Applying parametric cost modelling to Technology Insertion

Arthur Griffiths (HVR-CSL) and Dale Shermon (PRICE Systems)

June 2007 – ISPA SCEA Conference

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Agenda

- **Background and Requirements**
- **Concept of Analysis (COA)**
- **User Requirements Document (URD)**
- **Master Data and Assumptions List (MDAL)**
- **Cost Modelling**
- **Results**
- **Identified Shortcomings**
- **Next Steps**

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TI MPA Phase 2 Mission Statement

- ***"up to July 2007, support MOD's drive for acquisition change by providing all relevant stakeholders with integrated, evidence-based guidance on effective technology insertion, with special emphasis on lifecycles, open & modular systems and system adaptability."***

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User Needs

- **To explore the optimal Acquisition strategy for a System**
  - **Select preferred whole-life plan**
    - **Including upgrades and retirement (disposal)**
    - **Will be affected by planned investment in TI enablers**
  - **To explore and justify up-front investment in System characteristics that will facilitate subsequent TI**
- **To explore the optimal Procurement strategy for a System**
  - **Select the preferred approach to the procurement**
    - **Big Bang**
    - **Incremental**
    - **Evolutionary**

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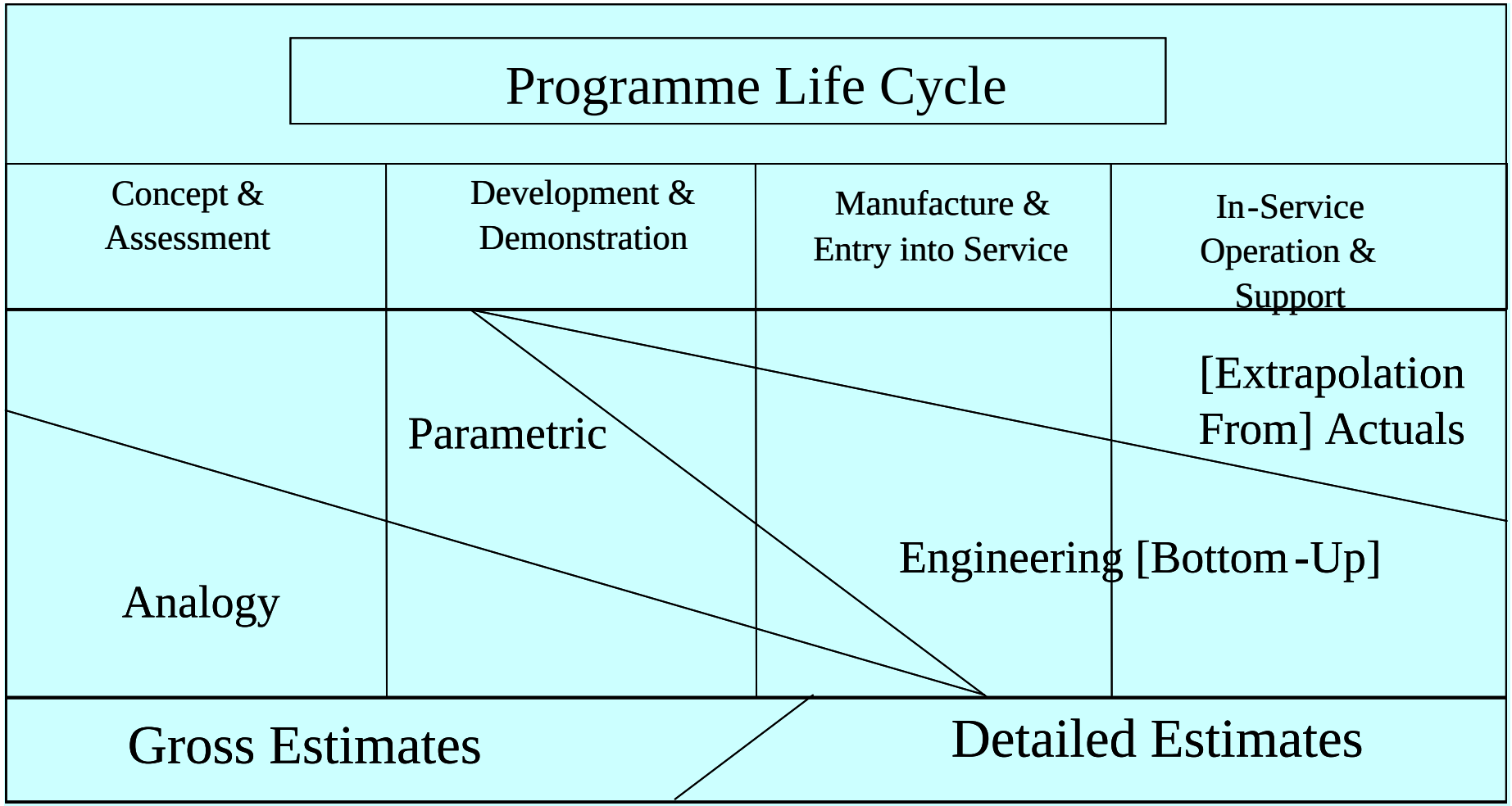
Estimating Methodology – Why Parametrics ?



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Why PRICE ?

The top commercially available parametric models in the world

- PRICE
- SEER
- FACET
- ACES
- FAST
- MATCH

Other bespoke models are used but not available outside their organisations (e.g. NASA, ESA, USAF, etc.)

- **FAST and MATCH are no longer supported**
- **ACES in not well known outside Germany**
- **FACET does not have the granularity to meet the requirement**
- **Only the SEER software licence is held by the MoD**
- **PFG has a site wide licence for all the PRICE models**

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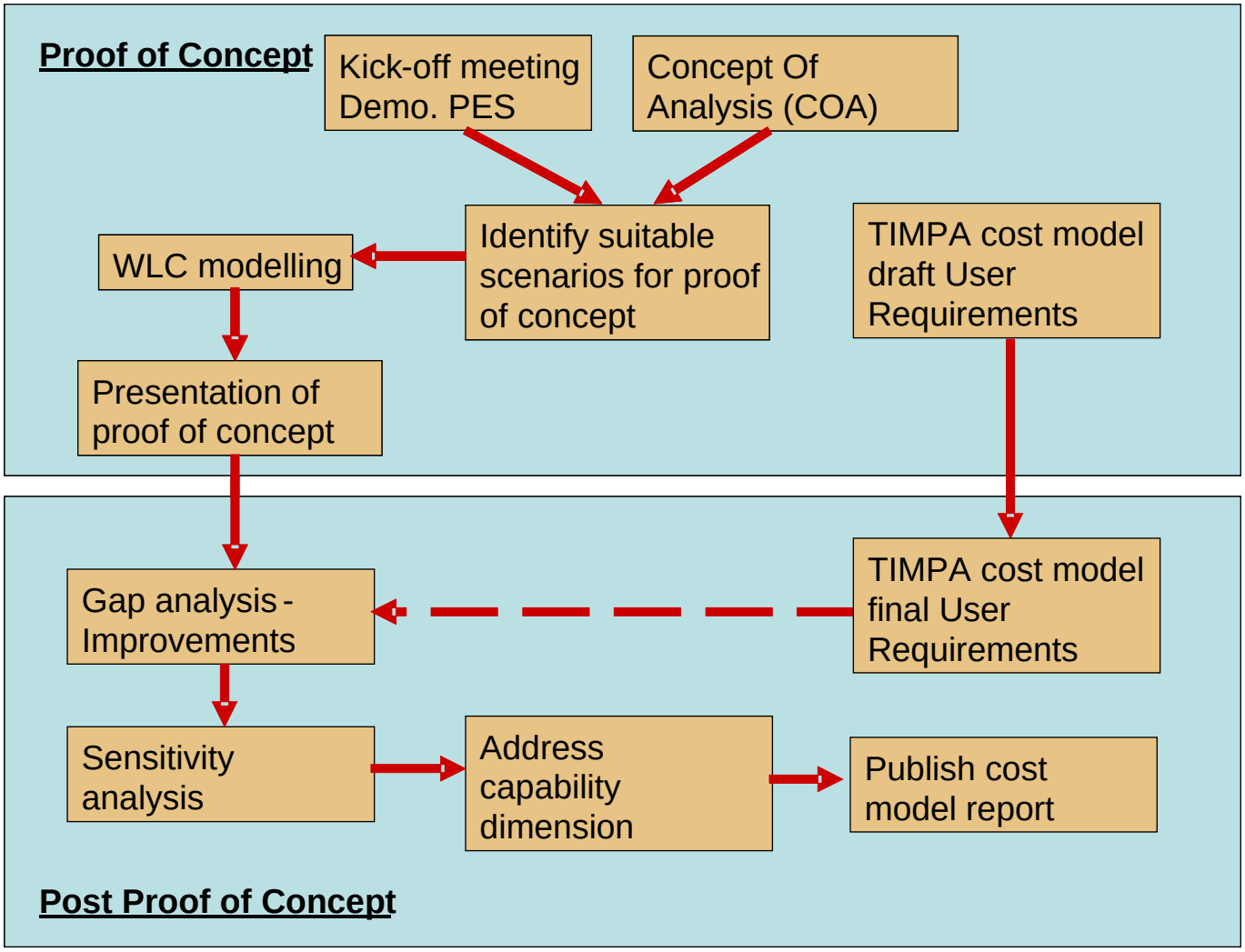
COA Structured Approach

- Proof of Concept is currently funded

Part one (Jan 07)

Part two (Jul 07)



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User Requirements Document (URD) - Single Statement of User Need

- **Previous discussions with the TIMPA Customer, and amongst the wider TIMPA Cost Model project team has resulted in the following Single Statement of User Need:**

To develop a Whole Life Cost modelling tool to enable the exploration and justification of up-front investment in System characteristics that facilitate subsequent Technology Insertion.

