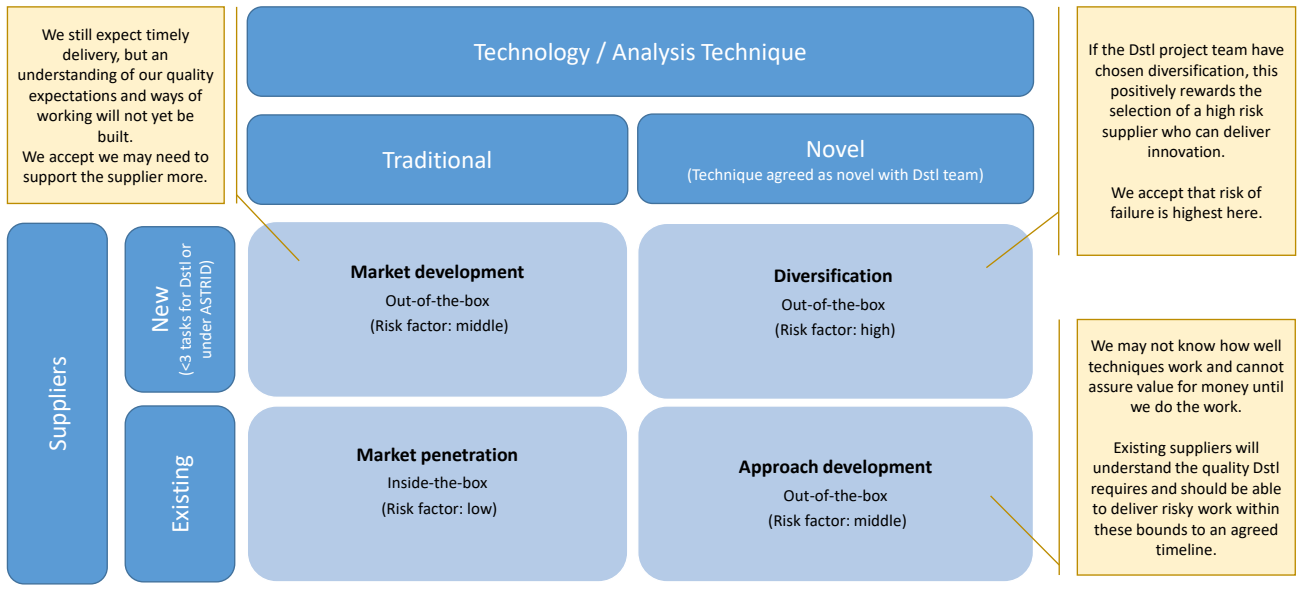
Statement of Requirement (SOR)

Contact & Project Information:

Project Manager	Name	[REDACTED]		
	Email	[REDACTED]		
	Telephone number	[REDACTED]		
Technical Partner	Name	[REDACTED]		
	Email	[REDACTED]		
	Telephone number	[REDACTED]		
iCas project number	711065			
Owning division	X-Division	**Delivering division**	X-Division	
Programme	S&T Futures			
Indicative task budget(s) £k	Core / initial work:	[REDACTED]	Options / follow on work:	

Innovation risk appetite:	Middle - Market development
Narrative (if applicable):	Futures investigation in the 2035 timespace.

Using the Ansoff matrix below, please indicate your risk appetite with regards to accepting innovative bids/solutions. The type of analysis/experimentation technique is included within 'Technology/Product'.



Use of Outputs:
This section is used to inform risks, liabilities, mitigations and exploitation. Questions 1-10 below should be a Yes/No/NA response. Please indicate if the questions do not make sense in the context of your task.
Intended uses (including the approximate time before use and any key decisions that will use the output):
This work will help to investigate “Generation-after-next Novel Computing” S&T [REDACTED]. The outputs of this contract will be used by a [REDACTED] triage board to down-select the concepts to be incubated and inform plans for incubation.
Possible uses:
It will help to identify, novel computing (including advanced electronics for novel computing) [REDACTED] for future procurement programmes.
Excluded uses:
Nil.

