

**Statement of Requirement for Data Analytics – FY 17/18**

**Title of the requirement** Data Science RCA FY1718

**Executive Summary of Requirement:**

The FY17-18 Data Science (DS) project sits under the Ministry of Defence (MOD) Chief Scientific Advisor (CSA) sponsored Information Systems (IS) programme. The DS project forms the backbone of the information and intelligence (i2) processing theme, and will deliver research and advice on a number of distinct technologies to MOD stakeholders. These technologies include: text processing, machine learning, pattern recognition, predictive analytics, association and fusion and management of uncertainty.

There are a number of work package streams within DS which aim to deliver these technology themes: Management of Uncertainty, Automation of Unstructured Data Processing, Associate and Fusion, Predictive Analytics, Data Science Innovation and Exploitation of Largescale Data Processing and OSINT. These work packages were selected as they represent reusable terminology across our stakeholders on their journey from data to user. The projects work package and research activities focus on underpinning data science research in order to deliver tools, techniques, and processes, designed to inform future Direct Process Disseminate (DPD) capabilities across Defence.

This RCA focuses on Association and Fusion (AFF) and Automation of Unstructured Data Processing (AUTO) work only. Within each of the Sections of the RCA the requirements from each of the WPs have been split in to 'Lots', with the premise that contractors can bid on one or more lots should they choose to.

For the purposes of this requirement, only the 25% cap on sub-contracting in clause 22.2 will not apply. However, fees to arrange sub-contracts will be deemed as a non-compliant criteria in the Authority's evaluation.

**Requirement(s):**

Lot	Title	Work Package	Indicative Budget (£k)
1	Text Analytics Exploitation	AUTO	£60k
2	Text Analytics Road Map	AUTO	£60k
3	ENVI Services Engine Research & Development	AUTO	£60k
4	Enhancing the resolution of overhead images	AUTO	£60k
5	Video summarisation	AUTO	£60k
6	Scalable Java Algorithms for Graph Similarity	AFF	£60k

**Lot 1—Text Analytics Exploitation**

Dstl requires that an extensible web application is developed to enable analysts to explore, exploit and manage the outputs of entity and relationship extraction, primarily by Baleen <https://www.github.com/dstl/baleen>.

The key underpinning feature of this work should be the extensibility, and the application should allow the easy integration of new functionality (e.g. a new REST API or UI component) and new data sources (e.g. a graph database store if this is supported by Baleen in the future). The application should also be highly and easily configurable, allowing for deployment in a range of different environments with minimal effort.

**Essential Requirements**

Project plan documents, including: activity breakdown, timelines and milestones, technical approach, risks and mitigations

The application shall be:

- Extensible – it should be possible for additional functionality to be developed and integrated by third parties in a clear and straight forward way
- Standards compliant – the latest web standards (see <https://www.w3.org/standards/>) should be

adhered to, and a modern web browser can be assumed such as modern versions of IE, Chrome and Firefox.

- Open source – the application must be released to Dstl under an Apache Software License 2 license, and any third party components used must also be under this or a compatible license.
- Well documented and fully unit/integration tested this documentation should include a list of open-source licence dependencies.
- Well documented and straight forward for a non-specialist to deploy and configure

The application must address:

- Authentication – It should be possible to use authentication to restrict access to the application
- Role based permissions – It should be possible to restrict access to functionality based on roles assigned to users
- UI and REST – All functionality should be available as both a UI component (i.e. through the browser), and as a REST API for programmatic use
- Usage monitoring – It should be possible to monitor usage of different capabilities within the application to inform future research towards commonly used functionality
- Integration with all core Baleen output formats (e.g. Mongo, Elastic, Postgres), and extensible such that new output formats can be added in the future
- Allow users to submit feedback and ideas for new functionality and capability

The application shall have the following functionality to explore, exploit and manage Baleen outputs:

- Full-text search;
- Exploration and visualisation of temporal data;
- Exploitation and visualisation of geospatial data;
- Exploitation, visualisation and editing of extracted entities and relations, ensuring that where editing occurs all available data sources are kept concurrent;
- Exploration and visualisation of metadata; and
- Corpus level overview information and statistics.

The following meetings are mandatory as part of the contract, but additional meetings may be requested by either Dstl or the supplier:

- Project kick off meeting (within 1-2 weeks of the contract starting)
- Face-face update meetings to be held every 2 months
- End of project meeting

As a minimum, the following deliverables should be provided:

- Source code
- Documentation, including build and deployment instructions
- A short report outlining the delivered functionality
- Demonstration

### **Approach and Way Of Working**

The use of existing open source libraries and components is encouraged wherever possible (bearing in mind the license). Any commonly used development language is accepted, with a preference for Java.

An agile approach to development should be considered (e.g. sprints), allowing for the steering of development by Dstl as work progresses.

The latest publically released version of Baleen at the start of the contract as the baseline version, though by agreement with the technical partner a later version may be used in order to make use of new features and bug fixes.

All work should be done at the supplier's premises.

