

UK Research and Innovation

[Supplier name]
[Supplier address]

Attn: **[insert Supplier contact name]**

By email to: **[insert Supplier contact email address]**

Date: **[Insert date]**

Your ref: **[Insert Supplier's
reference, if any]**

Our ref: DDaT19214

Dear Sirs,

Award of contract for the supply of Firmware development for the DUNE Data Acquisition System STFC

Following your tender/ proposal for the supply of Firmware development for the DUNE Data Acquisition System STFC to UKRI, we are pleased to award this contract to you.

This letter (Award Letter) and its Schedule(s) set out the terms of the Contract between:

- (1) **United Kingdom Research and Innovation**, a statutory corporation whose registered office is at Polaris House, North Star Avenue, Swindon, England, SN2 1FL ("**UKRI**"); and
- (2) **[insert Supplier's full name]**, [a company incorporated and registered in [COUNTRY] with company number [NUMBER] and registered VAT number [NUMBER] whose registered office is at [REGISTERED OFFICE ADDRESS]] **OR** [a partnership under the laws of [COUNTRY] whose address is [ADDRESS]] **OR** [a business with its trading address at [ADDRESS]] (the "**Supplier**").

Unless the context otherwise requires, capitalised expressions used in this Award Letter have the same meanings as in the terms and conditions of contract set out in Schedule 1 to this Award Letter (the "**Conditions**"). In the event of any conflict between this Award Letter and the Conditions, this Award Letter shall prevail. Please do not attach any Supplier terms and conditions to this Award Letter as they will not be accepted by UKRI and may delay conclusion of the Contract.

For the purposes of the Contract, UKRI and the Supplier agree as follows:

Term

- 1 Commencement Date: [Insert the start date of the contract]
- 2 Expiry Date: [insert the date on which the contract will end]
- 3 UKRI may extend this Contract for a period of up to three months by giving not less than 14 days' notice in writing to the Supplier prior to the Expiry Date. The terms and conditions of this Contract shall apply throughout any such extended period.

Description of Goods and/or Services

- 4 The Specification of the Goods and/or Services to be delivered is as set out in Schedule 2.

5 The Services shall be performed at [*insert description of premises (including whether they are UKRI's premises, the Supplier's premises and/or a third party's premises and in each case the address)*].

6 The Goods shall be Delivered in accordance with the following instructions:

Delivery Address

[*insert delivery address, including telephone number of receiving individual*]

Date of Delivery

[*insert date of delivery*]

Charges & Payment

7 The Charges for the Goods and/or Services shall be as set out in Schedule 3.

8 All invoices should be sent, quoting a valid purchase order number (PO Number) provided by UKRI, to: finance@uksbs.co.uk c/o UK Shared Business Services, Polaris House, North Star Avenue, Swindon, SN2 1FL.

9 To avoid delay in payment it is important that the invoice is compliant and that it includes a valid PO Number, PO Number item number (if applicable) and the details (name and telephone number) of your UKRI contact (i.e. Contract Manager). Non-compliant invoices will be sent back to you, which may lead to a delay in payment. If you have a query regarding an outstanding payment please contact our Accounts Payable section either by email to finance@uksbs.co.uk or by telephone 01793867004 between 09:00-17:00 Monday to Friday.

Supplier's Limit of Liability

10 The Limit of Liability of the Supplier under this Contract shall be: 125% of the total Charges paid and payable to the Supplier under this Contract.

Notices

11 The address for notices of the Parties are:

UKRI

Polaris House, North Star Avenue,
Swindon, England, SN2 1FL

Attention: [Insert Commercial Business
Partner name]

Email: [insert email for above]

Supplier

[*insert name and address of Supplier*]

Attention: [*insert title*]

Email: [*insert email address*]

Liaison

12 For general liaison your contact will continue to be [insert Contract Manager name and contact details] or, in their absence, [insert secondary name and contact].

We thank you for your co-operation to date and look forward to forging a successful working relationship resulting in a smooth and successful supply of the Goods and/or Services. Please confirm your acceptance of the award of this contract by signing and returning the enclosed copy of this letter to [insert UKSBS Procurement Officer name] at the above address. No other form of acknowledgement will be accepted. Please remember to quote the reference number above in any future communications relating to this contract.

Yours faithfully,

Signed for and on behalf of **United Kingdom Research and Innovation**

Signature:

.....

Name:

.....

Position:

.....

Date:

.....

We accept the terms set out in this Award Letter and the Schedule(s).

Signed for and on behalf of ***[insert full name of Supplier]***

Signature:

.....

Name:

.....

Position:

.....

Date:

.....

Terms and Conditions of Contract for Goods and/or Services

1 INTERPRETATION

1.1 In these terms and conditions:

"Award Letter"	means the letter from UKRI to the Supplier printed above these terms and conditions;
"Central Government Body"	<p>means a body listed in one of the following sub-categories of the Central Government classification of the Public Sector Classification Guide, as published and amended from time to time by the Office for National Statistics:</p> <ul style="list-style-type: none">(a) Government Department;(b) Non-Departmental Public Body or Assembly Sponsored Public Body (advisory, executive, or tribunal);(c) Non-Ministerial Department; or(d) Executive Agency;
"Charges"	means the charges for the Goods and/or Services as specified in the Award Letter;
"Commencement Date"	means the date for the start of the Contract as set out in the Award Letter;
"Confidential Information"	<p>means:</p> <ul style="list-style-type: none">(a) all confidential information and data which is acquired from or made available (directly or indirectly) by the Disclosing Party or the Disclosing Party's representatives however conveyed or presented, including but not limited to any information or document relating to the Disclosing Party's business, affairs, operations, budgets, policies, processes, initiatives, plans, product information, pricing information, technical or commercial know-how, trade secrets, specifications, strategies, inventions, designs, software, market opportunities, personnel, customers or suppliers (whether relating to this Contract or otherwise) either orally, in writing, or in whatever form obtained or maintained;(b) any information or analysis derived from the Confidential Information;(c) anything marked as confidential and any other information notified by or on behalf of the Disclosing Party to the Receiving Party as being confidential;(d) the existence and terms of this Contract and of any subsequent agreement entered into in relation to this Contract;(e) the fact that discussions and negotiations are taking place concerning this Contract and the status of those discussions and negotiations; and(f) any copy of any of the information described in (a), (b), (c), (d) or (e) above, which shall be deemed to become Confidential Information when it is made. For the purposes of this definition, a copy shall include, without limitation, any notes or recordings of the information described in (a), (b), (c), (d) or (e) above (howsoever made);
"Contract"	means the contract between (i) UKRI and (ii) the Supplier constituted by the Supplier's

countersignature of the Award Letter and includes the Award Letter and Schedules;

