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## Statement of Requirement for the R-Cloud Operational Research Strategic Capability

### Introduction:

The Defence Science and Technology Laboratory (Dstl), which is part of the UK Ministry of Defence (MOD), is refreshing its commercial agreement for Science and Technology (S&T) research contracts, known as R-Cloud (Research Cloud).

MOD places extensive fundamental, experimental and applied research with industry and academic suppliers and wants to broaden access for this supply base, reducing the cost of trading with MOD and enabling agile contracting. R-Cloud complements MOD's other contracting mechanisms and academic and industry suppliers of S&T research are now invited to apply to join MOD's research supplier community within the Operational Research Strategic Capability.

This statement of requirement relates to suppliers joining R-Cloud within the Operational Research capability area. R-Cloud provides a low barrier to entry for potential suppliers and offers direct access to MOD's current and future research requirements. Academic and industrial suppliers of Operational Research are invited to apply to R-Cloud if you are a supplier of Science and Technology Research in this area.

This document describes overarching requirements for the Operational Research (OR) strategic capability that will be drawn upon when placing work via R-Cloud.

*"The Operational Research capability helps Users with complex policy, planning and operational problems using analytical methods and techniques. It enables evidence-based decision-making through the development and application of rigorous analysis and decision support approaches. It comprises single and multiple disciplinary methods, models, techniques and tools (drawn from the applied sciences, formal sciences, humanities, natural sciences and social sciences) to inform evidence-based decisions across Defence and Security."*

Dstl Science and Technology Planning framework

Within UK Defence, the term Operational Analysis (OA) is often used synonymously with OR.

The OR capability relies on inputs, data and qualified people from almost all other strategic capabilities and those capabilities, in turn, need to draw on OR for evidence-based support to their decision making. R-Cloud tasks will often be let spanning multiple strategic capabilities, using OR as both a driving and as a supporting strategic capability. Suppliers with deep OR



specialisms are therefore encouraged to sign up to those areas in which they have domain expertise in addition to the OR area.

For example, the design of a munition may be subject to analysis to optimise the stability of its flight through the air. Operational Research could be used to examine the impact increased stability could have on factors such as tactics, the number of systems required and probability of success in military Operations.

This requirement covers:

- the conduct of OR studies to inform decisions;
- design, development, trial, testing, maintenance, modification and repurposing of techniques, tools, methods, models and computer hardware and software in order to conduct OR;
- collection, collation, cleaning, synthesis, management, storage and wrangling of data to enable OR;
- OR directly linked to science and technology research and development.

### **Requirements for the approach to OR tasks**

Over the next few years, MOD anticipate that the boundaries between Defence and Security will become less distinct. MOD aim to share our data and models seamlessly within security constraints, use data from outside of Defence and Security to fill gaps, and embrace a contemporary approach to communication of findings. We strive to work with suppliers and partners new to Defence and Security who can bring fresh ideas and perspectives.

We are looking to work with companies who are:

- New to Defence and Security but or willing to learn enough context in order to apply ideas and conduct OR;
- Experienced in Defence and Security, and willing to work constructively, openly and collaboratively with other companies;
- Able to create modern, interactive and potentially sophisticated visualisations and use innovative ways to communicate findings;
- Expert in one or more OR methods, or have made innovations around applications of techniques;
- Willing to work with us to bring techniques into common usage (which typically requires robust demonstration and support);
- Ready to work with data of variable age, provenance and relevance and find ways to improve it for application to problems, wherever possible making improved data available for subsequent work regardless of who conducts it;
- Willing to find or generate new data sets and apply them to Defence and Security;
- Prepared to constructively challenge the way MOD conducts and delivers OR in order to drive continuous improvement.

### **Requirement for use of OR techniques**

Requirements let under the OR R-Cloud area may require a diverse range of OR techniques to be used, developed or enhanced either individually or in combination. Examples of categories of techniques are:

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*Appraisal and evaluation techniques, basic modelling, communication, data collection approaches, data science techniques (including machine learning), economic techniques, forecasting techniques, heuristics, optimisation methods, performance measurement, problem structuring, qualitative techniques, scenario based techniques, simulation, statistical techniques, visualisation and wargaming.*

This list is not exhaustive. There are many specific techniques within each category and novel techniques that do not fall into any category; all are in scope if they can add value to OR problems. This requirement neither places specific requirements on technique specialism in suppliers, nor makes constraints on techniques that may be requested in OR tasks. However, **MOD welcomes and encourages declaration of specialisms by suppliers as part of the R-Cloud signup process.**

Suppliers are required to demonstrate appropriate knowledge and expertise in techniques where requested by MOD in specific tasks. Where suppliers are proposing techniques, MOD also require suppliers to be able to explain and justify their merits in the context of the specific task.

