UK Research and Innovation

Telespazio UK Limited

350 Capability Green,
Luton, LU1 3LU

United Kingdom

FOIA Section 40 Personal Information

Date: 8th December 2023

Our ref: UKRI-3142

Dear FOIA Section 40 Personal Information

Award of contract for the supply of UKRI-3142 EO DataHub Platform Software Development and Operations

Following your tender/proposal for the supply of UKRI-3142 EO DataHub Platform Software Development and Operations 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) **Telespazio UK Limited**, 350 Capability Green, Luton, LU1 3LU, United Kingdom (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 the contract set out in Schedule 1 to this Award Letter (the "**Conditions**"). Please do not attach any Supplier terms and conditions to this Award Letter as they will not be accepted by UKRI and may delay the conclusion of the Contract.

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

Term

1 Commencement Date: Monday 11th November 2023

2 Expiry Date: Monday 31st March 2025

Description of Goods and/or Services

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

Charges & Payment

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

5 All invoices should be sent, quoting a valid purchase order number (PO Number) provided by UKRI, to: Finance@uksbs.co.uk.

6 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 01793 867004 between 09:00-17:00 Monday to Friday.

Supplier's Liability

7 Pursuant to clause 20.4, the Supplier's Limit of Liability under this Contract shall be: 125% of the total Charges paid and payable to the Supplier under this Contract.

Notices

8 The address for notices of the Parties are:

UKRI	**Telespazio UK Limited**
Polaris House, North Star Avenue, Swindon, England, SN2 1FL	350 Capability Green, Luton, LU1 3LU, United Kingdom
Attention: FOIA Section 40 Personal Information	FOIA Section 40 Personal Information
Email: commercial@ukri.org	

Liaison & Disputes

9 For general liaison your contact will continue to be FOIA Section 40 Personal Information FOIA Section 40 Personal Information or, in their absence, FOIA Section 40 Personal Information FOIA Section 40 Personal Information

10 Pursuant to Clause 32.3, Disputes shall be escalated to the following individuals:

(a) Stage 1 escalation:

UKRI: Commercial Business Partner

Supplier: FOIA Section 40 Personal Information

(b) Stage 2 escalation:

UKRI: FOIA Section 40 Personal Information

Supplier: FOIA Section 40 Personal Information

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 FOIA Section 40 Personal Information 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: FOIA Section 40 Personal Information

Name:

Position:

Date: 21/12/23

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

Signed for and on behalf of **Telespazio UK Limited**

Signature: FOIA Section 40 Personal Information

Name:

Position:

Date: 20th December 2023

Schedule 1 - The Conditions

1 INTERPRETATION

1.1 **Definitions.** In the Contract (as defined below), the following definitions apply:

Award Letter: means the letter from UKRI to the Supplier printed above these terms and conditions;

Change in Law: any change in Law which impacts on the performance of the Goods and/or Services which comes into force after the Commencement Date;

Charges: the charges payable by UKRI for the supply of the Goods and/or Services as specified in Schedule 3;

Commencement Date: means the date for the start of the Contract as set out in the Award Letter;

Confidential Information: means:

(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);

but not including any information which:

(i) was in the possession of the Receiving Party without a breach of an obligation of confidentiality prior to its disclosure by the Disclosing Party;

(ii) the Receiving Party obtained on a non-confidential basis from a third party who is not, to the Receiving Party's knowledge or belief, bound by a confidentiality agreement with the Disclosing Party or otherwise prohibited from disclosing the information to the Receiving Party;

(iii) was already generally available and in the public domain at the time of disclosure otherwise than by a breach of this Contract or breach of a duty of confidentiality;

(iv) was independently developed without access to the Confidential Information; or

(v) relates to the Supplier's performance under this Contract or failure to pay any sub-contractor as required pursuant to clause 10.9;

Contract: means the contract between UKRI and the Supplier constituted by the Supplier's countersignature of the Award Letter and includes the Award Letter and Schedules;

Essentials Questionnaire: UKRI's questionnaire for suppliers regarding their cyber security arrangements, a copy of which is available from UKRI on request; **Cyber**

Data Protection Legislation: means, for the periods in 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), the GDPR 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;

Declaration of Ineffectiveness: a declaration made by a Court under regulation 98 which has any of the consequences described in regulation 101 of the Public Contracts

Regulations 2015 (as amended) or which is made under an equivalent provision implementing Directive 2014/23/EU in England, Wales & Northern Ireland and which has consequences which are similar to any of the consequences described in regulation 101 of the Public Contracts Regulations 2015 (as amended);

Deliver: means hand over of the Goods to UKRI at the address(es) specified in the Specification (or otherwise agreed in writing by the Parties) and on the Delivery Date, which shall include unloading and any other specific arrangement agreed in accordance with clause 6. “Delivered”, “Delivery” and “Deliveries” shall be construed accordingly;

Deliverables: all Documents, products and materials developed by the Supplier or its agents, contractors and employees as part of, or in relation to, the Services in any form, including computer programs, data, reports and specifications (including drafts);

Delivery Date: the date for delivery of the Goods specified by UKRI in writing and if no such date is specified, within 28 days of the date of UKRI’s written request;

Delivery Note: means a note produced by the Supplier accompanying each delivery of the Goods which shows the date of the order, the order number (if any), the type and quantity of the Goods (including the code number of the Goods, where applicable), special storage instructions (if any) and, if the Goods are being delivered by instalments, the outstanding balance of Goods remaining to be delivered;

Disclosing Party: means a Party that makes a disclosure of Confidential Information to another Party;

Dispute: means any dispute, conflict or disagreement arising out of or in connection with this Contract;

Document: includes, in addition to any document in writing, any drawing, map, plan, diagram, design, picture or other image, tape, disk or other device or record embodying information in any form.

EIR: the Environmental Information Regulations 2004 (or if applicable the Environmental Information Regulations (Scotland) 2004) together with any guidance and/or codes of practice issued by the Information Commissioner or relevant government department in relation to such regulations;

Expiry Date: means the date for expiry of the Contract as set out in the Award Letter;

FOIA: the Freedom of Information Act 2000 (or if applicable the Freedom of Information (Scotland) Act 2002) and any subordinate legislation made under the Act from time to time, together with any guidance and/or codes of practice issued by the Information Commissioner or relevant government department in relation to such legislation;

Force Majeure Event: shall be limited to one or more of the following events: hurricanes, tempest, acts of state or public enemy, wars, revolutions, uprisings, hostilities, civil disturbances, riots, civil war, insurrection and invasion. For the avoidance of doubt, strikes, lockouts and shutdowns of a Party (or of any person engaged by any of them) shall not be a force majeure event for that Party;

GDPR: means:

(a) the General Data Protection Regulations (Regulation (EU) 2016/679) which came into force on 25 May 2018; or

(b) any equivalent legislation amending or replacing the General Data Protection Regulations (Regulation (EU) 2016/679);

General Change in Law: a Change in Law where the change is of a general legislative nature (including taxation or duties of any sort affecting the Supplier) or which affects or relates to the supply of goods and/or services to another customer of the Supplier that are the same or similar to any of the Goods and/or Services;

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 supplies substantially similar to the Goods to customers of a substantially similar size and nature to UKRI;

Goods: means the goods to be supplied by the Supplier to UKRI, under the Contract as set out in the Specification;

Information: has the meaning given under section 84 of FOIA;

Intellectual Property Rights: all patents, rights to inventions, utility models, copyright and related rights (including moral rights), trademarks, service marks, trade, business and domain names, rights in trade dress or get-up, rights in goodwill or to sue for passing off, unfair competition rights, rights in designs, rights in computer software, database right, topography rights, rights in confidential information (including know-how and trade secrets) and any other intellectual property rights, in each case whether registered or unregistered

and including all applications for and renewals or extensions of such rights, and all similar or equivalent rights or forms of protection in any part of the world;

Key Personnel: means any persons specified as such in Schedule 4 or otherwise notified as such by UKRI to the Supplier in writing;

Law: means any law, statute, subordinate legislation within the meaning of section 21(1) of the Interpretation Act 1978, bye-law, enforceable right within the meaning of section 2 of the European Communities Act 1972 and section 4 of the European Union (Withdrawal Act 2018, regulation, order, mandatory guidance or code of practice, judgment of a relevant court of law, or directives or requirements of any regulatory body, with which UKRI and the Supplier (as the context requires) is bound to comply;

Limit of Liability: means the Supplier's limit of liability identified in the Award Letter;

Notifiable Breach: has the meaning set out at clause 8.3;

Party: the Supplier or UKRI (as appropriate) and "Parties" shall mean both of them;

Personal Data: has the meaning given to this term by the Data Protection Legislation;

Personal Data Breach: shall have the same meaning as in the Data Protection Legislation;

PO Number: means UKRI's unique number relating to the supply of the Goods and/or Services;

Public Body: any part of the government of the United Kingdom including but not limited to the Northern Ireland Assembly and Executive Committee, the Scottish Executive and the National Assembly for Wales, local authorities, government ministers and government departments and government agencies;

Public Procurement Termination Event: UKRI exercises its right to terminate the Contract in one or more of the circumstances described in either regulation 73(1) of the Public Contracts Regulations 2015 (as amended from time to time), or equivalent provisions implementing Directive 2014/23/EU in England, Wales & Northern Ireland (as amended from time to time);

Receiving Party: means a Party to which a disclosure of Confidential Information is made by another Party;

Remediation Plan: means a report identifying:

(a) the nature of the Notifiable Breach described at clause 8.3, its cause and its anticipated duration and impact on the Contract; and

(b) the procedures and resources the Supplier proposes to apply to overcome and rectify the Notifiable Breach and to ensure the impact of the Notifiable Breach is minimised and future performance of the Contract is not adversely affected;

Request for Information: a request for Information or an apparent request under FOIA or EIR;

Services: the services, including without limitation any Deliverables, to be provided by the Supplier to UKRI under the Contract as set out in the Specification;

SME: as defined by EU recommendation 2003/361/EC;

Specification: the description of the Goods and / or Services to be provided under this Contract as set out in Schedule 2;

Specific Change in Law: a Change in Law that relates specifically to the business of UKRI and which would not affect the supply of goods and/or services to another customer of the Supplier that are the same or similar to any of the Goods and/or Services;

Supplier's Associate: any individual or entity associated with the Supplier including, without limitation, the Supplier's subsidiary, affiliated or holding companies and any employees, agents or contractors of the Supplier and / or its subsidiary, affiliated or holding companies or any entity that provides Goods and or Services for or on behalf of the Supplier;

Supplier Dispute: means any disputes, claims, litigation, mediation or arbitration whether threatened or pending in relation to any incident involving the Supplier's, or another party's, provision of the Goods and/or Services;

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: the Transfer of Undertakings (Protection of Employment) Regulations 2006 as amended or replaced from time to time;

Working Day: 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 this Contract, unless the context requires otherwise, the following rules apply:

(a) A person includes a natural person, corporate or unincorporated body (whether or not having separate legal personality).

(b) A reference to a party includes its personal representatives, successors or permitted assigns.

(c) A reference to any Law is a reference to Law as amended or re-enacted. A reference to a Law includes any subordinate legislation made under that Law, as amended or re-enacted.

(d) Any phrase introduced by the terms including, include, in particular or any similar expression shall be construed as illustrative and shall not limit the sense of the words preceding those terms.

(e) The headings in the Contract are for ease of reference only and do not affect the interpretation or construction of the Contract.

(f) A reference to writing or written includes e-mails.

(g) A reference to numbered clauses are references to the relevant clause in this Contract.

(h) 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.

2 BASIS OF CONTRACT

2.1 The Contract comprises of the Award Letter and its Schedules, to the exclusion of all other terms and conditions, including any other terms that the Supplier seeks to impose or

incorporate (whether in any quotation, confirmation of order, invoice, in correspondence or in any other context), or which are implied by trade, custom, practice or course of dealing.

2.2 If there is any conflict or inconsistency between the Award Letter and its Schedules, the provisions of the Award Letter will prevail followed by the Conditions in this Schedule 1 to the extent necessary to resolve that conflict or inconsistency.

3 TERM

3.1 This Contract shall take effect on the Commencement Date and shall expire on the Expiry Date, unless it is otherwise extended or terminated in accordance with the terms and conditions of this Contract.

4 SUPPLY OF SERVICES

4.1 In consideration of UKRI's agreement to pay the Charges, the Supplier shall for the Term provide the Services to UKRI in accordance with the terms of this Contract.

4.2 The Supplier shall meet any performance dates for the Services (including the delivery of Deliverables) specified in the Specification or notified to the Supplier by UKRI.

4.3 In providing the Services, the Supplier shall:

(a) co-operate with UKRI in all matters relating to the Services, and comply with all instructions of UKRI using reasonable endeavours to promote UKRI's interests;

(b) perform the Services with reasonable skill, care and diligence in accordance with Good Industry Practice in the Supplier's industry, profession or trade;

(c) 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 this Contract;

(d) ensure that the Services and Deliverables will conform with the Specifications and that the Deliverables shall be fit for any purpose expressly or impliedly made known to the Supplier by UKRI;

(e) provide all equipment, tools and vehicles and such other items as are required to provide the Services;

(f) use goods, materials, standards and techniques, and ensure that the Deliverables, and all goods and materials supplied and used in the Services or transferred to UKRI are of a quality in line with Good Industry Practice and are free from defects in workmanship, installation and design;

(g) obtain and at all times maintain all necessary licences and consents, and comply with all applicable laws and regulations;

(h) 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;

(i) observe all health and safety rules and regulations and any other security requirements that apply at any of UKRI's premises; and

(j) not do or omit to do anything which may cause UKRI to lose any licence, authority, consent or permission on which it relies for the purposes of conducting its business, and the Supplier acknowledges that UKRI may rely or act on the Services.

4.4 UKRI's rights under this Contract are without prejudice to and in addition to the statutory terms implied in favour of UKRI under the Supply of Goods and Services Act 1982 and any other applicable legislation as amended.

5 SUPPLY OF GOODS

5.1 In consideration of UKRI's agreement to pay the Charges, the Supplier shall supply all Goods in accordance with the Contract. In particular, the Supplier warrants that the Goods shall:

(a) conform with their description in 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;

(b) be of satisfactory quality (within the meaning of the Sale of Goods Act 1979) and 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 shall not relieve the Supplier of any of its obligations under this sub-clause;

(c) where applicable, be free from defects (manifest or latent), in materials and workmanship and remain so for 12 months after Delivery;

(d) be free from design defects;

(e) comply with all applicable statutory and regulatory requirements relating to the manufacture, labelling, packaging, storage, handling and delivery of the Goods;

(f) be supplied in accordance with all applicable legislation in force from time to time; and

(g) be destined for supply into, and fully compliant for use in, the United Kingdom (unless specifically stated otherwise in the Specification).

5.2 In supplying the Goods, the Supplier shall co-operate with UKRI in all matters relating to the supply of the Goods and comply with all of UKRI's instructions.

5.3 The Supplier shall ensure that at all times it has and maintains all the licences, permissions, authorisations, consents and permits that it needs to carry out its obligations under the Contract.

5.4 UKRI and its representatives shall have the right to inspect and test the Goods at any time before Delivery.

5.5 If following such inspection or testing UKRI considers that the Goods do not conform or are unlikely to comply with the Supplier's undertakings at clause 5.1, UKRI shall inform the Supplier and the Supplier shall immediately take such remedial action as is necessary to ensure compliance.

5.6 Notwithstanding any such inspection or testing, the Supplier shall remain fully responsible for the Goods and any such inspection or testing shall not reduce or otherwise affect the Supplier's obligations under this Contract, and UKRI shall have the right to conduct further inspections and tests after the Supplier has carried out its remedial actions.

5.7 UKRI's rights under the Contract are without prejudice to and in addition to the statutory terms implied in favour of UKRI under the Sale of Goods Act 1979, the Supply of Goods and Services Act 1982 and any other applicable legislation as amended.

6 DELIVERY

6.1 Unless otherwise agreed in writing by UKRI, the Supplier shall Deliver the Goods to UKRI on the Delivery Date (with the carriage paid) to the address(es) specified in the Specification and in accordance with any other Delivery instructions provided to the Supplier.

6.2 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 (as well as any other specific arrangement agreed by the Parties has taken place) and UKRI has signed for the Delivery. The Supplier will unload the Goods at its own risk as directed by UKRI. The Goods will remain at the risk of the Supplier until Delivery to UKRI (including unloading) is complete and the Supplier has obtained sign-off of the Delivery Note by or on behalf of UKRI.

6.3 Unless otherwise stipulated by UKRI in writing to the Supplier, Deliveries shall only be accepted by UKRI on Working Days and during normal business hours.

6.4 The Supplier shall ensure that:

(a) the Goods are properly packed and secured in such manner as to enable them to reach their destination in good condition:

(b) each delivery of the Goods is accompanied by a Delivery Note; and

(c) if the Supplier requires UKRI to return any packaging material to the Supplier, that fact is clearly stated on the Delivery Note. Any such packaging material shall be returned to the Supplier at the Supplier's cost.

6.5 If the Supplier delivers to UKRI more than the quantity of Goods ordered, UKRI will not be bound to pay for the excess and any excess will remain at the Supplier's risk and will be returnable to the Supplier at the Supplier's expense.

6.6 If the Supplier delivers less than the quantity of Goods ordered, and UKRI accepts the delivery, a pro-rata adjustment shall be made to the invoice for the Goods.

6.7 The Supplier shall not deliver the Goods in instalments without prior written consent from UKRI. Where it is agreed that the Goods are to be delivered in instalments, they may be invoiced and paid for separately.

6.8 The Supplier shall:

(a) obtain, at its risk and expense, any export and import licences or other authorisations necessary for the export and import of the Goods and their transit through any country or territory; and

(b) deal with all customs formalities necessary for the export, import and transit of the Goods, and will bear the costs of complying with those formalities and all duties, taxes and other charges payable for export, import and transit.

6.9 Without prejudice to UKRI's statutory rights, UKRI will not be deemed to have accepted any Goods until it has had at least 14 Working Days after Delivery to inspect them and UKRI also has the right to reject any Goods as though they had not been accepted for 14 Working Days after any latent defect in the Goods has become apparent.

6.10 Without prejudice to clause 13.1, 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, 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 the Staff.

7 TITLE, RISK AND USE

7.1 Without prejudice to any other rights or remedies of UKRI, title and risk in the Goods shall pass to UKRI on completion of Delivery.

7.2 The Supplier warrants that:

(a) it has full clear and unencumbered title to the Goods;

(b) at the Delivery Date of any of the Goods it shall have full have 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 REMEDIES

8.1 UKRI's rights and remedies under the Contract are in addition to its rights and remedies implied by statute and common law.

8.2 Where (i) the Supplier fails to Deliver the Goods or part of the Goods including any instalment(s) or (ii) the Goods or part of the Goods do not comply with the provisions of clause 5 then without limiting any of its other rights or remedies in this Contract or implied by statute or common law, UKRI shall be entitled to:

(a) terminate the Contract in whole or in part without liability to the Supplier;

(b) accept late delivery of the Goods;

(c) require the Supplier, free of charge, to deliver substitute Goods within the timescales specified by UKRI;

(d) require the Supplier, free of charge, to repair or replace the rejected Goods, or to provide a full refund of the price of the rejected Goods (if paid);

(e) 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;

(f) buy the same or similar goods from another supplier; and

(g) 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.

8.3 Without prejudice to any of its other rights or remedies in this Contract or implied by statute or common law, in the event that:

(a) UKRI considers the Supplier is in breach of, or is likely to breach, clause 4.2 and the breach is capable of remedy; or

(b) the Supplier commits a breach of clause 4.3 which is capable of remedy,

(each a "**Notifiable Breach**"), the Supplier must as soon as practicable but in any event within 5 Working Days (or as otherwise agreed by UKRI) of being notified by UKRI of the Notifiable Breach, submit a draft Remediation Plan to UKRI for approval. UKRI may, acting reasonably, consider the draft Remediation Plan as inadequate to rectify the Notifiable Breach and reject the draft, in which case the Supplier shall submit a revised Remediation Plan to UKRI for review within 3 Working Days (or as otherwise agreed by UKRI) of UKRI's

notice rejecting the draft. Once the Remediation Plan is approved, the Supplier shall immediately start work on the actions set out in the approved Remediation Plan.

8.4 Where the Supplier fails to provide a Remediation Plan in accordance with the timescales specified in clause 8.3 or fails to comply with any approved Rectification Plan, UKRI shall be entitled to:

(a) terminate the Contract with immediate effect by giving written notice to the Supplier;

(b) recover from the Supplier any costs incurred by UKRI in performing the Services itself or obtaining substitute services from a third party;

(c) a refund of the Charges paid in advance for Services that have not been provided by the Supplier; and

(d) claim damages for any additional costs, loss or expenses incurred by UKRI which are in any way attributable to the Notifiable Breach and the Supplier's failure as described in this clause 8.4.

8.5 This Contract shall apply to any repaired or replacement Goods and any substituted or remedial Services provided by the Supplier.

9 UKRI OBLIGATIONS

9.1 UKRI shall:

(a) provide the Supplier with reasonable access at reasonable times to UKRI's premises for the purpose of providing the Goods and/or Services; and

(b) provide such information to the Supplier as the Supplier may reasonably request and UKRI considers reasonably necessary for the purpose of providing the Goods and/or Services.

10 CHARGES AND PAYMENT

10.1 The Charges for the Goods and/or Services are set out in Schedule 3, 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 provision of the Goods and/or performance of the Services.

10.2 All amounts stated are exclusive of VAT which shall be charged at the prevailing rate where applicable. UKRI shall, where applicable and 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.

