ISTARI

DATA & INFORMATION EXPLOITATION MANAGEMENT

SPACE-BASED ISR S&T CAPABILITY ENHANCEMENT

STATEMENT OF REQUIREMENT

31 MARCH 2023(AWARD)

1. INTRODUCTION

This Statement of Requirement covers the Contractor's minimum activities for proposed Space-based Intelligence, Surveillance and Reconnaissance (SBISR) S&T capability enhancement as part of the ISTARI Programme. The Programme aims to develop and deliver a UK multi-sensor ISR Constellation over 10 years, which includes satellites and a ground architecture that is enabled by advanced technologies to inform all domain decision making across Defence.

Programme ISTARI will not only deliver the UK with its 'own' satellites to collect Earth Observation (EO) data, but it will enable the integration of data 'accessed' from international partners and commercial entities. It will enable Tasking, Collection, Processing, Exploitation and Dissemination (TCPED) of EO data from Space through the development, delivery and operation of federated ground, transport and Space segments.

Within the Programme, the Data & Information Exploitation Management Project (DIEM) seeks to demonstrate the Processing, Exploitation & Dissemination (PED) of SBISR data capable of supporting MOD and partner operations. Through DIEM, a Business Case[1] has been proposed to fund the purchase of commercial off-the-shelf software and hardware for ISTARI, in order to enable accelerated development of the Programme in its ability to Task, Process, and Exploit SBISR data.

The Requirements as set out in this document are specifically targeted for a SBISR satellite telemetry processing, analytics, and archiving capability.

In this Statement of Requirement, Sections 1 and 2 cover the ISTARI Programme background. Section 3 covers the aims, objectives and benefits of proposed SBISR S&T capability enhancement solutions. Section 4 covers scope, technical objectives, and requirements associated with the elements highlighted above.

[1] 20220506- ISTARI-DIEM_CapDev_BC-OS

2. PROGRAMME BACKGROUND

The MOD Defence Space Community agreed vision for SBISR is developing, building and making ready the ground infrastructure elements required to kick-start the ISR constellation programme.

Programme ISTARI takes the next step, delivering capability to create a UK multi-sensor ISR constellation[2] over the next 10 years. This will include in Orbit Concept Demonstrators (OCD), and a ground architecture, enabled by autonomy, leveraging broader Defence programmes[3]. This will enable MOD to create a catalogued repository of SBISR data, which while of value to Defence could be used to service an element of the broader UK prosperity agenda.

The aim of Prog ISTARI is to meet the IR ambition of a multi-sensor ISR constellation and meet the vision and goals of the National Space Strategy. The high-level objectives that aim to enable this are:

a. The coherence of existing SBISR OCD programmes, in order to integrate the mature individual capabilities being produced.

b. The development and delivery of an architecture that is able to task satellites and sensors to collect ISR related data and to utilise the data to meet user requirements.

c. The development and delivery of satellites able to collect ISR related data.

d. To develop the ability to collaborate, cooperate and integrate with UK Defence, UK cross-Government and some International partner SBISR capabilities.

Specifically in relation to the National Space Strategy goals, the Prog aims to do the following:

Goal 1: Grow and level up our space economy. ISTARI will invest in the UK space sector to develop and deliver the capabilities required for an end-to-end system. The design and manufacture of Space systems across the UK will support this, as will the close partnerships between Defence, cross-Government, industry and academia developed through ISTARI supporting mechanisms, such as SpaceWorks.

Goal 2: Promote the values of Global Britain. ISTARI aims to be integrated by design with international partners, both utilising current partnerships and developing new ones.

Goal 3: Lead pioneering scientific discovery and inspire the nation. ISTARI will be led by S&T and R&D on all aspects of Space capability development, especially in ISR sensor development, in order to remain at the leading edge. ISTARI will utilise advanced and emerging technologies to enable the end-to-end system, which requires S&T guidance and support to deliver cutting edge capabilities.

Goal 4: Protect and defend our national interests in and through space. SBISR is a vital component of the UK's security and resilience, ISTARI will provide a national owned and operated capability that is at the forefront of this.

