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

Title of Requirement	**Tiny Wireless Switch To Enhance Deployments (TWiSTED)**
Requisition No.	**DSTLR1000165210**
SoR Version	**1.0**

1.	**Statement of Requirements**
1.1	**Summary and Background Information**
	Dstl (the Authority) has a requirement to replace traditional magnetically operated changeover reed switches, often used as the main power control mechanism for a range of **Redacted under FOIA exemption** equipment. The replacement will benefit from wireless operation, allowing the end user to remotely power equipment on and off without physical interaction. Wireless operation will also provide a communications link which can be exploited for rudimentary **Redacted under FOIA exemption** and programming purposes. To demonstrate the concept, the Authority has internally developed and manufactured a miniaturised wireless Radio Frequency Identification (RFID) switch, along with a complementary compact handheld controller. The Contractor shall present an enhanced solution of this concept, offering greater communications range and feature-sets without compromising Size, Weight and Power (SWaP). Diagrams of the existing concept will be made available for the tender process to aid understanding of the required system. This requirement will require the Contractor to investigate new approaches, technologies and techniques to provide an enhanced wireless switch capability to meet the requirements specified A proof of concept demonstrator will then be required, followed by a complete miniaturised prototype version if deemed by the Authority to be viable. Using a commercial short range wireless technology, the Authority has internally developed and manufactured an RFID switch concept with the potential to replace traditional magnetically operated changeover reed switches whilst closely matching their base performance and manufactured specifications. The technique delivers greater functionality than traditional changeover reed switches and overcomes many of the **Redacted under FOIA exemption** and handling issues associated with inherently fragile glass reed switches. The Authority's prototype system comprises two modules: • RFID Switch: providing the Direct Current (DC) switch function to make/break a circuit; • RFID Handheld controller: to half-duplex communicate with the switch remotely via a short range wireless link. However, whilst the Authority's design serves as an initial proof-of-concept, it does not provide the communication range, usability or feature-sets which would make it viable for further exploitation.
1.2	**Requirement**
	The Authority has a requirement to replace traditional magnetically operated changeover reed switches, often used as the main power control mechanism for a range of **Redacted under FOIA exemption equipment** The replacement will benefit from wireless operation, allowing the end user to power equipment on and off without physical interaction. Wireless operation will also provide a communications link which can be exploited for rudimentary **Redacted under FOIA**

exemption programming purposes. This development will be broken into three work packages (WP):

- WP1 System Design;
- WP2 Benchtop demonstrator;
- WP3 Prototype development.

A Firm Price costed proposal is required which includes all WPs stated below.
Each WP must be costed individually.

There will be a contract breakpoint between each Work Package.

Deliverables required for the below tasks :

WP 1
System Design:
WP1 shall develop an agreed system design best suited to meet the user requirements as specified at the end of this section.
The Contractor should investigate and propose new techniques, ultra-low-power wireless technologies and novel approaches to the requirement. This will enable development of a wireless switch with enhanced communication range over the Authority's previous development, without impacting on the SWaP of the final product. Hardware and software enhancements to increase the **Redacted under FOIA exemption** feature-set available to the end-user **Redacted under FOIA exemption** should also be considered as part of WP1.

The Contractor shall capture and derive a set of System Requirements to meet all mandatory and desirable requirements stipulated in this document. The Contractor shall host a System Requirements Review (SRR) with the Authority for endorsement. Documents that shall be available prior to the SRR include:
- System use cases;
- System requirements document (SRD);

The Contractor shall then proceed to derive the system design, based upon the endorsed SRD. It is expected that the Contractor will conduct any necessary trade-offs to maximise the compliance of the proposed solution with the SRD, with a focus on SWaP and reliability.
All trade-offs shall be mutually agreed with the Authority.
All design decisions and accompanying assumptions, cost and risk shall be captured by the Contractor, leading to a system design review. The design review will involve a presentation to the Authority of design options and recommendations for an approach which best meets the SRD.
Documents that shall be available prior to the review include:
- System Design Document;
- System Interface Control Document;
- System Architecture Description;
- Test Concept and Draft Test Plan.