"Data Protection Legislation"	means, for the periods for which they are in force, all laws giving effect or purporting to give effect to the GDPR, the Data Protection Act 2018, or otherwise relating to data protection, including the Regulation of Investigatory Powers Act 2000, the Telecommunications (Lawful Business Practice) (Interception of Communications) Regulations 2000 (SI 2000/2699), the Electronic Communications Data Protection Directive (2002/58/EC), the Privacy and Electronic Communications (EC Directive) Regulations 2003 (SI 2426/2003) and all applicable laws and regulations relating to the processing of personal data and privacy, including where applicable the guidance and codes of practice issued by the Information Commissioner, in each case as amended or substituted from time to time;
"Data Subject"	shall have the same meaning as in the Data Protection Legislation;
"Date of Delivery"	means that date by which the Goods must be Delivered to UKRI, as specified in the Award Letter.
"Deliver"	means hand over the Goods to UKRI at the address and on the date specified in the Award Letter, which shall include unloading and any other specific arrangements agreed in accordance with Clause 6. Delivered and Delivery shall be construed accordingly.
"Disclosing Party"	means a Party that makes a disclosure of Confidential Information to another Party;
"EIR"	means the Environmental Information Regulations 2004 (or if applicable the Environmental Information Regulations (Scotland) 2004);
"Expiry Date"	means the date for expiry of the Contract as set out in the Award Letter;
"FOIA"	means the Freedom of Information Act 2000 (or if applicable the Freedom of Information (Scotland) Act 2002);
"GDPR"	means: <ul style="list-style-type: none">(a) the General Data Protection Regulations (Regulation (EU) 2016/679); or(b) any equivalent legislation amending or replacing the General Data Protection Regulations (Regulation (EU) 2016/679);
"Good Industry Practice"	means all relevant practices and professional standards that would be expected of a well-managed, expert service provider performing services substantially similar to the Services or substantially similar to the Goods provided to customers of a substantially similar size and nature as UKRI;
"Goods"	means the goods to be supplied by the Supplier to UKRI under the Contract;
"Information"	has the meaning given under section 84 of the FOIA;
"Intellectual Property Rights"	means: <ul style="list-style-type: none">(a) copyright, rights related to or affording protection similar to copyright, rights in databases, patents and rights in inventions, semi-conductor topography rights, trade marks, rights in Internet domain names and website addresses and other rights in trade names, designs, know-how, trade secrets and other rights in Confidential Information;

	(b)	applications for registration, and the right to apply for registration, for any of the rights listed at (a) that are capable of being registered in any country or jurisdiction; and
	(c)	all other rights having equivalent or similar effect in any country or jurisdiction;
"Limit of Liability"		means the limit of liability identified in the Award Letter;
"Party"		the Supplier or UKRI (as appropriate) and "Parties" shall mean both of them;
"Personal Data"		means the personal data (as defined in the Data Protection Legislation) which relates to or originates from UKRI, or any of UKRI's employees, contractors or customers and which is processed by or on behalf of the Supplier under this Contract;
"Personal Data Breach"		shall have the meaning given in the Data Protection Legislation;
"Purchase Order Number"		means UKRI's unique number relating to the order for Goods and/or Services to be supplied by the Supplier to UKRI in accordance with the terms of the Contract;
"Receiving Party"		means a Party to which a disclosure of Confidential Information is made by another Party;
"Request for Information"		has the meaning set out in the FOIA or the EIR as relevant (where the meaning set out for the term "request" shall apply);
"Services"		means the services to be supplied by the Supplier to UKRI under the Contract;
"Specification"		means the specification for the Goods and/or Services to be supplied by the Supplier to UKRI (including as to quantity, description and quality) as specified in the Award Letter;
"Staff"		means all directors, officers, employees, agents, consultants and contractors of the Supplier and/or of any sub-contractor of the Supplier engaged in the performance of the Supplier's obligations under the Contract;
"Staff Vetting Procedures"		means vetting procedures that accord with good industry practice or, where requested by UKRI, UKRI's procedures for the vetting of personnel as provided to the Supplier from time to time;
"Term"		means the period from the Commencement Date to the Expiry Date as such period may be extended or terminated in accordance with the terms and conditions of the Contract;
"TUPE"		means the Transfer of Undertakings (Protection of Employment) Regulations 2006 as amended or replaced from time to time;
"VAT"		means value added tax in accordance with the provisions of the Value Added Tax Act 1994; and
"Working Day"		means a day (other than a Saturday, Sunday, public holiday or 27, 28, 29, 30 and 31 December) when banks in London are open for business.

1.2 In these terms and conditions, unless the context otherwise requires:

- (a) references to numbered clauses are references to the relevant clause in these terms and conditions;
- (b) any obligation on any Party not to do or omit to do anything shall include an obligation not to allow that thing to be done or omitted to be done;

- (c) the headings to the clauses of these terms and conditions are for information only and do not affect the interpretation of the Contract;
- (d) any reference to an enactment includes reference to that enactment as amended or replaced from time to time and to any subordinate legislation or byelaw made under that enactment; and
- (e) the word 'including' shall be understood as meaning 'including without limitation'.

2 BASIS OF CONTRACT

- 2.1 The Award Letter constitutes an offer by UKRI to purchase the Goods and/or Services subject to and in accordance with the terms and conditions of the Contract.
- 2.2 The offer comprised in the Award Letter shall be deemed to be accepted by the Supplier on receipt by UKRI of a copy of the Award Letter countersigned by the Supplier.

3 SUPPLY OF GOODS AND SERVICES

- 3.1 In consideration of UKRI's agreement to pay the Charges, the Supplier shall supply the Goods and/or Services to UKRI subject to and in accordance with the terms and conditions of the Contract.
- 3.2 In supplying the Goods and/or Services, the Supplier shall:
 - (a) co-operate with UKRI in all matters relating to the supply of Goods and/or Services and comply with all UKRI's instructions; and
 - (b) comply with all applicable laws.
- 3.3 The Supplier shall supply the Goods in accordance with the Specification. The Supplier warrants, represents, undertakes and guarantees that the Goods supplied under the Contract shall:
 - (a) be free from defects (manifest or latent), in materials and workmanship and remain so for 12 months after Delivery;
 - (b) be of satisfactory quality (within the meaning of the Sale of Goods Act 1979) and comply with any applicable statutory and regulatory requirements relating to the manufacture, labelling, packaging, storage, handling and delivery of the Goods;
 - (c) conform with the specifications (including the Specification), drawings, descriptions given in quotations, estimates, brochures, sales, marketing and technical literature or material (in whatever format made available by the Supplier) supplied by, or on behalf of, the Supplier;
 - (d) be free from design defects; and
 - (e) be fit for any purpose held out by the Supplier or made known to the Supplier by UKRI expressly or by implication, and in this respect UKRI relies on the Supplier's skill and judgement. The Supplier acknowledges and agrees that the approval by UKRI of any designs provided by the Supplier shall not relieve the Supplier of any of its obligations under this clause 3.3.
- 3.4 In supplying the Services, the Supplier shall:
 - (a) perform the Services with all reasonable care, skill and diligence in accordance with good industry practice in the Supplier's industry, profession or trade;

- (b) use Staff who are suitably skilled and experienced to perform tasks assigned to them, and in sufficient number to ensure that the Supplier's obligations are fulfilled in accordance with the Contract;
- (c) ensure that the Services shall conform with all descriptions and specifications set out in the Specification;
- (d) not do or allow anything to be done that would, or would be likely to, bring UKRI into disrepute or adversely affect its reputation in any way; and
- (e) provide all equipment, tools and vehicles and other items as are required to provide the Services.

