualised; under-spends are lost.

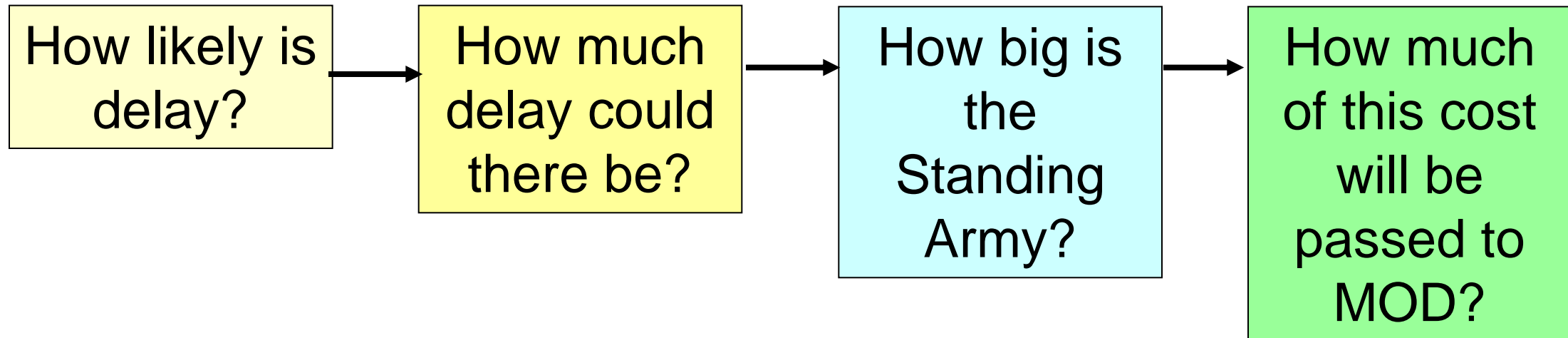
£0.92 – 2.15Bn p.a.

DE&S has a poor track record:

- Average MoD Project overrun of 81% (IG-ISD)
- 48% of (non-UOR) projects overrun their 90% ISD.



How much does schedule matter in costing any particular project?



- Workforce size/composition?
- Ability to flex to other projects?

Defence sector consolidation increasingly commits MOD to inflexible Standing Armies.

- Contract terms?
- Contractor's ability to absorb costs?
- MOD's vulnerability to re-negotiation?



What do we currently do?

Most current models are time-static - they allow for increases/decreases in cost within each year, but do not allow for movement of costs across years, or extension of the cost profile.

