Reference: LWC Op Research Cirsium Wargaming Programme 24-28

07 Nov 2023

**STATEMENT OF REQUIREMENT**

Support for Land Warfare Centre Op Research Branch

# CIRSIUM Wargame Development 24-28

# Background

The Army Command Plan directs Commander Field Army to Optimise the Fielded Force through Warfare Development (WARDEV). This directive is cascaded down to all formations under his command. The LWC Operational Research Branch (Op Research) is responsible for delivering robust evidence collection that is targeted to inform Force Optimisation programmes and critical outputs such as the Field Army Command Plan, the Field Army Estimate, the Capability Audit and Field Army/Army BoI review, whilst also shaping future Major Army exercises. A subset of Force Optimisation, and in response to the challenge included within **REDACTED**, the Field Army has initiated **REDACTED** to focus the analysis and development on specific and discrete **REDACTED**.

In support of Fd Army Force Optimisation LWC Op Research utilises wargames, tabletop exercises (TTX) and studies to examine problems and issue. Included in this is the development of a digital wargame as a tool for **REDACTED**. Specifically, a wargame that can operate within the planning timescales of the headquarters it is deployed into. Improving the efficiency of support into headquarters and enabling best use of available resources and assets within WARDEV. It will shape future exercises and operations supporting the drive toward delivering survivable and resilient Warfighting capability against a Peer threat.

This project is an innovative delivery mechanism for wargaming within Fd Army and, as directed by CFA following the Army Wargaming Symposium, will incorporate the requirement for coherence with all forms of wargaming delivered by LWC/Fd Army (Facilitated Training, Operational Force Testing, CAPDEV) as well as the wider Defence wargaming enterprise.

# Requirement

There is a requirement to continue the work conducted over the last 5 years to re-establish the UK capability to support Corps, Divisional and Brigade headquarters with analytical wargaming. CIRSIUM is now at the point that it can be deployed as an initial capability as a highly user-friendly and flexible computer assisted wargaming capability, suitable for use by military planners and analysts undertaking:

* + Operational Planning
	+ Force on force analysis of outcomes
	+ Support to Operations
	+ Training.

CIRSIUM will form a key element of the wider Operational Planning Tool Set used by Field Army Operational Analysts in support of land formations. Legacy models include **REDACTED,** **REDACTED**. These have been in use for 25 years, meaning the provenance of outputs is now questionable. A common ORBAT builder also exists for entering data into **REDACTED** and WPT. Unfortunately, this relies upon Excel macros which, due to recent changes in the MODNet Boundary Protection Service (BPS), are no longer able to be moved around meaning CIRISUM will rapidly become the primary tool in the toolset.

Studies examining this shortfall by Larrainzar Consulting and Red Scientific for the LWC Op Research Branch recommended that WPT should be retired, **REDACTED** updated, a new common ORBAT generator developed, and that the focus should be on CIRSIUM to deliver the full range of integrated wargaming capabilities.

There exists therefore, a clear requirement to upgrade and support the available tools and models to reflect modern equipment, emerging threats, and the full range of challenges faced by current and future commanders.

CIRSIUM is an innovative analytical digital wargame that can represent the modern battlefield and key challenges faced by commanders including Intelligence Surveillance and Reconnaissance (ISR), FIRES, Ground Based Air Defence (GBAD), Logistics and Equipment Support (ES). This functionality will be able to be used in a variety of modes with appropriate target users as follows:

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| *Table 1: Game modes and intended users* |
| **Serial** | **Game Mode** | **Target Users**  |
| **1** | Fully Integrated Analytical Wargame | Senior Analyst |
| **2** | COA Analysis | Analyst |
| **3** | Vignettes | Analyst |
| **4** | Sub Models eg: FIRES, Med, CSS | Analyst / Staff Officer |
| **5** | Bird Table | Staff Officers |
| **6** | Practise Mode | All Users |

A recent study[[1]](#footnote-2) conducted for HQ ARRC identified that **REDACTED** has withered in recent years and recommended that CIRSIUM should be used as the primary toolset to address this issue. Equally, whilst ISR is well-represented in technology and capability models, it’s representation within REDACTED is both essential and **REDACTED**. CIRSIUM has already begun to address both these needs by adding representations of each into its core functionality. A number of other aspects including representation of Captured Personnel (CPERS), Med and enhancements to the CSS capabilities have similarly been identified as adding value to the user community. There is now a clear need to develop these representations to ensure planners and analysts can make informed decisions that account for these critical enablers.