1	Will any output be directly used as part of a safety critical system, or will it be one of the most important factors in decisions on Cat A/B investments (>£100M), or at Ministerial level policy making?	No
2	Is this task collating and presenting previous work without making further / new recommendations?	No
3	Is this task research - for example, an exploration of new methods, models or tools?	Yes
4	Will a re-run of the modelling or analysis be required before outputs are presented to a decision maker?	No
5	Will the outputs form a minor part of the work that will be combined by the Dstl Project Team before being used for decision-making?	No
6	Has the approach to the work (how to undertake the work) been fixed by Dstl/MOD?	No
7	Will 100% of the technical assurance of the outputs provided by the Dstl Project Team?	No
8	Is the Dstl Project Team capping the maximum levels of verification and validation to be carried out on outputs?	No
9	Is this task developing or maintaining a method, model or tool (MMT) which will be used for multiple use cases over a period of time by Dstl Project Teams?	No

10	Can you confirm that there are no known intended uses of the outputs over and above those described here that could result in new risks if the output was incorrect?	Yes

Statement of Requirement (SoR)

Project's document ref	**711065**
Version number	**2.0**
Date	**07/07/2020**

1.	Requirement
1.1	**Title (including AST/ prefix)**
	AST/ Novel Compute concepts for [REDACTED]
1.2	**Summary**
	The overarching task is to develop a set of testable concepts and hypotheses, and associated plans to test the concepts and hypotheses, to enable MOD to understand the implications, opportunities and threats arising from emerging novel computing paradigms, and associated advanced electronics, that may be commercially available in the 2030-2040 timescale. Supporting this, the task needs to deliver an understanding of: (1) the future potential demand signal, both functional and non-functional, for computing in/by MOD, particularly the needs of [REDACTED], and; (2) how the future technological landscape of computing hardware, and associated electronics, could meet that demand. The work must be completed by March 2022.
1.3	**Background**

	The 2020 Government Spending Review settlement for MOD R&D provides in additional funding against the five Defence Challenges set out in the 2020 S&T Strategy. [REDACTED]. In line with MOD's S&T Strategy 2020 this task will **Identify** how generation-after-next computing paradigms, and associated electronics, could address the enduring capability challenges – focusing in particular on those associated with [REDACTED], but also more broadly to wider Defence applications. Hence, the task needs to address the opportunities presented by gen-after-next computing paradigms and the opportunities to enhance and transform current Defence capability (to both do things better and to do better things). In line with the Defence S&T Strategy programme the task is to **Identify** a broad set of testable concepts and hypotheses, and develop plans to **Incubate** (aka develop and test) a sub-set of the concepts and hypotheses in the period Jan 22 – Mar 25; with an initial demonstration showcase in Jan 23. The ultimate aim being to deliver a 5 year plan (in Nov 24) to *scale, rapidly exploit and advance applications of novel computing paradigms to MOD needs*. The task is to undertake the **Identify** activity; it is not to undertake the follow on **Incubate** activities, though there is the potential for follow on activity to provide additional analysis in support of plan development and the optional research requirements may begin to **Incubate** some hypotheses. The task needs to undertake **Outreach** to identify and develop collaborations with UK industry, UK academia and key international Defence partners, including identifying and collaborating with centres of excellence. The task needs to **Promote** the case for change and raise awareness of novel computing paradigms and the opportunities and threats they present to defence and security.

1.4	**Requirement**

Requirements:

Dstl wish to see a team of suppliers with the appropriate knowledge, skills, expertise and networks, working together to undertake the following activities within this Task:

a) **Collaborate**. Work collaboratively with Dstl on the task. One of the outcomes required is to improve Dstl SQEP and knowledge network on novel compute. The supplier is to identify and implement suitable methods and metrics for this.

b) **Scope.** Develop, with Dstl, a reasoned and documented view as to the scope of novel compute paradigms, and advanced electronics; identifying crucial, highly desirable, desirable, marginal and adjacent topics. It is expected that this will take account of work being conducted in other projects and programmes within Dstl and collaborators, as well as the technical remit and need to consider other Defence Lines of Development (DLODs). This should address the scope during both **Identify** and **Incubate** tasks: for example a very light weight review of other DLODs may be sufficient during Identify but may identify that the logistics burden of a particular concept needs to be addressed during **Incubate** for a particular **Concept & Hypothesis**. The supplier is to develop a representation of the scope that effectively communicates the key messages to a generalist audience.

