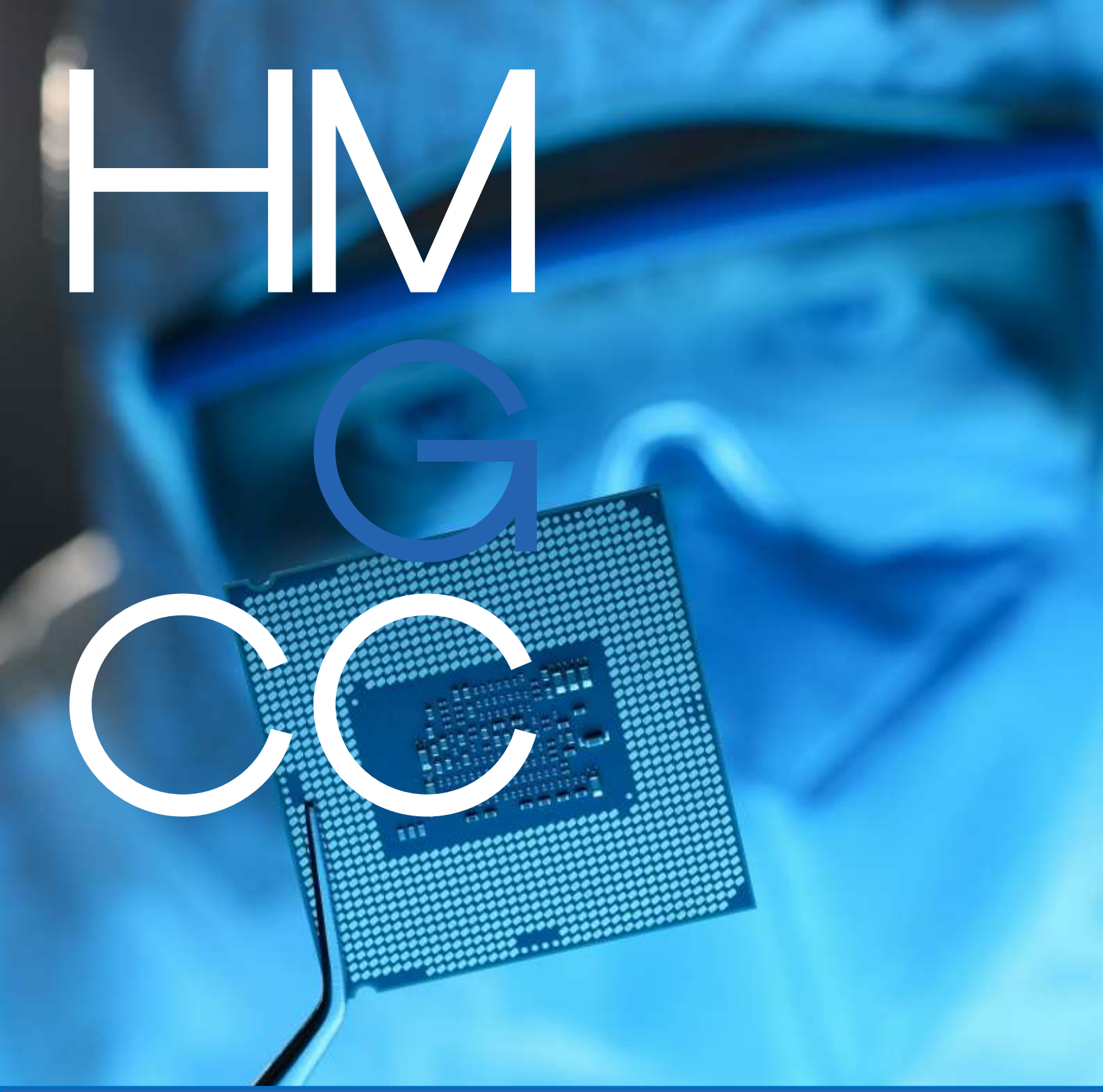

HMGCC Co-Creation

AI-enhanced x-ray imaging for bomb disposal

Clarification questions and answers

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Document Details: Clarification Q&A in response to the call for proposals

