RCloud Tasking Form – Part B: Statement of Requirement (SoR)

Title of Requirement	Augmenting Enhanced Video Quality Assessment (AeVQA) and Enhanced Video Quality Control (eVQC)
Requisition No.	**1000163816**
SoR Version	**0.1**

1.	**Statement of Requirements**
1.1	**Summary and Background Information**
	Background Dstl have identified two work packages (WP) which are identified and summarised as: WP1: Augmenting Enhanced Video Quality Assessment (AeVQA) and Enhanced Video Quality Control (eVQC), which were developed by 4Sight over several years. The latest iteration of the requirements consists of three broad areas: 1. Improving the current metrics 2. Improving the neural networks to combine multiple metrics (as opposed to the linear combinations as previously used) for both the video quality and camera control 3. Application of the video quality metrics for both measuring the quality of and controlling multi-band fusion One theme that runs through a lot of the above areas is optimising the power usage ruggedized REDACTED UNDER FOIA SECTION 43, COMMERCIAL INTERESTS, and WP2: Automation of video CODEC testing (AVCT): The variety/range of testing each CODEC needs to be assessed against is not only growing but also time consuming and mandrolic with current standard practices. Testing equipment now have interfaces that allow for test engineers to “script” test. This means multiple tests can be carried out with limited human interaction. It also allows the test engineer to control multiple test units from a single interface which reduces the control overhead of the CODEC testing. It also can enable tests to be scheduled to allow for testing to be carried out without the engineer being present. **Task Summary** **WP1: Augmenting Enhanced Video Quality Assessment (AeVQA) and Enhanced Video Quality Control (eVQC)** 4Sight Imaging have previously been working for Dstl to develop various video quality metrics including both full reference and no reference versions and the application of the latter to controlling both cameras and choice and parameterisation of image enhancement algorithms

	Dstl would like to continue this work. For the full reference version Dstl would like to: 1. Continue with the meaning of the AeVQA scores work. Of particular interest would be what is the difference between human and machine vision performance on the same task 2. Continue with incremental enhancements of the current metrics and introducing new ones where appropriate 3. Develop further the use of neural networks to combine the various metrics 4. Explore ways to reduce the computational burden of metric evaluation 5. Introduce an understanding of the scene into the application of video quality metrics 6. Investigating the possibility of using machine learning techniques to directly calculate the individual video quality metrics 7. Continue developing the use of the video quality metrics for controlling the various image enhancements. 8. Investigate the application of the current video quality metrics for multi-modal image fusion 9. Provide software upgrades for IPAOS 10. Provide support for the EOTB, including software upgrades and training **<u>WP2: Automation of video CODEC testing (AVCT)</u>** Dstl have created testing methodology to determine the performance of a video CODEC, assessing both visual quality and network performance in a degraded scenarios. To determine the performance Dstl have created a methodology which uses testing profiles, these profiles encompass a range of tests which are associated to a particular data rate or a specific communication application. These profiles encompass a range of network conditions and will use a range of different video content which is required for each profile (~150 tests). The metrics which need to be recorded within each test increases the time to conduct the testing profile, hence is very time consuming, therefore an automated approach is required. Each CODEC will then also be evaluated under multiple profiles which include up to 8 baseline profiles as well as up to 12 application specific profiles which each CODEC will need to be assessed against. In considering this requirement Dstl would like to emphasise that: 1. It is intended that this task will run until 31-March-2023, with tasks prioritised in order over that period, subject to funding availability, and 2. A formal breakpoint will exist at the end of March-2022 to the end of April 2023. In consideration of this costed and measurable deliverable(s) must be scheduled for delivery no later than End March 2022, and not further cost shall be incurred post End March 2022, without authorisation from Dstl.
1.2	**Requirement**
	WP1: Augmenting Enhanced Video Quality Assessment (AeVQA) and Enhanced Video Quality Control (eVQC) The following are a list of requirements but there is unlikely to be enough funding to conduct all of them. Hence Dstl would like a list of costing for each individual task and any dependencies (e.g. you need to do (say) task 2a before being able to do task 8b). This will enable the choice of tasks to be prioritized, with the hope of (given sufficient funding and subject to contract etc.) to completing the remaining tasks in the future.

Task 1.1: Meaning of AeVQA numbers

Using previously developed metrics, there was very little correlation between the results from the AeVQA and those from the ruggedized REDACTED UNDER FOIA SECTION 43, COMMERCIAL INTERESTS detection data set. The latest version of the metrics where the detail richness and naturalness metrics have been introduced show much better correlation, albeit the LWIR clips appear problematical. The following should be investigated:

REDACTED UNDER FOIA SECTION 43, COMMERCIAL INTERESTS

Task 1.2: Continue with incremental enhancements of the current metrics and introducing new ones where appropriate

- Identify which metrics are least satisfactory/need further work. Modify or replace as appropriate.

