The following presentation was given at:

SCAF Workshop
"Where has all the cost data gone: Do we need it?"

Tuesday 11th June 2019

Rolls-Royce Learning & Career Development Centre, Derby

Where has all the Operating & Support data gone?

Dr Stephen Curram
Decision Analysis Services Ltd

SCAF Workshop
"Where has all the cost data gone: do we need it?"

Derby, UK

11 June 2019

Dr Stephen Curram - bio

Stephen Curram is a Managing Consultant at Decision Analysis Services Ltd. He has worked in technical consultancy for over 20 years in Operational Research, with a particular focus on System Dynamics, simulation models and software development. He works across multiple domains including defence, health, transportation and telecoms.

Prior to consultancy he was a lecturer in Operational Research at Warwick Business School, where he also undertook a part-time PhD applying neural networks to represent “intelligent” decision-making in simulation models.

Stephen has worked for many years with the US Navy on developing their OSCAM models (**O**perating & **S**upport **C**ost **A**nalysis **M**odel). He developed the first version of the OSCAM Air model and led major revamps of the Ship and Air models. He has also developed equipment specific models for the F-35 Lightening II and the US Marines Expeditionary Fighting Vehicle. Since the first OSCAM models in 1996, over 1000 people have been trained to use OSCAM.

Where has all the Operating & Support data gone?

I don't know!

But I have some hypotheses!

And we have a lot of experts in the room (more expert than me!) who can help explore these hypotheses.

Maybe we can start to think of ways to generate/collect/transform/access* (delete as applicable) that data.

Outline of Presentation

1. What kind of data do we need for Operating & Support cost forecasting?
2. What data is being collected? Why can't we get the kind of data we need? – the hypotheses!
3. Review the hypotheses – gather knowledge from the room (interactive bit!)
4. What needs to happen to improve things, and where do we start? (another interactive bit)

I see no data!

Whilst I spend quite a lot of my time working on Operating & Support (O&S) cost models for US Navy, I do not have access to their data.

Nor do I often get involved in detailed O&S data collection and analysis for UK (though some of my colleagues do!)

However, in designing and developing O&S cost models I need to think very carefully in terms of what data is needed to generate the required output structure, and what data is generally available.

From my ivory or (more aptly) digital tower, I have developed a good understanding of the business processes that generate O&S costs, the requirements of cost estimating in the US Navy, and the type of data that is available to US Navy cost analysts for ships, boats and aircraft.

1. What kind of data is needed for Operating & Support cost estimating?

Operating and Support costs do matter!

- Typically O&S costs account for 50-80% of whole life costs
- UK MoD Equipment Support Costs (a sub-set of O&S costs) account for **~£5.8Bn** of DE&S 18/19 budget. By comparison, Equipment Procurement costs are **~£4.4Bn**
  DE&S Corporate Plan 2018

