Annex I – Requirements and standards for the technical assessment

CONTENTS

A. CONCEPT

In order to further accelerate the insertion of Uncrewed Systems of Systems across the land, sea and air domains, **the concept seeks to reap the fruit of the successful demonstrations by the European Border and Coast Guard Agency (hereafter, Agency) to date** on low and medium altitude systems **while using the opportunity for the Agency to pursue the state-of-the-art** high-altitude systems.

Together these seamless interoperable systems will gradually pave the way for a comprehensive - network-enabled border and securely connected – surveillance capability round the clock, **ensuring persistent large-area surveillance coverage at the strategic level, as well as re-deployable operational and tactical capabilities** to adapt to the changes in operational needs and operational areas.

NATO differentiates between types of uncrewed airborne systems according to weight ([1]).

- **Class I** covers the sub-tactical and tactical levels, using platforms of less than 150 kg, operating at altitudes up to 1,5 km with a mission radius of up to 50 km Line of Sight.
- **Class II** covers tactical and operational levels, with platforms ranging from 150 kg to 600 kg, at altitudes of up to 5,5 km and a mission radius of up to 200 km Line of Sight.
- **Class III** addresses strategic levels, operating with platforms heavier than 600 kg, providing surveillance at altitudes ranging from 14 km to 20 km with unlimited mission radius Beyond Line of Sight.

Unfortunately, classification according to weight is not suitable for the scope of this call. However, altitude and mission radius parameters are relevant and therefore for the purpose of conveying a comprehensive explanation of the types of platforms that can be used to fulfil the requirements of this call, the NATO classes have been cross-referenced.

Examples of platforms that are either available on the market or are maturing include (but are not limited to) the following.

- **High Altitude – Long Endurance Large Area**

  A comprehensive overview of platforms can be found in the Agency's Research Study on High-Altitude Pseudo-Satellites ([2]) and is briefly summarised below. These platforms operate in higher airspace above 13 km and correspond to **NATO Class III** in terms of operating altitude and mission radius.

  - **Lighter-Than-Air** platforms are elevated by using buoyant gas and are typically in the form of **ballons or airships**. Then can be tethered to the ground or come with on board propulsion systems. Their payload can be high and thus accommodate several different types of sensors and communication systems. Their operating endurance is high but the maturity for operating at high altitudes is low while the estimated cost

([1]) NATO Standard AJP-3.3 – Allied Joint Doctrine for Air and Space Operations

([2])https://www.frontex.europa.eu/assets/EUresearchprojects/2023/FX_HAPS_WP1_-_Market_Report_V4.pdf

thus is high as there is still a degree of development needed to be commercialised.

- **Heavier-Than-Air** platforms are based on a **fixed wing aircraft** design. The wingspans are far wider than that of a conventional aircraft. The platforms are lightweight and thus most likely can only carry a payload of less than 10 kg, limiting the sensor capability. Endurance can range from a week up to several months. The platforms come with ground stations and in total are relatively inexpensive. They have been tested by the defence sector for over a decade and operate using photovoltaics. Recommend modular payload bays to switch between EO/IR, comms relay, or RF sensors.

- **Medium Altitude – Long Endurance Medium Area**

These platforms operate in the commercial airspace, at between 2 km up to 13 km and correspond to **NATO Class II** in terms of operating altitude and mission radius. The platforms are available on the market albeit the supply base in the European Union is still developing. The platforms are typically Heavier-than-Air using either a **fixed-wing or rotary-wing aircraft** design. The Agency has been operating fixed-wing aircraft for some years through its full-service contracts. Depending on the size they can carry multi-sensor payload are more cost-effective to operate and have longer endurance compared to the corresponding crewed aircraft.

- **Low Altitude - Long Endurance Small Area**

Balloons and airships have long endurance and are typical platforms used for this purpose, which corresponds to **NATO Class I** in terms of operating altitude of up to 2 km and mission radius. The Agency has successfully piloted systems that use a tether. They are cost-effective and easily re-deployable. Require integration with ground control and autonomous winch/release capability for fast deployment.

- **Low Altitude - Medium Endurance Small Area**

Rotary wing platforms, either with single or multiple rotors, fall under **NATO Class I**, are readily available on the market and have seen a proliferation of use both in law enforcement and defence as well as for civilian purposes. They are relatively inexpensive, and the larger sizes can carry multiple sensors. **Fixed wing platforms** also exist and typically come with longer endurance but cannot take-off vertically.

