Statement of Requirement (SoR)

Purpose

This document is for new Extra-Mural (EMR) Contracts. Use the [REDACTED] *page when filling out this SoR and a supporting RCA. Please seek assistance if desired from* [REDACTED] *or your Divisional Procurement Representative.*

This document is supplier facing and the RCA is an internal document. Please delete non-essential grey text before issuing externally/ to suppliers.

Reference Number	[REDACTED]
Version Number	**1.6**
Date	**03/08/2022**

1.	**Requirement**
1.1	**Title**
	Quantum Computing Application to ISR Planning and Re-Planning for Decision Support
1.2	**Summary**

	The aim of the Quantum Computing Application to ISR (Intelligence, Surveillance, Reconnaissance) Planning and Re-Planning for Decision Support project is to increase technical understanding of the opportunities, algorithmic issues and system architectural issues associated with the future use of quantum computing to support the optimisation of the planning, operation and effectiveness of distributed, mobile battlefield active (eg. radar) and passive (eg. EO/IR) sensors. The project complements the existing Quantum Computing Application to Sensor Management project in this aim but is focussed on the use of quantum computer enabled optimisation within higher level planning and re-planning processes. It should be noted that the emphasis of this project is firmly on: a. The research and development of relevant quantum computing technical approaches, algorithms, information representation and interfaces applicable to task planning and re-planning. b. The implementation and testing of these using currently available quantum circuit computers. Potential suppliers should also note that task planning and re-planning techniques and approaches that are able to take into account multiple types of real world constraints during the determination of the feasibility of plans are considered to be the most relevant for the project.
1.3	**Background**

This work forms part of the project “AI and Autonomy for the ISR Enterprise (A2ISR)”, which seeks to release capacity and maximise understanding in our ISR enterprise in order to maintain Information Advantage. Specifically it will demonstrate a:

- World leading ISR capability, closely coupling ‘exploit’ and ‘collect’ throughout the ISR hierarchy, enabling collection tasking to be created dynamically and opportunistically, and AI enhanced PED from the core to the edge; and a

- Data-led and AI-enabled Intelligence Analysis function constrained by the available data, algorithms and computational power, rather than capacity of human operators.

The overall project is addressing one of the five core capability challenges identified in the 2020 MOD Science and Technology Strategy. It supports the development of generation-after-next capabilities. This requires it to work with cutting edge and innovative suppliers in industry and academia at pace.

The Quantum Computing Application to ISR Planning and Re-Planning for Decision Support project is designed to investigate the use of quantum computers to carry out the types of repeated, computationally intensive, near real time optimisation calculations involved in automated planning/re-planning processes. On current conventional hardware, such calculations are generally not feasible for large numbers of entities, actors or significant, real-world scenario complexity.

Potential suppliers should note that there are a number of other existing work items within the A2ISR project which address the research and development of new approaches to key ISR and related Sensor Management functions (eg. task decomposition, sensor scheduling, decision aiding). Hence, the focus of the Quantum Computing Application to ISR Planning and Re-Planning for Decision Support project is firmly on investigative research and development to ascertain whether quantum computing technology may potentially provide a means to overcome current processing limitations and deliver orders of magnitude improvement in speed for planning related optimisation calculations.

[REDACTED] For the purposes of this project, it is assumed that this planner will receive a number of different types of data/information inputs provided by other sub-systems that are not the subject of this project. For example, the types of data/information inputs might be:

i. Scenario information requests from task/goal decomposition functions - these scenario information requests might typically be lower level elements within graph based task/goal decomposition trees or lattices in which tree/lattice structures, task/goal node priorities, node mission values and node related constraints change dynamically in response to prevailing higher level situation assessments and task/goal prioritisations.
ii. List(s) of available ISR assets, including platforms, sensors and their associated capabilities from dynamic ISR asset/resource database(s) - these representations might typically be in the form of database entries covering platform and sensor status, performance characteristics and constraints.
iii. Existing target track information and/or, more generally, target state information for targets of interest – this information might typically be in the form of dynamic outputs from trackers, associated state vectors and descriptive text elements.
iv. Current probability estimates related to the areas/directions in which next targets of interest are likely to appear – This type of cueing information might typically be in the form of a set of discrete density functions associated with each part of the search space.