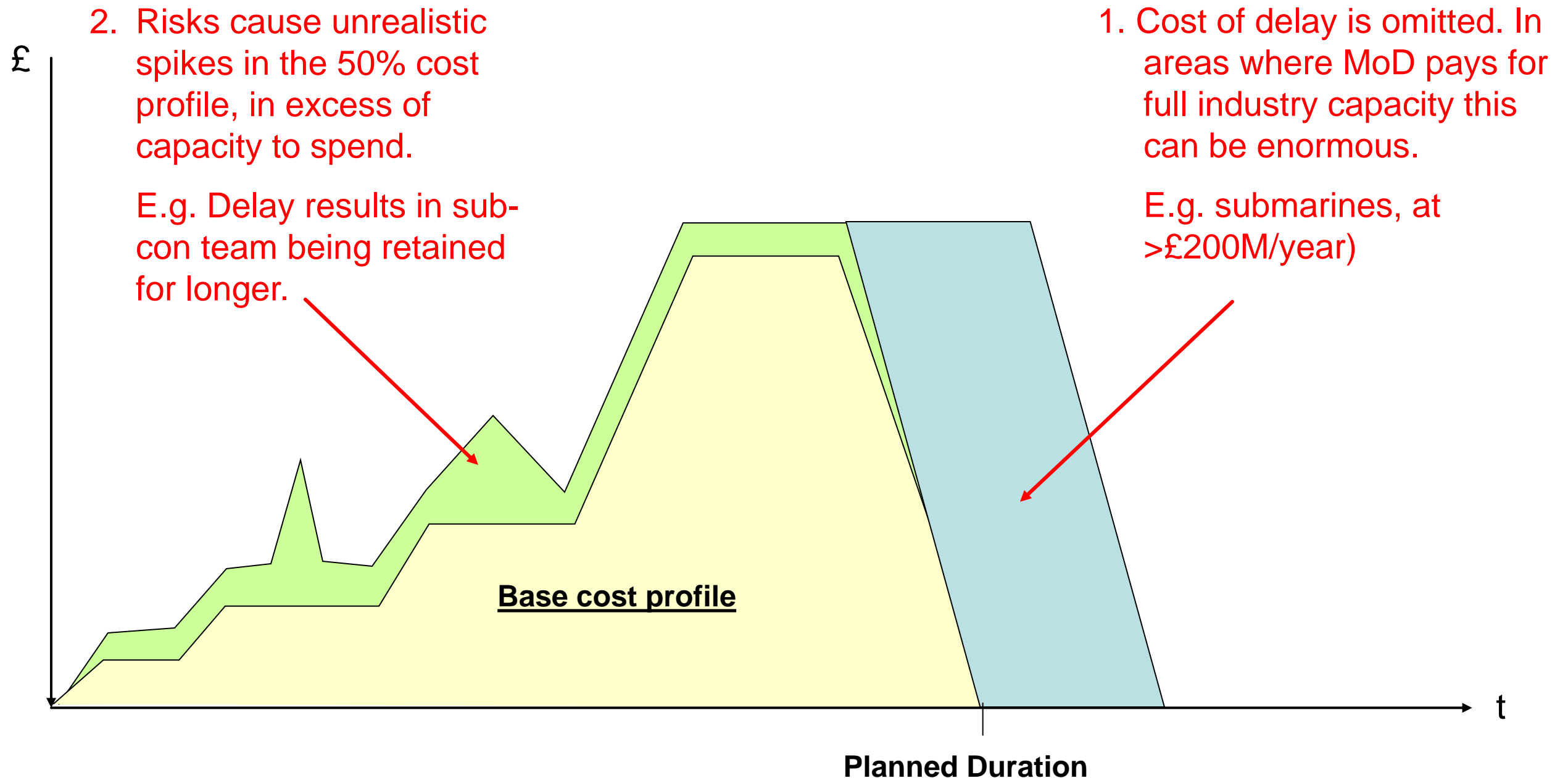
These models must assume a schedule outcome and tend to cost either:

- a. The Deterministic Schedule;
- b. The 50% schedule (as determined by a separate Schedule Risk Analysis).

Both approaches have significant flaws.