Challenge: AI-enhanced x-ray imaging for bomb disposal

Deadline for questions: Friday 16th October 2026

#	Question	Answer
1.	The challenge brief says training data will be provided to the winning solution provider. Could you confirm whether any sample images, component labels or data specifications are available before selection, and what we would need to do to access them? It would also help to know when the full dataset would become available and any restrictions on annotation, model training and evaluation.	It is intended that representative example images will be made available following release approval, and applicants will be advised if these can be shared before pitch day. The training dataset is intended to be made available at, or shortly after, project kick-off. Any conditions on annotation, model training and evaluation will be confirmed during contracting and project initiation.
2.	What approximate volume, image formats, bit depths, resolutions and annotation types will the supplied training data contain? Will any representative sample be available before project kick-off?	Native images are expected to be 16-bit greyscale 2D transmission radiographs in TIFF format, with a typical pixel pitch of the order of 150 µm. Solutions must also accept 8-bit JPEG. The volume and annotation types are to be confirmed following review of the available dataset. See the response to question 1 regarding the availability of representative samples.
3.	Will the supplied data include multiple views of the same item, and if so will viewing angle or other acquisition metadata be provided?	Typically, two approximately orthogonal views are acquired, and additional views may be obtained where required. Some items in the dataset will have multiple views. Where

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		this is the case, the sponsors will aim to indicate which images relate to the same item. Detailed viewing-angle and acquisition metadata cannot be guaranteed.
4.	Will images include sufficient scale, magnification, distance or equivalent metadata to support dimensional interpretation where appropriate?	Scale information cannot be guaranteed. Where geometry information or a reference object of known size is available, it may be provided, but solutions should not depend on it. In typical portable configurations, the object is placed close to the detector, so geometric magnification is usually modest. Any dimensional estimates should be presented as approximate and with an indication of uncertainty.
5.	May applicants supplement the supplied data with synthetic or independently captured X-ray images of benign electronics for development, augmentation or robustness testing?	Yes. Applicants may supplement the supplied data with synthetic, openly licensed or independently captured x-ray images, provided the provenance and licensing of all data are documented.
6.	What handling marking will the supplied data carry, and what storage or processing environments will be permitted or prohibited, for example local/offline systems, cloud-hosted environments or third-party services?	The supplied data will be provided at OFFICIAL. Specific handling, storage and processing conditions will be confirmed during contracting.
7.	What component attributes and what depth of “likely function” assessment does HMGCC expect, particularly where markings, colour codes, electrical values or connectivity cannot be determined reliably from X-ray imagery alone?	The main requirement is identification of components by type and physical form, with approximate physical dimensions where scale information or geometry permits. Markings, colour codes and precise electrical values are not expected to be determined from x-ray imagery alone. Where an attribute cannot be reliably determined, the system should state this clearly rather than infer it without

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		supporting evidence. For likely function, component identification is the foundation, but the greatest value lies in recognising how components are arranged and what an assembly or sub-circuit is likely to do. For example, recognising that a group of components forms a commercially available sensor, timer or power-supply module is more useful to an operator than a list of the discrete parts.
8.	What hardware, representative data, users and operating conditions would HMGCC expect to see in the TRL 5 relevant-environment demonstration?	The demonstrator should run on representative commercially available hardware, such as a laptop suitable for field use, ideally operating without an internet connection. It should process representative x-ray radiographs that have not been used in training and be usable by trained operators who are not electronic component specialists. The precise test dataset, hardware configuration and representative operating conditions will be agreed as part of project initiation and planning.
9.	Will representative trained operators or other sponsor users be available for a short usability or user-evaluation activity during the final stages of the project?	The sponsors will seek to make representative users or subject-matter experts available for a short usability or evaluation activity towards the end of the project, subject to availability. Arrangements will be agreed during the project.
10.	What is the image size and colour resolution for the dataset to be provided for training?	Native images are expected to be 16-bit greyscale. With a detector active area of approximately 35 × 43 cm and a pixel pitch of the order of 150 µm, a full-frame image would be roughly 2,300 × 2,900 pixels. Images may be cropped and smaller, and dimensions may vary between imaging systems.

