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

Title of Requirement	**Limits on Electromagnetic Activities (EMA)**
Requisition No.	**RQ0000010999**
SoR Version	**1.0 (Final for ITT) dated 15 July 2022**

1.	**Statement of Requirements**
1.1	**Summary and Background Information**
	To conduct three Lots of research activity into constrained[1] or derived process[2] limits on EMA[3]. Under the EMA Programme, the Electromagnetic Research and Science (ERAS) Project intends to identify fundamental Science and Technology (S&T) to surpass limitations, as to achieve generation after next EMA capabilities specifically associated with electronic attack, electronic defence, and tactical electronic surveillance and also synchronisation and coordination. This requirement looks to pursue three distinct methods for exploring limits, separated into three Lots (as defined in 1.2). Limits on EMA follows previous work to understand if the research supported by the Authority, regarding operating in the contested Electromagnetic (EM) environment, is sufficiently aspirational to realise generation-after-next capabilities. An approach was taken to look at the limitations to delivering EM effects, from which constrained[1] and derived process[2] limits were identified as most of relevance. Identification of these limits enables the Authority to gain insights on potential obstacles to step-change improvement of equipment capability, and enables more intelligent calls for research. The desired effects of relevance to this call align to electronic attack, electronic defence, and tactical electronic surveillance and also synchronisation and coordination; although electronic attack is a priority. The Authority has been working to understand the S&T landscape of EMA related research, leading to the scope as set out at Table 1. The aim of this is to understand which areas of S&T have potential for innovation which surpass specific limitations, thus enabling the development of generation-after-next EMA capabilities. It is considered likely that innovation potential can be realised at the intersection of these sub-families. [1] Defined as: Explanatory statements of fact about nature and about the working of nature. Associated with assumptions or constraints, cannot be bettered when those constraints apply. [2] Defined as: What we could aspire to and what performance improvements could be hoped for without constraining ourselves by the current way of doing things. What limits apply without knowing something about implementation? [3] Defined as: all offensive, defensive and inform activities that shape or exploit the electromagnetic environment and the enabling activities that support them.

1.2	Requirement

The aim of this work is to explore and quantify the impact of applying cutting-edge advances in S&T, such as through the S&T Families and Sub-Families at Table 1, to the constrained or derived process limits on delivering EM effects. The authority is looking for research outside the current trends in EW research, the Authority welcomes aspirational approaches, approaches that may carry a degree of uncertainty and technical risk. In addition to this condition, the following research areas are not of interest for any Lot: [Redacted]

S&T Family	S&T Sub-Family	S&T Family	S&T Sub-Family
Electronic Warfare Systems Research	Effector Technologies (Cyber)	Information and Communications Technology	Battlespace Information Acquisition and Processing
	Effector Technologies (Electronic Attack)		Command and Control Systems Research
	Electronic Protection Measures Research		Communications Systems Research
	Sensors (EOIR)		ICT Networks and Distributed Systems
	Sensors (ES)		Information Superiority Research
	Sensors (Graphene - THz, UV)		Pervasive and Ubiquitous Computing
	Sensors (Quantum)		RF and MW Communications
	Sensors (Radar)	Materials Science and Technology	Advanced Materials (Advanced Manufacturing)
	Sensors (Sensor Fusion)	Mathematical and Computer Sciences	Artificial Intelligence, Machine Learning and Data Science
Engineering Technology and Design	Advanced Electronics and Computing		Complexity Science
	Antennas And Loops (Tx and Rx)		Computing Hardware And Software Research
	Architecture and Operating Systems		Digital Signal Processing
	Autonomous Systems and Robotics		Graphics and Visualisation
	Control Engineering		Information Management Systems Research
	Human Factors Engineering		Mathematical Analysis
	Integrated Systems Engineering and Technology		Numerical Analysis
	Microelectronics Design		Operations Research and Systems Analysis
	Microelectronics Device Technology		Optimisation Planning And Decision Support Systems
	Microsystems		Statistics and Applied Probability
	Nanoengineering and Nanotechnology	Ordnance and Platform Protection Research	Defensive Aids Suites Research
	Power, Energy Storage, Conversion, and Transmission		Effector Technologies (Laser DEW)
	RF and Microwave Devices		Effector Technologies (RF DEW)
	Sensors and Instrumentation	Physics	Electromagnetic Pulses
	Simulation Technology		Electromagnetic Wave Propagation
Human Behavioural Sciences	Human Performance Research		Signature Control and Signature Reduction
	Training and Education Research	Space Research and Technology	Surveillance and Navigation Satellites Research