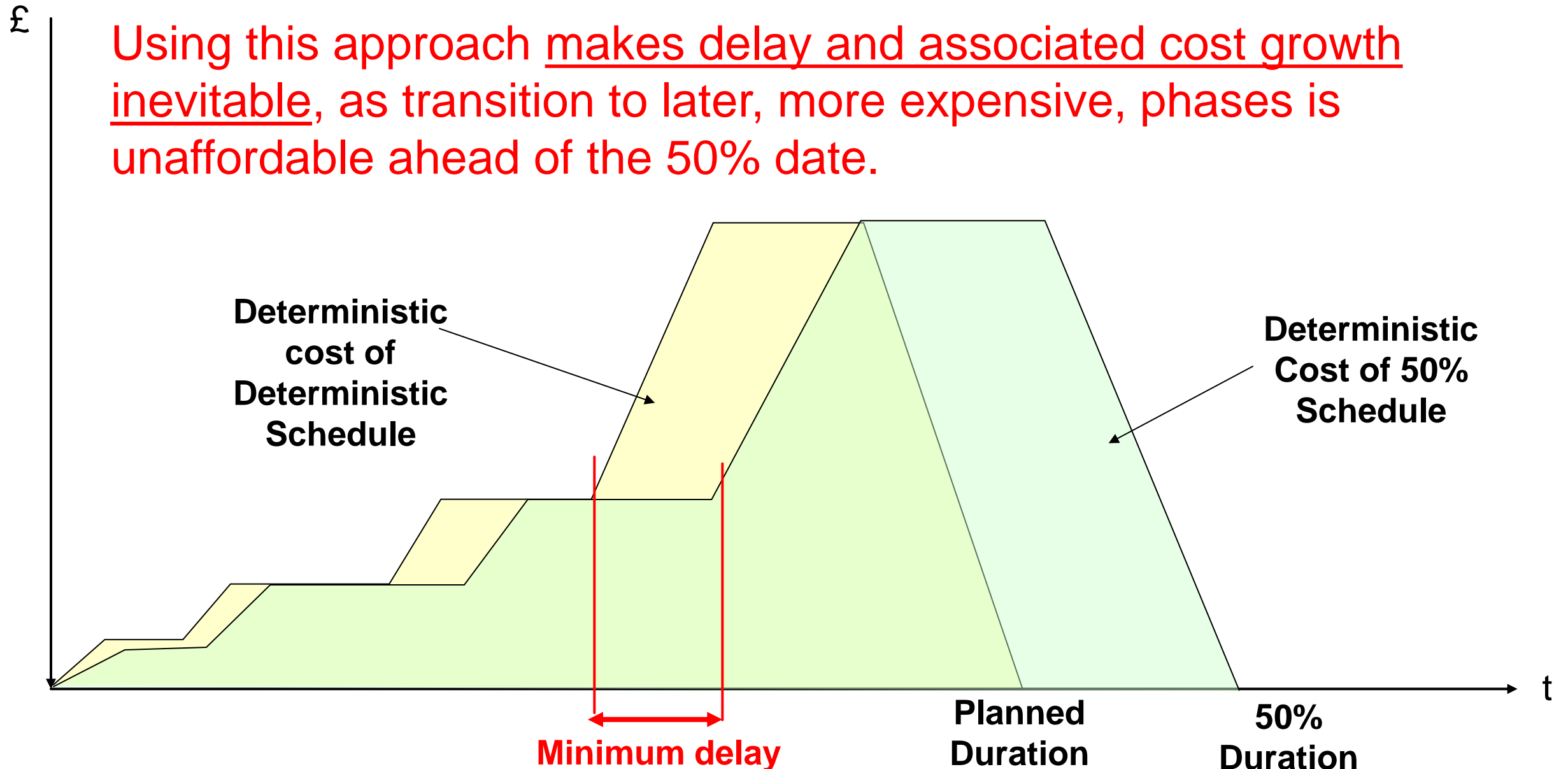
Problems with costing the Deterministic Schedule



Problems with costing the 50% schedule

The CAAS 50% Forecast Spend Profile is treated as a Recommended Budget.

Using this approach makes delay and associated cost growth inevitable, as transition to later, more expensive, phases is unaffordable ahead of the 50% date.



We also get an unrealistically narrow 10%-90% range.



Possible Options?

1. Schedule-Based Integrated Analysis

Uses schedule-based tools/models with fixed/variable costs added to activities. May or may not accommodate capacity constraints.

3. Spreadsheet-based Integrated Analysis

Conducts SRA within a spreadsheet environment.

2. Sequential Analysis

- a. Run SRA, then run CRA with one or more cost risks or uncertainties added to represent delay.
- b. Cost multiple schedule scenarios (Multi-Scenario Method)



Which of these are most viable?

1. Schedule-Based Integrated Analysis

Viable, but not pursued for CAAS because:

- They cannot (currently) produce the range of detailed cost outputs required by MoD.
- They require specialist software not currently available to CAAS (or on DII).
- They would require extensive re-training of CEF staff rather than building on existing skills.

3. Spreadsheet-based Integrated Analysis

Conducts SRA within a spreadsheet environment.



