Serapis Tasking Form

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

To:	Lot 1 Roke Manor Research Ltd	From:	The Authority

Any Task placed as a result of your quotation will be subject to the Terms and Conditions of Framework Agreement Number: LOT 1 DSTL/AGR/SERAPIS/COL/01

VERSION CONTROL

01-000

REQUIREMENT

Proposal Required by:	[17/09/2021]	Task ID Number:	C43
The Authority Project Manager:	[REDACTED]	The Authority Technical Point of Contact:	[REDACTED]
Task Title:	Future Radar ES ID		
Required Start Date:	[05/10/2021]	Required End Date:	[28/02/2022]
Requisition No:	1000165827	Budget Range	£600k

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

BACKGROUND

This task is part of the Understanding Unknowns challenge within the Future Electronic Surveillance (FES) research project within the Future Sensing and Situational Awareness (FSSA) programme. Understanding Unknowns addresses the challenge of characterising and labelling signals which have either not been previously observed, or are difficult for traditional ES systems to visualise.

Specifically, this task is addressing the increasing use of complex, modern radar systems which has led to a congested and complex EME. This task is therefore to assess, develop and evaluate alternate approaches to radar identification.

The Supplier shall deliver novel algorithmic approaches to the classification of radar exploiting data intercepted by an advanced radar electronic surveillance system. These algorithms shall be developed up to TRL3. The output from this will be able to enhance the host platform's threat awareness and that of the accompanying force within the vicinity. This information

will be exploitable by decision making processes (which are not part of this contract) and used to inform optimum selection of available tactics, techniques and procedures including manoeuvre, countermeasures and/or attack.

This task has 5 (five) work packages. They are:

- **WP1 - Data Processing and Synthesis:** Conversion of a large GFX dataset (raw IQ) into a Pulse Descriptor Word (PDW) representation with generation and analysis of a synthetic multi-behaviour dataset and its suitability for assessment in WP2 and WP3.
- **WP2 - Radar Assessment**: Development of techniques (to TRL3) to classify, at a tactical level, a radar based on its waveform and temporal characteristics; assessing a chosen technique(s) on the dataset from WP1.
- **WP3 - Deinterleaving:** Development of techniques (to TRL3) to assess and cluster intercepted radar pulses for subsequent classification, resilient to collection conditions.
- **WP4 - Demonstration Software:** Development and demonstration of a Graphical User Interface (GUI) that permits visualisation and interaction with software outputs from WP2 and WP3.
- **WP5 - Future Identification Architectures:** Holding a workshop and producing a white-paper assessment of potential future identification methods and concepts, including a Radar Electronic Surveillance 2041+ 'Architecture Vision' proposal.

Work Packages 1 through 4 have high levels of interdependencies. Additionally, the experience gained through those work packages is expected to contribute to and inform Work Package 5.

Work Package 1: Data Processing and Synthesis

This work package is focused on the processing and preparation of a GFX dataset and generation of a synthetic dataset on which to assess algorithms developed in WP2 and WP3.

The GFX dataset comprises data from six collections lasting 45 minutes each at 125 MHz bandwidth. There of approximately 30,000 files (910 GB) in .dta (IQ data) and .csv (receiver position) formats.

The Supplier shall convert this GFX dataset from its raw I/Q format into a Pulse Descriptor Word (PDW) representation. Using GFI waveform parameters, the Supplier shall then extract those pulses from the dataset which belong to a specific test emitter into a single pulse train of PDWs. Using Subject Matter Expert (SME) judgement, the Supplier shall then ground truth the extracted pulse train.

The complete PDW representation of the dataset, as well as the ground-truthed pulse train from the specific test emitter with the ground truth file shall be delivered (see Deliverables) in csv formats agreed with The Authority. The dataset is an output of a live flight trial and contains many sources of complex emissions. The Authority has identified and partially manually ground truthed a key radar in the dataset. The success of the Supplier's conversion process will be assessed using this ground truth with the expectation that at least 95% of those emissions are converted to an accuracy agreed with the Authority. The Supplier's conversion process should also output a large number of other emissions from other sources. It is acceptable that there will be errors associated with these and not every emission will be converted successfully.

The Supplier shall also generate a synthetic PDW dataset from a single multi-function radar. The dataset shall consist only of pulses from the single synthetic radar. A GFX MATLAB script will be provided for this, however the Supplier may use their own pulse synthesis tool if preferred. The Supplier shall ground truth the dataset.

The synthetic PDW dataset shall be complete enough and have sufficient levels of complexity and variability, to be agreed with Dstl as data synthesis occurs, to support the development and assessment of WP2 and WP3 and visualisation of the outputs under WP4. The dataset can grow throughout the duration of the contract in line with the Supplier's understanding of requirements.

The complete synthetic PDW dataset, as well as the ground truth shall be delivered (see Deliverables) in csv formats agreed with The Authority.