Table 1 S&T Families and Sub-Families

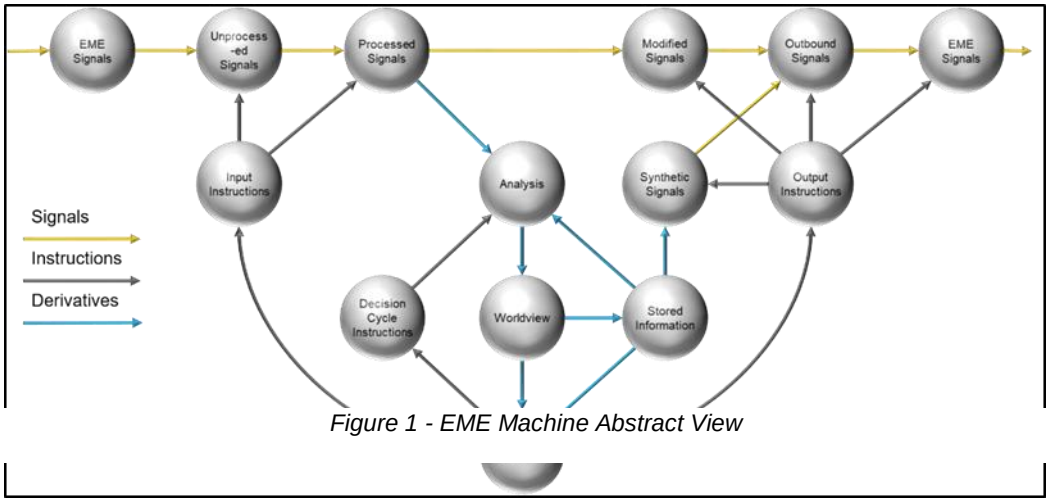
The aims of this research are:

- Understand the impact of cutting-edge advances in or between S&T sub-families on the constrained or derived process limits on delivering EM effects;
- To inform future calls for research by the Authority;
- Enable the Authority to pull findings of this research into planned future work; and
- Engage UK mathematical academic expertise through challenge based workshops (Lot 3).

Lot 1 looks first to identify limits and then analyse the potential for one or more combinations of S&T sub-families to surpass these limits on delivering EM effects, through a targeted study. The purpose of this approach is to identify impactful limitations, and the potential for surpassing them.

With a view of covering as many processes in Figure 1 as possible, Lot 2 will baseline a generic spectrum dependent system, designed not around Electronic Engineering, but themed around one or more other S&T sub-families. Examples include: Photonics, Micro-Electronics, Nano-Engineering and Nano-Technology, Control Engineering, or Advanced Computing or inspired approaches such as bio-inspired. The purpose of this approach is to identify where different S&T sub-families have the greatest potential to surpass the limits of cutting-edge electronic design.

Lot 3 will utilise mathematics to identify and/or analyse constrained or derived process limitations on delivering EM effects through challenges posed at a mathematics workshop. Challenges for the workshop to be agreed with the Authority. This workshop will be three to five days in duration. A physical-virtual hybrid workshop approach is the preference, though a virtual workshop shall remain an option if required at short notice. Attendees to the workshops shall be encouraged to

	submit ideas for short-term (one month in duration) studies, based on the findings from the workshop. Up to two extension studies shall be funded by the supplier from these proposals. Any extension study will deliver reports in line with the terms and conditions of this contract. Open-access research publication of the findings of any extension study shall be encouraged, mindful of security, this will be subject to approval by the Authority. The three Lots can run independently in parallel and each lot will take no longer than six months to complete. They shall all deliver a technical report and capping paper in addition to monthly progress meetings. The terms and conditions of the capping paper allow the Authority to directly use findings from the Lots for research planning and investment decisions.  *Figure 1 - EME Machine Abstract View* Enclosures to Part B of the Tasking Form: • Annex A - Security Aspects Letter – Redacted in full • Annex B - Research Worker Form – Redacted in full • Annex C - Lots summary • Annex D - Bidders Notes (Evaluation)
1.3	**Options or follow on work** *(if none, write 'Not applicable')*
	Not applicable
1.4	**Contract Management Activities**
	The contract will be managed locally by the project manager.
1.5	**Health & Safety, Environmental, Social, Ethical, Regulatory or Legislative aspects of the requirement**
	1.5.1- Standard adherence to office H&S regulations. 1.5.2 **- ISO9001** (Quality Management Systems)

1.6	Deliverables & Intellectual Property Rights (IPR)					
Ref.	**Title**	**Due by**	**Format**	**Expected classification (subject to change)**	**What information is required in the deliverable**	**IPR Condition**
TR	Technical Report (Applicable to all Lots) *TRL - 1-3	T0 +5.5 Months	Technical report (MS Word or PDF)	Redacted	Full technical report detailing research, including proposed solutions.	Redacted
CP	Capping Paper (Applicable to all Lots) *TRL - 1-3	T0 +6 Months	Formal Report (MS Word or PDF)	Redacted	To include general summaries throughout to capture key findings.	Redacted
MP	Monthly Progress Meeting (Applicable to all Lots) *TRL - 1-3	Monthly	Meeting held, MS PowerPoint	Redacted	To describe problems, limits and implications of achieving a solution.	Redacted

Notes:

Redacted

Redacted

*Technology Readiness Level required

1.7	**Deliverable Acceptance Criteria**
	1. All other deliverables shall follow the acceptance / rejection process detailed within the Framework terms. 2. All deliverables must be in accordance with Clause 19 – Deliverable Report Marking of the RCloud Version 4 terms and conditions. 3. Demonstrations will take place either at contractors' premises, or at a location to be mutually agreed. 4. If upon review of the reports and/or the final demonstrator, the Authority/Dstl does not accept the deliverables, the Contractor shall provide acceptable replacements at no additional cost to the Authority.