Goal 5: Use Space to deliver for UK citizens and the world. ISTARI will support the full range of Defence missions including MACA[4]. ISTARI will be integrated across Government to provide a dual-use system that allows multiple users to access and use the data collected for a wide range of tasks that support UK citizens and interests. ISTARI will support UK businesses and S&T investments as per Goals 1, 2 and 3.

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[2] The Defence Command Paper stated that Defence would 'Develop a UK-built Intelligence, Surveillance and Reconnaissance satellite constellation and a supporting digital backbone in space'. (Defence in a Competitive Age, 2021, p46).

[3] ISTARI will leverage Defence Digital Backbone and ensure it is interoperable with broader TCPED programmes and cloud-based architectures and improve the delivery of real-time intelligence to deployed force elements

[4] Military Aid to the Civil Authorities.

Building on the success of the Dstl Hermes ground station, the ISTARI programme is ready to move forward, engaging in practical activities working with Space-based assets, to develop and validate the complex mechanisms and function chains, and in parallel, to build and refine the Suitably Qualified Experienced Personnel (SQEP) support base.

The Space Command User goals include an integrated and coherent set of OCD missions, and enabling capabilities (Figure 1) which will:

- Provide an operational solution which implements the end to end Tasking, Collect, Processing, Exploitation, Dissemination (TCPED) lifecycle
- Interface to a secure UK ground architecture
- Ensure compatibility with 'current set' UK ground architectures, which develop, in conjunction with the accreditation bodies, a security approach proposal for review and refinement