## **Lot 2—Text Analytics Roadmap**

Dstl has a requirement to further develop well documented and applicable text analytics techniques, in order to support the automated understanding and exploitation of text reporting within Defence. These areas of interest should be researched and practical implementations are to be delivered using the Baleen (<https://www.github.com/dstl/baleen>) text analytics framework and for subsequent inclusion within that framework, up to TRL 6. The deliverables are well documented source code in accordance with standards described later and releasable under the Apache Software License 2 (ASL2), this applies to all essential and desirable requirements within this lot.

All of the following areas should be considered and delivered against, but it is accepted that it may not be possible to focus on all areas equally. The list below is therefore ordered in an approximate order of priority for Dstl.

### **Essential Requirements**

Project plan documents, including: activity breakdown, timelines and milestones, technical approach, risks and mitigations

- Relationship Extraction

Probably the biggest leap forward we can make in automatically understanding the content of a document is to be able to extract relationships between entities. This is a difficult problem, but one that will vastly increase our ability to automatically exploit text content.

There is existing academic work in this area, which should be leveraged as much as possible and extended to meet our specific use cases. A literature review, and the suppliers own ideas, to identify suitable techniques would be the starting point of this work, with any appropriate techniques then being implemented and evaluated for exploitation. The supplier would down select the candidate approaches and make clear the rationale and audit for this with the authority. This downselection and evaluation could, for example, cover type of open source licenses, dependencies, suitability for integration to Baleen, published/reviewed usage and wider adoption in community.

- Document Triage

Focus on extracting specific pieces of information from a document, such as entities or relationships remains a customer demand. However, it is possible to deduce broader statements about a document based on all its content and metadata – for example, we might be able to classify a document as an eye witness report or as a summary (document classification), or we might be able to determine that the topic of a document relates to narcotics smuggling (topic modelling).

In addition, there are techniques to automatically produce document summaries and this is an area for further exploration as a further means of allowing analysts to prioritise their efforts. These capabilities are important tools for the triage of documents, and shouldn't be neglected in favour of extraction techniques. These techniques might be enhanced by using the outputs of extraction techniques, and this is one approach that should be considered as part of this research and proof of concept.

- Cross Document entity Disambiguation

Same document disambiguation of entities is useful, but real analytical benefit comes from being able to do a similar thing with entities across multiple documents. This is a significantly harder problem however, and dependent on being able to understand the context of document which would significantly improve the overall capability.

As with relationship extraction, research in this area should largely leverage existing academic research and focus on adapting published techniques to work with our datasets and resources.

- Event Extraction

The ability to extract events from text remains important. An event consists of something happening at a particular place and time, usually with one or more 'actors' involved. It is therefore dependent on being able to extract those components as entities and link them together with relationships, in order to determine that they are involved in a given event.

- Knowledge Representation

Being able to extract information from text has little value if we can't exploit that information. How we persist and represent the information we extract is therefore a crucial area of research.

There are a number of existing formats we could use and standards we could adhere to, but it is unclear which (if any) suit the needs of defence and this is something that should be investigated.

As part of this, the normalisation and standardisation of extracted information will need to be considered, as will different storage formats (such as triple stores or graph databases).

- Scalability

Whilst scalability is an issue that should be addressed throughout the research process, a specific effort is worthwhile to try to optimise techniques for usage against Big Data style problem sets. As well as optimising for use against large data, this research area should also look at running the techniques in clustered environments.

The following meetings are mandatory as part of the contract, but additional meetings may be requested by either Dstl or the supplier:

- Project kick off meeting (within 1-2 weeks of the contract starting)
- Face-face update meetings to be held every 2 months
- End of project meeting

As a minimum, the following deliverables should be provided:

- Source code
- Documentation, including build and deployment instructions
- Technical report covering all work undertaken

In addition, we would gladly accept any additional reports or technical memos generated as part of the research process for the above areas.

### **Approach and Way Of Working**

Dstl will provide a technical partner for this work, who will help steer development and provide an appropriate defence perspective. Regular access to defence data during the contract is unlikely to be possible, but occasional access may be possible via the technical partner for evaluation purposes. It is expected that there will be a close relationship between the technical partner and the supplier, and that they will be in regular communication to assist with effective knowledge transfer in both directions.

The latest publically released version of Baleen at the start of the contract as the baseline version, though by agreement with the technical partner a later version may be used in order to make use of new features and bug fixes.

It is the intention that some of this work, such as the suppliers source code, will be open sourced at the discretion of Dstl, and included within the core release of Baleen. All code is therefore required to be under an Apache Software License 2 (ASL2) license, and any dependencies must be under ASL2 or a compatible license.

All work should be done at the supplier's premises.

### **Lot 3— ENVI Services Engine Research & Development**

Dstl has a requirement to fund the continued research, development and integration of ENVI Services Engine for users at RAF Wyton.

Under the FY16-17 Data Analytics project, the team successfully built and deployed a rule-based data processing framework capable of extracting GEOINT from imagery. This framework is designed to record observations from custom object extraction processes at scale, with the aim to reduce the manual burden on Imagery Analysts (IA), who are faced with increasing volumes of data being collected and exploited.

The core of the system relies on ENVI Services Engine (ESE) which provides image processing as a web service, giving the ability to call IDL/ENVI/Python processing remotely, on demand, and also to integrate it with other web technologies. This is particularly relevant as developers use these languages in their day to day imagery exploitation tasks.