2. Sequential Analysis

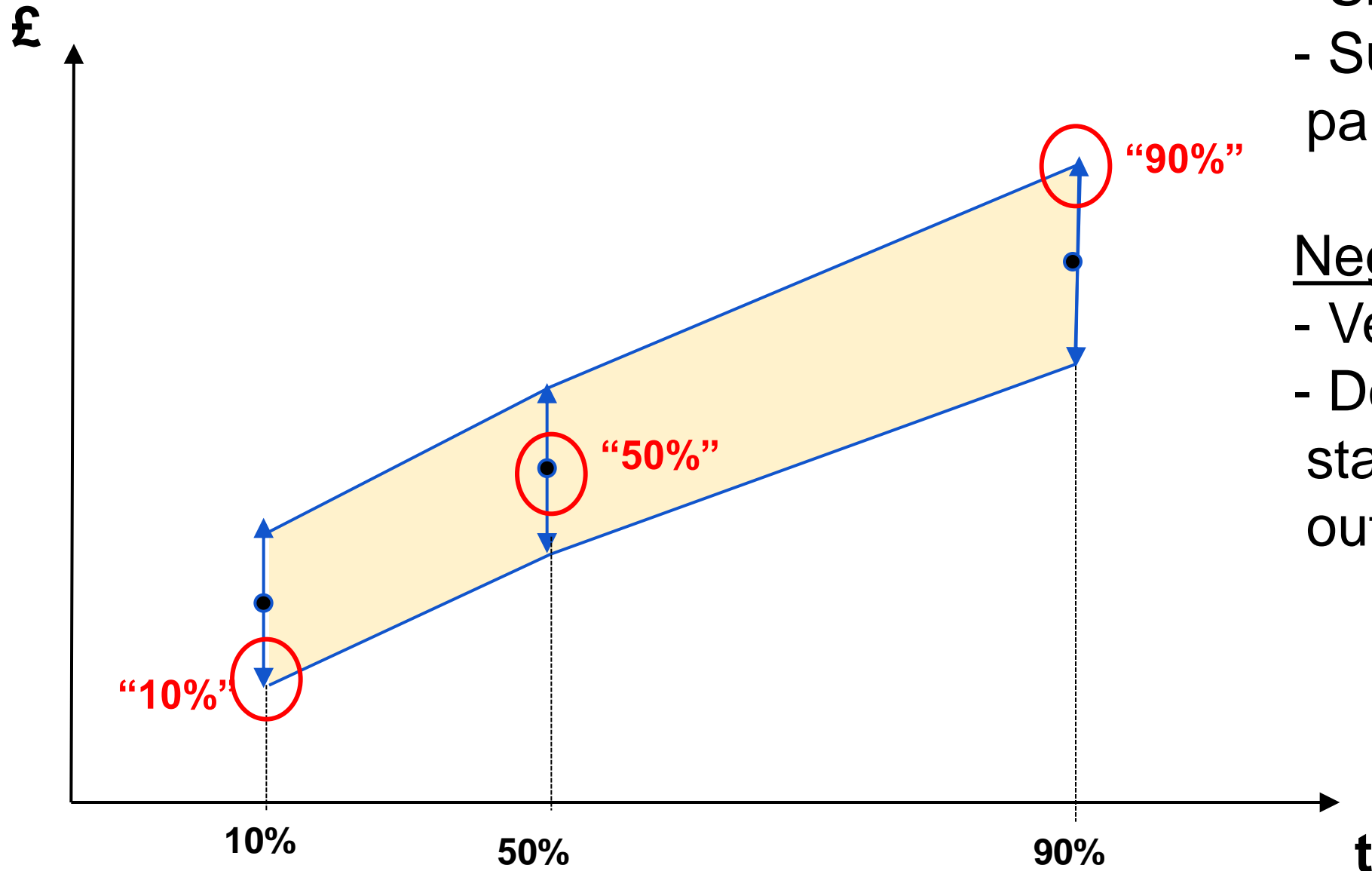
a. Suffers problems where SAC is not constant, or where there is a need to align schedule/cost impacts.

b. Cost multiple schedule scenarios (Multi-Scenario Method) ✓

Bolt-On Schedule (BOS) Model potentially offers easy integration with existing cost models.



The Multi-Scenario Method



Positive:

- Simple and reliable
- Suitable for use with parametric tools.

Negative:

- Very labour intensive.
- Does not produce statistically valid outputs.



Spreadsheet-based Integrated Analysis – Key Challenges

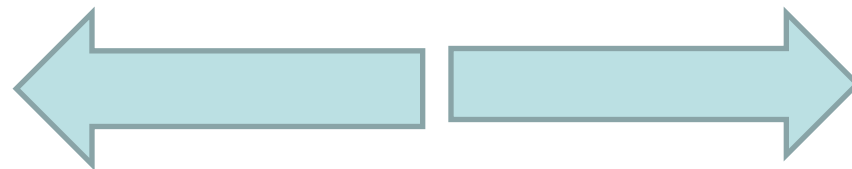
1. Representing a schedule in a spreadsheet

- Importing from MSP?
- Representing logic?
- Attaching risks?