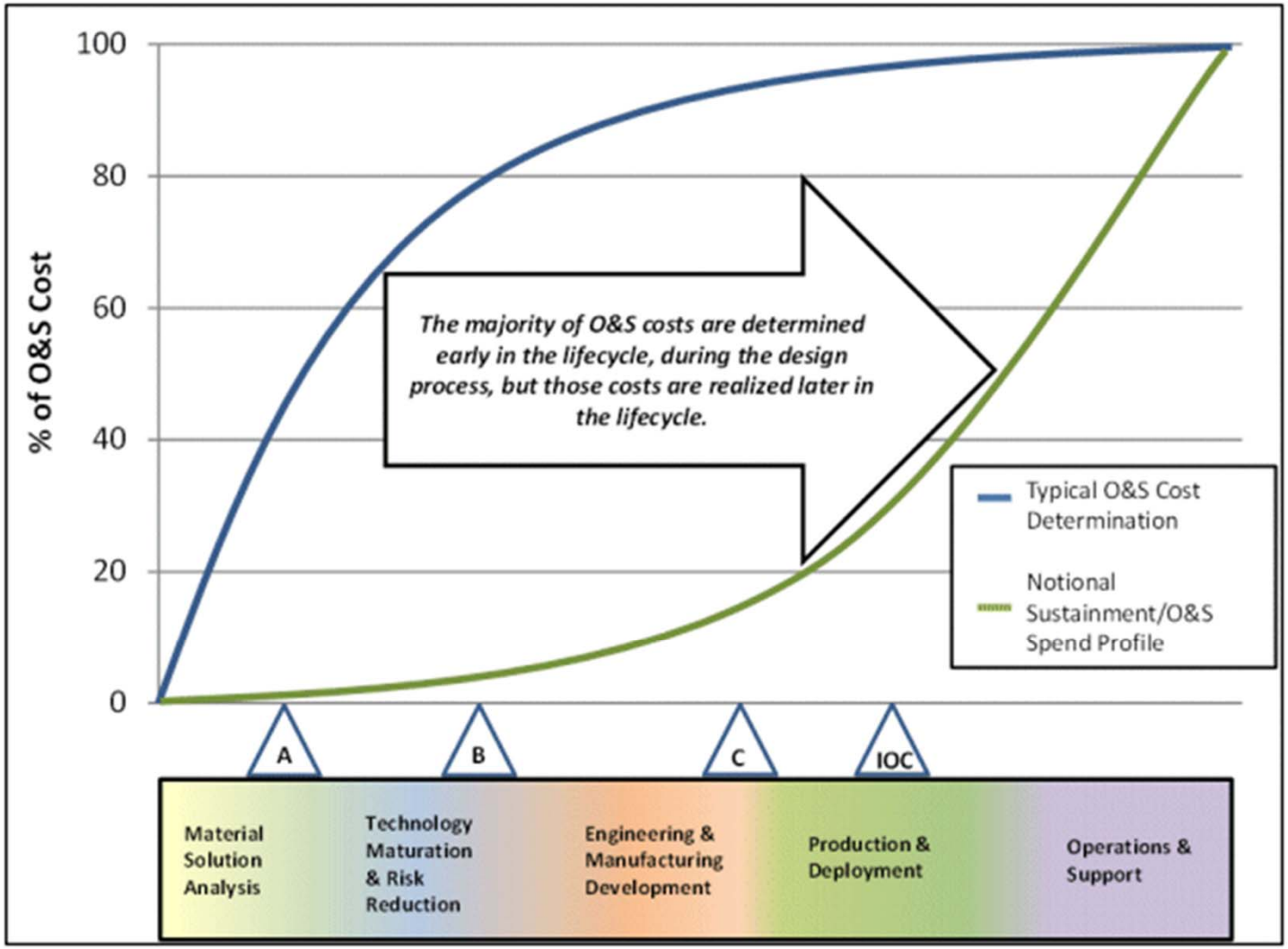
Historically Operating and Support costing estimating has been the poor cousin to Procurement cost estimating

- Procurement costs are nearer term and better understood
- During the procurement phase O&S costs were seen a problem for the future, not now

Attitudes are changing

- There is a recognition that O&S is a key part of the affordability question during procurement
- Equipment is becoming increasingly more complex and expensive to support
- The cans that have been kicked down the street are starting to pile up

The majority of O&S cost determinants are locked in early in the lifecycle, prior to production



Source: US DoD Operating and Support Cost Management Guidebook, Feb 2016

What information is required to support O&S cost estimating?

Understanding O&S costs for current equipment is important

- Near-term budgeting for commands
- Understanding trends in cost (e.g. cost escalation of ageing equipment)
- Analogy for support costs when procuring new equipment

The caveats

- By definition new equipment has not been seen before
  - but it is easier to determine support cost deltas for differences from existing equipment than work out costs from first principles
- Actual spend does not necessarily equate to what should have been spent on supporting equipment
- Be aware of short-term effects in early life of equipment or major short-term events (e.g. modernisations)
- How equipment is used affects support costs – activity generates costs

Equipment characteristics strongly affects support costs, but so does activity

Role of OSD CAPE

- US CAPE (Office of Cost Assessment and Program Evaluation) provides a leadership and scrutiny role for cost estimating. CAPE publishes guidance on expectations for cost estimates
- The CAPE '14 O&S Cost Structure lays out the top-level cost categories that are expected for all official submissions for milestones and reviews