These documents may be included as sections within a single document and will be used as the reference point for the remainder of the development.

1.3	**Options**
	In addition to the Research and Development Services detailed in Section 1.2 above the Contractor hereby grants to the Authority the irrevocable options detailed below to undertake additional Research and Development Services in accordance with the terms and conditions set out in R-Cloud V4 and this Task Form, it being agreed that the Authority has no obligation to exercise such options. These options are both Priced and Unpriced. 2. The Authority shall have the right to exercise any of the options detailed below by no later than the final completion date of the preceding Work Package. Should the Authority wish to exercise any of the Priced options below Dstl Commercial Services will seek confirmation of the Firm Price submitted in your proposal your proposal XISYS-827716926-367 Ver: 1 which Dstl acknowledge may be subject to revision in accordance with your assumption No 7 Where options have not been priced I,e WP 4 Dstl Commercial Services will seek submission of a Firm Price for consideration. 3. Should the Authority exercise the any of the options below Dstl Commercial Services and the Contractor shall jointly agree dates for completion of Deliverables. Following agreement, Dstl Commercial Services will issue a formal Task Amendment. 4. The Authority shall not be obliged to exercise any or all of the options below. **WP2 – (Costed Option)** **Benchtop Demonstrator:** WP2 shall result in the production of a demonstrable proof of concept model based on the System Design agreed in WP1. The Contractor is welcome to produce the model using large scale laboratory hardware, Commercial Off The Shelf (COTS) development boards, breadboards and accompanying software/firmware. The model shall demonstrate all functionality and capability of the design (both switch and controller) to the Authority and should (as close as can be reasonably expected) represent the performance of a miniaturised final design. The Contractor shall hold a Preliminary Design Review (PDR) prior to build to agree the design with the Authority. The PDR shall capture any deviation from the design agreed in WP1. Documents that shall be made available prior to the PDR include any updates to the strategic design review documents from WP1, plus: • Slide deck for the PDR; • System Test Specification. The Contractor shall build the model and validate compliance against the system requirements. A demonstration to the Authority shall be held at the Contractor's premises. Documents to be made available prior to the demonstration event include any updates to the PDR documentation plus: • Test Report; including explanation of any significant deviations from expectations, lessons identified and recommendations for improvements. **WP3 – (Costed Option)** **Prototype Development:** WP3 will design, build and test 5 miniaturised and encapsulated prototype switches and 2 miniaturised, housed controllers based on the WP2 output. Testing shall include environmental (temperature, vibration, shock) and specification validation, as well as Radio Frequency Interference (RFI) susceptibility and false operation validation tests.

The Contractor shall hold a Critical Design Review (CDR) prior to build to present the design for the switch and controller to the Authority. Documents that shall be available prior to the CDR include any updates to the PDR documentation plus:

- System Test Specification; this document shall be structured such that the Authority can independently replicate testing. The Authority may wish to provide additional test serials;
- Equipment breakdown structure (list of components);
- Assembly drawings (physical and logical assembly);
- Production plan.

The Contractor shall build the prototypes and validate their compliance against system and user requirements. The Authority may wish to be present for aspects of this testing. Any discrepancies or failures shall be assessed and a remediation plan put into effect. Once all tests have been passed according to mutual agreement of the Contractor and Authority, the Contractor shall hold a demonstration and handover event. Documents that shall be available prior to the event include any updates to the CDR documents plus:

- System Test Report; this will evidence all tests being passed;
- Technical Data Pack (TDP); this shall support potential future manufacturing of duplicate prototypes by the Authority. The TDP shall include (as a minimum):
    - All developed operational firmware for the switch module;
    - All developed operational software for the controller;
    - All circuit diagrams;
    - All Printed Circuit Board (PCB) diagrams;
    - PCB layout plot files;
    - Component listings;
    - Any accompanying configuration tools;
    - Mechanical assembly drawings;
    - User guide.