2. Mapping cost lines and schedule activities

Cost Breakdown Structure

- Often not product-based and therefore difficult to relate to activities.



Schedule Breakdown Structure

- Often very detailed.



Our solution - Periods

Periods provide a common structure for relating costs (typically defined by a Cost Breakdown Structure – CBS) and schedule activities (typically defined by a Work Breakdown Structure).

In schedule terms, a Period is effectively a summary task representing the net duration of a series of subsidiary tasks. All Periods are sequential, with no overlaps.

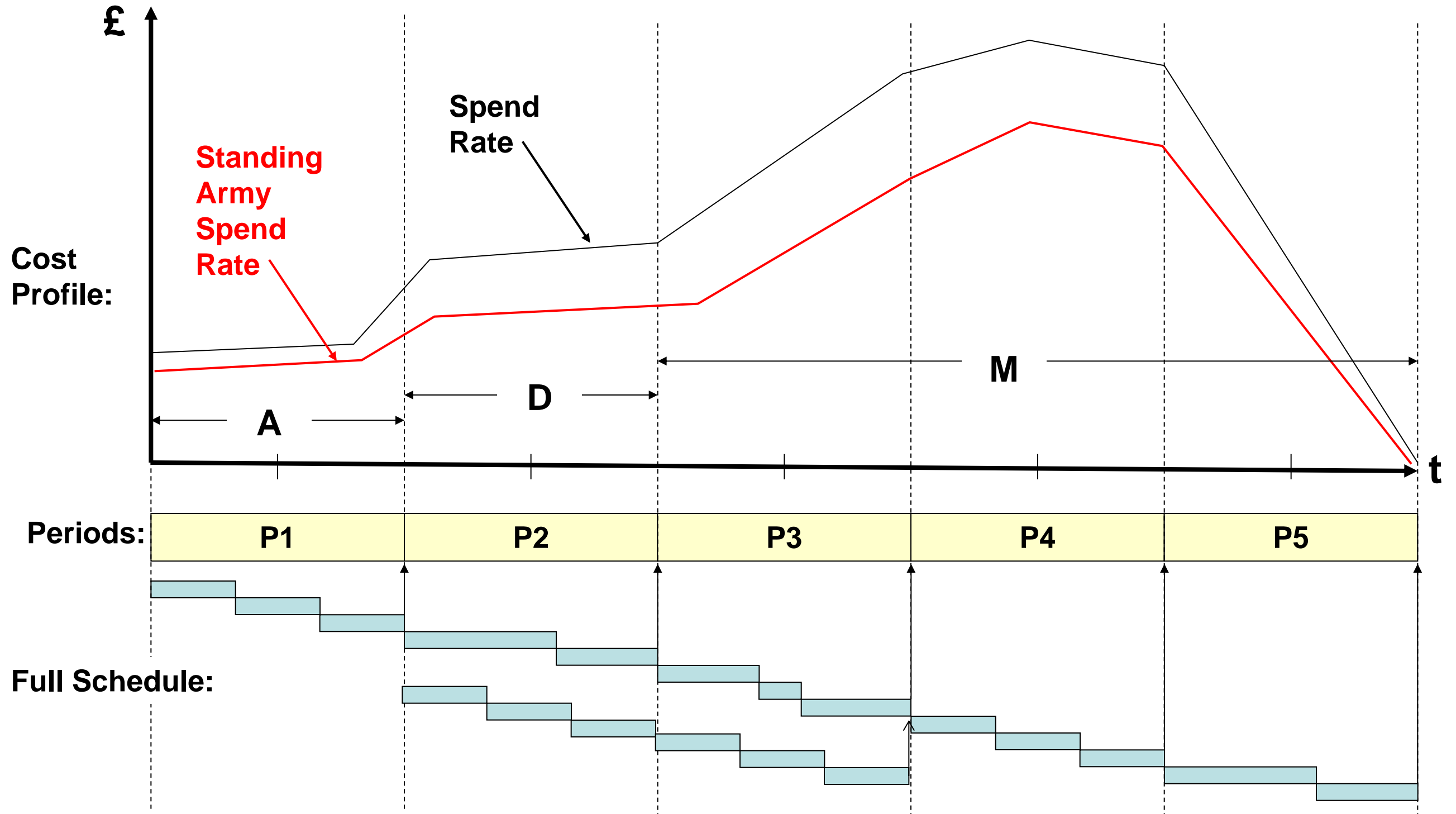
In cost terms, a Period defines a time interval. All costs within that period, regardless of their CBS line, are attributed to the cost of the Period.