	For the purposes of this study, it is also assumed that the planner will output action requests and low level, dynamic tasking information. For example, these outputs might include: i. Sets of sensing/observation and platform positioning requests – these requests might typically be produced, directed and scheduled based on the optimisation of the value of the information requested, sensor mode compatibility with the required scenario information task/goal, the relative values of the information that each sensor can produce, sensor availability and likely time to produce the required observation (this might need to take into account time constraints and sensor/platform repositioning). ii. Sets of dynamic goals – These might typically be low level task/goal nodes compatible with the structures produced by the higher level task/goal decomposition function(s), but representing a transition from tasks/goals to actionable functions, ie. Types of sensing/observation functions associated with the range of available sensing functionality and platform related functions associated with positioning/re-positioning. The designs of the planner interfaces, inputs, outputs and algorithms will need to take into account information dynamics and constraints in order to support the type of multi-element, battlefield ISR mission task planning and task re-planning that is of interest for future, fast moving war fighting scenarios. In such cases, the availability of ISR sensing assets is likely to be limited at the best of times, asset repositioning may take a relatively long time, assets will be added and lost during operations and asset tasking will need to be reprioritised during the conduct of operations. To aid potential Suppliers in their thinking about context, mission planning and high and low level task decomposition outputs, a simple hypothesised operational vignette has been outlined within the accompanying Annex.
1.4	**Requirement**
	The Quantum Computing Application to ISR Planning and Re-Planning for Decision Support project has been divided into two phases. The initial contract is for the conduct of Phase 1 work only. Phase 2 is subject to contract. Phase 1 comprises a number of subtasks. **Requirements for Phase 1** **Task 1: Input and output data/information, interfaces, processing and context assumptions for a quantum enabled planner** **Subtask 1/1** – To support the execution of optimisation tasks associated with ISR mission planning/re-planning on quantum computers, the Supplier(s) shall research, define, develop and assess the requirements for quantum enabled planner input data/information and suitable formats for this data/information. The Supplier(s) shall make clear their assumptions regarding the source sensor management sub-systems for the input data/information, particularly with regard to the methods by which high level command tasks/goals are decomposed, the methods by which values and priorities are assigned to tasks/goals within the decompositions and the methods by which available platform and sensor resources are identified. **Subtask 1/2** – The Supplier(s) shall research, define, develop and assess initial options for the quantum information processing that will be carried out on the input data within the quantum enabled planner to produce sets of optimised data/information outputs. These

	outputs will provide the basis for downstream demand scheduling and control of ISR assets in the battlefield and for subsequent planning/re-planning iterations. The Supplier(s) shall produce top level design(s) for these processing options. **Subtask 1/3** – The Supplier(s) shall research, define, develop and assess the requirements for the quantum information processing derived planning/re-planning data/information outputs and suitable formats for this data/information. The Supplier(s) shall take into account their initial assumptions about what quantum information processing will be carried out within the planner and shall make clear their assumptions regarding the receiving sensor management sub-systems for the output data/information, particularly with regard to their assumptions about what these sub-systems are going to do with the output data/information subsequently. Following discussions and agreement with Dstl, the Supplier(s) will take the most promising options from Sub-tasks 1/1, 1/2 and 1/3 into Task 2. **Task 2: Task planning and re-planning using quantum computers** **Subtask 2/1** – The Supplier(s) shall use the input and output data/information specifications and initial top level quantum information processing design(s) arising from Task 1 as the basis for the detailed design, test, demonstration and analysis of quantum enabled planning techniques and algorithms for optimised task planning. Following detailed design, the Supplier(s) shall implement the quantum enabled planning techniques and algorithms on current quantum computer simulators and/or current quantum circuit computers. The Supplier(s) shall analyse the performance of each of the quantum enabled planning techniques. ***Deliverable 1 – Technical Report – Initial Report on Quantum Enabled Planning - The technical report shall include, but not be limited to full technical details of: the definition of input data/information specifications; the definition of output data/information specifications; the design(s) for the implemented quantum enabled planning techniques and algorithms and their associated input and output data/information and interfaces; all assumptions made during the conduct of Task 1 and Sub-task 2/1; all application software code/quantum computer code/circuits; details of the performances of the techniques and algorithms and the analysis results. – Due: 30 November 2022.*** **Subtask 2/2** – The Supplier(s) shall research, define, develop and assess options for constrained, quantum enabled re-planning techniques and algorithms. Following discussions and agreement with Dstl, the Supplier(s) will take the most promising, preferred options forward for further design, development and testing within the Subtask. The Supplier(s) will carry out detailed design and implementation of these preferred options based on adaptations of the quantum enabled planner developed and tested in Sub-task 2/1. **Subtask 2/3** – The Supplier(s) will carry out further testing and demonstration of the quantum enabled planning and re-planning techniques on a range of different, dynamic task/goal input and constraint cases. In each case, the Supplier(s) shall analyse the performance of the planning and re-planning techniques and associated quantum processing algorithms. Potential Supplier(s) should note that within Task 2, the Supplier(s) are expected to design and scale use cases and algorithms to be compatible with implementation, testing and proof of principle demonstrations on:

