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Statement of Requirement for the R-Cloud Multi-Domain Systems Integration Strategic Capability Element

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 Multi-Domain Systems Integration (MDSI) element of the wider Multi-Domain Systems strategic capability.

This statement of requirement relates to suppliers joining R-Cloud within the MDSI capability element. 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 MDSI research are invited to apply to R-Cloud if you are a supplier of Science and Technology Research in this area.

MDSI complements the Maritime Systems, Land Systems and Air Systems elements of the wider Multi-Domain Systems Strategic Capability. It addresses the cross-domain and system-of-systems integration problems that sit between, above or across those domain elements.

Multi-Domain Systems Integration encompasses a broad range of technical areas, summarised here:

Multi-Domain Systems Integration (MDSI)

The ability to develop, evaluate and assure system-of-systems solutions, operational architectures, mission threads and decision-support approaches that integrate systems, information, effects and dependencies across multiple domains.

Capability sub-elements are outlined below:

Enterprise Architectures and Domain-Agnostic Enablers



S&T to create and assess enterprise, operational, system and technical architectures; open and modular approaches; interoperability approaches; and enabling methods and tools that can be applied across multiple domains.

Cross-Domain Concepts and Force Design

S&T to support cross-domain concepts of operation, concepts of use, force design options, mission-level capability concepts and analysis of how multi-domain effects and information must be combined to deliver operational advantage.

Mission Threads, Kill Chains and Integrated Sense-Decide-Act Chains

S&T to analyse and integrate end-to-end mission threads and sense-decide-act chains across platforms, services, systems, data, people, infrastructure and Defence Lines of Development.

Digital Engineering, Modelling, Simulation and Experimentation

S&T to develop and apply digital engineering, modelling, simulation, synthetic environments and experimentation approaches for cross-domain and system-of-systems problems.

Integrated Decision Support and Trade-Off Analysis

S&T to develop evidence, methods and tools that support cross-domain decisions, including mission-level measures of effectiveness and trade-offs between lethality, survivability, resilience, connectivity, autonomy, sustainability, cost and risk.

Statement of Requirement:

The work undertaken in this capability element aims to maximise the exploitation of S&T into coherent, integrated Defence capability across multiple domains. MDSI focuses on problems where a single-domain solution is insufficient, where significant integration risk exists across system boundaries, or where decision-makers require evidence on the performance, interoperability, sequencing or trade-offs of a system-of-systems.

The following areas of research are in scope for R-Cloud:

Multi-Domain Concept Development and Force Design

- Development and analysis of cross-domain concepts of operation and concepts of use.
- Mission-level and force-level capability concept development, including options that combine capabilities from maritime, land, air and relevant specialist domains.
- Analysis of future operating environments and their implications for cross-domain system design and force integration.
- Development of operational vignettes, mission scenarios and measures of effectiveness for cross-domain capability assessment.

Enterprise and System-of-Systems Architecting



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- Development and assessment of enterprise, operational, system and technical architectures spanning multiple platforms, services and domains.
- Architecture methods and tools for interoperability, open systems, modularity, legacy/new system integration and transition planning.
- Identification of system boundaries, ownership, dependencies, interface requirements and architectural risks across organisations and domains.
- Support to development of reference architectures and reusable architecture patterns for multi-domain capability problems.

Mission Threads, Kill Chains and Sense-Decide-Act Integration

- Analysis and integration of end-to-end mission threads and kill chains across sensors, effectors, command systems, communications, platforms, operators and supporting infrastructure.
- Assessment of information flows, data dependencies, decision timelines and resilience under contested, degraded or disrupted conditions.
- Identification of gaps, bottlenecks and interoperability risks that prevent coherent mission delivery.
- Development of evidence to support design decisions for integrated sense-decide-act chains.

Cross-Domain Requirements and DLOD Coherence

- Requirement setting, requirement engineering and requirement management for integrated capability rather than single-platform acquisition alone.
- Analysis of DLOD coherence for capabilities that span multiple platforms, services, domains or organisations.
- Identification of transition, adoption, training, support, policy, infrastructure and organisational constraints affecting integrated capability delivery.
- Support to problem statement development, options analysis and early lifecycle decision-making.

Information, Mission and Decision Systems Integration

- Information systems interoperability across domains and mission systems.
- Common information architectures, data models, interface definitions and integration patterns for system-of-systems operation.
- Design and assessment of machine-machine and human-machine teaming at force and mission level.
- Decision-support approaches for commanders, operators, acquisition teams and system integrators.

Digital Engineering, Modelling, Simulation and Experimentation

- Development or assessment of software, tools, models and methods to represent integrated capability performance.
- Digital engineering approaches that link mission threads, architectures, requirements, evidence, risks and design choices.
- Synthetic environments, modelling and simulation, wargaming, experimentation and trials approaches for multi-domain and system-of-systems problems.
- Integration of evidence from domain-specific models and tools into coherent mission-level assessments.

Integrated Performance, Trade-off and Decision Analysis



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- Measures of performance and effectiveness for cross-domain missions and integrated capabilities.
- Trade-off analysis balancing lethality, survivability, mobility, connectivity, autonomy, resilience, sustainment, cost and risk.
- Assessment of capability options where performance in one domain depends on actions, information or enabling capabilities in another.
- Evidence synthesis and decision-quality reporting for MOD and wider Defence decision-makers.

Integration of Cross-Cutting Specialist Capability Inputs

- Integration of specialist inputs from Survivability, RAS, Weapons, Human Systems, Cyber, Space, Sensing, Navigation, C4IS and other relevant capability areas into coherent cross-domain solutions.
- Translation of specialist evidence into system-of-systems design choices, mission architectures and operational concepts.
- Identification of where specialist capabilities remain responsible for technical depth and where MDSI provides the integrating context.
- Support to avoid duplication between domain-specific S&T and cross-domain integration activity.

Experimentation, Demonstration and Transition Support

- Experimentation and demonstration support for integrated concepts spanning multiple domains.
- Test and evaluation approaches for system-of-systems and mission-level capability.
- Support to transition integrated concepts into acquisition, force structures, service experimentation and operations.
- Configuration, assurance and exploitation planning where multiple domain systems interact.