4 TERM

- 4.1 The Contract shall take effect on the date specified in the Award Letter and shall expire on the Expiry Date, unless it is otherwise extended in accordance with the provisions of the Award Letter or terminated early in accordance with the terms and conditions of the Contract.

5 CHARGES, PAYMENT AND RECOVERY OF SUMS DUE

- 5.1 The Charges for the Goods and/or Services shall be as set out in the Award Letter and shall be the full and exclusive remuneration of the Supplier in respect of the supply of the Goods and/or Services. Unless otherwise agreed in writing by UKRI, the Charges shall include every cost and expense of the Supplier directly or indirectly incurred in connection with the supply of the Goods and/or performance of the Service.
- 5.2 All amounts stated are exclusive of VAT which shall be charged at the prevailing rate. UKRI shall, following the receipt of a valid VAT invoice, pay to the Supplier a sum equal to the VAT chargeable in respect of the Goods and/or Services.
- 5.3 The Supplier shall invoice UKRI as specified in the Contract. Each invoice shall include such supporting information required by UKRI to verify the accuracy of the invoice, including the relevant Purchase Order Number and a breakdown of the Goods and/or Services supplied in the invoice period.
- 5.4 In consideration of the supply of the Goods and/or Services by the Supplier, UKRI shall pay the Supplier the invoiced amounts no later than 30 days after verifying that the invoice is valid and undisputed and includes a valid Purchase Order Number. UKRI may, without prejudice to any other rights and remedies under the Contract, withhold or reduce payments in the event of unsatisfactory performance.
- 5.5 If UKRI fails to consider and verify an invoice in a timely fashion the invoice shall be regarded as valid and undisputed for the purpose of clause 5.4 after a reasonable time has passed (which shall be no less than 14 calendar days).
- 5.6 If there is a dispute between the Parties as to the amount invoiced, UKRI may reject the invoice in its entirety. The Supplier shall not suspend the supply of the Goods and/or Services unless the Supplier is entitled to terminate the Contract for a failure to pay undisputed sums in accordance with clause 18.5. Any disputed amounts shall be resolved through the dispute resolution procedure detailed in clause 21.
- 5.7 Where the Supplier enters into a sub-contract, the Supplier shall include in that sub-contract:
 - (a) provisions having the same effects as clauses 5.3 to 5.6 (inclusive) of this Contract; and

- (b) a provision requiring the counterparty to that sub-contract to include in any sub-contract which it awards provisions having the same effects as clauses 5.3 to 5.7 (inclusive) of this Contract.
 - (c) In this clause 5.7, "sub-contract" means a contract between two or more suppliers, at any stage of remoteness from UKRI in a subcontracting chain, made wholly or substantially for the purpose of performing (or contributing to the performance of) the whole or any part of this Contract.
- 5.8 If any sum of money is recoverable from or payable by the Supplier under the Contract (including any sum which the Supplier is liable to pay to UKRI in respect of any breach of the Contract), that sum may be deducted unilaterally by UKRI from any sum then due, or which may come due, to the Supplier under the Contract or under any other agreement or contract with UKRI. The Supplier shall not be entitled to assert any credit, set-off or counterclaim against UKRI in order to justify withholding payment of any such amount in whole or in part.
- 6 DELIVERY**
- 6.1 The Supplier shall Deliver the Goods to UKRI on or by the Date of Delivery. Unless otherwise agreed in writing by UKRI, Delivery shall be on the date and to the address specified in the Award Letter. Delivery of the Goods shall be completed once the completion of unloading the Goods from the transporting vehicle at the Delivery address has taken place and UKRI has signed for the Delivery.
- 6.2 Any access to UKRI's premises and any labour and equipment that may be provided by UKRI in connection with Delivery of the Goods shall be provided without acceptance by UKRI of any liability in respect of any actions, claims, costs and expenses incurred by third parties for any loss or damages to the extent that such loss or damage is not attributable to the negligence or other wrongful act of UKRI or its servant or agent. The Supplier shall indemnify UKRI in respect of any actions, suits, claims, demands, losses, charges, costs and expenses, which UKRI may suffer or incur as a result of or in connection with any damage or injury (whether fatal or otherwise) occurring in the course of Delivery or installation to the extent that any such damage or injury is attributable to any act or omission of the Supplier or any of his sub-Suppliers.
- 6.3 Delivery of the Goods shall be accompanied by a delivery note which shows the Purchase Order Number and the type and quantity of the Goods and, in the case of part Delivery, the outstanding balance remaining to be Delivered.
- 6.4 Unless otherwise stipulated by UKRI in the Award Letter, Deliveries shall only be accepted by UKRI on Working Days and during normal business hours.
- 6.5 Where (i) the Supplier fails to Deliver the Goods or part of the Goods or (ii) the Goods or part of the Goods do not comply with the provisions of clause 3, then without limiting any of its other rights or remedies implied by statute or common law, UKRI shall be entitled:
- (a) to terminate the Contract;
 - (b) to require the Supplier, free of charge, to deliver substitute Goods within the timescales specified by UKRI;
 - (c) to require the Supplier, free of charge, to repair or replace the rejected Goods, or to provide a full refund of the Charges of the rejected Goods (if paid);
 - (d) to reject the Goods (in whole or part) and return them to the Supplier at the Supplier's own risk and expense and UKRI shall be entitled to a full refund on those Goods or part of Goods duly returned;

- (e) to buy the same or similar Goods from another supplier; and
- (f) to recover any expenses incurred in respect of buying the goods from another supplier which shall include but not be limited to administration costs, chargeable staff time and extra delivery costs.

7 **PROPERTY AND GUARANTEE OF TITLE**

7.1 Without prejudice to any other rights or remedies of UKRI, title and risk in the Goods shall pass to UKRI when Delivery of the Goods is complete (including off-loading and stacking).

7.2 The Supplier warrants that:

- (a) it has full clear and unencumbered title to all the Goods;
- (b) at the date of Delivery of any of the Goods it shall have full and unrestricted right, power and authority to sell, transfer and deliver all of the Goods to UKRI; and
- (c) on Delivery UKRI shall acquire a valid and unencumbered title to the Goods.

8 **STAFF**

8.1 If UKRI reasonably believes that any of the Staff are unsuitable to undertake work in respect of the Contract, it may, by giving written notice to the Supplier:

- (a) refuse admission to the relevant person(s) to UKRI's premises;
- (b) direct the Supplier to end the involvement in the provision of the Goods and/or Services of the relevant person(s); and/or
- (c) require that the Supplier replace any person removed under this clause with another suitably qualified person and procure that any security pass issued by UKRI to the person removed is surrendered,

and the Supplier shall comply with any such notice.

8.2 The Supplier shall:

- (a) ensure that all Staff are vetted in accordance with the Staff Vetting Procedures and if requested, comply with UKRI's Staff Vetting Procedures as supplied from time to time;
- (b) ensure that no person who discloses that he/she has a conviction that is relevant to the nature of the Contract, relevant to the work of UKRI, or is of a type otherwise advised by UKRI (each such conviction a "**Relevant Conviction**"), or is found by the Supplier to have a Relevant Conviction (whether as a result of a police check, the Staff Vetting Procedures or otherwise) is employed or engaged in the provision of any part of the supply of the Goods and/or Services;
- (c) if requested, provide UKRI with a list of the names and addresses (and any other relevant information) of all persons who may require admission to UKRI's premises in connection with the Contract; and
- (d) procure that all Staff comply with any rules, regulations and requirements reasonably specified by UKRI.