	• Currently available cloud based quantum computer simulators and quantum circuit computers. or • Other suitable quantum simulator or computer facilities available to the Supplier(s). ***Deliverable 2 – Technical Report, Software and Presentation – Quantum Planning and Re-Planning for Decision Support – The technical report and presentation shall include, but not be limited to: detailed descriptions of and source code for all the developed quantum enabled planning and re-planning algorithms; all results from the testing and demonstration of the quantum enabled planning and re-planning techniques and algorithms; detailed analysis of the performance of the planning and re-planning techniques and algorithms; Phase 1 conclusions and recommendations. The recommendations within the technical report and presentation shall also contain details of the proposed way ahead and activities for Phase 2. Soft copies of all application source code and quantum computer code/circuits developed within Phase 1 shall be delivered to Dstl. – Due: 10 March 2023.*** To aid in the direction and management of the project, in addition to the deliverables identified above, the following project management deliverables are required: **Deliverable 0/1 – Minutes and presentations from the contract Start-up Meeting and project baseline WBS and Schedule.** **Deliverable 0/2/x – Monthly progress reports.** **Deliverable 0/3 – Minutes from the contract Completion Meeting.** Potential Supplier(s) shall provide a firm priced proposal for the conduct of Phase 1. See Section 1.5 for information about potential options for Phase 2 follow-on activities in FY 23/24. All Supplier reports shall be written up using a suitable MoD approved Report Template for sharing with Dstl and key stakeholders. **A note on the Dstl Technical Partner.** The role of the Dstl Technical Partner is to provide technical assurance to the Dstl Project Technical Authority and Project Manager. Given that the ISR Enterprise team is a 'rainbow' team consisting of members from Dstl and industry, it is possible that the Dstl Technical Partner role is fulfilled by an individual from a commercial organisation. In either case, the Dstl Technical Partner has agency to act on behalf of Dstl in the role of Technical Partner. The Dstl Technical Partner reports to the Dstl Project Manager and Project Technical Authority, both of whom are civil servants employed by Dstl.
1.5	**Options or follow on work** *(if none, write 'Not applicable')*

	a. The funding and conduct of any Phase 2 activities will depend on the results of the Phase 1 work and programme affordability. b. If a decision is made to proceed with Phase 2, it will be on the basis of tasking the Supplier(s) for either a 6 month, 9 month or 12 month period in order to carry out further design, development and testing to demonstrate capability enhancements to the quantum enabled planning/re-planning system developed in Phase 1. c. Without prejudice or commitment and subject to contract, if Dstl decides to proceed with Phase 2, Dstl will take up one of the 6 months, 9 months or 12 months options for conduct in FY 23/24 via a contract amendment. In order that this work may be taken up with as short delay as possible, the Supplier is requested to provide Firm Price manpower costs for FY 23/24 and ROM costs for each of the 6 month, 9 month and 12 month Phase 2 tasking options in their proposal.

1.6	Deliverables & Intellectual Property Rights (IPR)						
Ref.	**Title**	**Due by**	**Format**	**TRL***	**Expected classification (subject to change)**	**What information is required in the deliverable**	**IPR DEFCON/ Condition** *(Commercial to enter later)*
DEL 0/1	Minutes and presentations from contract start-up meeting and the project baseline WBS and Schedule	05/09/22	Minutes (MS Word file + pdf file); Presentations (MS Powerpoint file + pdf file) Baseline WBS (MS Word); Baseline Schedule (MS Project or MS Excel)	N/A	[REDACTED]	Minutes arising from the meeting and slides from Supplier presentations Copies of baseline project work breakdown structure and project schedule	[REDACTED]
DEL 0/2/x	Monthly progress reports	End of the 3rd week of each month	Monthly progress report template (MS Word)	N/A	[REDACTED]	Summary of monthly technical progress and updates on project schedule and spend.	[REDACTED]

