Serapis Tasking Form

Tasking Form Part 1: *(to be completed by the Authority's Project Manager)*

To:	Lot 4 QinetiQ Plc	From:	Dstl

Any Task placed as a result of your quotation will be subject to the Terms and Conditions of Framework Agreement Number:
LOT 4 DSTL/AGR/SERAPIS/AII/01

VERSION CONTROL
Version 0.a – 20220309 – Initial Version

REQUIREMENT			
Proposal Required by:	April 2022	**Task ID Number:**	**AII124**
The Authority Project Manager:	[REDACTED]	**The Authority Technical Point of Contact:**	[REDACTED]
Task Title:	AII124 DCEAT WP3.2 Generation after Next (GAN) Pulse Waveform Communications		
Required Start Date:	April 2022	**Required End Date:**	July 2022
Requisition No:	RQ0000008944	**Budget Range**	£150k to £200k

TASK DESCRIPTION AND SPECIFICATION	
Serapis Framework Lot	☐ Lot 1: Collect ☐ Lot 2: Space systems ☐ Lot 3: Decide ☒ Lot 4: Assured information infrastructure ☐ Lot 5: Synthetic environment and simulation ☐ Lot 6: Understand

Abstract

This research work supports the requirements of the "Deployed Communications Evolving Against the Threat" (DCEAT) project. This is to be achieved by conducting research at the lower Technology Readiness Levels (TRLs 2-4) to develop
- new capabilities,
- new tools,
- new simulations,
- new prototypes, and
- new experiments.

to allow the Generation After Next (GAN) communications systems **to step ahead and stay ahead** of the threat and to sustain effective command and control (C2) and communications in a denied,

degraded, intermittent and low-bandwidth (DDIL) environment, as well as **enhancing the capability of the UK** to develop and deliver these systems.

This task is focussed on understanding, within a short timeframe, the potential for UK defence **to exploit the opportunities associated with** pulse communications in GAN communications systems to counter the evolving electronic warfare (EW) threats. It is envisaged that the outputs from this task will inform the definition of future work under the DCEAT project within Work Package 3 – Advanced Waveforms.

DCEAT Programme Background and Drivers

The strategic framework document *Global Britain in a competitive age; The Integrated Review of Security, Defence, Development and Foreign Policy*[1] outlines the following four overarching and mutually supporting objectives:

1. *Sustaining strategic advantage through science and technology.*

2. *Shaping the open international order of the future.*

3. *Strengthening security and defence at home and overseas.*

4. *Building resilience at home and overseas.*

To support this framework The Defence Command Paper, *Defence in a competitive age*[2] highlights that

> *The electromagnetic environment, of which cyber is a part, is a fundamental aspect of the modern battlespace. Our adversaries are increasingly active across it and rely on it. We must be able to understand, exploit and secure advantage in this environment.*[Paragraph 7.14]

The ambitions and challenges expressed in this command paper are also reflected in the Ministry of Defence's (MOD's) *Science and Technology Strategy 2020*[3]. A key challenge expressed in this document is

> **Multi-domain Command & Control, Communications and Computers (C4)** - *develop the capability for multi-domain integration and ability to coordinate effects globally enabling us to execute joint operations against adversaries with well-integrated and resilient capabilities.*

The strategy highlights that it is essential that

- *we continue to invest in cross cutting S&T that offers disruptive potential, but where we have not yet identified exploitation routes.*

and that

- *Technologies vital for the generation after next of capabilities are those beginning to emerge now and in the near future. In some areas, particularly digital, they are evolving at a rapid pace. With our ability to understand our future context and therefore back those promising technologies, we will ensure we are ready and prepared to integrate them into our future capabilities.*

C4 "*is a broad, complex and technically challenging area characterised by rapid advances in technologies*"[4]. The C4 environment, however, is the connective tissue that provides the information needed to make decisions and support mobility in a global, and often infrastructure-less, environment. Therefore, fundamental S&T work is required to meet the future challenges of multi-domain C4. The aim of the DCEAT programme, which emerged from the Integrated Review, is to drive the development of resilient deployed communications systems that can stay ahead of the threat, respond rapidly to new threats and exploit new technologies into MOD spiral developments.