9 **TUPE**

- 9.1 The Supplier warrants that the provision of the Goods and/or Services shall not give rise to a transfer of any employees of the Supplier or any third party to UKRI pursuant to TUPE.

10 **ASSIGNMENT AND SUB-CONTRACTING**

- 10.1 The Supplier shall not without the written consent of UKRI assign, sub-contract, novate or in any way dispose of the benefit and/ or the burden of the Contract or any part of the Contract. UKRI may, in the granting of such consent, provide for additional terms and conditions relating to such assignment, sub-contract, novation or disposal. The Supplier shall be responsible for the acts and omissions of its sub-contractors as though those acts and omissions were its own.
- 10.2 Where UKRI has consented to the placing of sub-contracts, the Supplier shall, at the request of UKRI, send copies of each sub-contract, to UKRI as soon as is reasonably practicable.
- 10.3 UKRI may assign, novate, or otherwise dispose of its rights and obligations under the Contract without the consent of the Supplier provided that such assignment, novation or disposal shall not increase the burden of the Supplier's obligations under the Contract.

11 **INTELLECTUAL PROPERTY AND INDEMNITY**

- 11.1 All Intellectual Property Rights in any materials provided by UKRI to the Supplier for the purposes of this Contract shall remain the property of UKRI but UKRI hereby grants the Supplier a royalty-free, non-exclusive and non-transferable licence to use such materials as required until termination or expiry of the Contract for the sole purpose of enabling the Supplier to perform its obligations under the Contract.
- 11.2 The ownership of all Intellectual Property Rights in any materials created or developed by the Supplier pursuant to the Contract or arising as a result of the provision of the Goods and/or Services shall vest in UKRI. If, and to the extent, that the ownership of any Intellectual Property Rights in such materials vest in the Supplier by operation of law, the Supplier hereby assigns ownership of such Intellectual Property Rights to UKRI by way of a present assignment of future rights that shall take place immediately on the coming into existence of any such Intellectual Property Rights all its Intellectual Property Rights in such materials (with full title guarantee and free from all third party rights).
- 11.3 UKRI hereby grants the Supplier a royalty-free, non-exclusive and non-transferable licence to use any Intellectual Property Rights in the materials created or developed by the Supplier pursuant to the Contract and any Intellectual Property Rights arising as a result of the provision of the Goods and/or Services as required until termination or expiry of this Contract for the sole purpose of enabling the Supplier to perform its obligations under the Contract
- 11.4 Without prejudice to clause 11.2, the Supplier hereby grants UKRI a perpetual, royalty-free, irrevocable and non-exclusive licence (with a right to sub-license) to use any Intellectual Property Rights vested in or licensed to the Supplier on the date of the Contract or during the Term to the extent not falling within clause 11.2 including any modifications to or derivative versions of any such Intellectual Property Rights, which UKRI reasonably requires in order to exercise its rights and take the benefit of the Contract including the Goods and/or Services provided.
- 11.5 The Supplier shall indemnify, and keep indemnified, UKRI in full against all cost, expenses, damages and losses (whether direct or indirect), including any interest, penalties, and reasonable legal and other professional fees awarded against or incurred or paid by UKRI as a result of or in connection with any claim made against UKRI for actual or alleged infringement of a third party's intellectual property arising out of, or in

connection with, the supply or use of the Goods and/or Services, to the extent that the claim is attributable to the acts or omission of the Supplier or any Staff.

- 11.6 UKRI shall promptly notify the Supplier of any infringement claim made against it relating to any Goods and, subject to any statutory obligation requiring UKRI to respond, shall permit the Supplier to have the right, at its sole discretion to assume, defend, settle or otherwise dispose of such claim. UKRI shall give the Supplier such assistance as it may reasonably require to dispose of the claim and shall not make any statement which might be prejudicial to the settlement or defence of the claim.

12 RECORDS

- 12.1 If required by UKRI, the Supplier shall:

- (a) attend progress meetings with UKRI at the frequency and times specified by UKRI and shall ensure that its representatives are suitably qualified to attend such meetings; and
- (b) submit progress reports to UKRI at the times and in the format specified by UKRI.

- 12.2 The Supplier shall keep and maintain until 6 years after the end of the Contract, or as long a period as may be agreed between the Parties, full and accurate records of the Contract including the Goods and/or Services supplied under it, and all payments made by UKRI. The Supplier shall on request afford UKRI or UKRI's representatives such access to those records as may be reasonably requested by UKRI in connection with the Contract.

13 CONFIDENTIALITY, TRANSPARENCY AND PUBLICITY

- 13.1 Subject to clause 13.2, each Party shall:

- (a) treat all Confidential Information it receives as confidential, safeguard it accordingly and not disclose it to any other person without the prior written permission of the disclosing Party; and
- (b) not use or exploit the Disclosing Party's Confidential Information in any way except for the purposes anticipated under the Contract.

- 13.2 Notwithstanding clause 13.1, a Party may disclose Confidential Information which it receives from the other Party:

- (a) where disclosure is required by applicable law or by a court of competent jurisdiction;
- (b) to its auditors or for the purposes of regulatory requirements;
- (c) on a confidential basis, to its professional advisers;
- (d) to the Serious Fraud Office where the Party has reasonable grounds to believe that the other Party is involved in activity that may constitute a criminal offence under the Bribery Act 2010;
- (e) where the Receiving Party is the Supplier, to the Staff on a need to know basis to enable performance of the Supplier's obligations under the Contract provided that the Supplier shall procure that any Staff to whom it discloses Confidential Information pursuant to this clause 13.2(e) shall observe the Supplier's confidentiality obligations under the Contract; and
- (f) where the Receiving Party is UKRI:

- (i) on a confidential basis to the employees, agents, consultants and contractors of UKRI;
- (ii) on a confidential basis to any Central Government Body, any successor body to a Central Government Body or any company to which UKRI transfers or proposes to transfer all or any part of its business;
- (iii) to the extent that UKRI (acting reasonably) deems disclosure necessary or appropriate in the course of carrying out its public functions; or
- (iv) in accordance with clause 14.

and for the purposes of the foregoing, references to disclosure on a confidential basis shall mean disclosure subject to a confidentiality agreement or arrangement containing terms no less stringent than those placed on UKRI under this clause 13.

13.3 The Parties acknowledge that, except for any Information which is exempt from disclosure in accordance with the provisions of the FOIA, the content of the Contract is not Confidential Information and the Supplier hereby gives its consent for UKRI to publish the Contract in its entirety to the general public (but with any Information that is exempt from disclosure in accordance with the FOIA redacted) including any changes to the Contract agreed from time to time. UKRI may consult with the Supplier to inform its decision regarding any redactions but shall have the final decision in its absolute discretion whether any of the content of the Contract is exempt from disclosure in accordance with the provisions of the FOIA.

13.4 The Supplier shall not, and shall take reasonable steps to ensure that the Staff shall not, make any press announcement or publicise the Contract or any part of the Contract in any way, except with the prior written consent of UKRI.