WP 3 - Mandated User Requirements:

1. The communication range of the handheld controller to the wireless switch shall be improved over the Authority's previous development:
    a. 35mm or 70mm with longer handheld controller coil.
    b. An objective requirement should be **Redacted under FOIA exemption**

2. The mechanical size of the wireless switch shall not exceed the volume of the commercial glass read switches currently used by the Authority. The design does not need to conform to the cylindrical shape of a glass reed switch and may instead be laid flat/on a flexible PCB:
    a. 34.3mm length x 5.16mm diameter.
    b. An objective requirement should be smaller than the Authority's previous development (21.5mm x 5.5mm x 4.4mm).

3. Current handling specifications for the wireless switch shall meet or exceed the equivalent standard commercial high current glass changeover reed switch:
    a. 3A for the Littelfuse Inc DRS-DTH range.

4. The quiescent current (in circuit leakage current) shall be equivalent or less than the Authority's previous development:
    a. Average quiescent current: 32µA.

5. The operational voltage range of the wireless switch shall be equivalent or wider than the authority's previous development:

a. 3.0 to 4.2 V.

6. The temperature range of the wireless switch and controller shall be equivalent or wider than the Authority's previous development:
   a. -15°C to +70°C.

7. The wireless switch shall withstand impact equivalent to a 1 metre drop on to a hard surface.
   a. No formal defence standard needs to be followed for this development.

8. The wireless switch shall have resilience against RFI susceptibility and false operation caused by common transmissions. Specific criteria will be provided to the successful bidder.

9. The wireless switch shall remain operational **Redacted under FOIA exemption**

10. The mechanical size of the controller shall not exceed:
   a. 50 cubic centimetres.
   b. An objective requirement should be smaller than 30 cubic centimetres **Redacted under FOIA exemption**
   c. The controller should be as small, compact and ergonomic as possible for handheld operation.

11. The controller shall be battery powered. The Contractor may source a suitable, readily available COTS battery. The battery shall fit within the form factor specified in requirement 10.

12. The controller shall have a simple graphical display to provide informative information about switching **Redacted under FOIA exemption** events to the user.

13. The controller shall provide the following set of basic operational functions:
   a. On/Off: switch a specific wireless switch, or set of switches, on or off;
   b. Read Battery: read the voltage of the battery connected to the wireless switch;
   c. Test: send a repeated "ping" to a specific switch and report successful receptions via its user interface for performance and range testing;
      i. An objective requirement is to report signal strength of received pings.
   d. Provide visual acknowledgement via the graphical display when commands sent to the switch have been successfully actioned.

14. The controller shall include a haptic feedback to the user as an acknowledgement of switching a device on or off.

15. The controller shall be operable whilst wearing **Redacted under FOIA exemption** gloves.

16. Selecting functions and features within the controller shall be simple and intuitive for military operator use:
   a. A minimum number of menu layers and key presses shall be required to achieve the desired function, as agreed between the Authority and the Supplier;
   b. A minimum number of physical keys/buttons shall be required to enable performing an on/off switching operation without looking at the controller.

17. The development shall be future-proofed to enable an enhanced feature set, as suggested in requirement 18 below.
   a. This will be determined by additional memory capacity and microprocessor performance.