10.3 The Supplier shall invoice UKRI at the times specified in Schedule 3 and in accordance with this clause 10. If an invoicing schedule is not specified in Schedule 3, the Supplier shall invoice UKRI on or after the Delivery of the Goods or completion of the Services.

10.4 Each invoice shall include such supporting information required by UKRI to verify the accuracy of the invoice, including the relevant PO Number and a breakdown of the Goods and/or Services supplied in the invoice period as well as appropriate details in order to allow for payment via BACS transfer (sort code and bank account details).

10.5 In consideration of the supply of the Goods and/or Services by the Supplier, UKRI shall pay the invoiced amounts within 30 days of the date of a correctly rendered invoice after verifying that the invoice is valid and undisputed. Payment shall be made to the bank account nominated in writing by the Supplier unless UKRI agrees in writing to another payment method.

10.6 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 10.5 after a reasonable time has passed (which shall be no less than 14 calendar days).

10.7 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 this Contract for a failure to pay undisputed invoice in accordance with clause 21.5. Any disputed invoices shall be resolved through the dispute resolution procedure detailed in Clause 32.

10.8 If a payment of an undisputed invoice is not made by UKRI by the due date, then UKRI shall pay the Supplier interest at the interest rate specified in the Late Payment of Commercial Debts (Interest) Act 1998, accruing on a daily basis from the due date up to the date of actual payment, whether before or after judgment.

10.9 Where the Supplier enters into a sub-contract, the Supplier shall include in that sub-contract:

(a) provisions having the same effects as clauses 10.3 to 10.8 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 effect as 10.3 to 10.9 of this Contract.

(c) In this clause 10.9, "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.

10.10 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. 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.

11 TAXATION OBLIGATIONS OF THE SUPPLIER

11.1 The Supplier shall be fully responsible for all its own tax including any national insurance contributions arising from supplying the Goods and/or Services.

11.2 The Supplier shall indemnify, and shall keep indemnified, UKRI in full against all costs, claims, expenses, damages and losses, including any interest, penalties, fines, legal and other professional fees and expenses awarded against or incurred or paid by UKRI as a result of the Supplier's failure to account for or pay any taxes including any national insurance contributions.

12 UKRI PROPERTY

12.1 The Supplier acknowledges that all information (including UKRI's Confidential Information), equipment and tools, drawings, specifications, data, software and any other materials supplied by UKRI (or its agents on behalf of UKRI) to the Supplier ("UKRI's Materials") and all rights in UKRI's Materials are and shall remain at all times the exclusive property of UKRI. The Supplier shall keep UKRI's Materials in safe custody at its own risk, maintain them in good condition until returned to UKRI, and not dispose or use the same other than for the sole purpose of performing the Supplier's obligations under the Contract and in accordance with written instructions or authorisation from UKRI.

12.2 UKRI's Materials shall be returned promptly to UKRI on expiry or termination of the Contract.

12.3 The Supplier shall reimburse UKRI for any loss or damage to UKRI's Materials (other than deterioration resulting from normal and proper use) caused by the Supplier or any Staff. UKRI's Materials supplied by UKRI (or its agents on behalf of UKRI) shall be deemed to be in a good condition when received by the Supplier or relevant Staff unless UKRI is notified otherwise in writing within 5 Working Days.

13 PREMISES

13.1 If, in connection with the supply of the Goods and/or Services, UKRI permits any Staff to have access to any of UKRI's premises, the Supplier will ensure that, whilst on UKRI's premises, the Staff comply with:

(a) all applicable health and safety, security, environmental and other legislation which may be in force from time to time; and

(b) any UKRI policy, regulation, code of practice or instruction relating to health and safety, security, the environment or access to and use of any UKRI laboratory, facility or equipment which is brought to their attention or given to them whilst they are on UKRI's premises by any employee or representative of UKRI.

13.2 All equipment, tools and vehicles brought onto UKRI's premises by the Supplier or the Staff shall be at the Supplier's risk.

13.3 If the Supplier supplies all or any of the Goods and/or Services at or from UKRI's premises, on completion of the Goods and/or Services or termination or expiry of the Contract (whichever is the earlier) the Supplier shall vacate UKRI's premises, remove the Supplier's plant, equipment and unused materials and all rubbish arising out of the provision of the Goods and/or Services and leave UKRI's premises in a clean, safe and tidy condition. The Supplier shall be solely responsible for making good any damage to UKRI's premises or any objects contained on UKRI's premises which is caused by the Supplier or any Staff, other than fair wear and tear.

13.4 If the Supplier supplies all or any of the Goods and/or Services at or from its premises or the premises of a third party, UKRI may, during normal business hours and on reasonable notice, inspect and examine the manner in which the relevant Goods and/or Services are supplied at or from the relevant premises.

14 STAFF AND KEY PERSONNEL

14.1 If UKRI 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.

14.2 The Supplier shall:

(a) ensure that all Staff are vetted in accordance with the Staff Vetting Procedures;

(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 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.

14.3 Any Key Personnel shall not be released from supplying the Goods and/or Services without the agreement of UKRI, except by reason of long-term sickness, maternity leave, paternity leave, termination of employment or other extenuating circumstances.

14.4 Any replacement to the Key Personnel shall be subject to the prior written agreement of UKRI (not to be unreasonably withheld). Such replacements shall be of at least equal status

or of equivalent experience and skills to the Key Personnel being replaced and be suitable for the responsibilities of that person in relation to the Goods and/or Services.

15 TUPE

15.1 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.

16 ASSIGNMENT AND SUB-CONTRACTING

16.1 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.

16.2 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.

16.3 UKRI may (without any cost to or liability of UKRI) require the Supplier to replace any subcontractor where in the reasonable opinion of UKRI any mandatory or discretionary grounds for exclusion referred to in Regulation 57 of the Public Contracts Regulations 2015 (as amended) apply to the subcontractors.

16.4 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.

17 INTELLECTUAL PROPERTY RIGHTS

17.1 All Intellectual Property Rights in any materials created or developed by the Supplier pursuant to this Contract or arising as a result of the supply of the Goods and/or Services, including the Deliverables, 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).

17.2 The Supplier shall obtain waivers of all moral rights in the products, including for the avoidance of doubt the Deliverables, of the Services to which any individual is now or may be at any future time entitled under Chapter IV of Part I of the Copyright Designs and Patents Act 1988 or any similar provisions of law in any jurisdiction.

17.3 The Supplier shall, promptly at the request of UKRI, do (or procure to be done) all such further acts and things and execute all such other documents as UKRI may from time to time require for the purpose of securing for UKRI the full benefit of the Contract, including all rights, title and interest in and to the Intellectual Property Rights assigned to UKRI in accordance with clause 17.1.

17.4 All Intellectual Property Rights in any materials provided by UKRI to the Supplier shall remain the property of UKRI. UKRI hereby grants the Supplier a royalty-free, non-exclusive and non-transferable licence to use:

(a) any Intellectual Property Rights in the materials provided by UKRI to the Supplier;

(b) any Intellectual Property Rights in the materials created or developed by the Supplier pursuant to this 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.

17.5 Without prejudice to clause 17.1, the Supplier hereby grants UKRI a perpetual, royalty-free, irrevocable and non-exclusive licence (with a right to sub-license) to use:

(a) any Intellectual Property Rights vested in or licensed to the Supplier on the date of this Contract to the extent not falling within clause 17.1; and

(b) any Intellectual Property Rights created during the Term to the extent not falling within clause 17.1,

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.

17.6 Intellectual Property: we declare the use of Background IPR (BIPR) as follows in the below table and are prepared to provide evidence of such rights, their origin and ownership to STFC if requested:

Proprietary Information	Owner	Description	Patent # or Ref. / Issue / Revision / Version #	Contract / Funding Details under which the IPR was created	Date of creation of the version of the BIPR listed here	Affected deliverable	Description of impact on STFC rights	Protected Format (Y/N)

18 INDEMNITY

18.1 The Supplier shall indemnify, and shall keep indemnified, UKRI in full against all costs, claims, expenses, damages and losses (whether direct or indirect to include loss of profits, loss of business, depletion of good will and similar losses), including any interest, penalties, fines, legal and other professional fees and expenses awarded against or incurred or paid by UKRI as a result of or in connection with:

(a) the Supplier's breach or negligent performance or non-performance of this Contract;

(b) any claim brought against UKRI for actual or alleged infringement of a third party's Intellectual Property Rights arising out of, or in connection with, the manufacture, receipt, use or supply of the Goods and/or Services, to the extent that the claim is attributable to the acts or omissions of the Supplier or any Staff;

(c) any claim made against UKRI by a third party for death, personal injury or damage to property arising out of, or in connection with, defects in Goods and/or Services, to the extent that the defect in the Goods and/or Services is attributable to the acts or omissions of the Supplier and the Staff; and

(d) any claim whether in tort, contract, statutory or otherwise, demands, actions, proceedings and any awards arising from a breach by the Supplier of clause 15 of the Contract.

18.2 This clause 18 shall survive termination or expiry of the Contract.

19 INSURANCE

19.1 Unless otherwise specified in the Award Letter, during the Term of the Contract and for a period of 6 years thereafter, the Supplier shall maintain in force the following insurance policies with reputable insurance companies to insure the Supplier against all manner of risks that might arise out of the acts or omissions of the Supplier or otherwise in connection with the Supplier's performance of its obligations under this Contract.

(a) Professional indemnity insurance for not less than £2 million per claim;

(b) loss, damage or destruction of any of UKRI's property under the custody and control of the Supplier, with a minimum sum insured of £5 million per claim;

(c) public liability insurance for not less than £5 million per claim;

(d) employer liability insurance for not less than £5 million per claim; and

The Supplier shall ensure that UKRI's interest is noted on each insurance policy, or that a generic interest clause has been included.

19.2 On request from UKRI, the Supplier shall provide UKRI with copies of the insurance policy certificates and details of the cover provided.

19.3 From the Commencement Date, the Supplier shall notify UKRI in writing of any employer's liability or public liability incident arising out of or in connection with this Contract which:

(a) has the potential to exceed £25,000 (twenty-five thousand pounds sterling) (excluding costs); and/or

(b) irrespective of the claim's value, which may reasonably be considered to have the potential to adversely affect the reputation of UKRI,

within five (5) days of such an incident occurring.

19.4 The Supplier shall keep UKRI informed and up-to-date on the progress of any incident referred to in clause 19.3 and related claims, decisions taken in respect of liability and any movement of reserves with respect thereto.

19.5 The Supplier shall ensure that any subcontractors also maintain adequate insurance having regard to the obligations under the Contract which they are contracted to fulfil.

19.6 The Supplier shall:

(a) do nothing to invalidate any insurance policy or to prejudice UKRI's entitlement under it; and

(b) notify UKRI if any policy is (or will be) cancelled or its terms are (or will be) subject to any material change.

19.7 The Supplier's liabilities under the Contract shall not be deemed to be released or limited by the Supplier taking out the insurance policies referred to in clause 19.1.

19.8 If the Supplier fails or is unable to maintain insurance in accordance with clause 19.1, UKRI may, so far as it is able, purchase such alternative insurance cover as it deems to be reasonably necessary and shall be entitled to recover all reasonable costs and expenses it incurs in doing so from the Supplier.

20 LIABILITY

20.1 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.

20.2 Subject to clause 20.6, UKRI shall not have any liability for:

(a) any indirect or consequential loss or damage;

(b) any loss of business, rent, profit or anticipated savings;

(c) any damage to goodwill or reputation;

(d) loss, theft, damage or destruction to any equipment, tools, machinery, vehicles or other equipment brought onto UKRI's premises by or on behalf of the Supplier; or

(e) any loss, damage, costs or expenses suffered or incurred by any third party.

20.3 Subject to clause 20.6, 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 tortuous or statutory), tort (including negligence), breach of statutory duty or otherwise shall in no event exceed 100% of the Charges paid or payable to the Supplier.

20.4 Subject always to clause 20.5 and 20.6, the Supplier's aggregate liability 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 Services, misrepresentation (whether tortuous or statutory), tort (including negligence), breach of statutory duty or otherwise shall in no event exceed the Limit of Liability.

20.5 The Supplier's liability under the indemnity in clause 18.1(b), 29.1 and 27.7 shall be unlimited.

20.6 Nothing in the Contract restricts either Party's liability for:

(a) death or personal injury resulting from its negligence or that of its Staff; or

(b) its fraud (including fraudulent misrepresentation) by it or that of its Staff; or

(c) breach of any obligations 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.

21 TERMINATION

21.1 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.

21.2 UKRI may terminate the Contract at any time by notice in writing to the Supplier to take effect on any date falling at least 3 months (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.

21.3 UKRI may terminate the Contract with immediate effect by giving written notice to the Supplier if:

(a) the circumstances set out in clauses 8.2, 8.4 or 29.1 apply; or

(b) the Supplier is in material breach of any obligation under the Contract which is not capable of remedy; or

(c) the Supplier breaches any term of the Contract and (if such breach is remediable) fails to remedy that breach within 30 days of being notified in writing of the breach; or

(d) the Supplier repeatedly breaches any of the terms and conditions of this 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 this Contract; or

(e) the Supplier suspends, or threatens to suspend, payment of its debts or is unable to pay its debts as they fall due or admits inability to pay its debts or (being a company) is deemed unable to pay its debts within the meaning of section 123 of the Insolvency Act 1986, or (being an individual) is deemed either unable to pay its debts or as having no reasonable prospect of so doing, in either case, within the meaning of section 268 of the Insolvency Act 1986, or (being a partnership) has any partner to whom any of the foregoing apply; or

(f) the Supplier commences negotiations with all or any class of its creditors with a view to rescheduling any of its debts, or makes a proposal for or enters into any compromise or arrangement with its creditors; or

(g) (being a company) a petition is filed, a notice is given, a resolution is passed, or an order is made, for or in connection with the winding up of the Supplier; or

(h) (being an individual) the Supplier is the subject of a bankruptcy petition or order; or

(i) a creditor or encumbrancer of the Supplier attaches or takes possession of, or a distress, execution, sequestration or other such process is levied or enforced on or sued against, the whole or any part of its assets and such attachment or process is not discharged within 14 days; or

(j) (being a company) an application is made to court, or an order is made, for the appointment of an administrator or if a notice of intention to appoint an administrator is given or if an administrator is appointed over the Supplier; or

(k) a person becomes entitled to appoint a receiver over the Supplier's assets or a receiver is appointed over the Supplier's assets; or

(l) any event occurs, or proceeding is taken, with respect to the Supplier in any jurisdiction to which it is subject that has an effect equivalent or similar to any of the events mentioned in clause 21.3(e) to clause 21.3(k) inclusive; or

(m) there is a change of control of the Supplier (within the meaning of section 1124 of the Corporation Tax Act 2010); or

(n) the Supplier suspends, or threatens to suspend, or ceases or threatens to cease to carry on, all or substantially the whole of its business; or

(o) the Supplier's financial position deteriorates to such an extent that in UKRI's opinion the Supplier's capability to adequately fulfil its obligations under the Contract has been placed in jeopardy; or

(p) (being an individual) the Supplier dies or, by reason of illness or incapacity (whether mental or physical), is incapable of managing his or her own affairs or becomes a patient under any mental health legislation.

21.4 The Supplier shall notify UKRI as soon as practicable of any change of control as referred to in clause 21.3(m) or any potential such change of control.

21.5 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.

21.6 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 this clause and clauses 4, 5, 6, 7, 11, 12, 15, 17, 18, 19, 20, 24, 25, 26, 27, 28, 29, 34, 36, 37 or any other provision of the Contract that either expressly or by implication has effect after termination.

21.7 Upon termination or expiry of the Contract, the Supplier shall immediately:

(a) cease all work on the Contract;

(b) deliver to UKRI all Deliverables and all work-in-progress whether or not then complete. If the Supplier fails to do so, UKRI and/or its representatives shall have the right to enter the Supplier's premises (which the Supplier shall not refuse) in order to take possession of all Deliverables and all work-in-progress. The Supplier shall allow UKRI and its representatives such access and assistance as required by UKRI and its representatives to take possession of the Deliverables and the work-in-progress. Until the Deliverables and the work-in-progress have been returned to UKRI, the Supplier shall be solely responsible for their safe keeping and will not use them for any purpose not connected with this Contract;

(c) cease use of and return (or, at UKRI's election, destroy) all of UKRI's Materials in the Supplier's possession or control; and

(d) give all reasonable assistance to UKRI and any incoming supplier of the Goods and/or Services (as applicable); and

(e) return or destroy UKRI's Confidential Information in accordance with clause 24.3.

22 DECLARATION OF INEFFECTIVENESS AND PUBLIC PROCUREMENT TERMINATION EVENT

22.1 In the event that a Court makes a Declaration of Ineffectiveness, UKRI will promptly notify the Supplier in writing. The Parties agree that the provisions of clause 21.7 and this clause 22 will continue to apply as from the time when the Declaration of Ineffectiveness is made.

22.2 The Declaration of Ineffectiveness will not prejudice or affect any right, liability or remedy which has accrued or will accrue to either Party prior to or after such Declaration of Ineffectiveness in respect of the period prior to the Declaration of Ineffectiveness.

22.3 Consistent with UKRI's rights of termination implied into the Contract by Public Contracts Regulations 2015 (as amended), in the event of a Public Procurement Termination Event, UKRI shall promptly notify the Supplier and the provisions of clause 21.7 and this clause 22 shall apply as from the date of receipt by the Supplier of the notification of the Public Procurement Termination Event.

22.4 The Public Procurement Termination Event shall not prejudice or affect any right, liability or remedy which has accrued or shall accrue to either Party prior to or after such Public Procurement Termination Event in respect of the period prior to the Public Procurement Termination Event.

22.5 During any Court proceedings seeking a Declaration of Ineffectiveness or following notification of a Public Procurement Termination Event, UKRI may require the Supplier to prepare a contingency plan with the effect of achieving:

(a) An orderly and efficient cessation of the Contract or a transition of the provisions of the Goods and/or Services to UKRI or such other entity as UKRI may specify; and

(b) Minimal disruption or inconvenience to UKRI or to UKRI's supported organisations or clients,

and the Parties agree that this shall have effect in the event a Declaration of Ineffectiveness is made or a Public Procurement Termination Event occurs.

22.6 Where there is any conflict between the provisions of clause 21.7 and this clause 22 and the contingency plan then the clauses of this Contract shall take precedence.

22.7 The Parties will comply with their respective obligations under any contingency plan (as agreed by the Parties, or where agreement cannot be reached, as reasonably determined by UKRI) in the event that a Declaration of Ineffectiveness is made or a Public Procurement Termination Event occurs.

23 GOVERNANCE AND RECORDS

23.1 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 .

23.2 The Supplier shall keep and maintain until 6 years after the expiry or termination 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 and its representatives such access to those records as may be reasonably requested by UKRI in connection with the Contract.

23.3 UKRI may from time to time require the Supplier to complete the Cyber Essentials Questionnaire. The Supplier shall submit a completed Cyber Essentials Questionnaire to UKRI within 10 Working Days of a request from UKRI. UKRI shall not be liable for the Supplier's or the Staff's costs in complying with this clause 23.3.

23.4 The Supplier shall keep and maintain records of sub-contractors it uses to supply the Goods and/or Services, including whether the sub-contractor is an SME and the payments it has made to the sub-contractor as a result of the sub-contractor's work under this Contract. The Supplier shall provide such records to UKRI within 10 Working Days of a request from UKRI.

23.5 Where the estimated annual Charges are above £5 million, the Supplier shall:

(a) advertise on the UK Government's Contracts Finder website all sub-contractor opportunities above £25,000 arising from and in connection with this Contract. Each advert shall provide a full and detailed description of the sub-contract opportunity with each of the mandatory fields on Contracts Finder being completed.

(b) within 90 days of awarding a sub-contract, update the notice on Contracts Finder with details of the successful sub-contractor;

(c) monitor the number, type and value of the sub-contract opportunities placed on Contracts Finder in its supply chain during the Term;

(d) provide reports on the information at clause 23.5(c) to UKRI in the format and frequency reasonably requested by UKRI; and

(e) promote Contracts Finder to its suppliers and encourage those organisations to register on Contracts Finder.

23.6 Clause 23.5 shall only apply to sub-contractor opportunities arising after the Commencement Date and UKRI may by giving its prior written approval decide to waive the obligations under Clause 23.5 in respect of any sub-contractor opportunity.

24 CONFIDENTIAL INFORMATION

24.1 Subject to clause 24.2, 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.

24.2 Notwithstanding clause 24.1, a Receiving Party may disclose Confidential Information:

(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 Receiving Party has reasonable grounds to believe that the Disclosing 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 (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 other 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 28;

(v) 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 24.

24.3 All documents and other records (in whatever form) containing Confidential Information supplied to or acquired by the Receiving Party from the Disclosing Party or its representatives shall be returned promptly to the Disclosing Party (or, at the election of the Disclosing Party, destroyed promptly) on expiry or termination of the Contract, and no copies shall be kept.

25 TRANSPARENCY

25.1 The Parties acknowledge that, except for any information which is exempt from disclosure in accordance with the provisions of the FOIA or EIR, the content of the Contract is not Confidential Information and the Supplier hereby gives its consent for UKRI to publish this Contract in its entirety to the general public (but with any information that is exempt from disclosure in accordance with the FOIA or EIR (as applicable) redacted) including any changes to the Contract agreed from time to time.

26 PUBLICITY

26.1 The Supplier shall not make any press announcements or publicise this Contract in any way without prior written consent from UKRI.

26.2 UKRI shall be entitled to publicise this Contract in accordance with any legal obligation upon UKRI, including any examination of this Contract by the National Audit Office pursuant to the National Audit Act 1983 or otherwise.

