SERAPIS TASKING FORM

COMPLETE SQUARE BRACKETS AND REMOVE COMMENTS BEFORE SENDING TO THE SUPPLIER

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

To:	Lot 4 QinetiQ Plc	**From:**	Dstl

REQUIREMENT			
Proposal Required by:	–10/03/21	**Task ID Number:**	AII51
Project Manager:	[REDACTED]	**Technical Point of Contact:**	[REDACTED]
Task Title:	CHALLENGE CALL Free-Space Optical Communications (FSOC) – atmospheric turbulence mitigation techniques	**New Task ☒**	**Change ☐**
Required Start Date:	[15/03/21] estimated	**Required End Date:**	TBC depending on ideas taken forward
Requisition No:	1000160587	**Budget Range**	£125k for investigation phase (£50k to be spent by end FY21) £150K (for experimentation phase)
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		

Statement of Requirements (SOR)

INNOVATIVE IDEAS' CHALLENGE CALL: FSOC – atmospheric turbulence mitigation techniques

Free Space Optical Communication (FSOC) involves the modulation and transmission of optical signals over a free space atmospheric channel. In comparison to RF links, FSOC systems, due to the bandwidths available, offer potential data-rates similar to those achievable with fibre optics systems (i.e.Gb/s). As well as enabling high data-rate applications, they provide benefits of low probability of interception and detection due to the narrow beam-widths and directionality of the links.

A primary limiting factor of FSOC is the propagation environment. The free space propagation environment is time and spatially varying. The propagating signals, therefore, suffer signal attenuation, fading and very fast fading which impacts system performance.

Very fast fading is caused by atmospheric turbulence due to the mixing of hot and cold air creating variations in the air's refractive index and these refractive index variations impact data-link quality. To

enhance system performance, therefore, atmospheric turbulence mitigation techniques that can be used at the physical layer or at the network layer need to be developed and evaluated.

Options to mitigate atmospheric turbulence at physical layer could include;

- multiple beam/or band transmission,
- modulation and coding,
- increasing receiver Field of View (FOV),
- adaptive optics,
- relay transmission,
- hybrid RF/FSOC etc.

Alternatively, methods used in the network layer in order to improve the performance and availability of an FSOC system could include

- packet re-transmission (in FSOC link or network),
- network re-routing,
- quality of service (QoS) control,
- data re-play

The aim of this activity is call for innovative ideas to develop atmospheric turbulence mitigation techniques available at the physical and network layers in order to increase the range of FSOC terrestrial links.

An Investigate and Experiment/Simulate approach is planned

- In the Investigate phase a number of down-selected options will be further explored to test their viability
- In the Experiment/Simulate phase one or two investigate studies will be taken forward.

Task Requirement

This task is under the SERAPIS INNOVATIVE IDEAS' CHALLENGE CALL - PROCESS where innovative ideas are sought from the widest possible community for down-selection and further study.

Concepts and ideas are sought to address the following research questions.

1. What new atmospheric turbulence mitigation techniques (at the physical and network) could be used to enhance the communications range of FSOC system.

Whilst scattering, attenuation and bulk beam-wander effects caused by rain, snow, fog and bulk changes in the refractive index degrade the performance of FSOC systems, these effects are not required to be included within this research.

Additionally, it is assumed:

- that the receiver aperture is smaller than the correlation length of fading (limited/no aperture averaging) and
- that the receiver observation interval during each bit interval is smaller than the turbulence correlation time.

Task Output

The response to the Challenge Call is in a presentation-format that comprises 3 slides (one set of slides for each idea):

- Slide 1 – A free form description / illustration of the proposed solution.
- Slide 2 – A descriptive slide that is divided into 4 sections that map to the assessment criteria, namely:

1. What aspect of atmospheric turbulence are you mitigating (30% of overall assessment)
    - Aspect being mitigated and extent to which it could provide a solution – 15%
    - Technical performance enhancement – 7.5%
    - Scalability – 7.5%
2. Operational Relevance – (20% of overall assessment)
    - Deployability / Operational context – 10%
    - Size Weight and Power impact – 5%
    - Dependencies – 5%
3. Technical solution description– (40% of overall assessment)
    - Novelty – 16%
    - Potential wider impact – 8%
    - Further applications – 4%
    - Collaboration – 12%
4. Risks & Commercials – (10% of overall assessment)
    - Technical Risks - 5%
    - Commercial Risks – 5%

- Slide 3 – Reference slide / literature review,

Responses will be to be treated as DEFCON 705

Responses will not be shared with other bidders

Responses taken forward will be contracted under DEFCON 703

Presentations will be sought from up to 5-7 proposals

(Other ideas will be logged and may be directed to other themes)