B. TARGETS AND REQUIREMENTS

1. ADEQUACY

1.1. General

Target

European multinational comprehensive surveillance capability utilising platforms with appropriate payload that can be deployed at different altitudes from sea surface to space complementing one another.

Requirements

1.1.1(1) Applications could address the following types of Capability Platforms

- **High Altitude – Long Endurance Large Area** operating at an altitude corresponding to Higher Airspace
- **Medium Altitude - Long Endurance Medium Area** operating at an altitude corresponding to Commercial Airspace
- **Low Altitude – Long Endurance Small Area** operating at an altitude corresponding to the Urban Air Mobility Corridor
- **Low Altitude – Medium Endurance Small Area** operating at an altitude corresponding to the Urban Air Mobility Corridor

1.1.1(2) Equipment for Work package purchased under this call must be able to be operated remotely and include the necessary ground Command, Control and Support capabilities from which captured surveillance data can be monitored and stored.

1.1.1(3) All Airborne Work packages purchased under this call must:

- Incorporate dual navigation systems that are enabled by the Global Navigation Satellite System -
    - Galileo together with the European Geostationary Navigation Overlay Service;
    - The Global Positioning System.
- Be capable of operating when deployed in remote operational environments that feature degraded coverage of the Global Navigation Satellite System.

1.1.2 Airborne High Altitude – Long Endurance Large Area Surveillance

Target

Work package able to provide strategic wide area surveillance, land and sea, for extended periods of time, enhancing situational awareness.

Requirements

1.1.2 (1) The Work package revolving around a High-Altitude equipment platform must at a minimum be able to carry the necessary payload while sustaining the operational altitude in Higher Airspace in order to at least be able to:

- Navigate and sense-and-avoid collisions;
- Conduct electro-optical surveillance in line with requirement 1.1.3 (2).

1.1.2 (2) The platform must be able to endure continuous operation for at least 14 days.

1.1.3 Airborne Medium Altitude – Long Endurance Medium Area

Target

Work package able to provide operational medium area surveillance, for both land and sea, for long durations of time, enhancing situational awareness

Requirements

1.1.3 (1) Operating in Commercial Airspace, the Work package revolving around a Medium Altitude equipment platform must:

- Be able to conduct flights in any class of airspace rules under Visual Flight Rules and Instrumental Flight Rules;
- Have a flight endurance of minimum 20 consecutive hours when configured for the minimum payload described below;
- Be able to carry a payload of minimum 230 kg;
- Be able to fly both at night and day;
- Be able to take-off at least 15 kts of crosswind

1.1.3 (2) The minimum payload must include capabilities to sense-and-avoid while navigating in the skies as well as those addressing core capabilities

- Maritime Surveillance Radar operating in the X-band, designed for air-to-air and air-to-ground target detection, with automatic target tracking, Ground Moving Target Indication and adequate detection capabilities at sea state 3 of small and medium size targets.
- Electro-Optical sensors cued with the Maritime Surveillance Radar, which includes:
    - Gyroscopic stabilization of the turret enabling sufficient pan and tilt range as well as adequate high and low slew rates;
    - Thermal imaging operating in the mid-wave Infrared spectral band with adequate zooming capability, resolution and Field of View range;
    - Optical imaging in colour with adequate zooming capability, resolution and Field of View Range;
    - Colour spotting with adequate resolution and Field of View.
- Dual navigation systems as required by 1.1.2 (1) and an Automatic Identification System Receiver.
- Very High Frequency maritime band radio and Global System for Mobile Communications interfaces.
- Emergency Position Indicating Radio Beacons detection capability.

1.1.4 Airborne Low Altitude – Long Endurance Small Area

Target

Work package able to provide tactical small area surveillance, for both land and coast, from a static location for long durations of time, enhancing situational awareness.

Requirements

1.1.4 (1) The Work package must comprise a static Low Altitude equipment platform that is tethered to a ground Command, Control and Support capability to enable secure communication, energy supply and stationary positioning.