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11.	How many classes does it need to classify? For example, explosive, battery, capacitor and so on	The final taxonomy is to be confirmed, but the initial dataset will likely focus on a small number of common electronic component categories. Identification of explosives or energetic materials is not within the scope of this challenge.
12.	Are there any restrictions on the ML model that can be used? For example, open-source vs commercial licence.	No specific model architecture is mandated, and open-source or pretrained models are acceptable. Applicants must deliver source code, so any model, library or pretrained weights should be licensed in a way that permits use, modification and onward development by the sponsors. Proposals should identify any commercial licences, runtime dependencies or licence servers, and should avoid reliance on proprietary datasets where possible.
13.	What x-ray scanner will it need to integrate with?	No integration with a specific x-ray scanner is required. The solution should ingest exported image files, in particular TIFF and JPEG.
14.	What interface does the x-ray scanner provide for a PC access the image?	Integration with scanner hardware or acquisition software is not required for the demonstrator. Solutions should assume images are made available as exported image files.
15.	For the demonstrator, does it need to work with live images from the x-ray scanner? Or can simply process the images offline?	Processing of exported image files is sufficient. Live acquisition from an x-ray scanner is not required.

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16.	Labels: will the images come already annotated? If so, in what form (bounding boxes, polygons/segmentation masks or image-level labels) and in which annotation format (e.g. COCO, YOLO or Pascal VOC)? Which component classes are labelled (e.g. resistors, capacitors, transistors, ICs/microcontrollers, leads, wires), and roughly how many examples are there per class? Do the labels include any characteristics or functional information (e.g. component type, value, role in the circuit), or component identity only?	Some support with data labelling can likely be accommodated, but the extent, form and format of annotations remain to be confirmed. Labels are expected to focus primarily on component or subassembly type.
18.	Image formats: which file formats, bit depths and resolutions should we expect (e.g. 16-bit TIFF, 8-bit JPEG)? Will raw/unprocessed images be included alongside processed ones?	Native images are expected to be 16-bit greyscale TIFF, and solutions must also accept 8-bit JPEG. Where available, unprocessed TIFF images may be supplied alongside processed versions. A typical pixel pitch of the order of 150 µm should be expected, although resolution may vary between imaging systems.
19.	Content and variety: do the images show representative circuits only, or also full devices with overlapping components, clutter and varying image quality? Are there multiple views of the same item?	The dataset is to be confirmed, but it is anticipated to include individual components and circuit boards, and assemblies within housings. Solutions should expect operational images to include overlapping components, wiring, power sources, packaging, clutter and variable image quality, and should be designed to cope with this. Typically, two approximately orthogonal views are acquired, and some items may have multiple views.
20.	Surface-mount components: does the data include enough labelled surface-mount components to address the desirable requirement?	This is to be confirmed. Surface-mount components are a desirable rather than essential requirement, and it is possible that the supplied data will contain fewer surface-

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		mount examples. Applicants may supplement the supplied data as described in the response to question 5.
21.	Timing and access: when would the data be available after kick-off, and in what form (transfer to the supplier, or access on HMGCC premises/systems only)? Are there any handling, storage or security conditions we should plan for?	Data is intended to be made available at, or shortly after, project kick-off. It is expected that data will be transferred to the solution provider, subject to handling conditions that will be confirmed during contracting. See also the response to question 6.
22.	Evaluation: will HMGCC hold back a separate test set for evaluating the TRL 5 demonstrator, or should the supplier split the data provided?	It is anticipated that the sponsors will retain a held-back set of images for independent evaluation of the demonstrator. Arrangements will be confirmed during project initiation.
23.	Supplementary data: may suppliers supplement the provided data with their own captured or openly licensed X-ray images, and fine-tune pretrained models on it?	Yes. See the response to question 5. Fine-tuning pretrained models is acceptable, subject to the licensing considerations in the response to question 12.
24.	What sort of Xray Machine are you using to acquire the images?	Field radiography typically uses commercially available, portable, battery-powered pulsed x-ray generators with portable flat-panel digital detectors. The training data may originate from more than one imaging system, and solutions should not be tied to a specific scanner.
25.	Can the tube voltage be changed to do multi energy X-rays.	The portable pulsed generators typically used in this application operate at a fixed peak energy that is not readily adjustable, so multi-energy imaging is not in scope.