The following describes the intended minimum scope for this Task which must be considered as part of a 'learn fast, decide quickly' process. These topics and issues require active consideration and the recording of decisions, with supporting reasons. It is NOT an exhaustive list of topics and issues. Dstl expect the supplier to identify the set of topics and issues of interest. The investigation into novel computing and advanced electronics must include consideration of:

i. High Performance Computing,
ii. Quantum computing,
iii. Neuromorphic computing and neuromorphic (aka spiking) devices (incl. sensors, actuators & communications bearers);
iv. Memristors,
v. Biology used for data storage, cryptography and as a medium for computation,
vi. Application Specific Integrated Circuits,
vii. System on a Chip,
viii. Beyond CMOS (Complementary Metal-Oxide Semiconductors),

ix. Analog computing,

x. Thermodynamic computing,

xi. High capacity, reliability, adaptability and resilience, as well as low latency, size, weight and power devices,

xii. UK defence supply chain security,

xiii. Ability to understand novel computing for assurance, including of partner systems, and exploitation of 3rd party systems.

The investigation of the demand signal is not prescriptive, but must cover as a minimum:

xiv. Processing, and management, of data/information gathering across all domains and environments, including;

- The future Internet of Battlefield Things is expected to include many more sensors [REDACTED] operating in many more modalities. Additionally, many land tactical sensors rely on human operators to identify objects/activities. Thus need to cover potential demand signal associated with automating (wide-angle, multi-spectral) sensing in land tactical environments.
- The demand signal associated with the latency required to enable the defeat of [REDACTED] targets;
- Cyber and electro-magnetic environment (EME), including autonomic and human-on-the-loop systems operating in cyber/EME environments;
- Space environment;
- Multi-domain integration;
- Processing of multiple classifications and computation of encrypted data.

xv. Command and Control including;

- Dynamic and distributed planning and resource allocation;
- Monitoring and prediction of system performance (both technical and human/social).

xvi. Human augmentation;

xvii. Synthetic environments, digital twins, modelling and simulation, including;

- High fidelity hydro-dynamic models of physical (inc. chemical and biological) systems;
- Materials science and synthetic biology;

- Complex adaptive and chaotic systems (including social systems);
- Wargaming.

xviii. Data Analytics and information processing, and storage, in support of defence decision-making, including:

- Data wrangling and analytics (including artificial intelligence) for high volume, high variety, variable veracity, variable value and variable viscosity data;
- Data wrangling and analytics (including artificial intelligence) for highly uncertain situations involving multiple hypotheses;
- Cloud, Mobile (including on-the-move), Safety-Critical, Distributed, Federated, Coalition and Edge.

c) **Need.** Identify and communicate effectively MOD's future demand signal, both functional and non-functional, for computing, and associated advanced electronics, in 2030-2040. This should focus on the demand signal for [REDACTED]. It must address future on-platform demand signals, as well as off-platform including, but not limited to, those associated with the whole force, multi-domain integration, synthetic environments, simulation, digital twins, edge/fog/cloud computing, artificial intelligence, analytics, strategic to tactical operations and all elements of future force development. It must address the future context in which defence operations are expected, including climate change, affordability, technological churn and constant competition (including adversary action and the need to operate in a degraded, intermittent and latent communications environment). The task needs to identify and communicate the future demand across multiple dimensions; and is to produce a visualisation of the future demand surface [REDACTED]. The task will also need to engage with other work analysing the demand signals and supporting decisions. The task must identify a set of challenging/transformative needs where novel computing paradigms (and their associated advanced electronics) have the potential to provide significant benefits to Defence (either as part of a hybrid computing architecture and/or as a replacement).

d) **Limits.** Identify and effectively communicate the factors that limit current computation. A number of factors limit what can be achieved currently using computation. Some of these, like the Landauer limit (related to thermal efficiency), may be linked to particular computational substrates. Others, like Turing's Halting problem, may be linked to theoretical models of computation. This task needs to produce a summary of a wide variety of computational limits, including all of those that are commonly known. The summary should be brief (e.g. a few pages) and accessible to non-experts. It should be supported by more detailed references and a more

detailed repository which must enable Dstl to map novel and emerging developments, and proposals, which seek to overcome limits to the potential benefits of the development.