Periods should be defined/selected such that it is reasonable to calculate an average standing army spend rate for the period i.e. so that there are no large changes in standing army spend rate within the period.

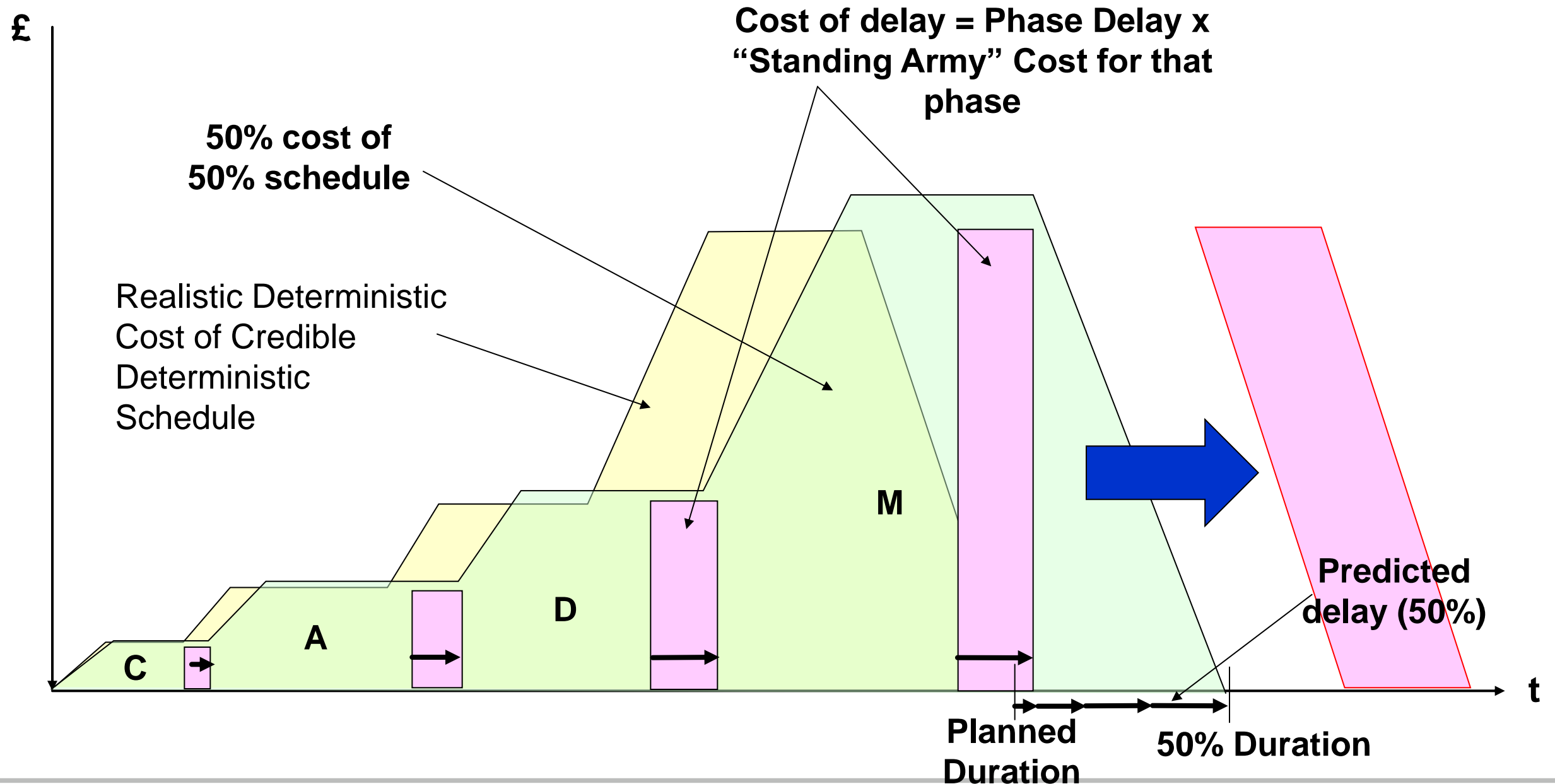
E.g. for most projects, Periods= CADMID Phases (except for Manufacture, which may need to be sub-divided to allow for ramp-down).



