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ASTRID

ANALYSIS FOR SCIENCE & TECHNOLOGY RESEARCH IN DEFENCE

Statement of Requirement (SOR)

Contact & Project Information:

Project Manager	Name	Redacted under FOIA Section 40 - Personal Information
	Email	Redacted under FOIA Section 40 - Personal Information
	Telephone number	Redacted under FOIA Section 40 - Personal Information
Technical Partner	Name	Redacted under FOIA Section 40 - Personal Information
	Email	Redacted under FOIA Section 40 - Personal Information
	Telephone number	Redacted under FOIA Section 40 - Personal Information

CHESS PJ Number	PJ100804	**CHESS Leaf Code**	NQT
Owning division	Exploration	**Delivering division**	Exploration
Programme	High Level Decision Support		

Indicative task budget(s) £k	Core / initial work:	~£50k	Options / follow on work:	N/A

Innovation risk appetite:	Redacted under FOIA Section 43 - Commercial Interest
Narrative (if applicable):	We require the supplier to have an understanding and/or experience of exploratory modelling. We are willing to consider any supplier as long as they have the relevant skills and experience. This includes both new academic and non-traditional industry suppliers as well as traditional suppliers.

Using the Ansoff matrix below, please indicate your risk appetite with regards to accepting innovative bids/solutions. The type of analysis/experimentation technique is included within 'Technology/Product'.

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Use of Outputs: *(This section is used to inform risks, liabilities, mitigations and exploitation)*
Intended uses (including the approximate time before use and any key decisions that will use the output):

This activity's output will be used for two purposes.
 	
• PRIMARY PURPOSE - Providing Dstl with a foundational level understanding of a method, **exploratory modelling**, that we may wish to develop as a Defence capability. The output will provide evidence that will help decision makers decide whether Dstl requires an exploratory modelling capability to answer the questions that the organisation is asked. Specifically it will help decision makers answer the following questions:
    o Would Defence benefit from having an exploratory modelling capability?
    o Should Defence develop an exploratory modelling capability?
    o Who should host a Defence exploratory modelling capability – MOD, industry or a mixture of the two?
    o How can Defence build an exploratory modelling capability?
• SECONDARY PURPOSE - Providing analysts with a foundational level understanding of a method they may wish to apply. This will help Dstl analysts understand what exploratory modelling is and whether they should consider applying it to a specific customer question / problem. It provides evidence to answer the following questions:
    o Would it be beneficial to apply exploratory modelling to my problem?
    o What do I need to consider if applying exploratory modelling to my problem?
 	
The key distinction between the primary and the secondary purpose is that the primary purpose is focused on whether Dstl should develop an exploratory modelling capability to help Dstl answer a wide range of customer questions. In comparison, the secondary purpose is focused on helping an individual analyst consider whether exploratory modelling could be a useful approach to answer a specific question that they have been asked.
 	
The output is not supporting a specific time sensitive decision.

Possible uses:
N/A
Excluded uses:
  N/A
Risk Assessment Process:
Project teams are required to complete the ASTRID Liabilities spreadsheet that will look at the direct and indirect risks associated with the work. The assessment must be completed at the outset before the draft SOR is submitted, this will prevent delays and lessen negotiations when the proposal is received. Redacted under FOIA Section 43 - Commercial Interest

Some generic risks are pre-filled so please ensure they apply to your task and delete/add as necessary. Each risk must be assessed in turn and a score entered in the spreadsheet. They will be automatically marked and a colour code produced. Please enter the results in the boxes below. Redacted under FOIA Section 43 - Commercial Interest

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In the event that a direct risk is identified as "Amber" or "Red" project teams should discuss the requirement with their Commercial POC before the task is submitted.

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In the event that the indirect risk is "Excluded" project teams may continue with the submission of their requirement to CORDA once all necessary approvals have been issued by the Redacted under FOIA Section 43 - Commercia

In the event that the indirect risk is identified as "Included" project teams should discuss their requirement with their Commercial POC before the task is submitted.