26.3 The Supplier shall not do anything or cause anything to be done, which may damage the reputation of UKRI.

27 DATA PROTECTION

27.1 In this clause 27, the terms, “processes”, “data controller” and “data processor” shall have the same meanings given to them under Data Protection Legislation.

27.2 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 UKRI Personal Data.

27.3 The Supplier shall itself, and shall procure that the Staff, comply with all Data Protection Legislation in relation to any Personal Data processed.

27.4 Without limiting clauses 27.2 and 27.3, 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) have in place a suitably qualified data protection representative to manage the Personal Data;

(d) disclose any Personal Data only on a need to know basis to Staff directly concerned with the provision of the Goods and/or Services;

(e) 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);

(f) 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;

(g) keep records of their data processing activities performed under this Contract in order to be able to provide information included in those records to the data protection authorities, upon request, including but not limited to the Information Commissioner. Records should include:

(i) details of the data controller and data processor and their representatives;

(ii) the categories of processing activities that are performed;

(iii) information regarding cross-border data transfers; and

(iv) a general description of the security measures that are implemented;

(h) 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;

(i) 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;

(j) 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 27 and the Data Protection Legislation;

(k) 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

(l) 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.

27.5 The Supplier shall only use a sub-processor with UKRI's formal written consent (specific or general, although where general consent is obtained processors must notify all and any changes to UKRI, giving them an opportunity to object).

27.6 To the extent that UKRI provides its consent pursuant to clause 27.5, the Supplier shall flow down the contractual obligations contained in clause 27.4 to sub-processors.

27.7 Notwithstanding any other remedies available to UKRI, fully indemnify UKRI as a result of any such breach of the GDPR, by the Supplier or any other party used by the Supplier in its performance of the Contract that results in UKRI suffering fines, loss or damages.

28 FREEDOM OF INFORMATION

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

(a) provide all necessary assistance and co-operation as reasonably requested by UKRI to enable UKRI to comply with its obligations under FOIA and EIR in relation to any Requests for Information relating to this Contract;

(b) transfer to UKRI all Requests for Information relating to this 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.

28.2 UKRI shall be responsible for determining whether any Information is to be disclosed in response to a Request for Information.

28.3 The Supplier acknowledges that UKRI may be obliged under the FOIA or EIR to disclose Information, in some cases even where that Information is commercially sensitive:

(a) without consulting with the Supplier, or

(b) following consultation with the Supplier and having taken its views into account.

28.4 Where clause 28.3(a) applies UKRI shall, in accordance with any recommendations issued under any code of practice issued under section 45 of FOIA, take reasonable steps, where appropriate, to give the Supplier advanced notice, or failing that, to draw the disclosure to the Supplier's attention as soon as practicable after any such disclosure.

28.5 Where the Supplier is subject to the requirements of the FOIA and EIR, UKRI shall assist and co-operate with the Supplier to enable the Supplier to comply with its obligations under the FOIA and EIR in relation to any Requests for Information received by the Supplier relating to this Contract.

29 CORRUPTION

29.1 Without prejudice to any other rights or remedies available to UKRI, UKRI shall be entitled to terminate the Contract immediately and to recover from the Supplier the amount of any loss resulting from such termination if the Supplier or the Supplier's Associate:

(a) offers or agrees to give any person working for or engaged by UKRI, UKRI's staff and agents, or any Public Body any favour, gift or other consideration, which could act as an inducement or a reward for any act or failure to act connected to the Contract, or any other agreement with UKRI or any Public Body;

(b) has entered into the Contract if it has knowledge that, in connection with it, any money has been, or will be, paid to any person working for or engaged by UKRI, or any Public Body by or for the Supplier, or that an agreement has been reached to that effect, unless details of any such arrangement have been disclosed in writing to UKRI before the Contract is entered into;

(c) breaches the provisions of the Prevention of Corruption Acts 1889 to 1916, or the Bribery Act 2010; or

(d) gives any fee or reward the receipt of which is an offence under Section 117(2) of the Local Government Act 1972.

29.2 The Supplier shall take all reasonable steps, in accordance with Good Industry Practice, to prevent fraud by the Supplier and the Supplier's Associates 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.

29.3 For the purposes of clause 29.1, "loss" shall include, but shall not be limited to:

(a) UKRI's costs in finding a replacement supplier;

(b) direct, indirect and consequential losses; and

(c) any loss suffered by UKRI as a result of a delay in the performance of the Services or its receipt of the Goods (as applicable).

30 MODERN SLAVERY ACT 2015

30.1 In performing its obligations under this Contract, the Supplier shall and shall ensure that any permitted sub-contractors shall comply with:

(a) all applicable laws, statutes and regulations from time to time in force, including but not limited to the Modern Slavery Act 2015; and

(b) Any anti-slavery policy adopted by UKRI from time to time.

30.2 UKRI may from time to time require the Supplier to provide information and evidence to demonstrate its and its sub-contractors' compliance with clause 30.1. The Supplier shall provide such information with 10 Working Days of a request from UKRI for the same. A breach of this clause 30.1 shall be deemed a material breach for the purpose of clause 21.3(b).

31 FORCE MAJEURE

31.1 Neither Party to this Contract shall in any circumstances be liable to the other for any delay or non-performance of its obligations under this Contract to the extent that such delay or non-performance is due to a Force Majeure Event. Subject to Clause 31.3, the date for performance of any affected obligations will be suspended for a period equal to the delay caused by the Force Majeure Event.

31.2 If a Party is delayed in or prevented from performing its obligations under this Contract by a Force Majeure Event, such Party shall:

(a) give notice in writing of such delay or prevention to the other Party specifying the nature and extent of the Force Majeure Event immediately on becoming aware of it; and

(b) use all reasonable endeavours to mitigate the effects of the Force Majeure Event on the performance of its obligations.

31.3 If the Force Majeure Event continues for a period of 30 (thirty) days or more following notification, then either Party may terminate this Contract by giving not less than 10 (ten) days' prior written notice to the other Party.

31.4 UKRI shall not be liable to pay the Charges in relation to any Goods and/or Services that are not provided by the Supplier due to a Force Majeure Event.

32 DISPUTE RESOLUTION

32.1 The Parties agree to co-operate with each other in an amicable manner with a view to achieving the successful implementation of this Contract.

32.2 If a Dispute arises between UKRI and the Supplier during the Term in relation to any matter which cannot be resolved by local operational management either Party may refer the matter for determination in accordance with the procedure set out in Clause 32.3.

32.3 A Dispute referred for determination under clause 32.2 shall be resolved as follows:

(a) by referral in the first instance to the decision of the individuals for each Party referred to in the Award Letter for stage 1 escalations; and

(b) if a Dispute is not resolved within 21 days of its referral pursuant to Clause 32.3(a) such Dispute shall be referred to the individuals for each Party referred to in the Award Letter for stage 2 escalations.

32.4 If the dispute cannot be resolved by the Parties within one month of being escalated as referred to in Clause 32.3(b), 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.

32.5 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.

32.6 Neither Party shall be prevented from, or delayed in, seeking orders for specific performance or interlocutory or final injunctive relief on an ex parte basis or otherwise as a result of the terms of this Clause 32, such clause not applying in respect of any circumstances where such remedies are sought.

33 CHANGE CONTROL PROCEDURE

33.1 In the event that either party desires to change the terms of this Contract, the following procedures will apply:

(a) the Party requesting the change will deliver a "Change Request" (in the form (or substantially in the same form) contained in Schedule 5 to this Contract) which describes:

(i) the nature of the change;

(ii) the reason for the change;

(iii) the effect that the requested change will have on the scope or Specification for the Services; and

(iv) any change to the Charges and the Term.

(b) Upon receipt of a Change Request, the receiving Party's authorised representative will contact his/ her counterpart within 5 working days to discuss and agree the Change Request. The parties will negotiate the proposed changes to the Contract in good faith and agree a timeline in which to finalise the Change Notice.

(c) Neither party is obliged to agree to a Change Request, but if the parties do agree to implement such a Change Request, the appropriate authorised representatives of both parties will sign the Change Request which will be effective from the date set out in the Change Request.

(d) If there is any conflict between the terms and conditions set out in the Contract and the Change Request, then the terms and conditions set out in the most recent fully executed Change Request will apply.

(e) The Supplier shall neither be relieved of its obligations to supply the Goods and/or Services in accordance with the terms and conditions of this Contract nor be entitled to an increase in the Charges as the result of:

(i) a General Change in Law; or

(ii) a Specific Change in Law where the effect of that Specific Change in Law on the Goods and/or Services is reasonably foreseeable at the Commencement Date.

34 ENTIRE AGREEMENT

34.1 The Contract constitutes the entire agreement between UKRI and the Supplier in relation to the supply of the Services and/or Goods and the Contract supersedes and replaces any

prior written or oral agreements, representations or understandings between them relating to that subject matter. 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 shall exclude liability for fraud or fraudulent misrepresentation.

35 NOTICES

35.1 Any notice to be given under the Contract shall be in writing and may be served by personal delivery, first class or recorded post or, subject to clause 35.3, 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 writing.

35.2 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.

35.3 Notices under clauses 21, 22 and 31 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 35.1.

36 GENERAL

36.1 If any court or competent authority finds that any provision of the Contract (or part of any provision) is invalid, illegal or unenforceable, that provision or part-provision shall, to the extent required, be deemed to be deleted, and the validity and enforceability of the other provisions of the Contract shall not be affected.

36.2 If any invalid, unenforceable or illegal provision of the Contract would be valid, enforceable and legal if some part of it were deleted, the provision shall apply with the minimum modification necessary to make it legal, valid and enforceable.

36.3 A waiver of any right or remedy under the Contract is only effective if given in writing and shall not be deemed a waiver of any subsequent breach or default. No failure or delay by a party to exercise any right or remedy provided under the Contract or by law shall constitute a waiver of that or any other right or remedy, nor shall it preclude or restrict the further exercise of that or any other right or remedy. No single or partial exercise of such right or remedy shall preclude or restrict the further exercise of that or any other right or remedy.

36.4 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.

36.5 A person who is not a Party to this 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.

36.6 The Contract cannot be varied except in writing signed by a duly authorised representative of both the Parties.

37 GOVERNING LAW AND JURISDICTION.

37.1 The Contract, and any dispute or claim arising out of or in connection with it or its subject matter or formation (including non-contractual disputes or claims), shall be governed by, and construed in accordance with, English law, and the parties irrevocably submit to the exclusive jurisdiction of the courts of England and Wales.

Schedule 2 - Specification

38 The Suppliers shall provide the Goods and/or Services in accordance with Appendix A – UKRI-3142 – Specification Document, and the Supplier's technical proposal "KPT92073 EO Data Hub Question 6.2 Technical Answer v1.0 and KPT92073 UK EO Data Hub Project Management Plan v1.0" as appended to this Contract Pack.

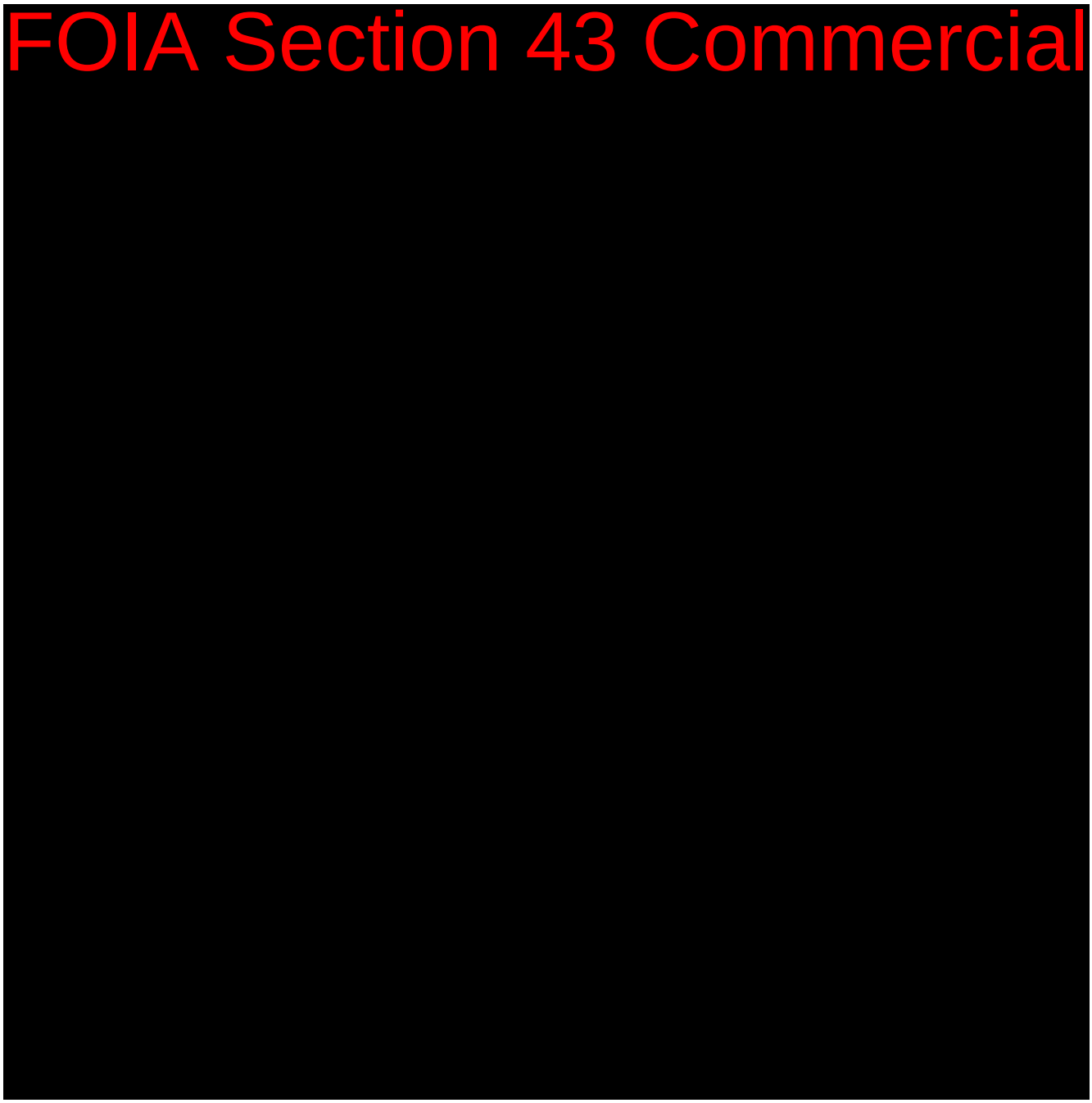
Schedule 3 - Charges

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

The total value of this contract shall not exceed £1,600,000 excluding VAT.

The following payment schedule is applicable to this Contract. Invoices will be submitted by the Supplier upon completion of the identified Milestone. UKRI will approve payment only when the Milestone is confirmed and accepted as complete.

FOIA Section 43 Commercial



Schedule 4 - Key Personnel

Key Personnel (name and title)	Role in the performance of this Contract
FOIA Section 40 Personal Information	

Schedule 5 - Change Control Notice

Contract Reference:	
1. Change Request Number:	
2. Requested amendments to Contract (including reasons):	
2.1 Effective date:	
This change is effective from: _____	
2.2 The Contract Term is amended as follows:	
Original Expiry Date: _____	
New Expiry Date: _____	
3. Cost impact	
3.1 The Charges are amended as follows:	

	Quantity	**Unit cost (£)**	**Net cost (£)**	**VAT (£)**	**Gross cost (£)**
Original Contract Value					
New contract Value					

3.2 New Contract terms:

Both UKRI and the Supplier agree that they are bound by the terms and conditions set out in this Change Request and, except as set out in this Change Request, all terms and conditions of the Contract remain in full force and effect.

Signed on behalf of	Signed on behalf of
UK Research and Innovation	***[Supplier's name TBC]***
by:	by:
Signature of authorised officer	Signature of authorised person
Name of authorised officer (please print)	Name of authorised person (please print)
Date	Date

Specification
for

EO DataHub Platform Software Development and Operations

Title of Request:	**EO DataHub Platform Software and Operations**
Duration of Engagement:	18 months
Required Commencement Date:	16th October 2023

1 Introduction

Data infrastructure for the UK is critical in the Earth Observation (EO) sector as it directly impacts the ability of UK science to produce world-leading information for discovery and policy, and the ability of our growing downstream industry to capitalise and invest in services built around UK capabilities and assets. The UK Government consistently recognises the value of EO capability with the importance of ongoing investment in the UK's role recognised in the National Space Strategy and at global events such as COP26.

Research and analysis repeatedly point to the need to invest in a way that catalyses that investment and bridges the "data to information" divide. Evidence from engagement with users in the EO sector has shown that there are barriers to the effective exploitation of Earth observation data. These include fragmentation of data sources and services and the fact that source data may not be in a form that is readily exploitable.

The EO DataHub (EODH) programme has been instigated to address these challenges. It represents **a first phase of a national asset**, supported by the government, and specified with the Department of Science, Innovation and Technology (DSIT) alongside NERC. Its role is to:

a) serve the UK national interest;
b) offer all UK users a step change in data access and quality, including commercial, government, researchers and students;
c) mitigate and transition the Copernicus-related data activities to a UK-orientated model;
d) provide a delivery approach that enables a much more rigorous, evidence-led legacy beyond the project - articulating UK capability, showcasing UK datasets, evidenced costs and user-specified sustainability needs

The EODH Core Team, which leads and works on the EODH programme, is made up of representatives from:

- The National Centre for Earth Observation (NCEO)
- The STFC Centre for Environmental Data Analysis (CEDA)
- The University of Leicester
- The Satellite Applications Catapult (SAC)
- The Met Office
- The National Physical Laboratory (NPL)
- The UK Space Agency (UKSA)

DSIT has also funded a sister activity, the EO Climate Information Service (EOCIS: https://www.nceo.ac.uk/article/eocis-information/EOCIS), which will create new climate data at high resolution for the UK specifically. This includes both rapid-response information for climate-linked events (fire early warning and urban flood mapping) and longer-term climate data linked to human and ecosystem health and landscape greenhouse gas emissions. EOCIS data will form one of the headline data products delivered through the EODH.

1.1 Overview of projects within the EODH Programme

The requirement set out in this ITT is the first of three calls covering different parts of the overall EO DataHub programme:

1) **The DataHub Platform – the subject of this ITT specification document (known as the "Hub Platform" from here onwards)**
2) Data streams – the integration of different sources of data into the Hub Platform.
3) Applications – the development of software applications which exploit the functionality provided by the Hub platform

The successful Tenderer will build and maintain the ***Hub Platform*** (i.e. a set of software services hosted on the public cloud) to assist application developers and Earth observation domain experts to find, access, analyse and process EO data from multiple distributed sources in a consistent manner and in a form that is suited for easy use in software applications and services to end-user communities.

The desired outcome is that through access to the platform, software developers and expert users can more easily implement applications and services that exploit EO data. The implication for the target users of the platform is that they will have a set of software tools and services that will allow them to find and access EO data, process it and build applications that exploit it.

Data Streams concerns the integration of different data sources into the Hub Platform. The Hub Platform will use a federated approach for the integration of these sources. i.e. data itself will reside at the source providers but through the establishment of agreed access interfaces, identity and access management functionality and search services it will be possible for Hub-users to be able to search and access data across multiple source providers.

The Data Streams work will start immediately with the integration of datasets from the CEDA Archive (https://catalogue.ceda.ac.uk). These will include *public* datasets such as Sentinel and climate model projections and observations. A second ITT will be released in the autumn to invite the participation of *commercial* data providers.

The successful supplier to this ITT (i.e. EO DataHub Platform Software and Operations) will work with the respective data providers (CEDA, and commercial suppliers) to integrate their data into the Hub Platform.

The last call, ***Applications*** concerns the development of applications which use the services and data provided by the Hub Platform to build exemplar applications which showcase the capabilities of the Hub Platform. It is expected that three applications will be funded. These will be focused on a set of pre-selected thematic areas based on stakeholder engagement:

1) Climate
2) Environmental Monitoring
3) Infrastructure and Utility Systems (including Water and Energy)
4) National Resilience

The vision for the entire EO DataHub system is articulated in Figure 1.