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		Solutions should assume single-energy greyscale transmission radiographs.
26.	Will the data provided during the project be labelled? - If so, in what form will the labels be given?	See the response to question 16.
27.	How much data will be provided for training and testing?	To be confirmed following review of the available dataset. See also the response to question 22 regarding test data.
28.	Roughly how many x-ray images will the winning provider receive, and will they be labelled? If so, in what form (for example bounding boxes, outlines or image-level labels)?	The number of images is to be confirmed following review of the available dataset. Some support with data labelling can likely be accommodated; the form of the labels is still to be confirmed. See the response to question 1.
29.	What equipment and settings produced the images (system type, resolution, bit depth, single or dual energy), and should the solution work across more than one x-ray system?	Images are expected to be single-energy, 16-bit greyscale transmission radiographs acquired using portable pulsed x-ray generators and flat-panel detectors, with a typical pixel pitch of the order of 150 µm. Data may come from more than one system, so solutions should be robust to variation in image characteristics between systems.
30.	Do the images show circuit boards on their own, or inside enclosures with other objects overlapping them?	It is anticipated that the dataset will include both standalone circuit boards and items within enclosures or housings. Operational images will often include overlapping components and other objects, and solutions should be designed to cope with this.

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31.	Will any sample images be available to applicants before the closing date or at pitch day?	See the response to question 1.
32.	Is there a defined list of component types for the essential requirement, and roughly how many?	The final taxonomy is to be confirmed. See the response to question 11.
33.	For “assess their likely function”, is the expectation a description of each component’s function, or of what a group of components does together? An example of an acceptable output would help.	Both are of interest, but the greater value lies in what a group of components does together. Identifying individual components is the foundation, while recognising functional groups or assemblies, such as a sensor, timer, switching or power-supply stage, and highlighting components likely to be critical to how a circuit works is the aim. An illustrative output might label each detected component with its type, form, location and confidence, then group related components into a likely functional block with a confidence level and the evidence that supports the assessment, such as component types, layout and visible connections. Any attributes that cannot be determined should be stated explicitly.
34.	How will the demonstrator be assessed at the end of the 12 weeks: against a held-back image set, in a trial with operators, or both? What counts as a relevant environment for Technology Readiness Level 5 here, and are there target performance levels?	It is anticipated that the demonstrator will be assessed against a held-back set of representative images, supported by a demonstration to the sponsors and, where possible, input from representative users. A relevant environment for TRL 5 is expected to involve the solution running on representative commercially available hardware, processing representative x-ray radiographs not used in training, and being operated by users who are not

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		electronic component specialists. Target performance levels have not been mandated and will be agreed with the successful applicant during project initiation.
35.	Are there constraints on the target hardware and operating system, and should the software stand alone or work alongside existing x-ray software?	No specific hardware or operating system is mandated. The solution should run on commercially available hardware, ideally laptop-class equipment suitable for field use. The software should operate as a standalone application that ingests exported image files; integration with existing x-ray software is not required.
36.	Can the training data be held and processed on the provider's own equipment and premises? Are there handling or vetting requirements for the people working with it, and are pretrained open-source models acceptable?	It is anticipated that the training data can be held and processed on the provider's own equipment and premises, subject to handling conditions to be confirmed during contracting (see the response to question 6). Eligibility criteria are provided in the challenge document and associated FAQs. Pretrained open-source models are acceptable; see the response to question 12.
37.	Are the images backscattered, transmission or a mix?	See the response to question 1.
38.	Is it contrast, multispectral or hyperspectral image types?	See the response to question 2.

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39.	What are the typical image dimensions and resolution?	See the response to question 3.
40.	What are the typical number and range of angles recorded?	See the response to question 5.
41.	Are the training data provided labelled or is it expected the successful applicant do this?	See the response to question 6.
42.	Are the electronic components within the image are of interest are other features to be considered?	See the response to question 7.
43.	Will the dataset contain multiple X-ray images of the same physical object/device, with some way of associating those images with the same object?	It is anticipated that some items in the dataset will have multiple views. Where this is the case, the sponsors will aim to provide a means of associating images of the same item, for example through file naming or an accompanying index.
44.	Will any acquisition metadata be provided alongside the images, such as image geometry/orientation, acquisition order, or other relevant parameters?	Comprehensive acquisition metadata cannot be guaranteed. Where available, basic information such as view order, approximate orientation or exposure settings may be provided, but solutions should not depend on it.