DEL 0/4	Minutes from the contract Completion Meeting	Following delivery of final report	Minutes (MS Word file + pdf file)	N/A	[REDACTED]	Minutes arising from the meeting and slides from Supplier presentations.	[REDACTED]
DEL 1	Technical Report – Initial Report on Quantum Enabled Planning	30 November 2022	MS Word file + pdf file (+ MS Excel files if required)	[REDACTED]	[REDACTED]	The technical report shall include, but not be limited to full technical details of: the definition of input data/information specifications; the definition of output data/information specifications; the design(s) for the implemented quantum enabled planning techniques and algorithms and their associated input and output data/information and interfaces; all assumptions made during the conduct of Task 1 and Sub-task 2/1; all application software code/quantum computer code/circuits; details of the performances of the techniques and algorithms and the analysis results.	[REDACTED]
DEL 2	Technical Report, Software and Presentation – Quantum Planning and Re-Planning for Decision Support	10 March 2023	MS Word file + pdf file (+ MS Excel files if required); soft copies of all programming source code and circuits used within the associated	[REDACTED]	[REDACTED]	The technical report and presentation shall include, but not be limited to: detailed descriptions of and source code for all the developed quantum enabled planning and re-planning algorithms; all results from the testing and demonstration of the quantum enabled planning and re-planning techniques and algorithms; detailed analysis of the performance of the planning and re-planning techniques and algorithms; Phase 1 conclusions and recommendations. The recommendations within the technical report and presentation shall also contain	[REDACTED]

			work activities			details of the proposed way ahead and activities for Phase 2. Soft copies of all application source code and quantum computer code/circuits developed within Phase 1 shall be delivered to Dstl.	

***Technology Readiness Level required**

Notes- IPR should be inserted / checked by commercial staff before sharing with the supplier(s) to ensure accuracy.

1.7	**Standard Deliverable Acceptance Criteria**
	As per R-Cloud Framework T&C's
1.8	**Specific Deliverable Acceptance Criteria**

2.	**Quality Control and Assurance**
2.1	**Quality Control and Quality Assurance processes and standards that must be met by the contractor**
	☐ **ISO9001** (Quality Management Systems) ☐ **ISO14001** (Environment Management Systems) ☐ **ISO12207** (Systems and software engineering — software life cycle) ☐ **TickITPlus** (Integrated approach to software and IT development) ☐ **Other:** (Please specify below)
2.2	**Safety, Environmental, Social, Ethical, Regulatory or Legislative aspects of the requirement**
	N/A

3.	Security	
3.1	**Highest security classification**	
	Of the work	[REDACTED]
	Of the Deliverables/ Output	[REDACTED]
3.2	**Security Aspects Letter (SAL)**	
	[REDACTED]	
3.3	**Cyber Risk Level**	
	[REDACTED]	
3.4	**Cyber Risk Assessment (RA) Reference**	
	[REDACTED] [REDACTED] [REDACTED]	

4.	Government Furnished Assets (GFA)				
GFA to be Issued - No *If 'yes' – add details below. If 'supplier to specify' or 'no,' delete all cells below.*					
GFA No.	**Unique Identifier/ Serial No**	**Description:** *Classification, type of GFA (GFE for equipment for example), previous MOD Contracts and link to deliverables*	**Available Date**	**Issued by**	**Return Date or Disposal Date (T0+)** *Please specify which*

5.	Proposal Evaluation criteria
5.1	Technical Evaluation Criteria

Evaluation Criteria Overview:

To enable your proposal to be assessed fairly, please submit response versions as follows:

- Technical Proposal - being a technical response containing only technical information/responses (i.e redacting any pricing information).
- Commercial Proposal - must be a full response to the ITT including technical and price/cost information.

This requirement will be competed and awarded on the basis of the Most Economically Advantageous Tender (MEAT) methodology. The overall evaluation equates to 100% in total, with a combination of Commercial, Technical and Price.

The Authority reserves the right to reject any tender response that scores '0' for a Technical Criteria or a 'Fail' for any Commercial Criteria.

In the event of two or more suppliers having the same evaluation score, the Authority will rank the suppliers according to the value of their proposal with the less costly proposal ranking higher.

