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Implementing National Security Through Technology
How to deliver capability in an uncertain world

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Dstl have been undertaking research into ways to future-proof defence acquisition by implementing the National Security Through Technology (NSTT) white paper.

- The NSTT white paper was published in February 2012 and outlined a high level approach to transforming defence procurement, providing transparency to industry, and clarity to invest in the right areas whilst protecting both national security and the contribution that industry makes to the UK economy.
- Dstl has been tasked with providing underpinning research for MOD head Office to investigate a number of high profile areas including Operational Advantage and Freedom of Action, Defence Standards, Defence Exports, Open Systems and developing a better understanding of costs within the equipment and support programme, as well as providing practical support to the Defence Transformation programme.

Key Themes from the NSTT

The National Security Through Technology White Paper mandates "Greater emphasis on use of S&T to reduce long-term costs and improve affordability of our programmes".
The key themes from the NSTT are:

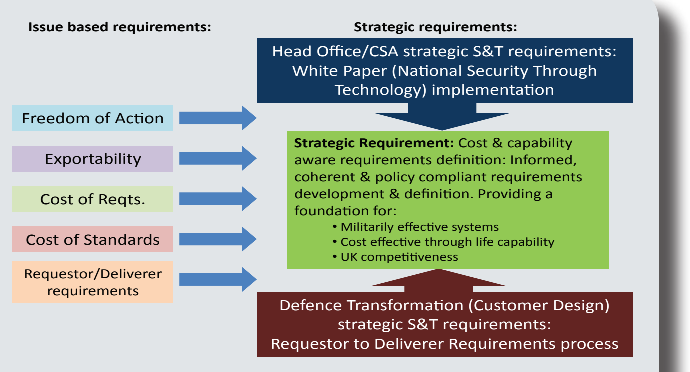
- **Value for Money – the Open Procurement principle**
  - Open competition
  - Off the shelf
  - Open Systems
- **Technology Advantage**
  - Sovereignty
  - Working with other countries
  - Technology
- **The UK defence and Security Industry**
  - Defence Exports

NSTT References

- National Security Through Technology: Technology, Equipment, and Support for UK Defence and Security
- Website: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/27390/cm8278.pdf

The Budgetary Resilience Project

- Under the Chief Scientific Advisor's Resilience Portfolio, the budgetary resilience project is responsible for delivering underpinning research and implementation support for the NSTT principles and defence transformation
- The Resilience portfolio delivered the following benefits:
  - The UK spends less to achieve its defence and security objectives;
  - The UK demonstrates increased operational effectiveness through agile capability acquisition;
  - The UK economy is stimulated by the implementation of an effective Defence Exports policy;
  - MOD is able to avoid future cost liabilities;
  - MOD has reduced vulnerability to supply risks from fuel and scarce or critical materials;
  - The UK preserves its operational advantage and freedom of action despite the impact of climate change and other factors;



Issue based requirements:

Freedom of Action
Exportability
Cost of Reqts.
Cost of Standards
Requestor/Deliverer requirements

Strategic requirements:

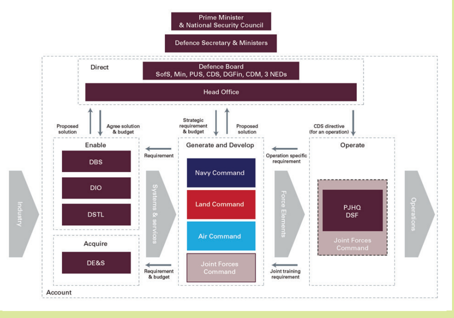
Head Office/CSA strategic S&T requirements: White Paper (National Security Through Technology) implementation

Strategic Requirement: Cost & capability aware requirements definition: Informed, coherent & policy compliant requirements development & definition. Providing a foundation for:
- Militarily effective systems
- Cost effective through life capability
- UK competitiveness

Defence Transformation (Customer Design) strategic S&T requirements: Requestor to Deliverer Requirements process

The budgetary resilience project

A changing defence context



The Defence Operating Model
(source Defence Reform: an independent report into the structure and management of the Ministry of Defence Ref: ISBN 9780108510663, ID P002437128)