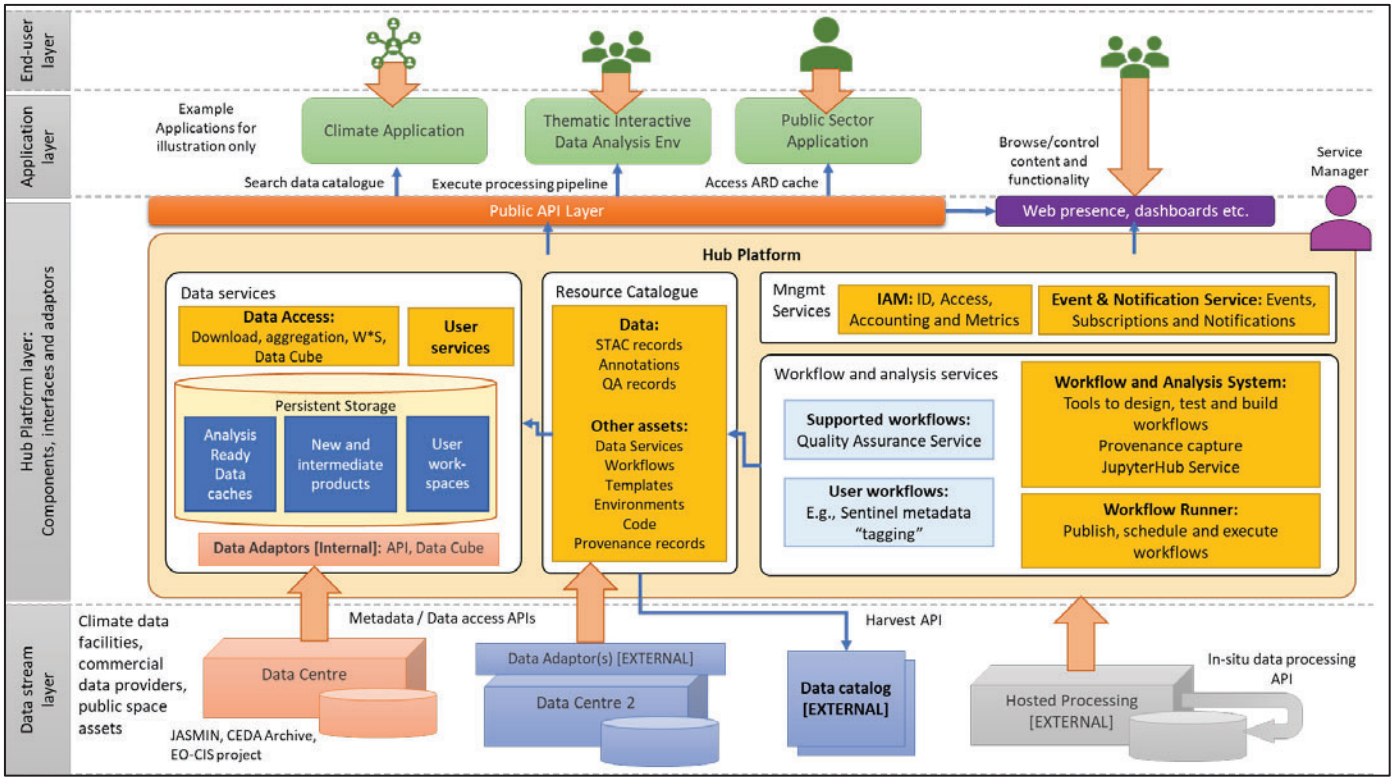


Figure 1. Overview of the EODH system showing n data providers or centres (bottom) whose data streams interface to the Hub Platform software (middle layer) enabling sector/thematic-specific applications (top) Note that there will be at least one funded Application with a climate theme; the other two will be selected from successful bids against the other thematic areas in the numbered list above.

1.2 Advice on the interpretation of this ITT

The Tenderer is asked to submit a proposal to build the Hub Platform that meets the broad vision outlined in Figure 1. The content of this ITT is structured around the functional areas and components presented in this architecture diagram. The horizontal layers of the diagram should be considered definitive as they essentially mirror the contracts and projects that are being issued with the EODH Programme.

However, the actual boxes and their descriptions may not match the exact solution proposed by the Tenderer. We actively encourage the Tenderer to propose an innovative solution without necessarily exactly mimicking the approach outlined here. Given the challenging timescales of the project, it is likely that a successful bid will involve the re-use of pre-existing building blocks which, in their composition, require alternative approaches to meeting the fundamental requirements of the Hub Platform. Where the proposal differs from our design then it is important for the Tenderer to explain the rationale behind those deviations when articulating their vision.

1.3 Team and supporting evidence

The Tenderer is invited to gather a team of staff with relevant expertise either within a single or multiple organisations. Only one contractor is expected to respond to this ITT, but the prime contractor may include additional organisations through sub-contracts. In the latter case, the Tenderer must provide assurances that no delays will occur due to sub-contracting.

The Tenderer should provide information about each organisation within the proposed team, including previous projects and activities that indicate their suitability for delivering the Hub Platform.

An indicative team might include a Senior Technical Project Manager (with experience in managing activities related to an ITT of this size and appropriate project methodologies), a Senior Software Architect, a Cloud DevOps Specialist and a number of Software Developers. Other staff should be allocated to the project based on their experience and relevance to the deliverables (such as experience of working in the EO sector or with specific software/data systems).

CVs should be provided to indicate the suitability of the individuals within the team. CVs are only required for team members who will be working more than 20% full-time on the project.

1.3.1 Responsibilities of the prime contractor

The prime will become a full partner in the EODH Programme, attending regular project management meetings. The prime will be expected to attend such meetings in-person every 2 months, along with online meetings held fortnightly with partners and twice-weekly online "stand-up" meetings for ongoing technical communication.

The prime will also contribute to various project documents such as the Sustainability and Legacy Plan, which will lay out the foundations for ongoing costs, management and support for the EODH beyond the initial funding period.

The prime will bear overall responsibility for the delivery of the Hub Platform.

1.4 Terminology

The following terminology is used throughout this, and related documents:

- EO DataHub:
- The EO DataHub (EODH) is the name for the *entire work programme*.

- DataHub Platform (typically known as the “Hub Platform”):
- The "DataHub Platform", or “Hub Platform”, is the collection of cloud-hosted software, processing and data services that deliver the core functionality. *This* ITT specification concerns the implementation of the DataHub Platform *only*.

- Application:
- An "Application":
  - is a software product that exploits the core functionality of the "Hub Platform"
  - acts as a *client* to services hosted on the "Hub Platform"
  - may be a web-tool, a GIS-app, a command-line tool or a software product hosted externally to the "Hub Platform"
  - may be a separate *platform* such as a Thematic Exploitation Platform, that accesses resources provided by the "Hub Platform"
  - will typically access data and/or processing capabilities of the "Hub Platform"
  - may contribute new data products to the "Hub Platform"

- Portal:
- A web-tool that provides a user interface to access resources and functionality that might be provided by other resources.

- User:
- A "User" is a human, or computational process, that accesses "Hub Platform" functionality
- There are different categories of users, as specified below.

- End-user:
- An "End-user" is a person who interacts with an "Application" that interacts with the "Hub Platform"

- Hub-user:

- A "Hub-user" is a person, or computational process, that interacts directly with the "Hub Platform"
- A "Hub-user" is associated with an account in the "Hub Platform" Identity and Access Management system.
- That account can be associated with a collection of permissions, related to data and processing resources.
- A "Hub-user" will interact with "Hub Platform" functionality via APIs or web-based user interfaces (UIs).

- Data Streams / Datasets:

- A “Data Stream”, or “Dataset”, is a group of data files from a particular source. Many "Data Streams" will be updated on a regular basis. Within the "Hub Platform" Resource Catalog, each "Data Stream" will have a unique record, which links to records for each data granule (i.e., the smallest element that can be resolved in a search result).

- EODH Core Team:

- The EODH Core Team consists of representatives from:
  - The National Centre for Earth Observation (NCEO)
  - The STFC Centre for Environmental Data Analysis (CEDA)
  - The University of Leicester
  - The Satellite Applications Catapult (SAC)
  - The Met Office
  - The National Physical Laboratory (NPL)
  - The UK Space Agency (UKSA)

- Authority:

- Throughout this document, the "Authority" means UKRI or anyone acting on behalf of UKRI.

- Tenderer:

- Throughout this document, the "Tenderer" refers to the organisation that is submitting a proposal in response to this ITT.

- Invitation to Tender (ITT):

- Throughout this document, the "ITT" refers to the document itself, and any associated documentation.

2 Aims & Objectives

2.1 EODH Programme Objectives

The subject of this tender, the development and operation of the Hub Platform, is one project within the overall EODH programme. The objectives of the EODH *programme* are:

- Be a new 'single point', national UK EO Data infrastructure, that builds on current infrastructures
- Bring together UK EO data offerings from public and commercial centres through the central hub model
- Demonstrate its application to specific sectors via the implementation of specific *web-based applications*
- Enable new EO services and tools through a transformational layer to support those applications
- Address key challenges in EO data access and discovery, interoperability, transparency, and trustworthiness by ensuring hub and platforms operate on common standards, together with a dedicated Quality Assurance Service.
- Provide access to a wide variety of public, scientific and commercial data including supporting data-proximate computing minimising downloads.
- Have a clear pathway to being self-sustaining:
    - Sustainability and Legacy Plan
    - Engaging with DSIT on future EO data infrastructures to be funded by the government
    - Assess hub data streams and exploitation for potential revenue generation
- Contribute to the NERC Environmental Data Service (EDS) – demonstration of shared infrastructure for data exploitation

2.2 Hub Platform Project Objectives

The specific objectives for the Hub Platform (as described in this ITT) are:

- Provide a collection of software and services to deliver the core functionality to deliver the EODH Programme objectives
- A scalable system designed for, and deployed in, the public cloud
- A catalog that provides discovery of a range of priority EO, climate and observational datasets (initially Sentinel 2 (including ARD and other derivative products), UKCP, CMIP6, CORDEX, datasets from the EOCIS project) from public and commercial sources
- Provide software adaptors that enable a common interface to the priority datasets
- A capability for ingesting and storing requested datasets – such as ARD products
- Data access tools providing easy use of datasets to meet a wide variety of use cases
- Provide Identity and Access Management, and Accounting services
- Data analysis environments, and tools for building, running and sharing data-intensive scientific workflows
- A system for managing events and notifications to enable scheduled and event-driven workflows
- A web presence that includes a website, map-interface, and other features highlighting the capabilities of the Hub Platform
- Integration of the EODH Quality Assurance workflows
- Integrate the technical development of the Hub Platform with the requirements and products drawn from the Data Streams and Applications projects
- A system that is usable directly by EO Experts and Developers
- Contribute towards a sustainability plan for the ongoing management and development of the Hub Platform beyond the lifetime of the project – including cost models for private, public and academic service usage. (This activity will be led by partners in the EODH Core Team).

3 Background to the Requirement

3.1 Background

The UK Business and Industrial Strategy Department (BIS, now renamed to DSIT), working with NERC, agreed with the Treasury the business case for a first national EO Data Hub, led by key UK national agencies and built on UK science and industrial capabilities hitherto deployed in Copernicus activities. ***The vision of the consortium, led by the National Centre for Earth Observation (NCEO), is to deliver an innovative, pre-operational pathfinder data and analysis asset, implementing a uniquely UK offering whose federated software approach brings value across the breadth of UK EO sector users.***

EOCIS is a sister activity that is funded through the same DSIT business case. EOCIS and the EODH are working together to ensure that new products generated by the UK scientific EO sector are made available through the Hub Platform.

3.2 Recent work in EO Platforms – developing the EODH Concept

Over the last decade, the *Platform* concept has developed and matured in the EO sector as a means to bring together data and computational resources into a unified virtual work environment for users. The EODH builds on this approach and will offer a software framework operating in a (public) cloud environment. This suite of software services will include - but not be limited to - identity and access management, a searchable catalog[1] for data and other resources, quality information about data, the capability to assemble data pipelines to transform data into value-added and/or analysis-ready data products. This software system is the key to unlocking the wide variety of data in a data stream layer, an extendable architecture in which any number of data sources can be integrated. An important feature of this UK EO Hub system is that it will interface, by intent, to public service data (state-funded through space agencies), commercial datasets e.g. from constellations, and UK scientific data as described above through Application Programming Interfaces (APIs), allowing data discovery and data access using open standards-based interfaces. Additionally, some datasets will be given a “trusted” approval status through a Quality Assurance service running in the Hub Platform software.

A further crucial element is that the automated workflows of the Hub will allow code containers (encapsulating algorithms or tools) that can transform the data into forms that the user can exploit more easily. These containers can be Hub-provided functions, user-supplied code or open-source routines; our aim is to provide some key tools centrally through experts in our organisations, ranging from data formatting to atmospheric correction and cloud clearing.

Finally, the **Hub Platform’s capabilities will support the development of web-based applications that build upon the data access and processing functionality to implement thematic area-specific portals and analysis environments for users**. These applications are intended to give end-users the ability to interrogate key products, customise data, request expert support, develop value-added products and support decision-making, all tailored to the specific application scenario or theme. These end-users are not expected to interact with the Hub Platform directly, as the Application will provide its own customised interfaces to meet the specific needs of that community.

The EODH is a pathfinder project to explore and validate the Hub service model. It will support the development and operation of up to three web-based applications as part of the national government-supported asset, one of which will be a climate data-driven offering and the other two of which will be directed at user-driven priority sectors. Beyond the initial path-finder timeline, we expect a steady growth in the number of focused user-commissioned web applications offering specific services to different customer bases.

[1] Note that the US spelling of "catalog" is used throughout this document. This spelling is used by the Spatio Temporal Asset Catalog definition and other external projects/technologies so we have used it for consistency.

Related work and State of the Art

Applicants should be aware of a broad range of pre-existing and emerging systems and specifications that can be used to inform the Hub Platform design and implementation. These can be broadly categorised into:

- Whole system solutions: providing all or most of the functional components required by the Hub Platform.
- Partial system solutions: providing one or more functional components required.
- Reference implementations: providing patterns and interfaces that may be relevant.
- Standards and specifications: providing API, interface and format rules.
- Other innovations: providing inspiration and/or technologies developed in other communities and domains.

This section begins by highlighting *whole system solutions* as these are considered most relevant to the Hub Platform. We then describe other work that might inform aspects of the solution proposed.

EOEPCA
The ESA Earth Observation Exploitation Platform Common Architecture (EOEPCA, https://eoepca.org/) is a reference implementation for a fully functional platform solution. It includes a set of building blocks to create an environment for developing, deploying and executing EO workflows, including:

- Login Service
- User Profile
- Policy Enforcement Point & Policy Decision Point
- Application Deployment & Execution Service (for workflows)
- Processor Development Environment (interactive environment)
- Resource Catalog
- Data Access Services
- User workspaces

Some strengths of the EOEPCA approach are the adoption of open (mainly OGC) standards and open-source software. The integration of different components through APIs reflects good design principles that enable flexible evolution of services with minimal lock-in to specific implementations.

Euro Data Cube and Earth System Data Lab
The Euro Data Cube (https://eurodatacube.com/) and Earth System Data Lab (https://viewer.earthsystemdatalab.net/) provide tools, visualisation and processing capabilities on top of EO data holdings. These services are built on a Python and Jupyter environment with the "Xcube" package (https://xcube.readthedocs.io/) providing the data interface.

The CSIRO Earth Analytics Science and Innovation (EASI) platform
EASI (Earth Analytics and Science Innovation, https://research.csiro.au/cceo/underpinning-technologies/earth-analytics/) is a high-performance data analytics platform developed by CSIRO in Australia. It makes extensive of the public cloud for scalability and is deployed using Kubernetes. Users typically access the system through JupyterHub instances with Dask and Argo processing capabilities. Data is accessed through a catalog which includes EO data indexed through the Open DataCube (https://www.opendatacube.org/).

Microsoft Planetary Computer
The Planetary Computer (https://planetarycomputer.microsoft.com/) provides a data catalog, API, hub and applications environment for scientific access to a multi-petabyte store of environmental data. It includes a JupyterHub environment and recipes for accessing and processing data.

Google Earth Engine
Google Earth Engine (https://earthengine.google.com/) provides a cloud platform for scientific data access and analysis. It hosts large amounts of EO data and allows users to apply and scale out their processing.

The Visualization, Exploration, and Data Analysis project
The Visualization, Exploration, and Data Analysis (VEDA, https://www.earthdata.nasa.gov/esds/veda) project is an open-source science cyberinfrastructure that supports data processing, visualization, exploration, and geographic information systems (GIS) capabilities.

3.2.1.1 Identity and Access Management (IAM)
Public clouds (such as AWS, Google Cloud and Azure) provide IAM, accounting and monitoring services integrated as part of their overall service offering.

In the research community, the AARC Blueprint Architecture (https://aarc-project.eu/architecture/) provides software building blocks that can be used to implement federated access management solutions for international research collaborations.

OIDC and OAuth 2.0 are the industry standards related to IAM. OIDC is used for single sign-on and OAuth 2.0 for the delegation of access to resources.

OGC testbeds have utilised these technologies to demonstrate identity and access management.

3.2.1.2 OGC activities
The Open Geospatial Consortium (OGC) provides a variety of outputs, including:

- Standards for system and data interoperability
- Testbed activities that identify, test and demonstrate new capabilities
- Reports and advice: such as the OGC Best Practice for Earth Observation Application Package

Since the OGC supports open standards, they are likely to be an important feature to enable interoperability within, and beyond, the Hub Platform.

3.2.1.3 Workflow tools and services
The creation, testing, deployment and execution of scientific/data workflows is an essential part of the Hub Platform. There are numerous tools and technologies available for managing scientific workflows. A set of interesting and possible approaches are listed here for reference:

- Common Workflow Language (CWL): is a general-purpose language for describing workflows. It has been employed by EOEPCA for describing applications (I.e. workflows), their inputs, outputs and resource requirements.
- Example technologies include Apache Airflow, Ray, Galaxy, Distributed Dask, VisTrails, Dagster and Argo
    - Many of these workflow tools are platform-agnostic and will run on any public cloud provider
- In the public cloud: Microsoft offers AzureML and MLflow (not limited to Machine Learning), Amazon offers AWS Step Functions and Amazon Managed Workflows for Apache Airflow (https://docs.aws.amazon.com/whitepapers/latest/best-practices-building-data-lake-for-games/workflow-orchestration.html), Google Cloud offers Workflows and more specific approach within Google Earth Engine.

3.2.1.4 Data discovery and catalogs
There are a number of standards and existing systems that define metadata content and interfaces for the harvest and discovery of data. The standards of relevance include:

- OGC Catalog Services for the Web
- OpenSearch
- Spatio Temporal Asset Catalog (STAC): a de facto standard in the EO community for metadata describing EO products and for search.
- OGC APIs – Records
- DCAT and GeoDCAT provide high-level catalog standards (https://www.w3.org/TR/vocab-dcat-3/)

Existing catalogs of large EO and climate data holdings include:

- CEDA Catalog: https://catalogue.ceda.ac.uk
- Catalog of ECMWF real-time products: https://www.ecmwf.int/en/forecasts/datasets/catalogue-ecmwf-real-time-products
- Copernicus Climate Data Store: https://cds.climate.copernicus.eu/
- ESGF Search Portal: https://aims2.llnl.gov/search
- Amazon Sustainability Data Initiative (ASDI): https://sustainability.aboutamazon.com/environment/the-cloud/amazon-sustainability-data-initiative
- Microsoft Planetary Computer STAC catalog: https://planetarycomputer.microsoft.com/catalog
- Google Earth Engine Data Catalog: https://developers.google.com/earth-engine/datasets/

3.2.1.5 Other initiatives

Other relevant initiatives, programmes, services in the EO sector, and broader environmental and Earth sciences such as the Copernicus Climate Data Store, Copernicus DIAS, Pangeo initiative, commercial and public sector-based platforms which provide access to data or aggregate access to data across multiple sources.

Additionally, these initiatives provide inspiration for the Hub Platform:

- NCEO website (showcasing datasets): https://www.nceo.ac.uk/data-tools/datasets/
- Dask processing dashboards: https://docs.dask.org/en/stable/dashboard.html
- UK Climate Projections User Interface: https://ukclimateprojections-ui.metoffice.gov.uk
- Copernicus Climate Change Service (C3S) Climate Data Store (CDS): https://cds.climate.copernicus.eu/
- Digital Earth Africa: https://www.digitalearthafrica.org/
- Digital Earth Australia: https://www.dea.ga.gov.au/
- ADAGUC - Atmospheric Data Access for the Geospatial User Community: https://adaguc.knmi.nl/
- Climate-ADAPT - European Climate Adaptation Platform: http://climate-adapt.eea.europa.eu/
- NASA EO Data Gateway: https://www.earthdata.nasa.gov/
- KNMI Climate Explorer - research tool to investigate the climate: http://climexp.knmi.nl/
- Climate4Impact portal: https://www.climateurope.eu/climate4impact/
- MyOcean - Marine environment monitoring service http://marine.copernicus.eu/
- SeaDataNet - Pan-European Infrastructure For Ocean & Marine Data Management: http://www.seadatanet.org/
- NCAR Research Data Archive: https://rda.ucar.edu/

3.3 Organisation and Staffing

3.3.1 Tenderer engagement with the project team, and partner projects

As part of the proposal the Tenderer should provide a plan for regular engagement with the:

- EODH Core Team (including members from NCEO, STFC CEDA, Leicester University, the Satellite Applications Catapult (SAC), the Met Office, the National Physical Laboratory (NPL), and the UK Space Agency (UKSA)).
- Data Streams Project Teams
- Applications Project Teams
- EOCIS project team

This should include scheduled meetings at least monthly, with more frequent communications planned through other tools and systems (such as Slack, Zoom and GitHub).

3.3.2 Specific relationship with the EODH Core Team

The EODH Programme is a very dynamic activity with a range of organisations collaborating closely in order to build this exciting new system to support EO science in the UK. Winners of all the ITTs will be invited into this collaboration. In particular, the winner of the Hub Platform ITT should be invested in the potential medium and long-term growth of the EODH which is likely to result in future expansion and related funding opportunities.

In-person technical meetings with the EODH Core Team should be planned at least every 3 months at the Rutherford Appleton Laboratory (where CEDA is based, in Oxfordshire), lasting at least 4 hours. The meetings will coincide with project milestones and will be used to monitor progress, maintain close collaboration, and plan the next work period.

3.4 Governance

The overall EODH Programme, and its constituent activities and projects, are governed by the EODH Core Team. As the programme progresses, this will evolve into a formal EODH Management Team. The Tenderer will become a partner in the Management Team as the role of the Hub Platform is crucial to the delivery of the overall aims.

In relation to the Hub Platform, the Tenderer is expected to provide guidance on how the various components, and their interactions, should be governed and controlled. This is particularly important in relation to the following areas:

- Responsibility for resource management (e.g. Who owns/manages which components? How are limits applied? How are resources switched off and reclaimed?)
- Ownership, quality and integrity of resource catalog records (e.g. How trustworthy is a given product? What QA has been undertaken? How should a user decide between competing algorithms/workflows?)