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45.	What, if any, annotations will be provided with the images? For example, will electronic components be labelled?	See the response to question 16.
46.	With regards to that explainability is this expected to be a visual output (e.g. a heatmap of regions of interest to the ML model) or text based (or both)?	Both are useful. As a minimum, outputs should provide visual evidence on the image, such as bounding boxes or outlines with confidence scores, together with a short text explanation of what was identified and why. Heatmaps or other visualisations may be included as supporting evidence but are not required.
47.	How much training data is available and is there a siloed set of data for validation/testing purposes?	The volume of training data is to be confirmed. See the response to question 22 regarding a held-back test set.
48.	With regards to the software; is this expected to be a an executable or API that an image is uploaded to or is a command line execution via a python file sufficient?	A simple standalone graphical interface, which may be locally hosted and browser-based, is preferred. A command-line interface or API may be provided in addition to support testing and integration.
49.	Is inference time of any concern for the software?	Yes. Processing should be fast enough to support use in the field on the target hardware. Applicants should state expected processing times per image on their minimum and recommended hardware profiles.
50.	What portable X-ray systems produced the training data? What bit depth are the TIFFs, and do the image sets include multiple angles of the same device?	Images are expected to come from commercially available portable pulsed x-ray generators with flat-panel detectors, and potentially more than one system. Native TIFFs are expected to be 16-bit greyscale. Typically, two

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		approximately orthogonal views are acquired, and some items may have multiple views.
51.	Would TRL 5 validation on real radiographs we capture ourselves, of representative inert circuits, count as a “relevant environment”?	Validation using radiographs of representative inert circuits captured by the applicant may contribute to the demonstration of a relevant environment, provided the imaging is representative of field conditions. However, the demonstrator is also expected to be evaluated on sponsor-supplied images that have not been used in training. The precise test arrangements will be agreed during project initiation.
52.	Is there a reference hardware spec for the field laptop, such as GPU or CPU-only?	No reference hardware specification has been mandated. Laptop-class commercially available hardware suitable for field use should be assumed. Applicants should identify minimum and recommended hardware profiles and processing times.
53.	When will the data be available: at kick-off, or later in the 12 weeks? Roughly how many images, how are they labelled (component boxes, part types, circuit function, or unlabelled), and do they include multi-angle sets of the same device? If two providers are funded, do both get the same data?	Data is intended to be made available at, or shortly after, project kick-off. The number of images and the form of labelling are to be confirmed; see the response to question 16. Some items are expected to have multiple views. If more than one provider is funded, it is anticipated that each would receive the same dataset.
54.	Will HMGCC test demonstrators on a held-out data set they keep back?	See the response to question 22.

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55.	Is there a target accuracy, or a minimum set of component classes that must be identified?	No target accuracy has been mandated. Technical performance metrics will be agreed with the successful applicant during project initiation. The essential requirement is to identify and analyse through-hole components, such as resistors and capacitors; the final taxonomy is to be confirmed.
56.	Could you provide an indication of the approximate volume of training data available, the extent to which it is annotated, and when it would be made available to the successful applicants?	The volume of training data and the extent of annotation are to be confirmed following review of the available dataset. Data is intended to be made available at, or shortly after, project kick-off. See the response to question 16.
57.	Could you clarify what constitutes the relevant environment for demonstrating TRL 5 within the 12-week project period? Will representative evaluation data and access to relevant subject-matter expertise be provided?	See the response to question 34 regarding the relevant environment. Representative evaluation data is expected to be provided, and access to relevant subject-matter expertise can likely be accommodated at agreed points during the project, subject to availability.
58.	Are there any mandatory requirements regarding X-ray imaging modalities, image resolution or bit depth beyond the specified TIFF and JPEG file support?	No. The images are 2D single-energy transmission radiographs. Solutions must support 16-bit TIFF and 8-bit JPEG and should cope with variation in image size and resolution between imaging systems.
59.	How are the images being transferred from the X-ray device? Is the device connected to a network and proprietary software from the device producer, or are they transferred by a physical storage medium such as an SD card?	Image transfer from the x-ray system is not within the scope of the demonstrator. Solutions should assume that images are made available as exported TIFF or JPEG files.