The software stack has been integrated into existing exploitation infrastructure on the Dstl Virtual Laboratory to enable experimentation that is linked to operational data sources and for developing and testing new services and applications that are focussed on operational problems. The system has since been transitioned to the Silver server environment at RAF Wyton, which will provide analysts access to bespoke GEOINT services deployed to ESE from their operational systems. RAF Wyton remains a key defence user of Dstl research and it is important that this capability is fully integrated into their systems for exploitation.

The software itself is composed of four subsystems which provide the functionality for data ingestion, processing, visualisation and administration. In its current state, the system actively watches a local directory for new data that have become available. Research is now required to modify this to provide integration with the existing image libraries (query and retrieval) at RAF Wyton. Access to image libraries will be through an API and will require on-site working.

It is equally important that this capability is accompanied by services that will allow analysts to rapidly assess activities, changes over time, patterns and anomalies relating to targets of interest. Research is therefore required to capitalise upon existing standalone image processing algorithms available at RAF Wyton and transition these fully for use on the ESE platform where they can be deployed autonomously and at scale. These algorithms are written in IDL/ENVI and/or Python so familiarity of these languages is essential.

### **Essential Requirements**

These shall include:

- Project plan documents, including: activity breakdown, timelines and milestones, technical approach, risks and mitigations.
- Develop a user and programmatic interface for ENVI Services Engine to query and retrieve data from existing image libraries at RAF Wyton.
- Support integration and deployment of existing standalone image processing routines for use in ENVI Services Engine at Dstl Porton Down and/or RAF Wyton Silver environments.

As a minimum, the following deliverables should be provided:

- Project plan document (PDF or docx at customer meeting).
- Source code, build and documentation for image library interface including user guide.
- Successful demonstration of image processing services on the Silver environment at RAF Wyton
- A short end of project report covering options for future work.

### **Approach and Way Of Working**

Development work will be conducted at the contractor site and at Dstl Porton Down with close technical partnering. Regular visits to RAF Wyton will be required in support of deployment and user engagement.

### **Lot 4- Enhancing the Resolution of Overhead Images**

This study will explore how the resolution of overhead (aerial/satellite) imagery can be increased to reveal previously indistinguishable details. This capability would find application in a variety of scenarios where

overhead imagery resolution is limited. One such example is for low cost earth-imaging satellites, where high revisit times are achieved but with lower resolution than from higher cost, lower revisit time systems.

A variety of super-resolution models should be considered and down-selected by the supplier, with a an explained rationale to the authority, for implementation against one or more overhead imagery datasets. One such candidate model is the 'pixel recursive super resolution' model<sup>1</sup>, which uses a combination of comparison to down-sampled training images together with the addition of artificial details based upon knowledge of the image class. It is proposed that this and/or similar models be applied to one or more overhead imagery datasets such as NAIP<sup>2</sup> or Open California<sup>3</sup>. The aim is to demonstrate accurate detail recovery through use of the models.

The following meetings are mandatory as part of the contract, but additional meetings may be requested by either Dstl or the supplier:

- Project kick off meeting at supplier's location (within 1-2 weeks of the contract starting).
- Weekly teleconferences.
- Face-to-face update meetings every 2 months at Dstl Porton Down.
- End of project meeting at Dstl Porton Down.

### **Essential Requirements**

- Project plan documents, including: activity breakdown, timelines and milestones, technical approach, risks and mitigations
- Scoping study of the most effective (e.g. scale, speed, cost, integration, overhead) super resolution models relevant to this application.
- Implementation of the most promising super resolution models identified from the scoping study at the suppliers recommendation, utilising overhead imagery dataset(s) with agreement between supplier and Dstl.
- Development of clear metrics to evaluate the effectiveness of the model(s).
- Provision of a command line tool to execute the models.
- Source code must be delivered in Python, Java or Scala.
- Source code must be able to be installed and run on an offline system with no Internet connection.
- Source code must be useable without any licensing costs, and must be delivered without any usage restrictions for MOD or government.
- The solution must be provided with full documentation, installation guides and user guides.
- The overhead imagery dataset(s) used for the study must also be provided.

### **Desirable Requirements**

- Implementation of additional super resolution model(s) with a quantified comparison of the different techniques.
- Publication of the results of the work as a document which, where appropriate, could lead to an article in a peer reviewed journal.

As a minimum, the following deliverables should be provided:

- Technical report detailing candidate super resolution methods and comparing their anticipated effectiveness for this application.
- Technical report that clearly details the model implementation(s), including installation and user guides.
- Complete source code for the model(s) implemented.
- A copy of the image dataset(s) used in the implementation(s), to be used for evaluation purposes.
- Presentation slides, and a presentation by supplier, (with detailed accompanying notes) explaining the methodology and capabilities of the model(s) and implementation(s).