- The Ministry of Defence is going through through an unprecedented period of change during peace time.
- The transition of financial authority to the Commands, Defence Operating Model and transformation of DE&S and its relationships with the Commands and MOD Head Office are revolutionising the way that defence does business.
- In addition, the defence environment has never been more uncertain: the future operating environment; austerity and shrinking budgets; the stability of the defence industrial base and increasing pace of technological change mean that procurement needs to become more responsive and agile

Support to Defence Transformation

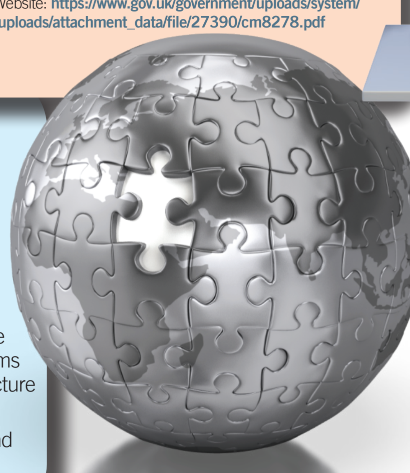
Strategic Partner
DES+
de&s
GOCO
Acquisition Blueprint

In 2013 Dstl ran a series of procurement scenario war-games with senior stakeholders to test the different options for the future structure of DE&S

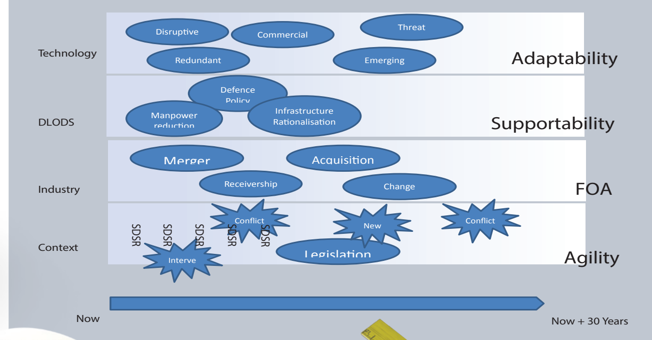
Defence Infrastructure Organisation

In 2013/14 Dstl undertook an enterprise systems analysis using the Viable Systems Model to support the Defence Infrastructure Organisation (DIO) change programme.

This work will be continuing in 14/15 and will be extended to cover DE&S.



Predicting the future



An Uncertain World

- Commercial technology is changing at an exponential rate – procurement strategies are needed to ensure that capabilities are future proof.
- Changes across the defence lines of development need to be anticipated and better represented in requirement trade offs
- A realistic understanding of industrial base issues and risks which impact upon Freedom of Action (FOA) need to underpin procurement strategy decisions
- There are a number of competing demands which impact on priorities for capabilities. Both the equipment and its procurement strategy need to be agile and able to keep pace with changing requirements.

Defence Standards

Research is ongoing to support the defence standards organisation to reviews how standards are delivered, and enable the appropriate use of commercial and international standards

Products **In Development** **Future Work**

Future Areas of Interest…

- Off The Shelf procurement
- Counterfeit Technology
- Procurement Behaviours
- Through life scenarios
- Approaches to System Safety

The Modular Open Systems Architecture Integrated Cost Model (MOSAIC)

Background

Open and modular systems use designs which are capable of extension, replacement. Open Systems enable this by adhering to freely available commercial standards, while modular systems are designed with the inherent ability to replace and reconfigure components.

Open Systems offer a potential solution to many of the issues faced by defence procurement. They could be an enabler for NSTT concepts such as FOA (open products could be sourced from multiple providers) and Defence Exports (by providing a cost effective way of developing national variants of a core capability). But by far the most significant benefit of open and modular systems is the cost savings that can be realised through life because of the use of commercial products, and simplification of integration and technology insertion activities throughout the project lifecycle.

Approach

A key problem with current procurement practices is generating evidence to decide whether or not to adopt the implementation of a modular or open system based on lifecycle costs.

In 2012, the Dstl Acquisition Policy Programme (the forerunner to the Resilience Portfolio) instigated a programme on behalf of DE&S to develop a Balance of Investment BOI framework that could support open and modular investment decisions. Arke ltd were contracted to undertake framework development.