Modern mobile and desktop applications demonstrate the importance and value of high-quality user interfaces. Military users expect software to meet the key tenets of good quality User Interfaces (UI) and deliver a strong User Experience (UX). Indeed, not to do so makes software less familiar and therefore less useable.

CIRSIUM work thus far has developed a wargame and supporting infrastructure that is both highly relevant to current threats and highly usable by OAs. User testing has been carried out using stand-alone systems during bespoke events and all the major exercises carried out by the Army in the last 18 months. In addition, it has been tested at **REDACTED**. Feedback from all activities has been highly positive. CIRISUM is currently available at O-S on the Defence Digital OCI. The focus at present is to incorporate CIRSIUM into **REDACTED** to ensure its availability in deployed HQ.

CIRSIUM has security clearance for use **REDACTED** either on a network or as a stand-alone package. This flexibility must be retained. It should have a security classification of O-S until loaded with data, at which point it takes on the security classification appropriate to that data. This factor is important to facilitate both operational usage across different HQs and a readily available O-S training environment.

CIRSIUM’s outputs will provide underpinning evidence to support Force Optimisation, CoA selection, hypotheses development for further experimentation serials, and ensure best use of resources and assets within WARDEV. CIRSIUM will aid in shaping future exercises and operations supporting the drive toward delivering survivable and resilient Warfighting capability against current threats.

This Task is part of the LWC Op Research multi-year analysis programme and will be delivered through a collaborative approach, with a contracted Task Lead, supporting sub-contracted SMEs and independent Technical Leads supporting LWC Op Research.

The software is already used in operational formation HQs and will influence the decisions commanders make on operations, with potentially very **REDACTED**. This necessitates that a full validation and verification (V&V) process be undertaken to declare the software fit for use. This is to satisfy any legal or ethical challenges that may arise.

# Project Funding

Provision for funding for the next 4 years of development is already made in the LWC budget.

# Project Methodology

The Project has thus far used an Agile project management methodology which is entirely appropriate to this kind of development and has worked well. It is intended that this will continue. Accordingly, the project will consist of an overall vision of the desired outcome and a number of sprints to develop the elements necessary to achieve that vision.

In support of the above process, the Supplier **must** provide suitably qualified and experienced persons (SQEP) to fulfil the following roles. Each role must be fulfilled by a *different individual*.

* 1. **Requirements Manager** - responsible for agreeing and documenting User Requirements, User Stories and Use Cases through close working with the Requirements Champion (see para 18a.).
	2. **Solution Architect & Cloud Engineer** - responsible for the overall design of the solution and the various components so that they work seamlessly and securely. This role will also be responsible for the deployment of CIRSIUM to the MOD Oracle Cloud Infrastructure (OCI) and continued Approval to Operate accreditation from CyDR for installation of CIRSIUM on various networks.
	3. **Software Development Lead** - responsible for the Software Development Roadmap, Agile development process, Scrum Management, quality. This role must implement the agreed software development process, as outlined in this document and defined by the Software Development Champion (see para 18b).
	4. **Algorithm & Features Development Lead** - responsible for Historical Analysis, algorithm development, data capture, feature development.
	5. **Test Lead** - responsible for all V&V activities, including defining Test plans and reporting on results, limitations and uncertainties.

To support the work, LWC/ARRC will provide the following roles:

* 1. **Requirements Champion** – prime interface with the LWC/ARRC responsible for coordinating and expressing the requirements of, and feedback from, the user community to the Supplier.
	2. **Software Development Champion** – responsible for setting and assuring the software development process to be used on this project.

The Supplier must:

* 1. Work in partnership with the LWC Op Research team to deliver associated milestones and deliverables through active membership of a Programme Steering Group (PSG); Provide regular progress and financial reports to LWC Op Research.
	2. Engage closely with the LWC Stakeholders to ensure requirements are understood.
	3. Work closely with Requirements and Software Development Champions to ensure user needs and feedback are effectively captured, and software is developed using an agreed standard.