	WP 3 Costed Options for consideration (18 to 21) : Each of the qty 4 below Options are to be individually costed, as they may or may not be included within the overall requirement and/or selected to be included at a later date. 18. The controller and switch should deliver an extended set of functions, programming opportunities **Redacted under FOIA exemption** to maximise operational utility. These may include, but are not limited to: a. Assign unique identification numbers to each switch such that they can be individually/collectively commanded and identified by a controller; b. **Redacted under FOIA exemption** c. Time delay between commanding the switch "on" and the wireless switch actually activating; d. Simple general purpose input which can be logged for egressing during a future interrogation (e.g. log an event on a logic-high pulse). 19. The wireless switches should be encapsulated and provide a method for users to simply and efficiently solder on appropriate gauge connecting wires; 20. The brightness of the graphical display on the controller should be changeable 21. The controller should be easily rechargeable, for example via a micro USB/USB-C connection. **WP4 – For Information only** (Not to be costed within this proposal) • **4a**: Explore the development of a wireless switch manufactured entirely on a flexi-PCB substrate to enable greater future operational potential; • **4b**: Investigate and report on the feasibility of developing an alternative form of communication such that an Android smartphone/smartwatch and associated application can be utilised in place of a controller; • **4c:** Study and report on the feasibility to develop a smaller version of the wireless switch (with reduced functionality) for micro/nano-scale deployments; • **4d:** Investigate and report on the feasibility and technologies available to develop a new version of the wireless switch and controller to operate over much larger communications ranges **Redacted under FOIA exemption**
1.4	**Contract Management Activities**
	This contract will be managed locally by the Project Manager.
1.5	**Health & Safety, Environmental, Social, Ethical, Regulatory or Legislative aspects of the requirement**
	No specific aspects.

1.6	Deliverables & Intellectual Property Rights (IPR)					
Ref.	**Title**	**Due by**	**Format**	**Expected classification (subject to change)**	**What information is required in the deliverable**	**DEFCON IPR Condition**
D1	System Requirements Review and presentation	*TO + 8 weeks*	*Presentation (.pptx)* *Documentation (Excel/Word)*	Official	Documentation to be available at least 5 days prior, including: • System use cases System requirements document	'Default RCloud Agreement Terms and Conditions shall apply – Full Rights Version to be delivered'
D2	End of WP1 System design review and presentation	T0+16 weeks	Presentation (.pptx) Documentation (Word)	Official	Updated documents to be available at least 5 days prior, including: • System design document • System interface control document • System architecture description • Test concept and draft test plan The above can be contained in	'Default RCloud Agreement Terms and Conditions shall apply – Full Rights Version to be delivered'

					individual or a combined document.	
D - 3	Preliminary design review and presentation	T0+24 weeks	Presentation (.pptx) Documentation (Word)	Official	Updated documents to be available at least 5 days prior, including: System test specification	'Default RCloud Agreement Terms and Conditions shall apply – Full Rights Version to be delivered'
D – 4 TRL 3	End of WP2 demonstration and presentation	T0+32 weeks	Presentation (.pptx) Documentation (Word)	Official	Updated documents to be available at least 5 days prior, including: • Test report Demonstration at Contractor's premises	'Default RCloud Agreement Terms and Conditions shall apply – Full Rights Version to be delivered'
D - 5	Critical design review and presentation	T0+38 weeks	Presentation (.pptx) Documentation (Word)	Official	Updated documents to be available at least 5 days prior, including: • System test specification • Equipment breakdown structure(list of components)	'Default RCloud Agreement Terms and Conditions shall apply – Full Rights Version to be delivered'

					• Assembly drawings (physical and logical assembly) Production plan	
D-6 TRL 5/6	End of WP3 demonstration and presentation	T0+44 weeks	Presentation (.pptx) Documentation (Word) Hardware	Official	Updated documents to be available at least 5 days prior, including: • System test report • Technical data pack (TDP). See WP3 for details • 5 x miniaturised switches 2 x housed controllers	'Default RCloud Agreement Terms and Conditions shall apply – Full Rights Version to be delivered'

. TRL - Technology Readiness Level required

1.7	**Deliverable Acceptance Criteria**
	• Technical data pack including all information required to allow future third-party manufacture of additional units. • Successful demonstration of all 5 miniaturised switches and 2 controllers functioning as per the mandatory requirements and agreed System Test Report. • The Authority to successfully operate one of the prototypes using the user guide supplied as part of the delivery process.