e) **Opportunity**. Identify and communicate effectively the emerging landscape of computing, and associated advanced electronics, which may be commercially available in 2030-2040. This needs to provide a thorough market intelligence report, addressing uncertainties (e.g. via providing 3-point estimates), drivers, constraints, development factors/issues and supply chain factors/issues. This needs to address the changing landscape of computing, the associated landscape of human capital, and all elements of research, design, development, manufacturing, test and assurance. It needs to cover, at least, the range of computing opportunities outlined in the scope section, the range of computing platforms from IoT devices to server farms, and the limits on current computing. In addition, it needs to provide representations (e.g. summary narratives and visualisations) which effectively communicate the key messages to (a) [REDACTED], platform and simulation domain experts (who are not experts in computing) and (b) wider Defence and Security stakeholders.

f) **Concepts & Hypotheses.** Develop a set of testable concepts and hypotheses, and associated **plans** to test a sub-set of the concepts and hypotheses, to enable MOD to understand the implications, opportunities and threats arising from emerging novel computing paradigms, and associated advanced electronics, in the 2030-2040 timescale. For planning purposes, and assuming a concept and hypothesis costs [REDACTED] to assess, then the final report will need to provide detailed plans for around 15 concepts & hypotheses. The plans should include evidence based estimates of costs and timescales, for staged development and testing of the concepts and hypotheses, alongside Statements of Requirement which can be used to contract for staged development and testing of the concepts and hypotheses. The created concepts and hypothesis need to cover a range of scales and risks. The concepts & hypotheses must identify the benefit to Defence if they are realised. The concepts and hypotheses should mostly address [REDACTED], but a significant fraction (10-30%) should address other Defence applications (e.g. materials, training, human augmentation, weapon effects and logistics/support). The risks, rewards and degree of uncertainty associated with each concept/hypothesis must be captured. The supplier is to develop and apply, in collaboration with Dstl and in consultation with DST, suitable methods and metrics to assess and down-select from a long list of hypotheses to a shorter list for which more detailed development and test plans are to be developed. {It is proposed, but the supplier is free to suggest an alternative, that regular review sessions are held every month with Dstl to review the developing set of concepts and hypotheses, with the intent

that this will enable a 'learn fast, decide quickly' process enabling and thus enable rapid development and triage of a long list of concepts.}

g) **Promote**. Organise and run a one-day symposium on Novel Computing for [REDACTED] Defence with speakers from MoD, Industry and Academia (and possibly Other Gov Departments). Deliver a 30-40 min presentation, and answers during a follow-on Q&A session, suitable for (and to) a generalist Defence audience as part of the DST lecture series.

h) **Outreach.** Develop and maintain, with Dstl, a collaborative network of academic and industrial experts and centres of excellence on novel computing, and associated electronics. This network must be developed in partnership with Dstl such that Dstl can take over the management of the network at the end of the contract. The intent is that the network will contain members with whom MOD/Dstl would wish to have an on-going collaborative relationship with on the subject of Novel Computing.

i) **Research.** Scope and deliver research against the below requirements, subject to agreement by Dstl (and available funding as per the overall limit of liability of the task). The requirements have been given an initial rating of high, medium or low priority to aid in their prioritisation. All requirements should be initially scoped to understand their likely cost, quality, outputs and time boundaries, thus enabling Dstl to decide which are to be enacted subject to the overall limit of liability associated with the task. {Some of the optional tasks have a degree of overlap with the mandatory requirements set out above, thus it is possible they will be (at least) partly addressed as part of the activities addressing the mandatory requirements. The intent is that the scoping of the optional tasks will address this issue.}

High Priority research requirements:

1) Support to Dstl on understanding the cost-benefit of undertaking a DASA themed call or an innovation focus area. The supplier is to identify options and undertake, in consultation with Dstl, a review of the options and the costs and benefits of each option. To deliver T0+3 months.
2) Development, in collaboration with Dstl and DASA, of an innovation focus area or themed call. The supplier is to develop and deliver the call documentation required to launch a call. This will require collaboration with DASA as well as Dstl. To deliver T0+6 months.
3) Neuromorphic on-line learning of patterns in Streaming Data. This task will demonstrate:

a. how a spike-based recurrently connected neural network is able to conduct on-line learning of temporal patterns in streaming data and identify patterns of interest (including known & un-known patterns);
b. compare the performance to other methods (including but not limited to CNNs and LSTM) and;
c. identify the developments required to enable on-chip (near) real-time learning in an energy-efficient manner.