14 FREEDOM OF INFORMATION

14.1 The Supplier acknowledges that UKRI is subject to the requirements of the FOIA and the EIR and shall:

- (a) provide all necessary assistance and cooperation as reasonably requested by UKRI to enable UKRI to comply with its obligations under the FOIA and the EIR;
- (b) transfer to UKRI all Requests for Information relating to the Contract that it receives as soon as practicable and in any event within 2 Working Days of receipt;
- (c) provide UKRI with a copy of all Information belonging to UKRI requested in the Request for Information which is in its possession or control in the form that UKRI requires within 5 Working Days (or such other period as UKRI may reasonably specify) of UKRI's request for such Information; and
- (d) not respond directly to a Request for Information unless authorised in writing to do so by UKRI.

14.2 The Supplier acknowledges that UKRI may be required under the FOIA and the EIR to disclose Information concerning the Supplier or the Goods and/or Services (including commercially sensitive information) without consulting or obtaining consent from the Supplier.

14.3 Notwithstanding any other provision in the Contract, UKRI shall be responsible for determining in its absolute discretion whether any Information relating to the Supplier or the Goods is exempt from disclosure in accordance with the FOIA and/or the EIR.

15 PROTECTION OF PERSONAL DATA AND SECURITY OF DATA

- 15.1 In this Clause 15, the terms, "processes", "data controller" and "data processor" shall have the same meanings given to them under Data Protection Legislation.
- 15.2 The Parties acknowledge that for the purposes of Data Protection Legislation, UKRI is the data controller and the Supplier is the data processor of any Personal Data.
- 15.3 The Supplier shall and shall procure that its staff and sub-contractors shall comply with all Data Protection Legislation in relation to any Personal Data processed.
- 15.4 Without limiting Clauses 15.2 and 15.3, the Supplier shall at all times (and shall ensure that at all times its staff):
- (a) process Personal Data only in accordance with the documented instructions received from UKRI and during the Term of this Contract. The Supplier shall immediately inform UKRI if, in the Supplier's opinion, an instruction from UKRI infringes the Data Protection Legislation or any other applicable law;
 - (b) ensure that any person to whom it provides the Personal Data is subject to appropriate confidentiality obligations;
 - (c) disclose any Personal Data only on a need to know basis to staff directly concerned with the provision of the Goods and/or Services;
 - (d) not transfer or direct the transfer of any Personal Data to any third party or process or direct the processing of Personal Data outside of the European Economic Area in each case without UKRI's prior written consent (which consent may be subject to conditions as directed by UKRI);
 - (e) keep all Personal Data confidential, and have in place now and shall on a continuing basis take all reasonable appropriate technical and organisational measures to keep all Personal Data confidential and secure and to protect against unauthorised or unlawful processing, accidental loss, destruction, damage, alteration, disclosure or access;
 - (f) upon request by UKRI, promptly do such other acts in relation to the Personal Data, or any part thereof, as UKRI shall request to enable UKRI to comply with its obligations under the Data Protection Legislation;
 - (g) notify UKRI promptly (and at least within 24 hours) if it receives a request from a Data Subject or a complaint relating to a Data Subject and promptly provide UKRI with all such data, information, cooperation and assistance as is required by UKRI in order to respond to and resolve the request or complaint within any applicable time frames;
 - (h) provide such information and allow for and contribute to audits, including inspections, conducted by UKRI or an auditor mandated by UKRI, as is reasonably necessary to enable UKRI to satisfy itself of the Supplier's compliance with this Clause 15 and the Data Protection Legislation
 - (i) on termination or expiry of this Contract, and at any other time on UKRI's request, either return or destroy (as elected by UKRI) the Personal Data (including all copies of it) and confirm in writing that it has complied with this obligation; and
 - (j) notify UKRI without undue delay on becoming aware of any Personal Data Breach and promptly following notification, provide such data, information and assistance as is required by UKRI in order for UKRI to notify the Personal Data Breach to the

Information Commissioner and/or Data Subject(s) and otherwise fulfil its obligations under Data Protection Legislation.

16 LIABILITY

- 16.1 UKRI shall not be responsible for any injury, loss, damage, cost or expense suffered by the Supplier if and to the extent that it is caused by the negligence or wilful misconduct of the Supplier or the Staff or breach by the Supplier of its obligations under the Contract. The Supplier shall not be responsible for any injury, loss, damage, cost or expense suffered by UKRI if and to the extent that it is caused by the negligence or wilful misconduct of UKRI or by breach by UKRI of its obligations under the Contract.
- 16.2 Subject always to clause 16.5 and 16.6 in no event shall either Party be liable to the other Party for any:
- (a) loss of profits;
 - (b) loss of business;
 - (c) loss of revenue;
 - (d) loss of or damage to goodwill;
 - (e) loss of savings (whether anticipated or otherwise); and/or
 - (f) any indirect, special or consequential loss or damage.
- 16.3 Subject always to clause 16.5 and 16.6, the aggregate liability of the Supplier in respect of all defaults, claims, losses or damages howsoever caused, whether arising from breach of the Contract, the supply or failure to supply of the Goods and/or perform the Services, misrepresentation (whether tortious or statutory), tort (including negligence), breach of statutory duty or otherwise shall in no event exceed the Limit of Liability.
- 16.4 Subject to clause 16.5, the aggregate liability of UKRI in respect of all defaults, claims, losses or damages howsoever caused, whether arising from breach of the Contract, misrepresentation (whether tortious or statutory), tort (including negligence), breach of statutory duty or otherwise shall in no event exceed a sum equal to the Charges.
- 16.5 Nothing in the Contract shall be construed to limit or exclude either Party's liability for:
- (a) death or personal injury caused by its negligence or that of its Staff;
 - (b) fraud or fraudulent misrepresentation by it or that of its Staff;
 - (c) breach of any obligation as to title implied by section 12 of the Sale of Goods Act 1979 or section 2 of the Supply of Goods and Services Act 1982; or
 - (d) any other matter which, by law, may not be excluded or limited.
- 16.6 The Supplier's liability under the indemnities in clauses 11.5, 15 and 20.3 shall be unlimited.
- 16.7 The Supplier shall effect and maintain an adequate level of insurance cover in respect of all risks that may be incurred by it in the performance of this Contract. On request from UKRI, the Supplier shall provide UKRI with copies of the insurance policy certificates and details of the cover provided.

17 **FORCE MAJEURE**

Neither Party shall have any liability under or be deemed to be in breach of the Contract for any delays or failures in performance of the Contract which result from circumstances beyond the reasonable control of the Party affected. Each Party shall promptly notify the other Party in writing when such circumstances cause a delay or failure in performance and when they cease to do so. If such circumstances continue for a continuous period of more than 30 days, either Party may terminate the Contract by written notice to the other Party.