1.0 Unit Level Manpower

- 1.1 Operations
- 1.2 Unit-Level Maintenance
- 1.3 Other Unit-Level

2.0 Unit Operations

- 2.1 Operating Material
- 2.2 Support Services
- 2.3 Temporary Duty
- 2.4 Transportation

3.0 Maintenance

- 3.1 Consumable Mat'ls & Repair Parts
- 3.2 Depot Level Reparables
- 3.3 Intermediate Maintenance
- 3.4 Depot Maintenance
- 3.5 Other Maintenance

4.0 Sustaining Support

- 4.1 System Specific Training
- 4.2 Support Equipment Replacement & Repair
- 4.3 Sustaining/Systems Engineering
- 4.4 Program Management
- 4.5 Information Systems
- 4.6 Data and Technical Publications
- 4.7 Simulator Operations & Repair
- 4.8 Other Sustaining Support

5.0 Continuing System Improvements

- 5.1 Hardware Modifications
- 5.2 Software Maintenance

6.0 Indirect Support

- 6.1 Installation Support
- 6.2 Personnel Support
- 6.3 General Training & Education

VAMOSC Systems – Visibility and Management of Operating and Support Costs

- Each service department is required to provide a single source of authoritative, processed financial and logistics data organised by system or infrastructure
  - **Navy – Navy VAMOSC**
  - **Army – OSMIS** (Operating and Support Management Information System)
  - **Air Force – AFTOC** (Air Force Total Ownership Cost)
- Key for cost estimating is that all of these systems capture both costs and non-cost elements that allows an understanding of the levels of activity that generated the costs
  - Both the cost and non-cost information is vital for O&S cost estimating
  - It allows costs to be converted into an appropriate **$ per** … metric, e.g.
    - $/Year
    - $/Ship/Year, $/Aircraft/Year, $/System/Year
    - $/Flying Hour, $/Steaming Hour Underway, $/Operating Hour, Gallons/Flying Hour, $/Gallon
    - $/Person/Year,
    - $/Action/Year, Person Months/Action, $/Person Month
    - Parts/Action, $/Part
  - New estimates determine deltas in costs and metrics, apply new numbers of systems, equipment, Operational Tempo, etc.

Naval VAMOSC collects and reports historical Navy and USMC Operating and Support (O&S) data