4) Resource Allocation & Novel Compute. Several novel computing paradigms have shown the potential to outperform traditional computing on a number of problems concerned with planning and resource allocation (e.g. travelling salesman, knapsack). This task is to review the state of the art, identify the problem and computing factors (what, when, where, how, why) which would lead to a novel computing solution providing advantage over a traditional solution (& assess the likelihood of this being achieved by 2040) and map these to (potential) Defence use cases [REDACTED]. The task is to review the feasibility, efficiency & effectiveness of integrating the required novel computing with traditional computing capabilities; and demonstrate/model the logical process flow.

5) Symbolic/Semantic Computation. It has been argued that the use of a semantic pointer architecture and spikking neural network hardware has the potential to revolutionise artificial intelligence (e.g. 'How to Build a Brain', C Eliasmith). This task is to review and assess the potential benefit to Defence of such computation. It is to review, link & assess the range of cognitive functions (inc. but not limited to, attention, planning, reasoning, syntax, semantics, learning to learn) required for Gen-After-Next AI, associated (mathematical/information science) techniques (e.g. infomatics, sematic web, probabilistic logic programming, constraint based reasoning) and hardware processing architectures in order to identify associated limitations and opportunities. The tasks should demonstrate the ability to reason/plan about a number of potential courses of action and adjust the plan as more data becomes available (c.f. 7 questions & F2T2EA): the demonstration must either use symbolic processing hardware or may simulate the hardware (e.g. simulation of spiking neural network hardware).

6) DNA-Based Monte-Carlo Simulation. DNA-based approaches provide an efficient way of considering large problem spaces. This can be useful in finding a solution to a "computationally hard" problem (like the Travelling Salesman Problem). It might also be a way of tracking an entire probability distribution through a series of transformations. If so, it

could provide results analogous to many replications of a Monte-Carlo simulation. This task should produce a model, or emulation, of a DNA-based approach to Monte-Carlo simulation, and assess the potential value to Defence of such DNA-based approaches. String rewriting (or Thue-based) approaches may be an attractive approach. Techniques that allow many small-scale implementations (e.g. micro-services) to be efficiently run may be helpful in implementing the model.

7) Latency & Hypersonic Targets. Investigation into the latency, and reliability, requirements of the information processing chain for the defeat of hypersonic targets. Assess the typical latency, and reliability, of current information processing chains. Assess the potential of developments required to enable the tactile internet to meet the required latency and reliability requirements. Identify any resulting shortfalls.

Medium priority research requirements:

1) Neuromorphic processing of Future Tactical Sensing. Currently many land tactical sensors rely on human operators to identify objects/activities, and are disconnected from the network. The future Internet of Battlefield Things is expected to include many more sensors [REDACTED] operating in many more modalities; exploiting this data is hypothesised to require the sort of low power, edge data processing, analytic and AI capabilities offered by neuromorphics. This task will assess the potential of neuromorphics to provide real-time instance sementation and activity recognition using imagery (inc. 3 D point cloud, visual/EO (inc. direct vision systems), audio and radar data, and will demonstrate the state of the art. It will develop a roadmap for the provision of required low power, edge data processing, analytic and AI capabilities.
2) DNA-based Storage. DNA has the potential to provide stable long term storage of data at very high densities, so supporting task such as data centre back-up, data centre cleaving and transfer of very large data sets (where delay is tolerable). The task will:
    a) identify the potential benefits provided to Defence by DNA-storage (including identification of use cases);
    b) investigate the state of the art, performance requirements and development pathways to ensure the confidentiality and integrity of DNA storage (if such DNA storage was to be used within Defence systems for storage, archiving and transport of data);
    c) Identify the read and write performance necessary to provide useful functionality.