4 Scope

4.1 Components within Scope

The scope of this ITT includes the components *labelled* in the streamlined architecture diagram in Figure 2. The unlabelled boxes will be delivered by the EODH Programme or projects delivered by other ITTs.

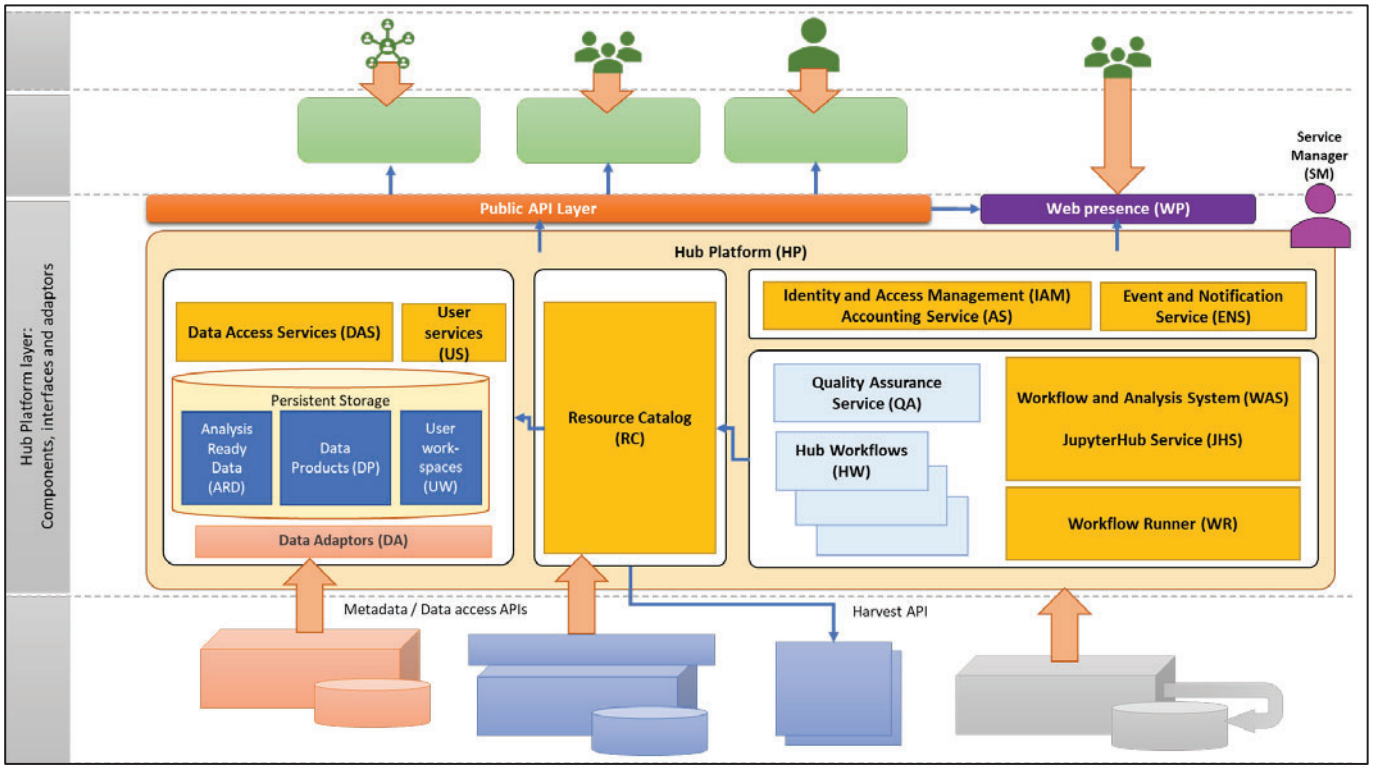


Figure 2. Streamlined EODH architecture diagram - only the components within the scope of the Hub Portal are labelled.

4.2 Resource demand during the project lifetime

The project will run until 31st March 2025. During this period, the main focus of the Tenderer will be on the delivery of the system and interactions with the partners as specified elsewhere in this document.

In the final 6 months, the project enters a pre-operational and then an operational phase. During this period, the use of the Hub Portal services is expected to grow steadily. The Tenderer should plan for this growth and build in contingency for more rapid expansion beyond the project duration.

The design of the system should factor in scalability based on the use of public cloud compute and storage services.

4.3 Exclusions

The main focus of the EODH is on the UK domain and UK science. We therefore expect the public cloud-hosting to take place in a region with excellent bandwidth to the UK.

4.4 Known constraints

4.4.1 Public cloud provider

The Tenderer will need to design and deploy the Hub Platform on the public cloud provider chosen by the Authority.

4.4.2 Data Stream providers

Initially, the Tenderer will work with CEDA as the main data provider. Once the data stream contract(s) has/have been established then the Tenderer will also need to work with the successful supplier(s) to these award(s).

4.5 Period of Agreement

The Period of the Agreement of this ITT matches that of the overall EODH Programme, to be completed by 31st March 2025.

4.6 Use Cases

4.6.1 Rationale and Role of Use Cases

The Use Cases (UCs) are here to convey the requirements through a set of stories that link together the components and functional areas of the Hub Platform, along with the external drivers such as Hub-users and *Applications*. These narratives are cross-referenced with the main architectural diagram and the requirements listed in the next section.

Each use case is described as follows:

- Core information:
  - UC number
  - Short title
  - Long title
  - Summary
  - Main actors
  - Main beneficiaries
- Individual steps of the UC:
  - Step number: e.g. "UC6.2"
    - Some UCs include possible extensions. These are indicated by the naming convention "UCn.EXm" (where "EX" means extension).
  - Step description
  - Hub components (or functional areas) associated with this step – see below for the acronyms that are used

The UCs will be used as a qualitative tool in the following stages of the project:

- Proposal to this ITT: The Authority will assess how well each proposal supports the UCs.
- Regular project meetings: The UCs will be used as a reference point to check that the project is progressing on course (e.g. "*How will the current approach deliver a solution to UC3.4?*").

4.6.2 Overview of Use Cases

Here is a reminder of the acronyms used in the Use Case descriptions:

- ARD: Analysis Ready Data
- AS: Accounting Service
- DA: Data Adaptor
- DAS: Data Access Services
- ENS: Event and Notification Service
- HW: Hub Workflow
- IAM: Identity and Access Management
- JHS: JupyterHub Service
- QA: Quality Assurance service
- RC: Resource Catalog
- US: User Service
- UW: User Workflow
- WAS: Workflow and Analysis System
- WR: Workflow Runner

The following table provides a high-level view of the UCs 1-8.

Short title	Title	Main actors	Beneficiaries	Summary	Hub Components
UC1. System Configuration	Configuration and Population of the EODH	Service Manager	Researchers Industry Public	The EODH is launched. An EODH Admin needs to start creating/adding content.	RC, ENS, ARD, JHS, WR, IAM, AS
UC2. Adding a Dataset	Existing dataset available via the EODH	Data supplier	Researchers Industry Public	The Hub-user, in this case, a Data Supplier, wishes to add their data to the EODH. This involves both cataloguing and creating an adaptor for data access.	RC, DA, DAS, WAS
UC3. Time-critical Sentinel Processing	Time-critical data access to Sentinel products hosted at a data centre	Data supplier Remote Sensing Team	Researchers Industry Public	The Hub-user, in this case a Remote Sensing Team, is required to generate time-critical environmental analyses for land-use monitoring system. When certain Sentinel products arrive, they need to run a specific workflow.	RC, WAS, RC, ENS, WR, HW
UC4. Share new analysis	New EO analysis and outputs developed from EODH experimentation	Research Group	Researchers Industry Public	The Hub-user (HU), in this case a Research Group, develops a new EO workflow to derive new outputs from existing data sets available through the EODH.	IAM, JHS, WAS, RC, WR, UW

UC5. ARD Pipeline with QA	Analysis-Ready Data (ARD) Pipeline established with QA and Tagging	Research Community Commercial Groups Service Manager	Researchers Industry Public	Community (e.g. a collaboration of research and commercial groups) define useful ARD products to be hosted on the EODH	RC, WAS, QA, ARD, WR, IAM, ENS
UC6. Enabling a Commercial App	Commercial Coastal Change Application built on EODH data and processing	EO Company Service Manager	Researchers Industry Public	The Hub-user (HU), in this case an EO Company, plans to build a Web Application (App) that uses the EODH for access to processing and data downloads. The App uses Sentinel (and other) data to provide imagery and other products of coastline at chosen locations. End-users will pay the HU for direct access to the App, and the HU will pay for access to resources on the EODH.	IAM, AS, WAS, UW, RC, WR, ENS, DAS
UC7. Enabling a Climate Risk App	Climate Risk Web Application built on ARD climate projections	Geospatial Consultancy Data Centre Service Manager	Researchers Industry Public	The Hub-user (HU), in this case a Geospatial Consultancy, has developed a Climate Risk Web Application (App) to predict risks from climate change such as flooding, drought and heat waves. The application takes in locations and time periods (historical and future), and then calculates events and thresholds - resulting in the probability of future events happening or of thresholds being exceeded. In order for the App to work in real-time, it requires UKCP, CORDEX and CMIP6 data pre-cached in a Data Cube. The App is a very lightweight React client.	ARD, RC, JHS, IAM, AS, WAS, US, UW

				All data processing/interactions happen on the Hub Platform.	
UC8. Pay-per-use Commercial Data	Pay-per-use Commercial Hyperspectral product available via the EODH	Commercial satellite company Service Manager	Researchers Industry Public	The Hub-user, in this case, a commercial satellite company, has deployed a new satellite and wishes to provide paid access for certain products. The EODH community is keen to incorporate these new hyperspectral products.	IAM, RC, AS, JHS

4.7 Detailed Use Cases

4.7.1 UC1. System Configuration

Short title	Title	Main actors	Beneficiaries	Summary	Hub Components
UC1. System Configuration	Configuration and Population of the EODH	Service Manager	Researchers Industry Public	The EODH is launched. An EODH Admin needs to start creating/adding content.	RC, ENS, ARD, JHS, WR, IAM, AS

Step #	Step	Hub Components
UC1.1	Admin user created for EODH.	-
UC1.2	Pre-configured catalog entries and workflows are available by default.	RC
UC1.3	External data catalogs are automatically harvested into the RC.	RC
UC1.4	Supported workflows are added to the ENS in order to start populating ARD/intermediate products hosted on the EODH.	ENS, ARD
UC1.5	Example code is developed in the JHS to demonstrate the use of the cached products.	JHS
UC1.6	Example HWs are published to the RC to demonstrate access to and use of processing capabilities of the Hub Platform.	RC, WR
UC1.7	Example HWs are executed, and the outputs are verified to ensure the workflows are running as expected.	WR
UC1.8	Early adopter accounts are set up for Apps and scientific users.	IAM, AS

4.7.2 UC2. Adding a Dataset

Short title	Title	Main actors	Beneficiaries	Summary	Hub Components

UC2. Adding a Dataset	Existing dataset available via the EODH	Data supplier	Researchers Industry Public	The Hub-user, in this case, a Data Supplier, wishes to add their data to the EODH. This involves cataloguing, creating an adaptor for data access and the appropriate access policy.	RC, DA, DAS, WAS

Step #	Step	Hub Components
UC2.1	HU has EO data already at their own data centre.	-
UC2.2	Existing data holdings are available via FTP only.	-
UC2.3	HU creates an authorisation access policy for a new dataset.	IAM
UC2.4	HU creates STAC records for addition to the RC, associating the access policy with the catalog records,	RC
UC2.5	HU creates a data adaptor so that data can be served through OGC web service interfaces and/or read into the WAS.	DA, DAS, WAS

4.7.3 UC3. Time-critical Sentinel Processing

Short title	Title	Main actors	Beneficiaries	Summary	Hub Components
UC3. Time-critical Sentinel Processing	Time-critical data access to Sentinel products hosted at a data centre	Data supplier Remote Sensing Team	Researchers Industry Public	The Hub-user, in this case a Remote Sensing Team, is required to generate time-critical environmental analyses for land-use monitoring system. When certain Sentinel products arrive, they need to run a specific workflow.	RC, WAS, RC, ENS, WR, HW

Step #	Step	Hub Components
UC3.1	Existing data centre has sub-daily feeds of Sentinel data arriving.	-
UC3.2	The data centre updates its STAC catalog when each new file arrives.	-
UC3.3	The RC harvests the STAC records to maintain an up-to-date view of the data availability.	RC
UC3.4	HU develops and publishes a HW that reads the STAC records in order to access the latest Sentinel scenes and process them.	WAS, RC
UC3.5	HU visits the dashboard of the ENS and creates an event rule that will trigger the HW to run whenever a new record arrives for a specific Sentinel product.	ENS, RC
UC3.6	The WR runs the HW whenever the event occurs.	WR, HW

4.7.4 UC4. Share new analysis

Short title	Title	Main actors	Beneficiaries	Summary	Hub Components
UC4. Share new analysis	New EO analysis and outputs developed from EODH experimentation	Research Group	Researchers Industry Public	The Hub-user (HU), in this case a Research Group, develops a new EO workflow to derive new outputs from existing data sets available through the EODH.	IAM, JHS, WAS, RC, WR, UW

Step #	Step	Hub Components
UC4.1	HU registers using the Identity and Access Management services (IAM).	IAM
UC4.2	HU uses JupyterHub Service (JHS) to construct a Hub Workflow (HW) to generate some novel outputs.	JHS
UC4.3	HU uses the Workflow and Analysis System (WAS) to package the HW as a container.	WAS
UC4.4	HU creates an authorisation access policy in the IAM.	IAM
UC4.5	HU publishes the HW in the Resource Catalog (RC), associating it with the access policy.	RC
UC4.6	HU associates the RC record for the HW with RC records for data sets used as inputs in the HW.	RC
UC4.7	A scientist, Hub-user 2 (HU2), discovers the existence of the HW via the RC.	RC
UC4.8	HU2 registers for the HW, to gain access to it.	IAM
UC4.9	HU2 requests to execute the HW on chosen input data using the Workflow Runner (WR).	WR
UC4.10	WR deploys container(s) for the HW and executes it, depositing the output files in the User Workspace (UW).	WR, UW
UC4.11	HU2 downloads output files using the DAS or interacts with them directly using the JHS.	DAS, JHS

4.7.5 UC5. ARD Pipeline with QA

Short title	Title	Main actors	Beneficiaries	Summary	Hub Components
UC5. ARD Pipeline with QA	Analysis-Ready Data (ARD) Pipeline established with QA and Tagging	Research Community Commercial Groups Service Manager	Researchers Industry Public	Community (e.g. a collaboration of research and commercial groups) define useful ARD products to be hosted on the EODH	RC, WAS, QA, ARD, WR, IAM, ENS

Step #	Step	Hub Components

UC5.1	A Product Team (PT) is convened to define the required input data sets, processing algorithms, output definitions and QA.	-
UC5.2	The PT, Community and SM agree that the ARD products will be supported through community funding, to be free at the point of use, and accessible from the EODH.	-
UC5.3	A Deployment Team (DT) takes requirements from PT and uses RC, WAS and HW to develop a multi-step workflow that produces multiple ARD products and includes additional Quality Assurance and Tagging workflows.	RC, WAS, HW, QA
UC5.4	DT defines the resource requirements to process 50TB of input data to generate the ARD products. SM allocates appropriate space in the ARD cache.	ARD
UC5.5	DT tests and deploys HW using WAS.	WAS
UC5.6	WR runs the entire HW and generates outputs.	WR
UC5.7	Intermediate QA and Tagging workflows are triggered by the generation of data using the ENS.	QA, ENS
UC5.8	WR and WAS provide suitable logging and error reporting to enable re-runs and de-bugging of failed runs.	WR, WAS
UC5.9	ARD products are published to the RC, according to the agreed rules of visibility and access.	RC, IAM
UC5.10	RC product records include a full provenance chain of data inputs as workflow steps. QA and Tagging records add extra information and metadata to improve search and discovery of appropriate data.	RC, QA
UC5.EX1a	A third-party may decide to build a new web-application that exposes or exploits the new ARD products.	WAS, US
UC5.EX1b	Optionally, near real-time running of the HW is enabled through the ENS. In support of this new HW, an authorisation access policy is created.	ENS, WR, IAM

4.7.6 UC6. Enabling a Commercial App

Short title	Title	Main actors	Beneficiaries	Summary	Hub Components
UC6. Enabling a Commercial App	Commercial Coastal Change Application built on EODH data and processing	EO Company Service Manager	Researchers Industry Public	The Hub-user (HU), in this case an EO Company, plans to build a Web Application (App) that uses the EODH for access to processing and data downloads. The App uses Sentinel (and other) data to provide imagery and other products of coastline at chosen locations. End-users will pay the HU for direct access to the App, and the HU will pay for access to resources on the EODH.	IAM, AS, WAS, UW, RC, WR, ENS, DAS

Step #	Step	Hub Components
UC6.1	HU registers with EODH.	IAM

UC6.2	HU registers its App with the EODH account.	IAM
UC6.3	HU and SM set up a costing model (using the Accounting Service (AS)) for access to processing and data cache.	AS
UC6.4	HU configures the cache to store outputs in EODH (cloud) storage.	IAM
UC6.5	HU develops a Docker container at its own repository, containing code that generates an ARD product for the App.	-
UC6.6	HU uses WAS to wrap the container in a HW and tests the HW works correctly with data accessible via the RC.	WAS
UC6.7	HU configures the HW to write to its own EODH storage (which is a UW).	IAM, WAS, UW
UC6.8	HU registers the HW with the Resource Catalog (RC), limiting access to the App only.	RC, IAM
UC6.9	HU also registers the App with the RC, so that it is added to the list of applications built on top of the EODH.	RC
UC6.10	HU decides on the visibility of the HW in the RC.	RC
UC6.11	HU connects the App to the HW, and data is generated on-demand by the WR and outputs are cached in the UW.	WR, UW
UC6.12	HU later decides to improve performance by pre-caching certain locations for near real-time data feeds. HU uses ENS to trigger the running of the HW whenever new data is available for certain feeds.	ENS
UC6.EX1	The wider community learns of the cached data set and requests open access for broader usage.	-
UC6.EX2	HU and SM agree to transition near real-time running of the HW to a workflow provided as a supported part of the EODH rather than within a user-managed workflow.	-
UC6.EX3	Outputs are generated routinely, data is considered a "supported" dataset in the EODH, and is accessible via the RC.	HW, RC, WR
UC6.EX4	End-users can discover the new dataset through the RC and access it via the Data Access Services (DAS).	RC, DAS

4.7.7 UC7. Enabling a Climate Risk App

Short title	Title	Main actors	Beneficiaries	Summary	Hub Components
UC7. Enabling a Climate Risk App	Climate Risk Web Application built on ARD climate projections	Geospatial Consultancy Data Centre Service Manager	Researchers Industry Public	The Hub-user (HU), in this case a Geospatial Consultancy, has developed a Climate Risk Web Application (App) to predict risks from climate change such as flooding, drought and heat waves. The application takes in locations and time periods (historical and future), and then calculates events and thresholds - resulting in the probability of future events happening or of thresholds being exceeded. In order for	ARD, RC, JHS, IAM, AS, WAS, US, UW

				the App to work in real-time, it requires UKCP, CORDEX and CMIP6 data pre-cached in a Data Cube. The App is a very lightweight React client. All data processing/interactions happen on the Hub Platform.	

Step #	Step	Hub Components
UC7.1	Data Centre creates appropriate datasets in Analysis Ready Cloud Optimised (ARCO) format (e.g. STAC catalog, Zarr and/or Kerchunk interface to NetCDF) for required datasets (CMIP6, CORDEX, UKCP, HadUK-Grid).	-
UC7.2	Datasets are uploaded to the ARD cache and STAC records are added to the RC.	
UC7.3	Data Cube has been defined as a Python interface for the relevant ARD climate datasets.	JHS
UC7.4	HU registers with EODH.	IAM
UC7.5	HU registers its App with the EODH account.	IAM
UC7.6	HU signs up to AS, to account for financial cost of processing on the Hub Platform.	AS
UC7.7	HU develops a Docker container on its own repository, containing code that extracts the input data required by the App.	-
UC7.8	HU develops a US using the WAS. Small cached products are generated and stored in the UW.	WAS, US, UW
UC7.9	HU registers the US with the Resource Catalog (RC), limiting access to the App only.	RC, IAM, US
UC7.10	HU decides on the visibility of the HW in the RC.	RC
UC7.11	HU connects the App to the US, and processes are called dynamically by the App.	US

4.7.8 UC8. Pay-per-use Commercial Data supplier

Short title	Title	Main actors	Beneficiaries	Summary	Hub Components
UC8. Pay-per-use Commercial Data	Pay-per-use Commercial Hyperspectral product available via the EODH	Commercial satellite company Service Manager	Researchers Industry Public	The Hub-user, in this case, a commercial satellite company, has deployed a new satellite and wishes to provide paid access for certain products. The EODH community is keen to incorporate these new hyperspectral products.	IAM, RC, AS, JHS

Step #	Step	Hub Components
UC8.1	HU registers with the EODH.	IAM
UC8.2	HU provides catalog records via STAC (either via an external catalog or individual records) to the RC.	RC

UC8.3	Records include information about pricing and usage limitations.	RC, AS
UC8.4	A scientific data consultant, HU2, discovers the hyperspectral commercial data in the RC.	RC
UC8.5	HU2 selects certain records and accesses them through the JHS.	JHS
UC8.6	The AS measures the data usage and charges HU2 accordingly.	AS
UC8.7	HU receives payment for the usage by HU2.	AS

5 Requirement

5.1 Overview of Requirements

The Hub Platform is intended to be delivered through a set of infrastructure components that will be hosted on a public cloud provider. The details of *how* the Platform is delivered are a choice for the Tenderer, and we encourage innovative and creative solutions to be put forward. However, in order to fairly and consistently score the project proposals, we provide a set of detailed requirements that represent the functionality that we expect to see in the final Hub Platform.