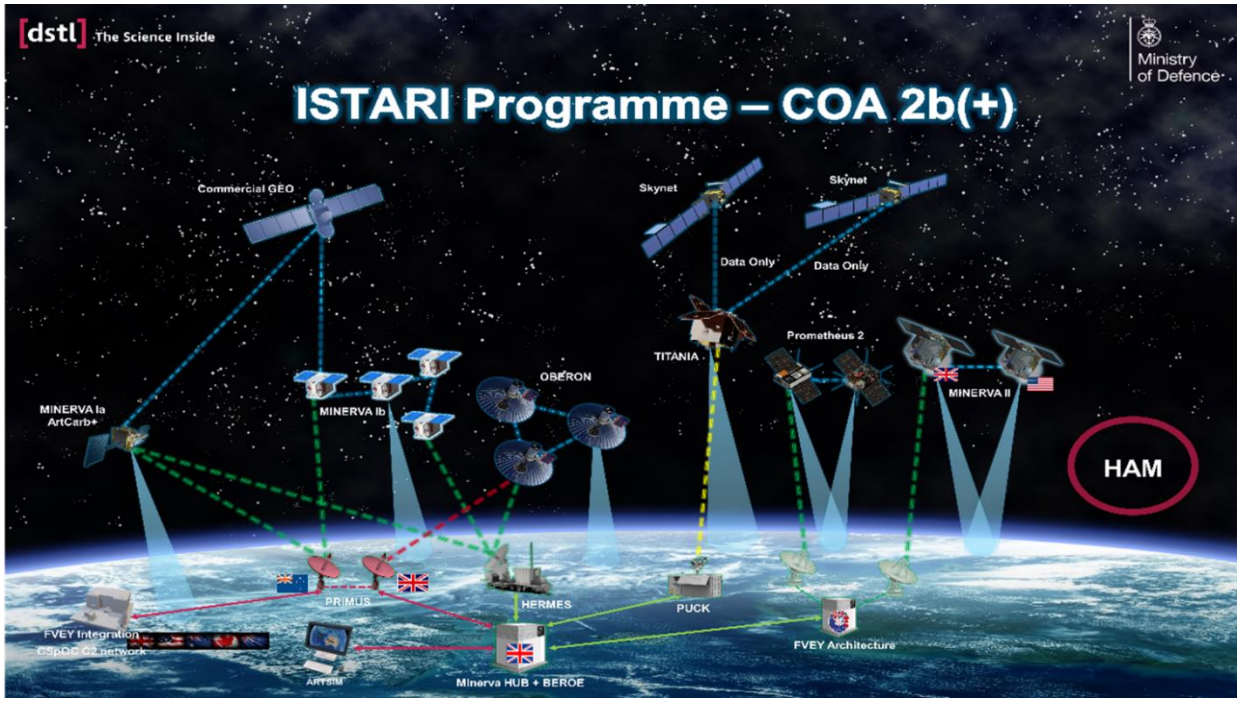

Figure 1: The ISTARI Initial Operating Concept for 2025

Each ISTARI Space mission solution of the future Full Operational Capability (FOC) will need to be able to plug-in to the UK's ground infrastructure, therefore, early development, implementation and assurance will ensure a resilient and usable set of integrated Space systems, are able to provide information collect which can be put through the strong UK Processing, Exploitation and Dissemination (PED) capability, resulting in disseminated product which meets the tasking requirements.

3. PROPOSAL AIMS, BENEFITS, & OBJECTIVES

3.1. AIMS

Through DIEM, a Business Case [A.1] has been proposed to fund the purchase of commercial off-the-shelf software and hardware for ISTARI, in order to enable accelerated development of the Prog in its ability to Process and Exploit SBISR data.

The proposed solution focuses on three main objectives,

- Maximising the potential impact of defence S&T spend, aligning the key objectives of the MOD Defence Space Community with the wider UK community, enabling a wide range of stakeholders to benefit from SBISR sensing capability development through the ISTARI programme, aligned with cross-community co-creation initiatives.
- Ensuring cross-community benefit by means of alignment of the ISTARI ground-element capability development with contribution and participation with the UKSA's engineering capability development and the inclusion of partnerships across government in experimentation opportunities and space based use case development to identify capabilities and strategies for high fidelity EO.
- Commissioning the design and implementation of high resolution commercial ground segment processing capabilities, aligned with high resolution Space segment image acquisition to enable a range of innovative experimentation opportunities, coupled with advanced artificial intelligence and machine learning techniques to maximise and accelerate the UK's capability development.

Achieving these core objectives will result in a range of outcomes which will provide wide ranging benefits to the cross-government community, enabling the development and implementation of R&D solutions which will enhance the operational and experimentation capability of the MOD Defence Space Community and the wider UK space community.

The proposed solution and the associated courses of action can be integrated into the current UK MOD Defence Space ground segment infrastructure, including the Dstl Hermes ground station, and the future UK MOD Primus ground stations, and will also link to the UK's in-place world beating capabilities provided by the National Centre for Geospatial Intelligence (NCGI).

It should be noted that the proposed 'course of action' in the proposal mirrors currently implemented Space Command Programme ARTEMIS and NCGI approaches for SBISR processing and exploitation.

The provision of the solution presented will provide fundamental building blocks for the ISTARI Prog, providing a significant boost in capability development, and significantly accelerating the completion of its objectives. The 'bringing forwards' of these capability functions will accelerate this particular scope of the ISTARI Prog by at least one full year.

The proposal targets providing the ISTARI programme with:

- Satellite Telemetry (TM) Processing Capability
- Satellite ISR Tasking Product Analytics
- Satellite ISR Tasking Product Archiving
- ISTARI Data Centre Hardware for Processing and Analytics
- Satellite ISR Product Training Archive

When combined, these elements will provide an end-to-end ability to deliver products derived from on-orbit commercial Space EO systems. This in itself will significantly de-risk and optimise the ability to deliver the end-to-end process for ISTARI's 'own' capabilities once developed. Whilst the

benefits of the programme are currently focused on MOD's outputs, this investment will significantly increase cross-government understanding of the benefits and potential use-cases for EO data, as well as inform and de-risk any potential future national EO programme.