REDACTED UNDER FOIA SECTION 43, COMMERCIAL INTERESTS

Task 1.3: Develop further the use of neural networks to combine the various metric

REDACTED UNDER FOIA SECTION 43, COMMERCIAL INTERESTS

Task 1.4: Explore ways to reduce the computational burden of metric evaluation

REDACTED UNDER FOIA SECTION 43, COMMERCIAL INTERESTS

Task 1.5: Introduce an understanding of the scene into the application of video quality metrics

REDACTED UNDER FOIA SECTION 43, COMMERCIAL INTERESTS

Task 1.6: Investigating the possibility of using machine learning techniques to directly calculate the individual video quality metrics

REDACTED UNDER FOIA SECTION 43, COMMERCIAL INTERESTS

REDACTED UNDER FOIA SECTION 43, COMMERCIAL INTERESTS

Task 1.7: Continue developing the use of the video quality metrics for controlling the various image enhancements

- Repeat the work for the unsharp masking for enhancements that mitigate different degradations
- Repeat for simultaneous multiple enhancements

Task 1.8: Investigate the application of the current video quality metrics for multi-modal image fusion

REDACTED UNDER FOIA SECTION 43, COMMERCIAL INTERESTS

Task 1.9: Provide software upgrades for IPAOS

- Provide software upgrades for IPAOS whenever sensible

Task 1.10: Provide support for the EOTB, including software upgrades and training

- Upgrade EOTB software (eVQA/eVQC). Ideally all the new metrics should be installed so that they can be run simultaneously. If this is impossible because of the limitation of the current EOTB hardware this should be done by splitting the updated metrics into subsets, each of which can be loaded separately. If all of the metrics cannot be run simultaneously, the latter would allow the subsets to be run and tested individually

- 4Sight Training Day: to support future EOTB use, a symposium session will be conducted by 4Sight Imaging. The aims for this are to:

- Explain the individual metrics that make up the eVQA score and (if possible) explain how these are calculated

- Understand what features the metrics are 'looking for' for their calculations

- Understand impacts (if any) of combining the metrics to create the overall score

- Facilitate open discussion for any additional questions during the day

- Example Data Pack: an 'example' data pack should be produced with sample images at multiple known scores for individual metrics (e.g. sharpness = 0.5) to visualise how the changes in the input imagery are reflected in the eVQA score.

- On-going support: the option to ask any additional questions (that arise from testing or after training session) to 4Sight – most likely virtually through email/calls, or via a WebEx (or similar) meeting.

- Annual future training days: it is proposed that there is the option to host the training/symposium session annually to support new staff, future eVQA releases and generally provide refresher training.

WP2: Automation of video CODEC testing (AVCT)

Note: at ITT stage, only a FIRM PRICE cost is required for WP2.1. Detailed discussions leading to a Design Output will enable costs to be submitted for the remaining tasks as part of the WP2.1 output.

Task 2.1 (T0+3month) Requirement Capture:

This will be an initial workshop to capture testing methodology, testbed configuration and plan the structure of the automation scripts. This workshop will also capture Dstl aspirations for the testing script and determine desirable and mandatory requirements.

Deliverable will be a Design Output Report, including costings & delivery timescales for the remaining tasks. Note that there will need to be a natural breakpoint against a measurable deliverable for end of Mar-22 if the development is scheduled to fall into FY22/23.

BREAKPOINT: Dstl may choose not to continue with the remaining tasks under WP2 depending on cost etc.

These tasks below are indicative of the remaining requirement but the requirement will be firmed up as part of the activity undertaken within WP2.1.

Task 2.2: Creation of Script
Creation of testing script(s) that allow options to be selected to allow the test engineer to select what inputs, network conditions and outputs are required. The testing script is to encompass the testing profiles and should allow for multiple options to be switched on and off depending on the specific test requirements (i.e. network conditions or visual quality assessments).

	Previous discussions with manufacturers of the equipment indicate that bash or Java scripts would be the optimum method of implementing the automation scripts. The scripts must interface into all testing units including an iTrinegy unit, and 2 visual quality assessment units. A testing script must include the ability to: • Pull multiple videos to be streamed through the testbed serially (i.e. once test footage 1 finishes automatically run test footage 2) • Apply network conditions and allow the users to implement how they would like the network conditions to be applied (i.e. increasing latency by 10ms every 15 seconds) • Select what visual quality metrics are required to be conducted • Allow for multiple tests to be run serially allowing for minimal interaction once the script is started. **Task 2.3: Integration** Final requirement of this project has three key elements: • Integration validation – this is to ensure the scripts work in the testbed and integrate with all components. For this the contractor must integrate into the testbed and demonstrate the automation functioning across all element of the testbed. • Training – provide Dstl staff with training on how to use and modify the scripts Document – training documentation shall be provided, providing a detailed of how to modify them to change parameters, options and other changeable conditions within the script
1.3	**Options or follow on work** *(if none, write 'Not applicable')*
	WP1: Any of the non-funded tasks identified above. WP2: Future versions of the testing scripts must have the ability to pull video from a video on demand (VOD) server/video database.
1.4	**Contract Management Activities**
	No specific activities identified
1.5	**Health & Safety, Environmental, Social, Ethical, Regulatory or Legislative aspects of the requirement**
	No specific activities identified

