Annex D to Agreement No DSTL/AGR/00803/01

ANNEX D - Call-Off Tasking Form

Call-Off Tasking Form Part A

CALL-OFF TA SKING FORM [TO CONTRACTOR)

To:	[IBM UK LTD)	**From,**	Dstl

REQUIREMENT *(to be completed by Ost/ Demand Owner)* **Date Quotation Required :**			
Project Manager:	[REDACTED]	**Technical Lead:**	
Call-Off Task Title:	**TIN07 continuation - VSA Transition**	**Call-Off Task/Change**	
Required Start Date:	**15/09/21**	**Required End Date:**	**31/03/22**
Requisition No:			

1000167024

CALL-OFF TASK DESCRIPTION AND SPECIFICATION (to be completed by Dstl Demand Owner)

Call-Off Task to be completed under Firm Price [ ] Ascertained cost **[X]**

Firm Pricing shall be in accordance with DEFCON 127 or DEFCON 643 and DEFCON 649 or Ascertained Costs DEFCON 653 .

RISK ASSESSMENT Completed Y/N (NA- Office Working)

DEFCON 602A (Quality Plan) Y/N

DEFCON 602B (Quality Plan) Y/N

DEFCON 76 (Contractor' s Personnel on The Authority's Premises) [X]

Statement of Requirement Reference no: (detail ownership, where background IPR is known, for each Deliverable).

Call-Off Task Deliverable: Acceptance/ Rejection Criteria

DEFCON 524 Rejection [ ] Period (10 Days] As described below

DEFCON 525 Acceptance [X] Period [10 Days] As described below

Task Description - DAIS ITA Transition - Vector Symbolic Architecture (VSA)

Summary: This Statement of Requirement is a continuation of the current DTIN07 VSA transition contract. Using the existing DAIS ITA software and transition work, this task continues the current programme of ITA transition work by IBM Research and Cardiff University, as follows:

VSA Requirements - IBM

1. Research experimentation of VSA prototypes with NATO IST-161 Working Group

Using existing DAIS demonstrators and VSA transition task outputs, a short trial with US/ARL researchers of VSA software using the Tactical Edge experimentation testbed used at CWIX21, and DAIS ITA experimentation testbeds.

Outputs:

1) Workshop and proposal to apply existing DAIS ITA VSA software and demonstrators on existing NATO CWIX testbed environment, for a virtual small-scale experiment with US ARL involvement .
2) Demonstration and experiment showing how VSA functionality can be implemented onto coalition network
3) Delivery of code, VMs and demonstrator to Dstl and MOD stakeholders with supporting material for how MOD can use and further develop the systems (Feb 22).
4) Conference publications for leading conferences such as AAAI, ICML, NeurIPS, MILCOM, ICMCIS, SPIE or IEEE INFOCOM (Feb 22)

2. AI systems designed to learn new patterns of behaviour at the network edge

Current DAIS ITA work has developed a new symbolic machine learning system (FastLAS), able to learn new patterns of behaviours from a few examples and with limited computing facilities. The FastLAS system can integrate multiple AI systems for feature extraction from unstructured data, and different symbolic learning solvers, and requires limited computational power. As a result, the system can perform 'edgeof network' learning for a range of tactical applications (e.g. network management, logistics, sensing).

FastLAS has been demonstrated on images and structured data, and this transition task will investigate its applicability to defence scenarios including other time-series data (e.g. network traffic, access control policies, decision-making strategic policies).

Outputs:

1) Report and experimentation applying the existing DAIS ITA software and demonstrators to Defence problem sets. (Feb 22)

VSA Requirements - Cardiff University

1. Energy Efficient VSA Using Neuromorphic Processing

VSA has been shown to be applicable for a range of edge of network operations, however energy efficient hardware implementations are required to perform some of the VSA operations. These operations include the VSA binding/bundling operations and vector 'clean-up' memory operations. Much of the work done in the DAIS ITA and elsewhere has focussed on processing dense VSA hyper-vectors. Energy efficient implementations, using in-memory and near-memory processing, have been investigated and demonstrated. Recent work in DAIS has shown that sparse vector representations might offer an alternative approach and that emerging neuromorphic processing technology might offer alternative ultra-low energy solutions for VSA.