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MDAL Caveat

- **The information contained within this MDAL is for illustrative purposes only.**
- **It has been developed to provide sufficient information to allow the cost modelling of the options to be evaluated.**
- **It is not intended to represent an actual cost estimate of a UCAV programme.**

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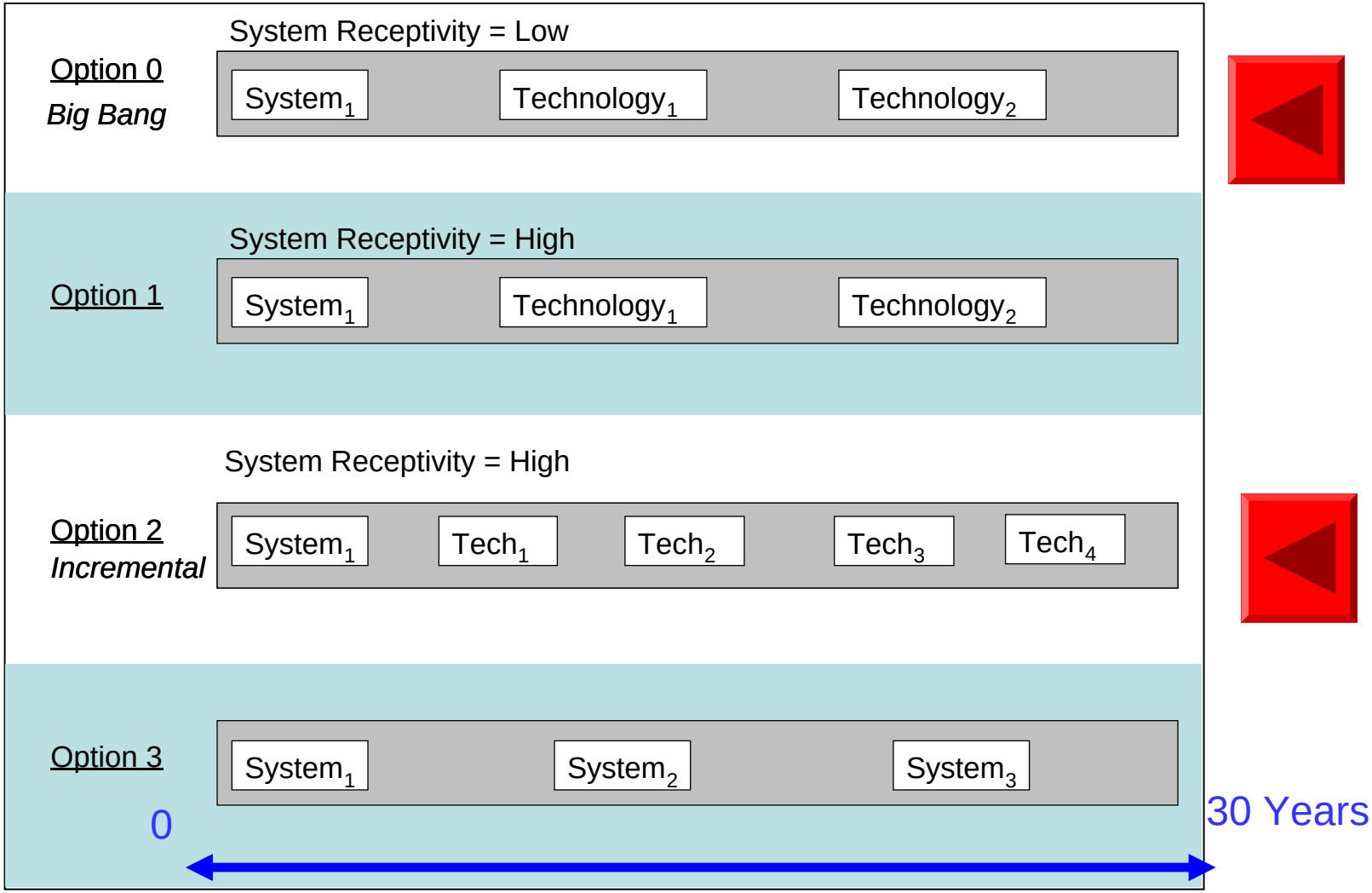
Options to be considered

- Options 0 and 2 conducted during the Proof of Concept



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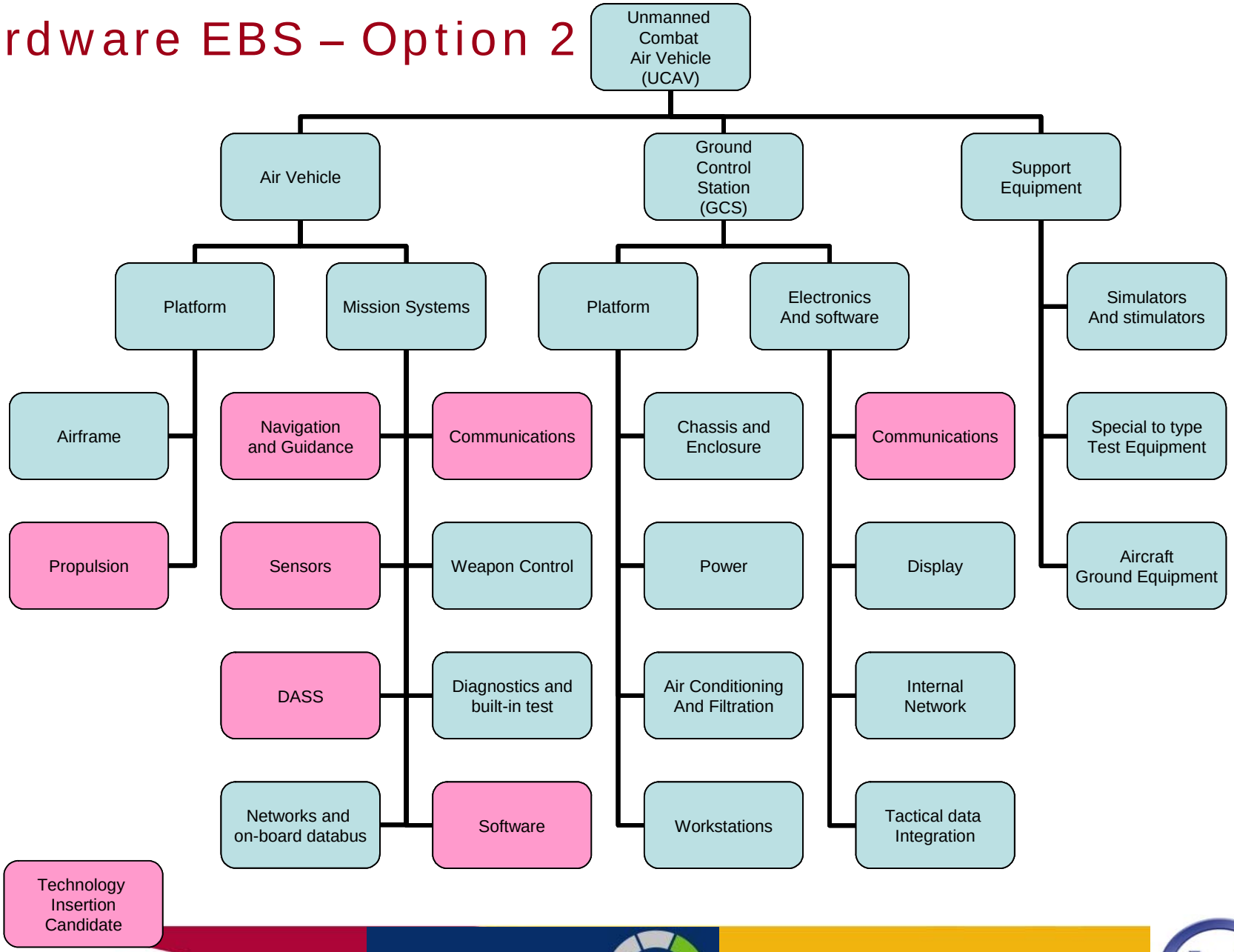
Hardware EBS – Option 2