$104+ B/year

Annual weapon system specific costs including DON Personnel

130 sources

Financial and non-financial data sources

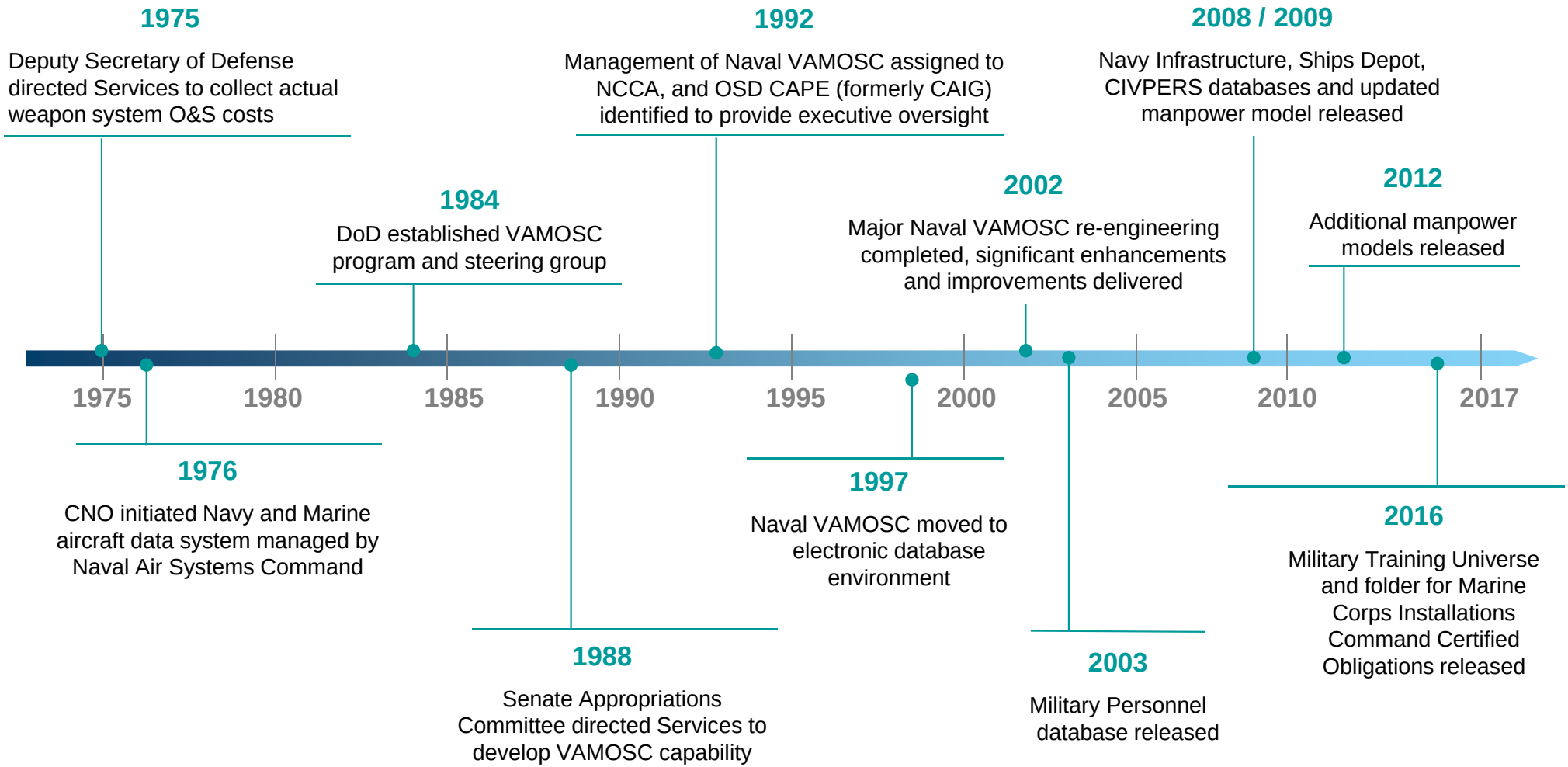
1200 Elements

O&S cost and non-cost elements

- Weapons systems direct and linked indirect costs
- Related non-cost operational and support data
- Costs in Then Year and Constant Year dollars
- Data presented in alternative hierarchical formats
  - Freeform maintenance/facilities databases
  - OSD CAPE 2014 and Navy Cost Element Structures

Material courtesy of Naval Center for Cost Analysis

VAMOSC continues to evolve and provide increasing value to its users



Material courtesy of Naval Center for Cost Analysis

Naval VAMOSC Components

Aviation

A/C Level Report	FY86-18
O&I Level Maint.	FY96-18

Ships

Ships	FY84-18
Military Sealift	FY93-18
Shipboard Systems	FY93-18
Depot Availability	FY93-18

Personnel

DON Military	FY02-18
DON Civilians	FY04-18
Military Training	FY11-18

USMC Ground Systems

Ground Systems FY95-18*

1,549 Ground Combat Systems and Weapons

Infrastructure

Navy Infrastructure FY06-18

CNIC Certified Obligations
MCICOM Certified Obligations
NAVFAC Property Records

Weapon Systems

Weapon Systems FY90-18

18 Air-launched missiles
9 Surface-launched missiles
5 Torpedoes

Material courtesy of Naval Center for Cost Analysis

2. What data is being collected? Why can't we get the kind of data we need?

The hypotheses

Hypothesis #1: Very little data is being collected

Hypothesis #2: Data is being collected at source but is not being shared beyond its immediate purpose

Hypothesis #3: Data is being collected and shared but is being aggregated/stored in a format that is not suitable for cost estimating

Hypothesis #4: Data is being collected and stored in suitable format but is localised and not widely shared

Hypothesis #5: Data is being collected in a suitable format in a central location but is not being shared

3. Review the hypotheses – gather knowledge from the room

Interactive bit!

