BAE Systems Military Air & Information the need for -

Costing for Avionic Through-life Availability

IeMRC Annual Conference 2012

5th September 2012
BAE Systems MAI - Key Facts

- Approx. 13,350 people.
- 2011 Turnover of c£4.1bn.
- Organised as 3 “lines of business”
  - Combat Air
  - Defence Information, Training & Services
  - F-35
Military Air Products in Manufacture

**Hawk**
Training aircraft of choice for many customers
Over 1000 aircraft sold

**Typhoon**
European collaborative project 4 workshare partners
Currently sold to 6 Nations

**F-35**
To be the largest military contract – worldwide
Industrial partnerships
3 versions in development and Low Rate Initial Production
BAE Systems MAI – Operating Locations

1. Brough
2. Chadderton
3. Christchurch
4. Farnborough
5. Filton
6. Fort Worth
7. Frimley
8. Hillend
9. Malvern
10. Munich
11. New Malden
12. Preston
13. RAF Brize Norton
14. RAF Coningsby
15. RAF Cottesmore
16. RAF Leuchars
17. RAF Lossiemouth
18. RAF Lyneham
19. RAF Marham
20. RAF Valley
21. RAF Waddington
22. RAF Wyton
23. Samlesbury
24. St Athan
25. Warton
26. Yeovil
Support
A Traditional Support Solution
Military Air & Information

A Modern Support Solution

© BAE Systems 2012
Availability Support Solution
Unmanned Aircraft Systems - The Future?
‘If we were starting from scratch what would we do differently and why?’

Focus of our research

Costing for Avionic Through-life Availability
Estimating the cost of availability support solution

- Cost modellers are experienced in estimating cost for products
- Commercial systems are in general still product based
- Little evidence of in-service/utilisation modelling
- Understanding of service is still being developed
- Availability contracts already in place
  - Rigour in cost estimating has lagged behind implementation
Benchmark – data analysis and availability

- Cost estimating relationships, based on industrial data and knowledge, for predicting the cost of maintaining availability

Utilised Current Aircraft Data
Cost Estimating Relationships (CERs)

- CER1 – Indicative failure rate – 23%
- CER2 – Probability of 2nd fail
- CER3 – Identified probability of failure in lifecycle phase (majority in build and test)
- CER4 – probability of a particular fault code
- CER5 – failure rate for particular aircraft users

Limited detailed trace back to manufacturing history
  - Not yet known
  - MTBF
  - Flying hours
  - Select fault code – avoid selection of ‘other’
  - Time to failure
Benchmark

- Gave a product focused view.
- Product reliability.
- Traditional approach
- Challenges in terms of quality data for Through Life cost estimating.
- Companies at this stage are not realising their expected benefits.

So,

- We need a paradigm shift on how we undertake TLC.

*What would I do differently now when designing for service?*
A “neutral” example

• Have 100 pairs of customer’s hands dried on an average business day
• pay per pair of dried hands

- What is known about the service delivery system;
- What are the available competencies;
- What competencies may be necessary in the future

- How value in exchange is replaced by value in use;
- How customer, provider and supplier cooperate to manage complexity and meet expectations;
- How success and performance are measured across the enterprise.

- What are the uncertainties at both the individual PSS and the enterprise level;
- Which uncertainties are endogenous, which are exogenous;
- How the availability contract is executed
What do we enable?

Performance?

Availability?
Team required to achieve this

MoD DE&S

BAE Systems MAI

GE Aviation

Prof. Sandborn
CALCE, Univ of Maryland

Dr Newnes*
University of Bath

Dr Parry
University West of England

Prof. Paredis
SRL Georgia Tech

Dr Goh
Loughborough University
Operations-based approach

Cost flow based upon the network of activities

Network of activities based upon technological knowledge
What does this cover in CATA

- PSS Technological Knowledge
  - Process understanding
  - Avionics TK: (COTS, PHM etc.)

- Relationships within the service enterprise
  - Boundaries & interdependencies
  - Contractual aspects

- CATA
  - Service operations modelling
  - Complexity in value co-creation
  - Realistic risk management

- Uncertainty
  - Types and source of uncertainty
  - Criteria for associating uncertainty to variables

- Through-life cost estimation
  - Represent system's structural information
  - Computational aspects

- Through-life cost estimation
  - Criteria for associating uncertainty to variables
  - Represent system's structural information
  - Computational aspects
Costing for Avionic Through-Life Availability (CATA)

Any questions?