3.2. OBJECTIVES

High-level objectives for the proposal:

- Targeted research and development activities focusing on the realisation of a high fidelity UK ground segment advanced processing capability, able to support the delivery of future operational solutions enabling high-fidelity data to be disseminated to all parties via Cloud centric networks, with dissemination of data directly to assets in the field.
- Integration of commercial Electro-Optical, and Synthetic Aperture Radar (SAR) Space-based data collect capabilities into the ISTARI ground segment architecture, providing a multi-sensor data collection capability, which will complement the UK owned and operated ISTARI SBISR constellation, which will deliver an Initial Operating Capability (IOC) in 2025.
- Focused development and rapid prototyping of advanced ground processing techniques, enabling the development of high resolution 3-D imaging, coupled with AI and machine learning capabilities providing tools to automatically detect objects, identify patterns of life, to generate targeting data from broad area datasets which enable a wide range of commercial and sovereign solutions to be operationally applicable for the UK Space community.
- Specific cross-community co-creation activities to define and realise the potential opportunities to have strong linkage of AI assisted analytics work taking place in the UK AI co-creation Space, with the ISTARI programme Digital Hub, which enables future ISR constellation autonomous operations.
- Focusing effort on future co-operative experimentation strategies to realise forward compatibility, and, where possible, cross-community participation in the Space-based data downlink, processing, exploitation and dissemination for transformational experiments.

4. REQUIREMENTS

4.1. SCOPE

The scope of this Statement of Requirements covers
the implementation of a copy of the **Airbus Intelligence (UK) Payload Data Ground Segment (PDGS)** system, to be supplied and installed on bare metal at Redacted. The system is for R&D and capability building purposes only and will not be used for production purposes. It will contribute towards the processing capability building block of the ISTARI programme.

4.2. TECHNICAL OBJECTIVES

4.2.1. **PDGS Applications Suite.** The Contractor shall supply and install a copy of the Contractor's Vision-1 PDGS applications suite for DSTL, to comprise of:

- The PDGS data management & orchestration
- The PDGS radiometric and attitude and orbit control system (AOCS) information processing (SSTL Terra and AGP systems for radiometric and AOCS processing)
- The PDGS Vision-1 optical data processing (Airbus Pixel Factory for optical data processing)
- The enabling operating and middleware systems which support the Vision-1 PDGS applications and its components

PDGS IT infrastructure. The Contractor shall supply and install Redacted at Redacted the necessary IT infrastructure to run and store the Vision-1 PDGS applications suite and data. The system shall be built, configured, and validated prior to delivery to Redacted for installation, final testing, and handover to the Authority for research and development use.
It will be the responsibility of the Contractor to work with the MOD to help ensure that the capability is accessible and working for the user at the point of handover and acceptance by the Authority. The MOD will provide the Contractor with the required accesses and user engagement to support the deployment of the infrastructure.

Redacted

4.2.2. **Capability Inputs**. The system shall be initially supplied and installed for the processing of Vision-1 data as a base input sensor.
The PDGS is designed to support the addition of new sensors/satellites, however modification of the system for new sensors/satellites is outside the scope of the initial deployment of the PDGS for Vision-1. Such changes shall be subject to the Contract Change Control procedure.

4.2.3. **Capability Outputs**. The initial system deployment shall be able to generate the following Vision-1 products:

- Primary image in sensor geometry (as either a panchromatic, multispectral, or bundled product)
- Projected image in a projected or geographic coordinate system (as either a panchromatic, multispectral, or bundled product)
- Orthorectified image in a projected or geographic coordinate system (as either a panchromatic, multispectral, pansharpened, or bundled product)

The PDGS is designed to process Vision-1 data, other data sources shall be evaluated and discussed during the term of the contract duration. The system shall be able to generate radiometrically & geometrically calibrated analysis ready data products for all input data sources subject to the development of the specific sensor model and the capabilities of the individual sensor. Any sensor models that are required in addition

to the sensor model for the Vision 1 data supplied under the Contract shall be subject to the contract Change Control procedure

4.2.4. **Processing Workflows**. The system shall be delivered with automated workflows to allow for the processing of both newly acquired and archive data. Automated system workflows shall be delivered with pre-defined quality checks scheduled at relevant stages throughout the processing chain.
The Vison-1 PDGS will process Vision-1 data to the described outputs via a series of pre-defined automated workflows. Any additional workflows shall be subject to the contract Change Control procedure.