# Overarching Requirements

It is intended that by early 2025, CIRSIUM be available on **REDACTED** available to all users and formations. The remainder of the contract period will be involved with additional developments as requirements emerge as well as ongoing support, training and maintenance activities associated with normal usage.

The Supplier must deliver the following overarching requirements:

* 1. Deliver the required SQEP.
	2. Deliver assurance to agreed timescales and budget.
	3. Deliver a collaborative Project Management function co-ordinated by WS&T.
	4. Deliver software developments in accordance with the workflow described below that meets the User Requirements and passes V&V testing.

# Software Development Process

Software is to be developed to meet the agreed software development roadmap, using an Agile methodology and engaging regularly with the User community to test and adjust assumptions.

An ‘architecture on a page’ document is to be created and maintained to enable clear visibility of the planned and future software architecture for all parties.

Based upon the User Requirements, User Stories and Use Cases for each sprint, the Supplier is to agree with the Customer a software development roadmap identifying what will be achieved in each of the incremental test builds and the final software build. The Supplier is then to deliver in accordance with the agreed roadmap.

# Network Integration Process

Network Integration activities are to follow broadly the same process as for Software Development. Accepting that different military networks have different requirements, any necessary process changes and amendments are to be agreed by at the PSG.

# Software Development Workflow

All software development must be conducted in accordance with the following workflow of high-level deliverables. Additional detail on lower level deliverables appropriate to individual requirements are identified with each requirement later in this document:



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| *Table 2: Software Development Workflow Steps* |
| **Step** | **Activity** | **Supplier Deliverables** (#) |
| **1** | Work-package agreed at the project level with an estimated level of effort and estimated timings. | (1) Updated **Software Roadmap** and **Short-form Proposal**. |
| **2** | LWC identify an SME to help guide Supplier thinking, answer questions and give the military viewpoint. | Nil |
| **3** | Supplier runs a requirements capture event with the analysts from LWC and the SME in order to scope the development regardless of budgetary constraints. This allows the optimal solution to be captured and the Supplier to assess how much can be achieved within the level of effort agreed in Step 1. | (2) **Candidate User Stories** and **Requirements** |
| **4** | Once the user stories and requirements are written, the Supplier must use them to create designs to meet the agreed requirements within the level of effort agreed in Step 1 and review them with LWC. Designs should include relevant low-fi prototypes such as wireframes, mock-ups of screens that users might expect to see or excel models. As part of this Step the Supplier will identify which of the captured user stories and requirements they can fully or partially meet and the corresponding validation test plan for the functionality being covered. This is to be discussed and agreed with LWC. | (3) **Design Documentation** including any relevant prototypes, wireframes, mockups, use cases and example workflows. (4) **Endorsed User Stories** and **Requirements.** (5) **Test Plans** (V&V) showing exactly how, when and why the software will be tested to prove it meets the requirements. |
| **5** | The Supplier develops to the agreed scope, integrating into the software and demonstrating to user representatives regularly as part of an Agile methodology. Any feedback received must be reflected in updated design documentation and User Stories or Requirements as necessary.  | (6) **Demonstrations and Feedback Capture Sessions.** A minimum of two demonstrations and feedback capture sessions with users and stakeholders within the work package development life-cycle. |
| **6** | Once the software under development reaches an appropriate level of maturity, Supplier must undertake verification testing to prove the functionality works as intended and is free from error. If issues are found, then a return to Step 5 may be necessary.  | (7) **Verification Test Reports** to show the scope of the testing completed and the results. |
| **7** | Validation testing according to what was agreed in Deliverable (4) as part of Step 4 above. This could be some basic hands-on user testing, “excursions” (small validation exercise) or some flavour of wargame.  | (8) **Validation Test Reports** to show the scope and results of the testing completed. This should include assumptions and limitations of the testing. This is to ensure that analysts using CIRSIUM in the future can easily understand in what they can have confidence in using CIRSIUM for, and what it was not designed for or what has not been tested. |
| **8** | The Supplier is to package up the software in a format agreed with LWC. Software version should be obvious. | (9) **Software** packaged in agreed format. (10) **Software Release Notes** detailing the following as a minimum:* Date of release
* Name of lead developer
* Accreditation status of the release
* Changes since the last release
* Limitations
* Minimum PC system requirements.
* 3rd party software dependencies
* Installation instructions
* References to the relevant version of both the Verification Test Report and Validation Test Report.