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[1] "Global Britain in a competitive age: The Integrated Review of Security, Defence, Development and Foreign Policy", March 2021, CP 402, ISBN: 978-1-5286-2453-4, available at this link.

[2] "*Defence in a competitive age*", March 2021, CP 411, ISBN: 978-1-5286-2462-6, available at this link.

[3] *"Science and Technology Strategy 2020"*, October 2020, V1.2, available at this link.

[4] "*Defence and Security Industrial Strategy: A strategic approach to the UK's defence and security industrial sectors*", March 2021, CP 401, ISBN 978-1-5286-2496-1, available at this link.

The research outcomes from the DCEAT programme will enable MOD to rapidly develop and field technologies that are fit to operate in the contemporary and future battlespace and that will sustain effective C2 in a DDIL environment, from deep ocean to space.

The future challenges in a C4 environment that DCEAT will aim to address include the need for:

- new techniques and technologies that mitigate against rapidly emerging communications threats,
- radio systems to operate in a DDIL environment due to spectrum congestion and/or interference,
- resilient and robust communications systems (i.e low probabilities of detection, interception and exploitation),
- connectivity to all mobile/static platforms (underwater, land, sea, air and space),
- communications links that can support communications ranges from beyond line of sight (BLoS) to short range,
- communications capacities from low to very high data rate systems,
- global operations, often in an infrastructure-less environment,
- conducting operations that range from disaster relief, peacekeeping and surveillance to military engagement,
- interoperability with national and international partners,
- low signature networking,
- new architectures and protocols,
- systems that are application aware, and
- satisfying convergence of systems and networks.

The research within the DCEAT programme is structured along the following inter-dependent headline work streams:

- Materials S&T
- Novel & Advanced Technologies
- Advanced Waveforms
- Operational Agility
- Test, Experiment and Evaluation

The aim of the research defined in this statement of requirement is to understand the potential opportunities **to exploit advanced waveforms, and specifically pulse waveforms to stay ahead of the evolving EW threat**.

Background to Requirement

[REDACTED]

A key complicating factor in establishing and maintaining resilient deployed communications is that communications systems must perform within a dynamic military operational environment, which is influenced by military doctrine and strategies, the mission goals and the physical environment (e.g. terrain, land use) and this environment may change during a mission.

To address the resilience needs of GAN deployed military communications capabilities, the key technology-based behaviours and features need to be identified so that the S&T work to be conducted under the DCEAT programme can be shaped. The identified behaviours and features will need to address the AI&RA across the full communications stack to enable performance and resilience trade-offs to be made. A corresponding set of management-control behaviours and features will also need to be developed and ultimately implemented to ensure that operational agility can be achieved.

In order to step ahead and stay ahead of potential threat evolutions, it will be important to understand the state of the art in advanced waveforms and the way in which these are likely to develop over the coming years. One area of focus is ultra-wideband systems using **pulse waveforms** that make use of very short pulses of radio frequency (RF) energy to exchange information by, for example, using pulse position modulation. These waveforms are attractive in a threat environment for a number of reasons [REDACTED].

Requirement

The requirement of this consultancy research task is to perform and present the results of a strengths, weaknesses, opportunities and threats (SWOT) analysis for ultra-wideband and specifically pulse waveforms (and potentially other waveforms).

It is envisaged that this consultancy research task will commence with a review to understand the start-of-the-art of pulse waveforms and UWB communications in both the military and commercial sectors and also, where possible, the 'direction of travel' in this technology (e.g., what are the active research areas for pulse waveforms).

The SWOT analysis itself should include consideration of a range of factors including the resilience of pulse waveforms and other UWB waveforms against EA techniques, the ability of an adversary to detect and exploit these waveforms, the complexity and availability of the equipment required to support the necessary transmission and reception technologies and the likely size, weight, power and cost (SWaP-C) requirements.