The aim is to take up to 3 proposals forward to “Investigate” stage

The aim is to take up to 1-2 forward to a future “Experiment/Simulate” stage

Benefits

The expectation of the task is that it will:

- Enhance decision making
- Increase Technical Readiness Level

It is expected that the task will take as inputs:

- General theory or concepts such as general COTS methods and techniques and models

It is expected that the task exploitation will be via:

- Knowledge or capability in UK industrial/Dstl base
- Improved decision making
- Achieve strategic influence

Budget

It is estimated that up to 3tasks (<£50k each) will be taken forward in the investigate phase – under the initial contract for AII51

It is estimated that up to 1-2 tasks (<125k) will be taken forward to an experimentation/simulation phase – as a contract change to AII51

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 ☐	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	

DELIVERABLES

The output of this task will be a technical report that shall provide the authority with sufficient information and detail to enable them to judge the merits of this potential capability and to inform the decision that takes this task to the next stage logical stage.

Deliverable: Acceptance / Rejection Criteria *(30 business days unless agreed otherwise)*

DEFCON 524 Rejection ☒ period [30] days DEFCON 525 Acceptance ☒ period [30] days

ISSUE OF EQUIPMENT/MATERIAL/INFORMATION

N/A

QUALITY STANDARDS

SECURITY CLASSIFICATION OF THE WORK *(A Security Aspects Letter (SAL) will be required for each Task above Official-Sensitive, Quotes are covered by the Framework SAL)*

The highest classification of this SOR

OFFICIAL ☐ OFFICIAL-SENSITIVE ☐ SECRET ☐ TOP SECRET ☐ STRAP ☐ SAP ☐

The highest expected classification of the work carried out by the contractor

OFFICIAL ☐ OFFICIAL-SENSITIVE ☐ SECRET ☐ TOP SECRET ☐ STRAP ☐ SAP ☐

The highest expected classification of Deliverables/Output

OFFICIAL ☐ OFFICIAL-SENSITIVE ☐ SECRET ☐ TOP SECRET ☐ STRAP ☐ SAP ☐

SAL Attached ☐

TASK CYBER RISK ASSESSMENT. *(In accordance with DEF STAN 05-138 and the* Risk Assessment Workflow)

Cyber Risk Level	[REDACTED]	Risk Assessment Reference	[REDACTED]

ADDITIONAL TERMS AND CONDITIONS APPLICABLE TO THIS CONTRACT

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

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

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

To:	The Authority FAO: Tel:	**From:**	The Lot Lead

Proposal Reference **Please see below** **(attached)**

Delivery of the requirement:

This proposal includes three technical proposals from QinetiQ, PA-Consulting, and University of Edinburgh as follows:

- QinetiQ Technical Proposal: Serapis Lot 4 Task AII51: Free-Space Optical Communications (FSOC) – Atmospheric Turbulence Mitigation Techniques: Multiple Aperture FSOC Turbulence Mitigation, QINETIQ/21/00991 Version 2.0
- PA-Consulting Technical Proposal: Serapis Task AII51: Free Space Optical Communications using adaptive OFDM, TGP-21-5505-D_A9 Version 2.0
- University of Edinburgh Technical Proposal: Serapis Lot 4 Task AII51: Exploiting Polarisation State and Subcarrier Modulation for Turbulence Mitigation in FSOC, QINETIQ/21/02283, Version 1.0

PA Consulting have some background IP, please refer to their technical proposal

V3 – Updated to include UCL hourly rate and number of hours
V4 – Updated to include UCL daily rate and number of days
V5 – University of Edinburgh proposal costs added
V6 – Updated to include latest Edingburgh price and revised start date

PRICE BREAKDOWN

The Firm Price offer is shown below.

Please refer to the pricing breakdown below.

COMMERCIAL

[REDACTED]

Total Proposal Price in £	£243,060.70		(ex VAT)
Start Date:	16th August 2021	**End Date:**	31st March 2022

Lot Leads Representative	Name	[REDACTED]
	Tel	[REDACTED]
	Email	[REDACTED]
	Date	28th July 2021
Position in Company	Assistant Commercial Manager	
Signature	[REDACTED]	

Contractor price breakdown

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

TOTAL Price						**£243,060.70**			

Tasking Form Part 3:

1. **Offer of Contract:** *(to be completed by the Authority's Commercial Officer or Contract Manager and copied to the Authority's Project Manager)*		
Authority's Commercial Officer	Name	[REDACTED]
	Tel	[REDACTED]
	Email	[REDACTED]
	Date	11/08/2021
Requisition Number		R1000160587
Contractor's Proposal Number		QINETIQ/21/00991
Purchase Order Number		DSTLX-1000161791
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.		