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60.	What type of metadata is included in these images?	Metadata is likely to be limited and may vary between imaging systems. Standard TIFF header information will typically be present, but detailed acquisition parameters cannot be guaranteed, and solutions should not depend on them.
61.	To better understand the nature of the data and the deployment environment, could you provide details regarding the imaging systems that generate the scans? In particular: - What types of imaging systems are expected to be used (e.g., projection X-ray, dual-energy X-ray, CT, or a combination thereof)? - Will the imagery consist of single-view scans or multiple views? - What image resolutions, formats, and detector characteristics can be expected? - Are scanner operating parameters or image quality characteristics available for participants? - Should solutions be expected to generalise across multiple scanner models and manufacturers?	Images will be 2D single-energy transmission radiographs acquired using portable pulsed x-ray generators and flat-panel digital detectors; dual-energy and CT imagery are not in scope. Typically, two approximately orthogonal views are acquired, and additional views may be obtained where required. Native images are expected to be 16-bit greyscale TIFF, with a typical detector active area of approximately 35 × 43 cm and a pixel pitch of the order of 150 µm. Detailed scanner operating parameters and image quality characteristics cannot be guaranteed for all images. Data may come from more than one system, so solutions should be robust to variation between scanner models and manufacturers, and to variable image quality.
62.	Training Dataset - We would also appreciate additional information about the dataset that will be provided for training and development. Specifically:	The size of the dataset is to be confirmed following review of the available data. The dataset will focus on electronic components and assemblies rather than complete devices, so a proportion of positive IED examples is not applicable. See the response to question 16 regarding annotations and

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	- What is the approximate size of the dataset? - What proportion of the data contains positive examples of IEDs? - What annotations and labels will be provided? - Could you share some representative sample images with the participants? - Are there any anticipated differences between training and evaluation data distributions?	the response to question 1 regarding sample images. Evaluation images may differ from training data in clutter, overlap, image quality and imaging system. Solutions should be designed to generalise and to flag low-confidence or unfamiliar content.
63.	IED Assumptions and Scope - we would like to understand the assumptions participants may make regarding the target devices. Specifically: - Do the IEDs of interest share common components or construction characteristics? - Are there particular components that may be assumed to be present? - Should solutions be designed to detect highly diverse and novel device constructions? - Is the objective to detect complete IEDs, individual components, or both? - What range of variation should be expected in terms of size, materials, concealment methods, and packaging?	The objective is to identify and analyse electronic components, and to assess the likely function of groups of components, from x-ray images. Detection of complete devices or explosives is not within the scope of this challenge. Solutions should not assume that any particular component will be present. They should be robust to wide variation in components, layout, size and packaging, and should flag unfamiliar or uncertain content rather than force a classification.
64.	The scope mentions offline or disconnected operation, but also refers to retraining or refinement. Is retraining/refinement also expected to be conducted offline, or could this be completed on another platform	Retraining or refinement may be carried out on a separate platform, with the resulting model weights deployed to the offline or mobile device. Core analysis should ideally run locally without an internet connection. Applicants should

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	with the resulting model weights deployed to the offline/mobile compute device?	describe how retraining and model updates would be managed and controlled.
65.	Will the training data provided to the successful solution provider consist of X-ray imagery? Approximately how much data will be provided, and what labels or annotations are available for this data?	Yes, the training data will consist of x-ray imagery. The volume is to be confirmed, and labelling is addressed in the response to question 16.
66.	The scope states that X-ray imagery should be the primary source of analysis. Are other imaging sensors or data sources available as secondary or supporting inputs?	No other sensor data or data sources are expected to be supplied. X-ray imagery must remain the primary source of analysis.
67.	Will representative X-ray hardware and example electronic components/assemblies be available for development, testing and demonstration?	Provision of x-ray hardware or example electronic assemblies to solution providers is not currently planned. The sponsor-supplied images are expected to be the primary data for development, testing and demonstration.
68.	What level of functional analysis is expected? For example, should the system infer the likely function of individual components, identify functional groups/sub-circuits, or infer the overall function or connectivity of the circuit?	Inferring the likely function of individual components is the foundation, but the greatest value lies in identifying functional groups or sub-circuits and how they relate to one another. Inferring connectivity is valuable where it can be resolved. Full circuit reconstruction is not expected. See also the response to question 33.
69.	What level of component identification is expected? For example, component category (e.g. resistor, capacitor or IC), component subtype, individual component	The priority is component category, with subtype where it can be reliably determined from the image. Where an attribute cannot be determined, this should be stated.