18 **TERMINATION**

18.1 UKRI may terminate the Contract in whole or in part at any time before the Goods and/or Services are provided with immediate effect by giving the Supplier written notice, whereupon the Supplier shall discontinue the provision of the Goods and/or Services (in whole or in part as applicable). UKRI shall pay to the Supplier:

- (a) such Charges or that part of the Charges for Goods which have been Delivered to UKRI or, on the deemed date of service of the notice of cancellation, are already in transit and the costs of materials which the Supplier has purchased to fulfil the order for the Goods and which cannot be used for other orders or be returned to the supplier of those materials for a refund; and/or
- (b) such Charges or that part of the Charges for Services provided and a fair and reasonable portion of the Charges for work-in-progress in performing the Services at the time of termination,

but UKRI shall not be liable for any loss of anticipated profits or any consequential loss and the Supplier shall have a duty to mitigate its costs and shall on request provide proof of work-in-progress claimed.

18.2 UKRI may terminate the Contract at any time by notice in writing to the Supplier to take effect on any date falling at least 1 month (or, if the Contract is less than 3 months in duration, at least 10 Working Days) later than the date of service of the relevant notice.

18.3 Without prejudice to any other right or remedy it might have, UKRI may terminate the Contract by written notice to the Supplier with immediate effect if the Supplier:

- (a) (without prejudice to clause 18.3(e)), is in material breach of any obligation under the Contract which is not capable of remedy;
- (b) repeatedly breaches any of the terms and conditions of the Contract in such a manner as to reasonably justify the opinion that its conduct is inconsistent with it having the intention or ability to give effect to the terms and conditions of the Contract;
- (c) is in material breach of any obligation which is capable of remedy, and that breach is not remedied within 30 days of the Supplier receiving notice specifying the breach and requiring it to be remedied;
- (d) undergoes a change of control within the meaning of section 1124 of the Corporation Tax 2010, unless UKRI has given its prior written consent to the change of control or does not raise an objection within 6 months of the Supplier's written notice to UKRI that a change of control has occurred;
- (e) breaches the provisions of clauses 8.2, 13, 14, 15 and 19;
- (f) becomes insolvent, or if an order is made or a resolution is passed for the winding up of the Supplier (other than voluntarily for the purpose of solvent amalgamation

or reconstruction), or if an administrator or administrative receiver is appointed in respect of the whole or any part of the Supplier's assets or business, or if the Supplier makes any composition with its creditors or takes or suffers any similar or analogous action (to any of the actions detailed in this clause 18.3) in consequence of debt in any jurisdiction; or

- (g) fails to comply with legal obligations in the fields of environmental, social or labour law.
- 18.4 The Supplier shall notify UKRI as soon as practicable of any change of control as referred to in clause 18.3(d) or any potential such change of control.
- 18.5 In addition to the Supplier's statutory rights, the Supplier may terminate the Contract by written notice to UKRI if UKRI has not paid any undisputed invoice within 90 days of it falling due.
- 18.6 Termination or expiry of the Contract shall be without prejudice to the rights of either Party accrued prior to termination or expiry and shall not affect the continuing rights of the Parties under clauses 2, 3.2, 3.3, 8, 11, 12.1, 13, 14, 15, 16, 18.7, 19.4, 20.3, 21 and 22.9 and any other term or condition of the Contract that either expressly or by implication has effect after termination.
- 18.7 Upon termination or expiry of the Contract, the Supplier shall:
- (a) give all reasonable assistance to UKRI and any incoming supplier of Goods and/or Services; and
 - (b) return all requested documents, information and data to UKRI as soon as reasonably practicable.
- 19 **COMPLIANCE**
- 19.1 The Supplier shall promptly notify UKRI of any health and safety hazards which may arise in connection with the performance of its obligations under the Contract. UKRI shall promptly notify the Supplier of any health and safety hazards which may exist or arise at UKRI's premises and which may affect the Supplier in the performance of its obligations under the Contract.
- 19.2 The Supplier shall:
- (a) comply with the reasonable requirements of UKRI's security arrangements;
 - (b) comply with all UKRI's health and safety measures;
 - (c) notify UKRI immediately in the event of any incident occurring in the performance of its obligations under the Contract on UKRI's premises where that incident causes any personal injury or damage to property which could give rise to personal injury;
 - (d) perform its obligations under the Contract in accordance with all applicable equality law and UKRI's equality and diversity policy as provided to the Supplier from time to time;
 - (e) take all reasonable steps to secure the observance of clause 19.2(d) by all Staff; and
 - (f) supply the Goods and any packaging in accordance with UKRI's environmental policy as provided from time to time.

19.3 The Goods shall be packed and marked in a proper manner and in accordance with any instructions specified in the Award Letter, any statutory requirements and any requirements of the carriers. All packaging materials shall be considered non-returnable. The Supplier shall indemnify UKRI against all actions, suits, claims, demands, losses, charges, costs and expenses which UKRI may suffer or incur as a result of, or in connection with, any breach of this clause 19.3.

19.4 If notified by UKRI, the Supplier shall comply with, and shall ensure that its Staff shall comply with, the provisions of:

- (a) the Official Secrets Acts 1911 to 1989; and
- (b) section 182 of the Finance Act 1989.

20 PREVENTION OF FRAUD AND CORRUPTION

20.1 The Supplier shall not offer, give, or agree to give anything, to any person an inducement or reward for doing, refraining from doing, or for having done or refrained from doing, any act in relation to the obtaining or execution of the Contract or for showing or refraining from showing favour or disfavour to any person in relation to the Contract.

20.2 The Supplier shall take all reasonable steps, in accordance with Good Industry Practice, to prevent fraud by the Staff and the Supplier (including its shareholders, members and directors) in connection with the Contract and shall notify UKRI immediately if it has reason to suspect that any fraud has occurred or is occurring or is likely to occur.

20.3 If the Supplier or the Staff engages in conduct prohibited by clause 20.1 or commits fraud in relation to the Contract or any other contract with the Crown (including UKRI) UKRI may:

- (a) terminate the Contract and recover from the Supplier the amount of any loss suffered by UKRI resulting from the termination, including the cost reasonably incurred by UKRI of making other arrangements for the supply of the Goods and/or Services and any additional expenditure incurred by UKRI throughout the remainder of the Contract; or
- (b) recover in full from the Supplier any other loss sustained by UKRI in consequence of any breach of this clause.

21 DISPUTE RESOLUTION

21.1 The Parties shall attempt in good faith to negotiate a settlement to any dispute between them arising out of or in connection with the Contract and such efforts shall involve the escalation of the dispute to an appropriately senior representative of each Party.

21.2 If the dispute cannot be resolved by the Parties within one month of being escalated as referred to in clause 21.1, the dispute may by agreement between the Parties be referred to a neutral adviser or mediator (the "**Mediator**") chosen by agreement between the Parties. All negotiations connected with the dispute shall be conducted in confidence and without prejudice to the rights of the Parties in any further proceedings.

21.3 If the Parties fail to appoint a Mediator within one month, or fail to enter into a written agreement resolving the dispute within one month of the Mediator being appointed, either Party may exercise any remedy it has under applicable law.

22 GENERAL

22.1 Each of the Parties represents and warrants to the other that it has full capacity and authority, and all necessary consents, licences and permissions to enter into and perform

its obligations under the Contract, and that the Contract is executed by its duly authorised representative.