**(**11) **Training Materials and Activities** appropriate to the software release. |
| **9** | Agreement at the project level that the work-package is complete and review of the actual level of effort versus that estimated in Step 1.  | (12) **Project Learning.**  Modification of future work packages based on review. |

**User Requirements**

Building on any existing documentation, the Supplier is to generate, in close partnership with ARRC and LWC representatives, a comprehensive set of User Requirements and User Stories documents that capture:

* 1. An overarching and customer agreed set of requirements encompassing (including but not limited to) Security, Speed of Use, Version Control, Access Control, Inputs, Outputs, Features, Usability, Versatility (can be changed during a run), Flexibility (can be changed between runs) and Adaptability (can be changed between versions). As a start point the following User Requirements from the current contract should be considered the minimum requirement. These are likely to change as experience grows through wider user interactions and the outcomes of separate but linked Agile sprints:
1. Cirsium shall provide Operational Analysts and Military Planners useable full functionality and be approved for use within **REDACTED** IT infrastructure without an active internet connection.
2. Cirsium shall enable Operational Analysts and Military Planners to report and analyse the results across all modelled scenarios to help them evaluate and communicate the magnitude of success or failure of predicted outcomes to non-technical users including, where relevant, the confidence associated with the outcome.
3. Cirsium shall allow Operational Analysts and Military Planners to import ORBATs from a standard format to ensure consistency of data entered between tools.
4. CIRSIUM versions built after Version 4 must be able to run earlier ie: back to Version 4, wargames without seeking to run an earlier version of the game. Schema change inputs must be presented to the user as optional defaults or user inputs.
5. Cirsium should enable Operational Analysts and Military Planners to import via an API, geospatial Course of Action data from SITAWARE to ensure consistency and eliminate duplication of effort.
6. Cirsium should enable Operational Analysts and Military Planners to import real logistical resource data from **REDACTED** before running a CIRSIUM wargame to allow comparison against planned ORBATs and forecast resource usage.
	1. These requirements should be underpinned and illustrated by a series of agreed User Stories and Use Cases, representing the workflows required by the LWC and Field Army users, for each role and feature/module agreed to be within scope of the project.
	2. All Requirements, User Stories and Use Cases are to be prioritised, accompanied by well-articulated success factors/metrics, means of testing and test PASS/FAIL criteria and maintained and updated as part of an Agile software development process.

# Specific Requirements

Based upon the existing development programme, the following features are expected to be required, subject to confirmation that they align with the updated and prioritised Requirements, User Stories and Use Cases. As an example of this Wargame 2 provided numerous ideas for developments.