<sup>1</sup> Dahl, M. Norouzi and J. Shlens, Pixel Recursive Super Resolution, arXiv:1702.00783 (<https://arxiv.org/abs/1702.00783>) (2017)

<sup>2</sup> United States Department of Agriculture, Farm Service Agency, NAIP (National Agriculture Imagery Program) Imagery, <https://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-programs/naip-imagery/>

<sup>3</sup> Planet, Open California Dataset, <https://www.planet.com/products/open-california/>

## **Approach and Way Of Working**

The work should be completed no later than T0+ 6 months although an earlier completion is desirable.

All work will be conducted at the supplier's premises, apart from the meetings that will be held at Dstl Porton Down.

### **Lot 5- Video Summarisation**

The rate of data produced in the form of video is increasing. This is due to both the widespread use of camera systems within Security and Defence, and drive of social media companies to expand further beyond text and static images. These video streams vary from a constrained scenario, where the camera system, orientation, and purpose are known, to an uncontrolled video such as a video captured from a mobile phone of an event or incident.

Due to the quantity of video being generated it is unfeasible for analysts to manually view all imagery in order to extract information and intelligence.

Dstl has a requirement to create a software tool/algorithm capable of automatically generating an English text summary of video files. This text summary should be human-readable and allow an analyst to quickly understand the content of a video. Furthermore this allows subsequent text processing algorithms/tool to be applied to the output. There are various levels of sophistication of this solution, such as:

- A statistically derived summary of the top keywords of interest within a video
- Automatically captioning individual frames of interest
- Generating a natural language paragraph describing the whole video

The following meetings are mandatory as part of the contract, but additional meetings may be requested by either Dstl or the supplier:

- Project kick off meeting (within 1-2 weeks of the contract starting)
- Face-face update meetings to be held every 2 months to demo current progress
- End of project meeting

### **Essential Requirements**

- Project plan documents, including: activity breakdown, timelines and milestones, technical approach, risks and mitigations
- The solution must be able to process individual video files orders of magnitude (i.e. >10x) faster than real time, and performance should scale with the processing hardware available. It is acceptable for the solution to utilise a GPU if available, but CPU processing must be possible.
- The solution must be delivered with a capability relevant to security and defence. For example, vehicles and human movement/interaction will be of more relevance.
- The solution must associate the text in the summary with times within the video file, allowing a user to easily refer back to the original video file.
- The solution must display and/or store the text associated with each video file in a manner that is clear and easily understood. An example of this would be as a JSON file.
- The solution must be able to be trained on new objects/activities of interest, such that the solution is adaptable for various scenarios or use-cases. The data required to do this, and associated process, must be made clear in the proposal.
- At this stage of maturity the algorithm does not need to have a graphical front-end, and can be delivered and demonstrated using a development tool such as a Python notebook with appropriate developer comments.

### **Desirable Requirements**

- The text summarisation should aim to utilise the temporal information that a video file provides, rather than treating frames independently. Therefore solutions which can incorporate activities or provide context are preferred.

As a minimum, the following deliverables should be provided:

- Project plan document (PDF or docx at customer meeting) and presentation.
- Source code, build and documentation – including a user guide.
- Successful demonstration of the solution running on a consumer grade laptop.
- A short end of project report covering options for future work.

### **Approach and Way Of Working**

The above stated work should be completed within 6 months of the contract commencing, in keeping with the timeline for the Data Science project and associated deliverables.

Development work will be conducted at the contractor site, with visits to Porton Down for demonstrations and progress meetings – planning on approximately 3 meetings.

### **Lot 6- Scalable Java Algorithms for Graph Similarity**

Dstl requires that an existing Java graph analytics framework (<https://www.cs.kent.ac.uk/projects/dover/>) be extended with graph similarity measures that can be used in statistical models for tasks such as graph classification, clustering and community detection.

Both simple metrics (e.g. graph edit distance) and measures that characterize a graph in a reduced dimension vector space (e.g. graphlets) are of interest. The key aim is to strengthen the analytical tools available within the existing framework; so submissions that consider more than one measure are encouraged.

The following meetings are mandatory as part of the contract:

- Project kick off meeting (within 1-2 weeks of the contract starting)
- Face-face update meetings to be held every 2 months
- End of project meeting

### **Essential Requirements**

- Project plan documents, including: activity breakdown, timelines and milestones, technical approach, risks and mitigations
- Exact methods are desirable, but it is recognized that computational complexity means that exact algorithms may not scale. In the spirit of the existing framework, the authority invites paired “exact” and “approximate” methods for any measure in such cases – where the approximate method is an heuristic that can be applied at large scale<sup>4</sup>. The performance and scalability characteristics of such methods must be described in the final report.
- Methods for unlabelled graphs are required. Extension of these methods to labelled graphs is desirable. The final report should, in any case, at least comment on graph similarity measures in labelled graphs.
- The Dover framework allows “dynamic” graphs to be modelled as a series of connected time slices. The similarity measures requested here must work on “static” graphs, and are not required take note of the time-dependent structures in Dover. However, comments on how (or if) any suggested measures might be extended to dynamic graphs are invited, as are suggestions for measures relevant only to dynamic graphs.

<sup>4</sup> and should be in line with the performance characteristics of the existing subgraph isomorphism and motif finding algorithms (at least a million nodes and 10 million edges).