The SWOT analysis should also identify and highlight the potential 'supplementary' benefits of the use of pulse (and other UWB)waveforms [REDACTED]

Pulse and UWB signals may span a number of RF spectrum bands and the challenges this brings (with potential high level solutions) will need to be considered.

It is expected that the output from this task will provide an informed view of the current status and direction of travel of pulse waveform technologies, the ways in which the technology could be exploited by UK Defence and the threats to our own operations if the technology is adopted by our adversaries.

The output of the task should also provide recommendations for further research work to explore and understand this area in more detail that could form the basis of future (long term research or consultancy research) tasks as part of the DCEAT project.

Innovation Benefits and Exploitation Plan (IBEP)

By conducting the work outlined in this SoR and any future tasks that it helps to define, the following are anticipated.

1. Innovation – (i.e. what are we building on?)
   a. academic and other lower TRL research
   b. applications know-how in a military/civil domain
   c. previous academic collaborations

2. Benefits (i.e. what will the contracted stakeholders get from this?)
   a. increased defence know-how
   b. access to industrial defence sector expertise
   c. new cross-domain collaborations
   d. development of new capabilities
   e. closer defence-sector / academic collaboration

3. Exploitation (what are the artefacts that Dstl will get that can be more widely exploited)
   a. know-how in the defence industrial base (conference/journal papers, reports, presentations)
   b. know-how in the academic supply base
   c. Research recommendations

4. Plan (what's the plan for exploitation)
   a. Future know-how into the industrial base via new work
   b. enhanced UK reputation in defence S&T
   c. exploitation internationally e.g. USA DoD research themes
   d. international influence through ideas and generation of best practice/standards

Wider economic and societal benefits of the work

The wider societal benefits of the work include:
- advancing discovery and know-how in the field of resilient communications
- maintaining and developing UK expertise.
- increasing technology in the defence and security sector
- creation of new networks
- enhanced international profile
- engagement in communications standards forums (e.g. 6G, ETSI, ITU, 3GPP)

Outputs.

Outputs (or artefacts) of the project activities that may be exploited more widely include:
- demonstrations / prototypes of hardware based technologies
- demonstrations / prototypes of software or algorithms
- demonstrations of results
- conference papers/presentations
- interface description documents
- experimentation plans
- system design architectural plans

Deliverables.

The formal deliverables of the project are highlighted in the Deliverables section and which may be enhanced during the proposal stage.

A consolidated report will be required in on task completion highlighting:
- Aims
- Technical Progress
- Achievements
- Exploitable outputs
- Recommendations

Procurement Strategy

☒ Lot Lead to recommend   ☐ Single Source / Direct Award

Pricing:

☒ Firm Pricing   ☐ Ascertained Costs*   ☐ Other*

Firm Pricing shall be in accordance with DEFCON 127 and DEFCON 643

Ascertained Costs shall be in accordance with DEFCON 653 or DEFCON 802.

*only at Authority's discretion

Task IP Conditions

Task IP Conditions (Follow the NIPPY guide to identify your information and IP requirements for each deliverable)	Summary of the Authority's rights in foreground IP (IP generated by the supplier in performance of the contract)
DEFCON 703 ☐	Vests ownership with the Authority
DEFCON 705 Full Rights ☒	Enables MOD to share in confidence as GFI or IRC under certain types of agreements.

	Can be shared in confidence within UK Government.
OTHER IP DEFCONS: 14* ☐, 15* ☐, 16* ☐, 90* ☐, 91* ☐, 126* ☐	Generally only suitable for deliverables at TRL 6 and above.
BESPOKE IP Clause ☐ *	Details to be added and agreed by IP Group

* Do not use without IPG advice and approval

Please state in this text box if MOD or the customer has a requirement a) that one or more Other Government Departments is able to share confidentially with their own suppliers, b) to publish but you do not think there is a requirement to own or control the deliverable, or c) to share under a procurement* Memorandum of Understanding (MOU).

If any of these three issues applies, please contact IPG for advice before completing this form.
*Listing research MOUs is not required, but can be a helpful courtesy to the supplier.