4.2.5. **Processing Performance**. The initial system deployment shall be able to process five (5) strips of Vision-1 data (minimum three (3) scenes per strip) per day. Processing performance shall be readily expandable allowing for future enhancement.

4.2.6. **Parallel Processing**. The system shall be able to run multiple jobs in parallel.

4.2.7. **Licensed Vision-1 Data**. The Contractor shall provide a catalogue comprising of five-hundred (500) strips of existing Vision-1 RAW data, pre-installed and catalogued within the system. The system will also support the ingestion of additional un-catalogued Vision-1 RAW data, initiated by an electronic transfer (*e.g.* FTP) or a physical transfer (*e.g.* HDD). The Vision 1 data will be subject to the End User Licence Agreement previously agreed with the Authority.

4.2.8. **Reference Datasets.** The Contractor shall make the following reference datasets available:

- 3D Reference data - Digital Elevation Model : WorldDEM4ortho data, and the World Dem,
- 2D Reference Basemap: OneAtlas Basemap
- 3D Reference data - SRTM
- 3D Reference data - GlobeDEM

The datasets are supplied subject to acceptance of the License Agreements referenced in Schedule 10 to the Contract. The reference datasets shall be made available to the Authority either physically or via remote protocols such as Web Map Tile Service (WMTS) to cover all capability outputs pre-installed, covering both 2D (e.g. basemap) & 3D (e.g. digital elevation model) referencing.

4.2.9. **Data Storage.** The system shall allow for the storage and archiving of processed data products. The infrastructure supplied under the Contract is itemised in Section 8 “Bill of Materials” of this Annex A. The storage array shall be readily expandable allowing for future enhancement.

4.2.10. **Backup.** The system shall support full, incremental, and differential backup techniques, running either continuously or on a predefined schedule.

4.2.11. **Virtualisation.** Under the scope of the Contract the PDGS shall be deployed on a Physical infrastructure at the Authority’s site at Redacted. The PDGS system shall be capable of being deployed on Cloud infrastructure through virtualisation, such deployment shall be subject to the contract Change Control procedure. The Contractor shall provide support to the Authority in deploying the system to Redacted architecture when appropriate (time to be confirmed by the Authority) and to this end twenty (20) technical consultancy days have been included to assist with the development of a statement of requirements for deployment on the Redacted infrastructure.

Redacted. The Contractor will provide the Redacted with all information and evidence required to enable a safe and Redacted.

4.2.12. **Cyber Protection.** The system shall be provided with the firewall & anti-virus software, specified in Section 7 “Subscriptions/Licences/Cots Bill Of Materials” of this Annex A, pre-installed. The Authority will work with the Contractor to clarify security requirements for the necessary accreditation.

4.2.13. **Logging & Monitoring.** The system shall support logging and monitoring to report on system health and help ensure nominal operation. The Contractor shall work with the Authority to implement most appropriate reporting method (to be confirmed).

4.2.14. **Training.** The Contractor shall provide Redacted end-user training course to a maximum of Redacted users covering the operational use of the system and what happens at each stage of the data processing chain. The training course will enable participants to become trainers of the capability for other Redacted staff.

The training course shall cover the Vison-1 PDGS and the production of the defined Vision-1 products.

The Contractor shall provide Redacted

The Authority shall be responsible for assigning suitably qualified and experienced personnel to the training courses.

The Contractor shall provide the Redacted with all relevant user and associated training manuals so that the Redacted is able to fully utilise software and hardware systems provided and developed throughout the programme.

The Contractor will work with the Redacted to capture clearance or administration requirements in advance of the training sessions. Redacted staff who take up the training course will be provided with all relevant documentation to augment and implement course learning.

The Contractor shall support Redacted

4.2.15. **Proxy Access.** While the procured system is being delivered, the Contractor shall make a PDGS processing specialist available at Redacted premises. Redacted transfer. . The Contractor shall make appropriate Subject Matter Experts (SMEs) Redacted pre go-live of the PDGS to support relevant knowledge exchange discussions and workshops .