### Requirement areas

There are three overarching OR requirements within R-Cloud: (1) Decision Support, (2) Enabling OR Services and (3) Science and Technology research linked OR.

### Requirements for Decision support OR

**Strategy, policy and enterprise level decision support.** Tasks in this area will provide OR to support decision makers with strategic and wider reaching issues that could have a profound effect across Defence and Security. This will usually be at the early stages of strategy or policy formulation and comprises:

- Identifying geo-political drivers, regional contexts, futures and trends;
- Development, analysis and testing of Defence and Security strategy and policy options;
- Understanding the cost-effective balance across capability perspectives (e.g. manpower, equipment, enablers, training) at the enterprise level (including Defence industry);
- Scenario development and assessment (detailed contextual situations to test military capabilities, often set in the future);
- Historical analysis across Defence and Security to provide evidence for future planning.

**Capability decision support.** These studies provide OR to support decision makers with capability planning and decisions relating to delivery options for capabilities within current and future force structures across and within air, land, maritime, space, cyber and joint environments, and across the majority of the other strategic capabilities. This embraces enabling capabilities (“enablers”, such as communications), as well as



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assessment across the breadth of Defence Lines of Development<sup>1</sup> (DLODs) and their equivalents in the broader Security environment.

OR work placed via R-Cloud will usually support the earlier phases in the lifecycle of capabilities, and will not typically directly inform equipment investment decisions. Requirements may include:

- Development of system, organisational elements of the armed forces and enabler capability options, including collection and collation of necessary and sufficient cost and performance data;
- Assessment of the appropriate balance between capabilities required and associated organisational elements and enablers within a domain;
- Defining the necessary missions (roles, tasks and tactical situations) for individual systems, capabilities, force elements, support and enablers to meet scenario and broader requirements.
- Assessment of the cost effectiveness and cost benefit of alternative investments, including military capabilities and organisational, process and business options.

**Defence and Security business space analysis and decision support.** To provide OR related to organisations including back-office support, systems and processes across Defence and Security environments. Requirements may include OR to examine:

- Organisational structures;
- Infrastructure options;
- IT options.

**1. Requirements for enabling OR Services.** To provide services to enable the conduct of OR, including:

- Development, operation, modification and maintenance of enduring OR and analysis capabilities, including models, methods and tools. This includes testing, fixing of bugs as they are identified, and advising on and implementing improvements to models and tools;
- Development, operation, modification and maintenance of digital twins of systems or capabilities that may be linked to their physical equivalents (including assets in active service) to enable OR to support rapid insight generation and continuous improvement;
- Verification and Validation of models, methods, tools and previous OR studies to assure that the rate of errors is reduced to an appropriate level, and outputs adequately represent the systems or situations being examined;
- Collection, collation and delivery of required data to support OR tasks;
- Technical OR advice;
- Running trials and experiments to generate data, or test the efficacy of solutions derived using OR in real world contexts, (e.g. a military exercise).

**2. Requirements for science and technology research linked OR**

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<sup>1</sup> 'Defence Lines of Development' (DLODs) include training, equipment, personnel, information, doctrine and concepts, organisation, infrastructure and logistics. The DLODs provide a useful summary of the range of factors that we need to consider when making decisions on capability and force structure.



This type of requirement is directly linked to science and technology research and development within other strategic capability areas. Tasks will have elements of OR and areas of work covered by other R-Cloud statements of requirement, for example manufacturing or laboratory based work. There will usually be clear benefits from delivering the OR and non-OR elements together.

The majority of R-Cloud OR requirements are anticipated to fall within this category. Examples are listed in Table 1. These are indicative of the types of requirement in this category; the list is not comprehensive.