No hypothesis is entirely right or wrong

- It will vary by domain and sub-domain
- It will vary by DLoD / budget item

Remember we are considering both cost and non-cost data required for O&S cost estimating

I will provide the first mole to whack at

Please throw your own moles into the mix

(No moles were harmed during the making of this presentation)

Hypothesis #1: Very little data is being collected

This seems unlikely to be true for any domain

- Bar code readers are likely to be pinging for logistics systems
- Safety critical systems require detailed maintenance tracking
- Personnel and training are carefully tracked
- Fuel deliveries must be captured to some extent

It may be difficult to assign some costs to assets or activities

Unexpected avionics system in the bagging area!

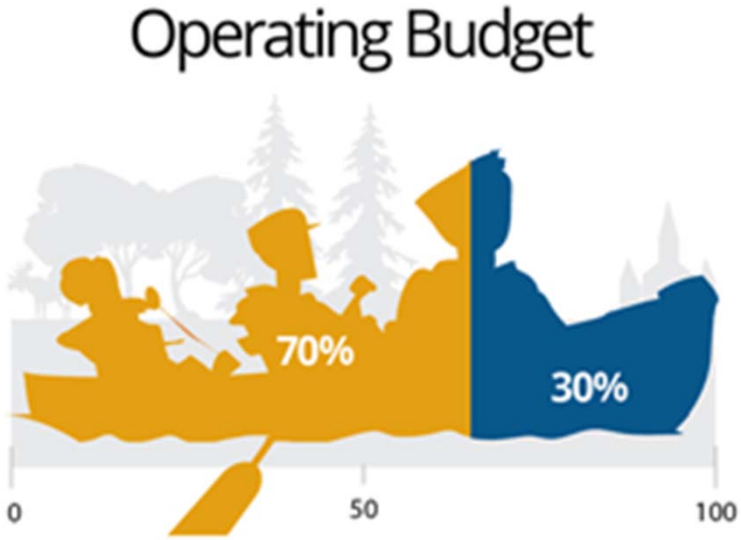
Hypothesis #2: Data is being collected at source but is not being shared beyond its immediate purpose

This seems unlikely to be true for any domain

- Commands require data for budgeting purposes so some information must be passed up the chain

But …

- Might be too aggregated for cost estimating purposes
- Might be missing the required non-cost information



Hypothesis #3: Data is being collected and shared but is being aggregated/stored in a format that is not suitable for cost estimating

This seems a more likely explanation of lack of data for cost-estimating

- Data is being aggregated into a format that is suitable for budget tracking by Commands and stored in this format
- Budget categories are too broad and insufficiently aligned to activity to be suitable for cost estimating purposes
- Appropriate non-cost information is not being captured
- Data that is suitable for cost estimators would also be useful for Commands since it will provide more of the "why" information to help identify opportunities for cost savings in the future

Hypothesis #4: Data is being collected and stored in suitable format but is localised and not widely shared

This is also likely to be true in some areas

- Good quality cost estimating is being done for specific programs
- Data has been collected by cost estimators for those studies and is being held locally
- Potentially the same data has been collected multiple times

Hypothesis #5: Data is being collected in a suitable format in a central location but is not being shared

To some extent it would be good if this was true, but if so, why is it not being shared?