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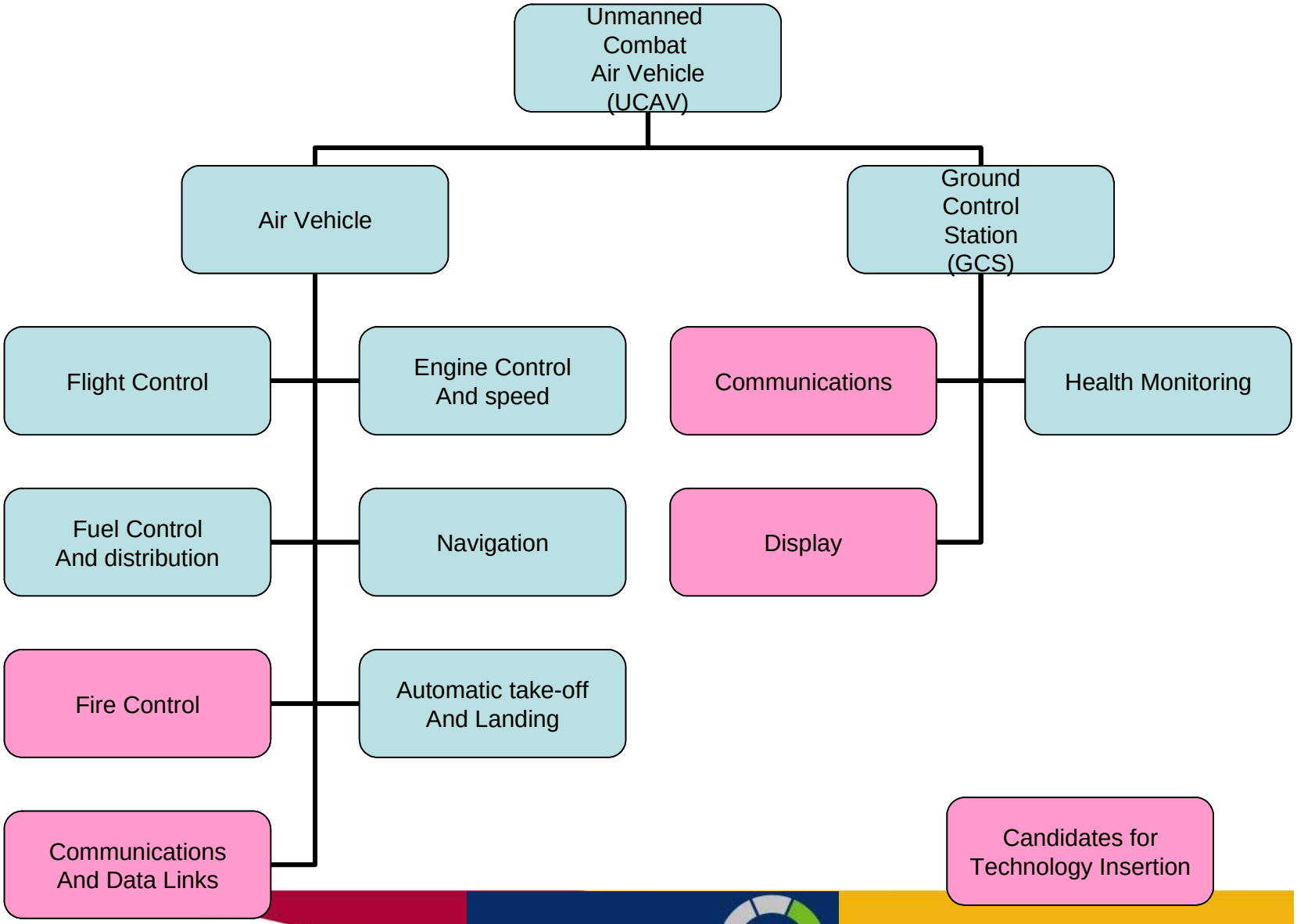
Software EBS – Option 2



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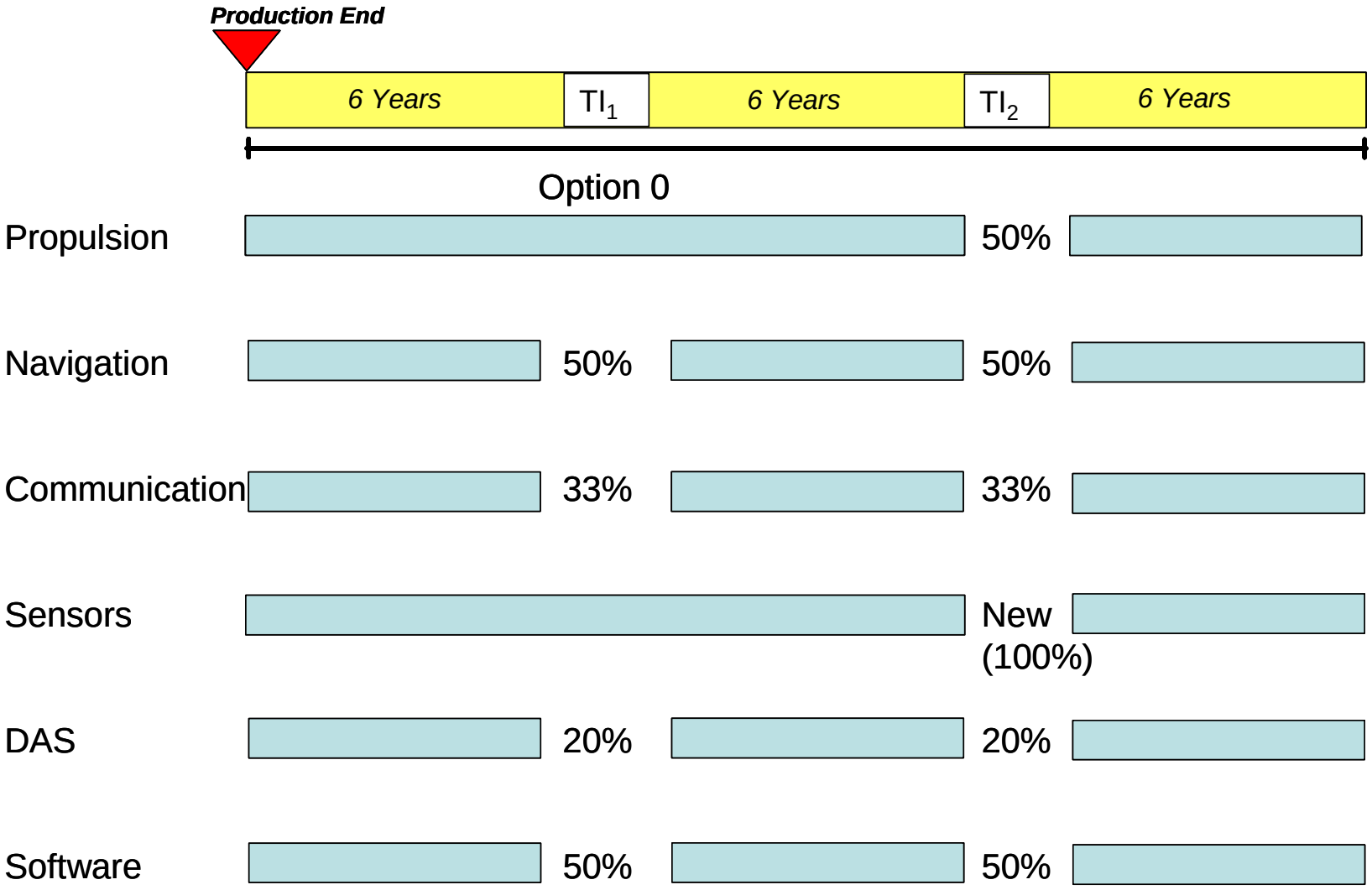
Option 0 – Assumed Magnitude of the Technology Insertion