Technical Marking Scheme:

Each proposal will be scored against each of the criteria listed in the table below by Dstl Subject Matter Experts (SMEs). Each SME will independently score the proposals against each of the criteria. The scores will then be moderated and a final score decided with the proposals ranked accordingly.

The Technical/Price Ratio is 70:30

Each element will be marked with a value from 0 to 10 as per the following marking scheme.

Mark	Criteria
0	Inadequate - the response does not address or explain how the requirement will be fulfilled and fails to demonstrate the ability to meet the requirement.
3	Adequate - the response addresses the majority of elements of the requirement but is weak in some areas and does not fully detail or explain how the requirement will be fulfilled.
7	Good - the response addresses all of the elements of the requirement and provides sufficient detail and explanation of how the requirement will be fulfilled.
10	Excellent - the response addresses all elements of the requirement, and provides a comprehensive, unambiguous and thorough explanation of how the requirement will be fulfilled.

Criteria and Weightings:

Assessment criteria are as follows:

Area	Criterion	Title	Weighting	Total percentage
Technical	1a	Level of technical detail and description of how the supplier will meet the requirements and the research, design, development, testing and demonstration methods that will be used in the each of the tasks.	15 %	50 %
	1b	Level of team experience and understanding of automated planning and re-planning systems and techniques, task decomposition, task scheduling, task value assignment techniques and task priority assignment techniques and associated techniques.	15 %	
	1c	Level of team experience and understanding of sensor management systems.	5 %	
	1d	Level of team experience, knowledge and understanding of quantum computing, quantum computer optimisation algorithms and their applications; the range of quantum computer programming skills within the team; the range of quantum computing facilities that the team have access to and propose to use for the conduct of the project.	15 %	
Delivery	2a	WBS/Plan/Schedule for meeting project requirements to time, cost and quality and level of detail in the definition of technical and programme risks for each proposed task.	5 %	20 %
	2b	Evidence of SQEP availability/commitment for	15 %	

5.	Proposal Evaluation criteria				
5.1	**Technical Evaluation Criteria**				
			personnel that will be used within the project		
	Commercial	3a	Cost and cost breakdown	30 %	30%
5.2	**Commercial Evaluation Criteria**				

Commercial Evaluation Criteria:

Evaluation of Commercial Proposals will be undertaken against responses to the criteria detailed below and scored in accordance with the 'Commercial Scoring Key' underneath.

The Authority reserves the right to reject any Tender if a supplier scores a 'Fail' in the criteria below.

Commercial Evaluation Criteria		
Ref	**Criteria**	**Weighting**
C1	Please submit your full firm price breakdown for all costs to be incurred to fulfil this requirement, including: • What rates are being used for what role • Quantity of manpower hours per role • Any Materials costs • Any Facility costs • Any sub-contractor costs • Any travel and subsistence costs • Any other costs	Pass/Fail
C2	Compliance with this Task specific terms and conditions as stated within the Statement of Requirement and respective Call-Off Tasking Form.	Pass/Fail
C3	The Tenderer shall clearly identify in the submission and background Intellectual Property that they intend to use in the execution of the contract and any limited rights terms (if any).	Pass/Fail

Please upload your response to the above as Commercial Proposal.

Commercial Evaluation Scoring Definitions:

The score (Pass/Fail) awarded to each of the Commercial Sub-criteria will be in accordance with the definitions:

Score	**Definition**
Pass	Fully meets the Authority's requirement. Provision of the information stated in the format requested, which is clear, unambiguous and transparent in accordance with any applicable terms and conditions.
Fail	Unacceptable/Nil Return.

5.	Proposal Evaluation criteria
5.1	**Technical Evaluation Criteria**

	Tenderer did not respond to the criteria or the tenderer did not provide the cost breakdown in full.

Price Evaluation Criteria:

The Price criteria will be scored and converted to a maximum percentage or up to 30%. A score of 30 will be awarded to the lowest priced commercially and technically compliant tender. The price scores of other tenders will be calculated as a percentage (%) difference using the following formula:

$$\frac{Lowest\ Compliant\ Price\ Tendered}{Tenderer's\ Price} \times 30 = Pricing\ Score$$

The Authority will assess the Firm Price Proposal to ensure that all costs are fully detailed, and the Firm Price shall be commensurate with the work to be undertaken.

Annex A – Outline Description of a Fictional Mission Vignette

[REDACTED]