3) Quantum Computers and Hydrodynamic Simulation. Given the proven potential of quantum computing to solve the Navier-Stokes equations: this task will:
   a) assess the state of the art in using quantum computing (potentially as an adjunct to High Performance Computing (HPC)) to undertake high performance modelling of fluid dynamics for defence purposes (inc. but not limited to, shock waves in materials and across boundaries, dispersion of particulates in urban and rural environments, signature modelling, decay of explosives and associated materials);
   b) assess the required performance of quantum computing (inc. analysis of how required performance scales with simulation size/complexity and the what/when/why/whwere/how of quantum computing providing an advantage over traditional HPC);
   c) identify development pathways and;
   d) develop a roadmap for the use of quantum computing as an adjunct to Dstl's current High Performance Computing environment.
4) Overcoming limits. This task will investigate and assess the potential for new/novel materials and approaches to tackle the limits of conventional computing.
5) Quantum Computing for Wargaming. This task will undertake a study of the potential for a quantum computer to optimise a winning strategy in a wargame. It will include the demonstration of a quantum computer playing a (probably simple) game to establish proof of concept rather attempting to demonstrate use in a complex wargame. The task must assess how the level of Quantum compute needed scales with game complexity.
6) System Integration. Review and assess the challenges associated with introducing novel computing into the Defence computing estate. Should include use in Hybrid Approaches to Computing systems involving a mixture of novel and traditional computing systems. Should address X-DLODs implications.
7) Setting up a Novel Compute Challenge. Investigate the ability to run a novel compute challenge where 'teams' (industry and/or academia) bring novel compute solutions to a challenge event (with challenge acting as a down-selection and award contract to the winner(s) for the solution). The firewalling of this task will need to be considered.

Low priority research requirements:

1) Machine Learning & Novel Computing. Current quantum computers have been shown to complete machine learning tasks faster and produce a 'better' model (deep neural network) than classical (GPU) based approaches. This task should undertake a review of the different

	types of Machine Learning approaches (e.g. supervised, unsupervised, adversarial etc), assess what will lead to changes in relative advantage in undertaking them using different forms of computing (e.g. GPU, ASIC, Neuromorphic, Quantum, DNA) and produce a representation (model).
1.5	**Options or follow on work**
	Follow on. There may be potential follow on work associated with: a) Review and updating of MOD's future demand signal; b) Review and updating of the emerging landscape of computing, and associated advanced electronics; c) Review and updating of the set of testable concepts and hypotheses, and associated plans to test the concepts and hypotheses, developed in earlier work; d) Development of new testable concepts and hypotheses, and associated plans to test the concepts and hypotheses; e) Further development and maintenance of the a network of academic and industrial experts and centres of excellence on novel computing, and associated electronics; f) Delivery of further novel computing symposia and/or show case events; g) Incubation of the concepts and hypotheses developed in earlier work, and (possibly) presentation at a show case event. h) Support to the handover of a concept to a delivery programme. i) Provision of SQEP for technical partnering of follow-on work on the development and testing of concepts and hypotheses. j) Provision of SQEP to assess proposals resulting from a DASA call. k) Provision of SQEP to technically partner tasks resulting from a DASA call.

1.6	Deliverables & Intellectual Property Rights (IPR)						
Ref.	**Title**	**Due by**	**Format**	**TRL ***	**Expected classification (subject to change)**	**What information is required in the deliverable**	**IPR DEFCON/ Condition** *(Commercial to enter later)*
D-1	Novel compute metrics, methods and presentations	T0+1.5 months (mid-Sep)	Document	n/a	UKO	Report setting out principles, metrics and methods to be used to address **collaborate, scope, need, limits, opportunity, concepts & hypotheses, outreach, promote & research**. To include; • Metrics and methods to be used to assess desirability, feasibility and viability of concepts and hypotheses; Representation (aka format) in which concepts & hypotheses (including plans) will be	703

						delivered. To include a worked example (the example can be fictitious).	
D-2	Initial scope and research plans	T0+2 months	Document	n/a	OS	Presentation setting out initial reasoned view as to the **Scope** and providing costed plans to address the optional **Research** requirements.	703
D-3	Initial Triage of Novel Compute	T0+3 months (1st Nov)	Document	n/a	OS	Report setting out finding from initial triage stage of the project. To include: • **Collaborate.** Evidence of collaboration with Dstl. • **Need.** Initial view as to future demand signal, identifying areas of significance and uncertainty, and assessment as to coverage. Must include a visualisation of the future demand surface of [REDACTED]. • **Limits.** Initial view as to current limits, including a list of full set of limits plan to address.	703