At the end of WP1 the Supplier will deliver a Data Processing and Synthesis report (see Deliverables) to include the algorithmic flow of the PDW extraction process, observations on the quality of the GFX data and suitability for use in algorithm assessment, and the process followed to define and generate the synthetic dataset. The suitability of the dataset is to be agreed with Dstl. The proposed measures of suitability are to be recommended within the Suppliers proposal.

Requirements

SoR ID	Requirement Description	Outputs	Inputs
R1.1	Convert data from IQ to PDW and extraction of PDW belonging to specific waveforms. This shall include conducting a 'ground truth' of waveforms.	Labelled PDW Dataset	GFX IQ dataset, Background information to dataset
R1.2	Generate a synthetic PDW dataset to a complexity and variability to be proposed by the Supplier and agreed with Dstl.	Labelled PDW Dataset	Matlab data generation script

Work Package 2: Radar Assessment

This work package is focused on the development of techniques to classify, at a tactical level, a radar based on its waveform and temporal characteristics.

The Supplier shall then conduct an assessment of techniques to classify a radar. This shall include a consideration of how ambiguous such an assessment may be, given many modern radars employ complex processing to improve their capabilities, which ES is blind to. Modern radars undertake complex receive processing and as such any capability determined through ES may only be an indication of true capability, especially if a radar is part of a wider network capable of sharing information.

The Supplier shall then develop a technique agreed on in conjunction with The Authority, to TRL 3. This shall be written in a language to be agreed with The Authority and compatible with the software outputs of WP3 and WP4.

The Authority place no constraints on the development in terms of computer resources, however the implementation must run at a latency similar to that of the algorithm developed in WP3. The algorithm will accept pulse trains of pulse descriptor words. The algorithm will make an assessment of the radar for each pulse train.

The Supplier shall assess the performance of the implemented algorithm against the datasets prepared and synthesized in WP1. Performance will be assessed against the datasets both by using the ground truth and by using the algorithm developed in WP3 (in an end-to-end process). As a part of this assessment the datasets must be varied with:

- The addition of random pulses
- The dropping of random pulses
- The adding of statistical noise onto the PDW parameters

The problem space over which to test the algorithms will be agreed with The Authority. The Supplier is to propose variations to be applied during the work package within their proposal.

Algorithm performance should be assessed using typical metrics associated with confusion matrices (i.e. precision, recall, F-measure). The Supplier is to propose the scope and metrics used to assess algorithm performance during the work package within their proposal.

Should The Supplier have access to additional suitable data sets where the supplier has the rights to use and distribute the dataset, these may be used for assessment of the technique. These data sets shall then be deliverable to the Authority (as DEFCON705 - see Deliverables).

The Authority accept that the algorithmic techniques developed across WP2 and WP3 may have mutual reliance and as such would be open to proposals for methods that intrinsically link the deinterleaving process with algorithms developed in WP2.

All software developed for this task shall be a deliverable to the Authority (see Deliverables). Should the Supplier employ software declared as Background IP, these may be delivered as an executable or object library. However, the addition of background IP is not preferred due to the constraints it places on the Authority to further exploit the outputs of the task.

At the end of WP2, the Supplier shall deliver of a Radar Assessment report, to include a full and detailed description of the algorithms considered, and classification techniques, the decision and down selection criteria, the algorithm implementation (including software flow), and performance assessment against all datasets (see Deliverables).

All software developed for this task shall be a deliverable to the Authority (see Deliverables). Should the Supplier employ software declared as Background IP, these may be delivered as an executable or object library, although the addition of background IP is not preferred.

Requirements

SoR ID	Requirement Description	Outputs	Inputs
R2.1	[REDACTED]	Report Section	
R2.2	[REDACTED]	Report Section	
R2.3	[REDACTED]	Report Section	
R2.4	[REDACTED]	Report Section	
R2.5	Assess the level of ambiguity and confidence in radar classification given modern radar processing	Report Section	
R2.6	Implement, at TRL3, a down selected technique or combinations of techniques identified during R2.2, R2.3 and R2.4 within a non-real time software environment operating on outputs from WP1. *Note: The input to the implementation can be assumed to be a series of PDWs*	Software	

R2.7	The implementation shall run with an equivalent latency to the software output from WP3 but with no restrictions on compute form factor and processing capacity.		
R2.8	Propose a performance assessment plan for the implemented technique(s)	Tech Note	
R2.9	Carry out the performance assessment plan utilising the WP1 datasets.	Report Section	
R2.10	Carry out the performance assessment plan utilising other datasets available to the Supplier	Report Section Datasets	
R2.11	The Supplier shall not use software containing Background IP		

Work Package 3: Deinterleaving

This work package is focused on the development of techniques to assess and cluster intercepted radar pulses for subsequent classification.

Radar ES deinterleaving focuses on clustering received emissions together that emanate from the same radar transmitter and produce a single track per emitter. Spatial information such as angle-of-arrival is a big discriminator for this.