Key requirements for the approach were that it would need to comply with JSP507, and be able to undertake "what if?" studies and pre-concept analysis through to investment appraisals and business cases. A 7 stage OSA process was developed, supported by a monte-carlo cost modelling simulation tool. This framework was named MOSAIC.

MOSAIC needs to be implemented by an experienced cost modelling team, it is not a simple parametric model. It can be used to compare up to three options against a baseline, and as well as assessing investments, it captures benefits and disadvantages associated with each option.

The MOSAIC 7 step process is shown in the figure to the right:

- **Step 1**, the global objectives are identified and set. These are applicable to all options. This includes defining the Cost Data Assumptions List, and stakeholder and budget holders who will provide date necessary to drive the assessment
- **Step 2**, the baseline architecture is defined and WBS to enable **Step 4**, a WLC estimate. During this stage assumptions are made about the lifecycle, including technology refresh and mid life updates.
- **Step 3**, open system options for relevant elements of the WBS are generated to enable, **Step 5**, forecasts for each option.
- An iterative process is then undertaken to capture (**Step 6**) risks and benefits associated with each of the options, undertake analysis (**Step 7**) and feed the results back into the option forecasts. This stage requires detailed participation from the stakeholders identified in Step 1.

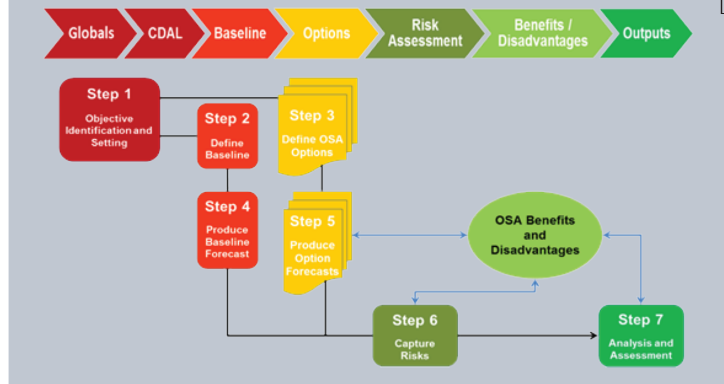
When the most significant risks have been assessed, MOSAIC then provides costs for each option across CADMID allocating costs to each of the budget holders.

A variety of output formats are available including a cumulative "breakeven" plot which identified the point at which Open Systems investment starts to demonstrate a cost saving over the baseline; a cost per system; an equivalent annual cost for the baseline and options and EPP/ESP year on year cash streams for each option

Status

To date MOSAIC has been used by DE&S project teams to support BOI decision making on 13 open system projects including: GVA on Challenger and Foxhound; the Active Integrated Protection System; Maritime Combat System projects including T23 and FLAADs; and the helicopter Common Defensive Aids System (CDAS)

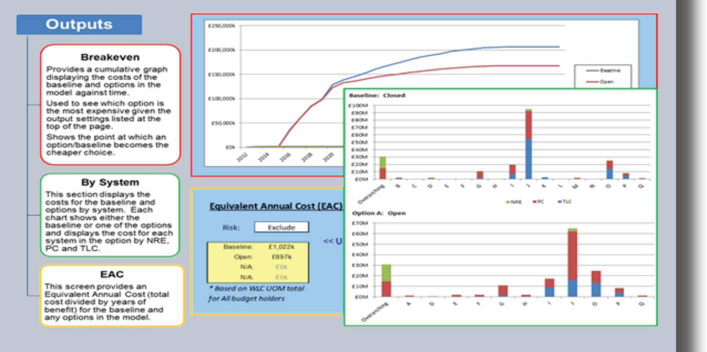
Arke Ltd



Globals → CDAL → Baseline → Options → Risk Assessment → Benefits / Disadvantages → Outputs

Step 1 Objective Identification and Setting
Step 2 Define Baseline
Step 3 Define OSA Options
Step 4 Produce Baseline Forecast
Step 5 Produce Option Forecasts
OSA Benefits and Disadvantages
Step 6 Capture Risks
Step 7 Analysis and Assessment

The MOSAIC 7 stage model



Outputs

Breakeven
Provides a cumulative graph displaying the costs of the baseline and options in the model against time.
Used to see which option is the most expensive given the output settings listed at the top of the page.
Shows the point at which an option/baseline becomes the cheaper choice.