						• **Opportunity**. Initial map of novel computing (and advanced electronics) opportunities, with short description of technology, value & maturity. Plus taxonomy and assessment of coverage. **Concepts & Hypotheses**. Initial set of concepts and hypotheses, with outline plans to test. Must include options for a portfolio which is selected on different bases including, at least: (a) biased towards high impact concepts with potential to be transformational (a future which is fundamentally different from the existing), (b) balanced in terms of risk, (c) focused on [REDACTED], (d) more balanced across Defence. Must show how the concepts advance the capability to meet the future demand surface of [REDACTED]. *{These options will be used in consultation with DST*	

						and other stakeholders to determine the Authorities preference.}	
D-4	Refined Understanding of Novel Compute	T0+5 months (1st Jan)	Document		OS	To include: **Collaborate**: Evidence of further collaboration with Dstl. **Scope**: Finalised scope. Report setting out a reasoned argument for the scope of novel compute paradigms, and advanced electronics; identifying topics and issues which are in scope, those which are out of scope and those which could be in scope (on a case by case basis). Needs to address the scope during both **Identify** and **Incubate** tasks. **Scope/Promote:** A representation which effectively communicates the key messages to a generalist audience. **Opportunity**: Market intelligence report and repository, addressing:	703

						• uncertainties (e.g. via providing 3-point estimates), drivers, constraints, development factors/issues and supply chain factors/issues. • the changing landscape of computing, the associated landscape of human capital, and all elements of research, design, development, manufacturing, test and assurance. Repository must be compatible with the data model used in the Defence Technology Matrix, and use standard tools (e.g. Excel) already available on Dstl core infrastructure. User guide for the repository. Evidence of feasibility and viability of updating the repository with horizon scanning and scientific intelligence outputs. **Opportunity/Promote:** Representations (e.g. summary narratives and visualisations) which	

						effectively communicate the key messages to (a) [REDACTED], platform and simulation domain experts (who are not experts in computing) and (b) wider Defence and Security stakeholders. **Need:** Report and repository setting out MOD's future demand signal, both functional and non-functional, for computing, and associated advanced electronics, in 2030-2040. Needs to select and map the future demand signal across an appropriate set of dimensions; must include a visualisation of the future demand surface of [REDACTED]. Repository must be compatible with the data model used in the Defence Technology Matrix, and use standard tools (e.g. Excel) already available on Dstl core infrastructure. User guide for the repository.	

						Evidence of feasibility and viability of updating the repository. **Need/Promote:** Representations (e.g. summary narratives and visualisations) which effectively communicate to a generalist Defence audience the key messages about (a) future [REDACTED] demand surface and (b) wider Defence and Security demand surface. **Limits.** Report and repository setting out the current limits on computation. User guide for the repository. Evidence of feasibility and viability of updating the repository. **Limits/Promote**. Representations (e.g. summary narratives and visualisations) which effectively communicate to a generalist Defence audience the key messages about limits on current computation.	

						Outreach. Document the network of academic and industrial experts and centres of excellence on novel computing, and associated electronics.	
D-5	Novel Compute symposium	T0+5 months (1st Jan)	Symposium	n/a	O	**Promote.** One-day symposium on Novel Computing [REDACTED] Defence with speakers from MoD, Industry and Academia (and possibly Other Gov Departments). **Promote.** Deliver a 30-40 min presentation, and answers during a follow-on Q&A session, suitable for (and to) a generalist Defence audience as part of the DST lecture series. {It is expected that this will be available to deliver from T0+2 months}	703
D-6	Finalised Concepts & Hypotheses	T0+6.5 months (mid Feb)	Document		OS	**Concepts & Hypotheses**. Revised and refined (following feedback on set in initial triage of novel compute deliverable) of testable concepts and hypotheses.	703

						Detailed plans, including evidence based three-point estimates of costs and timescales, for staged development and testing of the concepts and hypotheses. Developed Statements of Requirement which can be used to contract for staged development and testing of the concepts and hypotheses. Developed Statement of Requirement which can be used to contract for a demonstration showcase in Jan 23.	
D-7	Final Report	T0+7.5 months (mid-Mar)	Document, video of demonstrations.		OS	Final Report to capture all of the tasks under this contract (including optional **Research** requirements)	703
D-8	Monthly Progress Meeting	Life of contract	Teleconference		OS	A kick-off meeting, followed by monthly progress meetings, to be organised by the supplier with Dstl	703