- 22.2 The Supplier warrants and represents that during the Term it shall not accept work from other sources that will in any way impair or affect its ability to provide the Goods and/or Services and comply with the terms of this Contract.
- 22.3 The Supplier must make sure that neither it nor any of its Staff or sub-contractors are placed in a position where there is or may be an actual conflict, or a potential conflict, between their interests or the interests of its Staff or sub-contractors and the Supplier's obligations under this Contract. You must disclose to us the particulars of any conflict of interest that arises.
- 22.4 A person who is not a party to the Contract shall have no right to enforce any of its provisions which, expressly or by implication, confer a benefit on him or her, without the prior written agreement of the Parties.
- 22.5 The Contract cannot be varied except in writing signed by a duly authorised representative of both the Parties.
- 22.6 The Contract contains the whole agreement between the Parties and supersedes and replaces any prior written or oral agreements, representations or understandings between them. The Parties confirm that they have not entered into the Contract on the basis of any representation that is not expressly incorporated into the Contract. Nothing in this clause 22.6 shall exclude liability for fraud or fraudulent misrepresentation.
- 22.7 Any waiver or relaxation either partly, or wholly of any of the terms and conditions of the Contract shall be valid only if it is communicated to the other Party in writing and expressly stated to be a waiver. A waiver of any right or remedy arising from a breach of contract shall not constitute a waiver of any right or remedy arising from any other breach of the Contract.
- 22.8 The Contract shall not constitute or imply any partnership, joint venture, agency, fiduciary relationship or other relationship between the Parties other than the contractual relationship expressly provided for in the Contract. Neither Party shall have, nor represent that it has, any authority to make any commitments on the other Party's behalf.
- 22.9 Except as otherwise expressly provided by the Contract, all remedies available to either Party for breach of the Contract (whether under the Contract, statute or common law) are cumulative and may be exercised concurrently or separately, and the exercise of one remedy shall not be deemed an election of such remedy to the exclusion of other remedies.
- 22.10 If any provision of the Contract is prohibited by law or judged by a court to be unlawful, void or unenforceable, the provision shall, to the extent required, be severed from the Contract and rendered ineffective as far as possible without modifying the remaining provisions of the Contract, and shall not in any way affect any other circumstances of or the validity or enforcement of the Contract.

23 NOTICES

- 23.1 Any notice to be given under the Contract shall be in writing and may be served by personal delivery, first class recorded or, subject to clause 23.3, e-mail to the address of the relevant Party set out in the Award Letter, or such other address as that Party may from time to time notify to the other Party in accordance with this clause.
- 23.2 Notices served as above shall be deemed served on the Working Day of delivery provided delivery is before 5.00pm on a Working Day. Otherwise delivery shall be deemed to occur

on the next Working Day. An email shall be deemed delivered when sent unless an error message is received.

- 23.3 Notices under clauses 17 and 18 may be served by email only if the original notice is then sent to the recipient by personal delivery or recorded delivery in the manner set out in clause 23.1.

24 **GOVERNING LAW AND JURISDICTION**

- 24.1 The validity, construction and performance of the Contract, and all contractual and non-contractual matters arising out of it, shall be governed by English law and shall be subject to the exclusive jurisdiction of the English courts to which the Parties submit.

Specification

- 1 The Suppliers shall provide the Goods and/or Services in accordance with this Schedule
- 2.

• **Introduction**

The DUNE experiment (<http://www.dunescience.org/>) needs to store all the data from the detector (rather than a triggered sub-set) if a potential Super Nova is detected. It is anticipated that this will be done by writing to Non-Volatile Memory Express (NVMe) attached storage (<https://nvmexpress.org/>). Approximately 300 devices will be written to in parallel for each 10kTonne detector module, with a total bandwidth of approximately 540 GBytes/s.

This is a specification for the design, development and production of a suitable Very High-Speed Integrated Circuit Hardware Description Language (VHDL) field-programmable gate array (FPGA) firmware and any necessary software for Xilinx 7 series Ultrascale or Ultrascale Plus FPGAs to implement this in an open VHDL source code form suitable for the project to use and develop further as wanted.

• **Aims & Objectives**

Closed source IP is available to write from FPGA fabric to NVMe drives over PCIe x4. However, the distributed code development model used within Particle Physics makes the use of tightly licensed closed source IP extremely onerous, slowing development and increasing schedule risk.

This tender is for the supply of IP in source code form that can be distributed freely inside the DUNE collaboration or released as open source.

To facilitate the development for data acquisition firmware for the DUNE experiment far detector by providing FPGA fabric NVMe interface in source code form

Each FPGA will interface to two or more NVMe devices.

• **Background to the Requirement**

The DUNE data acquisition (DAQ) system is being developed by an international collaboration of physicists and engineers.

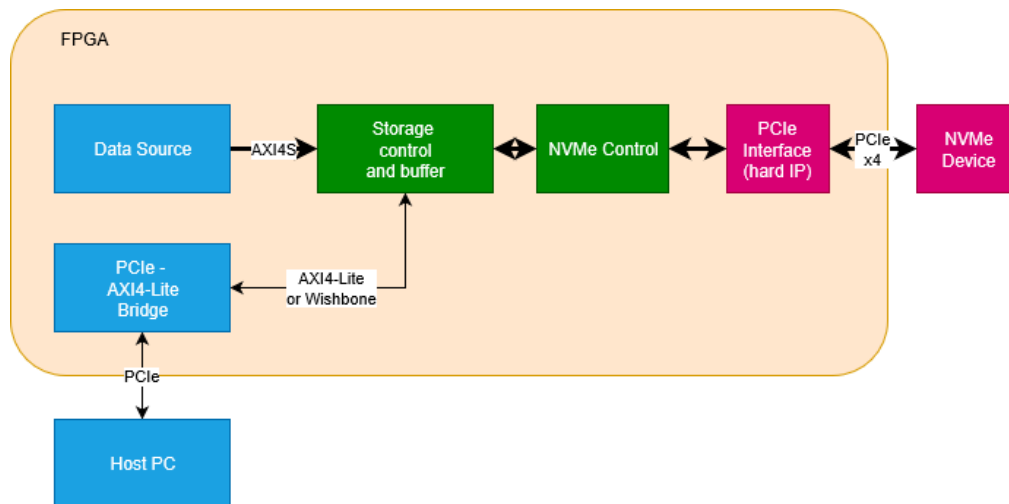
The functions of the DAQ are distributed between “firmware” that configures FPGAs housed on custom PCIe boards and software that runs on the server PCs that house the PCIe boards.

The normal working model is to distribute tasks between institutes and developers and use “Git” code repositories.

It is normal for every member of the team to expect to be able to build a configuration file “bitstream” for the FPGA.

• **Possible Implementation**

A possible implementation design for illustrative purpose is shown below. However, alternative designs will be considered for this procurement.



There will be a test harness either implemented in software on a host PC or on the FPGA in VHDL. The choice of this will depend on the host → FPGA evaluation boards interface abilities of the chosen development platform.

To simplify the design the NVMe parameters, such as the erase block size and overall size, may be configured within the FPGA VHDL rather than read from the NVMe devices. This will be considered during the design phase.

