SERAPIS TASKING FORM

COMPLETE SQUARE BRACKETS AND REMOVE HIGHLIGHTS BEFORE SENDING TO THE SUPPLIER

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

To:	Lot 5 Newman & Spurr Consultancy Ltd	From:	Dstl
REQUIREMENT			
Proposal Required by:	17/12/2021	**Task ID Number:** **(Provided by the Lot Technical Advisor)**	SSE36
Project Manager:	Redacted under FOIA Section 40 – Personal information	**Technical Point of Contact:**	Redacted under FOIA Section 40 – Personal
Task Title:	Improvement of ML predictions from COTS game data	**New Task** ☒	**Change** ☐
Required Start Date:	ASAP	**Required End Date:**	31/03/2021
Requisition No:	[1000170XXX]		
TASK DESCRIPTION AND SPECIFICATION			
Serapis Framework Lot	☐ Lot 1: Collect ☐ Lot 2: Space systems ☐ Lot 3: Decide ☐ Lot 4: Assured information infrastructure ☒ Lot 5: Synthetic environment and simulation ☐ Lot 6: Understand		

Statement of Requirement

Dstl is interested in applying machine learning (ML) to computerised games of warfare to analyse the moves players have chosen.To this end Dstl has recently completed a project with its industry partner Montvieux examining the use of ML models to asses player moves and provide player feedback using the Slitherine Published commercial off the shelf (COTS) wargame Flashpoint Campaigns. This project demonstrated that it was possible to extract the necessary data from the COTS game to train a ML model, and that this model could make predicitons about the future state of the game based on it's current state. In addition to predicting the location and sustained casualties of units within the wargame, the previous work also trained a value model. This model was capable of inspecting a given game state and computing a score of how likely each side was to achieving overall victory in the scenario. In combination, these two models allowed a method of providing player feedback by predicting the position of units, the casulaties taken by those units and the overall chance of victory that would result from the given set of orders. Similarly, the project showed that it was possible to recommend a "good" move to the player by using a brute-force method where possible moves were selected at random and the ones which resulted in the highest predicted likelihood of success were presented to the player.

Although the previous project demonstrated many of the key enabling steps, the predictions generated from the final ML models have not yet proved sufficiently accurate to allow good tactical insight to be gained by players or for reliably "good" moves to be suggested. However many suggestions were made in the initial work about possible ways to improve these predictions by making use of either more elaborate ML models, such as reinforcement learning, that there was not sufficient time initially to implement, or by exploiting data that was made available by the COTS game but that has not yet been exploited e.g influence maps.

Requirments

Dstl would therefore like to build on previous work by tasking a team of suppliers to take the existing code base and improve it in order to ultimately offer players more tactically useful suggested moves. Improvements could take many forms but may include some or all of the following, in no particular order:

1. Improving the accuracy of predictions regarding unit position and casualties inflicted/sustained at future times based on the current game state. This could be done for example by expanding the existing models to make use of the local context surrounding each unit (including terrain, mobility and cover) or by tuning existing hyperparameters.

2. Improve the accuracy and utility of the existing value network. If the value network could predict further into the future how a given set of orders will improve or diminish the players chance of success, and more accurately the chance of success for a given game state, than this would provide valuable feedback to the player. This could be achieved, for example, by using offline reinforcement learning or by making use of the concept of combat power as measured by the games inherit victory point system.

3. Improve the utility of suggested moves. It is hoped that by improving the other items mentioned above the suggested moves will become more tactically useful. However it may also be possible to improve the quality of suggested moves further by replacing the existing brute force method of selecting possible moves with one more sophisticated e.g monte carlo tree search.

4. Improvments to the graphical user interface. The existing code base contains a functional graphical user interface for displaying the current state of the game as well as predicted future states and suggested orders. As the predictions made by the model improve and grow in complexity Dstl would expect that the user interface will be updated to allow rapid input of potential orders and clear display of their predicted outcome.

5. To facilitate the above suggestions Dstl would expect the publishers of Flashpoint Campaigns, Slitherine, to be involved by making available extra information about the current game state through the generated log files. Specifically, we would like to see Slitherine add information regarding each unit's standing operating procedure (SOP) to the logs, which could then be used by the machine learning models to better improve model predictions. It is also anticipated that Slitherine will need to be part of any work due to the intellectual property position for Flashpoint Campaigns.

While it is anticipated that most of the training data for the project will be generated using the games built in AI vs AI play mode Dstl expects that the project should demonstrate accurate predictions and move suggestions both in human vs AI and human vs human modes. As final deliverables Dstl would expect both a high level summary demonstrating the end to end use of the models to give human players tactically useful suggested moves as well as a more in depth technical report describing the process for generating new training data, using that data to train models and using newly trained model to provide player feedback.

Indicative Budget

Up to £90K FY21/22

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 or DEFCON 643 and DEFCON 648

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

*only at Authority's discretion

Task IP Conditions DEFCON 703 ☐   or   DEFCON 705 ☒ DEFCON 91 (Software) ☐

DELIVERABLES –

1. Progress meetings at appropriate states in the project, to allow Dstl to provide feedback where appropriate to shape the project.

2. For the machine learning element of the project, deliverables should include full working code, code documentation, code tests if useful, and a brief user guide. A high level summary demonstrating the use of the tool and its predicitons should also be included.

3. A written report, summarising the work carried out, that includes technical details in annexes (including a description of the data gathered, any input data pre-processing, and details of machine learning approach taken).

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

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

ISSUE OF EQUIPMENT/MATERIAL/INFORMATION – None from Dstl

QUALITY STANDARDS

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

Redacted under FOIA Section 24 - National Security

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

Cyber Risk Level	Redacted under FOIA Section 26 – Defence	Risk Assessment Reference	Redacted under FOIA Section 26 – Defence

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

Any Task placed as a result of your quotation will be subject to the Terms and Conditions of Framework Agreement Number:

Choose an item.

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

To: The Authority	**From:** The Contractor
Redacted under FOIA Section 40 – Personal information	

Proposal Reference <u>NSC-820-1693 V2.0</u> **(attached)**
Delivery of the requirement:
The proposal shall 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 Deliverables and Interim Payments (Milestone/stage) due dates.   - A work breakdown structure/project plan with key dates and Deliverables identified including required delivery dates for Government Furnished Assets.   - 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: Contractors 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.

Total Proposal Price in £	£60,079.80		(ex VAT)
Start Date:	14 Mar 22	**End Date:**	31 Mar 22
Contractor's Representative	Name	Redacted under FOIA Section 40 – Personal information	
	Tel	Redacted under FOIA Section 40 – Personal information	
	Email	Redacted under FOIA Section 40 – Personal information	
	Date	10 Mar 22	
Position in Company	Redacted under FOIA Section 40 – Personal information		
Signature			

Redacted under FOIA Section 43 - Commercial Interests

Core Work – Milestone breakdown costs

Proposed Milestones Payments

Tasking Form Part 3:

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

1. Acceptance of Contract:		
Authority's Commercial Officer	Name	Redacted under FOIA Section 40 – Personal information
		Redacted under FOIA Section 40 – Personal information
	Email	Redacted under FOIA Section 40 – Personal information
	Date	11/03/2022
Requisition Number		RQ0000003156
Contractor's Proposal Number		NSC-820-1693 V2.0
Purchase Order Number		DSTL0000001715
Signature		
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.		