1.1.4 (2) It must be configured to:

- Be elevated through the use of buoyant gas in e.g. an airship or balloon, or a propelled platform;
- Have an elevation height of at least the range 100 m to 1500 m with an endurance of at least 7 consecutive days;
- Acquire data from on board -
    - Electro-optical sensor systems for day and night vision;
    - Electromagnetic sensor systems;
- Enable tracking using –
    - Automatic tracking based on sensor data;
    - Vessel tracking based on the Automatic Identification System;
- Adequate anchoring in the ground ensuring that the Platform is adequately secured in the ground in order to ensure safe operation.
- Allow for operational flexibility through the reconfiguration of sensor payloads based on evolving tactical requirements;
- Be easily re-deployable.

1.1.5 Airborne Low Altitude – Medium Endurance Small Area

Target

Work package able to provide tactical small area surveillance, for both land and coast, for medium durations of time, enhance situational awareness.

Requirements

1.1.5 (1) The inherent equipment and systems under this Work package must comprise a remotely operated mobile platform, able to take-off and land vertically in accordance with

the applicable Technical Standard ([3]) for Vertical Take-Off and Landing Remotely Piloted Aircraft Systems.

1.1.7 Command, Control and Support

Target

Work package able to feed the tactical situational awareness picture by capturing visible and non-visible information, statically, over a long period of time from a particular location while being easily re-deployable.

Requirements

1.1.7 (1) All airborne Work packages must come with Command, Control and Support enabling:

- Remote command, control and operation of the equipment and systems;
- Tethering for the purpose of energy supply and communications where required
- Data fusion (from both on board sensors and from other sources), discrimination processing and display;
- Adequate electrical energy supply and inherent quality to operate autonomously in remote areas without access to the electric grid, drawing on developments in renewable and alternative energy supply systems;
- Adequate lighting in accordance with EN 12464-1:2021 ([4]);
- Secure communication systems (including for Satellite Communication), with capacity for live streaming;
- Adequate weather protection and heating, ventilation and air conditioning systems (HVAC) to ensure good overall working conditions;

Adequate workplace conditions for the operators to perform their tasks compliant with relevant EU legislation based on European Framework Directive (1989/391/EEC) ([5]) and its derivatives as well as established standards such as ISO 6385:2016 ([6]) and DEF-STAN 00-25 ([7]) where relevant.

1.2. Environmental Conditions

Target

([3]) Management Board Decision 51/2021, Technical Standards for Aerial Equipment, TS-2021-002: 1) PDF – TT-09-21-346-EN-N; ISBN 978-92-9467-033-5; doi: 10.2819/966225. 2) FPI – 21.0078

([4]) EN 12464-1:2021 Light and Lighting - Lighting of Work Places - Part 1: Indoor Work Places

([5]) Council Directive 89/391/EEC on the introduction of measures to encourage improvements in the safety and health of workers at work

([6]) ISO 6385:2016 Ergonomics Principles in the Design of Work Systems

([7]) DEF-STAN 00-25 Human Factors for Designers of Equipment

Work Packages able to operate in all relevant operational areas pertinent to the external borders, the pre-frontier areas and applicable Third Countries.

Requirements

1.2.1 (1) The Work packages must be designed for use in the following natural environmental conditions equivalent to those described in DEF-STAN 00-35 ([8]).

- A2: Hot Dry
- A3: Intermediate
- C0: Mild Cold
- C1: Intermediate Cold
- C2: Cold

1.2.1 (2) Measures must be taken to ensure that the respective Airborne Work package can adequately sustain operation with induced environmental conditions taking into account e.g. shock and vibration equivalent to what is given by DEF-STAN 00-35 and electro-magnetic environmental effects in line with MIL-STD 464 ([9]) or equivalent.

1.3. Interoperability

Target

Work packages seamlessly interoperable with existing ones as well as with the operational theatres, facilitating market response to subsequent procurement procedures.

Requirements

1.3.1 (1) The Technical Specifications for the purchase of the Work packages under this call should, wherever possible, make reference to internationally established standards to enhance clarity.

1.3.1 (2) The Technical Specifications must also address interoperability aspects related to deployments in the Agency's operational activities for e.g. energy supply and communications.

2. AVAILABILITY

2.1. Strategic

Target

([8]) DEF-STAN 00-35 Environmental Handbook for Defence Materiel

([9]) MIL-STD 464 Electromagnetic Environmental Effects – Requirements for Systems

Availability for deployment in the Agency's operational activities of the Work packages ensured over time.