By System
This section displays the costs for the baseline and options by system. Each chart shows either the baseline or one of the options and displays the cost for each system in the option by NRE, PC and TLC.

EAC
This screen provides an Equivalent Annual Cost (total cost divided by years of benefit) for the baseline and any options in the model.

Examples of Mosaic Outputs

The Operational Advantage (Op Adv) and Freedom of Action (FOA) framework

1. Understand	1.1	Ability to identify and understand how to access the BWE and achieve Op Adv and FoA
	1.2	Ability to set requirements that optimise Op Adv and FoA
	1.3	Ability to understand risks in the supply chain
	1.4	Ability to identify investment requirements and priorities for skills development
2. Acquire and deliver effective BWE	2.1	Ability to gain effective access to critical capability elements through time (consider accessibility of UK and non-UK sources)
	2.2	Ability to effectively exploit accessible critical capability elements through time (UK and non-UK)
	2.3	Ability to prevent third party from exploiting vulnerability in supply chain
	2.4	Ability to prevent third party from exploiting unintentional vulnerability in system design
3. Ability to use acquired capability effectively	3.1	Ability to understand performance of system under specified conditions in theatre
	3.2	Ability to use how, when and where we need to, at performance level required
4. Sustaining Op Adv and FoA through technology	4.1	Ability to keep pace with threat evolution; regulatory or environmental changes
	4.2	Ability to effectively maintain systems
	4.3	Ability to effectively insert new BWE technologies into existing systems/sub-systems
	4.4	Ability to prevent third party exploitation of recovered equipment / information / capability

The operational Advantage and Freedom of Action Framework

"Operational advantage is the ability to find and maintain an edge over potential adversaries, both to increase the chances of our success in hostile situations and to increase the protection of the UK assets involved, especially our people. This is also fundamental to the overall effect that a given capability can achieve."

"we often need superior technology and other forms of battle-winning edge (so-called "operational advantage")

"Freedom of action is the ability to determine our internal and external affairs and act in the country's interests free from intervention by other states or entities, in accordance with our legal obligations. This freedom is the essence of national sovereignty. It is also essential to be able to use a capability effectively, although not at any cost ………
…… able to use them – or continue to use them – whenever we need to; and that when we do so, they will perform as we require."

"we must be able to operate, maintain, and refresh certain capabilities effectively, without being dependent on others (so-called "freedom of action")

Background

The Defence Industrial Strategy, published in 2005, set out those industrial capabilities needed to ensure that the UK could continue to operate its equipment in the way that it chose. The NSTT introduced the new terms Operational Advantage (Op Adv) and Freedom of Action (FOA), and acknowledged that:

"Procurement in the defence and security areas is, fundamentally different from other forms of procurement, so we will also take action to protect the UK's operational advantages and freedom of action, but only where this is essential for our national security". (NSTT white paper)

Implementation of the White Paper requires the MOD to develop an understanding of what Op Adv and FoA it will need to protect.

Approach

In 2013, the Directorate of Exports and Commercial Strategy (Industrial Policy) (DECS(IP) commissioned Dstl to undertake rapid development and test design of a risk assessment framework that would enable the Front Line Commands to take a consistent approach in complying with the White Paper principles.

- The framework (shown in the table to the left) was developed to identify issues and risks associated with four different aspects of capability ownership:
- Having enough understanding of and access to Battle Winning Edge (BWE) to develop, achieve, and support Op Adv and FOA (being the intelligent customer)
- Having the ability to acquire the capability and its critical elements over time without the risk of exploitation by third parties
- Having the ability to operate the capability effectively under future operational conditions
- Having the ability to sustain BWE over time, responding to technology challenges, obsolescence and technology refresh issues and robustness to operational exploitation

Using the Framework

The framework should be used to identify risks at key acquisition and support decision points during the capability lifecycle, across the CADMID cycle, and including capability refresh and upgrades. The framework provides a 'handrail' to enable desk officers to identify categories of risk that are important to their projects.

The capability must first be broken down into constituent elements (and subsystems) at a level of abstraction appropriate to the decision point within the cycle – although for early assessments, it may be more appropriate to identify issues associated with the entire capability. Individual DLODs can also be used as a basis for assessment.