This research task will investigate the potential for using sparse VSA vector representation and the possibility of using neuromorphic processing as an alternative ultra-energy efficient method for performing the VSA operations. The research will investigate, both theoretically and through simulation, how sparse vector representations can efficiently perform all the required VSA operations. The task will include a theoretical analysis of the processing and energy required to perform these operations.

The task will:
- Investigate different possible neuromorphic architectures for performing VSA operations (e.g., different neuron models, synchronous vs asynchronous processing)
- Compare, and contrast the neuromorphic approach with the equivalent dense hyper-vector models previously investigated
- Lay the foundations to enable future design decisions for edge of network VSA processing to be made as emerging neuromorphic processing devices become more generally available.

Deliverables:
1) Workshop with stakeholders to identify, define and scope use cases for ultra-low energy VSA technology which will be used to contextualise the research. Report and presentation to inform and agree on progression. (November 21)

2) Report summarising the research results and simulation demonstrations showing the neuromorphic processing being performed in the context of a relevant use case. Short capping paper aimed at stakeholders which highlights the key achievements and impact from this work in simple language, as well as presentational material to support this same goal. (Feb 22)

3) Conference publications for leading conferences such as AAAI, ICML, NeurIPS, MILCOM, ICMCIS, SPIE or IEEE INFOCOM (Feb 22)

2. Rapid trust calibration for AI assets: explainable AI and uncertainty-awareness

Artificial intelligence (AI) based assets are increasingly employed in operating environments, and operators need to make decisions based on the output of such assets, they need to be able to calibrate their trust in the asset. Explainable AI (XAI) and uncertainty-awareness are key parts of trust calibration. Commonly, XAI is seen as a matter of being able to ask an AI system questions in response to an output. In real-time settings such as monitoring live sensor feeds it can be more convenient to see live explanations with associated indications of the AI system's confidence in an output, at least while an operator is becoming familiar with a new asset.

The Selective Relevance XAI technique operates in real-time on an edge processor and highlights changes in continuous time-series data, for example, between frames of a video or in an audio stream. The Evidential Deep Learning (EDL) approach provides a deep neural network with a means of "knowing when it doesn't know". This work will utilise the software and demonstrators developed under the DAIS ITA, applying the research to a MOD scenario to evaluate the effectiveness with which Selective Relevance and EDL allows an operator to receive explanations that focus on the most relevant features and modalities:

Deliverables:

1) Workshop with stakeholders to identify, define and scope the use cases which will be used to show application of proposed approaches across multiple domains and coalition systems, supporting multiple scenarios. Report and presentation to inform and agree on progression. (Sept-Oct 21)
2) Experimentation applying demonstrator to defence scenarios. (Oct-Dec 21)
3) Report summarising the research results and customer internal demo and feedback. Short capping paper aimed at stakeholders which highlights the key achievements and impact from this work in simple language, as well as presentational material to support this same goal. Handover of demonstrator and software to customer. (Jan-Feb 22)
4) Conference publications for leading conferences such as AAAI, ICML, NeurIPS, MILCOM, ICMCIS, SPIE or IEEE INFOCOM (Mar 22)

3. Adaptive AI systems for recognise new patterns of distributed activity

Military operations typically involve working with partners to resolve rapidly evolving situations where adversaries are adapting their tactics, techniques and procedures, and the behaviour of the civilian population is changing . Military AI systems will need to learn, from a few examples, new patterns of behaviour to deliver edge-of-network reasoning and decision-making capabilities. This requires the ability to learn, from heterogeneous data and few examples of previous decisions, new services for optimal decision-making, which can be interpreted and therefore trusted by users.