The Supplier shall initially conduct a review of state-of-the-art pattern recognition and clustering techniques. The advantages and disadvantages to each should be recorded. The Supplier shall propose Deinterleaving approaches which:

- Must be resilient to realistic collection conditions, such as non-linear pulse measurement errors, dropped and split pulses and pulse collisions

The Supplier shall then develop a Deinterleaving technique agreed on in conjunction with The Authority, to TRL 3. This shall be written in a language to be agreed with The Authority and compatible with the software outputs of WP2 and WP4.

The Authority place no constraints on the development in terms of computer resources, however the implementation must run at a latency similar to that of the algorithm developed in WP2. The algorithm will accept a single pulse trains of PDWs, which can be assumed to from a single emitter. The algorithm shall cluster the input data and output these as pulse trains of PDWs.

The Supplier shall assess the performance of the implemented algorithm against the datasets prepared and synthesized in WP1. As a part of this assessment the datasets must be varied with:

- The addition of random pulses
- The dropping of random pulses
- The adding of statistical noise onto the PDW parameters

The problem space over which to test the algorithms will be agreed with The Authority. The Supplier is to propose variations to be applied during the work package within their proposal.

Algorithm performance should be assessed using typical metrics associated with confusion matrices (i.e. precision, recall, F-measure). The Supplier is to propose the scope and metrics used to assess algorithm performance during the work package within their proposal.

Should the Supplier have access to additional suitable data sets where the supplier has the rights to use and distribute the dataset, these may be used for assessment of the technique. These data sets shall then be deliverable to the Authority (as DEFCON705 - see Deliverables).

All software developed for this task shall be a deliverable to the Authority (see Deliverables). Should the Supplier employ software declared as Background IP, these may be delivered as an executable or object library. However, the addition of background IP is not preferred due to the constraints it places on the Authority to further exploit the outputs of the task.

At the end of WP3 the Supplier shall deliver a Deinterleaving report, to include the review of clustering and pattern recognition methods, a full and detailed description of the algorithms considered, the decision and down selection criteria, the algorithm implementation (including software flow), and performance assessment against all datasets (see Deliverables).

All software developed for this task shall be a deliverable to the Authority (see Deliverables). Should The Supplier employ software declared as Background IP, these may be delivered as an executable or object library. However, the addition of background IP is not preferred due to the constraints it places on the Authority to further exploit the outputs of the task.

Requirements

SoR ID	Requirement Description	Outputs	Inputs
R3.1	Review, develop and assess different clustering and pattern recognition algorithms that could be used to split a series of ES detections	Report Section	
R3.2	Develop approaches to combine different algorithms	Report Section	
R3.3	Implement, at TRL3, a deinterleaving algorithm within a non-real time software environment operating on outputs from WP1.	Software	
R3.4	The deinterleaving algorithm shall be resilient to realistic collection conditions, such as non-linear pulse measurement errors, dropped and split pulses and pulse collisions		
R3.5	The deinterleaving algorithm will consider identification process that includes the techniques developed in WP2		
R3.6	[REDACTED]		
R3.7	The behavioural deinterleaving algorithm shall run with an equivalent latency to the software output from WP2 but with no restrictions on compute form factor and processing capacity.		
R3.8	Propose a performance assessment plan for the implemented technique(s)	Tech Note	
R3.9	Carry out the performance assessment plan utilising the WP1 datasets.	Report Section	
R3.10	The assessment shall include modifications to the WP1 datasets to simulate missing pulses and corrupted pulse measurements.		
R3.11	Carry out the performance assessment plan utilising other datasets available to the Supplier	Report Section Datasets	
R3.12	The Supplier shall not use software containing Background IP		

Work Package 4: Demonstration Software

This work package focuses on the development of a Graphical User Interface that permits visualisation and interaction with software outputs from WP2 and WP3.

The Supplier shall initially generate software requirements to be agreed with the Authority, and propose designs for a GUI and software back end that allows the PDW and ground truth data from WP1 to be loaded, and the algorithms developed in WP2 and WP3 to subsequently run on the loaded data. This will involve diagrams of potential visual representations of the input, ground truth and output data and labelling schemes and indications to highlight algorithm performance against the ground truth. The Supplier may wish to consider multiple 2D colour-coded plots of PDW parameters as one possible method of visualising the data and algorithmic performance.

The Supplier shall then develop those elements of the software proposal agreed on in conjunction with The Authority

The GUI must allow the loading of PDW and ground truth files between start and end time-stamps to allow visualisation of subsets of input data, and pausing of the GUI and processing.

With the exception of user-defined start and end processing time-stamps and the ability to pause the GUI and processing, there is no requirement for the software to be interactive.

The software shall be written in a language to be agreed with The Authority and compatible with the software outputs of WP2 and WP3. The use of 3rd party software packages will be allowed with prior agreement from The Authority.