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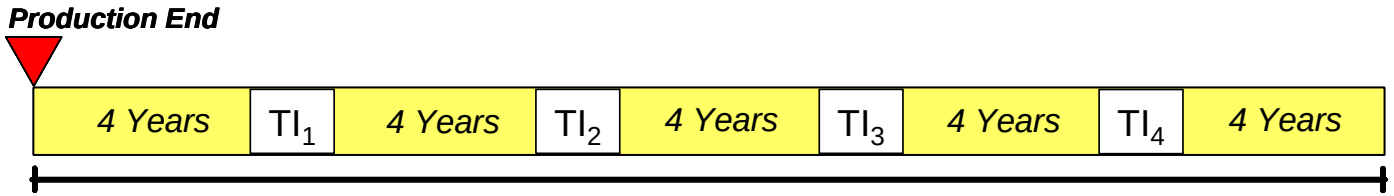
Option 2 – Assumed Magnitude of the Technology Insertion



Option 2

Propulsion		10%		20%		20%		
Navigation		25%		25%		25%		25%
Communication		20%		20%		20%		20%
Sensors		5%		15%		15%		10%
DAS		5%		5%		5%		5%
Software		25%		25%		25%		25%

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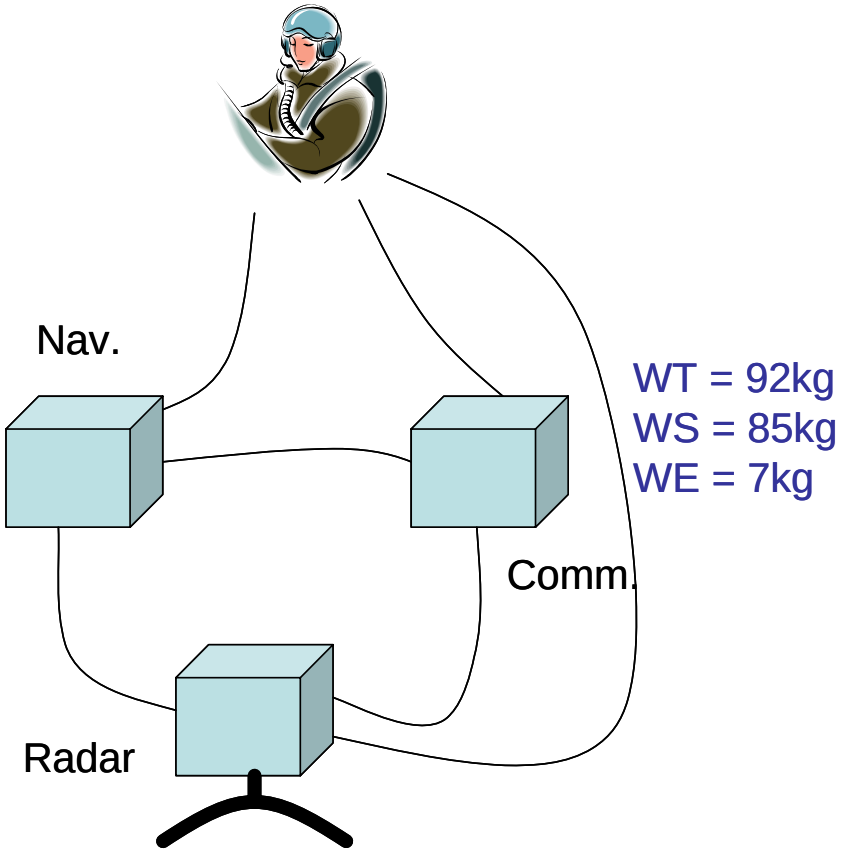
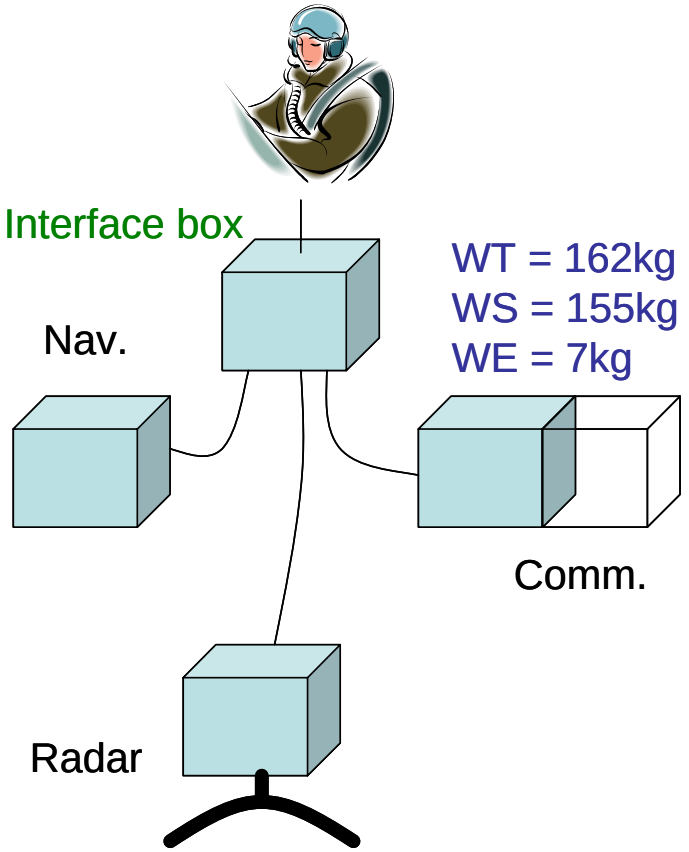
Technology Insertion Architectures

TI Non-Receptive Architecture



TI Receptive Architecture



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Cost modelling – TI issues and [PRICE parameters]

- **Support and maintaining Configuration Management information for multiple concurrent versions [PROSUP]**
- **Dependency on previous procurements [INTEGE/S]**
- **Capturing user feedback [not explicit]**
- **Discontinuity costs within procurements [PSF]**
  - This refers to the cost of maintaining an industry team between feedback regarding prototypes.
- **Modularity of architecture [ECMPLX]**

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Cost modelling – TI issues (continued)

- **Spare capacity [WT & WS]**
  - Space
  - Cooling
  - Bandwidth
  - Etc.
- **Documentation of system to facilitate change [Calculated]**
- **Configuration management information [Calculated]**
- **IPR Ownership [not explicit]**
- **Openness [DLEVE/S]**
  - Openness is defined as standard interfaces in the public domain, not requiring IPR. For example, ISO standards, RS232, Bluetooth, USB connections. There are multiple sources of suppliers. These interfaces can be referenced, they do not require a specification.

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Cost modelling – TI issues (continued)

- **Availability of relevant knowledge, skills and tools [various]**
- **Obsolescence [HL properties]**

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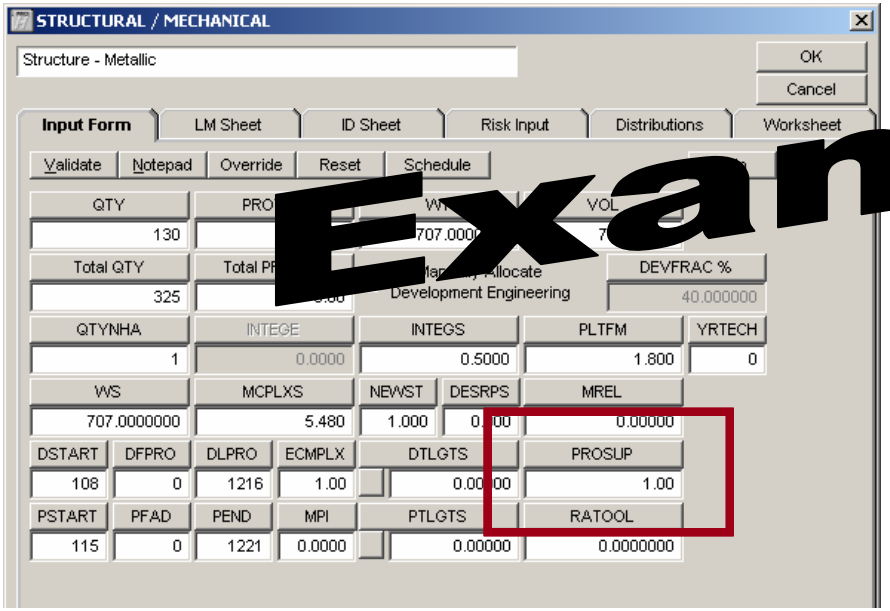
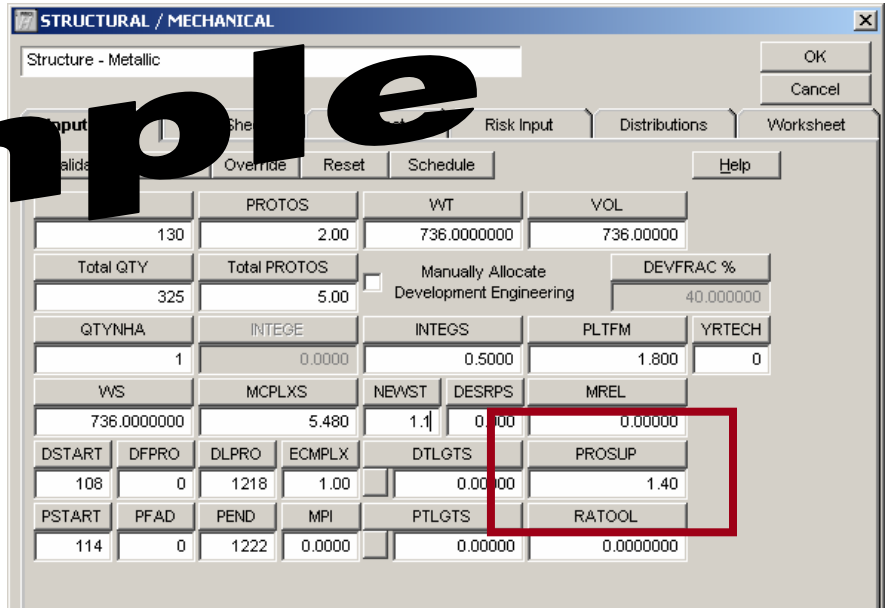
Technology issues – Incremental process - Prototype Support Adjustment Factor (PROSUP)