The delivered software must:

- Be an extension of the existing Dover “fast graph” analytics framework. See the Dover project web page (<https://www.cs.kent.ac.uk/projects/dover/>) and the Dover GitHub project (<https://github.com/peterrodgers/dover>) for details.
- Be delivered as Java source code.
- Be self-contained, to be installed on systems with no internet connections.
- Be useable without any initial or on-going licensing costs. Source code must be delivered without MOD / Government usage restrictions. Open Source components must be released under permissive licensing allowing for all work to be sharable in UK government and exploitable by MOD.
- Have well documented code and be fully unit/integration tested.

As a minimum, the following deliverables should be provided:

- Source code.
- Software documentation, including build and deployment instructions.
- A report describing the delivered functionality. This must include any design decisions made, justification of any modifications to the underlying Dover framework, and a description of all algorithms implemented – including comment on performance and scalability. Comment on alternative options and suggestions for future work is invited but not mandated.

**Approach and way of working**

The use of existing open source libraries and components is encouraged wherever possible (bearing in mind the license). An agile approach to development should be considered (e.g. sprints), allowing for the steering of development by Dstl as work progresses:

- It is assumed that the supplier will base new code on a version of the Dover framework forked from the github repository at the start of the project. The supplier is not required to track any changes in Dover after this point.
- Any bugs discovered in the Dover framework must be reported to the original GitHub Dover project as an issue via the standard GitHub issue tracking mechanism.
- New function should make use of existing Dover framework capabilities where possible.
- If the supplier feels modification of the underlying Dover framework is necessary or desirable then a justification must be recorded in the final report, and should also be raised as an issue on the original Dover GitHub project. The supplier should consult the authority in these circumstances where practical – but may arbitrarily change the forked copy of the underlying framework as they see fit, without recourse to the authority, provided the justification is properly recorded.
- The supplier is not required to arrange or support the merging of final results back into the Dover framework. [The intention of the authority is that results will, ultimately, be merged back into Dover – but that effort is out-of-scope here]

All work should be done at the supplier’s premises.

**Government Furnished Assets (GFA)**

GFE  GFI  GFF  GFR  In the form of a Dstl Technical Partner per lot.

**Anticipated Start Date:**

**Anticipated End Date:**

Lot	Anticipated start date	Anticipated end date
1	01/10/2017	31/03/2018(T0+ 6 months)
2	01/10/2017	31/03/2018(T0+ 6 months)
3	01/10/2017	31/03/2018(T0+ 6 months)

4	01/10/2017	31/03/2018(T0+ 6 months)
5	01/10/2017	31/03/2018(T0+ 6 months)
6	01/10/2017	31/03/2018(T0+ 6 months)

**Deliverables**

Progress Reports	<input checked="" type="checkbox"/>	Delivery date: monthly from Contract Award to take the form of an summary report detailing: Work completed in month; progress against the provided project plan; any risks, issues or dependencies that have arisen in month together with proposed accompanying mitigating actions. Explanations of any cost, performance and timescale variances against those planned.
Customer Presentation(s)	<input checked="" type="checkbox"/>	Please refer to the table of lots below for specific delivery time frame.
Technical Report(s)	<input checked="" type="checkbox"/>	Please refer to the table of lots below for specific delivery time frame.
Final Technical Report	<input checked="" type="checkbox"/>	Please refer to the table of lots below for specific delivery time frame.
Software Source Code	<input checked="" type="checkbox"/>	Ongoing + 1m interval minimum through open/private source control e.g. Github.
Software Executable Code	<input checked="" type="checkbox"/>	Please refer to the table of lots below for specific delivery time frame.

**Other deliverable (please state below)**

Lot	Deliverables
1	As a minimum, the following deliverables should be provided: <ul style="list-style-type: none"> <li>• Source code</li> <li>• Documentation, including build and deployment instructions</li> <li>• A short report outlining the delivered functionality</li> <li>• Demonstration</li> </ul>
2	As a minimum, the following deliverables should be provided: <ul style="list-style-type: none"> <li>• Source code</li> <li>• Documentation, including build and deployment instructions</li> <li>• Technical report covering all work undertaken</li> </ul> <p>In addition, we would gladly accept any additional reports or technical memos generated as part of the research process for the above areas.</p>
3	As a minimum, the following deliverables should be provided: <ul style="list-style-type: none"> <li>• Project plan document (PDF or docx at customer meeting).</li> <li>• Source code, build and documentation for image library interface including user guide.</li> <li>• Successful demonstration of image processing services on the Silver environment at RAF Wyton.</li> <li>• A short end of project report covering options for future work.</li> </ul>
4	As a minimum, the following deliverables should be provided: <ul style="list-style-type: none"> <li>• Technical report detailing candidate super resolution methods and comparing their anticipated effectiveness for this application.</li> <li>• Technical report that clearly details the model implementation(s), including installation and user guides.</li> <li>• Complete source code for the model(s) implemented.</li> <li>• A copy of the image dataset(s) used in the implementation(s), to be used for evaluation purposes.</li> </ul>