The Authority place no constraints on the development in terms of computer resources, or run-time.

It is not anticipated that the Supplier will require this software for the in-depth performance assessment aspects of WP2 and WP3.

The software developed for this task shall be a deliverable to the Authority (see Deliverables). Should The Supplier employ software declared as Background IP, these may be delivered as an executable or object library, although the addition of background IP is not preferred.

Requirements

SoR ID	Requirement Description	Outputs	Inputs
R4.1	The Supplier shall generate complete software requirements, to be agreed with the Authority, for a GUI to demonstrate the performance of the technique(s) implemented within WP2 and WP3.	Requirement Set	
R4.2	The Supplier shall propose a design for the GUI to be agreed with the Authority.	Presentation (Powerpoint)	
R4.3	The Supplier shall implement an executable GUI according to the agreed design in a software framework agreed with The Authority. *Note: The GUI does not need to be fully interactive or operate in real-time*	Software and Documentation	
R4.4	The GUI shall enable the User to select and load PDW datasets in formats used in WP1.		

R4.5	The GUI shall enable the User to select and load ground truth records in formats used in WP1.		
R4.6	The GUI shall enable the User to replay the loaded PDW datasets between two user defined time stamps.		
R4.7	The GUI shall give a visual demonstration of how both the algorithms in WP2 and WP3 operate.		
R4.8	The GUI shall display both ground truth and algorithm output		
R4.9	The Supplier shall demonstrate the GUI to the Authority at Authority or Supplier Premises on Supplier Equipment.		
R4.10	The Supplier shall provide installation instructions describing the installation process and any hardware or software installation dependencies.		

Work Package 5: Future ID Architectures

WP5 shall produce a white-paper assessment of potential future ID methods and concepts, including a RES 2041+ 'Architecture Vision' proposal.

The Supplier will produce an assessment of current literature different classification and identification algorithms and provide discussion on relative merits of different methods as part of an ES system.

The Supplier shall produce an assessment of timescales in the ES process.

The Supplier will arrange, host and act as facilitators for all aspects of a Subject Matter Expert workshop where current radar ES ID challenges are captured from a range of supplier representatives, covering various supplier types (primes, small to medium enterprises, non-traditional defence suppliers and, if appropriate, academia). The workshop shall present concepts for solving these challenges and propose a 'vision' for discussion. Multiple concepts and ideas shall be presented for discussion, including but not limited to those concepts assessed previously in WP5, traditional emitter type ID. The output of this workshop and totality of WP 5 would be a proposed RES ID 'architecture vision' for the Authority to agree and identification of research options to realise this for consideration.

The Supplier shall provide recommendations for research covering all of the aforementioned points.

The output of WP5 shall be a white paper including the points detailed above and delivered to the Authority (see Deliverables).

Requirements

SoR ID	Requirement Description	Outputs	Inputs

R5.1	The Supplier shall arrange, host and facilitate a Subject Matter Expert workshop on RES ID challenges and solutions to inform a (2041+) RES ID architecture vision. The Supplier is to include a proposed scope of attendees within the proposal.	Calling Notice. Attendee List. Presented Materials. Workshop Minutes/Notes.	Dstl SME's and other attendees	
R5.2	[REDACTED]			
R5.3	[REDACTED]			
R5.4	[REDACTED]			
R5.5	[REDACTED]			
R5.6	[REDACTED]			
R5.7	The Supplier shall produce a White Paper encompassing the outputs of R5.1 through R5.6 with a suggested future (2041+) RES ID architecture vision.	Report (White Paper)		

Part 6; Project Monitoring and Communication.

Approach:

This part is to provide overall project management and articulate monitoring expectations of the Trials support provided by the supplier and ensure adequate coordination between parties to maximise successful outcomes for each of the Trials.

Formal communications shall be between the Supplier's Project Manager and the PMO Project Manager. Informal technical communications between the Supplier and the Authority's Technical Partner should copy in their respective Project Managers and the PMO if of a contractual nature.

Requirements:

SoR ID	Requirement Description	Outputs	Inputs
R6.1	The Supplier shall arrange a kick-off meeting to take place within 1 week of Contract Award (CA) via teleconference. The purpose of this meeting is to confirm plans, risks, and issues. The Supplier shall confirm the dates and locations for all subsequent meetings. The Supplier shall send a completed kick-off presentation at least 2 working days prior to the kick-off meeting.	Agenda. Kick Off presentation.	Kick-off Template
R6.2	The Supplier shall also arrange Monthly Project Board meetings via teleconference. These will consider the monthly progress reporting. The meetings shall be attended by the PMO and may also be attended by the Authority's Project Manager and/or Technical Partners. Depending upon the proposed schedule, Monthly Project Board meetings may not be required; for example, if near-coincident with other formal customer engagements. However, monthly progress reporting will remain a requirement in this case. The Supplier shall provide monthly inputs to be delivered 5 working days before the associated Project Board meeting.	Standing Agenda. Monthly reports.	Meeting/Report Template
R6.3	Any activity associated with this task falling outside of the sub-contractor's normal working practices shall require a risk assessment. All risk assessments shall be made available for review and approval prior to any activity being carried out.	Risk Assessments	
R6.4	The Supplier shall arrange a close-down meeting to take place no later than 1 week prior to the end of the contract. This shall also serve as a formal close down meeting at which lessons identified, future exploitation, and benefits shall be captured.	Agenda. Close down minutes.	Close Down Template