2	**Evaluation Criteria**
2.1	Method Explanation
	The evaluation shall be conducted under the Most Economically Advantageous Tender (MEAT) principles, with the application of an Absolute Method, defined as the Value for Money (VfM) Index. This approach sets out to divide the total score of the non-cost (Technical Quality) criteria by the tender cost; the tenders are ranked on the technical quality (represented by the non-cost score) for each £ (or £k) of cost.
2.2	Technical Evaluation Criteria
	Proposals which pass the commercial evaluation, shall be assessed against the following technical questions: The Technical evaluation team will evaluate the unpriced responses only. A total technical score will be calculated using a weighted sum of the marks awarded for each of the four questions. Each question can be scored on a scale of 0-10 prior to the weighting being applied, resulting in a maximum achievable score of 120. A pro-rata score is then calculated

The scoring range shall apply the following definitions:

Excellent	The response addresses all elements of the Requirement and provides a comprehensive, unambiguous and thorough explanation of how the Requirement will be fulfilled.	10
Good	The response addresses all elements of the Requirement and provides sufficient detail and explanation of how the Requirement will be fulfilled.	7
Adequate	The response addresses the majority of elements of the Requirement but is weak in some areas and does not fully detail or explain how the Requirement will be fulfilled.	3
Inadequate	The response does not address or explain how the Requirement will be fulfilled and fails to demonstrate the ability to meet the Requirement.	0

Points will be awarded for each criterion shown in the table below.

ID	Technical Evaluation Criteria	Score	Weighting
1	Proposal clearly demonstrates through the provision of evidence that the contractor is highly experienced with the design and implementation of RFID communication technologies for short range command and control applications	0-10	2
2	Proposal provides evidence that the contractor is highly experienced in ultra-low power electronic circuit design, supported with proficient skills in implementing efficient low power microcontrollers and low level algorithm development.	0-10	2
3	Proposal demonstrates through the provision of evidence that the contractor is highly experienced and proficient in the design and manufacture of ultra-miniature surface mount technologies and a background in delivering ultra-miniature form factor capability demonstrators.	0-10	2
4	Contractor demonstrates completing the work package within the required timescales (WP1 as a minimum to be completed by March 2022). Indicative timescales required for the remaining WP2 & 3.	0-10	1
5	Proposal indicates that the Contractor takes a flexible, novel and innovative approach and is keen to help Dstl shape its requirement and provide the best possible solution.	0-10	1
6	Proposal describes the technical approach to meet the WP3 mandated technical requirements within the SOR and addresses the additional (costed option) requirements separately.	0-10	3
7	Proposal indicates a willingness to engage with appropriate Sub-Contractors where relevant (up to 50%)	0-1	1
	Total available score		120

2. Commercial Evaluation Criteria

The commercial evaluation shall assess the proposal on the following questions:

Serial	Question	Marking
1	Does the proposal for WP1 only, fall within the specified maximum budget (£70k)	Pass / Fail
2	Has the proposal been submitted against a Firm Price	Pass / Fail
3	One full technical proposal, excluding all price detail has been submitted	Pass / Fail
4	One full Technical and Commercial proposal, including all price detail, has been submitted	Pass / Fail
5	A completed RCloud Part C Task Response Form has been completed and submitted	Pass / Fail
6	A completed Cyber Risk Profile form has been completed and submitted	Pass/Fail

	Noting that only proposals which pass the commercial evaluation (compliant) shall be considered for Technical Evaluation. Once a preferred bidder has been identified following the evaluation, Dstl shall request the completed research worker forms (PPRW) to be submitted. Once Dstl has identified the preferred bid following proposal ranking under the VfM Index, consideration may be given to the award the Option task(s) if this is affordable within the overall stated budget. However, Dstl make no guarantee to the potential placement of the requested costed Options.