	<ul style="list-style-type: none"> <li>• Presentation slides (with detailed accompanying notes) explaining the methodology and capabilities of the model(s) and implementation(s).</li> </ul>
5	<p>As a minimum, the following deliverables should be provided:</p> <ul style="list-style-type: none"> <li>• Project plan document (PDF or docx at customer meeting) and presentation.</li> <li>• Source code, build and documentation – including a user guide.</li> <li>• Successful demonstration of the solution running on a consumer grade laptop.</li> <li>• A short end of project report covering options for future work.</li> </ul>
6	<p>As a minimum, the following deliverables should be provided:</p> <ul style="list-style-type: none"> <li>• Source code.</li> <li>• Software documentation, including build and deployment instructions.</li> <li>• A report describing the delivered functionality. This must include any design decisions made, justification of any modifications to the underlying Dover framework, and a description of all algorithms implemented – including comment on performance and scalability. Comment on alternative options and suggestions for future work is invited but not mandated.</li> </ul>

**Deliverable Acceptance Criteria**

Standard Acceptance criteria (Reports)

- 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) @ <http://www.dstl.gov.uk/athenareportssubmission> which defines the requirements for the presentation, format and production of scientific and technical reports prepared for MoD.
- 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.
- All Reports shall be free from spelling and grammatical errors and shall be set out in accordance with (1) above.
- Failure to comply with the above may result in the Authority rejecting the deliverables and requesting re-work before final acceptance.

Specific Acceptance criteria: (Please specify):

Lots	Specific Deliverable Acceptance Criteria
1	<p>Technical documentation will be reviewed by DSTL staff who will provide feedback and evaluation against the essential requirements.</p> <p>Source code, will require full documentation (using an appropriate method) and a</p>

	high (min 80%) level of unit test coverage. Source code must be delivered for all development work, and code review by a SQEP'd member of the Data Science team will be required before acceptance
2	<p>Technical documentation will be reviewed by DSTL staff who will provide feedback and evaluation against the essential requirements</p> <p>Source code, will require full documentation (using an appropriate method) and a high (min 80%) level of unit test coverage. Source code must be delivered for all development work, and code review by a SQEP'd member of the Data Science team will be required before acceptance</p>
3	<p>Acceptance testing will take the form of a demonstration, evaluation and discussion event held at RAF Wyton. The audience will be comprised of Dstl and RAF Wyton representatives.</p> <p>Specifically, acceptance criteria include:</p> <ul style="list-style-type: none"> <li>• Dstl Technical staff to approve plan. Dstl partnering to include advice and guidance to design and planning stage.</li> <li>• Dstl project lead and technical partner will review progress statements and will provide feedback on progress, as required.</li> <li>• Feedback from the demonstration will be captured to determine the uptake, usage statistics and loading for future recommendations.</li> </ul>
4	<p>Acceptances of the final deliverables shall be judged against the following criteria:</p> <ul style="list-style-type: none"> <li>• The ability to fully replicate the results documented in the technical paper and presentation, using the provided source code and dataset(s).</li> <li>• All deliverables will be reviewed by Dstl against the agreed requirements.</li> <li>• An acceptance decision will take place within 15 working days of all deliverables being received.</li> </ul>
5	<p>Project plan and kick-off meeting</p> <ul style="list-style-type: none"> <li>• During the kick-off meeting the project plan should be presented which includes: Objectives, Technical approach, Timelines, Risks, Dependencies, Assumptions.</li> <li>• The content presented at the kick-off meeting must be provided following the meeting as a Microsoft Word, PowerPoint or Adobe PDF file.</li> </ul> <p>Source code</p> <ul style="list-style-type: none"> <li>• Code must include comments to aid understanding.</li> <li>• Documentation, including a user-guide, must be provided as a Microsoft Word docx file, or Adobe PDF file.</li> </ul> <p>The demonstration must show :</p> <ul style="list-style-type: none"> <li>• Full HD video files being processed faster than real time.</li> <li>• The ability to process multiple videos, in parallel or batched.</li> <li>• Human-readable text output produced for each video file processed</li> <li>• The demonstration must be performed on a laptop which has the maximum specifications of: Intel i7 CPU, 16GB DDR4 RAM, NVidia GTX1080 GPU. Demonstration should also operate without processing support from the GPU.</li> </ul> <p>End of project report</p> <ul style="list-style-type: none"> <li>• Report to be provided as a Microsoft Word Document or Adobe PDF file.</li> </ul>
6	<p>Technical documentation will be reviewed by Dstl staff, who will provide feedback and evaluation against the essential requirements.</p> <p>Software deliverables acceptance will be assessed by Dstl staff against the following criteria:</p> <ul style="list-style-type: none"> <li>• The functionality of the algorithms meeting the essential requirements.</li> <li>• The eases at which the software can be installed on an offline system.</li> </ul>

- The ability to replicate test results in the development data sets.

**Acceptance (or not) will take place within 20 working days of deliverables being received for all lots.**

**Security Classification.** The highest classification of this work and outputs will be UK OFFICIAL.

**Options & Follow-On Work**

The desirable elements of an individual lot that **cannot** be costed within budget can be added for Dstl's consideration later.

**Plan for end of Contract / Closure**

Contract closure should be met by delivery and satisfactory acceptance (by the Authority) of all the contracted deliverables.