Levels of Technical Assurance:

The framework can offer three levels of Technical Assurance Support, and you have the ability to determine which level is suitable for your task.

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It may be that the level of support you require changes in the early discussion phase. Please ensure the final version of your SOR has the correct level indicated.

Please indicate below which level you require

Minimum ⊠	Standard ☐	Enhanced ☐

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Statement of Requirement (SoR)

Project's document ref	**20230215-Exploratory_Mod_Lit_Rev_SOR_v1.1 O**
Version number	**V1.1**
Date	**15/02/2023**

1.	**Requirement**
1.1	**Title (including AST/ prefix)**
	AST296/Exploratory Modelling Literature Review
1.2	**Summary**
	Dstl is considering the development of a Defence **exploratory modelling** capability.
	It is assumed that exploratory modelling has significant potential to support Dstl's Exploration Division in achieving its vision - "[to] assess which ideas [strategies, concepts, systems and technologies] have the most potential for Defence and Security". If this assumption is correct, exploratory modelling offers the potential to help Defence "make the right decisions" and "adopt anticipatory policy making" as outlined in the _MOD Science and Technology Strategy 2020_.[1]
	To inform our decision making, we need to improve our understanding of exploratory modelling.
1.3	**Background**

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Why is Dstl interested in exploratory modelling?

The vision of Dstl's Exploration Division is to "assess which ideas [strategies, concepts, systems and technologies] have the most potential for Defence and Security". This supports the achievement of the *MOD Science and Technology Strategy 2020*. This strategy states that "it is not enough to just understand the future, it is essential that we make the right decisions in response".[2]

However, many of the issues that Defence must take decisions on are deeply uncertain (deep uncertainty is also referred to as radical and ontological uncertainty).[3]

> *"Deep uncertainty exists when parties to a decision do not know, or cannot agree on: the system model that relates action to consequences; the probability distributions of the inputs to these models; which consequences to consider; and their relative importance. Deep uncertainty often involves decisions that are made over time in dynamic interaction with the system".[4]*

The strategies, policies, forces, capabilities and technologies we could adopt are many, with the efficacy of each predicated on external factors that we cannot predict. Our stakeholders also have different values and perspectives that need to be explored and negotiated when answering these questions.

Exploratory modelling is believed to be a useful method for supporting decision making under deep uncertainty and its use is advocated by the Decision Making under Deep Uncertainty Society.

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What is exploratory modelling?

Exploratory modelling was defined in 1993 by S. C. Bankes[5]. Bankes divided computational simulations into two types:

1) Consolidative models – "models, which gather all known facts together into a single package that, once validated, can serve as a surrogate for the real world".

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[2] *MOD Science and Technology Strategy 2020* (MOD, Oct 2020). p.10.
[3] Examples of deeply uncertain topics include: future interest rates; the future price of raw materials; whether certain technologies will become obsolete; and the likelihood and nature of a future European war.
[4] Vincent Marchau et al, Decision Making under Deep uncertainty: From theory to practice (Springer, 2019)
[5] Bankes, S. C. (1993). Exploratory modelling for policy analysis. Operations Research, 41(3), 435–449.

2) Exploratory models - "models, which map a wide range of assumptions onto their consequences without privileging one set of assumptions over another".

It is argued that "exploratory models are useful when no single model can be validated because of missing data, inadequate or competing theories, or an irreducibly uncertain future".[6] In these situations, it is not possible to build a consolidative model. If an attempt is made to build a consolidative model, it would be based on a person's, or group's, assumptions. These assumptions could turn out to be significantly wrong. Such approaches therefore involve an analyst substituting a well-defined, but potentially irrelevant problem, for the less well-defined problem that is actually faced. In contrast, exploratory modelling has the potential to enable Defence to explore the actual problem by enabling Defence to explore the potential impact of different assumptions. In other words, exploratory modelling is useful to support decision making under conditions of deep uncertainty.

What is a capability?