D-9	Research Tasks	To be agreed with supplier, but should deliver prior to D-7 Final Report	1. Report. 2. Presentation		OS	1. Report with executive summary. 2. For tasks that include a demonstration, a technical demonstration video (potentially a narrated powerpoint presentation).	703

*Technology Readiness Level required, if applicable

1.7	**Standard Deliverable Acceptance Criteria**
	Deliverable Acceptance Criteria (As per ASTRID Framework T&Cs) 1. Acceptance of Contract Deliverables produced under the Framework Agreement shall be by the owning Dstl or wider Government Project Manager, who shall have up to 30 calendar days to review and provide comments to the supplier. 2. Task report Deliverables shall be accepted according to the following criteria except where alternative acceptance criteria are agreed and articulated in specific Task Statements of Work: • All Reports included as Deliverables under the Contract e.g. Progress and/or Final Reports etc. must comply with the Defence Research Reports Specification (DRRS) which defines the requirements for the presentation, format and production of scientific and technical reports prepared for MoD. Reports shall be free from spelling and grammatical errors and shall be set out in accordance with the accepted Statement of Work for the Task. • Interim or Progress Reports: The report should detail, document, and summarise the results of work done during the period covered and shall be in sufficient detail to comprehensively explain the results achieved; substantive performance; a description of current substantive performance and any problems encountered and/or which may exist along with proposed corrective action. An explanation of any difference between planned progress and actual progress, why the differences have occurred, and if behind planned progress what corrective steps are planned. • Final Reports: shall describe the entire work performed under the Contract in sufficient detail to explain comprehensively the work undertaken and results achieved including all relevant technical details of any hardware, software, process or system developed there under. The technical detail shall be sufficient to permit independent reproduction of any such process or system. 3. Failure to comply with the above may result in the Authority rejecting the Deliverables and requesting re-work before final acceptance. 4. Acceptance criteria for non-report Deliverables shall be agreed for each Task and articulated in the Statement of Work provided by the Contractor
1.8	**Specific Deliverable Acceptance Criteria**

2.	Quality Control and Assurance
2.1	**Quality Control and Quality Assurance processes and standards that must be met by the contractor**
	☒ **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)
2.2	**Safety, Environmental, Social, Ethical, Regulatory or Legislative aspects of the requirement**
	This contract is anticipated to be office-based and therefore is classed as low risk to safety. There are no environmental, social, ethical, regulatory or legislative aspects that the contractor should be aware of.

3.	Security	
3.1	**Highest security classification**	
	Of the work	OFFICIAL-SENSITIVE
	Of the Deliverables/ Output	OFFICIAL-SENSITIVE
	Where the work requires more than occasional access to Dstl premises (e.g. for meetings), SC Clearance will be required.	
3.2	**Security Aspects Letter (SAL) – Note the ASTRID framework has an overarching SAL for quotation stage (up to OS)**	
	Yes If yes, please see SAL reference- *Enter iCAS requisition number once obtained*	
3.3	**Cyber Risk Level**	
	Very low	
3.4	**Cyber Risk Assessment (RA) Reference**	
	[REDACTED] If stated, this must be completed by the contractor before a contract can be awarded. In accordance with the Supplier Cyber Protection Risk Assessment (RA) Workflow please complete the Cyber Risk Assessment available at https://suppliercyberprotection.service.xgov.uk/	

4.	Government Furnished Assets (GFA)

GFA to be Issued - Choose an item.

If 'yes' – add details below. If 'supplier to specify' or 'no,' delete all cells below.

GFA No.	Unique Identifier/ Serial No	Description: *Classification, type of GFA (GFE for equipment for example), previous MOD Contracts and link to deliverables*	Available Date	Issued by	Return or Disposal *Please specify which*
1	1DTM	Defence Technology Matrix input template	Start of contract	Dstl	N/A – blank input template only

If GFA is to be returned: It must be removed from supplier systems and returned to the Dstl Project Manager within 2 weeks of the final Task deliverable being accepted. (Any required encryption or measures can be found in the Security Aspects Letter associated with the Task).

If GFA is to be destroyed: It must be removed from supplier systems and destroyed. An email confirming destruction should be sent to the Dstl Project manager within 2 weeks of the final Task deliverable being accepted

5.	Proposal Evaluation
5.1	**Technical Evaluation Criteria**
5.2	**Commercial Evaluation Criteria**
	As per ASTRID Framework T&Cs.