Option 0



Option 2



Example

$$PROSUP = \frac{0 + 5}{5} = 1.0$$

$$PROSUP = \frac{2 + 5}{5} = 1.4$$

Non Recurring Eng.

SM | EM | EM | EM | QM

Non Recurring Engineering

~~SM~~ | ~~SM~~

SM | EM | EM | EM | QM

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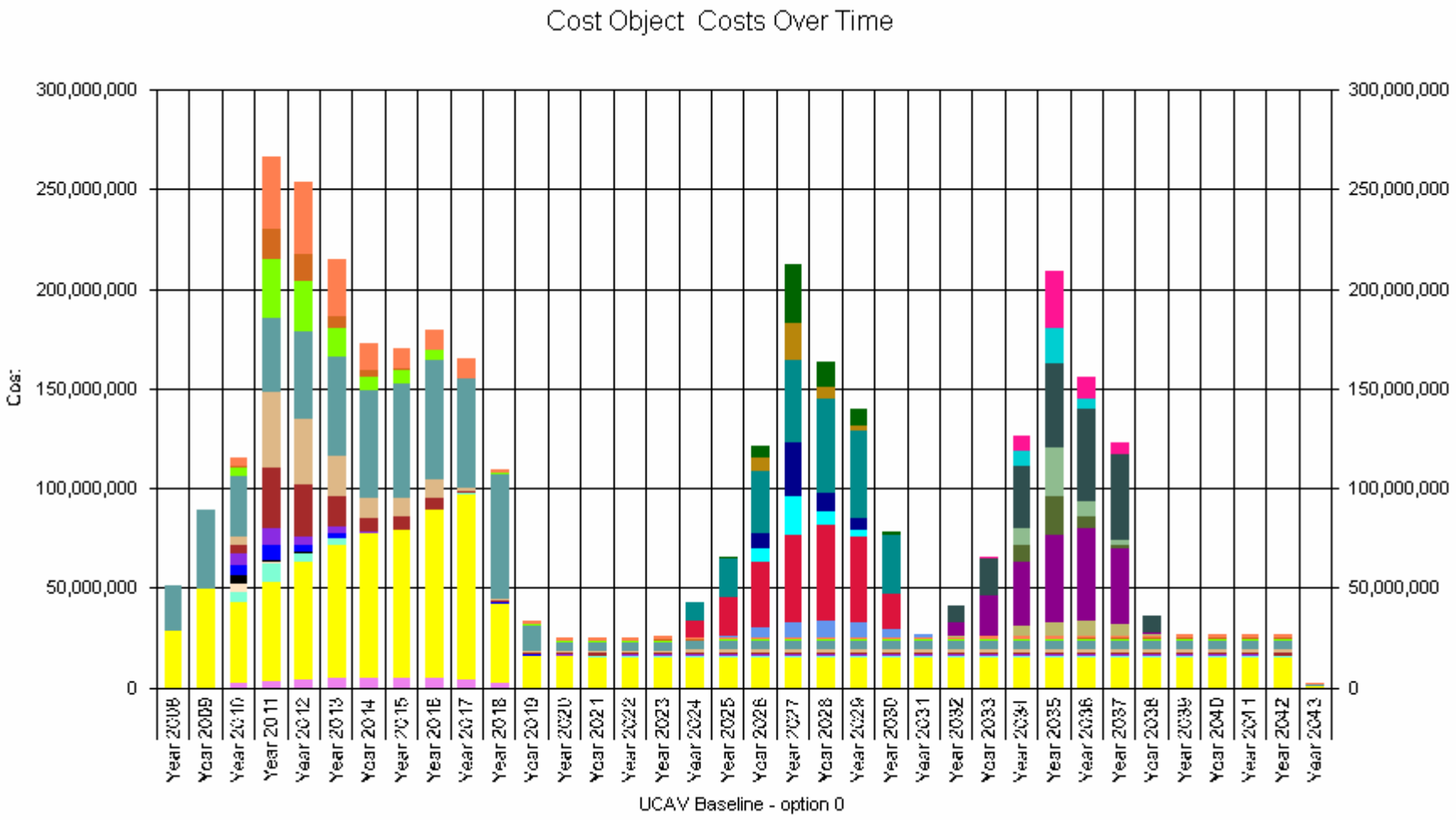
Software cost – Option 0



Currency in GBP (£) (in January 2007)

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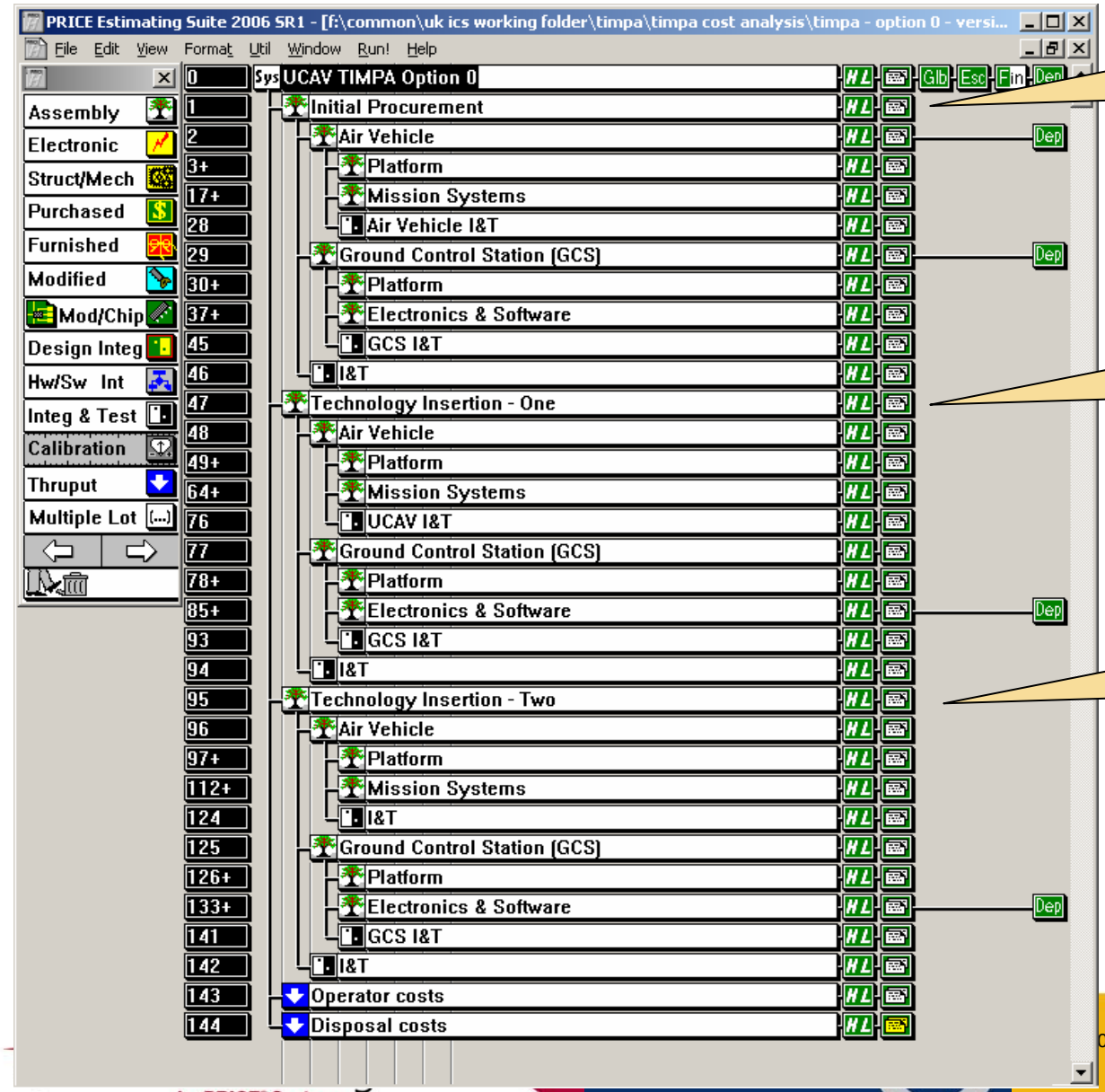
Option 0 – Hardware- How to model – Parametric Inputs – Initial procurement