**Proposal Evaluation Criteria**

The proposals will be evaluated on the basis of the Most Economically Advantageous Tender (MEAT). The weighting is 30% Commercial (42.86) and 70% Technical (100) per bid per lot.

**Your proposal must clearly state on the front which lot the proposed solution is intended for. If you intend on bidding for more than one lot separate proposals should be used for each lot you have bid for. You may submit more than one proposal per lot.**

**The budget for each lot is indicative, this means that it is at the suppliers discretion to cost the work within that budget or not. The Authority may, at its ultimate discretion award more than one contract per lot and/or move money around within lots to fund proposals.**

**Scoring Guide**

All questions will be scored from 0-5 as follows:

<b>Criterion Scores</b>		
Each individual criterion will be evaluated against the following scoring mechanism, with specific examples as to what the Authority is expecting for the individual lots detailed below. If your proposal scores a 0 or 1 in any area after moderation it will be deemed non-compliant and excluded from further evaluation.		
0	Not Answered	Nil or inadequate response. Fails to demonstrate an ability to meet the requirement.
1	Poor	The response addresses some of the elements of the requirement but does not fully detail or explain how the requirement will be fulfilled.
2	Partially Acceptable	The response addresses half of the elements of the requirement but contains insufficient / limited detail or explanation how the requirement will be fulfilled.
3	Acceptable	The response addresses the majority of the elements of the requirement but does not fully detail or explain how the requirement will be fulfilled.
4	Good	The response is sufficiently detailed and demonstrates a good understanding and provides details of how the requirement will be fulfilled.
5	Excellent	The response is comprehensive, unambiguous and demonstrates a thorough understanding of the requirement and provides details of how the requirement will be met in full.

**Commercial Criteria**

All elements described as 'Essential Requirements' above should be costed (the Authority recognises that Lot 2 is essentially a prioritised shopping list, and should be presented as such) where all the Essential Requirements are not costed, the Authority reserves the right to reject your bid outright.

Prices shall be compared within each lot with the lowest tendered price being awarded the maximum

score (42.86); the remaining submitted prices shall be awarded points on a pro-rata basis i.e. Lowest Price / Tendered Price x Weighting

Worked Example:

Tender	Price Tendered*	Calculation	Score Awarded
1	£75,000	75000/75000x42.86	42.86
2	£89,000	75000/89000x42.86	36.12
3	£95,000	75000/95000x42.86	33.84

\*figures quoted are for example purposes only.

Sub-Contract fees		
I confirm that I have not charged a fee within my price to arrange or place a sub-contract.*	Yes / No	Any fee charged for arranging or placing a sub-contract will be marked as non-compliant and excluded from further participation in this Competition by the Authority.

\*for the avoidance of doubt this is only fees that are in addition to the quoted sub-contractor costs. Please provide these quotes to the Authority for information.

Optional / Desirable Work Packages
<p>Where there is enough information to provide a firm price for an optional / desirable requirement this should be done. Where there is not enough information, or a desirable / optional requirement follows a de-risking exercise within a task a ROM may be given.</p> <p>The Authority will not evaluate on the basis of these optional work packages. They are provided for information only, and there is no obligation on the Authority to invoke these work packages. Where a firm price is given, this should be valid for 6 months post contract completion, where a ROM is given, the option to have this firmed up and a proposal provided should be valid for 6 months post contract completion.</p>

Permissive OpenSource Licences (only for use on Lots that require OpenSource software to be built)	
Permissive OpenSource Licences used (i.e. MIT, Apache 2.0, BSD)*	Pass / Fail

\*Note: GPL is not considered a 'permissive' OpenSource Licence, if you are planning on using a licence (and by extension a piece of OpenSource software) that is not MIT, Apache 2.0 or BSD please email in a clarification question.

### Technical Criteria

**NB: All Lots will be evaluated against the Generic Criteria, however, suppliers should use this criteria as a skeleton that should be fleshed out according to the specific criteria in the table below.**

### Generic Technical Evaluation Criteria

1. Technical Approach (Marks 5 – Weighting 10 so the total possible score is 50 marks)  
There is a credible, logical methodology to address the requirements set out.

2. Relevant Experience (Marks 5 – Weighting 4 so the total possible score is 20 marks)  
Evidence of experience/research in the following subject areas:

Lot	Relevant Experience – failure to address these elements will result in your bid being non-compliant
1	Must have : <ul style="list-style-type: none"> <li>• Demonstrable experience developing web applications</li> <li>• Demonstrable experience working with text data.</li> </ul>
2	Must have: <ul style="list-style-type: none"> <li>• A background in the text analytics domain</li> <li>• Demonstrable experience using and developing for Baleen.</li> </ul>
3	Must have: <ul style="list-style-type: none"> <li>• Capacity to work with and change the back ground mechanics of ENVI Services Engine e.g. for data ingestion.</li> <li>• Evidence of programming experience using IDL and Python for image analysis</li> <li>• Hold DV clearances to access to Dstl and to RAF Wyton Pathfinder building.</li> </ul>
4	Must have: <ul style="list-style-type: none"> <li>• Demonstrable evidence of prior work in deep learning and super-resolution/image generation.</li> </ul>
5	A knowledge of computer vision, image analysis, video processing or neural networks is beneficial, and will be positively scored.t
6	Must have: <ul style="list-style-type: none"> <li>• Demonstrable experience of developing academically rigours network graph algorithms</li> <li>• High performance computing, Java development.</li> </ul>