4.2.16. **Support & Maintenance.** Once deployed, the Contractor shall provide ongoing support and maintenance throughout the duration of the Contract. Ongoing support shall include:

- Redacted

The Contractor shall provide support and maintenance between the hours of 09:00 and 17:00 hours, Monday to Friday excluding public holidays in England and Wales.

The Authority shall provide the Contractor with remote access to the PDGS deployed on its site to facilitate the provision of the support and maintenance.

4.2.17. **Sensor Plugins.** Redacted

4.2.18. **Vision-1 Tasking.** The system shall be capable of enhancement to provide tasking capability for Vision-1. If required during the term of the Contract, such enhancements shall be subject to the contract Change Control procedure.

4.2.19. **Capability Enhancement.** The system shall be capable of future enhancement through the deployment of additional capability. Additional capability options include, but are not limited to, supported sensor expansion, tasking, processing, connectivity, and extension to the volume of data that the system may store/process. If required during the term of the Contract, such enhancements shall be subject to the contract Change Control procedure

4.2.20. **Discovery Workshops.** The Contractor shall organise and deliver technical workshops to align with the ongoing requirements and the evolutions of the PDGS for DSTL. During the workshops, a review of the users' technical requirements shall be conducted covering, for example, APIs. Redacted office.

4.2.21. **PDGS Restful APIs.** The Contractor shall design, develop and integrate Restful APIs to interact with the data in the PDGS system. The Contractor shall conduct a requirement phase, and the end of which shall present the requirements prioritization for validation. Based on those requirements, the Contractor shall develop the Vision-1 PDGS Restful APIs as specified below and shall provide associated documentation. Redacted.

4.3. PROGRAMMATICS

4.3.1. **Acceptance.** The Contractor shall build and test the system prior to delivery. System integration will include tests for each stage of the satellite data processing chain.

On completion of system integration, the Contractor shall conduct a Factory Acceptance Tests (FAT) which may be witnessed by Authority personnel. Following successful FAT, the Contractor shall install the system at DSTL premises, and conduct subsequent tests of the processing chain in this environment, followed by site acceptance tests (SAT), which may be witnessed by appropriate Authority personnel.

Upon SAT completion, the Contractor shall provide familiarisation training on the installed system as specified in section 4.2.15 of this Annex A. Following which the system shall be transferred from the Contractor to the Authority. The PDGS shall be supplied subject to the Licence Agreement referenced within Schedule 10 to the Contract.

4.3.2. **Integration, Verification, & Validation (IV&V).** The Contractor shall produce an IV&V plan to cover:

- Assembling and testing, at configuration item level (*e.g.* servers, storage, applications, data), the various subsystems (IT infrastructure components, applications, data) of the system, including interfaces and non-functional requirements
- Ensuring that technical and engineering requirements are properly met, in other terms, that the system has been built according to pre-defined specifications and standards
- Laying the ground work for key acceptance tests activities, preparing the transfer of the system operation from the Contractor to the Authority

As specified in Section 7 "Installation, Test, Acceptance" of this Annex A.

4.3.3. **Accreditation.** The system shall be integrated, verified, and validated in compliance with Authority accreditation and safety processes as defined and agreed by the Parties during the associated project work packages.

4.3.4. **Engagement**. Throughout the Programme, the Contractor shall contribute to and attend necessary Technical Exchange Meetings. Where required, the Contractor should support anomaly resolution, maintenance activities and provide expert advice for demonstrations, trials, case studies, and mission planning to increase effectiveness of the proposed capability solutions.

4.3.5. **Safety & Security.** Due to the Contractor software being integrated into MOD environments there may be a requirement for a security assessment. The MOD will confirm this requirement with the Contractor prior to availability of the MOD system test and development environment. If there is a requirement, the Contractor will work with the MOD to provide initial relevant security information and a costed option for further information requests and implementation of additional security controls. The Contractor will develop software for integration onto MOD systems at no higher classification than Redacted.