Existing DAIS ITA research has used Inductive and Evidential Logic programming to enable the learning of rules from a set of examples, which can be used to enable a system to learn the rules of a game from observing the moves made. Such sets of rules can be explained to users. They are, inherently interpretable and are outcomes of symbolic learning systems. This ITA research has integrated the FastLAS symbolic machine learning system, able to learn new patterns of behaviours from a few examples, into a neural -symbolic architecture (DeepProbCEP) that extracts symbolic features from heterogeneous contextual data, by means of pre-trained Deep Learning (DL) systems, and uses these features to learn context -aware optimal patterns of behaviour. This work will utilise the software and demonstrators developed under the DAIS ITA, applying the research to a MOD scenario to evaluate the effectiveness when performing edge of network learning for a range of tactical applications (e.g. network management, logistics, sensing).

Deliverables:

1) Workshop with stakeholders to identify, define and scope the use cases which will beused to show application of proposed approaches across multiple domains and coalition systems, supporting multiple scenarios. Report and presentation to inform and agree on progression. (Sept-Oct21)
2) Experimentation applying demonstrator to defence scenarios. (Oct-Dec21)
3) Report summarising the research results and customer internal demo and feedback. Short capping paper aimed at stakeholders which highlights the key achievements and impact from this work in simple language, as well as presentational material to support this same goal. Handover of demonstrator and software to customer. (Jan-Feb 22)
4) Conference publications for leading confer ences such as AAAI, ICML, Neur lPS, MILCOM, ICMCIS, SPIE or IEEE INFOCOM (Mar 22)

DELIVERABLES *(to be completed by Ost/ Demand Owner) (state what is required e.g. reports etc)*

Interim Report [X] **State how many if Interim _** **Final Report [ ] Assets Generated**

Detail supp ly of any materials for each deliverable and required due date:

ISSUE OF EQUIPMENT/ M ATERIAL/INFORM ATION *{Tick all relevant boxes and detail what has been issued)*

Not Applicable [ ] Government Furnished Equipment [ ] Government Furnished Information [X]

Government Furnished Facilit ies D

Details of equipment/ information / facilities: Influence Scenarios

Accounting for Government Property {DEFCON 694):

Contract Embodiment Item [ ] Contract Support Item [ ] Contract Work Item[ ]

QUALITY STANDARDS *(Define the applicable Allied Quality Assurance Publi cations (AQAPs) and Defence Standards (Def Stans)).*

SECURITY CLASSIFICATION OF THE WORK *{A Security Aspects Letter (SAL) amendment will be required for each Call-Off Task where additional security aspects are not stated in the overarching SAL)*

UK OFFICIAL [X] UK OFFICIAL SENSITIVE [] SECRET [ ] TOP-SECRET [ ]

Dstl Commercial

Contact: [REDACTED]

Contact Number: [REDACTED]

Any Call-Off Task placed as a result of your quotation will be subject to the Terms and Conditions of Contract Number DSTL/AGR/00803/01

CALL-OFF TASKING FORM [Return from Contractor]

To:	Dstl	**From:**	**[REDACTED]**
	FAO**[REDACTED]** Tel: Fax:		**[REDACTED]**

1. **Proposal Reference IBM proposal for DTIN07 Continuation: VSA Transition Ref: GRPlhAAP Issue 1.0 dated 29 August 2021 (attached)**

The proposal shall include, but not be limited to:

- A full technical proposal that meets the individual activities that are detailed in Statement of Requirement (Part A to Draft call-off 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.

COST BREAKDOWN *(to be completed by the Contractor)*

You are to apply Man Day rates in accordance with Annex E.

Provide a price breakdown which should include, but is not limited to: labour costs, direct costs i.e. facility charges, transportation, Sub-Contracting breakdown, travel and subsistence, overheads and profit. In support of your proposal you are requested to provide clear details of all dependencies, assumptions, risks and exclusions that underpin your breakdown of costs.