Understanding Periods

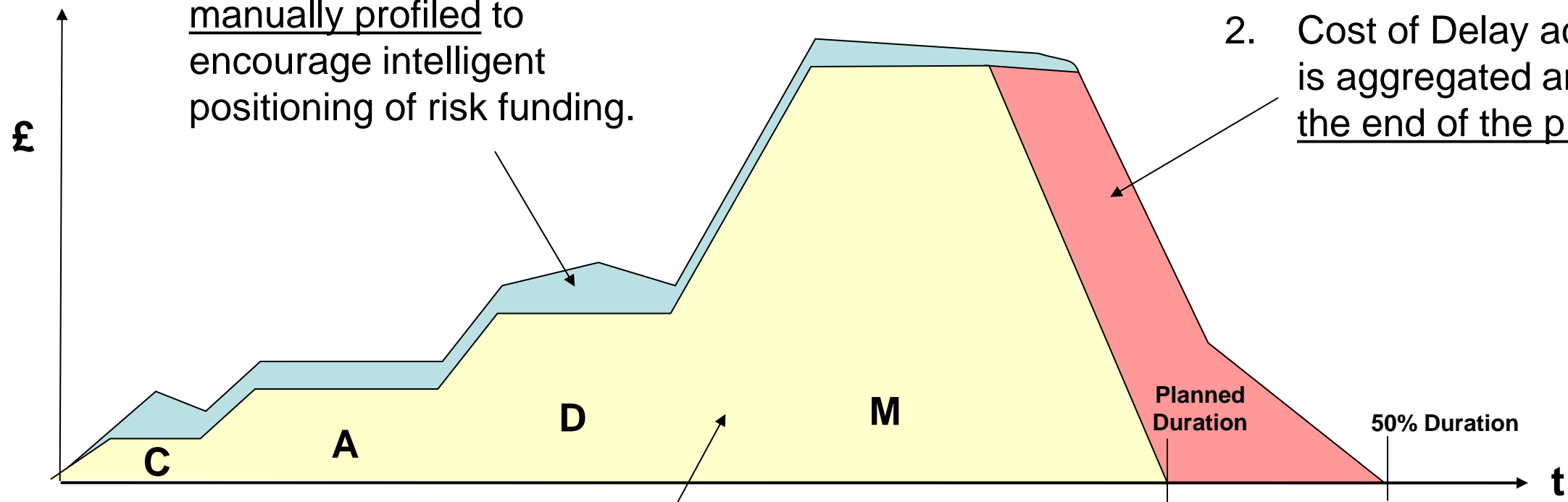


Calculating Cost of Delay



Generating Budget Profiles

3. Remaining cost risk and uncertainty should be manually profiled to encourage intelligent positioning of risk funding.



2. Cost of Delay across all phases is aggregated and profiled at the end of the project.

1. The Planned Cost of the Project should be profiled in accordance with the Planned schedule. This ensures that a project always has enough funding in every year to deliver the plan and avoids the budget profile becoming an unrecognised constraint.



Problems Encountered

The BOS approach works, but there were some problems:

- Not all models were compatible
- Current BOS Model can only handle a single path, which isn't always sufficient.
- Understanding of Standing Army Costs are often weak, especially amongst “Cost Forecasters” as opposed to “Cost Engineers”.
- Excess faith placed in “Firm Price” contracts.
- Realism of underlying SRAs sometimes lacking.
- Manual output profiling is novel and causes discomfort.