Simply put, a capability is the "ability to do something".[7]

NATO provides a more detailed definition and defines a capability as "the ability to create an effect through employment of an integrated set of aspects categorized as doctrine, organization, training, materiel, leadership development, personnel, facilities, and interoperability".[8]

A capability is therefore more than just a piece of equipment, a method or an individual. For example, a method does not enable you to provide decision support if you lack the people, with the right skills and experience, to apply it, the equipment required to apply it and wider culture for it to be exploited effectively. It is only possible to generate the full capability when all of these elements are combined together.

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[6] Vincent Marchau et al, Decision Making under Deep uncertainty: From theory to practice (Springer, 2019), p.29.
[7] Cambridge English Dictionary, https://dictionary.cambridge.org/dictionary/english/capability [Accessed 24 January 2023]]
[8] Record 27626, NATO Terminology Database. This is consistent with the UK definition of Capability, found within Knowledge in Defence (KID) (1 Nov 2009). [Accessed 10 May 2022]

1.4	Requirement
	Dstl seeks to improve its understanding of exploratory modelling. We are therefore commissioning a literature review.

<u>Questions to answer</u>

The following questions must be answered.

- What is exploratory modelling?
  - Is there an agreed definition?
  - What different definitions exist?
  - How does exploratory modelling differ from other types of modelling?
    - The supplier should consider:
      - Whether Bankes definition of exploratory modelling is commonly accepted.
      - Other definitions for exploratory modelling. Is the term used to describe something different to what Bankes describes.
      - Other types of modelling that might not be called exploratory modelling but could be considered exploratory modelling. It may also be possible that others are doing exploratory modelling but calling it something different.
- What are the benefits of conducting exploratory modelling?
- What are the criticisms of exploratory modelling?
- What questions have been answered / explored using exploratory modelling?
  - It would be useful to describe specific use cases when answering this question.
- Who conducts exploratory modelling?
  - In academia
  - In industry
  - In government
  - In intergovernmental and non-governmental organisations
    - Names of specific organisations and experts is required. This will enable Dstl to understand who possesses expertise in exploratory modelling.
- When should I consider using exploratory modelling?
- What is required to conduct exploratory modelling successfully?
  - What types of questions is exploratory modelling useful for answering?
  - What capability is required to conduct exploratory modelling successfully? |

- The supplier is expected to use the Defence Lines of Development (DLoD), or a similar framework, that enables them to consider the full range of characteristics that comprise a capability. This ensures that the study comprehensively considers factors such as the resources, equipment, organisation, skills and expertise that is required to conduct exploratory modelling.
  - o What contextual conditions are required to conduct exploratory modelling successfully?

Approach

The supplier will be expected to apply a rigorous and systematic research method to search databases, identify relevant reports and critically appraise them.

They will be expected to:

- Identify databases to be searched;
- Set agreed search terms for identifying potentially relevant documents;
- Set criteria for assessing whether to include the identified documents in the review;
- Develop a framework for synthesising the reviewed documents.

Additional considerations

The supplier, Project Manager and Project Technical Authority and/or Technical Partner must have regular progress meetings. This will help ensure the project progresses as planned and that risks and opportunities are raised and resolved early. Rather than being time bound (e.g. fortnightly), the meetings should occur at agreed feedback and decision points. This could include:

- Project kick off – At the start of the project. This enable the supplier to understand the requirement and develop a technical approach.
- Technical approach confirmation - This enables the technical partner to review and agree the proposed technical approach.
- Completion of each phase of the work
  - o Conclusion of database search – To enable the supplier to provide feedback on the amount of existing research and initial conclusions. The approach for reviewing documents should be reviewed at this stage.
  - o Conclusion of document synthesis – To enable the supplier and customer to discuss initial findings and how they should be reported.

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<table>
<tr><td></td><td>o   Conclusion of report writing – To enable the supplier and customer to discuss and resolve any customer review comments. This enable the report to be revised and a final version delivered.

In addition, the supplier will deliver a monthly financial forecast for the remainder of the period of the contract. This will be delivered on the third working day of each month and will detail:

• The actual spend incurred for each complete month of the tasking to date;

• The forecast spend for each remaining month of the task.