DELIVERABLES

[REDACTED]

DELIVERABLE: ACCEPTANCE / REJECTION CRITERIA

Unless otherwise stated below, Standard Deliverable Acceptance / Rejection applies. This is 30 business days, in accordance with DEFCON 524 Rejection, and DEFCON 525 Acceptance.

Standard Deliverable Acceptance / Rejection:-

Yes ☒ (DEFCON 524 Rejection, and DEFCON 525 Acceptance)

No ☐ (if no, please state details of applicable criteria below)

Deliverable Acceptance / Rejection Criteria:-

If there are any other specific acceptance/rejection criteria you would like to apply to any of the deliverables, please state them here.

Government Furnished Assets (GFA)

ISSUE OF EQUIPMENT/RESOURCES/INFORMATION/FACILITIES (*if not applicable, delete table and insert "None" in this text box*)

Unique Identifier/ Serial No	Description	Classification	Type	Available Date	Issued by	Return or Disposal Date	Any restrictions?
N/A	N/A						

QUALITY STANDARDS

☐ **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 in free text below)
[REDACTED]
TASK CYBER RISK ASSESSMENT. *(In accordance with DEF STAN 05-138 and the* Risk Assessment Workflow) **[REDACTED]**
ADDITIONAL TERMS AND CONDITIONS APPLICABLE TO THIS CONTRACT N/A

Please ensure all completed forms are copied to DSTLSERAPIS@dstl.gov.uk when sending to the Lot Lead.

Tasking Form Part 2: *(To be completed by the Lot Lead)*

To:	The Authority	From:	The Lot Lead

Proposal Reference	Serapis Task AII124: Generation After Next Pulse Waveform Communications, QINETIQ/22/03190, v1.0 **(attached)**

Delivery of the requirement:

The proposal <u>shall</u> include, but not be limited to:

- A full technical proposal that meets the individual activities that are detailed in Statement of Requirements (Part 1 to Tasking Form).
- Breakdown of individual Deliverables, with corresponding Intellectual Property rights applied.
- Breakdown of Interim Milestone Payments, with corresponding due dates.
- A work breakdown structure/project plan with key dates and deliverables identified.
- A list of required Government Furnished Assets from the Authority, including required delivery dates.
- A clear identification of Dependencies, Assumptions, Risks and Exclusions which underpin your Technical Proposal.
- Sub-Contractors Personnel Particulars Research Worker Form and security clearances (if applicable)

COMMERCIAL

[REDACTED]

Offer of Contract: *(to be completed and signed by the Contractor's Commercial or Contract Manager)*

Total Proposal Price in £	**£220,284.61**		(ex VAT)
Start Date:	12/09/22	**End Date:**	28/02/23
Lot Leads Representative	Name	[REDACTED]	
	Tel	[REDACTED]	
	Email	[REDACTED]	
	Date	01st September 2022	
Position in Company	Assistant Commercial Manager		
Signature	[REDACTED]		

Core Work – Breakdown

[All tables REDACTED]

<u>Core Work – Milestone breakdown costs</u>

Proposed Milestones Payments

Your TMS bid costs shall be included in milestone 1.

The final Milestone must reflect the actual cost of the deliverable, and be greater than 20% of the Task value, unless otherwise agreed with your Commercial POC

Please duplicate the template per milestone table format below as necessary, and rename milestone number accordingly.

[REDACTED]

Tasking Form Part 3:

To be completed by the Authority's Commercial Officer and copied to the Authority's Project Manager.

1. **Acceptance of Contract:**		
Authority's Commercial Officer	Name	[REDACTED]
	Tel	[REDACTED]
	Email	[REDACTED]
	Date	27/10/2022
Requisition Number		
Contractor's Proposal Number		AII124 - DCEAT WP3.2 Generation after Next (GAN) Pulse Waveform Communications
Purchase Order Number		DSTL0000009158
Signature		[REDACTED]
Please Note: Task authorisation to be issued by the Authority's Commercial Officer or Contract Manager. Any work carried out prior to authorisation is at the Contractor's own risk.		