Summary – Parting Thoughts

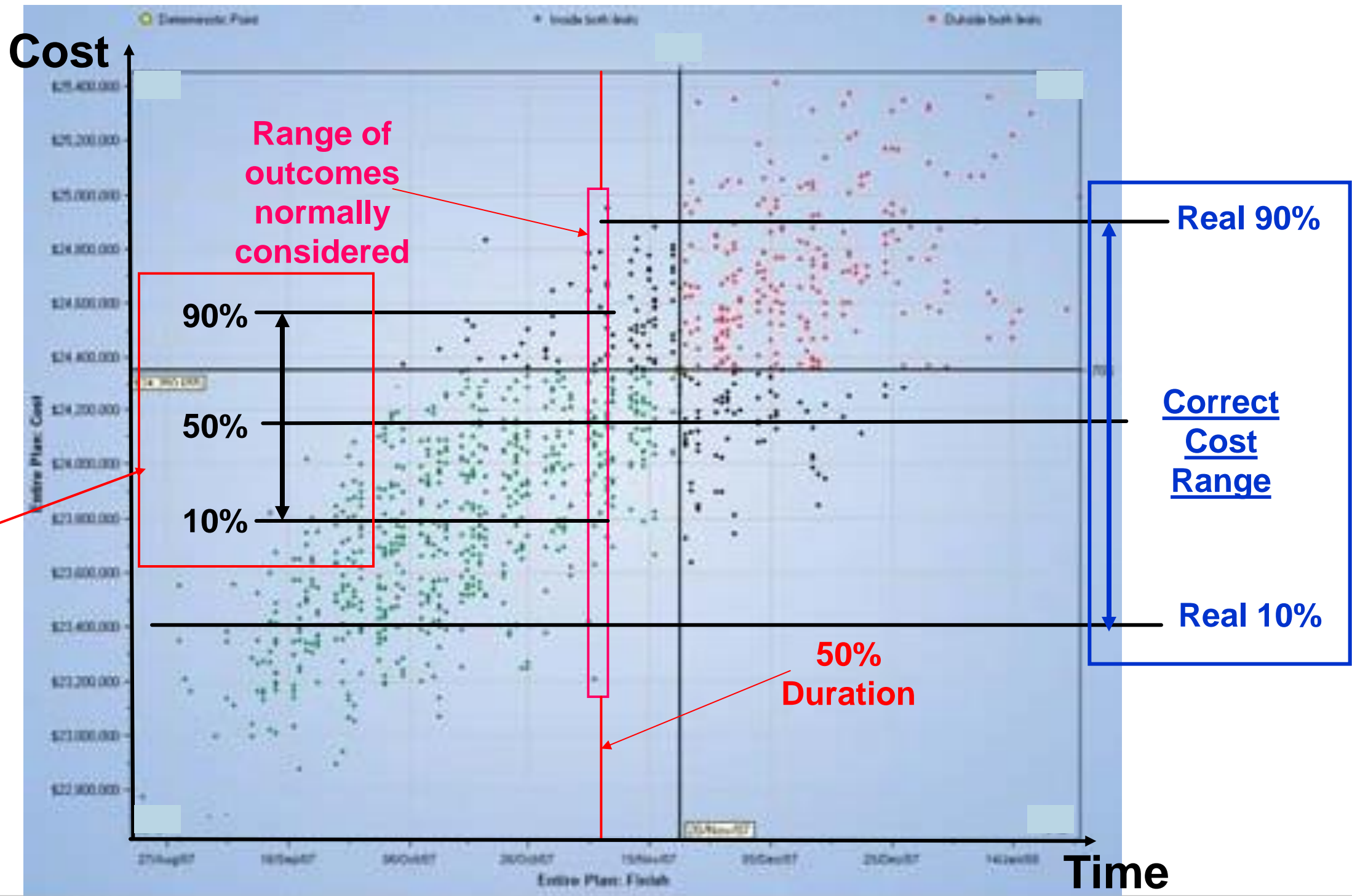
- Some form of Integrated analysis is often essential for realism, even if ignoring it is tempting.
- With annualised budgets, profiling is just as important.
- In both cases, KISS applies and something is better than nothing.
- We've made some significant progress in CAAS, & many PR-ICE estimates now allow for schedule.
- We still have a long way to go in achieving realism, consistency and the habit of integrated analysis.
- The biggest obstacles are cultural, not technical.



Other problems with use of 50% schedule

Example Cost- Schedule Scatter Plot

Current approach significantly under-estimates cost range



Where would you place 50% schedule?
What about 10-50-90% costs?