EVALUATION

The following sections summarise the evaluation criteria on which proposals will be assessed. The full criteria and is detailed in **a separate evaluation criteria matrix which must be completed by the supplier**. Suppliers should ensure that adequate evidence is presented in the matrix and clearly referenced, where applicable, to justify any compliance claimed. The criteria are split into three categories with different weightings.

Criteria Category	Category Weight
Commercial	Pass/Fail
Governance and Capability	30%
Technical	70%

It is important to note that the weighting given to individual criteria is based on the importance to assessment of the *proposal*, and **not** related to the expected effort for each area during the *contract*.

For each of the evaluation criteria in a category, the following definitions apply to the Priority:

Priority	Description
Mandatory (M)	The supplier must meet this requirement to comply with **legislative** or other Authority/Lot 1 **policy and process** requirements
Key (K)	**A key requirement to enable the Authority objectives** of the task to be met. Failure of a supplier to meet the requirement or part of it may prejudice the value of placing the task.
Priority 1 (1)	An important requirement that **will require acceptance by the Authority** if the requirement cannot be met in full or in part
Priority 2 (2)	A desirable requirement that has **perceived additional benefit** to the task if included by the supplier, but that does not require discussion with the authority if the requirement or part of it cannot be met by the supplier

Proposals shall be scored based on the assessor's confidence in the proposal to meet requirements within the Task Form and associated evaluation criteria, based on example qualitative characteristics in areas of the proposal such as but not limited to understanding and compliance with requirements, clarity of proposal, evidence presented and residual risk.

For each weighted governance, capability and technical criteria, or grouped criteria, a confidence level will be assigned based on the evidence presented within the proposal and the associated score awarded.

Score	Confidence Level
Zero (0)	The assessors have no confidence in the supplier's response
3	The assessors are somewhat confident in the supplier's response
7	The assessors have good confidence in the supplier's response
10	The assessors have complete confidence in the supplier's response

For Mandatory criteria, scoring shall be Pass/Fail.

The total score for a supplier is the summation of all criteria scores multiplied by their weight within each category, multiplied by the category weighting.

$$\text{Score} = \sum(\sum Criteria\ Score \times Criteria\ Weight) \times Category\ Weight$$

Any score of zero or Fail shall be grounds to reject a proposal as non-compliant.

COMMERCIAL EVALUATION (Pass/Fail):

The following table summarises the commercial aspects that will be assessed. Refer to the evaluation criteria matrix for full details.

ID	Commercial Criteria Category	Priority	Criteria Weight
C1	Conflicts of Interest	M	Pass/Fail
C2	Validity Period	M	Pass/Fail
C3	Subcontracting (Part B)	M	Pass/Fail
C4	Future phases ROM	n/a	n/a
C5	Cyber Security	M	Pass/Fail
C6	PoC Details	M	Pass/Fail
C7	Legal Entity	M	Pass/Fail
C8	Milestone Deliverables and IP	M	Pass/Fail
C9	Acknowledge Lot 1	M	Pass/Fail
C10	Insurances	M	Pass/Fail
C11	SAL	M	Pass/Fail
C12	Personal Particulars	M	Pass/Fail
C13	Complete Tasking Form	M	Pass/Fail
C14	Separate priced response	M	Pass/Fail
C15	Milestone breakdown (>£250k)	M	Pass/Fail
C16	Compliant or variant	M	Pass/Fail

CAPABILITY AND GOVERNANCE:

The following table summarises the capability and governance aspects that will be assessed. Refer to the evaluation criteria matrix for full details.

ID	Category	Priority	Criteria Weight
G1	Company Capability	K	12.5%
G2	SQEP	K	12.5%
G3	Deliverables and Output	K	11%
G4	Acceptance/Rejection Period	M	Pass/Fail
G5	Monitoring	1	6%
G6	Sub-contractors	K	9%
G7	Health and Safety	M	Pass/Fail
G8	Project Plan	K	10%
G9	Named Project Team	K	10%
G10	GFX	K	6%
G11	Assumptions, Exclusions, Dependencies	K	6%
G12	Risk Management	K	11%
G13	Quality Management	1	3%
G14	Quality Standards	1	3%
G15	Security	M	Pass/Fail
		Total Weight	100%

TECHNICAL EVALUATION:

The following table lists the technical requirements for each phase, against which submissions will be assessed. This assessment will act as guidance to which proposal should be taken forward by the Authority.