One issue with NVMe and NAND FLASH devices in general is the need to erase complete blocks before write. The management of blocks is performed by a controller on the NVMe device. Its algorithms are not publicly available. These algorithms can lead to large latencies during write operations. It will be likely be necessary to erase blocks before use and/or not use all of the logical blocks present on a device (say use 80% of available blocks). NVMe's provide TRIM functionality as well as other techniques to manage this. Part of the work will be to manage this and test the performance, especially write speed and latency, with a few different types of NVMe. The maximum latency will be determined which will provide a value for the data buffering requirements needed. There will be small block buffers in the NVMe IP, but it is expected that the main latency handling data buffer will be provided by the client firmware.

• **Demonstration Equipment**

The supplier shall supply the appropriate hardware equipment to demonstrate the required firmware as per specification below or alternative agreed with DUNE:

- Xilinx evaluation board VCU118.
- Xilinx NVMe adapter board, AB17-M2FMC, with two NVMe M2 locations.
- 6 x 500 GByte NVMe devices (each with > 2000 MBytes/s write speed).
Each set of two would be from a different vendor.

For the avoidance of any doubt, the hardware equipment supplied under this contract shall remain the ownership of UKRI.

• **Program of Work**

- Design a suitable architecture to drive the NVMe devices over 4 x PCIe lanes each. This may use direct FPGA state machines or soft cores to generate the necessary NVMe commands to send and parse responses.
 - Implement a streaming data interface, based on the AXI4S standard, to receive data that will be written to the NVMe device. Implement a readout and control interface based on AIX-4 Lite or Wishbone standards to set up and control operation of the core and read data from the NVMe device.
 - Implement a simple FPGA IP test harness and Linux host software test system to send and receive data from the NVMe. This would provide statistics such as overall data rate and latency figures as well as validate the data passed through the NVMe devices.
 - Test a minimum of two vendors/types of NVMe devices using the test rig.
 - Perform a minimum of two long-term tests to check reliability and longer-term performance.
 - Document the IP and produce a firmware/software package.
- **Scope**
 - Supply of Firmware source code in a suitable format
 - Supply of Documentation (description of major blocks, description of the two interfaces, including memory map for AXI-4 Lite/Wishbone)
 - Demonstration in hardware (as specified in likely equipment including the ability to generate FPGA configuration file for demonstration from source code)
- **Requirement**
 - 8.1 Technical Solution**
 - Supply of firmware source code to write from Xilinx 7 series Ultrascale+ FPGAs to NVMe devices.
 - Supply of firmware software to exercise the functionality of the NVMe firmware.
 - Firmware will be targeted for Xilinx 7 series Ultrascale or Ultrascale Plus FPGAs.
 - Firmware will be targeted at programmable logic only (i.e. no use of Zynq ARM cores).
 - Data shall be written in continuous bursts.
 - The maximum burst length can either be a programmable parameter or used at synthesis time.
 - The burst length will be between 20GBytes and 200GBytes.
 - The firmware should be able to cope with up to two separate bursts of data stored to NVMe.
 - The third burst will overwrite the first, the fourth burst the second, etc.
 - The maximum write speed should be limited by the NVMe drive, not the firmware.
 - It shall be possible to instantiate more than one NVMe interface in an FPGA (the expectation is two NVMe devices per FPGA)

- The FPGA resources used shall be such that it is possible to instantiate at least two NVMe interfaces in a Kintex KU11P device.
- The interface for data writing will be AXI-4 Stream.
- The interface for data reading should be AXI-4 Lite or Wishbone.
- Writing data takes priority over reading data; Firmware should switch to write mode without data loss even when reading is taking place.
- The readout can be “block oriented” with a register written to indicate what block should be read and a status register to indicate that the block has been read to memory buffer.
- It should be possible to read data at an average speed of 100MBit/s or greater.
- The same interface can be used for setup and control and for reading data.
- Functionality (for example, setting up drive, preparing lists of blocks to write, etc.) can be moved between the firmware and software but an “end-to-end” implementation should be demonstrated for setup, monitoring, writing and reading.

8.2 Solution Testing

- A demonstration of the firmware and software must be supplied running on an Evaluation FPGA board as specified in the likely equipment section above or equivalent.
- All features of the solution must be tested including automated highly accelerated lifetime testing. The test scripts/software to test the solution must be provided to DUNE.
- Test write speed to NVMe device (new) shall be minimum 2GB/s and be sustained for 100GB blocks).
- Test reading shall back data and shall verify no data corruption.
- Correct handling of simultaneous read and write requests must be tested. (Writing data shall override data reading.)

8.3 Code Quality

- The supplier must utilise a coding convention. Details of the coding convention used must be shared with DUNE.
- The supplier shall ensure code readability (i.e. the supplier must have procedures in place for ensuring code quality.).
- Test-benches shall be utilised to test functionality of individual code blocks. These test benches must be shared with DUNE

8.4 Knowledge Sharing

- Firmware and software shall be supplied in source code form.
- Firmware and software may be released by the DUNE collaboration as Open Source (license TBD) or retained within the collaboration.
- Regardless of method of release and licensing both DUNE and the supplier will retain permanent irrevocable license to use and develop the firmware and software.
- Firmware and software must be as unencumbered as possible by patent and license restrictions. (For example, if a soft-core microprocessor is used it should be Open Source).

- Documentation about the structure of the firmware and software should be provided to enable maintenance by DUNE.
- There shall be regular meetings between a member of the DUNE team and the supplier to discuss progress and technical details (not less than one per month, unless by mutual agreement)
- There may be a member of the DUNE DAQ firmware development team permanently allocated to liaise with the supplier. In this case meetings will be expected to be more frequent (by mutual agreement).
- The supplier should provide on-going support to the DUNE collaboration with up to 3 staff days of effort spread over up to 3 months from delivery of the firmware.

9 Timetable

The contract shall cover a six (6) month period and the deliverables as outlined in the scope section of this specification must be delivered within that period commencing on the date the contract is awarded.

Schedule 3

Charges

- 1 The Charges for the Goods and/or Services shall be as set out in this Schedule 3.
- 2 The Charges for the Goods and/or Services are set out in the Appendix to this Schedule 3.
- 3 Where the Services are to be provided on a time and materials basis, the Charges for those Services will be calculated as follows:
 - (a) the charges payable for the Services will be calculated in accordance with the Supplier's day rates as follows:

[Day rates to be inserted]
 - (b) the Supplier's day rates for each individual person are calculated on the basis of an eight-hour day worked between such hours and on such days as are agreed by UKRI and the Supplier;
 - (c) the Supplier will not be entitled to charge pro-rata for part days without the prior written consent of UKRI;
 - (d) the Supplier will ensure that every individual whom it engages to perform the Services completes time sheets recording time spent on the Services and the

Supplier will use such time sheets to calculate the charges covered by each invoice and will provide copies of such time sheets to UKRI upon request; and

- (e) the Supplier will invoice UKRI monthly in arrears for its charges for time, as well as any previously agreed expenses and materials for the month concerned calculated as provided in this paragraph 3 and paragraph 4.

Expenses

- 4 UKRI will reimburse the Supplier at cost for all reasonable travel, subsistence and other expenses incurred by individuals engaged by the Supplier in providing the Services to UKRI provided that UKRI's prior written approval is obtained before incurring any such expenses, that all invoices for such expenses are accompanied by valid receipts and provided that the Supplier complies at all times with UKRI's expenses policy from time to time in force.