Initial procurement of UCAV and GSC

TI_1 procurement of UCAV and GSC

TI_2 procurement of UCAV and GSC

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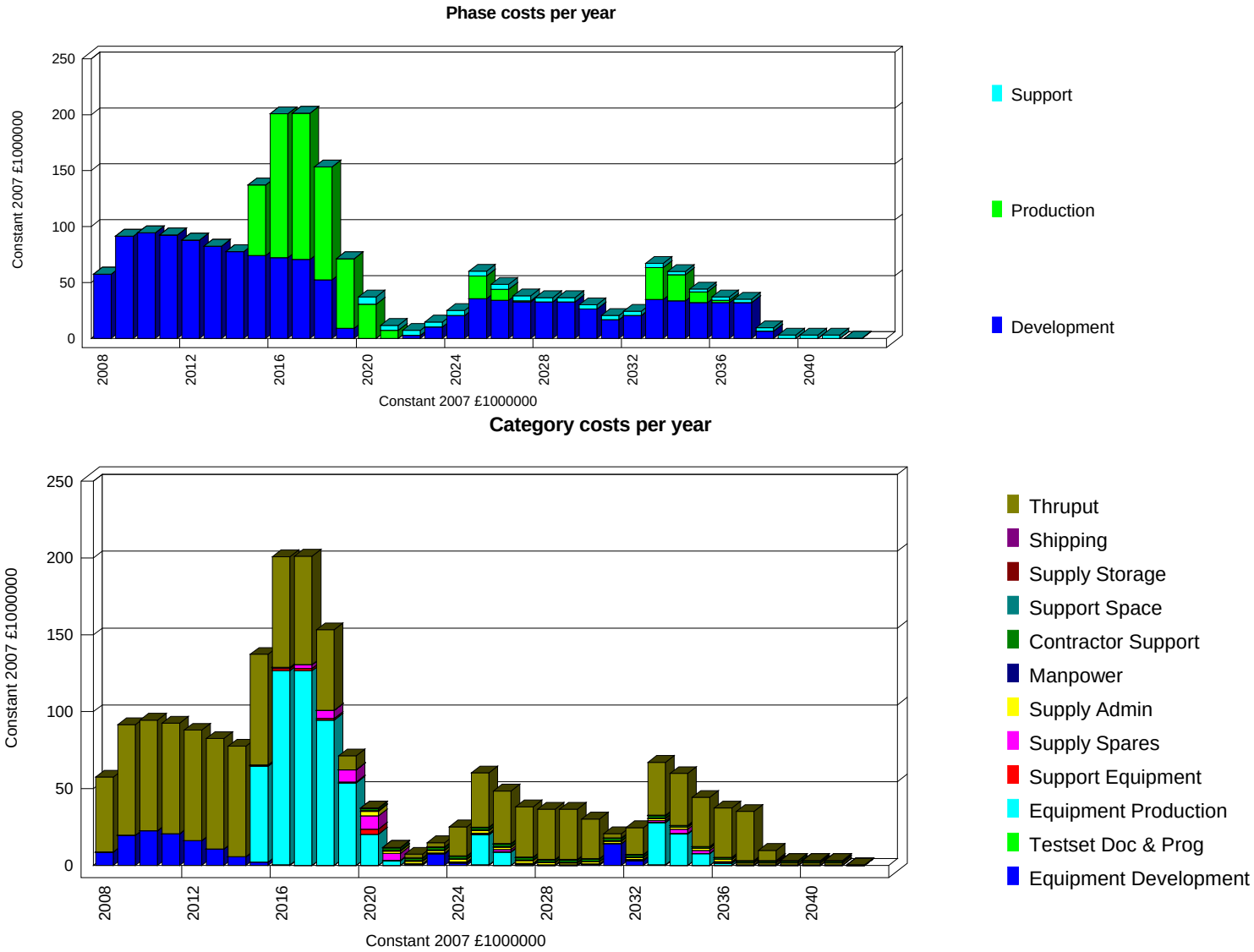
Option 0 – Total UK Acquisition Cost



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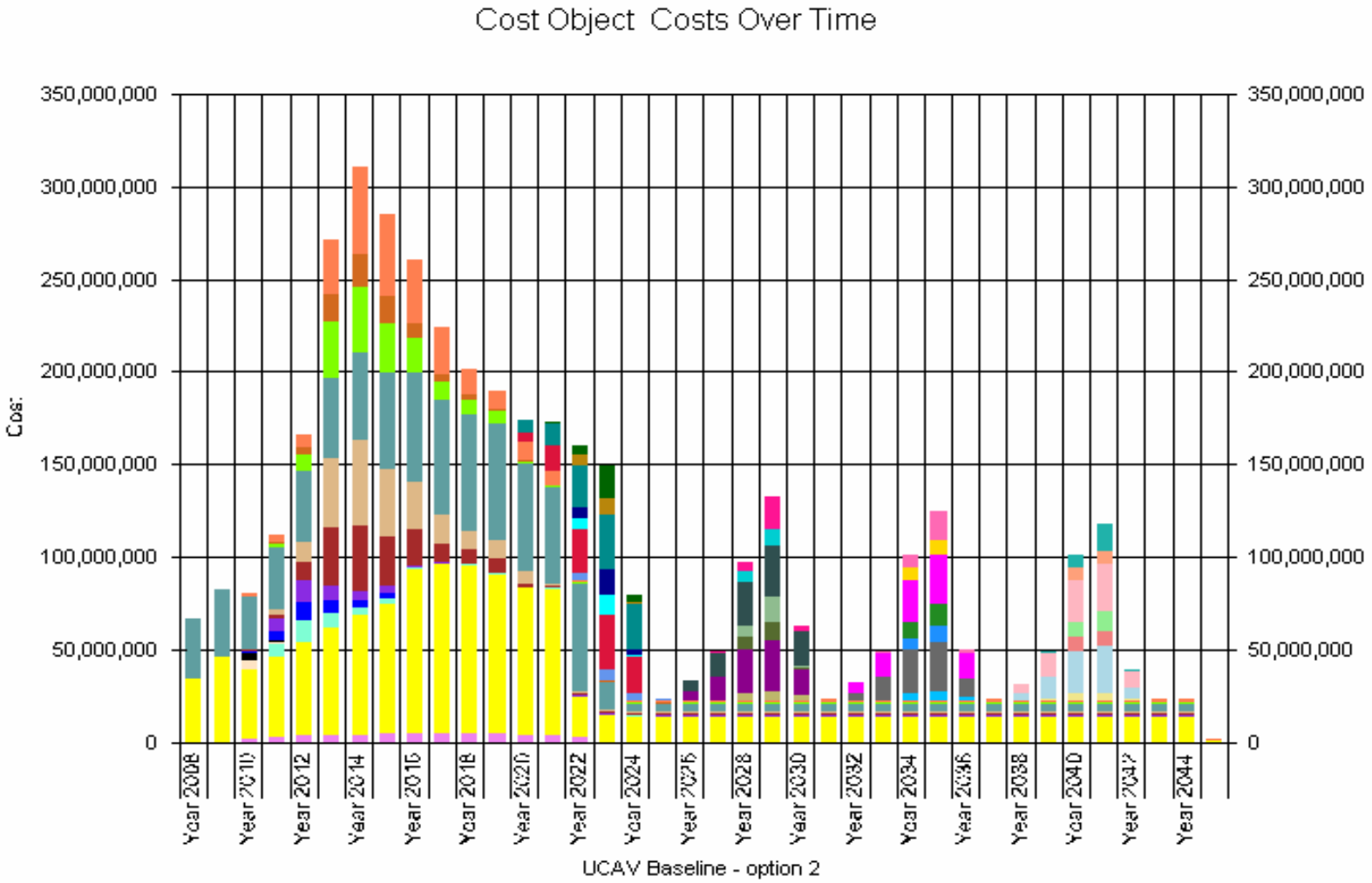
Software Cost – Option 2