STRATEGIC CAPABILITY	EXAMPLES OF LINKED OR
Above water systems	Supporting OR, which may be linked to scientific or technology development into: Anti-Air Warfare, Anti-Surface Warfare, Maritime Fires, Maritime Force Protection, Maritime Logistics or ship design.
Advanced materials	OR to examine the military strategic or operational impacts of using advanced materials, potentially coupled with development activities, direction and design of trials.
AI & Data Science	Application of existing, new, experimental, or partially developed AI & data science techniques to solve real OR problems.
Air Systems	Supporting OR, which may be linked to scientific or technology development into offensive effects, Air enablers, Air Operations in the information age or cost engineering.
CBR	To support the understanding of the impact that chemical or biological substances may have on the UK or its armed forces whilst deployed overseas, including methods for understanding risk, and conducting balance of investment and cost-effectiveness assessments of potential mitigation measures.
Communications and networks	OR supporting the employment of novel future communication techniques and their place in command and control structures for future operating environments, including during military trials.
Cyber	OR to help assess and test cyber resilience, dependency and effectiveness, concepts of operation analysis, potentially linked to cyber technical activity or research.
Electromagnetic activities	OR to examine the impact of electromagnetic (EM) concepts for UK forces' freedom of operation, whether in the air, at sea, on land or in cyber space including synchronisation and coordination of EM activities, understanding and accessing the EM spectrum and electronic attack (including delivery of the EM effects: deception degradation, disruption, denial and destruction).



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STRATEGIC CAPABILITY	EXAMPLES OF LINKED OR
Explosives and energetics	OR in support of development or use of detection, diagnostic, identification and disposal systems for current and emerging explosives threats (including search dogs for explosives detection), assisting understanding of the home-made explosives threat and choices surrounding employment of low-technology-readiness concepts.
Homeland Security and CT systems	OR to support balance of investment and cost-effectiveness assessments of potential mitigation measures, methods for identifying and predicting threats and modelling, simulation and war-gaming supporting situations.
Human & Social Sciences	OR that examines non-traditional issues such as cognitive perspectives and social factors, and their integration into OR considering the wider problems including kinetic effects. Work could be linked to fundamental human and social science research.
Information systems	Decision making in the Information age requires leaders to have access to the best information as quickly as possible. OR in this area may seek to exploit novel information approaches for other problems, or inform development by for example supporting balance of investment decisions.
Land Systems	OR supporting assessment of operational advantage linked to land environment-focused research, for example protection, systems integration or prototypes of future concepts.
Robotics and Autonomous systems	OR supporting the needs, numbers and effectiveness of autonomous systems, risk and cost minimising, which may be linked to ongoing concept or technology development activity.
Sensing	OR analysing the potential impact of the next generation of novel sensor technology, or optimising ways to employ sensor systems.
Space Systems	OR to support work to help the UK exploit the full potential of space for Defence and Security, including around emerging concepts, hazards, or on future funding or capability requirements.
S&T Futures and Incubator	OR around the benefit and impact of emerging Science and Technology areas, including its means of employment and to support Decision making on future S&T and capability investment across Defence and Security.
Strategic Systems	OR supporting S&T research in the field of missile defence, strategic technologies and the provision of advice in strategic systems to senior decision makers.



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STRATEGIC CAPABILITY	EXAMPLES OF LINKED OR
Survivability	<p>A very closely linked strategic capability. OR informs integrated survivability analysis studies into platforms, personnel, structures in any domain. Including:</p> <ul style="list-style-type: none"> <li>• Definition, design, development, realisation and use of weapon assessment methods, techniques and models;</li> <li>• Techniques and metrics to assess the balance of effector performance against threats, including kinetic and non-kinetic options (e.g. electronic attack).</li> <li>• Cost of survivability features;</li> <li>• Support to the maintenance and development of Integrated Survivability models;</li> <li>• Development of tools and techniques to assist in the capture and analyse casualty data.</li> </ul>
Underwater Systems	<p>Supporting OR, which may be linked to scientific research or technology development into: Anti-Submarine Warfare, maritime geospatial information / Intelligence activities, maritime mine countermeasures, submarine Warfare, general underwater battlespace activities.</p>
Weapons	<p>Supporting capability investigation and technical research studies into future capability requirements.</p>

*Table 1: Examples of OR linked to requirements in other Strategic capabilities*