* 1. Hardware / Software / Network Compatibility. Ensuring the software (including any additional ancillary software for CIRSIUM to run effectively) is compliant with UK MoD/NATO software policies so that it can be installed and used on MODNet and on standalone IT.
	2. New Work Packages. Completion of the following new work packages:
		1. Rapid Combat Resolution Sandbox Tool. Development of a separate tool or mode facilitating the immediate use of the CIRSIUM GUI and combat resolution algorithms, without requiring the detailed scenario setup necessary for a full wargame.
		2. Reduced Modes.Development of reduced modes for CIRSIUM in specialist roles, eg; ICSC and 1 Avn BCT, to enable use by staff other than trained OAs.
		3. CPERS Modelling. CPERS modelling (Including detention areas and CPERS chain) with its impact on manoeuvre represented.
		4. Representation of the movement of Civ Pop. Modelling of displaced person camps and convoys including sentiment towards the respective forces (Red, Blue, Orange and Green) and representation of their impact on manoeuvre and logistics elements of a force.
		5. Enhanced Medical Modelling:
			1. Representation of the patient care pathways for different levels of casualty, including CASEVAC and the positioning of field hospitals.
			2. Representation of the additional burden of injured enemy personnel.
		6. Enhanced Logistics:
			1. Design and implement a 'Constrained' logistics mode, where the user can specify a level of supply that is achievable over time for each type. Activities which exhaust stocks held and cannot be supplied will not be able to be scheduled or will execute with reduced effectiveness (dependent on type of activity).
			2. Develop a representation of variation in the supply route capacity to reflect surging transport capacity or restriction of capacity due to attack of a supply route, for example using harassing fires, remotely delivered mines or Special Forces.
			3. Develop dynamic forecasting of stocks to assist players when they are reallocating transport assets or setting the priority of supplies.
			4. Representing the logistic demand of Equipment Support spares.
		7. Multi-Player Teams (Comd, Logs, JFIB etc.):
			1. Expand CIRSIUM to include tailored user roles for Command, Logistics and Fires/Information.
			2. Exploration of how CIRSIUM can serve these 3 lenses for each side through layers, controls and permissions as well as coordination between them with UX story boarding.
			3. Testing of 8 users connected on the same game - Blue and Red Commander, Logistician and JFIB as well as a White player and the Game Controller.
		8. Further development of Sensors:
			1. Representation of Weather
		9. Development of the Representation of Equipment Support (ES):
			1. Develop a representation of Equipment transporters.
			2. Develop a representation of the ES of helicopters.
		10. Influence
			1. Towards the end of this contract, it is likely that we will seek to incorporate functionality relating to Influence. Unfortunately, this is far from fully defined at this point but is unlikely to be built in functionality. It should be assumed an external Influence model (not developed under this contract) will create numerical outputs from which the corresponding impact on CIRSIUM units and formations will need to be incorporated. In responding to this SOR, the requirement to incorporate such inputs should be considered.
		11. Development of Supporting Models - ORTOLAN (Weight of Fires and ORCIN (Medical Role 3 Capacity).
			1. Stand-Alone models able to draw upon FORMATIONS ORBATS and data.
		12. Integrated Models built into CIRSIUM to permit immediate outputs from current ORBATS and data in a specific game.
		13. Minor Software Amendments. The agile process has shown the benefit of a small all-encompassing work package for quick win activities based on regular project reviews, operational requirements, user experience, GITLAB logs and unanticipated logged issues.
		14. Re-Accreditation with CyDR or its Replacement.
		15. Installation onto Secure Cloud and with other Secure Systems eg: SITAWARE Headquarters

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| *Table 3 - User Requirements Deliverables* |
| ID | Description | Date | Acceptance Achieved Through |
|  | Overarching User Requirements Document. | Created by end Sep 24 and updated monthly through to project completion | * Inspection
* Review
 |
|  | Detailed User Stories and Use Case Log incl. success metrics, means of testing, PASS/FAIL criteria. | Created by end Sep 24 and updated monthly through to project completion | * Inspection
* Review
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**Maintenance of the Reference Dataset**. Ensure the Reference Dataset is maintained in a condition that permits accurate usage without generating errors in game setup.

**Validation and Verification**. Generate and action a detailed Verification (proving the software functions as intended) and Validation (proving the software is useful) plan that will clearly fulfil the test needs of each of the User Requirements, User Stories and Use Cases against which software is being developed. The results of this V&V will:

* 1. Provide evidence that the software is fit for purpose (in accordance with Aqua Book principles) and can be relied upon when used for its intended purpose. This should be across MOD Cloud hosted and standalone variations of the wargame.
	2. Demonstrate that required inputs are at the right level and the time required to make them is reasonable.
	3. Demonstrate that outputs are of a required level of precision and given in a useful format.
	4. Provide evidence that the software is free from errors that could affect its use.
	5. Identify any limitations of the software.
	6. Quantify and make clear any uncertainties (particularly in the output data).

The expectation is that the above requirements are to be met through a mixture of user testing, surveys, peer review and carefully controlled validation/usability CIRSIUM wargames. These wargames are to be based on current LWC/ARRC scenarios and to be developed by staff as a demonstrator of CIRSIUM’s usability to support planning and wargaming within a Corps or Division HQ.

The results are to be documented in an agreed format in a formal Model Logbook.

The Customer will be responsible for external assurance of the deliverables, with support and guidance from the Technical Reviewer / Lead. The Supplier will be responsible for the internal assurance of deliverables, again with support and guidance from the Technical Lead / Reviewer.