Each bid is expected to state how it will meet each requirement. However, it is important to stress that the Tenderer can satisfy requirements by offering alternative approaches that will deliver an equivalent, or better, outcome. The evaluation system will enable different technical solutions to be compared and scored fairly.

Following the functional requirements, a set of operational requirements are included. These are relevant to the operational phase of the project, the final 3 months.

5.1.1 Mandatory and optional requirements

All the functional requirements are considered mandatory unless they are specifically labelled as "optional", following the notation:

- Rn.m (e.g. R1.3): a mandatory requirement, section "n", number "m".
- Rn.m.OPT (e.g. R2.11.OPT): an optional requirement, section "n", number "m".

The optional requirements are included to prompt the Tenderer to include additional capabilities at their discretion. This may be particularly useful when pre-existing solutions are proposed that already meet the optional requirements. Additionally, we strongly recommend that the Tenderer includes information about extra features and functionality that they intend to provide that are not directly mentioned in our requirements set.

The operational requirements follow the naming conventions of "ORn", where "n" is the requirement number.

5.1.2 Format of functional requirements

The requirements are all tabulated using the following components:

- Functional area: to be cross-referenced with the main architecture diagram, reproduced in simplified form below
- Requirement number: including label denoting whether optional
- Short title
- Description
- Notes to Tenderer: if applicable

Figure 3 is included here as a reminder of the functional areas and the acronyms used in the requirement descriptions.

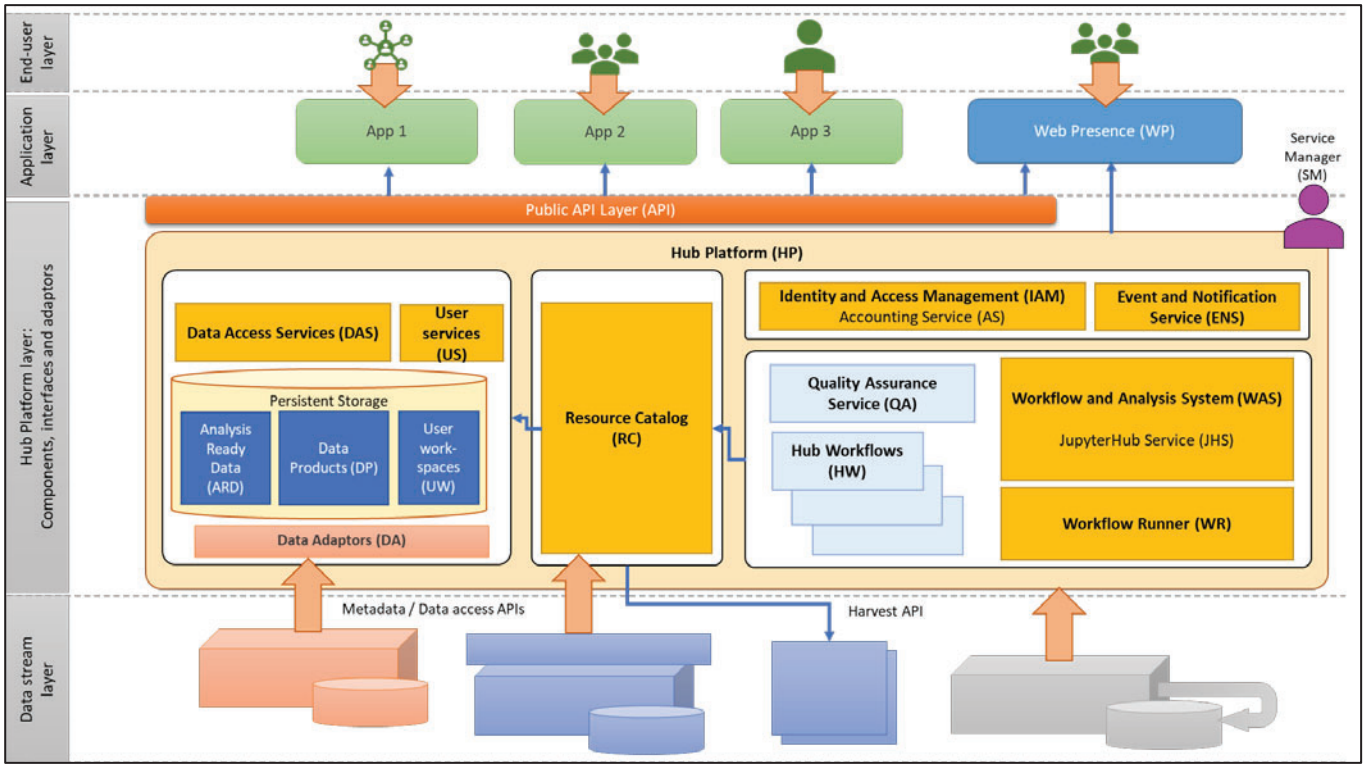


Figure 3: Hub Platform Overview, showing functional areas and their acronyms.

5.2 Detailed functional requirements

5.2.1 General requirements

5.2.1.1 Description

The overall objective is to develop and operate the Hub Platform, a software system to provide a common and consistent access layer to a range of EO data sources, to provide services to discover, manipulate and cache data products. The Hub Platform facilitates the development of applications that utilise EO data to produce value-added products, gain insights and support decision-making for given application scenarios. The Hub platform is targeted at application developers and EO expert users to support them with services and data access to meet their needs.

The successful Tenderer will need to develop an overall system architecture including interfaces and data model. This must use appropriate standards and best practice. It should apply experience from examples of the successful implementation and operation of federated and cloud-based infrastructures for the EO community. The architecture should reference and consider examples of infrastructures, standards and specifications in the EO sector such as the ESA Earth Observation Exploitation Platform Common Architecture, OpenEO, the EuroDataCube, ESA Thematic Exploitation Platforms programme, the Copernicus CDS, European Weather Cloud, European Open Science Cloud. Examples of standards and other literature include but should not be limited to the OGC family of specifications, reports from their interoperability experiments and testbeds, CF-netCDF, OpenID Connect, OAuth 2.0, STAC, and CEOS OpenSearch Best Practice. Parts of the required functionality may be delivered through existing off-the-shelf solutions and services from Public Cloud Providers. The Tenderer is encouraged to re-use existing production-ready solutions wherever possible.

The Tenderer will implement services and interfaces as outlined in the system architecture on a public cloud provider. The Tenderer will need to work closely with the other funded work streams in the EO DataHub programme. This is critical to its overall success. To reiterate, the work streams are:

1) The Hub Platform – the subject of this ITT document.
2) Data streams – the integration of different sources of data into the Hub Platform.
3) Applications – the development of software applications which exploit the functionality provided by the Hub Platform.

5.2.1.2 Interactions with other FAs

The General requirements underpin the delivery of the Hub Platform and therefore relate to all other FAs.

5.2.1.3 Interactions with other EODH ITTs and projects

The General requirements involve collaborations and interactions with the:

- Data Streams ITT
- Applications ITT

5.2.1.4 Requirements

Number	Title	Description	Notes to Tenderer
R1.1	High-level design	The Tenderer shall provide evidence through a high-level design of how they would construct the Hub Platform.	The Tenderer should make use of open standards and open source* software as much as possible. Building on the design of existing systems that perform similar functions or part of the total capability will give greater confidence in the ability to deliver the required output. *All closed source, licensed software and any associated costs should be declared in the software register included in your proposal.
R1.2	General support	The Tenderer shall provide the Authority with expertise, tooling and support in managing data, processing data and making data available, discoverable and accessible to the customers of the EODH.	The Tenderer should describe how they will support the Authority in managing data, processing data and making data available, discoverable and accessible to all customers in ever increasingly simpler ways despite: 1. the global challenges of ever-increasing data volumes 2. the challenge to control costs due to scale The Tenderer should consider opportunities to create or facilitate the: 1. provision of experience/learning sharing in supporting large-scale non-heterogeneous data platforms 2. provision of data and processing through a self-service common platform 3. assistance in creating and supporting tools and techniques for efficient data transport and data-compute affinity between system environments
R1.3	Agile delivery	The Tenderer shall work with the Authority in an agile delivery manner.	

R1.4	Support for use cases	The Tenderer shall ensure that the Hub Platform is able to support the use cases identified in this ITT.	
R1.5	Open source code	The Tenderer shall create the Hub Platform software under suitable Open Source licensing and make all code available on a GitHub (or similar) instance dedicated to the project.	The Tenderer may include code located in other Open Source repositories. In such cases, the exact release versions of each dependency should be clearly stated in the system documentation.
R1.6	Maintainability	The Tenderer shall develop a system that is easy to maintain by another party that was not involved in the development and deployment process.	This requirement should influence the design, modularisation and choice of software.
R1.7	Public cloud hosting	The Tenderer shall build the Hub Platform upon the Authority's chosen public cloud platform. All cloud services have to be built using an Infrastructure as Code (IaC: https://www.redhat.com/en/topics/automation/what-is-infrastructure-as-code-iac) approach.	
R1.8	Baseline "test" version of the Hub Platform	A baseline, or test, version of the Hub Platform should be able to be built using Infrastructure as Code recipes. The resulting instance of the platform should automatically run integration tests that demonstrate its functionality and interfaces are all working as expected.	
R1.9	Cost-effectiveness	The Tenderer shall state how they will ensure that the development and running of the Hub Platform is cost-effective.	
R1.10	Usability and efficiency	The Tenderer shall consider usability and efficiency (in terms of time and money) as key drivers for the successful creation of the Hub Platform.	In designing the Hub Platform, the Tenderer should consider usage questions, such as: - How many clicks does a user have to make to get from A to B? - How long does it take a user who knows what data they want to find and access their data? - How long does it take a user who doesn't know what data they want to find and access their data? - Once a user has their data how easy is it to achieve their end goal? - Does the user need to refer back to the catalog for any supplementary information? - Does the catalog assist users in making better decisions around which

			datasets/services are more appropriate for their use cases how to measure this? - Does the catalog help users satisfy their use case for less total cost due to them making use of more appropriate access patterns?
R1.11	Cost transparency	The Tenderer shall design and build the EODH to provide cost transparency.	The cost of the proposed and actual use of the EODH should be clearly presented and explained to all Hub-users. Some users, such as academic researchers, may access many resources free at the point of use, but all costs and knowledge of who pays should be clear. All accounting and metrics should be recorded so that the Authority has full knowledge of the usage and financial costs of the system.
R1.12	Collaboration and engagement	The Tenderer shall engage frequently with the winners of the Applications and Data Streams ITTs to plan and communicate an integrated delivery of the overall EODH solution.	The Tenderer is expected to take a lead in the communication with other EODH activities since the requirements management and integration depend on the Hub Platform delivery.
R1.13	Responsiveness to Application contracts	The Tenderer shall be responsive to the requirements that are highlighted during the development of the contracts funded through the Applications ITT.	Being responsive to the Applications developed on top of the Hub Portal will require an agile approach to resource planning and prioritisation. Changes in the project direction should be agreed with the Authority through regular meetings and constructive collaboration.

5.2.2 Data Streams Interface

5.2.2.1 Description

This component concerns the integration of data sources with the Hub Platform which includes EO data products, other observational data and climate model outputs. Fundamental to the Hub Platform design is the goal of integrating source data from different data providers such that users of the Hub have a common point for discovery (see section Resource Catalog) and access.

The Tenderer is required to work closely with the suppliers implementing the data streams project activity within the overall EODH programme. CEDA will act as a supplier for climate-related and publicly accessible EO data products. Additionally, a specific data streams ITT will be issued in the autumn to contract supplier(s) for further datasets. This is likely to include high-resolution commercial data.

The Hub Platform provides links to these data and integrates them through the definition of standard interfaces and the development of adaptors as required. These adaptors enable a set of interfaces for access to the data from the Hub Platform.

The second core function of the Hub Platform is to support the ability to take source data and transform it into other forms be they value-added products in themselves or intermediate outputs suitable for consumption by dependent applications. This could include Analysis-Ready Data products or the creation of data cubes. This functionality comes under the scope of the Workflow and Analysis System in the Hub Platform.

Consequently, as well as providing interfaces to support access to external data, the Data Streams component will need to support caching of data within the Hub infrastructure itself.

This part of the system is to allow access to a federated system of data supply. It will support access to:
- open and commercial EO datasets
- data sources from a range of catalogs and platforms

It may also support access via:
- data cube technologies

5.2.2.2 Interactions with other FAs

The Data Streams interface requirements mainly interact with:
- Resource Catalog
- Identity and Access Management, Accounting
- Data Services
- Persistent Storage

5.2.2.3 Interactions with other EODH ITTs and projects

The Data Streams interface requirements are heavily interlinked with the:
- Data Streams ITT

5.2.2.4 Requirements

Number	Title	Description	Notes to Tenderer
R2.1	Metadata and data interfaces	The Tenderer shall define the metadata and data interfaces to enable the ingestion or harvesting of metadata records and data assets into the Hub Platform.	Data *Adaptors* (i.e. software interfaces that enable seamless access to a data stream) may be developed by the Tenderer, the data stream provider, a third-party or through a collaboration.
R2.2	Data licensing	The Tenderer shall allow a data producer to define the licence terms for the data input	
R2.3	Data stream monitoring	In the event of data not being available when "expected", the Hub Platform should have the capability to notify the data producer.	

5.2.3 Resource Catalog

5.2.3.1 Description

This component provides a searchable inventory of metadata related to resources managed by the Hub. A resource catalog is a complete list of items. Its purpose is to aid consumers, users and owners of data with the discovery, understanding and management of the catalogued items, such as data. A catalog provides the ability to define and describe data assets and data collections as indexed, linked and searchable information to support efficient data usage including the curation of catalog records. All datasets within the data catalog will include interfaces linked by this capability. The catalog should be built so that new datasets and APIs can be published without the need to change the catalog schema(s) or software.

Resources include data products federated from data providers, application templates for deploying services and compute environments in the Hub, data products, analysis code and workflow provenance information about computations or data and quality information.

The catalog must support search and indexing (i.e. ingesting content about resources into the catalog). A fundamental capability of the Hub concept is to aggregate different data sources such that they can be discovered and accessed in a consistent manner. The Hub will need to be able to support the discovery of data across a discrete set of different data providers determined as part of the data streams (separate ITTs) and will need to be extensible such that new providers may be integrated. Data providers include organisations hosting public datasets such as the CEDA data archive but also commercial providers of EO data. Initial data holdings to be supported in the CEDA archive include Sentinel, UK Climate Projections (UKCP), the COordinated Regional Downscaling EXperiment (CORDEX) and the 6th Coupled Model Intercomparison Project (CMIP6). When the EOCIS begins to generate data then its products should also be included. The Resource Catalog should have the capability to harvest such data records from external catalogs, or federate content seamlessly.

A specific part of the functionality within the Resource Catalog will be support for the Quality Assurance metrics system. Working closely with the QA work package of the EODH project, the Tenderer will need to support a system for associating quality-related metadata with the main records in the RC. The QA system could be implemented as an exemplar for a more general model of annotation (or tagging) that enables additional content to be associated with data records, at both the collection and granule levels. This information should be accessible for discovery, search and browse - through both API and web-based interfaces.

5.2.3.2 Interactions with other FAs

As a central component of the Hub Platform, the Resource Catalog requirements interact with many FAs:

- Data Streams Interface
- Identity and Access Management, Accounting
- Workflow and Analysis System
- Workflow Runner
- Web Presence
- Data Services
- Event and Notification Service

5.2.3.3 Interactions with other EODH ITTs and projects

The Resource Catalog will interact with:

- Data Streams ITT
- Applications ITT

5.2.3.4 Requirements

Number	Title	Description	Notes to Tenderer
R3.1	Unique indexing	The catalog must be indexed, records must be uniquely identifiable and uniquely addressable from external systems (must have a unique URI).	
R3.2	Filtering and ordering	The catalog must support the filtering and ordering of records in a user-defined way.	
R3.3	Searchable metadata	The catalog must index the properties of records so that they are searchable	
R3.4	Export	The catalog should be exportable to a machine-readable format that	

		could be ingested into another system	
R3.5	Linking	Records should be able to reference, and be referenced by, other records/resources both inside and outside the Hub Platform.	
R3.6	Hierarchical relations	Records should be able to be arranged into navigable hierarchies, as defined by users.	
R3.7	Search capabilities	Records should be searchable by keywords, specific properties and free text queries.	
R3.8	Spatio-temporal search	Records should be searchable by spatial and temporal specifiers.	
R3.9	Natural language search	Natural language search should be supported	The Tenderer may support an alternative to this if the resulting search capability is intuitive and effective.
R3.10	Search logic	Search results should be sortable by relevance, frequency of use, and should be automatically filtered based on user permissions/preferences.	
R3.11	Search responsive-ness	Simple (e.g. single term) catalog searches should respond within 5 seconds. Advanced queries (e.g. including spatial and temporal bounds) should respond within 10 seconds.	The Tenderer should provide an explanation of how the search response times will not significantly increase when the catalog scales to hundreds of millions of records.
R3.12	Result Pagination	The search service should include a paginated response capability, through both the API and the web-interface.	
R3.13OPT	OPTIONAL: Search similarity	Similar/linked items to those matching the search are promoted alongside records.	
R3.14	Catalog scope	The scope of the catalog should be clear: it is well defined what criteria to use to judge whether an entry fits the scope.	
R3.15	Catalog structure	The information is structured with a view to sensible granularity, elements of similar granularity are presented together, with hierarchies presented where they exist.	
R3.16	Catalog integrity	Records can be Created, Read, Updated, or Deleted based on user permissions.	
R3.17	Version control	Records are version-controlled, with the ability to revert to a previous state.	

R3.18	Multiple version support	Multiple versions can simultaneously exist.	
R3.19	Status flags	Records can be given a status flag (such as "beta", "current", or "deprecated").	
R3.20	Catalog modification interfaces	Curation can be managed through an API or via a GUI interface.	
R3.21	Completeness and consistency	The catalog should contain full, accurate and up-to-date information on all data assets it is aiming to describe. The content should be consistent across all catalog records with respect to metadata.	
R3.22	STAC catalog	The main data catalog should be provided using the Spatio Temporal Asset Catalog (STAC) community standard. The dynamic backend should support scaling to 100s of millions of records.	
R3.23	Efficient user experience	User testing and feedback should be gathered to improve the catalog system to streamline the user experience.	
R3.24	Annotation capability	The catalog should include the capability for annotations to be connected to records, at all levels of the hierarchy. The initial annotation capability will support linking with QA results.	
R3.25	QA results catalog	The results of QA workflows should be recorded in a catalog, which may optionally be part of the main data catalog or implemented separately.	
R3.26	QA interface with data catalog	The results of QA workflows should be searchable as part of the main data catalog. The visual interface should present QA results graphically (such as a "Passed EODH QA") in a form that can be clicked to investigate more detailed results and links to the documented QA processes that were run.	
R3.27	Annotation visibility	The catalog should allow different types of annotations to be actively managed by the search system. Supported annotations, such as the QA results, should be switched on by default, whereas user-defined annotations might only become visible when a search query actively enables them.	

R3.28	Initial supported datasets	The initial datasets to be supported by the catalog are: Sentinel, UKCP, CORDEX, CMIP6	The Tenderer should note that the list of datasets to be supported by the Hub Platform will be updated during the course of the contract. The Tenderer will be expected to resource this aspect of the work in collaboration with the EODH Team. When EOCIS data becomes available, that should also be provided through the Hub Platform.
R3.29	Support for non-data assets	Workflows (i.e. "process offerings") should be managed and searchable within the catalog. Other non-data assets to be supported include Data Services, Templates for code and environments, Software environments, Code and Provenance records.	
R3.30	Associations between data and workflows	The catalog should support the linking of process offerings (workflows or services) with specific data records at the most granular level.	
R3.31	Timely updates	The Hub Platform should include capabilities to harvest new data into the catalog in a timely manner based on user-defined specifications.	
R3.32	Integration with a cost model	The catalog should include the capability to interface with the cost model so that any charges for data/processing are made clear to users when choosing which resources to access.	
R3.33	Integration with controlled vocabularies	The catalog should support integration with domain-specific controlled vocabularies and definitions via the use of unique identifiers.	

5.2.4 Identity and Access Management, Accounting

5.2.4.1 Description

This component concerns the management of identities and authentication and authorisation to access resources protected by the Hub Platform. It also encompasses related functionality: accounting and monitoring the use of resources. This component must also implement an Accounting Service to charge for resource consumption. Resources include – but not exclusively - data products, processing capacity, execution and analysis environments. The system must therefore also be able to monitor and measure resource utilisation to ensure that financial charges are based on actual usage.

The system must support single sign-on, enabling users to authenticate against identity providers that include commercial providers, providers from research federations (EduGAIN), and meet the needs of public sector users.

This component will also need to mediate access to data from third-party data providers serving data streams that are integrated with the Hub. As such it is necessary to implement delegated access to such resources.

The IAM must support the integration of applications that consume the Hub Platform services. It must be possible for these applications to be able to mediate access using browser-based and API-based interactions (enabling both command line interface and software library-based access).

5.2.4.2 Interactions with other FAs

Identity and Access Management, Accounting controls who can access each part of the Hub Platform. It therefore interacts with all FAs.