ID	Requirement Summary (Refer to SoR for details)	Priority	Criteria Weight
R1.1	Data conversion	K	21%
R1.2	Synthetic data generation	K	
R2.1	[REDACTED]	K	4%
R2.2	[REDACTED]	K	8%
R2.3	[REDACTED]	K	
R2.4	[REDACTED]	K	
R2.5	Confidence	1	
R2.6	TRL3 Implementation	K	8%
R2.7	Run time latency	1	
R2.8	Assessment plan	1	
R2.9	Assessment (WP1 Data)	K	
R2.10	Assessment with extra data	2	
R2.11	Background IP	1	3%
R3.1	Review algorithms	K	8%
R3.2	[REDACTED]	1	
R3.3	TRL3 Implementation	K	8%
R3.4	Resilience	1	
R3.5	[REDACTED]	1	
R3.6	[REDACTED]	1	
R3.7	Run time latency	1	
R3.8	Assessment plan	1	
R3.9	Dataset Modifications	1	
R3.10	Assessment (WP1 Data)	K	
R3.11	Assessment with extra data	2	
R3.12	Background IP	1	3%
R4.1	GUI Requirements	K	21%
R4.2	GUI Design	K	
R4.3	GUI implementation	K	
R4.4	Load Datasets	1	
R4.5	Load Ground Truths	1	
R4.6	Replay Datasets	1	
R4.7	Visualise WP2 and WP3	1	
R4.8	Display Outputs	1	
R4.9	GUI Demonstration	K	
R4.10	Installation instructions	1	
R5.1	Workshop	K	8%
R5.2	Flexible architecture review	1	8%
R5.3	Relative Merits of Methods	1	
R5.4	[REDACTED]	1	
R5.5	[REDACTED]	1	
R5.6	[REDACTED]	1	
R5.7	White Paper	K	
	Total Weight		**100%**

Note: R6.1 through R6.4 will be assessed as part of the Cpability and Governance Criteria.

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

The Supplier shall provide the deliverables described below no later than the due date, expressed relative to Contract Award (CA), Contract End (CE) or receipt of an associated input (T0).

Final drafts of any reports or plans shall be issued for review and comment 1 week prior to delivery due dates.

All electronic data is to be supplied in accordance with protection measures required for the classification of the data (e.g. over RLI or using recommended encryption products for removable media).

ID	Deliverable Description	Due Date
WP1 Data Processing and Synthesis (DEFCON 703)		
D1.1	Data Processing and Synthesis Report; to include the algorithmic flow of the PDW extraction process, observations on the quality of the GFX data and suitability for use in algorithm assessment, and the process followed to define and generate the synthetic dataset.	CE

D1.2	Full PDW dataset extracted from GFX dataset in csv formats agreed with the Authority	CE
D1.3	Specific Emitter PDW dataset extracted from GFX dataset in csv formats agreed with the Authority	Contract Award (CA) + 11 Weeks
D1.4	Ground truth behaviours and capability for the Specific Emitter PDW dataset in csv formats agreed with the Authority	CA + 2 Weeks
D1.5	Synthesized PDW dataset in csv formats agreed with the Authority. Dataset shall be complete enough and have sufficient levels of complexity and variability to support the development and assessment of WP2 and WP3 and visualisation of the outputs under WP4	CE
D1.6	Ground truth for the Synthesized PDW dataset in csv formats agreed with the Authority	CA + 6 Weeks
WP2 Radar behaviour assessment (DEFCON 705)		
D2.1	Radar Assessment Report; to, a full and detailed description of the algorithms considered, the decision and down selection criteria, the algorithm implementation (including software flow), and performance assessment against all datasets	CE
D2.2	Software implementation of radar classification (see Software acceptance criteria)	CE
D2.3	Performance assessment plan as a concise technical note; to propose how to test the impact of addition of random pulses, dropping of random pulses, adding of statistical noise onto the PDW parameters and other factors that hypothetically could affect performance.	CA + 12 Weeks
D2.4	All additional datasets used by the Supplier to test the techniques	CE
WP3 Behavioural Deinterleaving (DEFCON 705)		
D3.1	Deinterleaving Report; to include the review of clustering and pattern recognition methods, a full and detailed description of the algorithms considered, the decision and down selection criteria, the algorithm implementation (including software flow), and performance assessment against all datasets	CE
D3.2	Software implementation of a deinterleaver (see Software acceptance criteria)	CE
D3.3	Performance assessment plan as a concise technical note; to propose how to test the impact of addition of random pulses, dropping of random pulses, adding of statistical noise onto the PDW parameters and other factors that hypothetically could affect performance.	CA + 12 Weeks
D3.4	All additional datasets used by the Supplier to test the techniques	CE
WP4 Demonstration Software (DEFCON 705)		
D4.1	Design of a GUI and software back end that allows the PDW and ground truth data from WP1 to be loaded, and the algorithms developed in WP2 and WP3 to subsequently run on the loaded data. This will involve diagrams of potential visual representations of the input, ground truth and output data and labelling schemes and indications to highlight algorithm performance against the ground truth.	CA + 6 Weeks
D4.2	GUI software (see Software acceptance criteria)	CE
D4.3	Demonstration of GUI to Authority	CE
WP5 Future ID Architectures (DEFCON 703)		
D5.1	Workshop initial findings note to include list of attendees and any recorded commentary	CA + 12 Weeks
D5.2	A RES ID 'architecture vision' proposal and identification of research options to realise this	CE
D5.3	Future ID Architectures white paper style report; to include assessment of potential future ID methods and concepts	CE
WP6 – Monitoring and Communication		
D6.1	Kick-off meeting minutes in agreed format	CA + 1 Week
D6.2	Monthly Progress Reports, where T0 is the agreed date for the Project Board Meeting of the reporting month. (See monitoring)	T0 – 5 Days
D6.3	Close Down meeting minutes in agreed format.	CE – 1 Week

