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

Challenge: Data logging in extreme temperatures

Deadline for questions: 8th July 2025

#	Question	Answer
1.	Sensor Configuration: Are the two shock sensors and two angular rate sensors on-board or external? If they are on-board, why are two of each required? If they are external, are they part of the deliverable system, or will they be provided externally? In that case, what is the required communication protocol (e.g., NMEA)?	The sensors would be external to the datalogger and should be compatible with the system. The solution can be just thermal protection for our current system (DTS Slice) or an alternative logger including the sensors. If an alternative solution is presented, then the sensor and logger must be compatible e.g. NMEA or analogue connection to the sensors.
2.	Are there any specifications this equipment has to conform to?	The sensors and logger need to measure to the ranges detailed in Q.5, and be calibrated to ISO 17025 with a certificate.
3.	Do you have preferred external ACC gyro sensors?	As Q.2, they don't have to be, but we currently use the DTS 6DX Pro-A
4.	Regarding the analogue sensors you currently use, you mentioned output range, are they powered, what supply range? what shock survivability is required?	Current sensor specifications are detailed in Q.5, and the intention is that we can reuse sensors as practically as possible and survive the environments.

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5.	Can you confirm if the sensors also must survive such temperatures or just the data logging part?	The test consists of two shock events that require the acceleration, angular rate and pressure to be measured. The following thermal event requires the temperature and pressure to be measured. It is preferable that all the sensors except strain gauges are reusable, but it is understood that some solutions may not allow for this. Current Sensor Specifications: 6DOF (acceleration and angular rate) – 2000g and 1,500°s-1 (Bridge/Amplifier e.g. DTS 6DX Pro-A) Temperature - 500 °C (PRT or K-Type Thermocouple) Strain Gauge – 20,000 µƐ (Quarter bridge 5V Excitation) Pressure Transducer – 345kPa (Bridge Sensor eg. Endevco 8515C-15)
6.	The requirement for breach/access for data transfer- are there any more specifics on that?	The datalogger is embedded within a location that physical access is not available between tests. The sensors are mounted at various points within the container and need connecting to the logger itself. A cable link can also allow data download and battery recharge from outside the container, but this solution would be sacrificial link as temperatures externally can reach over 1200°C.
7.	The current solution uses Slice equipment. Going forward is the intention to continue to use Slice or will it be different/bespoke hardware? Does the budget exclude the electronic hardware?	The solution can be to protect the Slice equipment thermally and mechanically, suggest alternative hardware (with conformance evidence) or provide a bespoke solution. Please also see the answer to Q.12.

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8.	How many units are you likely to require going forward?	Up to 20.
9.	Does the envelop constraints include the battery? If the thermal transients after collision/fire not known to share, would you be able to share the internal free volume of the 5 × 2 × 2 m container (i.e., volume not occupied by hazardous material), and any assumptions on fuel load and composition?	The solution would preferably include a power source, but high temperature batteries are available that could sit outside of the protection envelope. As per the challenge summary the dimensions should conform to: The data capture package inclusive of battery and any thermal protection must be accommodated within a limited overall size of 200 mm x 200 mm x 150 mm. • If a thermal insulated package is developed, then a minimum of 150 mm x 150 mm x 80 mm internal volume is required to mount the current data logger system.
10.	Is your preference generally for a higher-TRL device that's ready to use, vs a more novel approach which might be lower-TRL but with potential to achieve higher capability once fully developed?	The preference is for TRL Level 9, but we will consider proposals of a lower TRL with development being achieved within the timescales given.
11.	Are you happy if the datalogger is disposable per trip i.e. with a non-rechargeable battery?	The associated cost of the datalogger would guide the preference on this but non-rechargeable batteries are acceptable.
12.	Are there any constraints on cost per data logger once in production?	The overall solutions will be considered with their associated budget costs. It is suggested that the solution is competitive against other participants in this challenge.

13.	I assume the environment the logger will see is clean and dry and it is just the 90C temperature that is the main issue, is that correct?	Yes, but bear in mind the mechanical shock the system will see.
14.	Would you consider applications from international companies (maybe in collaboration with UK partners)?	Certainly. We welcome applications from any community, bearing in mind the UK government trade restrictions.
15.	Does the data logger require any connectivity or require data to be collected offline?	The data can be collected offline and there is a preference for data download between events, given the restriction on access and wireless restrictions.
16.	We have amassed a high level of expertise in heat management as we are building prototypes and hardware that needs to operate nearby extremely high temperature systems. We have some concrete ideas as to how to solve this challenge using rapid prototyping, heat and stress resistant materials, and passive manipulation of shapes and air to dissipate heat. Our focus would be to build a resistant enclosure for the data logger. Would this be applicable?	If you can produce a material / enclosure that would protect the system, then yes.
17.	Regarding Thermal Boundary Conditions: From the gap section, we understand that the highest internal temperature peaks at 90 °C during 14hrs exposure (is that correct?). Then, the essential section states the test item is exposed to 90 °C for 14 hours (I feel like this is contradictory!). Could you please clarify: Is this internal temperature the result of post-collision fire	Most of the heat from the fuel load is absorbed by the container and other packaging within. Whilst this protects from the full heat load, it also has a large thermal mass which prolongs the internal temperature. To clarify, the temperature where the datalogger needs to sit reaches 90°C and takes 14 hours to cool to below 60°C after the thermal event. There is other free space within the