1.6	Deliverables & Intellectual Property Rights (IPR)					
Ref.	**Title**	**Due by**	**Format**	**Expected classification (subject to change)**	**What information is required in the deliverable**	**IPR Condition**
WP1	Bimonthly progress report	T0+2 Months etc.	email	OFFICIAL	This should document progress and highlight any risks/issues affecting delivery. [Could be a simple quad chart format for each task.]	Default RCloud Agreement Terms and Conditions shall apply
WP1	Biannual Technical report	(31/03 –T0)/2, 31/03	Report	OFFICIAL	Detailed description of technical progress of Tasks 1 -8 (depending on what is funded)	Default RCloud Agreement Terms and Conditions shall apply
WP1	Biannual Presentation (to coincide with the report)	(31/03 –T0)/2, 31/03	Presentation	OFFICIAL	In conjunction with the above technical report	Default RCloud Agreement Terms and Conditions shall apply
WP1	Biannual Presentation (to coincide with the report)	(31/03 –T0)/2, 31/03	Presentation	OFFICIAL	In conjunction with the above technical report	Default RCloud Agreement Terms and Conditions shall apply
WP1	Demonstration of software	Probably in December	Demonstration	OFFICIAL	The intention of this is to demonstrate progress and allow Dstl to comment on the work so far before the end of the project. 4Sight shall	Default RCloud Agreement Terms and Conditions shall apply

					provide a demonstration for each of the completed or near completed metrics contracted in WP1	
WP1	Update software for IPAOS	When appropriate and towards end of contract	Software	OFFICIAL	The software update should be provided on suitable media to allow Dstl to install it onto the IPAOS laptop. Assistance should be provided if necessary.	Default RCloud Agreement Terms and Conditions shall apply
WP1	Install latest metrics onto EOTB	When appropriate	Software	OFFICIAL	The EOTB will be lent to 4Sight and should be returned with the updated software installed, including a method to load the different subsets of the metrics if necessary	Default RCloud Agreement Terms and Conditions shall apply
WP1	Task 9: Datapack	To support Training Day	Guide	OFFICIAL	Data pack should be produced with sample videos at multiple known scores for individual metrics	Default RCloud Agreement Terms and Conditions shall apply
WP2	Design Output	T0+3 Months	Report	OFFICIAL	Capture testbed, testing methodology and Dstl requirements for scripting	Default RCloud Agreement Terms and Conditions shall apply
WP2	Software Development	T3+6Months	Software	OFFICIAL	Create automation testing scripts with the requirements captured in R1	Default RCloud Agreement Terms and Conditions shall apply

					• Automation executable which represents Dstl testing methodology Interface with all Dstl testing units, including: iTrinegy, video clarity and 4sights full reference metric	
WP2	Demonstration & Training	T7months	Workshop	OFFICIAL	The contractor must supply Dstl with training to use/modify the script and give details of the scripting to provide Dstl staff deep understanding of how the scripting has been implemented. This must include: • A user manual Commissioning of automation (i.e. user acceptance testing)	Default RCloud Agreement Terms and Conditions shall apply

1.7	**Deliverable Acceptance Criteria**
	The acceptance criteria will be agreed with 4Sight. In particular the software upgrades should be able to demonstrate that the different metrics are working and are able to produce satisfactory results. Software Specific criteria: The software needs to be compatible with all testing units and not be written in any proprietary code which cannot be replicated or modified without the contractor.

2	**Evaluation Criteria**
2.1	Method Explanation
	N/A.
2.2	Technical Evaluation Criteria
	The technical assessment shall set out to review and assess how the proposed technical approach and solution meets the Dstl requirement.
2.3	Commercial Evaluation Criteria
	The commercial assessment shall consider: • Has the proposal been submitted as a firm price, with individually priced work packages, • Has One (1) unpriced technical submission has been received, and One (1) full commercial proposal has been received, • Has a completed Part C – Task response form has been submitted (Including section 3.3), • Has a response been provided to the Cyber security requirement, • Have copies of the research workers form been submitted, or a statement been provided that individuals hold active clearances.