Different procurement strategies and options can also be used as a criteria for assessment either to highlight issues with particular technologies during concept, or to distinguish between options during assessment.

The framework can then be used to identify and assess risks against each of the categories and for each of the subsystems. The framework has two levels in its hierarchy, but for early assessments, the information to complete the lower level is unlikely to be available, and should be used for information and guidance. Some questions will either not be relevant for particular capabilities/decision points, or the information will not be available during the current lifecycle stage.

Following the assessment, the risks either need to be entered into the risk register of the project or programme being assessed, or used to initiate more detailed investigations. Where the MOD identifies significant risks to Op Adv and FOA that need to be addressed, the assessment outputs can be used to support BOIs for mitigation strategies

Status

IIn late 2013 a series of pilot assessments were undertaken with personnel from the Front Line Commands, DE&S and Industry to assess the suitability of the framework to assess projects in Concept and Assessment. The success of these pilot assessment has led to the framework being adopted across significant areas of the Command Portfolios.

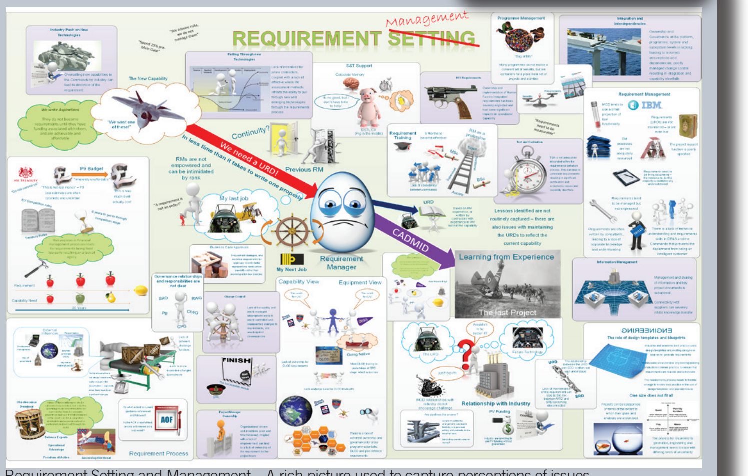
The next stage of work, to be undertaken in late 2014, will be to trial the framework on a number of more mature projects and programmes within DE&S. If successful, the framework will provide a standard tool for the assessment of Op Adv and FOA risk under the future Defence Operating Model.

Support to Customer Design

The Levene report stated that requirements setting and understanding of the cost drivers has been a major issue in Defence procurement resulting in an overheated programme and poor interface between DE&S and the Commands.

Customer Design is the MOD Head Office organisation responsible for designing the future Acquisition System including the interface between the Commands and DE&S.

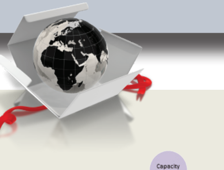
Developing a robust approach to requirement setting and management is essential to ensure that an achievable and cost effective equipment programme can be delivered .



Requirement Setting and Management – A rich picture used to capture perceptions of issues

Dstl is currently undertaking an investigation of requirements setting and management within MOD, focusing on case studies to illustrate examples of good and bad practice. Analysis of the results will be used to support the design of the Intelligent Customer (Requester) - Deliverer interface under the future Defence Operating Model.

https://www.gov.uk/government/publications/defence-reform-an-independent-report-into-the-structure-and-management-of-the-ministry-of-defence--2



Supporting Defence Exports

In 2013/14 Dstl undertook an assessment of the MOD's approach to defence exports:

- Its not about changing Military requirements so that the MOD buy more UK equipment!
- Its about setting requirements that are able meet UK military needs whilst also being aligned with the needs of development partners and export customers.

As well as economic benefits of scale, this approach will also enhance sovereignty and increase opportunities for shared development.

This study will be ongoing throughout 2014/15 with the development of an assessment framework, and studies comparing the approaches taken by other nations.

A map of the benefits of Defence Exports

There is a strong relationship between Op Adv and FOA and Defence Exports. The frameworks are being developed to complement each other, and tie in with the requirement setting and management studies.

The intention is to provide guidance to delivery teams and project sponsors to enable the potential benefits of exports to be identified at an early stage of the procurement process so that features that enhance exportability such as modular architectures and assurance measures can be incorporated in the early design with a reduced cost overhead.