3. Clear Understanding of the Requirements and Benefits to MOD, Operational relevance, and Customers (Marks 5 – Weighting 2 so the total possible score is 10 marks)—Evidence of a clear understanding of the background to the project and the benefits.
4. Team & Interactions (Marks 5 – Weighting 2 so the total possible score is 10 marks)—The bidder shall provide evidence of times when they have worked closely with another party; Evidence should consist of examples of successful collaboration and may include but not be limited to, instances co-location (such as with an agile development project), collaboration agreement; joint ventures; or working closely in a team environment
5. Management Plan (Marks 5 – Weighting 2 so the total possible score is 10 marks)  
The project timescales meet the requirement a gantt chart outlining timescales for each individual piece of work within a lot and resource allocated against that. There is evidence of the ability to meet the completion dates and to support other key events (e.g. sprints). All deliverables will be completed on time. Evidence of project management skills necessary to undertake the research. Inclusion of a quality review of each deliverable (appropriate to the size of the project).

The maximum technical score per lot is 100.

### Specific Evaluation Criteria

#### NB: Marked as part of the Technical Approach

Lot	Evidence which should be included in the technical proposal
1	For high scoring bids, we would expect to see thought given to the technology choices, and the overall architecture of the system. Suggestions for functionality beyond that given in the RCA would also be expected in order to score full marks.

2	For high scoring bids, we would expect to see thought given to all of the sections and potential approaches identified for each (accepting that in some cases a full literature review may be required and that this isn't expected at this stage). Thought should also be given to how the various requirements will interact with each other, and how they can be integrated within Baleen.
3	<p>For high scoring bids we would expect to see :</p> <ul style="list-style-type: none"> <li>• The proposal describes a solution that addresses the mandatory requirements.</li> <li>• The usefulness of the proposed solution to users at RAF Wyton.</li> <li>• The proposal shows evidence of prior experience using and/or developing with ENVI Services Engine.</li> <li>• The level of flexibility the solution provides to both the analyst and the developer/administrator</li> <li>• The proposal describes how any existing technology and background IP in particular that will be incorporated in the solution will be made available for future experimentation, if it is not freely available.</li> <li>• The proposal includes evidence of the skills of the staff who will be involved in the project.</li> </ul>
4	<p>For high scoring bids we would expect to see :</p> <ul style="list-style-type: none"> <li>• Evidence of prior work in deep learning and super-resolution/image generation.</li> <li>• Brief CVs or other evidence of the skills of the staff who will be involved in the project.</li> <li>• Preliminary details of which models may be considered for the study and why.</li> <li>• Details of the overhead imagery dataset(s) to be used and why.</li> <li>• Proposed metrics for assessing the utility of each technique.</li> </ul>
5	<p>For high scoring bids we would expect to see :</p> <ul style="list-style-type: none"> <li>• The proposal describe the technical approach to be taken in order to produce text.</li> <li>• The proposal describe how the text produced is stored/displayed in a practical manner allowing for the output to be use further down the processing chain.</li> <li>• The proposal describe how the solution will process video files faster than real time.</li> <li>• The proposal describe how the text output will contain time, or frame number, information, in order to link to the original source. Alternatively the proposal describes why this is not possible or not appropriate.</li> <li>• The proposal describe how the solution scales with hardware, including utilising a GPU if available.</li> <li>• The proposal describe the range of objects/activities to be applied by the solution.</li> <li>• A graphical front end proposed .</li> <li>• The proposal describe how the solution can be transferred to other data/imagery. For example, how to retrain the algorithm.</li> <li>• The solution use temporal information in order to improve the output.</li> <li>• The proposal list the technical risks with a measure of their</li> </ul>

	<p>likelihood and severity.</p> <ul style="list-style-type: none"> <li>The team delivering the proposal has the relevant technical experience.</li> </ul>
6	<p>The quality of the bid shall be assessed based on usefulness, complexity and academic rigour of proposed solutions.</p> <ul style="list-style-type: none"> <li>The quality and diversity of the proposed similarity measures.</li> <li>The number of proposed similarity measures.</li> <li>The size (nodes/links) of graphs that it is possible to compare.</li> <li>Proposals will be given greater consideration if the proposed solutions are shown to be time optimal.</li> <li>Proposals will be given greater consideration if the proposed solution is shown to be scalable beyond the minimum data requirement.</li> </ul>

**Innovation**

This section relates to encouraging innovative solutions to Dstl's needs through procurement.

Will you accept innovative tenders?    Yes     No   
 Will you accept variant bids?        Yes     No

**Quality**

Are there any specific Quality Control or Quality Assurance processes or standards that must be met by the Contractor? If appropriate, provide details of the standards with which the contractor must comply.

ISO9001        ISO12207 (Software)        TickIT+   

These QC and QA processes are for information only, whilst it is desirable to have these if a particular bidder has a similar process to ensure QC / QA this should be detailed within the proposal.