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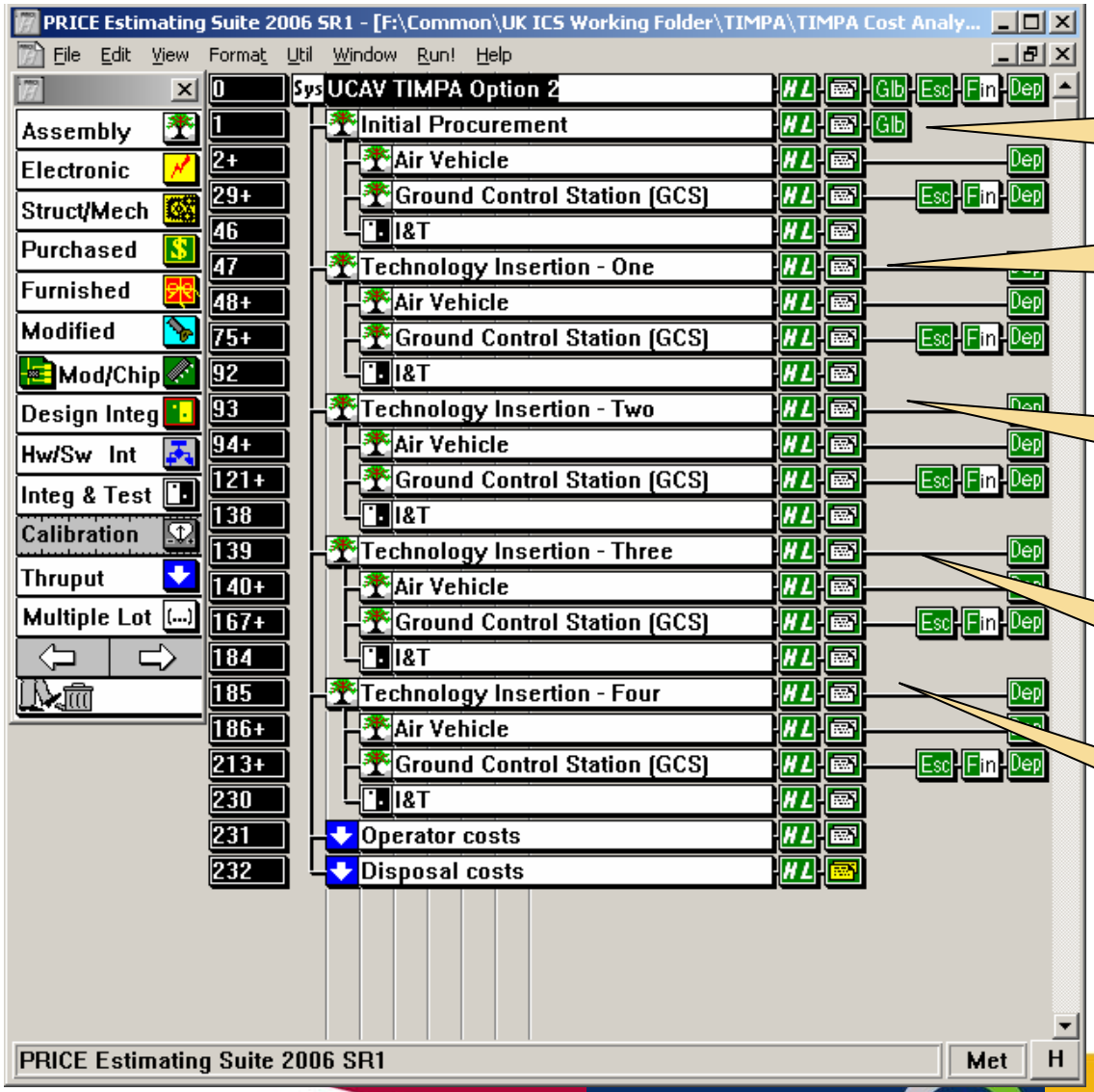
Option 2 – Hardware – How to model – Parametric Inputs – Initial procurement



Initial procurement of UCAV and GSC

TI_1 procurement of UCAV and GSC

TI_2 procurement of UCAV and GSC

TI_3 procurement of UCAV and GSC

TI_4 procurement of UCAV and GSC

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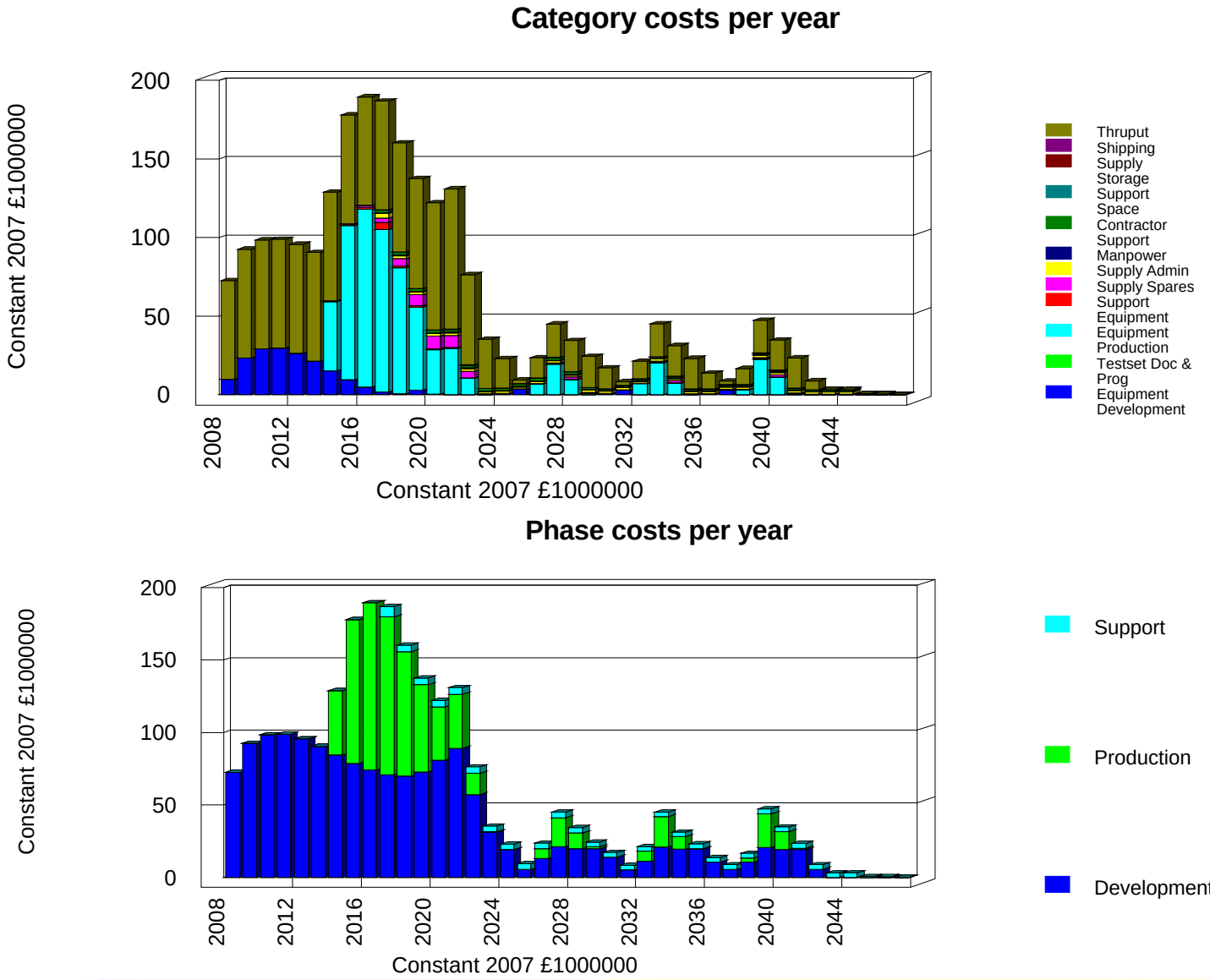
Hardware Cost – Option 2



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Total Acquisition (Including Software costs) – UK Share - Jan 2007 (£M)

Cost (£m)	Option 0	Option 2
Development	1,298	1,539
(Software)	(1,128)	(1,309)
Production	618	718
Support	230	274
(Software)	(48)	(46)
Total	2,146	2,531
(Software)	(1,176)	(1,355)
NPV	1,449	1,721