D6.4	All software developed as a result of this contract (see Software acceptance criteria)	CE	

Monitoring

Monthly input to the Prime to be delivered 5 working days before the associated Programme Board meeting (to be notified). The Prime will supply the report to the Authority. The Supplier shall include the following in each progress report as a *minimum*:

- Highlights / Lowlights;

- Risks and Issues;

- Details of the Supplier current project team working on the project (any changes are to be highlighted to the Authority including the provision of a CV);

- Table of all Deliverables (to include agreed "Due Date", "Forecasted Delivery Date", Estimated % complete and RAG status);

- Table of all Milestones (to include "Due Date" and "Current Status", e.g. delivered, invoiced, etc.);

- Gantt Chart (Microsoft Project or PDF);

- Details of all planned or to be scheduled project meetings;

- Details of any Supplier requirements from the Authority's Technical Lead (e.g. supply of information or review of documents);

- Record of Actions and Decisions;

- Details of any requested contract changes or commercial actions (or confirmation that none are required); and

- Details of all Government Furnished Assets (GFA / GFx) and their status, e.g. requested, delivered, destroyed etc.

Software Acceptance Criteria.

Final delivery of software shall comprise:
- Source code including algorithms developed in WP2 and WP3 in git version 2.9.2 or later stored within a self-decrypting archive;
- Software architecture document (e.g. flowcharts);
- Software build instructions including dependencies;
- Software system level test harness and test data (to enable the Authority to validate performance);
- Software system level test report providing evidence of tests and results; and
- Software User Guide (noting any errors, warnings and exceptions agreed with The Authority).

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?
GFX1	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED] [REDACTED]	[REDACTED]	[REDACTED]
GFX2	IQ Dataset (WP1)	OFFICIAL - SENSITIVE	GFI	CA	Dstl	CE	n/a
GFX3	IQ Dataset format (WP1)	OFFICIAL - SENSITIVE	GFI	CA	Dstl	CE	n/a
GFX4	Description of specific Transmitter in dataset (WP1)	OFFICIAL - SENSITIVE	GFI	CA	Dstl	CE	n/a
GFX5	Dstl Pulse Synthesis Software (Matlab file) (WP1)	OFFICIAL - SENSITIVE	GFI	CA	Dstl	CE	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)

SECURITY CLASSIFICATION OF THE WORK

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 ☐

Is a Security Aspects Letter (SAL) required? *(A Security Aspects Letter (SAL) will be required for each Task at Official-Sensitive and above)*

Yes ☒   No ☐

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

Cyber Risk Level	Very Low
Risk Assessment Reference	965926048

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.

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

To:	The Authority	From:	The Lot Lead

Proposal Reference	**1.** [REDACTED]	**(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)

PRICE BREAKDOWN

You are to use the costs detailed in Item 2 Table I in the Schedule of Requirement and at Annex E Table 2 of the Serapis Framework Agreement. Please also provide a price breakdown which should include, but is not limited to: Lot Lead Rates, Sub-contractors costs and rates, travel and subsistence. In support of your Proposal you are requested to provide clear details of all Dependencies, Assumptions, Risks and Exclusions that underpin your price.