4.3.6. **Future Costings.** Should there be any changes to proposal as a result of studies or additional scope requests, the Contractor shall provide costed options post contract award. Rough Order of Magnitude (ROM) costing exercises require thirty (30) days for company approval and gating.

4.3.7. **Standards Coherence.** The Contractor shall work in International System of Units (SI units) and Coordinated Universal Time (UTC). The Contractor shall seek approval from the MOD for use of frames of reference, standards, accuracy level and systems that are applied across interfaces.

5. DELIVERABLES AND OBLIGATIONS

Key Deliverables Spreadsheet					
Phase	**Month**	**Deliverable**	**Format**	**Evaluation Panel/Group**	**Acceptance Criteria**
Contract Award	**T+0**	**D1 - Kick-off (KO)** kick-off meeting (after contract is signed) to outline the path to delivery. Together with all other progress Reports and meeting Notes.	Meeting and minutes documentation pack (e.g. .doc and .ppt)	Redacted	Confirmed receipt.
Phase 1A Software Access	**T+0**	**D2 - PDGS** Provision of interim access to Redacted PDGS system Redacted	System Access. Supplier personnel to be on premise at Redacted to access Redacted of the PDGS system for demonstration and knowledge transfer to Redacted	Redacted	Confirmed access.
		D3– Training (part 1) Knowledge exchange workshops and technical consultancy commences over 11 months, with summary of exchanged knowledge delivered in writing.	Face to face support, backed up by delivery of relevant documented knowledge (e.g. .doc).	Redacted	Confirmed receipt.
Phase 1B PDGS Implementation	**T+7 months**	D4A – Hardware (of Hardware and PAAS)	Hardware	Redacted	Confirmed receipt
		D4B – Third Party COTS Software (for Hardware and PAAS)	Redacted	Redacted	Confirmed receipt
	T+8 months	**D5** Interface Control Specification for relevant hardware and software interfaces.	Documentation (e.g. .doc)	Redacted	Confirmed receipt.

	T+10 months	**D6 - Hardware Installation and testing** Set up of PDGS at Airbus Redacted includes: environment & PAAS, installation of applications, environment testing, release to Factory Acceptance Testing, and test report.	Hardware and test report document.	Redacted	Successful installation and test.
	T+11 months	**D7- Software installation and testing** Installation of PDGS Software at Redacted, site acceptance testing report, release for user training.	Software and test report document.	Redacted	Confirmed receipt. Successful installation and test.
	T+12 months	**D8 -** Training User training (Including Training manuals and Documentation**)**	Training delivery and Documentation (e.g. .doc .ppt etc)	Redacted	Confirmed receipt and completion of training.
Phase 1C Security	**T+12 months**	**D9 - Security Accreditation** Security accreditation, IT health checks, security acceptance.	Accreditation & Documentation	Redacted	Confirmed receipt & acceptance.
Phase 2 Support & Maintenance	**April 2024 to 31 Mar 2025**	**D10 - Support & Maintenance** Implementation of support & maintenance as per Airbus ITIL v4 framework. **D10A – Support/Services**	Maintenance. Maintenance documentation and records as reports e.g. .doc	Redacted	Confirmed receipt.
		D10b – Maintenance documentation and records of support outcomes			
Phase 2 Options	**T.B.C.**	**D11 - Sensor Plugins** *Optional* Implementation of additional sensor plugins (*e.g.* Redacted) into Redacted PDGS deployment	Redacted	Redacted	Successful installation and test.

		D11 - OneAtlas Registration & access to Airbus OneAtlas data portal and Vision-1 data archive.	System Access.	Redacted	Confirmed access.

WORK BREAKDOWN STRUCTURE

REDACTED

~~6.~~

7. INSTALLATION, TEST AND ACCEPTANCE

REDACTED

7.1. INTEGRATION, VERIFICATION AND VALIDATION (IV&V)

REDACTED

8. HARDWARE BILL OF MATERIALS

REDACTED

9. SUBSCRIPTIONS/LICENCES/COTS BILL OF MATERIALS

REDACTED