4. What needs to happen to improve things, and where do we start?

Some initial suggestions – borrowing from US processes

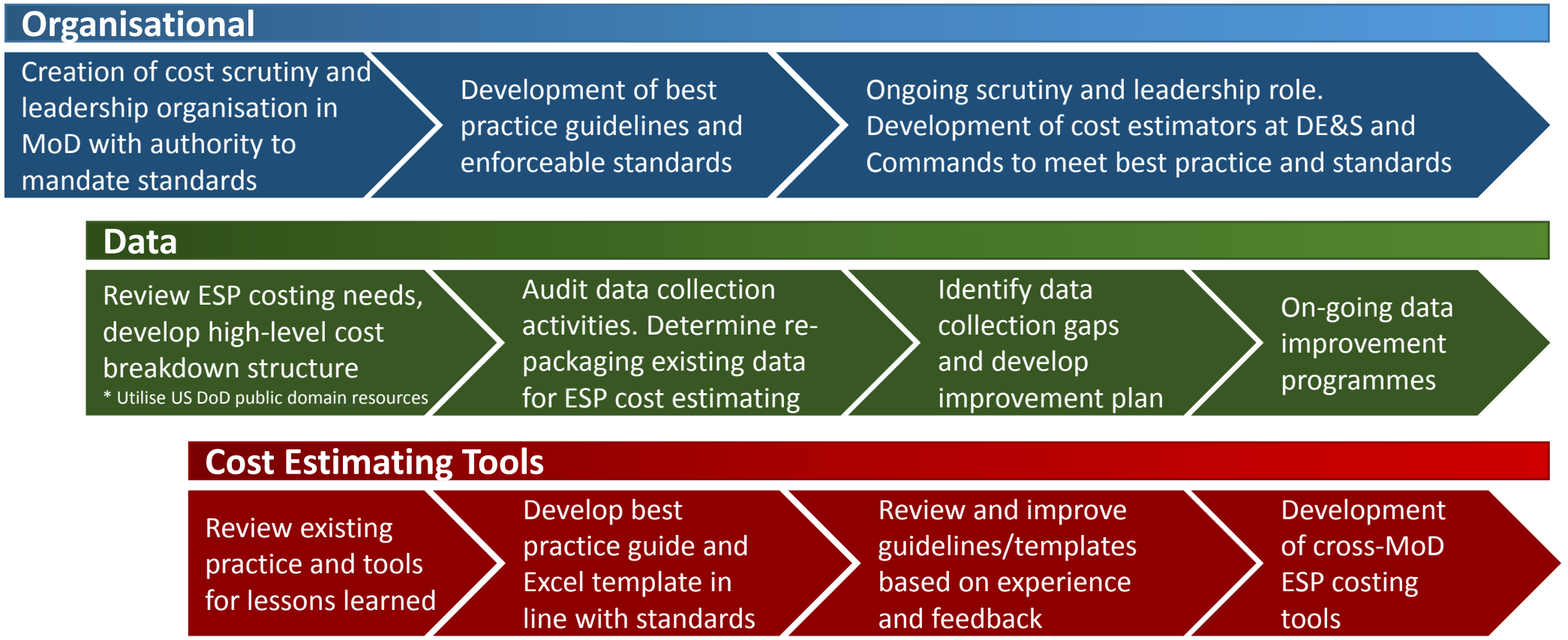
O&S (including ESP subset) cost estimating has long been recognised as a problem, but little progress has been made in resolving it.

- Commands have been investing in in-service cost data collection as part of budget management, but CAAS has stated that lack of good equipment support cost data is a major impediment to effective ESP cost estimating. This impacts ESP cost estimating for procurement gates, the 10 year plan, and the annual budget cycle.
- Budgeting and cost estimating needs differ. Although both use the same core data, the way it is "bucketed-up" differs. If data is only available in budget format it cannot be used for cost estimating.
- While CAAS has the role of centre of excellence for cost forecasting, it has no authority to direct more effective data collection.
- US DoD CAPE (Cost Assessment and Program Evaluation) combines the roles of cost scrutiny and centre of excellence. It provides advice on best practice, can reject procurement gate submissions on a cost and cost estimating approach basis, and has authority to mandate minimum requirements for data collection and cost estimating practice to each of the services.
  - Centrally available operating and support cost reporting systems are mandated (US Navy has VAMOSC, USAF has AVTOC, US Army has OSMIS).
  - An operating & support cost breakdown structure is specified for initial and main gate submissions, as well as other DoD reporting.
  - CAPE publishes best practice guides.
  - Much of the policy and advice provided by CAPE is in the public domain and can be referenced by MoD.

A potential road map for improving

The road map does not aim to replace the data collection activities of the Commands nor does it propose to a new large information system development programme. Instead, it proposes an incremental improvement process from what is currently being done.

The roadmap covers three areas of development: Organisational, Data, Tools.



Discussion

Thank You

For further information contact:

Dr Stephen Curram
stephencurram@das-ltd.co.uk

www.das-ltd.co.uk