Time and Materials Price Quotation *(Define alternative pricing when applicable).* £246,977 (ex-VAT) in accordance with IBM proposal for DTIN07 Continuation: VSA Transition Ref: GRPlhAAP Issue 1.0 dated 29 August 2021

Start Date: 10 September 2021 **End Date:** 31 March 2022

Signed on behalf of the Contractor:

Name: **[REDACTED]** **Date:** 31 August 2021

Contractors Cost Breakdown

PROVISION FROM	IBM UK Limited WP1 £105,186 (VAT-ex) including expen			
PROVISION FROM SUB-CON TRACTORS	Cardiff University			
Service	**Cost£**	**Qty**	**Subtotal**	**Total**
Cardiff University WP1 incl expenses	£90,399	1	£90,399	£90,399
Cardiff University WP3 incl expenses	£51,392	1	£51,392	£51,392
Sub-Contracts *(provide* a *detailed breakdown in the cost breakdown box above)*	Prices are VAT-ex			
Travel & **Subsiste nce** UK Road Mileage Accommodation Day and Night subsistence Other (Rail/Air) (provide detail)				
	GRAND TOTAL			£246,977

GENERATED IP

Provide details of IP generated by Sub-Contractors and ensure that a DEFFORM 177 has been completed and returned to the Authority.

SUB-CONTRACTOR	**DETAIL OF IP GENERATED**

Milestones Deliverables and Payments

	Description	**Amount** £	**Due Date**	**Deliverable DEFCON (Please insert as appropriate)**
Milestone 1	Estimated Effort & expense incurred in Oct-Nov 21	£77,780	30 Nov 2021	
Milestone 2	Estimated Effort & expense incurred in Dec 21	£21,009	31 Dec 2021	
Milestone 3	Estimated Effort & expense incurred in Jan 2022	£21,009	31 Jan 2022	
Milestone 4	Estimated Effort & expense incurred in Feb 2022	£106,170	28 Feb 2022	
Milestone 5	Estimated Effort & expense incurred in Mar 2022 (invoice by 11 Mar 22)	£21,009	11 Mar 2022	
TOTAL			**£246,977**	

Call-Off Tasking Form Part C

1. Offer of Contract: *(to be completed by Ost/ Call-Off Task owner and forward to* Ost/ *Commercial Services for approval)*

Dstl Commercial Name: _____ **Tel:** _____

Approved _____

Requisition Number: 1000167024

Dstl Commercial Acceptance : **[REDACTED]** **Purchase Order Number:** 1000162744

Date: 14 September 2021

Please Note: Call-Off Task Authorisation to be issued by Dstl Commercial Services Department once the Purchase Order has been inserted. Any work carried out prior to issue is at the Contractor's own risk

2. Unqualified Acceptance of Offer: *(to be completed by the Contractor and return to Ost/ Commercial Services)*

Contractor's Name: **Tel:** _____

Position in Company: _____ **Signature:** _____

Date: _____

Please Note: Call-Off Task Authorisation to be issued by Dstl Commercial Services Department once the Purchase Order has been inserted. Any work carried out prior to issue is at the Contractor's own risk

2. COMPLETION OF CALL-OFF TASK *(to be completed by Contractor and returned to the nominated Ost/ Call-Off Task owner as detailed in Section 1- failure to return completed Part 3 could result in payment being delayed}*

Confirmation of Deliverables as per part 1 vD ND

Actual Start Date: Actual Completion Date:

Invoice Submitted on: For Firm Price of: £

Comments by Contractor on the Call-Off Task

Call-Off Task completed to Dstl's satisfaction (to be completed by Ost/ Call-Of/ Task owner)

Signed: Date:

Comments by Contractor on the Call-Off Task

THE DSTL NOMINATED CALL-OFF TASK OWNER SHALL FORWARD A COPY OF EACH COMPLETED CALL-OFF TASKING FORM TO: DSTL COMMERCIAL SERVICES