5.2.4.3 Interactions with other EODH ITTs and projects

The Identity and Access Management, Accounting will interact with:

- Data Streams ITT
- Applications ITT

5.2.4.4 Requirements

Number	Title	Description	Notes to Tenderer
R4.1	Integration with IAM standards	The Hub Platform should work and integrate with existing identity and access management standards and systems. The Hub Platform must support OpenID Connect (OIDC) and OAuth 2.0 for single sign-on and user delegation.	The Tenderer shall list which identity and access management standards shall be supported and any that will be explicitly not supported. The system should also consider other relevant standards such as SAML 2.0 for interfaces and the expression of access policies (e.g., OPA https://www.openpolicyagent.org/)
R4.2	Accounting	The Tenderer shall design and build the Hub Platform to allow users of the system to be charged for their use of resources supplied through the Hub Platform.	
R4.3	Customisable access	The Tenderer shall allow users to be given access to different datasets depending on customisable "roles" that the Authority can place against organisations or groups that the user is associated with.	
R4.4	Usage metrics	The Tenderer shall facilitate the capturing of metrics on the operation of the Hub Platform. The captured metrics must be able to be displayed in a standard open-source logging dashboard such as Kibana or ELK (https://www.elastic.co/what-is/elk-stack). The Tenderer must design the system to allow the level of metrics captured to be easily adjusted.	The Tenderer can expect that detailed metrics will be defined, and related to KPIs, as the project develops. The Monitoring and Evaluation (M&E) activities within the EODH Programme will impact these requirements.

R4.5	Access control	The Tenderer shall develop the necessary access control functionality to fully support licensing associated with data or other resources mediated through the Hub Platform.	
R4.6	Privacy and data protection	Any user accounts and information related to users should be protected. Users should have full control over deleting their accounts and any related assets.	It should be possible for commercial workflows to be developed, deployed and executed whilst maintaining confidentiality about the details, code, data and users involved.
R4.7	Support for single sign-on with external identity providers	The system must support single sign-on, enabling users to authenticate against identity providers that include commercial providers, providers from research federations (EduGAIN), and meet the needs of public sector users	The Tenderer should consider the AARC architectural pattern to mediate access between the Hub Platform and external identity provider: https://aarc-project.eu/architecture/

5.2.5 Workflow and Analysis System

5.2.5.1 Description

This component provides the facility for users to analyse data and run processing of datasets in the Hub environment with the ability to store outputs and intermediate products for ongoing consumption by applications as required. The functionality should support the processing of data in the hosted environment (both interactive and batch modes), to enable different processing elements to be assembled and executed in workflows; the capability to record and keep provenance information about the processing applied to produce a given data output.

The overall purpose is to allow the processing of datasets to create additional value. This could be for example to create analysis-ready datasets, share algorithms or create data cubes to allow easy access and manipulation of existing data.

We envisage that some workflows will be "supported" within the Hub Platform. The EODH includes a Quality Assurance work package that will deliver specific workflows to check the quality of key datasets. Additionally, users will be able to add their own workflows and make them available to others via the Resource Catalog.

The Workflow and Analysis System will include a JupyterHub Service that enables Hub-users to explore data, services, and develop workflows. Additional interactive development tools may also be provided to streamline the process of creating a workflow from Notebooks or code components.

It will:

- allow users to alter datasets through custom and pre-defined algorithms
- provide a Jupyter Notebook capability
- allow users to orchestrate processing components

It will not:

- provide unfettered access to large-scale computing

5.2.5.2 Interactions with other FAs

The Workflow and Analysis System requirements interact with many FAs:

- Resource Catalog
- Identity and Access Management, Accounting
- Workflow Runner
- Data Services
- Event and Notification Service

5.2.5.3 Interactions with other EODH ITTs and projects

The Workflow and Analysis System will interact with the supplier(s) for the Applications ITT, as workflows will be invoked by applications that build on the Hub Platform. It will also interact with the suppliers for Data Streams for scenarios where workflows need to access data from external sources.

5.2.5.4 Requirements

Number	Title	Description	Notes to Tenderer
R5.1	Workflow support	Hub-users must have access to tools for designing, testing and building persistent workflows on the Hub Platform.	
R5.2	Workflow composition	Workflows should be able to be composed of multiple steps, each defined within code elements. Parallel execution of steps should be supported.	
R5.3	JupyterHub support	A JupyterHub platform should be accessible to Hub-users, with supported software environments and the ability to deploy their own user-defined environments.	
R5.4	Workflow management	Workflows to be shared in the Resource Catalog should be constructed using Docker containers as their basic building block.	The Tenderer may deviate from this approach if they can present a strong argument for managing workflows using other tools and approaches. The chosen approach must be able to be supported on the public cloud compute platform to be adopted by the EODH.
R5.5	Workflow tools	Tools shall be provided to simplify the process of converting code blocks, or Jupyter Notebooks, into workflow components (typically as containers).	
R5.6	Workflow language	A suitable, machine-readable, workflow description language should be adopted to enable workflows to be captured, shared, published and executed.	
R5.7	Provenance management	All workflows should include a wrapper that captures detailed provenance metadata about each stage of processing. This should capture information about the	The Tenderer should consider using existing standards and approaches for provenance management, such as the PROV standard.

		operating system, processing environment, software dependencies and versions of the workflow and input datasets.	
R5.8	Storage integration	Tools should enable workflows to read data efficiently from Hub Platform storage (e.g., S3), staging data into workflow environments, and write data to User Workspaces.	
R5.9	Data Catalog integration	Tools should include hooks for publishing outputs from workflows directly into the Resource Catalog. Additionally, workflows should be able to interface with the catalog to publish those annotations.	
R5.10	Non-data Catalog integration	Tools should include hooks for adding non-data assets to the Resource Catalog. These include all non-data assets mentioned in the Resource Catalog requirements.	

5.2.6 Workflow Runner

5.2.6.1 Description

This component is closely coupled with the Workflow and Analysis System (WAS) but is separated out for clarity. The Workflow Runner (WR) provides the capability to execute Hub Workflows that have been developed using the (WAS). The WR will also support the publication of workflows to the Resource Catalog and scheduling of workflow execution.

It is envisaged that the common execution environment of a HW is likely to be a Docker container and that the WR will enable the selection of different flavours of container based on features such as Operating System, processor type (CPU vs GPU) and size, and memory. It should be possible to define and run workflows that chain a set of individual operations together and/or require parallel execution (such as multiple instances of an operation) for certain steps.

5.2.6.2 Interactions with other FAs

The Workflow Runner requirements interact with many FAs:

- Resource Catalog
- Identity and Access Management, Accounting
- Workflow and Analysis System
- Data Services
- Persistent Storage
- Event and Notification Service

5.2.6.3 Interactions with other EODH ITTs and projects

The Workflow Runner will interact with the Applications ITT, as workflows will be invoked by applications that build on the Hub Platform.

5.2.6.4 Requirements

Number	Title	Description	Notes to Tenderer

R6.1	Workflow publication	Workflows should be publishable to the Resource Catalog using easily accessible tools. Updates and unpublishing functionality should also be supported.	
R6.2	Workflow execution	The Workflow Runner should be able to take a workflow description, and a set of inputs (including URIs to data records) and execute the workflow on a cloud-based architecture.	Additionally, support for monitoring, cancelling and debugging workflows would be desirable.
R6.3	Workflow initiation	Workflows should be initiated via an API so that they can be triggered by remote applications or interactively via a range of clients.	
R6.4	Workflow scheduling	It should be possible to schedule workflows through the functionality provided by the ENS.	
R6.5	Supported QA workflow	The specific QA workflow(s) developed by the QA work package in the overarching EODH project must be deployed and published as the first supported workflow.	The Tenderer will be expected to project guidance and assistance to the QA Team in order to deploy this workflow.
R6.6	Deployment as User Services	Tools should be provided to enable Hub-users to take an existing workflow and deploy it as a User Service. It is expected that the OGC Web Processing Service (WPS) standard is the most likely interface candidate for this capability.	

5.2.7 Web Presence

5.2.7.1 Description

This component concerns the user interfaces that act as an entry and first point of contact for Hub-users. Since the Hub Platform supports a variety of capabilities, the web presence helps users to navigate to, and between different features. It also acts as the public "shop window" to the Hub Platform, showcasing the datasets and processing capabilities, and providing a map-interface for interactively browsing key datasets. A core role for the web presence is also signposting Hub-users to appropriate resources to manage their interactions with the Hub Platform, such as registering for an account, accessing resources, and developing and executing workflows. Up-to-date and correct documentation is a crucial part of the web presence content, guiding users on how to use both web-enabled features and those that are accessible solely through APIs.

It is expected that many aspects of the web presence will be built on top of existing capabilities, such as IAM and resource management dashboards that are available from public cloud providers. The Tenderer may decide to build additional web components that either communicate directly to the services in the Hub Platform or interact via APIs. It is expected the best solution will support re-use and extension rather than the building of numerous brand-new components.

The Web Presence will:

- provide an entry point to the Hub Platform, showcasing the main areas of functionality and key products (data and processing)

- allow Hub-users to log in to the Hub Platform
- allow Hub-users to discover datasets
- allow Hub-users access to build data pipelines/workflows through notebooks

It will not:

- provide access to all functionality within the Hub Platform – some functionality will only be accessible through APIs
- allow the setup of new data sources
- be a place to access the Applications built upon the Hub Platform

The web presence component is intrinsically linked with all components of the Hub Platform because it has the potential to provide a user interface to each component. However, this ITT is not focused on building a website and extensive portal functionality. The focus of the ITT is to deliver a set of capabilities that demonstrates a unique and desired Hub Platform that Hub-users gain real value from exploiting. Some of the requirements are optional for this component and the Tenderer is expected to provide a rationale for which components include a web interface in their proposal.

Where a functional component is not provided through an accessible web interface, the proposed solution must ensure that clear and up-to-date documentation exists to support the use of that component via the relevant external tools and APIs.

5.2.7.2 Interactions with other FAs

The Web Presence will interact with all the FAs as it has the role of providing the front-end to some of the components, and/or documentation and guidance on how to access others.

5.2.7.3 Interactions with other EODH ITTs and projects

The Web Presence will need to interact with the Data Streams and Applications ITTs, because it will need to ensure that the appropriate content is provided to support the requirements that emerge from them.

5.2.7.4 Requirements

Number	Title	Description	Notes to Tenderer
R7.1	Reuse as a principle	A core requirement is to avoid building new web interfaces wherever possible. The Tenderer shall re-use existing web interfaces when they exist as part of existing systems used to make up the Hub Platform.	Whilst re-use is encouraged, the web presence must present an overall consistent, easily navigable interface
R7.2	Open navigation and exploration	A core requirement is that users should be able to navigate as much of the functionality as possible without being required to log in.	
R7.3	Hub Platform website	The Tenderer shall design and build an attractive Hub Platform website to showcase the core datasets and functionality available through the Hub Platform.	The website should adopt the branding specified by the Authority. It should be responsive and include, as a minimum, the following: • A view of the Resource Catalog • A browsable interactive map interface • Detailed documentation and signposting: to guide users in how to access the various components of the Hub Platform

			The rest of the features included in the website will be agreed upon through discussion with the EODH Team.
R7.4	Hub Platform Documentation	The Tenderer shall provide detailed, up-to-date and comprehensive documentation on all aspects of the Hub Platform functionality.	The Tenderer should consider: • documentation should be managed in an accessible format • where documentation includes code snippets, links and images from external sources: these should be maintained and tested regularly (ideally through automated methods) to ensure they are working • greater emphasis should be placed on documenting components of the Hub where web interfaces are not available: in such cases, example code and templates should be provided to educate users on how to interact with the relevant APIs
R7.5	Resource catalog web interface	The Tenderer shall provide access to the Resource Catalog through a browsable and searchable web interface.	The Tenderer should consider the use of existing tools, such as the STAC Browser (https://github.com/radiantearth/stac-browser) to provide this functionality. Note that some of the non-data assets captured within the Resource Catalog cannot be managed within STAC.
R7.6	Web interface to IAM and AS	The Tenderer shall provide web interfaces to access the Identity and Access Management and Accounting Systems for user and resource management (including charging mechanisms).	The Tenderer may consider using existing solutions for IAM, such as those delivered through third-party public cloud providers. Such out-of-the-box solutions may already include full access through web interfaces and/or APIs. Some extensions may be required to support integration with certain components of the Hub Platform.
R7.7	JupyterHub Service	The Tenderer shall provide a Jupyter Notebook Service to enable interaction with the Hub Platform components through both a Python notebook and a Bash terminal.	The Tenderer should consider how extensions to the JupyterHub ecosystem could be integrated in order to offer additional functionality. For example, tools to create simple web applications from Notebooks may offer useful functionality.
R7.8	Web map interface	The Tenderer shall provide a responsive web map interface integrated into the main Hub Platform website. The map interface shall provide access to key Sentinel products and other headline datasets provided through the Hub.	The Tenderer should consider existing interfaces, such as EuroDataCube and the Open DataCube services, as possible starting points for providing the required functionality. The datasets made accessible through the interface will be agreed upon with the Hub Team at fixed integration points during the project.
R7.9	Help facility	The Tenderer shall provide a Help web page with a contact form that allows Hub-users to access technical support.	

R7.10.OPT	OPTIONAL: Workflow creation (dev) web tools	The Tenderer may include web-based tools to support the creation of workflows.	
R7.11.OPT	OPTIONAL: Workflow execution web tools	The Tenderer may include web-based tools to enable users to execute workflows.	
R7.12.OPT	OPTIONAL: Workflow monitoring web tools	The Tenderer may include web-based tools to enable users to monitor workflows. This might include a view of overall system resources and allocations (anonymised).	
R7.13.OPT	OPTIONAL: User dashboard	The Tenderer may include web-based tools to provide a unified dashboard of user resources, preferences and activities. This might include tagged workflows, datasets, subscriptions and event notifications. Additionally, it could include the ability to view current activities, download results, and create and cancel requests.	
R7.14.OPT	OPTIONAL: Event and notification web tools	The Tenderer may include web-based tools to allow users to define and select events to be notified about.	

5.2.8 Data Services

5.2.8.1 Description

This component provides the services that allow external applications, internal workflows and end-user processes to access data made available through the Hub Platform. The data services will include direct download options (typically through S3 and HTTP(s) interfaces), along with OGC web services as appropriate. It is expected that the public API to the process offerings within the Resource Catalog will be provided through a Web Processing Service (more recently OGC API - Processes) interface.

Hub-users may also create their own user services which could be accessible through the public API layer. This capability is closely coupled with the Workflow management tools.

Additionally, data may be exposed through Data Cube technologies which would enable external applications to load data directly into a Python environment. Development of such an approach should utilise existing developments and practices in this area, typically interfacing geospatial data into a form that can be directly loaded into Xarray.

5.2.8.2 Interactions with other FAs

The Data Services requirements interact with the:

- Resource Catalog
- Identity and Access Management, Accounting
- Workflow and Analysis System
- Persistent Storage

- Event and Notification Service

5.2.8.3 Interactions with other EODH ITTs and projects

The Data Services will be integral to supporting the requirements of the projects funded through the Applications ITT and will be required to work closely with the providers of Data Streams.

5.2.8.4 Requirements

Number	Title	Description	Notes to Tenderer
R8.1	Download service	The Hub Platform must support download capabilities for all hosted datasets. These are expected to use HTTP(s) and S3 as the main protocols.	
R8.2	Support for HTTP range requests	The Hub Platform should support requests of partial files using HTTP "range request" functionality.	
R8.3	OGC Web Services	The Hub Platform should support access to datasets through modern open APIs. Typically, the OGC W*S (more recently badged as OGC APIs: https://ogcapi.ogc.org/) are likely to provide the main interfaces.	
R8.4	Map Service	A map service should be provided to serve map tiles for high-priority datasets.	The Tenderer will be given a definitive list of the datasets that should be provided via the map interface.
R8.5	User Services	Workflows developed by Hub-users should be deployable as persistent services available through the WPS, or equivalent, API.	
R8.6.OPT	OPTIONAL: Data Cube	The Tenderer may, optionally, develop a Data Cube interface for the main datasets provided through the Resource Catalog. If provided, a Python interface would be expected, that enables loading content into Xarray data structures.	

5.2.9 Persistent Storage

5.2.9.1 Description

This component is key to underpinning many of the functional areas provided by the Hub Platform. Persistent storage is required for storing datasets that are cached on the Hub, such as Analysis Ready Data products optimised for highly performant access. Many Hub Workflows will require storage for intermediate and newly generated outputs. Additionally, each Hub-user should have access to an allocation of persistent storage (i.e. a User Workspace) to support the analysis and development of new workflows. It is envisaged that the storage will be primarily provided as S3-compatible object store but there may also be support for mounting storage into processing environments.

5.2.9.2 Interactions with other FAs

The Persistent Storage requirements interact with the:

- Data Streams Interface
- Resource Catalog

- Identity and Access Management, Accounting
- Workflow and Analysis System
- Data Services
- Event and Notification Service

5.2.9.3 Interactions with other EODH ITTs and projects

The Persistent Storage will interact with the:

- Supplier(s) for the Data Streams ITT
- Supplier(s) for the Applications ITT

5.2.9.4 Requirements

Number	Title	Description	Notes to Tenderer
R9.1	Cloud storage	The Hub Platform must provide access to cloud-based data storage with appropriate levels of volume, reliability and performance to support a range of data-intensive applications and workflows.	Since the storage will be supplied by a public cloud provider it is anticipated that elastic scalability will be supported in terms of data volumes.
R9.2	POSIX access within workflows	Within processing environments, such as workflow development, workflow execution, and JupyterHub, it should be possible for storage to be mounted as a local (POSIX) file system to enable read and write operations.	It is expected that some Hub-users will be content to use object-store (e.g. S3) interfaces but others will require POSIX access.
R9.3	ARD caches	Supported data products will mainly be focussed on Analysis Ready Data caches.	
R9.4	Storage for data products	Short and long-term storage should be available to support new and intermediate data products.	
R9.5	User workspaces	Individual user workspaces should be made available to support Hub Workflows and interactive data analysis modes.	Note that the Accounting Service should specify how user workspaces are paid for, and whether they are bounded or elastic in volume.

5.2.10 Event and Notification Service

5.2.10.1 Description

This component is relatively simple but provides an important area of functionality: the ability to control when things happen in the Hub Platform. The Event and Notification Service enables actions to be triggered based on other events occurring or based on date and time constraints. Examples of events are a new file arriving for a given dataset, a workflow being triggered to run every day at a certain time, and the completion of a specific workflow. Hub-users can subscribe to events, and associate actions (such as running a workflow) with them, including receiving notifications via email or other methods.

5.2.10.2 Interactions with other FAs

The Event and Notification Service requirements may involve interactions with all FAs depending on the nature of events that are monitored or scheduled.

5.2.10.3 Interactions with other EODH ITTs and projects

The Event and Notification Service will interact with the:

- Supplier(s) for the Data Streams ITT
- Supplier(s) for the Applications ITT

5.2.10.4 Requirements

Number	Title	Description	Notes to Tenderer
R10.1	User access to the ENS	Hub-users should be able to connect to the Event and Notification Service, and be able to browse, create and edit events. Events can be associated with triggers to perform some action (such as running a workflow) or send a notification.	The ENS should retain an accessible history of past events for a reasonable time period.
R10.2	Time-based events	The ENS should support events that are triggered by date and time (equivalent to Cron).	
R10.3	Action-based events	The ENS should have the ability to monitor changes in the Hub Platform that might be used to trigger an event. The most common is likely to be the arrival of new data records, which would trigger the running of a specific workflow.	
R10.4	Notification	The ENS should be able to send notifications via email or send a service request over HTTP(s).	
R10.5	Subscription	It should be possible to subscribe to the ENS in order to activate certain actions based on a prescribed event.	

5.3 Operational Requirements

The Operational Requirements laid out in this section refer to the final 3 months of the contract during which the system will be deployed operationally.

Number	Title	Description	Notes to Tenderer
OR1	Uptime (98%)	The core components of the Hub Platform should be monitored and demonstrate an uptime of at least 98%.	Any external dependencies, such as the availability of external data platforms that interface with the Hub Platform, are excluded from this requirement. The Tenderer should work with the Authority to agree on a monitoring and reporting system for measuring the uptime of specific components.
OR2	Core technical support	The Tenderer should provide technical support for use by the Authority that is available 0900-1700 (UK time) on weekdays. At least one member of staff should be available	

		to respond to requests (from the Authority).	
OR3	User support	The Tenderer should provide support to Hub-users through a publicly advertised facility.	This is also noted in R7.9. The EODH has purchased a Helpdesk facility using the HelpScout (https://www.helpscout.com/) service. The Tenderer will be expected to integrate their approach with this.
OR4	Disaster Recovery	In the event of a disaster, the entire Hub Platform should be re-deployable (in the public cloud) within 5 working days.	The Tenderer should make appropriate arrangements for backups of catalogs, configurations, and key datasets. It is not expected that every single data entity (e.g., from user workflows) would be preserved in the case of a disaster.
OR5	Functional completeness	All parts of the Hub Platform exposed to users must be working correctly.	The Tenderer must only release components of the system that are tested and functional. If some components are not yet fully functional for a release, they should be flagged in the documentation and guidance as not yet being available, and they should be scheduled for future releases following full integration testing.
OR6	Service Manager Training	Provide a 1-day in-person training session to the Service Manager Team	
OR7	Hub-user Training	Provide online training sessions (introductory and advanced) to Hub-users who plan to work directly with the Hub Platform	

5.4 Key Performance Indicators

As part of the bid, the Tenderer shall propose a set of Key Performance Indicators (KPIs) appropriate for the various aspects of the Hub Platform. The KPIs shall be designed to quantify different aspects of quality of service against the requirements described in this document, and any additional features suggested. These initial specifications shall be refined together with the Authority during the negotiation of the contract. KPIs should be SMART (specific, measurable, actionable, realistic and time-bound) and may be related to factors such as:

- Code quality
- Service delivery
- System uptime
- Data throughput
- Usage statistics
- Counts of datasets, workflows, etc.
- Contract management

The final KPIs will be aligned with the Monitoring and Evaluation (M&E) activities within the EODH Programme. KPIs will be reported to the Authority in Quarterly and Annual Reports and will be reviewed in terms of their fitness for purpose each year.