Requirements

2.1.1 Key enabling requirements for e.g. crews, training and logistics – effectively addressing all the Agency's Capability Lines of Development ([10]) - must be defined and timely actioned in order to ensure that the equipment purchased under this call is made available to the Technical Equipment Pool and subsequently deployed once the acquisition process has been concluded.

2.1.2 The Technical Specifications for the equipment to be purchased under this call must include requirements that mitigate risks to the Security of Supply, in particular with regard to:

- Supply chain dependencies stemming from outside the European Union in relation to e.g. –
    - Intellectual Property rights;
    - Energy supply, and in particular dependencies on fossil fuels;
    - Raw materials;
    - Technologies and techniques;
    - Components;
    - Export control restrictions;
    - Possible disruptions as a result of trade wars, pandemics and crisis including armed conflicts.
- Single sourcing both from within and outside the European Union;
- Existing and possible future adverse Foreign Direct Investments in the different parts of the supply chains;
- Risks linked to the integrity of information especially for acquired and stored surveillance and positioning data in the context of security risks linked to the Internet-of-Things and the use of cloud-services, as well as those linked to compliance with applicable European Union law for Fundamental Rights and Data Protection;
- Evolving cyber threats.

2.1.3 Once the equipment purchased under this call has been registered in the Technical Equipment Pool, any relevant changes to the Lifecycle Management Plans for the whole

([10]) Management Board Decision 16/2024 on the Approval of the Capability Roadmap of the European Border and Coast Guard: (https://prd.frontex.europa.eu/wp-content/uploads/mb-decision-16_2024_capability-roadmap-of-the-ebcg-1.pdf): Doctrine, Policies, and Concepts; Culture, Organisation, and Leadership; Science, Technology, and Innovation; Personnel, Competencies, and Learning; Equipment, Systems, and Support; Logistics, Facilities, and Infrastructure; Safety, Security, and Health; Interoperability, Architectures, and Standards.

Work package that may affect the projected multiannual operational availability will be shared with the Agency e.g. during the Annual Bilateral Negotiations.

2.1.4 The Technical Specifications drafted for the equipment to be purchased under this call must ensure that there will be no contractual constraints, including in relation to warranty or similar, for its operation in the Agency's operational activities.

2.1.5 Equipment lifespan must be indicated when registering the equipment in the Technical Equipment Pool.

2.2. Operational and Tactical

Target

Following its registration in the Technical Equipment Pool, equipment made available for the Agency's operations.

Requirements

2.2.1 Integrated Logistic Support for the entire lifecycle must be employed.

2.2.2 Trainings relevant to the operation and sustainment of the acquired equipment and the overall Work package must be updated and delivered throughout the lifecycle.

2.2.3 Measures must be taken to optimise preventive – calendar or condition-based – maintenance of the equipment as well as spare parts management for both preventive and corrective maintenance, exploring emerging opportunities stemming from local additive manufacturing.

3. AFFORDABILITY

Target

Through-life management approach to costs adopted, to ensure affordability of the Work packages over time.

Requirements

3.1 During the early stages of the action, when assessing options and defining the scope and requirements for the Work packages, a thorough cost-effectiveness analysis must be performed in line with existing best practices such as the European Commission's Economic Appraisal Vademecum 2021-2027 ([11]), which provides the rationale for opting for cost-effectiveness analysis as opposed to cost-benefit analysis.

([11]) Economic Appraisal Vademecum 2021-2027 – General Principles and Sector Applications (https://ec.europa.eu/regional_policy/sources/guides/vademecum_2127/vademecum_2127_en.pdf)

3.2 Lifecycle costs must be calculated and updated regularly during the course of the action, adhering to international standards such as ISO 15288 ([12]), NATO TR-SAS-054 ([13]) or equivalent.

4. ADAPTABILITY

Target

Work packages able to be adapted to emerging needs throughout their lifecycle within a reasonable set of change requirements.

Requirements

4.1 A modular approach to the design of the Work packages must be employed in order to enable upgrades, including through refurbishments and retrofits, throughout their lifecycle.

4.2 Particular emphasis must be made to the interfaces of the Work packages, adhering to relevant international technical standards.