	(e.g., fuel burn scenario)? Or is 90 °C an average condition inside the test piece after a defined thermal event? If transients are not known to share with us we will aim for dynamic fire modeling: Would you be able to share the internal free volume of the 5 × 2 × 2 m container (i.e., volume not occupied by hazardous material), and any assumptions on fuel load and composition? This information would help us define accurate thermal boundary conditions and evaluate the thermal soak profile realistically.	container but at higher temperatures and with no fixing points for equipment. It is preferred that the 200 mm x 200 mm x 150 mm or 150 mm x 150 mm x 80 mm envelope is used but a novel solution outside these boundaries could be considered.
18.	Material Compatibility and Insulation History: Are you open to the use of Phase Change Materials (PCMs) as part of a passive thermal control solution? Have any insulation materials or methods already been trialled, and can you share those outcomes or material specs (e.g., aerogels, VIPs, ceramics)? We aim to propose a hybrid approach combining insulation with latent heat buffering, and understanding previous attempts will help avoid redundancy and improve efficacy.	We have investigated the use of aerogel, a bio based PCM, ceramic wrap, insulative concrete and combinations of these materials. The detailed results are outside the scope of this Q&A but, in summary, none were able to withstand the long heat-soaked environment. Most materials are designed to withstand high levels of heat for short periods but proved ineffective against long term temperatures. In terms of phase change materials, we would only accept inert solutions due to the sensitivity of other components in the test item.
19.	Sampling Rate and Event Logging: What is the required sampling rate for the shock accelerometers? Should these sensors log data continuously or only when events occur? The same question applies to the angular rate sensors.	The sampling rate for we use for shock is 100,000 sps and only need to log for 500ms post two drop events. The angular rate, pressure sensors and strain gauges should measure at the same rate and for the same duration. For the thermal event, we would require measurements at 1sps for 40 hours, but this would be pressure and temperature only.

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20.	On the requirement of batteries being able to last for >= 14 hours operating in 90°C, is there any test proof required to be submitted during application stage or will this be assessed during the implementation of the project?	It would be preferred that this could be demonstrated, and the solution remains safe during the thermal environment.
21.	You've stated a solution of TRL of 5-9. Demonstrating in the representative environment can be proven in lab; would the authority be content with a packaged solution that has reached TRL 6?	Please refer to the response from Q.10.
22.	Is the authority open to solutions with no existing hardware, but new custom design?	We are looking for a working solution, whether it is custom hardware, a casing to protect existing hardware or a design that can be proven to work.
23.	A number of additional sensors have been requested. Six temperature channels (PRTS) or thermocouples and Eighteen strain gauge/pressure channels are specified. Are details of the electrical/mechanical interfaces to these sensors going to be supplied by the authority? Is there a product in mind or should the system include the sensors as part of the final build, or should the system suggest sensors as part of the final product?	The sensor interfaces are mainly bare wire, which are subsequently wired into Omnetics 7/16 pin connectors to connect to the DTS Slice system. This can be wired to suit an alternative logger, or alternative sensors provided as part of the solution. More detail is provided as a response to Q.5.
24.	What level of software maturity is expected to be provided to extract the data, and are there any specific formats? Should it be a computer standard (e.g. USB) or is removable memory preferred?	The software should be able to extract the data and be able to export to at least a CSV format.

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25.	What is the logging resolution, e.g. Hz, samples per minute? Are all channels to be equally logged and are there any precision metrics?	Please refer to Q.19 for this detail.
26.	Is a power supply part of the design or does the authority already have a candidate?	The requirement is for power to be supplied by a battery and we are aware of single use high temperature batteries so do not consider this as the most technical part of the challenge.
27.	Is it within scope for a custom unit to provide some indicative information of a fault/overtemperature (e.g. a status LED) without having the need for the data to be extracted first?	The system will be contained within a large container so the status LED would have to be remote and sacrificed in the thermal event.
28.	From the challenge statement, we have the information about the data capture package and numbers of channels. We wonder if the datalogger will be free issued to the winner for later integration, or the applicant have to supply equivalent datalogger (e.g., SLICE) as integrated unit to the challenge owner as part of the contract? Or the applicant will only provide thermal barrier enclosure to accommodate the datalogger? Finally, how many prototype units required to supply from the winning design concept?	The solution can be of any of the types set out as the answer to Q.22 and there is scope to provide the datalogger for integration. Further details are in Q.30 and Q.8.
29.	Apart from withstanding the extreme temperature, the design has to survive the shock impact due to collision. Will the challenge owner provide shock profile later, or	The shock has historically been up to 300g

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	the applicant can assume the shock profile from their own experience in the submission?	
30.	Is the electronic data logging hardware selected and free issued by HMGCC i.e. HMGCC is responsible for this section.	Dependant on the solution, the logging hardware could be provided by the authority for inclusion in a protection system. Ideally this would be a system where access is available to insert and remove the logger at will. The intent is to reuse the system a multiple number of times and the logger to be calibrated between uses.
31.	Are there any environmental specifications the equipment needs to conform too? i.e. Mil-STD, Def-Stan, etc.	As per Q.2, it only needs to be calibrated to ISO 17025
32.	Does the equipment include the data acquisition hardware only or does it include the processing unit and memory storage? i.e. heat generation devices from the processing units.	Similar to Q.22, the solution can be a casing, logger or both. The current datalogger produces a negligible amount of heat.
33.	Is there a thermal mass where the equipment is attached too so in effect a thermal interface at 90 degree C?	The solution would have to interface with a metallic surface that reaches that temperature.
34.	How many potential suppliers are typically invited to the pitch day?	It varies per challenge but typically, a maximum of 5 or 6.

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35.	How detailed a breakdown of budget do you like to see. Is a simple breakdown into materials and labour sufficient?	A simple breakdown is fine. We are more interested in the tech solution and how it can meet the needs of the challenge.