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| *Table 4 - V&V Deliverables* |
| ID | Description | Date | Acceptance Achieved Through |
|  | Verification & Validation Test Plan | Created by end Sep 24 and updated monthly through to project completion | * Inspection
* Review
 |
|  | Successful completion of three validation Wargames | * by end Feb 25
* by end Feb 26
* by end Feb 27
 | * Inspection
* Review
* Hands-On Testing
 |
|  | Software Model Logbook, including V&V results | Updated monthly through to project completion | * Inspection
* Review
 |

**User Training**. Provision of both hands-on and written training suitable for Basic and Advanced Users. Training is to consist of a mixture of:

* 1. Small group ‘Reduced Mode’ sessions for specific user groups;
	2. Hands-on group update training for All Users;
	3. Specific training for new OA users.
	4. User manuals;
	5. ‘Cheat sheets’, simplified user manuals.

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| *Table 5 – Training Deliverables* |
| ID | Description | Date | Acceptance Achieved Through |
|  | Completion of hands on training for new OA Users | As required | * Inspection
* Review
 |
|  | Completion of “Reduced Mode” training | As required | * Inspection
* Review
 |
|  | Provision of User Manuals and Cheat Sheets | by end Jun 24 | * Inspection
* Review
* Hands-On Testing
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# Project Governance

The programme will be coordinated by the Supplier in collaboration with the sponsors, and their delegated Authority Representative, with oversight provided by LWC/HQ ARRC OARB. It will be governed as follows:

* 1. Programme Management Meeting. A programme management meeting, beyond routine planning meetings, between the Supplier(s)’ Requirements Manager and Technical Leads and LWC Op Research/HQ ARRC OARB will be conducted at least once every month to:
		1. Facilitate meetings with proponents & key stakeholders where appropriate.
		2. Conduct progress reviews.
		3. Identify Risks and Report issues that may affect project delivery.
		4. Take corrective actions as required.
		5. Be attended by designated Authority Representatives where required.
		6. Confirm the programme remains affordable.

Routine working activitywill be coordinated by LWC Op Research/HQ ARRC OARB, supported by the Authority Representative and its Requirements and Software Champions, alongside the Supplier(s), they will:

* 1. Facilitate Supplier access to information, documentation and organisations as required, including facilitating appropriate GFX.
	2. Conduct quality assurance of all deliverables.
	3. Act as designated officer for contractual purposes. They will approve deliverables as fit for purpose prior to payment sign off. This will be under the guidance and approval of the LWC Programme Capability Manager.

Project Risk.A Risk Register will be prepared by the Supplier and will be updated jointly between LWC Op Research and the Supplier throughout the life of the programme. It will be populated, and risks managed to ensure they are as low as reasonably possible. It will be reviewed at all Programme Management Meetings. The Risk Register shall be provided in electronic format compatible with MS Office software.

Lessons.A Lessons Register will be prepared by the appointed Supplier and will be updated jointly between the Authority and the appointed Supplier throughout the life of the programme. It will be reviewed at all Programme Management Meetings and will be updated after each wargame serial at a minimum. The Lessons register shall also include military planning lessons of organising a wargame, therefore the Supplier will seek input from the Authority Representative at a minimum. The Lessons register shall be provided in electronic format compatible with Microsoft Office software.

Security and Ethics.The CIRSIUM wargame in normal use will be OFFICIAL-SENSITIVE. However, all Supplier staff employed on the task will require at least SC clearance because, when in use, CIRSIUM may be expected to be loaded with data that is more sensitive in nature **REDACTED**.

Data Protection Act 2018 (GDPR compliance). This contract will not require handling of personal data.

Assurance and Acceptance:

* 1. Internal technical assurance will be provided by the LWC Task Lead (LWC Op Research or HQ ARRC OARB) and validated by LWC Op Research AH as required. Independent external technical assurance should be contracted by LWC through the framework PMO as required.
	2. Authority Representatives, in collaboration with the Wargame Designer/Facilitator, will be responsible for ensuring each game delivers the required military insights. Issues surrounding the delivery of this aspect are to be raised with LWC Op Research/HQ ARRC OARB in a timely manner to allow resolution.

# Payment

The Supplier will be paid on satisfactory completion of Project Deliverables within a Limit of Liability or a Firm Price contract, likely consisting of several agreed Lines of Effort (LOE), Work Packages and supporting Deliverables (terminology to be agreed) which will be endorsed and accepted by LWC Op Research.

1. Specialist Logistics OA, QinetiQ/21/00903, 31/03/21 [↑](#footnote-ref-2)