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

Total Proposal Price in £	£542,848.89	(ex VAT)

Start Date:	25/10/2021	**End Date:**	21/03/2022
Lot Leads Representative	Name	[REDACTED]	
	Tel	[REDACTED]	
	Email	[REDACTED]	
	Date	[REDACTED]	
Position in Company	[REDACTED]		
Signature	[REDACTED]		

Core Work – Breakdown

Lot Lead Rates for Task Management Services (TMS) *Please insert/delete rows as necessary*							
Team Member Name	**Role**	**Activity Type**	**Rate (£)**	**Total Hours**	**LMS recovery per role per hour** ('d' element)	**Total LMS recovery due (£)** ('d' x total hours)	Total TMS Cost (£) (Rate x total hours)
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
		Total		[REDACTED]		[REDACTED]	[REDACTED]

SOR Development

- *Engagement with Authority to understand task requirements. Shaping of task form for clarity and bounding of scope and agreement with Authority.*

- *Supplier Engagement through Expression of Interests and shaping procurement strategy.*
- *Generation of Evaluation Criteria for supplier proposal assessment. Completion of Supplier Assurance Questionnaire.*

Contracting / Competition

- *Preparation and distribution of Request for Quotation to suppliers. Assessment and response to supplier clarification questions.*
- *Review and evaluation of supplier proposals against commercial, governance and capability, and technical evaluation criteria. Processing PMO or Authority clarifications questions. Preparation of recommendation to Authority.*

Research Management

- *Project Management of sub-contractor delivery, including consideration of Health and Safety, Supplier liaison and Customer Liaison.*

Assurance

- *Assurance of all deliverables, including checking against contractual obligations, review of deliverable materials for completeness, editorial changes and general technical assurance.*

Work Delivered by Sub-Contractor(s)

We recognise that suppliers may fit into multiple categories, please choose the drop down that categorises the supplier by the definition that is lowest on the list (i.e. a Defence Supplier Academic would be treated as an Academic.

Please insert/delete rows as necessary

Name of Sub-Contractor	Supplier Type	Activity Description	Rate (£)	Total Hours	Total Cost (£)
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
			Total	[REDACTED]	[REDACTED]

Travel, Subsistence, Materials & Equipment					
Please insert/delete rows as necessary					
Supplier Name	**Spend Type**	**Description / Rationale**	**Unit Cost (£)**	**Qty**	**Total Cost (£)**
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
				Total	[REDACTED]

Travel, Subsistence, Materials & Equipment					
Please insert/delete rows as necessary					
Supplier Name	**Spend Type**	**Description / Rationale**	**Unit Cost (£)**	**Qty**	**Total Cost (£)**

Core Work – Milestone breakdown costs

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.

Milestone 1						
Description	TMS cost (£)	Self-Delivery cost (£)	Sub-contractor cost (£)	Total milestone cost (£)	Milestone due date	DEFCON
<u>Research Delivery</u> **D1.6 – Synthesised Ground Truth** **D4.1 – GUI Design Pack**	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	703 (D1.6), 705 FULL RIGHTS (D4.1)
Travel/Subsistence	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	
Materials/Equipment						
Milestone LMS recovery (£)	[REDACTED]					

Milestone 2						
Description	TMS cost (£)	Self-Delivery cost (£)	Sub-contractor cost (£)	Total milestone cost (£)	Milestone due date	DEFCON
<u>Research Delivery</u> **D1.3 – Specific Emitter PDW Dataset** **D1.4 – Specific Emitter Ground Truth** **D6.1 – Kick off meeting minutes**	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	703 (D1.3, D1.4, D6.1)
Travel/Subsistence						
Materials/Equipment						
Milestone LMS recovery (£)	[REDACTED]					

Milestone 3						
Description	**TMS cost (£)**	**Self-Delivery cost (£)**	**Sub-contractor cost (£)**	**Total milestone cost (£)**	**Milestone due date**	**DEFCON**
<u>Research Delivery</u> **D1.1 – Data Processing and Synthesis Report** **D1.2 – Full PDW Dataset** **D1.5 - Synthesised PDW Dataset** **D2.1 - Radar Behaviour Assessment Report** **D2.2 - Behaviour Classification** **D2.3 - Performance Assessment Plan** **D2.4 - Supplier Dataset** **D3.1 - Behavour Deinterleaving Report** **D3.2 - Behaviour Deinterleaver Software** **D3.3 - Performance Assessment Plan** **D3.4 - Supplier Dataset** **D4.2 - GUI Software** **D4.3 - GUI Demonstration** **D5.1 - RES ID Architecture Workshop** **D5.2 - RES ID 'Architecture Vision'** **D5.3 - Future ID Artchitecture White Paper**	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	703 (D1.1, D1.2, D1.5, D5.1, D5.2, D5.3, D6.2, D6.3, D6.4) 705 FULL RIGHTS (D2.1, D2.2, D2.3, D2.4, D3.1, D3.2, D3.3, D3.4, D4.2, D4.3)

D6.2 - Monthly Progress Reports **D6.3 - Closedown Minutes** **D6.4 - Software Package**					
Travel/Subsistence			[REDACTED]	[REDACTED]	
Materials/Equipment					
Milestone LMS recovery (£)	[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	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]
Requisition Number		[REDACTED]
Contractor's Proposal Number		[REDACTED]
Purchase Order Number		[REDACTED]
Signature ([REDACTED]**)**		[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.		