

**RCloud Tasking Form – Part B: Statement of Requirement (SoR)**

<b>Title of Requirement</b>	<b>Application of Pulsed Power for the Efficient Reduction of Water</b>
<b>Requisition No.</b>	<b>iCAS: 1000169044</b>
<b>SoR Version</b>	<b>1.0</b>

<b>1.</b>	<b>Statement of Requirements</b>
<b>1.1</b>	<b>Summary and Background Information</b>
	<p>The global hydrogen economy is predicted to grow significantly over the next two decades as the world moves away from fossil fuels to address climate change (£334bn by 2025-30, S&amp;P Platts). Technologies which could evolve as a consequence, such as advanced electrolysis and pulsed power, have the potential to provide <small>Redacted under FOIA Section 26 - Defence</small> benefits and policy challenges for Defence and Security. If hydrogen becomes a significant part of the global energy mix, which is predicted by economists, then this will present challenges and opportunities that MOD needs to understand in order to respond accordingly. Dstl is seeking a research partner, <small>Redacted under FOIA Section 26 - Defence</small> at Loughborough University, led by <small>Redacted under FOIA Section 40 - Personal</small> who are able to undertake quantitative laboratory based research and evaluation of three distinct methods of water reduction <small>Redacted under FOIA Section 26 - Defence</small> as well as provide support to Dstl in undertaking relevant aspects of that research at UK government facilities at particular dates. <b>Redacted under FOIA Section 26 - Defence</b></p>
<b>1.2</b>	<b>Requirement</b>
	<p>During the 2 years programme, Dstl require the following three methods to be investigated. The budget for this work, <b>Redacted under FOIA Section 43 - Commercial Interests</b>.</p> <p><u>Method 1:</u> <small>Redacted under FOIA Section 26 - Defence</small> <u>DC electrolysis of water.</u></p> <p>This technique focuses on <b>Redacted under FOIA Section 26 - Defence</b> nominally pure water via electrical contact electrodes and will build on work reported previously in <small>Redacted under FOIA Section 26 - Defence</small></p> <p style="text-align: right;">in order</p> <p>to identify if an enhanced efficiency regime exists.</p> <p>The following research programme for Method 1 is suggested:</p> <ul style="list-style-type: none"> <li>a) Acquisition of relevant <small>Redacted under FOIA Section 26 - Defence</small> systems, having the following approximate characteristics: <b>Redacted under FOIA Section 26 - Defence</b></li> <li>b) <b>Milestone 1: Finalising preliminary testing</b> to demonstrate assembly of the <small>Redacted under FOIA Section 26 - Defence</small> system into a preliminary prototype cell with measurement capability to record the rate of reduction of water as a function of input parameters.</li> </ul>

- c) **Milestone 2: Finalising the studies of hydrogen production** and determination of the limits of an optimum parameter space for increasing the efficiency

Method 2: Redacted under FOIA Section 26 - Defence

This work requires evaluation of the viability of achieving similar effects as that described in Method 1 but Redacted under FOIA Section 26 - Defence through the use of direct metal contact electrodes. It is anticipated that pulsed signals may be required of Redacted under FOIA Section 26 - Defence. The focus of this work will involve investigating Redacted under FOIA Section 26 - Defence if a regime exists for optimal hydrogen generation.

The following research programme for Method 2 is suggested:

- d) Acquisition of a relevant Redacted under FOIA Section 26 - Defence
- e) **Milestone 3: Finalising preliminary testing** with the aim of reproducing results reported in open literature, specifically that of Redacted under FOIA Section 26 - Defence
- f) **Milestone 4: Finalising the studies of hydrogen production** and determination of the limits of an optimum parameter space for increasing the efficiency

Method 3: Redacted under FOIA Section 26 - Defence Aluminium-water reduction

This work requires the quantifying of the degree of hydrogen generation during the well-established aluminium-water reaction, but when using modified reaction conditions. Redacted under FOIA Section 26 - Defence

The following research programme for Method 3 is suggested:

- g) Development of specific diagnostic methods required for the Redacted under FOIA Section 26 - Defence
- h) **Milestone 5: Practical demonstration** at a proving ground using the diagnostic methods mentioned above as well as the dynamics of a laboratory-scaled Redacted under FOIA Section 26 - Defence
- i) Redacted under FOIA Section 26 - Defence

**Milestone 6: Practical demonstration** at a proving ground of a shaped charge unit operated with an Redacted under FOIA Section 26 - Defence

The desired outcome for Dstl is quantification of the rate and volume of hydrogen production for methods 1 and 2 above, with an equivalence value of the energy released for method 3. Estimation of the maximum possible rate of hydrogen generation is sought as well as the electrical efficiency of generation for each method and the system complexity. It should be noted that Dstl's aim for this work is not to expect optimisation under this work but to understand the viability of each system and ideally identify an enhanced regime that would justify further testing.