The forecast should be supplied in Excel spreadsheet format.</td></tr>
<tr><td>1.5</td><td>**Options or follow on work**</td></tr>
<tr><td></td><td>Not applicable</td></tr>
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Technology Readiness Level required, if applicable

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1.7	**Standard Deliverable Acceptance Criteria**
	Deliverable Acceptance Criteria (As per ASTRID Framework T&Cs) 1. Acceptance of Contract Deliverables produced under the Framework Agreement shall be by the owning Dstl or wider Government Project Manager, who shall have up to 30 calendar days to review and provide comments to the supplier. 2. Task report Deliverables shall be accepted according to the following criteria except where alternative acceptance criteria are agreed and articulated in specific Task Statements of Work: • All Reports included as Deliverables under the Contract e.g. Progress and/or Final Reports etc. must comply with the Defence Research Reports Specification (DRRS) which defines the requirements for the presentation, format and production of scientific and technical reports prepared for MoD. Reports shall be free from spelling and grammatical errors and shall be set out in accordance with the accepted Statement of Work for the Task. • Interim or Progress Reports: The report should detail, document, and summarise the results of work done during the period covered and shall be in sufficient detail to comprehensively explain the results achieved; substantive performance; a description of current substantive performance and any problems encountered and/or which may exist along with proposed corrective action. An explanation of any difference between planned progress and actual progress, why the differences have occurred, and if behind planned progress what corrective steps are planned. • Final Reports: shall describe the entire work performed under the Contract in sufficient detail to explain comprehensively the work undertaken and results achieved including all relevant technical details of any hardware, software, process or system developed there under. The technical detail shall be sufficient to permit independent reproduction of any such process or system. 3. Failure to comply with the above may result in the Authority rejecting the Deliverables and requesting re-work before final acceptance. 4. Acceptance criteria for non-report Deliverables shall be agreed for each Task and articulated in the Statement of Work provided by the Contractor
1.8	**Specific Deliverable Acceptance Criteria**
	Not applicable.

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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)
2.2	**Safety, Environmental, Social, Ethical, Regulatory or Legislative aspects of the requirement**
	Not applicable.

3.	Security
3 .1	**Highest security classification**

	Of the work	Redacted under FOIA Section 26 - Defence
	Of the Deliverables/ Output	Redacted under FOIA Section 26 - Defence
	Where the work requires more than occasional access to Dstl premises (e.g. for meetings), SC Clearance will be required.	

3.2	**Security Aspects Letter (SAL) – Note the ASTRID framework has an overarching SAL for quotation stage (up to OS)**
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3.3	**Cyber Risk Level**
	Redacted under FOIA Section 43 - Commercial Interest

3.4	**Cyber Risk Assessment (RA) Reference**
	Redacted under FOIA Section 43 - Commercial Interest

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4.	Government Furnished Assets (GFA)

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 or Disposal *Please specify which*

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If GFA is to be returned: It must be removed from supplier systems and returned to the Dstl Project Manager within 2 weeks of the final Task deliverable being accepted. (Any required encryption or measures can be found in the Security Aspects Letter associated with the Task).

If GFA is to be destroyed: It must be removed from supplier systems and destroyed. An email confirming destruction should be sent to the Dstl Project manager within 2 weeks of the final Task deliverable being accepted

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5.	Proposal Evaluation
5.1	**Technical Evaluation Criteria**
	Process will be as per ASTRID Framework T&Cs. This study also requires the below skills / knowledge. We expect the supplier to provide evidence of these within their proposal. • Research skills. The supplier MUST have a proven ability to conduct research in systematic and academically rigorous manner. Experience of conducting REAs and/or systematic reviews is desirable. • Exploratory modelling skills – The supplier MUST have a prior understanding of, and experience conducting, exploratory modelling. This will help the supplier to define search terms, identify initial key papers and understand and contextualise the results. It therefore enables the supplier to add additional value beyond just conducting a review. • Communication skills – The supplier MUST have a proven ability to synthesis information from a large number of documents into a short report and summary document.
5.2	**Commercial Evaluation Criteria**
	As per ASTRID Framework T&Cs.