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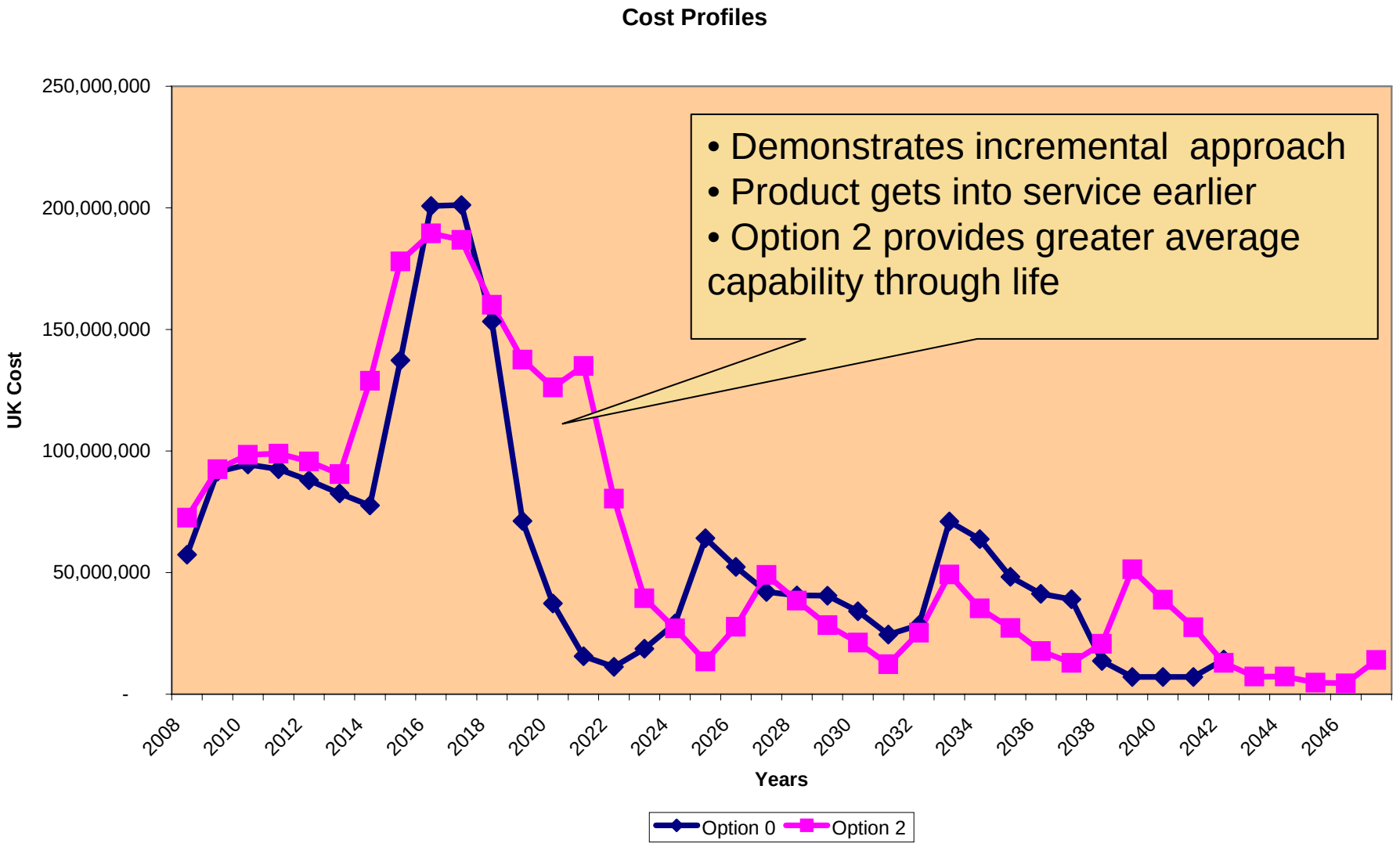
Cost Profiles



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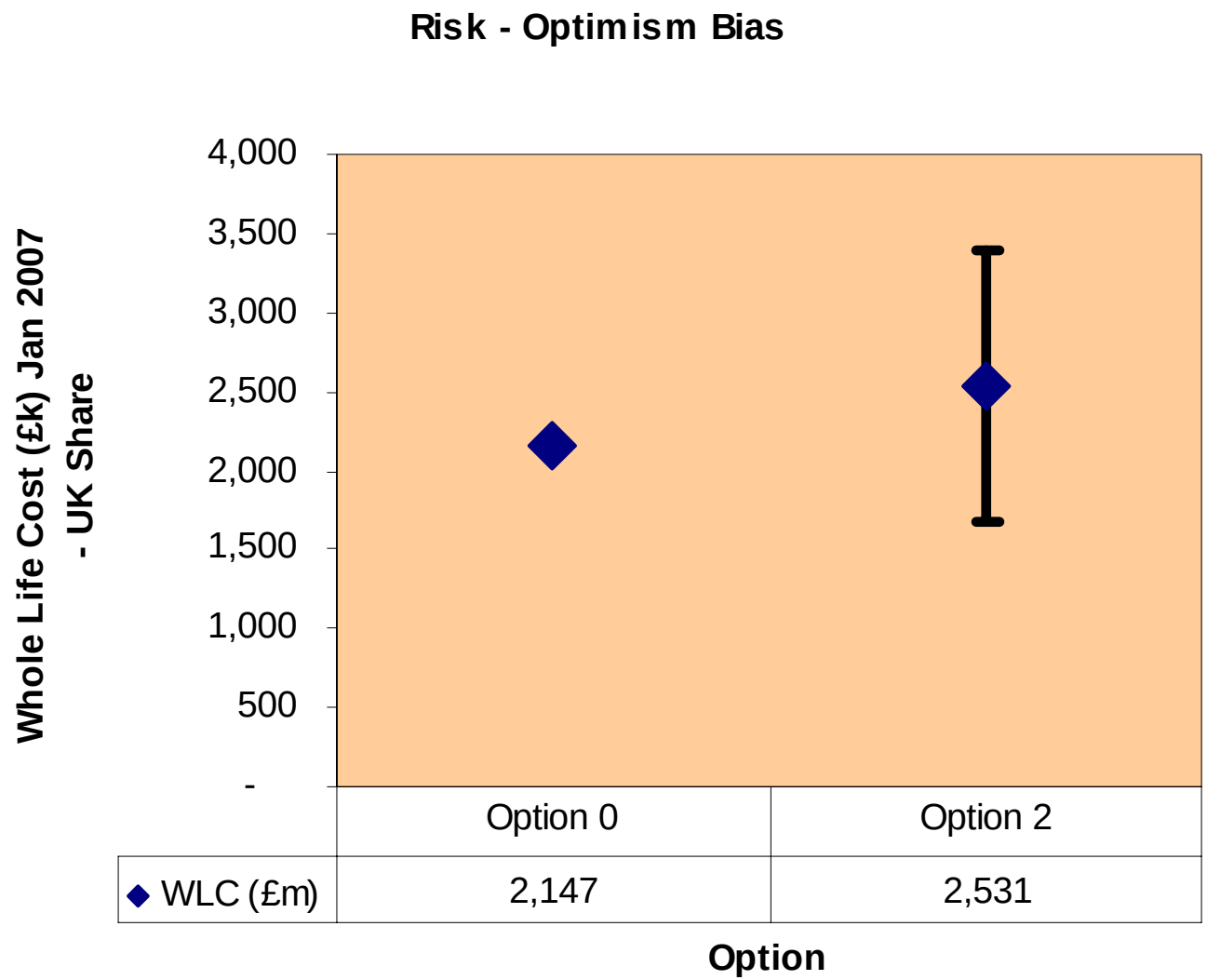
Risk



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Identified Shortcomings

- **All Technology Insertion (TI) issues were able to be modelled.**
- **Cost models exist, capable of estimating all platforms, however implementation was complex in some areas. Expansion of the PRICE models would help for:**
  - Obsolescence
  - Hardware development Life Cycles
- **UK MoD Users would be capable of applying this methodology with:**
  - Comprehensive documentation of this application of the models
  - Awareness training

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Next Steps

- **Proved to be a useful concept and provides the IPTs with the ability to put TI considerations in their Business Case**
- **What haven't we been able to do – is the gap important ?**
- **Address the Capability dimension**
- **Other considerations**
  - Model different environments
  - Conduct sensitivity analysis
  - Develop an instruction set
  - Training
- **Constraints – current WLC practice ignores upgrades**
  - Upgrades treated as separate down-stream procurement programmes, with their own funding line and approvals process – discuss with Economic Advisor

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Technology Insertion MPA

Any Questions?

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