To achieve this work Dstl is anticipating an extended laboratory based research phase in addressing the research considerations. The establishment and undertaking of Redacted under FOIA Section 26 - Defence to undertake work that is directly relevant to this activity's research aims, and

	<p>a transitional period preparing and de-risking trials to be carried out at Porton Down or other suitable research facility.</p> <p><b>Timeline of deliverables assuming the contract start date as November 2021</b></p> <ul style="list-style-type: none"> <li>• <small>Redacted under FOIA Section 26 - E</small> Nov 2021 - December 2025</li> <li>• Support at government facilities Apr 2022 – Mar 2024</li> </ul> <p>Method 1</p> <ol style="list-style-type: none"> <li>4 months; Progress report at the end of March 2022</li> <li>8 months; Report on <b>Milestone 1</b> at the end of November 2022</li> <li>12 months; Report on <b>Milestone 2</b> at the end of November 2023</li> </ol> <p>Method 2:</p> <ol style="list-style-type: none"> <li>4 months; Progress report at the end of March 2022</li> <li>8 months; Report on <b>Milestone 3</b> at the end of November 2022</li> <li>12 months; Report on <b>Milestone 4</b> at the end of November 2023</li> </ol> <p>Method 3:</p> <ol style="list-style-type: none"> <li>4 months; Progress report at the end of March 2022</li> <li>8 months; Report on <b>Milestone 5</b> at the end of November 2022</li> <li>12 months; Report on <b>Milestone 6</b> at the end of November 2023</li> </ol>
<b>1.3</b>	<b>Options or follow on work</b> <i>(if none, write 'Not applicable')</i>
	Follow on work may occur dependant on Programme availability and topic results.
<b>1.4</b>	<b>Health &amp; Safety, Environmental, Social, Ethical, Regulatory or Legislative aspects of the requirement</b>
	None

1.5	Deliverables & Intellectual Property Rights (IPR)					
Ref.	Title	Due by	Format	Expected classification (subject to change)	What information is required in the deliverable	IPR Condition
D-1	Progress Report	011/05/2022	Word doc.	Redacted under FOIA Section 24 - National Security	<ul style="list-style-type: none"> <li>Progress of equipment purchase</li> <li>Progress of preliminary testing preparations</li> <li>Provision of suitable resource to carry out the work</li> </ul>	DEFCON 705
D - 2	End of year report	30/12/2022	Word doc.	Redacted under FOIA Section 24 - National Security	<ul style="list-style-type: none"> <li>Results from preliminary testing of all methods</li> <li>Preparations and progress of finalising and demonstrations for all methods</li> </ul>	DEFCON 705
D - 3	Final report	03/01/2024	Word doc.	Redacted under FOIA Section 24 - National Security	<ul style="list-style-type: none"> <li>Results from finalising of all methods</li> <li>Analysis of results considering enhanced regimes and recommendations for future work</li> </ul>	DEFCON 705

1.6	Deliverable Acceptance Criteria
	<p>Deliverables will be accepted by the Technical Partner. Deliverables will be held for consideration by Dstl for up to 14 days and returned with any requested edits or changes. These changes should be made and returned to Dstl within 14 days. After acceptance of a given deliverable, the supplier may then invoice for payment.</p> <p>All reports/presentations 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.</p> <p>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. The reports should be delivered in MS Word format and include: Approach/Methodology, Key findings (and supporting evidence), Additions or Amendments made to the Behavioural Matrix, Conclusions and Recommendations.</p> <p>All Reports shall be free from spelling and grammatical errors and shall be set out in accordance with the Statement Of Requirement (1) above.</p> <p>Failure to comply with the above may result in the Authority rejecting the deliverables and requesting re-work before final acceptance.</p>

2	Evaluation Criteria
2.1	Technical Evaluation Criteria
	<p>The supplier needs to demonstrate that they have the capability and experience to perform the work stated in this SoR.</p> <p>The technical elements of the proposal will be evaluated on a pass/fail basis depending on how successfully the supplier team can:</p> <ul style="list-style-type: none"> <li>• Show understanding of relevant work in the subject area of methods 1, 2 and 3</li> <li>• Provide suitable testing facilities, equipment and personnel to explore the above 3 methods</li> </ul>

2.2	Commercial Evaluation Criteria
	<p>The supplier shall provide evidence to demonstrate that they can meet the following commercial requirements;</p> <ul style="list-style-type: none"> <li>• A completed 'Tasking Order Form' confirming a resulting contract will be in accordance with the R-cloud Version 4 Terms and Conditions</li> <li>• The supplier must provide their full FIRM price breakdown for all costs to be incurred to fulfil this requirement, including: What rates are being used for what Grade (using their respective R-Cloud Grades), Quantity of manpower hours per Grade, Materials costs Facility costs, Profit rate applied, Any sub-contractor costs and the level of sub-contracting required, Any other costs applicable to this requirement.</li> </ul> <p>The Authority will assess the proposal to ensure that all costs are fully detailed, in line with the R-Cloud rates and price shall be commensurate with the work to be undertaken.</p> <p>When placing any contract the Authority is required to satisfy itself that the agreed price represents Value for Money (VFM). In single source contracting you must provide to the Authority sufficient information in support of your price proposal and during subsequent price negotiation, to enable the Authority to fulfil its obligation to assure VFM. The Authority approaches all contract pricing on the basis of the NAPNOC principle (No Acceptable Price, No Contract). The Authority reserves the right to not enter into any contract that is unacceptably priced or unaffordable.</p>