6 Timetable

6.1 Project Timetable

Figure 4 shows the main EODH Programme timeline. This includes the core EODH project and the 4 separate ITTs. This ITT specification document concerns work to be executed in the second work package of the overarching EODH Project (known as the "Hub Platform Software"). Activities for each of the main tasks are shown with orange horizontal bars with start and end times related to months and financial year quarters. Each of the ITTs will be managed separately and may be contracted to different organisations/consortia.

The role of the Tenderer for the Hub Platform (as described in this ITT) will be central to the delivery of the EODH solution. As such, the Tenderer is expected to take the lead in communications with the core EODH project, Data Streams contractors and Application developers. The Tenderer will be expected to define integration targets and deadlines with the Data Stream and Application teams.

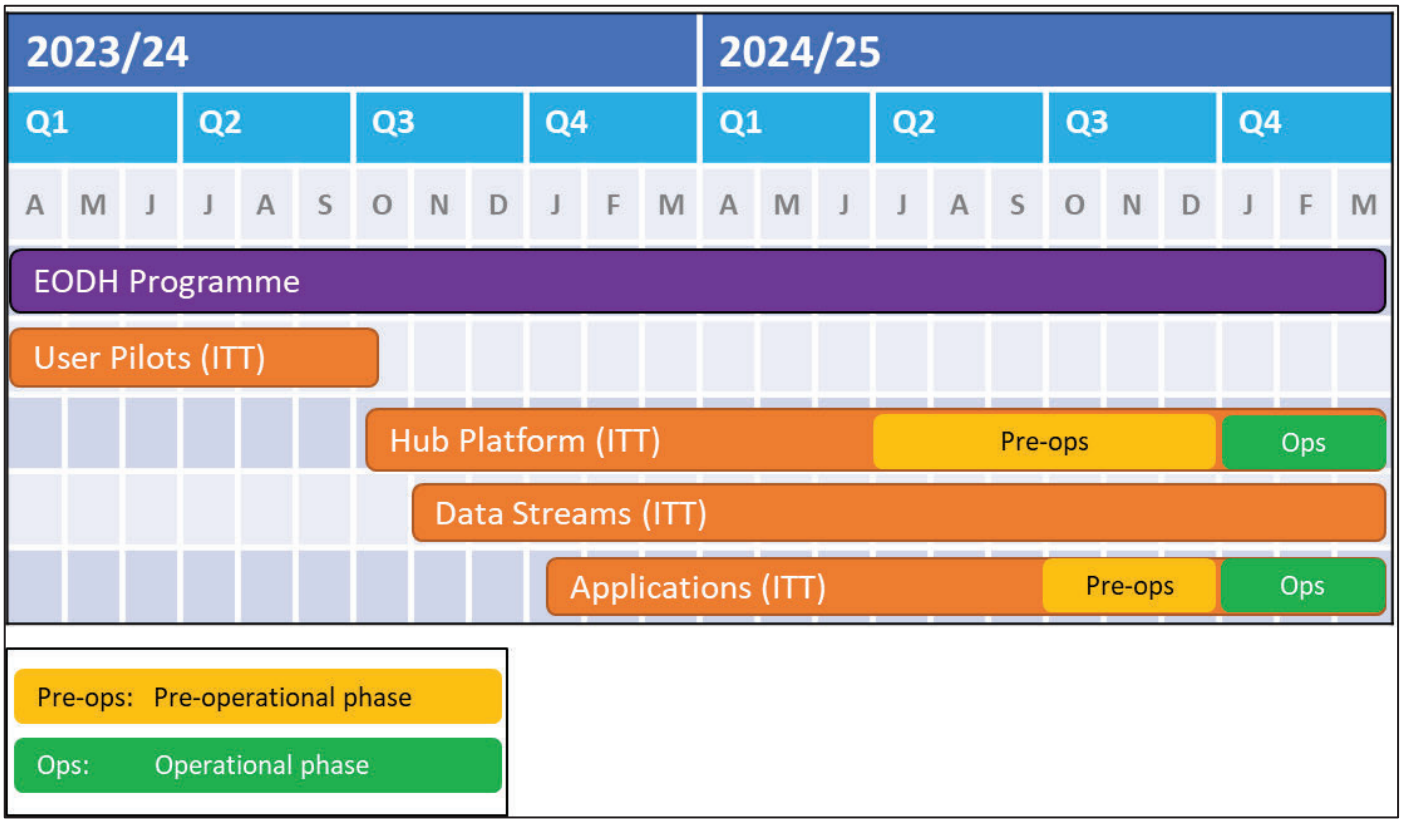


Figure 4: Chart showing the main timeline for the primary contracts, including the pre-operational and operational phases of the Hub Platform and Application components.

6.2 Milestones

A set of indicative project milestones is presented here:

- M1 [Month 3]: Hub Platform Delivery Plan and prototype components – defining a detailed plan of what will be delivered, along with working prototypes of key components ready for testing by the Core Team.
- M2 [Month 6]: Hub Platform Minimum Viable Product – demonstrate the functionality of the Hub Platform showing the integration of climate data and the ability of a pilot application to exploit the functionality it needs.

- M3 [Month 9]: Prototype Hub Platform – provide the functionality for the Hub Platform to meet the requirements of a climate application, including a prototype of all aspects of the web presence.
- M4 [Month 12]: Pre-Production Hub Platform – provide the functionality for the Hub Platform to additionally meet the requirements of a public sector/commercial application and access public EO datasets.
- M5 [Month 15]: Production Hub Platform – provide the functionality for the Hub Platform to additionally meet the requirements for accessing commercial EO datasets and enable applications to access these data
- M6 [Month 18]: Final Report on Future Plans – including review of project successes, lessons learnt, sustainability and continuity plans.

The Tenderer is invited to present their own schedule of milestones, including integration points with other work streams. However, some aspects of the indicative milestones should be incorporated into the proposed schedule. An alternative schedule will be subject to approval by the Authority.

Payments will be awarded for work based on the successful completion of the milestones.

Due to the designated funding profile, the Tenderer should frontload the resourcing for the project to include proportionately more effort in the first financial year (FY23-24). This should be reflected in the planned work and milestone costs.

The work must be completed against the timescale shown in order to ensure successful integration between the other dependent workstreams and enable successful overall completion of the programme.

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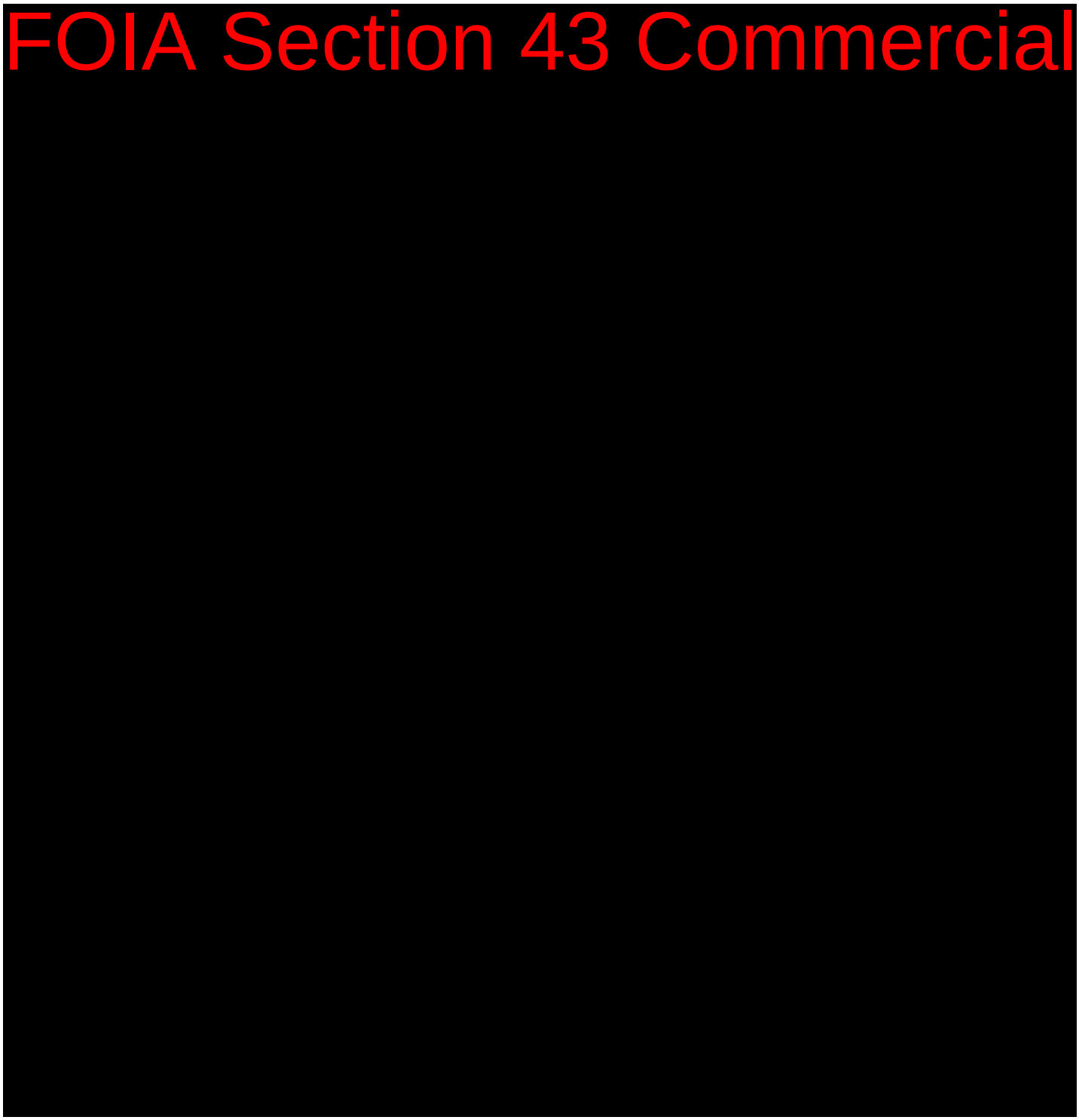

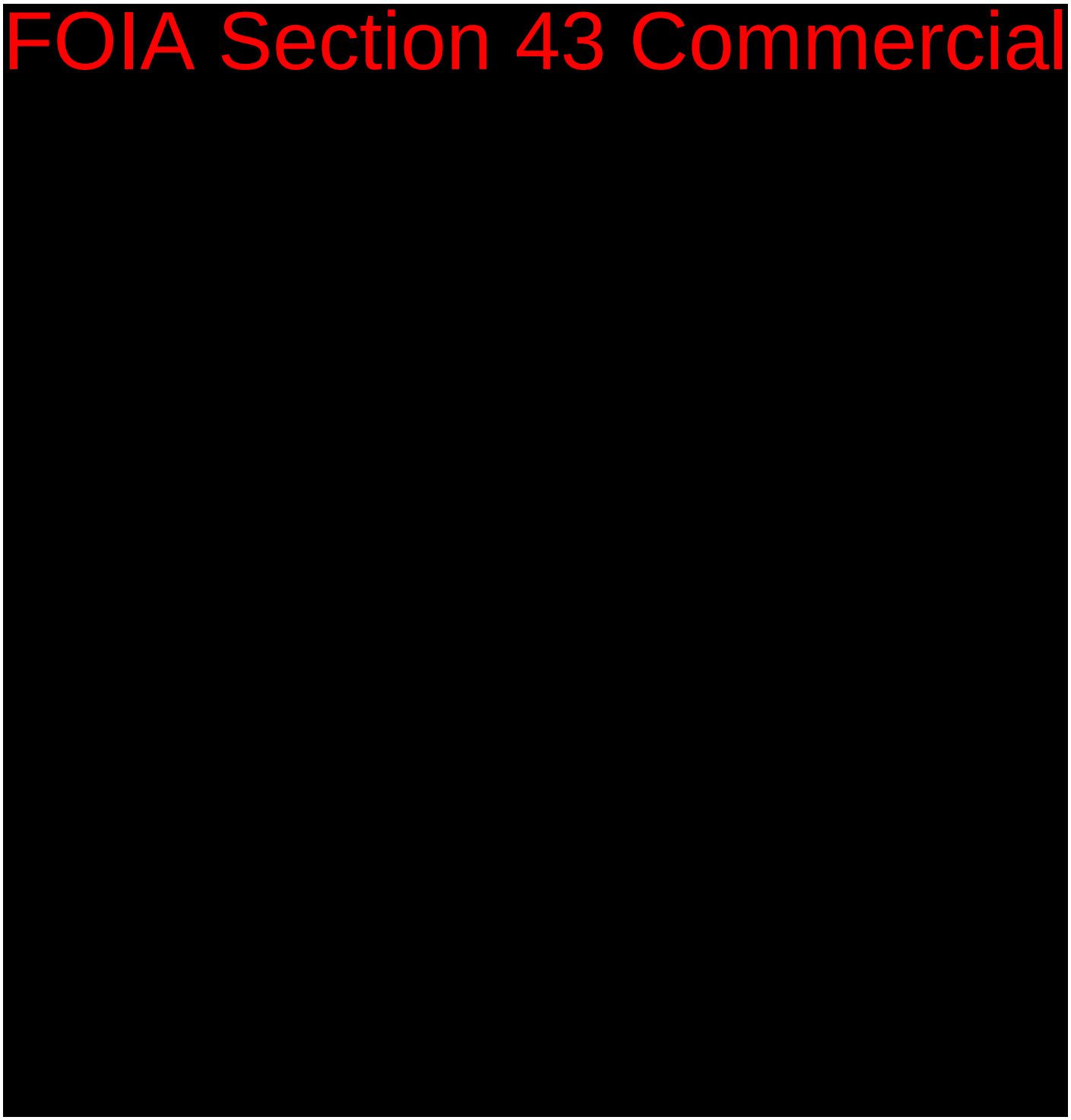
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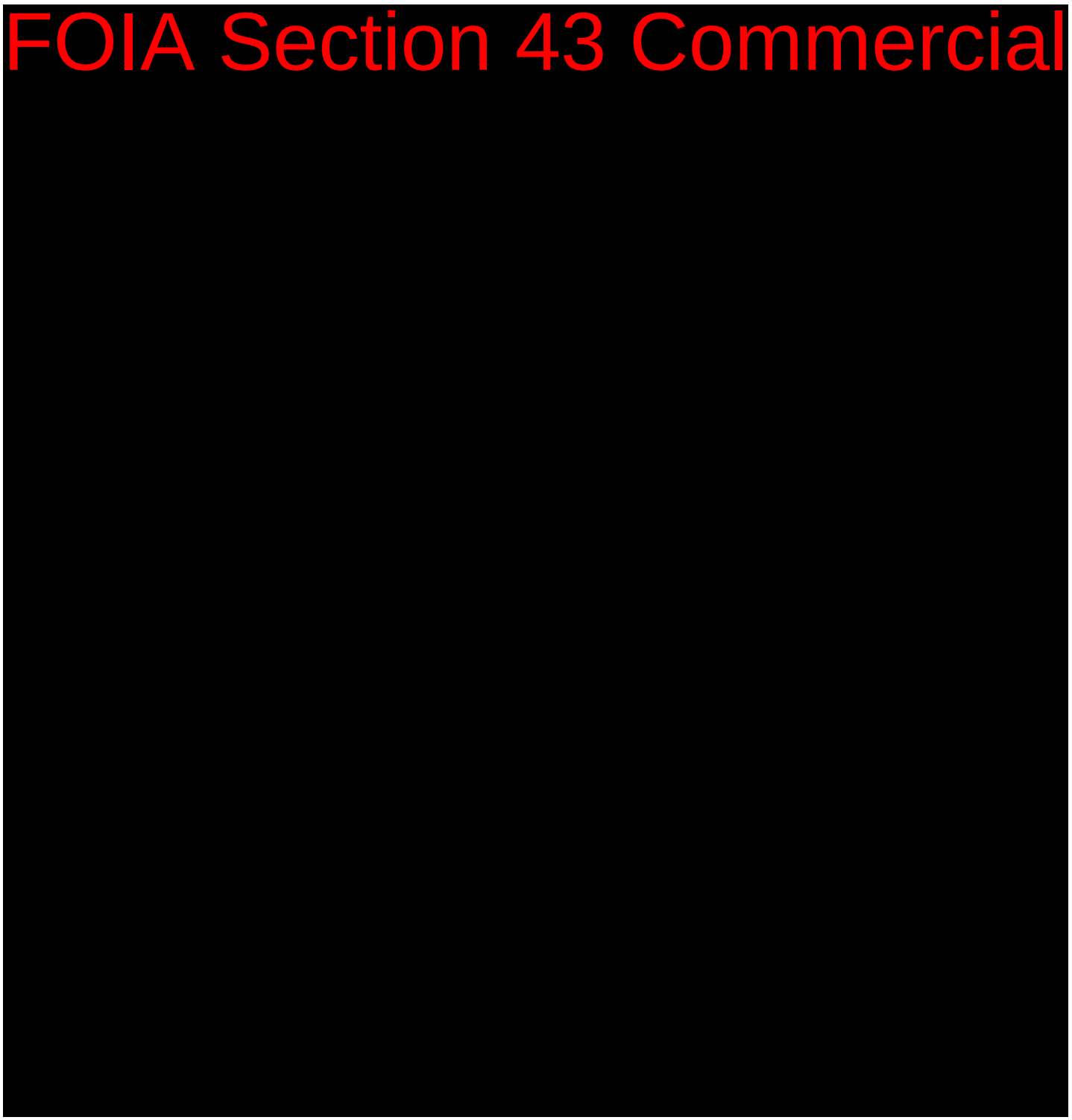

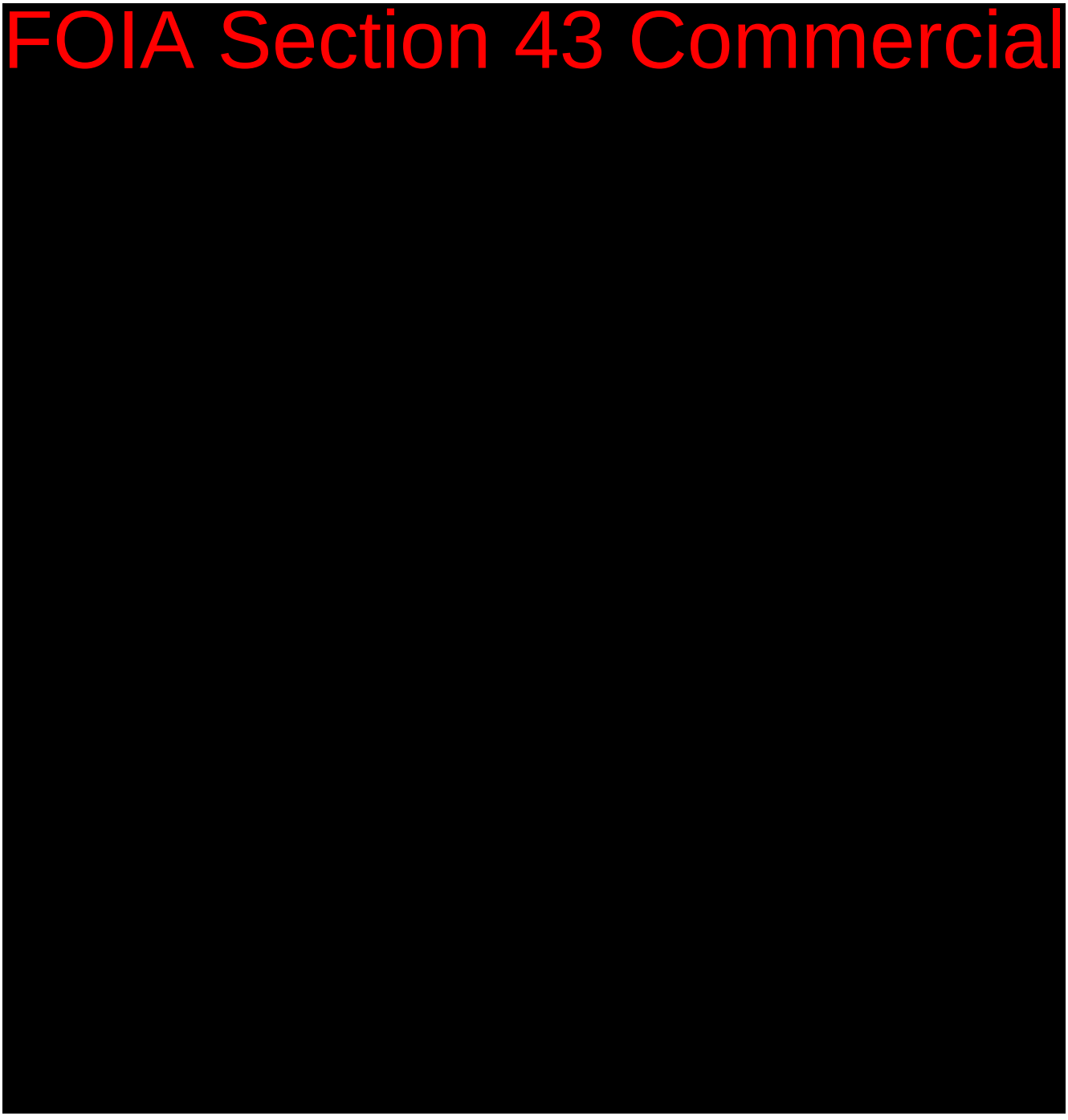
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