2	**Evaluation Criteria**
2.1	Method Explanation
	This Task is split into three Lot's (as detailed above) and each Lot is being treated as a separate task to enable Bidder submit a proposal for all or part of this stage of the Project. This requirement awarded to the Most Economical Advantageous Tender (MEAT), on the basis of the Value for Money Index (VFM Index). All bids received by the closing date will be assessed against the tender following evaluation process. The Authority will use an evaluation model consisting of three criteria as follows: 1. Commercial: PASS / FAIL 2. Technical – Weighted and scored, as below 3. Price (total) **Full details can be found in the Notes for Bidders document at Annex D to Part B of the Task.**
2.2	Technical Evaluation Criteria
	Responses for Lot 1 and 2 will be assessed against technical evaluation criteria one to five. Responses for Lot 3 will be assessed against technical evaluation criteria two, three, four, and six. This is also captured in Table 2. The response to each technical criteria will be assessed against the scoring matrix in Appendix A. A final score will be a weighted sum of the scores for each technical criteria, as defined at Table 2. <u>Technical Evaluation Criteria:</u> 1. Literature review as evidence for choice of S&T sub-family/sub-families ○ *It is vital that the selection for research focus area is made on the grounds of a strong scientific evidence-base.*

2. Expected findings of the research
    - *It is vital that the research be impactful. The Authority requires an understanding of the questions the research seeks to answer.*

3. Research timeline
    - *Mindful of the six month timescale, it is vital that a strong plan is in place to ensure the research outcomes are met.*
    - To include key research milestones and means for achieving them.

4. Identification and evaluation of risks to the research
    - *While the Authority welcomes aspirational approaches that may carry a degree of uncertainty and technical risk, it is important to understand and monitor these risks to increase the chance of success where possible.*
    - The Authority requires an understanding of the risks, and how they balance against the level of aspiration, to make an informed decision when selecting a proposal.

5. Evidence of delivering high quality research for Defence, since 2017, between technology readiness levels one to four. Evidence must be relevant to the Lot in question.
    - *Mindful of the six month timescale, it is vital that we partner research active organisations who already have the necessary skills and capabilities in place to deliver the research.*
    - See the GOV guidance on Technology Readiness Levels[4]:

6. Description of the mathematically-skilled community to be engaged through workshops, and means of securing this engagement.
    - *It is vital to Defence that UK academia is engaged in the research portfolio.*
    - The Authority seeks proof of engaging a diverse mathematics community in workshop-style activities within the last two years.
    - Evidence in the last two years of delivering research, at Technology Readiness Levels one to four[4]
    - It is required that the response include a plan to secure workshop attendance of at least 15 mathematically-skilled individuals, from at least five UK institutions.

Technical Evaluation Criteria	**Weighting**	**Max available score** (score x weighting)
1 (Lot 1 and 2 Only)	2	20
2	2	20
3	1	10
4	1	10
5 (Lot 1 and 2 Only)	2	20
6 (Lot 3 Only)	3	30

Table 2 Assessment Table

[4] See: https://www.gov.uk/guidance/defence-and-security-accelerator-terms-and-conditions-and-contract-guidance [Accessed June 2022].

Appendix A: Scoring Matrix:

Rating	Characteristic	Score
High Confidence	The Tenderer's approach/justification/evidence to this subject matter and the delivery of the confidence characteristics sought results in the Authority judging that it is highly likely to achieve the objectives sought in this area.	10
Good Confidence	The Tenderer's approach/justification/evidence to this subject matter and the delivery of the confidence characteristics sought results in the Authority judging that it is likely to achieve the objectives sought in this area.	7
Minor Concerns	The Tenderer's approach/justification/evidence to this subject matter is satisfactory in the main however there are some minor areas where either the level of risk to the Authority, the combination of issues or the lack of particular justification/evidence will require managing.	3
Just Acceptable	The Tenderer's approach/justification/evidence to this subject matter has some significant areas of concern and demonstrates either a lack of understanding or a reluctance to fully meet/deliver the entire needs of the Authority. These are however deemed manageable and resolvable either prior to contract award or once on contract and so do not warrant exclusion.	0
Major Concerns (Fail)	The Authority does not have sufficient confidence in the tenderers response in order to successfully deliver the needs of the Authority in this area and is therefore unable to proceed with this tender (Bid Rejected).	n/a Tender Rejected

2.3	Commercial Evaluation Criteria
	Pass/Fail - Tenderer has submitted a commercially compliant bid in accordance with Annex D to Part B of the Task (Bidders Notes).