5. ACCOUNTABILITY

5.1. Quality

Target

Sound management of the project as well as adherence to legislation and management of quality.

Requirements

5.1.1 Established international project management standards must be applied, including during the purchase phase - i.e. the European Commission's PM^2, PMBOK, PRINCE2 or equivalent.

5.1.2 ISO 9001 ([14]) certification must be required for all contracted suppliers.

5.2. Sustainability

Target

Principles of sustainability employed to increase operational effectiveness and overall strategic autonomy while mitigating adverse effects to collateral, including the environment, during all phases of the lifecycle.

Requirements

([12]) ISO 15288 Systems and Software Engineering – System Life Cycle Process

([13]) TR-SAS-054 Methods and Models for Life Cycle Costing

([14]) ISO 9001 – Quality Management System

5.2.1 Procurement and lifecycle management of equipment purchased under this call must draw on the guidance of ISO 20400 ([15]) and ISO/IEC/IEEE 24748-1 ([16]) other applicable standards or best practices such as e.g. ISO 14001 ([17]), ISO 14090 ([18]), ISO 26000 ([19]), ISO 50001 ([20]) in relation to:

- Overall lifecycle sustainability including on energy efficiency, consumption and fossil fuel dependency, materials consumed, pollutants emitted, and climate- and ecology impairments, from manufacturing through operation when in service to decommissioning and disposal;
- Moral and ethical aspects taking into account both the supply chain and in-service use of the Work packages throughout their lifecycle;
- Risks associated with the supply chain, including sourcing outside the EU (in particular single sourcing), taking into account risks in relation to propriety of intellectual property, production, integration and Third Country export restrictions
- Dependencies on Economic Operators with a high degree of Foreign Direct Investments or dependency from outside the EU, which may pose a security risk to the lifecycle management and subsequent operational availability of the Work packages.
- Where possible, fostering the growth and innovation potential of Economic Operators based in the European Union.

5.3. Safety, Security, Health and Compliance

Target

Mitigated risks to safety, security and health.

Requirements

5.3.1 Established System Safety Management standards must be applied, e.g. SM-0001 ([21]), MIL STD 882 ([22]), H SystSäk ([23]) or equivalent, to mitigate safety risks associated with the design of the equipment/overall Work packages and systems purchased under this call across their whole lifecycle, e.g. adversely affecting both the Work packages – hardware, software and personnel – and collateral.

([15]) ISO 20400 - Sustainable Procurement — Guidance

([16]) ISO/IEC/IEEE 24748-1:2024 Systems and Software Engineering — Life Cycle Management

([17]) ISO 14001 – Environmental Management Systems

([18]) ISO 14090 – Adaptation to Climate Change

([19]) ISO 26000 – Social Responsibility

([20]) ISO 500001 – Energy Management

([21]) SMS Standard (SM-0001) - International Industry Standard Implementing a Safety Management System in Design, Manufacturing & Maintenance Organisations

([22]) MIL-STD-882 - System Safety

([23]) HSystSäk - Handbook System Safety

5.3.2 Measures must be taken to mitigate security risks of the equipment purchased under this call as part of a Work package in terms of hardware, software and information integrity.

5.3.3 ISO 45000 ([24]) must be adhered to when operating the Work packages.

5.3.4 Airborne equipment and systems must comply with other relevant legislation and international standards, specifically in relation to materials, safety and operation, such as EU Regulations 2019/947 ([25]) and 2019/945 ([26]), ISO 17717 ([27]) and ISO 21384-3([28]).

5.3.5 Cybersecurity measures must be taken in compliance with the Directive concerning measures for a high common level of security of network and information systems across the Union ([29]).

([24]) ISO 45000 Occupational Health and Safety

([25]) Regulation (EU) 2019/947 on the Rules and Procedures for the Operation of Unmanned Aircraft

([26]) Regulation (EU) 2019/945 on Unmanned Aircraft Systems and Third Country Operators of Unmanned Aircraft Systems

([27]) ISO 17717 Meteorological Balloons

([28]) ISO 21384-3 Unmanned Aircraft Systems

([29]) Directive (EU) 2016/1148 of the European Parliament and the Council of 6 July 2016 Concerning Measures for a High Common Level of Security of Network and Information Systems Across the Union