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	instance, manufacturer/part number, electrical value, or some combination of these?	
70.	How are identified components expected to be presented to the operator? For example, image-level classification, bounding boxes, segmentation masks, labels overlaid on the X-ray image, or another representation?	Labels and bounding boxes or outlines overlaid on the x-ray image, each with a confidence score, are expected to be the most useful presentation, supported by a list or structured report of detections. Segmentation masks may be used where they add value, but are not required.
71.	Are there target performance measures or minimum acceptance criteria for the demonstrator, such as precision, recall, component detection rate, classification accuracy or confidence calibration?	No minimum acceptance criteria have been mandated. Technical performance metrics will be agreed with the successful applicant during project initiation.
72.	Is a standalone graphical operator interface expected as part of the demonstrator, or would another form of operator interface be acceptable?	See the response to question 48.
73.	What level of explainability and traceability is expected? For example, would confidence scores and visual evidence supporting individual detections be sufficient, or is more detailed model-level explainability and audit information required?	Confidence scores and visual evidence supporting individual detections, together with a short explanation of the basis for any functional assessment, are expected as a minimum. Outputs should also be traceable, for example by recording the input image, model version, settings and results, so that a reviewing specialist can understand and reproduce the assessment. Detailed model-level explainability is not required.

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74.	Could HMGCC clarify how clauses 10.2–10.5 of the Co-Creation terms apply to software and model weights developed or trained during the project, including ownership, licensing and any assignment of rights associated with the Deliverables?	Clauses 10.2–10.5 should be interpreted collectively. In accordance with the terms and conditions, ownership of Project IP remains with the Supplier, subject to the provisions of Clause 10.2. – please refer to "Project IP" Definition. The Authority is granted the rights necessary to use the Deliverables to the extent set out in Clause 10.4. These provisions relate to the Authority's rights of use and do not alter the underlying ownership of Project IP. Clause 10.5 is included solely to clarify that any usage rights granted under the Agreement upon completion of Services are granted for the benefit of the Authority and not Cranfield University. It does not create any additional rights for Cranfield or affect the ownership position established under Clauses 10.2 to 10.4.
75.	Are there any restrictions or preferred licence conditions for third-party open-source software incorporated into the delivered source code?	Any proposed use of third-party open-source software must be disclosed within the proposal, including details of the software to be used and its intended purpose. Suppliers should ensure an appropriate assessment of the applicable licence terms has been undertaken and the proposed utilisation does not restrict or limit commercial use, nor impose restrictions that would conflict with the HMGCC Co-Creation Terms and Conditions.
76.	How will the successful applicant be paid: against milestones, monthly in arrears, or on completion? Is any payment available at contract start, and what are the invoice payment terms?	For a standard 12 week Challenge, payments are aligned to agreed sprint completion points, such as at 4, 8 and 12 weeks, with Solution Providers invoicing fixed amounts at each milestone. Please see the HMGCC Co-Creation Terms and Conditions for further detail on invoicing and payment arrangements.

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		An early-stage hardware procurement milestone (or Sprint 0#) may be considered in exceptional circumstances where there is a clear and evidenced requirement. Any such request should be clearly outlined within the proposal and justified in the context of project delivery. Requests will be assessed by the Authority on a case-by-case basis prior to contract award, taking into account their necessity for achieving the required project outcomes. Suppliers should also consider whether elements of the work can be progressed in parallel to minimise any impact on the overall project schedule. Please note that all approved payment milestones will remain subject to the payment terms (see clause 4 Invoices and Payments) set out in the Co-Creation Terms and Conditions.
77.	Registration: The challenge guidance indicates that sole innovators are eligible to apply. However, the online application form currently requires both “Organisation Name” and “Registration Number”, and the registration number field requires 6-10 alphanumeric characters. I do not have a registered company or organisation. Could you please confirm what a sole innovator should enter in these two required fields?	For a sole trader, your can enter your full name and the “Organisation Name” and zeros in the “Registration Number” field.

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